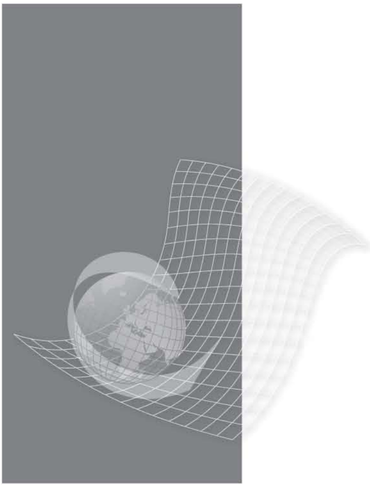
NON-DISTORTING FARM SUPPORT TO ENHANCE GLOBAL FOOD PRODUCTION



NON-DISTORTING FARM SUPPORT TO ENHANCE GLOBAL FOOD PRODUCTION

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Preface

This book is the culmination of a two-year project on non-distortionary support to farmers initiated at FAO. The papers contained in this volume were commissioned for this project and two expert consultations were held, the first in December 1-2, 2008 and the second in May 19-20, 2009. The papers were presented and discussed at the consultations; initial versions were reviewed externally, revised and resubmitted.

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Contents

Page

Tables

Figures

Introduction and Overview

Aziz Elbehri and Alexander Sarris

The recent world food crisis highlighted the critical issue of global food security and the need to enhance global agricultural production capacity to meet current and future food demand. Increased investment in agriculture and adequate incentives to farmers are required to meet this global challenge. A key challenge is how to shape and design support to farmers in both the developed as well as the developing world while minimizing those distortions to global markets that are potentially harmful to developing countries, and at the same time promoting global food supply adequacy, food security for the undernourished, and poverty reducing and growth incentives for the farmers in low income food deficit countries. The objective of the book is to explore options for shaping farm support in a non-distortionary manner in both developed and developing countries.

The first part of the book tackles the thorny issue of developed countries' support to agriculture and its distortionary implications. Developed countries (largely represented by the OECD) heavily subsidize their farmers to support their incomes, but also create distortions in world markets, inducing disincentives in developing countries' agricultural production in the long run. However, the global situation has changed recently, as excess supply and falling prices, which were the characteristics of earlier periods, have given way to strong demand for agricultural commodities - driven in part by the rising demand for biofuels in response to environmental impacts of climate change. Still, high farm subsidies in OECD countries continue to be hotly debated and can be effectively confronted only through a new Doha Agreement that places greater discipline and binding limits on current and future farm support.

The second part of the book turns to developing countries, who confront other impediments that slow their agriculture and weaken their abilities to raise rural incomes and provide for food security. There are many strategies developing countries can implement to support their own farmers in non-distortionary ways. All require a rekindled drive for more robust investments in agriculture after more than two decades of relative neglect. There are myriad market failures hampering agriculture and faster productivity growth that call for justified interventions.

Legitimate areas of support can range from input supply systems, accessibility of credit to institutional reform and human capital investments. Trade policies also must be designed to complement domestic investment policies and development strategies.

Together these issues form the core theme of this book. Running through all the chapters is the central question of how to forge policy that maintains legitimate or politically desirable support to farmers in both developed and developing countries, but is less trade distorting, and, at the same time, promotes global food adequacy and food security.

The first chapter by **Elbehri** and **Sarris** is an overview of the issues examined individually in the following chapters. After reviewing the salient features of policy support in OECD countries and evidentiary information on their relative distortionary degree, the chapter takes up a few keys issues for in-depth discussion. Key issues include shifts in policy support to decoupled payments, rising interest in the role of policy in managing farm price and income risks, the critical issue of border policies and the significance of seriously reducing market access restrictions, and the implications for agricultural commodities from providing subsidies and tariff protection for biofuels.

In the second part, the chapter turns to developing countries' diminished attention to agriculture, starting with a range of policy options that qualify as legitimate non-distortionary support. The paper then argues for the critical importance of re-energizing public investments toward agriculture. It also discusses the merits and conditions under which appropriate input support could be designed to stimulate production and enhance productivity. The chapter then shifts to trade policy and argues that any policy should be designed in a way compatible with an open trading system, and should ultimately harmonize with domestic developmental policies and goals. Developing countries too, have a way to go to reduce their own border restrictions, and doing so could stimulate regional and south-south trade, an area still largely unexplored. The chapter also addresses the prospects of new sources of investments to agriculture tied to climate change and greenhouse gas emissions. Potential benefits could be substantial, especially if these new investments flow are accompanied by improved technologies with positive spillovers on the agricultural sector. Nevertheless, there are still many unresolved technical and institutional questions that warrant much work. Finally, the chapter ends with a list of policy recommendations as a response to the central question of this book.

In chapter 2, **Skully** reviews broadly the major OECD farm policies and conceptually examines the degree of their distortionary effects. The starting argument is that OECD policies in general encourage production and discourage consumption of agricultural products within developed countries, and this tends to increase their net exports and reduces world prices. Consequently, as non-OECD agricultural production and trade are reduced, investment and agricultural development are inhibited. Using the OECD farm support database from 1986 through 2007, Skully calculates the aggregate indicators of support (relative to the value of production) and distortions (relative to the default market support price) and finds these indicators to slowly decline over this period, but from a high starting point. For example, the ratio of producer support to the gross value of production declined from 40 percent to 29 percent, while the overall aggregate indicator of policy distortions declined from 0.96 in 1986 to 0.74 in 2007.

Skully attributes much of these declining trends to a re-instrumentation of support policies in OECD countries and to the rising share of decoupled support (payments based on non-current farm attributes and that do not require agricultural production) relative to total support. Decoupled payments are thought to generate little or no distortions compared to subsidies tied to production. Decoupled payments channel their effects via income or wealth effects and the analysis of their economic and distortionary effects must be examined using a household perspective instead of using agricultural production models. The latter part of Skully's paper is devoted to household-related literature that examines the linkages between decoupled payments and the effects on farm credit, risk reduction and increased land value (since payments are tied to agricultural land). The last section of Chapter 2 is devoted to biofuel policies, their demand-boosting effect for agricultural commodities, potentially offsetting some of the market and price effects of conventional distortionary farm policies.

Chapter 3 by **Orden and Blandford** examines U.S. farm policies from 1995 to the most recent legislation for 2008 and covering the period up to 2012. The authors highlight three interacting components of recent policies: commodity price and income support, long-term land idling and other agri-environmental programs, and crop and revenue insurance and disaster relief. The authors also assess implications for support of a new policy instrument in the 2008 bill, ACRE-an optional new state revenue guarantee program, as well as biofuel mandates whose effects interface with the more traditional programs. The authors highlight how the relative importance of various policy instruments has also changed, as the demand-boosting instruments (Biofuel mandates and tax credits) lead to higher commodity prices and consequently reduce the price-linked commodity support. Also highlighted are the increased support agri-environmental payments (for long-term land idling) and subsidies for crop and revenue insurance. The authors offer a detailed analysis of the implications of an eventual Doha agreement (along the lines of the July 2008 proposals) on the levels of current US farm support and the level of binding disciplines such an agreement could have. The authors also argue that strengthened disciplines in the 2008 draft agricultural modalities under the Doha Round WTO negotiations would reduce the U.S. leeway for providing trade-distorting support. Also, proposed product-specific caps on the Aggregate Measurement of Support

(AMS) when fully implemented might prove limiting for some politically sensitive commodities such as cotton and sugar. At the same time, the new ACRE program could make it more difficult for the United States to meet the proposed Doha commitments on support since payments can be triggered even when prices are high. The authors show under what price conditions farm payments under the new ACRE program could exceed the Doha Round draft modalities of 2008.

In Chapter 4, **Bureau** and **Gohin** review the European Union's (EU) Common Agricultural Policy (CAP) and examine the empirical evidence for production and trade distortion impacts of the CAP. The CAP policy is complex, targeting many objectives and involving interrelated instruments. The series of reforms since the early 1990s are due largely to budgetary pressures, environmental concerns and foreign pressure through the WTO. The Uruguay Round negotiations, for example, were a crucial factor in prompting the 1992 MacSharry reform, and subsequent CAP reforms have been largely driven by the WTO and accommodation of its *Everything but Arms* (EBA) initiative for least developed countries. The authors then detail the decoupling of EU farm support and the introduction of the Single Payment Scheme to compensate for cuts in support prices. As implemented, decoupling is by no means uniform across agricultural commodities or between Member States. The latter can opt for partial decoupling, or can chose to make payments on the basis of a farm's historic entitlements or on a flat-rate regional basis. Despite being decoupled from agriculture, single farm payments remain linked to land since the recipients must be 'farmers' and the requisite area of farmland must be at the farm's disposal.

In response to production and trade-distorting impacts of the CAP, Bureau and Gohin argue that the EU farm support policy has generated a significant externality by stabilizing its own domestic prices at the expense of net food importing countries. For example, the authors posit that during the 2007-2008 food crisis, the overall effect on world prices of the EU tariff cut was likely to have been comparable in magnitude to the much criticized decision of rice exporting countries who had implemented export restrictions. In terms of policy impact on developing countries, the authors emphasize the complexity of the effects and the heterogeneity of the developing countries own positions. The authors point out that there are many methodological challenges facing empirical studies on policy impacts and that current models are inadequate to account for all the necessary interrelations between policy instruments. On the possible evolution of the CAP, the authors conclude that the future outlook for CAP is uncertain and that its fate will depend more on post-2013 budgetary decisions than on an eventual Doha agreement. Finally, the authors address the impact of EU bioenergy policies on developing countries and stress that future biofuel policies will likely be shaped not only by economics but equally by sustainability criteria related to climate change and GHG emission goals.

Chapter 5 by **Anton and Moreddu** presents the OECD framework for the analysis of risk management in agriculture and applies it to measure the magnitude of risk-related measures in the Producer Support Estimates (PSE). In most OECD countries farm policies affect considerably the risks faced by farmers, and these policies may have distorting effects, but perhaps smaller or more indirect ones than more output or price based support measures. The authors indicate the types of risk management instruments normally utilized and how they can affect farm decisions and outcomes. They also review a series of policy dilemmas concerning risk related measures, such as, for instance, the possible crowding out of private sector risk management providers, and whether risk measures indeed increase farmer welfare.

Chapter 6 by **Bouet and Laborde** addresses the issue of market access of agricultural trade and the likely impacts of cutting border restrictions under a Doha agreement. The main argument of the paper is that market access restrictions (mostly tariffs) can be shown to be more distortive than domestic support on world welfare and on developing countries' agricultural trade. This is because an import tariff is equivalent to a combination of a production subsidy and a consumption tax; because import tariffs are much more prominent than domestic support, and because tariff dispersion is much larger than domestic support dispersion. Tariff escalation is still sizeable and the importance of the specific component makes protectionism volatile. Market access restrictions are particularly severe for developing countries. For example, the 70 countries most penalized by agricultural protectionism are developing countries. However, market access restrictions vary widely across countries and between products. They depend not only on developing countries' income and development levels but also on whether countries are subject to MFN or preferential tariffs, on countries' product specialization, and on their net trade position. Agricultural protection is particularly high for a small number of commodities such as sugar, meat products, dairy, and tobacco and beverages. The authors carried out a model-based assessment of the Doha round and compared the trade and welfare effects on several developing countries under the Doha modalities of July 2008 to complete trade liberalization. The authors conclude that the impact of the Doha July 2008 proposal on developing countries agriculture will remain modest due to numerous flexibilities.

Anderson in the following chapter (7) uses a World Bank study that estimated agricultural distortions as the basis for arguing for trade liberalization and removal of policy interventions that could hinder freer trade. In the World Bank study, agricultural distortions were proxied by the Nominal Rate of Assistance (NRA), which measure the percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention. The study covered 75 countries from the period of 1955 to 2007. For each country, the NRA was estimated separately for import-competing, exportable, and nontradable farm products. Overall, the NRA estimates show that aggregate farm support for

High Income Countries (HIC) rose steadily from the 1950s to the late 1980s before declining slightly over the 15 years to 2004. In contrast, developing countries followed broad trade and price policies that taxed farming in aggregate from the early 1960s to the late 1970s/early 1980s before gradually reducing that taxation. By the mid-1990s, they switched to slightly positive assistance to agriculture in the aggregate. Rice, sugar and milk are the most assisted products in both HIC and developing countries, followed by beef and poultry meat and cotton (for HICs). Such tariff dispersion implies greater welfare costs from distortions than would be the case if NRAs were equal across products. When expressed on a per farmer basis, the gross subsidy equivalent (GSE) of these distortions varies greatly between high-income and developing countries. In 1980-84 the GSE in high-income countries was already around $8,000 and by 2000-04 it had risen to $10,000 on average, or $13,500 when 'decoupled' payments are included. In contrast, the GSE in developing economies was minus $140 per farmer in the first half of the 1980s and rose to around $50 per farmer by 2000-04- or about less than one percent of the support received by the average farmer in high-income countries.

Anderson argues that the policy reforms undertaken by developing countries since the 1980s, while contributing to removing taxation of agriculture, nonetheless remain unfinished. For example, developing countries, while cutting agricultural export taxes, are also raising agricultural import restrictions. Trade measures at the border (already dominant in the NRA estimates) are still too high and their reduction will greatly benefit countries via trade expansion. Moreover, there are still high tariff peaks for some commodities, implying a need for larger proportional reductions in high tariffs and a commitment to place a cap on farm tariffs. In addition, insulation of domestic food markets from international volatility has changed little, so the latter continues to be exacerbated by the former. International food markets remain 'thin' and adjustments to shocks, such as in 2008, take longer than if markets were freer to adjust and participants did not have to guess how governments might alter their interventions. Anderson argues that developing countries should not use the flexibilities allowable under WTO rules to keep high tariff protections. Instead, they should equalise the treatment of agriculture versus non-agriculture sectors. Rather than providing direct support to farmers, developing countries should rely on more-efficient domestic policy measures for raising government revenue (e.g., income and consumption or value-added taxes in lieu of trade taxes) and to assist farm families through public investments in rural education and health, rural infrastructure, and agricultural research and development.

Chapter 8 by **Conforti** reviews agricultural insurance in developing countries and concludes that most government (public) supported insurance schemes suffer from lack of financial sustainability, crowding out of private insurances, inefficiencies and lack of demand from farmers. The author applies the concept of "risk layering", borrowed from a study by World Bank, to categorize different types of risks facing farmers from the perspective of their insurability. Three risk layers were distinguished:

retention layer (non-insurable risks absorbed by producers), insurance market layer, and tail risks layer (catastrophic type losses beyond the ability of insurance firms to viably cope with). Layers are determined by the specific risks of each environment but their size also depends upon the market for agricultural services, and government's policies which affect decision making. The author then reviews index-based or parametric insurance, whereby disbursements to insured are made once the target level of indicator is reached. This approach has been proposed as an alternative to the many failures of traditional insurance programs which have rarely worked adequately under developing country conditions given the lack of necessary information to ascertain the level of damages. These index-based insurance schemes are often supported by governments and assisted by international donor and development institutions such as the World Bank. Finally, the author reviews a number of insurance programs in developing countries distinguishing between those that are privately run (rare cases), from cases where governments re-insure against catastrophic cases, to cases where governments subsidize premiums (most common). There are few success stories among these programs, leading the author to conclude that agricultural insurance may not be a panacea and that it must be viewed as part of a broader risk management strategy, which include enhanced access to agricultural services. Also, avoiding premium subsidization and/or granting support only temporarily (exit strategy) may contribute to counteract some of the problems encountered in the existing agricultural insurance programs.

In the following chapter (9), **Dorward** discusses input subsidies targeted to small farmers growing staple foods in developing countries. In this detailed study, Dorward reviews the economics of subsidies and provides an overview of the arguments for and against subsidies. In particular, the author reviews the various reasons behind the many failures of input subsidy programs in the past by developing countries. These past failures stem primarily from the large size of these programs which are costly due to large transfers to recipients, many of whom are not in need of such support. These programs also encourage rent seeking behaviour from various powerful stakeholders (usually not the small poor farmers).

Dorward then lays out the conditions he sees as necessary for effective use of input subsidies: input subsidies are likely to succeed best when they are applied to overcome market failures constraining their use; when they are applied to production of staple crops (grains and tubers); when they can be targeted to farmers who otherwise wouldn't or couldn't use inputs without subsidies, and when they can be rationed to limit costs. Implementation should be with the aim of creating market thickening, building farmers' know-how and capital, improving supply systems, and dynamic spill over effects on rural economies and other agricultural activities beside the targeted commodities. At the same time, Dorward cautions that input subsidies entail substantial risks in terms of costs and ineffective implementation, especially if input subsidies are not accompanied by large complementary investments, and by other necessary output market development policies and institutional support.

Another weakness inherent in all past government-run input subsidy programs is the political economy considerations due to "leakages" (subsidies not going to those producers targeted and not the staple commodities but to high-value cash crops, often grown by larger producers less likely to need a subsidy). Finally, the author reviews several fertilizer subsidy programmes in Africa and shows that often these input subsidy programs tend to over-emphasise production target objectives without due consideration to consumer interests or to wider pro-poor economic growth. As a result, input subsidies programs, as currently implemented in many African countries, are rarely implemented with necessary complementary investments in input market infrastructures and other market instruments (such as institutional support to farmers organizations) needed to ensure effective, long-term implementation of such programmes.

The final chapter (10) by **de Gorter** addresses the issue of carbon offsets and targeted agricultural subsidies for climate change and greenhouse gas mitigation. This is a new topic with potentially large consequences for shaping agricultural development, especially among developing countries. The author argues that carbon offsets and targeted subsidies will largely benefit developing countries on the simple premise that developing countries agriculture contributes close to ¾ of all agricultural sourced GHG emissions. The author also argues that most of the mitigation potential in developing country agriculture will be from emission abatement activities resulting in changes in production practices and not from reducing fossil fuel consumption and output. Technology-led change can be facilitated with carbon offsets in the form of targeted subsidies for abatement activities. However, because of market failures in the development and diffusion of technologies in developing countries, large amounts of public expenditures in R&D, extension services and technology transfer packages are required. Using a highly stylized and simplified conceptual model, the author argues why targeted subsidies for abatement (e.g., subsidies for clean technologies) are preferable to a tax on emission such as cap-and trade. His main line of argument is that a targeted subsidy for abatement induces less leakages (i.e. transfer of GHG emitting activities within a country or internationally) than a tax on emission such as cap-and-trade. Finally, the author argues that the Clean Development Mechanism (CDM) as currently designed (and little used in developing country agriculture due to high transaction costs) needs to be modified and preferably changed from project-based to sector or regional based. The author concludes that new financing mechanisms, such as a Climate Fund, may be needed to achieve the desired goals of GHG emission reductions.

1

Farm support policies that minimize global distortionary effects: A synthesis

Aziz Elbehri and Alexander Sarris[1]

Introduction

A necessary condition for global food security is adequate global food production to meet current and future food demand. Increased investment in agriculture and adequate incentives to farmers are required to meet this global challenge. During the past century many now developed countries (largely the countries of the OECD) found it necessary to support farmers in response to a variety of external and internal economic events and pressures. Such support grew and became an integral part of countries' economic policies to the point of causing considerable frictions in the trade relations between key developed countries. At the same time many such policies caused distortions in international trade that affected negatively many developing countries. This "disarray" in international agricultural trade, to use the terminology of the late D. G. Johnson, provided the motivation for an Agreement on Agriculture (AoA) during the Uruguay round of trade negotiations in the context of the then General Agreement on Trade and Tariffs (GATT) that culminated in the creation of the World Trade Organization (WTO) in 1986. The AoA specified the general rules of agricultural trade, organized the various types of farm support into categories, and placed agreed limits on the use of trade distorting support.

Most developing countries showed small interest in the AoA as many of them had not provided significant farm support or protection to their agricultural sectors. In recent years, however, several developing countries have also faced pressures to support their agricultural sectors and farmers. The recent global food price spike of

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2007-8 alerted many countries, both developed and developing ones, to the need for adequate food production in the future, and raised concerns about global food adequacy. There have been questions raised about the push towards reduction in farm support under the WTO, as this may reduce farm incentives and reduce food production. It is generally acknowledged that increased farm and food production requires adequate incentives for producers. Hence a key question is how to shape and design incentives and support to farmers in both the developed as well as the developing world while minimizing distortions to global markets.

Developed countries provide support to farmers to increase farm income, reduce income variability, improve competitiveness of the agricultural sector, and provide for safe (in terms of production processes and health) and quality food. Recently other functions of agriculture, such as environmental services, have provided additional impetus for farm support. Many farm support policies stimulate domestic production, but also create distortions in world markets, inducing disincentives in developing countries' agricultural production in the long run. These distortions have been the objective of considerable debate within the WTO agreement on agriculture (AoA), where three "boxes" have been identified (amber, blue, and green) to classify the degree of distortion of various domestic support policies, in the sense of their negative implications for trade of other countries. At the same time, developing countries are not affected uniformly by OECD policies owing to differentiated selective trade preferences between countries and heterogeneous trade positions at the country and household levels. Moreover, the global environment under which the OECD support policies operate has changed over time from endemic excess supply and falling real commodity prices to rising prices from stronger demand, driven in part by the rise of demand for biofuel feedstocks in light of the pressing need to face up to environmental impacts of climate change.

Several measures can be pursued by developing countries to mitigate the effects of distortionary farm support and stimulate agricultural production and development. Moreover, farm support in high income countries is not the only impediment to agricultural growth and poverty reduction in developing countries. Over the last 3 decades, public investments in agriculture in many developing, especially least developed, countries have declined in real terms. Since the onset of the structural adjustments in the 1980s and the policy reforms that followed under the general push towards "liberalization", many developing countries experienced a disengagement from agricultural investments and spending not matched by the private sector and the results of these reforms have been at best mixed. Frustrated by lack of progress, many developing countries have grown wary of the so called "Washington Consensus" whereby developing countries governments were advised to get out of agriculture and be replaced by the private sector. The recent food price crisis (2007-2008) jolted many complacent governments in developing countries to reverse course and commit to new investments and support toward agriculture as the concern for food security took on a high priority status. The donors and developments agencies themselves have come around accepting the critical importance of agriculture and there has been a noticeable shift in their programs, in the last two years, with increased attention to agricultural development.

The chapter provides a review of farm support in high income countries, and discusses options for support to achieve some of the same objectives in a less distorting fashion. It also addresses non-distorting responses that could be adopted in developing countries to support farmers, ensure a long term and sustained faster growth in the agricultural sector, enhance food production and rural incomes, and lower poverty. The chapter is divided into two parts. In part one, the chapter focuses on the OECD farm support policies and their implications for market distortions in third countries. A particular focus will be given to decoupled support and the complementary policies needed to support developed countries farmers without resorting to distortionary support. Other issues examined are risk mitigation and insurance related schemes, trade and market access reform under the Doha Round, and biofuel policies.

The second part of the chapter addresses the policy responses in developing countries that address both the challenge of policy-induced market distortions as well as seeking new impetus to revive production capacity to meet the growing demand for food. Among the issues addressed in the second part are the issues of investments, trade policy, effective input subsidies, insurance and risk management schemes, and carbon offsets under climate change. Our goal is to examine the issues analytically and arrive at recommendations as the types of policies that could be least distortive in achieving a given policy objective. We draw largely from the literature and key insights from two expert meeting consultations held at FAO Rome between December 2008 and May 2009 on this topic.

1.1 OECD farm support and distortionary effects

Current OECD agricultural support encourages production and discourages consumption of agricultural products within the OECD; this increases OECD agricultural net exports, reduces the volume of rest of the world net agricultural exports and tends to reduce commodity prices in world markets. Hence it reduces returns to non-OECD agricultural producers and thus inhibits investment and agricultural development. Consequently, agricultural support in OECD countries is costly and distorts international commodity markets. It also disproportionately benefits wealthier households that own large amounts of agricultural land and it raises food costs, which disproportionately reduce the real incomes of lower income households (Skully, 2009). However, agricultural support is not uniformly distorting. Concerning producer price support, a tariff causes more trade distortion than an output-based payment because the former increases production and reduces domestic consumption, while producer price support only raises production. Thus, the tariff causes a larger reduction in imports and a larger decline in the world price of the commodity.

The overall OECD support to farming has been remarkably stable over time despite periodic reforms since the on-set of the Uruguay Round. According to OECD, from 1986-87 until 2005-07, the value of OECD agricultural production increased by 53%, while total producer support increased by 10%. The ratio of producer support to the value of production declined from 40 to 29%. Market price support and payments based on output have decreased. Combined, support based on commodity output accounted for 82% of total support in 1986-88; in 2005-07 it accounted for 55%. Consequently, the aggregate trade-distortion coefficient for OECD agricultural support declined from 0.96 in 1986 to 0.74 in 2007. Also the estimated Producer Subsidy Equivalent (PSE) for all OECD agricultural support has declined from 39% of the total value of agricultural production in 1986 to 23% in 2007 (Skully, 2009).

These slow but declining levels of distortionary policies reflect a re-instrumentation of support policies in OECD countries. In the OECD countries, support based on commodity output is the primary means of producer support, while tariffs are the predominant form of border measure. Restrictions on market access (such as tariffs) by OECD countries account for almost all – over 90% – of these distortions. Market price support and payments based on output have decreased. Also, export subsidies and foreign surplus disposal, heavily used in OECD in 1980s, are now relatively minor.

OECD farm support policies are distinguished and categorized by the "transfer basis" of support (Skully, 2009). Transfer is made on the basis of output, input use, area planted, animal numbers, receipts, income and non-commodity criteria. Overall the distribution of support across different instruments has also changed significantly over this period. Market price support and payments based on output have decreased.

1.1.1 Decoupled support

Since the mid-1980s, when multilateral agricultural trade negotiations began under the Uruguay Round, many OECD countries enacted policy reforms which essentially re-instrumented the support instruments by introducing direct payments to producers. These tax-financed payments partially compensate for policy reforms such as reduced tariff protection and lesser reliance on product-specific support programs. One form of direct payment, decoupled support, has been introduced in the United States and the European Union. Decoupled direct payments are based on past, non-current, characteristics of the recipient's farm operation and are not contingent on producing agricultural output or employing factors in agricultural production; nor are they contingent on receipts, income, or current prices. The payments are financial transfers to individuals.

Direct payments distort output and trade, but to a lesser degree than tariff protection. Decoupled payments are introduced to replace pre-existing support policies: they represent an attempt to exit from agricultural support (Skully, 2009). They are a product of political and budgetary necessity. What recipients provide in return for decoupled support is refraining from opposing policy reform. Decoupled payments do not provide a direct incentive to produce a particular output or, indeed, any output; similarly there is no direct incentive to employ any productive factors. Decoupled payments do not yet account for a large share of OECD agricultural support but their share is increasing. From less than $2 billion in 1986-88 this form of producer support reached $48 billion in 2005-07 (Skully, 2009). Decoupled payments are now the second most important means of support to agricultural producers in OECD countries.

The distortionary effects of farm support are examined in the literature from the prism of their "degree" of coupling/decoupling from production and input use decisions. Payments based on area, historical entitlements, input constraints, and farm income are decoupled from current production decisions and hence have a lesser impact on production and trade. WTO defines decoupling only in the context of farm income support, but not in correcting for market failure or to provide for public goods. Decoupled payments can change with market prices, but they must be financed by taxpayers. Policies correcting for market failures or providing public goods normally affect production and need to be evaluated in terms of their being minimally trade distorting (Baffes and De Gorter, 2005)

Decoupled support has smaller production effects because these payments are fixed in value and not contingent on any current action by the recipient. However, while payments are not directly tied to level of output, payments themselves can influence future production decisions. This is because payments can reduce farmers' aversion to risk through the 'wealth effect. Depending on how payments are disbursed, the variability of farm income can be reduced, hence reducing risks facing farmers, and lead to increased output. Also decoupled payments can affect farmers' investment and exit decisions by relaxing constraints facing them in capital and labour markets.

Using a household model framework, Skully (2009) examines how different types of households have different responses to decoupled payments and what characteristics a decoupled policy must have to ensure minimal production-distortion and trade-distortion effects. Decoupled payments may influence a recipient household's decisions through credit. The receipt of a decoupled income transfer by a net creditor household may simply be deposited into savings or invested in other financial assets. It increases household net worth but does not relax any binding financial constraint on the household. In contrast, a decoupled transfer to a credit-constrained household can relax the binding credit constraint and expand its feasible choice set. There are at least two ways decoupled payments can relax the household's financial constraint. The direct effect is that the payment increases current cash flow. The indirect effect may arise because the entitlement to a stream of decoupled payments may improve the recipient's credit rating.

Skully (2009) argues that decoupled support is redundant since most recipients do not need government support. Existing decoupled support is based on agricultural land ownership or use in a specific base period. Much of the value of coupled agricultural support is capitalized into the value of farmland; reducing coupled support will reduce farmland values. Linking decoupled support to land partially compensates or mitigates this decline in asset values. Consequently, the value of decoupled support is correlated with land ownership and large landowners receive most of the payments. Thus most decoupled support goes to wealthy recipients and the additional income has little impact on their decisions. There are low-income recipients but they receive a very small share of payments and they account for a very small share of agricultural output. The small production impact we observe from decoupled payments, comes, in large part, from recipients that have low incomes or that can not obtain credit: additional income can influence output in such cases, but the quantity increase is low. The bulk of agricultural output in the OECD is produced by households that are wealthier than the average household. With relatively complete markets and higher farm household incomes the scope for production effects under decoupled support is lower.

Besides reducing the level of distortions, OECD decoupled support policies could also strengthen the capacity to maintain an agricultural production "reserve". Such policies which could include support for land set aside, support for technology and farm human capital skills, incentives to maintain set-aside land in production ready and environmentally sustainable condition, and other similar policies could be a powerful alternative to physical and very expensive "commodity reserves" which are not only hard to organize, but also very questionable in their effectiveness. On the other hand set-aside productive land can be brought into physical production in high income countries within 6-10 months (the recent supply response is evidence to that), providing a powerful reserve to any future food shortages while, at the same time, not distorting current global markets with overproduction.

1.1.2 Market access restrictions to trade

It is commonly acknowledged by economists that market access restrictions imposed by OECD countries on third countries products have greater impact on agricultural trade than domestic support. According to the GTAP database estimates of support to global agriculture and processed food in 2001, import tariff barriers represented 81.4% of total support to agriculture in all countries (tariffs accounted for $691 billion, direct domestic subsidies accounted $97 billion, and export subsidies only $61 billion) (Anderson, Martin and Valenzuela, 2006).

Market access restrictions come in the form of tariff barriers and a wide range of non-tariff measures (standards, seasonal restrictions, tariff-rate-quotas, etc.). The relatively higher prominent role of market access vs. domestic support can be explained by different factors. First, from the economic theory of protectionism, tariffs represent a double distortion acting as both a consumption tax and production subsidy (Corden, 1977) whereas domestic support is mostly a production subsidy. Second, tariffs are widely adopted in agriculture and all countries use them, developed and developing ones, even in cases where no domestic support is present; moreover tariff dispersion is high not only in terms of products but also in terms of partners (because of regional agreements, preferential schemes and tariff rate quotas).

Market access to agricultural trade is still restrictive for developing countries. The 70 countries most penalized by agricultural protectionism are developing countries (Bouet and Laborde, 2009). However, market access restrictions are not uniform across products, countries, and groups of countries, depending not only on developing countries' income and development levels but also on whether countries are subject to MFN or preferential tariffs, on countries' product specialization, and on their net trade position. Exports from developing countries still face high import barriers, except for countries that benefit from preferential tariff access such as under the Generalized system of Preferences (GSP), the African Growth and Opportunity Act (AGOA), the Everything But Arms (EBA) initiative etc .

Tariff liberalization studies converge in concluding that tariff liberalization accounts for the lion's share for potential increases in trade and global welfare (much more than domestic support). Not only do tariffs hinder trade directly (being equivalent to a consumption tax plus a production subsidy), but they are also the most widely used instrument of trade protection. Import barriers account for over 80% of total support to agriculture in all countries (Anderson et al., 2006). Trade liberalization studies concur that tariffs are by far the main source of distortions and account for more than 90% of expected benefits and that developing countries, as a group, could be large beneficiaries of these reforms.

However, developing countries are a very heterogeneous group, some are net exporters others net food importers and so the impact of protectionist policies in OECD can be quite different from one country to another. Also trade policy and impacts of liberalization affect LDCs (least developed countries) differently from MIC (middle income countries). A recent assessment by Bouet et al. (2008) of the Doha Round latest proposal as of 2008 shows that some of the LDCs will lose out from the reform, if they rely on few commodities for exports and export high shares to markets that offer preferential treatments. LDCs from Africa that export more to EU are in vulnerable position.

Market access restrictions are not limited to import tariffs. Non-tariff barriers can often impede trade severely, as in the case of agriculture. Disdier, Fontagné, and Mimouni (2008) show that Sanitary and Phyto-Sanitary (SPS) measures and Technical Barriers to Trade (TBT) are highly prevalent in the OECD agriculture, and that they negatively influence OECD imports. These authors' estimations also suggest that SPS and TBT significantly reduce Developing Countries and LDCs exports to OECD countries while having no significant impact on trade between OECD members. Clearly, a new Doha Round agreement must place a significant ceiling on commodity-based distortionary farm support and must include significant reductions in market access restrictions.

One way to remedy the perceived inequity of OECD governments spending large amounts of resources to support their agricultural production is to propose a counter-measure as compensation for developing countries agriculture, especially for those countries badly in need of assistance to prop up their production capacity, particularly among the resource-poor countries. The basic idea is for OECD countries to offer compensatory financing for developing country producers as a way to achieving fairer trade. One option is to agree that a certain percentage of farm subsidies in OECD countries be put into a global development fund to be distributed to eligible developing country (especially LDC) farmers along established criteria for eligibility, such as the estimated distorting effect on them from developed country policies. The funds could be used for projects to raise production, ensure sustainability of productive resources, agricultural research, and improvement of local human capital that is tied to agriculture.

1.1.3 Risk management and policies in OECD

As OECD farm support shifts from commodity based to decoupled measures, farm incomes have become more variable, and safety nets in the form of risk mitigation measures, such as revenue or weather insurance have been increasingly relied upon to provide protection from unpredictable swings in farm incomes. Several agricultural policies have been justified, through time, with the attempt to reduce farmer's risks and stabilize agricultural income. For instance, support policies adopted by OECD countries until the late 1980s were directly aimed at reducing price and income variability, while at the same time pursuing a wider reliance on domestic production. It is known, however, that rather than reducing variability, price support coupled with the necessary market protection has resulted mostly in a transfer of instability from some markets to other markets and specifically from OECD markets to the rest of the world. The need to bring agricultural tariffs and agricultural policies in the GATT and later in the WTO resulted, *inter alia*, from the increased trade integration and the related improved awareness of the instability that was being transferred from some markets to others.

Considering the major recent agricultural policy developments in the OECD – particularly the 2008 US Farm Bill, Canada's Growing Forwards Framework, Mexico's increasing support to price hedging, the Australian on-going revision of drought policies and EU Health Check of the Common Agricultural Policy - there seem to be an increasing attention to risk and the risk-related effects of agricultural policies (OECD, 2009).

One popular idea in OECD countries has been that insurances can substitute for market intervention as a tool to shield farmers from income and production risks. Insurances, *per se*, are market-based products, which can be sold at a market price and such price reflects the degree of risk attached to risky event, as computed by the insurance company. The decision of a farmer to purchase insurance should, therefore, depend on her/his own risk consideration, and should not require public intervention. The only public good that the State may supply into this market is information, which may not be universally and/or symmetrically available: hence validating, certifying and diffusing the data required to assess probability distributions of risky events is virtually the only role that public policies should logically play in the insurance market.

Yet agricultural insurances have been widely subsidized in OECD countries. They are classified as "green box" or "minimally distorting" policies in the WTO negotiation. In the US, for instance, farm insurance and payments under crop and weather insurance are projected to reach $22 billion in the 2008-2012 period; this represents a substantial share of total farm support. The EU has also started re-examining its current agricultural insurance schemes, based on the observation that existing ones tend to be inefficient, expensive, and distortionary, as they entail high transaction costs and tend to increase the expected returns of covered products.

Sources of risk in agriculture are numerous, diverse, and often interrelated (OECD, 2009). They include prices, as well as a diversity of weather, pests and diseases hazards, or personal circumstances. Unexpected changes may occur in access to services such as credit, finance, or in the legal framework. Managing risk is an important part of farming, and improving risk management is a concern for several Governments in the OECD. Risks that are frequent but do not imply large losses are typically managed on the farm. Risks that are infrequent but generate a large amount of damage to farm income are likely to fall under the catastrophic risk layer, for which market failure is more likely. In between these two layers there are intermediate risks for which some insurance or market solutions can be developed. It is important to allow solutions to each type of layer to develop so that a variety of instruments are available to farmers.

Given the prevalent government support to agriculture in OECD countries, it is difficult to disentangle risk management from these policies. All agricultural policy measures have an impact on risk. Some of them, however, are specifically designed to reduce price, yield or income variability, or to smooth consumption and thus help farmers in managing risk, either because they prevent or reduce the occurrence of risk (risk reduction), or because they limit the effect of risk on income (risk mitigation) or consumption (risk coping) (OECD, 2009). An example of risk reduction measure is vaccination for animal disease control. Market price support (MPS) measures, which stabilise domestic prices, also reduce price risk. Risk mitigation and coping can operate through established (ex ante) mechanisms, such as countercyclical payments with variable rate, subsidies to insurances, futures, options, income tax smoothing, diversification, or income stabilisation programmes. Ex post interventions, such as disaster payments include mainly ad hoc assistance to compensate income losses in the aftermath of a catastrophic event. In the U.S. subsidized insurance, which was started in 1980, seems not to have replaced the need for disaster assistance (Glauber, 2004). On the other hand, evidence from the EU shows that countries where insurances are less common spend more in ex post disaster payments (Garrido and Bielza, 2008). OECD (2009) report that risk-related policies account for a significant share of the Producer Support Estimate (PSE) in OECD countries, about 51% in the European Union and 63% in the US for 2002-07 average period.

The existence of support policies that reduce risks may reduce the willingness of farmers to engage in on-farm mitigation strategies, or to purchase insurances. However, policies may tackle risks which are not insurable by the private sector, and are complementary to insurable risks, and reduce information gaps and asymmetries, hence leading to an increase in the demand and supply of market based risk management tools. Evidence for the OECD indicates that the cost of yield insurance in excess of a "fair" premium increases with diversification, and that the proportion of planted area insured decreases with the size of the Single Farm Payment for major crops in the EU (OECD, 2009). Evidence also indicates that market-based risk management tools are better suited for reducing risks but other support measures, such as area payments, are found to be more transfer efficient in terms of profits or income, and less efficient in reducing risk (OECD, 2005).

Another policy dilemma arises between the objective of reducing risk and that of minimising the distortionary impact of policy measures on production and trade. In fact, all programmes which affect variables in the current period, such as prices or revenues, do affect production and trade in a number of ways. Particularly, dynamic effects on production may materialize through an increased ability to invest ("insurance effects") or through a reduced risk of bankruptcy (Vercammen, 2000; 2003). Evidence indicates that measures with larger impact in terms of risk reduction, such as crop insurance and price hedging, also have relatively larger impacts on production (OECD, 2005), as they can substantially modify market incentives.

1.1.4 Biofuel policies

A growing area of complication in agricultural policies is the role of biofuels and the increasing linkage between agriculture, energy, and climate change mitigation policies in general. Since a major driver for biofuel push in OECD countries is due to production subsidies, tariffs and mandates, these support policies are becoming more in-meshed with traditional agricultural support policies adding a new dimension to the distortionary effects on agricultural production and trade. Proponents of biofuel subsidies argue that these subsidies may lessen the use of farm subsidy programs, as biofuels offer a new domestic market for agricultural products that could stimulate demand and push up prices, thus ultimately reducing the level of farm-subsidy payments. Moreover, biofuel growth tends to raise world prices thus masking the price depressing effects of traditional farm policies, making it more difficult to sort out the distortionary effects of each.

Biofuel policies are not agricultural policies but influence agricultural output and trade. Biofuel policies have the opposite effect of traditional market-price-based agricultural support: they effectively subsidize the consumption of biofuel feedstocks – maize for ethanol and oilseeds for biodiesel – and this increases commodity prices and reduces net commodity exports. Thus, current biofuel policies tend to benefit net exporters of cereals and oilseeds and to reduce the real incomes of net importers. Feedstock use is expanding rapidly and has raised concerns about global food security. In the short-run, grain and oilseed prices are likely to be higher and more variable than in the absence of biofuel programs. It appears likely, however, that alternative feedstocks will become economically viable, replacing maize and oilseeds and reducing the growing diversion of farmland to energy use.

In summary, this review of OECD farm policies and their distortionary effects, shows that overall, OECD farm support have been stable over many decades with increasing protectionism up to mid-1980’s when it began slightly declining; this coincided with the onset of the Uruguay Round which succeeded in bringing agriculture under the WTO disciplines. Since the mid-1980’s, OCED farm support policies followed a more or less steady pattern of policy re-instrumentation characterized largely by a shift away from commodity-based (and highly distortive) support to more or less decoupled support that less distortionary effects on production and trade. From the perspective of aiming to expand non-distortionary policy support, further decoupling in OECD support policies should be encouraged and expanded to more OECD countries and for all agricultural commodities. Also with increased decoupling there is greater interest in OECD toward policies that directly reduce price and income risks in other means (such as subsidizing insurance). However, to avoid creating new sources of distortions, it is important that agricultural insurance support policies in OECD deal mostly with extreme and unpredictable agricultural risks that cause market failures, and be more market-based so as to provide non-distortive safety nets to farmers.

From trade perspective, this review showed that the distortionary effects of border policies that restrict market access are larger than those of domestic support. As a consequence, much more emphasis on slashing market access provisions in the Doha agenda should be the main aim of the Doha negotiations.

1.2 Developing countries farm policies

Pubic support to agriculture in developing countries is essential for raising productive capacity, stimulating growth, improving income and reducing overall poverty. Legitimate public investments in agriculture in developing countries can be justified to correct for many market failures and to achieve higher productive capacity, reduce income and price risks and uncertainty, or preserve natural resources and the environment. Examples of the types of non-distorting policy support for developing countries are summarized in Table 1.1.

TABLE 1.1

Types of non-distorting farm support for developing countries' agriculture

Policy Goals	Types of Government (Public) Interventions
Maintain or improve productive capacity	• Research and development (new varieties) • Better management techniques • Efficient use of inputs (water, fertilizer, pesticides) • Develop input market systems • Improved storage, processing, product quality • "hard" infrastructure (irrigation, land restoration) • "soft" infrastructure (information systems, lowering transaction costs, extension of best practices)
Correct market failures	• Facilitate exchange between producers/buyers • Provision of credit (subsidized) • Technology dissemination/farmers training • Support producers organizations/inter-professions • Promote value chain development
Reduce income and price risks/uncertainty	• Support information for insurance markets • Market information systems for exchange • Investments in post-harvest storage • Veterinary services to livestock • Insurance/safety nets against crop failures, droughts..etc
Better food security and lower hunger	• Foster rural employment • Targeted input subsidies (fertilizer, seeds) • Storage/safe processing for staple foods • Subside credit to farm and off-farm activities • Staple food/cash crops promotion/demand creation • More R&D in staple food varieties, improved techniques • Investments/subsidies in post-harvest storage • Quality control for stored grain • Improve processing for perishable staples
Preserve natural resources and environment	• Soil fertility management • More efficient use of water (proper pricing) • R&D in varieties adapted to climate change • Best practices for less pesticides

Source: Compiled by authors

1.2.1 Agricultural investments

In developing countries the question is how to ensure farm support in order to increase food production and ensure food security and other growth related goals, without generating large distortions or impeding progress toward an open international trading system. In the last 20 years, many developing countries have steadily reduced spending and investments in agriculture and the latter have received a disproportionately small allocation of public resources (Bezemer and Headey, 2006). Likewise, foreign aid to agriculture has also contracted during this period. DFID (2005) shows that absolute global assistance to agriculture decreased from $6.2 billion to $2.3 billion between 1980 and 2002 (expressed in 2002 prices). Thus, agricultural aid per rural inhabitant sharply declined in the past 20 years.

This marked de-emphasis of agriculture in developing countries over the past two decades is partly blamed on the so-called "Washington Consensus" in which donor/development agencies led by the World Bank and IMF pushed developing countries to scale back public role in agriculture and promoted privatisation and market forces to steer growth. Bezemer and Headey (2006) show that market-oriented reforms ("liberalization") in LDCs, while contributing to reducing the anti-agriculture biases, also coincided with reductions in agricultural expenditure. These reforms had profound effects on the agricultural sector, since privatisation did not quite take off for lack of prerequisite conditions and resulted in a net disinvestment or simply elimination of the many public policies and institutions (e.g., marketing boards). In some cases, the dismantled public agencies were viewed as constraining private sector development while in other cases the motivation was to remove inefficiency or drains on public resources and their adverse effects on macro stability. Consequently, public spending on agriculture declined at the same time as the lowering of net taxation of agriculture. The effects of these dual-policy reversals within agriculture have been mixed (Bezemer and Headey, 2006).

The real challenge today is to reverse this trend and augment investments in agriculture and stimulate growth while learning from recent experiences and failures. Recent developments point out that such reversal is possible. The global food crisis (2006-2008) jolted many governments in the developing world to begin paying attention to agriculture after a long period of neglect, most notably in Africa where calls for sharp increases in agricultural expenditures are heard in many capitals. Even the development aid/donor community have loosened their resistance to direct public intervention and have begun reallocating more resources to agricultural development. However, the challenge is to avoid measures that would introduce large and detrimental distortions, impede the move toward a more open trading system and avoid focusing on short public expenditures that can neither be sustained nor truly contribute to long term rise in agricultural productivity and sustainably improved farm incomes. Learning from the recent experiences, both the successes and the failures would help, and the focus should be not so much on just spending money at programs and initiatives, but rather tackling institutional, bureaucratic as well as human capital deficit challenges. The latter point is particularly critical for Africa, where it has been shown that government spending in human capital is strongly linked to economic growth (Yu, Fan and Saurkar, 2009).

1.2.2 Policy-induced distortions, trade policies, and Doha Round

A. Agricultural distortions

An important element in promoting agricultural growth is trade and policy-induced distortions that limit its potential. A recent World Bank study estimated agricultural distortions for 75 countries from the period of 1955 to 2007 (Anderson, 2009). In this study, agricultural distortions were proxied by the Nominal Rate of Assistance (NRA), defined as the percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention. For each country, agricultural and non-food products were separated between importables, exportables and non-tradables and an NRA coefficient was estimated for each.

In developing countries farm policies have been driven largely by the need to accelerate a transition from low income agrarian structures to more developed industrialized and service oriented economies. The overall effect of such policies, as measured by Nominal Rates of Assistance (NRA), has been largely to tax producers (namely negative NRAs). In the process, the agricultural sectors in many countries have faced negative policy biases and low growth while inducing increasing import dependence. However, when average incomes grow (typically at a per capita income level of $ 8000 or more), the type of farmer support in developing countries seems to turn positive and seems to follow a pattern similar to that of now developed countries, namely NRAs increase as the share of agriculture in the economy declines and average agricultural and total incomes increase. The results from the World Bank study bore this out by showing that broadly developing countries taxed agriculture via price and trade policies from the early 1960s to the late 1970s/early 1980s before gradually reducing the taxation and, by the mid-1990s, switching to slightly positive assistance to them in aggregate (Figure 1.1).

By contrast, high income countries supported agriculture and that support rose steadily from the 1950s to the late 1980s before declining slightly over the 15 years to 2004. Within countries, farm support and resulting distortions were more pronounced for importables than for exportables or non-tradables. Commodities that received the highest form of support included rice, sugar, dairy, beef, poultry and cotton. Trade measures at the border (export and import taxes or subsidies and their equivalent from quantitative trade restrictions and multiple exchange rates) accounted for 75 % of the total NRA for developing countries and over 90% for high-income countries.

FIGURE 1.1

Average Nominal Rate of Assistance (NRA) to agricultural producers as a function of country per capita income

Source. Masters (2009)

When expressed on per farmer basis, the gross subsidy equivalent (GSE) of these distortions varies greatly between high-income and developing countries. In 1980-84 the GSE in high-income countries was already around $8,000 and by 2000-04 it had risen to $10,000 on average or $13,500 when 'decoupled' payments are included. By contrast, the GSE in developing economies was negative $140 per farmer in the first half of the 1980s and rose to around $50 per farmer by 2000-04 or about less than one percent of the support received by the average farmer in high-income countries. Clearly, developing countries as a whole managed to reduce or even reverse the long-standing anti-agriculture bias via changes to prices and trade policies. Unfortunately, the other side of the coin was a steady decline in investments and public expenditures on agriculture since the 1980s, a dual policy path that, for too many developing countries, had only mixeded results (if not outright negative in some cases) in terms of agricultural growth.

B. Trade policy and Doha development round

While slashing market access restrictions from high income countries would provide a significant boost to agricultural trade and hence production and growth in developing countries, the latter also need to lower their own often high border protections on their imports to fully benefit from a more open trading system; this is particularly important in light of enormously underexploited exchange opportunities in regional and south-south trade.

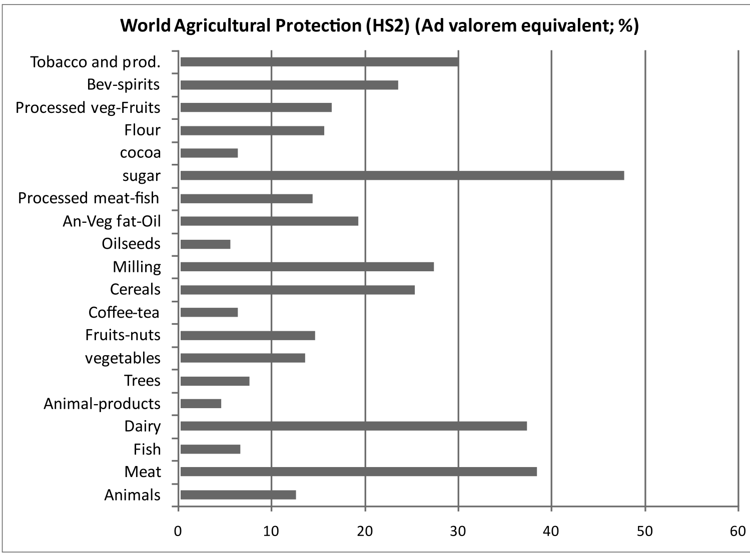
Tariff levels remain high but vary widely by region and countries, and there is a great deal of tariff dispersion between countries. Dispersion of agricultural protection between countries is high in Africa, Asia, and low in South America. In Africa, agricultural protection is relatively low in Western Sub-Saharan Africa, higher in the South African region, and even higher in the Central African and North African regions. Tariff dispersion is particularly high for Middle Income Countries like Egypt (41.5%), India (58.4%), Morocco (40.8%), Nigeria (42.6%), Thailand (38.8%), Tunisia (46.3%) and Turkey (35,3%) (Bouet and Laborde, 2009). The agricultural exports of 108 countries out of 183 are restricted by average taxes amounting to more than 15%, 29 countries by average taxes amounting to more than 30% and five by more than 50%. In terms of agricultural trade diversification, least developed countries (LDCs) rely precariously on a very small set of traded products for their trade. By comparison HICs and MICs tradable product mix is more diversified.

On a product basis, agricultural protection is particularly high for a small number of commodities such as sugar, meat products, dairy, and tobacco and beverages (see Figure 1.2). Tariff escalation is still sizeable and the coexistence of ad-valorem with specific tariffs makes protectionism volatile. For example border tariffs are higher on average for meat products than livestock, milled products than cereals, and processed food than raw commodities.

Another factor that needs revisiting in light of its impact on developing agriculture is food aid. The issue has become increasingly contentious. It is also one of a handful of significant points of disagreement in current agricultural trade negotiations under the World Trade Organization (WTO)'s Doha Round, as the United States and the European Union wrangle over the possible trade displacement and developmental effects of food aid. Food aid is often blamed for creating disincentives for small farmers in recipient countries by depressing food prices, distorting markets, discouraging overdue policy reforms and fostering dependency.

During last year's global food shock, many low income food deficit countries (LIFDCs) were unable to import enough food to maintain domestic consumption levels because of trade finance restrictions imposed by export financing institutions in developed countries. This problem is a recurring one and was supposed to be dealt with under the Marrakesh Decision of the Uruguay Round but was never tackled. A way to deal with it would be to promote the creation of a Food Import Financing Facility (FIFF). The purpose of such a FIFF would be to provide additional trade financing to the agents of LIFDCs for the cost of excess food import bills, so as to maintain normal levels of quantities of imports in the face of price shocks, or to make it possible to import extra quantities in excess of normal commercial import requirements. FAO has worked out the modalities of such an international scheme, the idea of which is supported by export financing banks.

Figure 1.2
World agricultural protection at the HS 2 level



Source: Bouet and Laborde, 2009

Commodity export earnings instability has been a long standing problem for low income commodity dependent economies. Existing or past international instruments are being debated a new. Examples include the EU's STABEX system (devised for ACP countries), SYSMIN (for the mineral sector) and the IMF's Compensatory Financing Facility. The STABEX was devised for the benefit of ACP countries that are party to the Lome Convention with the European Union. Through this policy, the EU attempted to stabilize the export earnings of the ACP countries. The STABEX objective was to reduce the instability of the agricultural export earnings of the developing countries which signed the Lome agreement. A commodity-by-commodity analysis by Aiello provided an empirical evaluation of the effects of the financial transfers disbursed by the EU. The results showed that STABEX had a positive impact on the sectors in which the drop of export earnings occurred (Aiello, 1999).

However, both the STABEX and SYSMIN (minerals) subsidy systems have been criticized for being procyclical rather than compensatory, and also contributing to the reinforcement of lop-sided production structures and not to the diversification of production. As a result, the EU has reduced reliance on these subsidy schemes.

Agricultural growth in Africa can only proceed through development of a diversification and value addition strategy, and not reliance on exports of raw materials alone. Nevertheless, a new type of policy to manage export earnings risks would be to link commodity related compensatory payments to index based financial products, so that compensation can be made automatically and objectively.

1.2.3 Input subsidies and enhancing production capacity

Input use (especially seeds and fertilizers) is obviously an important factor in improving agricultural production, productivity and farm income. Use of improved (selected) seed varieties is often associated with markedly higher yields. Likewise, lack of access to fertilizer is commonly cited by farmers as a major constraint on yields and production. Obviously, when such necessary inputs are underutilized, this inevitably points to one or different types of market failures. And input subsidies have often been used as a mechanism to stimulate agricultural production and induce agricultural growth and rural development.

In Africa, there has been a renewed interest in input subsidies to stimulate domestic production for enhanced food security, especially after the aftermath of the recent food price crisis. Such pressing demands are coming not only from the African governments, but also NGOs and supported by the international donor and development aid institutions, who have been chastened in the past by the failures of liberalized policies in supporting broad based agricultural development, particularly sustainable intensification of staple food crop production.

The question is whether input subsidies are a wise approach to spend public resources. If so, what conditions are required for successfully meeting their intended goals. Equally important are the lessons from past input subsidy experiences can we draw for designing better programs in the future. The key criteria for input subsidy success is to entice farmers who currently do not use fertilizer to do so. This means an input subsidy program would ideally avoid a situation where input subsidies are transferred to farmers who already use fertilizer without the subsidy; target products with high supply response potential and with inelastic demand and supply among poor producers and consumers (e.g., staple grains). Input subsidies should also strive to avoid rent seeking from straight transfers resulting in economic (deadweight) losses (Dorward, 2009).

Effective input subsidies are best applied to overcome market failures constraining their use, especially in the production of staple crops (grains and tubers) when input use is sub-optimal. To be effective, input subsidies must also be targeted and rationed to limit costs. This is because a general input subsidy is difficult to channel to smallholders unless there is a limited number of tightly controlled supply chains, clear ways of identifying intended beneficiaries, and a high degree of discipline and control of private fertilizer transactions (Dorward, 2009). Consequently, effective subsidies need not be large scale and across the board subsidies, for that would make them extremely costly with large transfers to recipients, not all of whom are in need of such outlays, and rent seeking behaviour from various stakeholders (especially the non-poor).

Often input subsidies are not enough by themselves. To be effective, they require large investments in complementary investments, output market development policies and institutional support. If successful, input subsidies could help develop a functioning input market and improved supply systems, build farmers know-how, and induce dynamic and spill over effects on rural economies and other agricultural activities beside the targeted commodities.

Yet, input subsidies have often run into ineffective or inefficient implementation entailing substantial risks in terms of costs; lack of exit strategy; practical difficulty of targeting the input subsidies to particular farm types; and inciting over use of inputs and adoption of input-intensive rather than labour-intensive management practices. There is also the problem of resource (mis)allocation between subsidising inputs and other priorities (e.g. research, investment in infrastructure) and on the targeted beneficiaries of the subsidies (consumers, producers, taxpayers). Moreover, input subsidies are always subject to the type of political economy considerations that have derailed programmes in the past, especially for rationed input subsidies which create opportunities for those controlling the subsidies to divert them from their intended beneficiaries, be it users (subsidies not going to those targeted producers) and/or products (subsidies not going to those low productivity crops most in need of raising input use for greater productivity).

There are few cases of success stories relating to effective use of input subsidies in developing countries. In many cases, such programs have been plagued by weaknesses of design and implementation (Dorward, 2009). Such weaknesses are often linked to the failure to develop an effective input supply and delivery system to the farmers, hence limiting any success from the intended program. The failure of past input subsidies also stems mainly from the lack of careful targeting and the absence of monitoring and evaluation of how these programs worked.

A review of several fertilizer subsidy programmes in Africa by Dorward (2009) shows that often these input subsidy programs tend to over emphasise setting specific production targets without due consideration to consumers' interests or to wider pro-poor economic growth. As a result, input subsidies programs, as currently implemented in many African countries, are rarely implemented with necessary complementary investments in input market infrastructures and other market instruments (such as institutional support to farmers organizations) needed to ensure effective implementation of such programmes in the long run.

In face of these institutional and endemic implementation difficulties in developing countries, the question is whether input subsidy is the best way to encourage higher input use when desired. Are there alternatives to input subsidies or if justified, how can input subsidies be made part of broader strategies encompassing other critical market failure remedies that can also result in more optimal use of inputs in agricultural production.

One alternative to direct input subsidies is to devote the limited public resources to the development of an effective input delivery system that can ensure greater input accessibility and affordability. Examples of intervention under this form of support include funding seed multiplication farms, support to local production/ processing of fertilizer, developing facilities to process imported input formulas, support to agronomic research focusing on developing adapted fertilizer formulas for specific crops and promoting extension demonstration for best practices in input use, subsidizing infrastructure and transport of inputs from factory to local points of sales, etc. The advantages of investing in input delivery and marketing systems are the potential widespread benefits to a large number of producers across a number of crops, allowing farmers to make optimal decisions on how much input to use and for which crops. Besides the clearly public-good dimension of such support, it also avoids the pitfall of inducing input over use and allows for fewer opportunities for leakages and wasteful rent seeking behaviour. Still the actions may not be enough to correct for too high price of inputs (fertilizer) relative to produce prices. In such case, small scale farmers may still be discouraged from input use from high costs.

Another channel to enhanced input use is better access to credit. Credit access is considered a prerequisite to input use in most farming situations. One alternative to direct input subsidy is to provide subsidized credit to farmers to finance input purchases. This form of support would overcome one of the most endemic causes of underutilization of inputs among small farmers. In fact, in many cases past state interventions on stimulating input use involved subsidized credit. Such approach has the advantages of avoiding the input-overuse possibility from subsidy and would also allow optimal decisions by farmers in deciding on the mix of input to use. However, this approach too has limitations. Even with subsidized and accessible credit, the price of unsubsidised inputs may still be too high relative to product prices and hence remain out of reach for small farmers who would need it the most. Also, misuse of agricultural credit programs in the past led to financial losses, and credits were often applied regressively (loans to well-connected and wealthy borrowers). In fact, the demise of the farm credit programs in many developing countries allowing farmers to purchase inputs, is one of the justification for opting for significant subsidies to inputs as the only option that will significantly incite small poor farmers to access and use inputs such as fertilizer.

1.2.4 Agricultural risk, insurance markets and government role

The role of the public sector in reducing agricultural risk could take many forms including supporting market-based insurance schemes. For insurance, the government role can range from simply providing the underlying regulatory framework for private insurance to subsidizing premiums or co-insurance to private schemes in cases of catastrophic losses.

The type of government role and its scope is determined by the type of risk, its frequency, and the scope of resulting losses. The World Bank (2005) offers a useful framework, termed risk layering, to categorize risks in terms of their insurability. Three layers are distinguished: (i) retention layer, (ii) insurance market layer, and (iii) tail risks layer. Layers are determined by the specific risks of each environment but their size also depends upon the market for agricultural services, and government's policies which affect decision making (Conforti, 2009).

The first layer (retention layer) implies expected types of risks that are frequent and losses that are small or manageable and are born by producers or operators. Here additional insurance normally is not required. The ability of farmers to retain small and frequent losses - that is, the size of the retention layer - depends upon access to agricultural services, and the functioning of the relative markets, such as those for credit, finance, transport, storage, or extension. Where such markets are incomplete or uncompetitive, farmers' ability to retain risks is hindered. In these cases, small scale farmers are forced to rely on other mitigation or informal ways to smooth consumption, which may perpetuate subsistence, hinder farm capital formation, and limit agricultural productivity growth (Carter, 2008). Farm support policies, such as those listed in table 1.1 can play a role in alleviating these constraints.

There are other types of unexpected events that cause larger farm losses, but which can be mitigated by risk pooling via insurances. However, the agricultural insurance market remains largely underdeveloped in most developing countries, and for multiple reasons. In most cases, farmers are simply not aware of insurance programs or cannot properly understand how their work. Premiums may be out of reach for poor farmers and high transaction and delivery costs in remote rural areas may undermine incentives for insurance companies to operate. Lack of information (on risk exposure) and high transactions costs are main causes behind market failures in insurance. In those small cases where agricultural insurance does exist, the record has been mixed, and its sustainability outside government support is often questioned (Conforti, 2009).

One approach to insurance termed index-based insurance has been promoted as a solution to the problems facing conventional insurance programs in developing countries context (World Bank, 2005). The index-based (or parametric) insurance relies on using pre-determined indemnities that can be triggered by changes in an index whose values are expected to affect individual subscribers to a pre-determined extent. Indexes replace costly *ex-post* damage assessments by insurers, and help reduce information asymmetries (required to calculate risk exposure). However, the approach implies that the subscriber assumes the so called basis risk, that is no compensation is paid for damages which exceed – or are short of - what is predicted by the correlation between the occurrence of an event (such as annual rainfall below a given amount) with the expected damage (Berg and Schmitz, 2006). Parametric insurances have been developed mainly on weather parameters, based on the notion that climatic variability is the first most important reason for vulnerability (OECD, 2008). But there may be other index types to use such as area-based yield insurances.

We have seen that governments can play a variety of roles in correcting for market failures blocking the development of insurance markets and/or helping farmers better cope with non-insurable risks via strengthening basic agricultural service markets (credit, extension, storage, market information and price policies). To overcome the market failures (lack of or asymmetric information resulting in high start up and transaction costs) that prevent the growth of private insurance markets (including index-based programs), government can provide support through a variety of channels including investments in market information systems and related infrastructure required for proper functioning of private or market based insurances. For those infrequent but high (catastrophic) loss events (tail risks layer), governments can also help with co-insurance since these types of risks cannot normally be handled by private insurance without running insurance firms out of business.

However the record of government interventions in formal insurances schemes has not been very successful. Conforti (2009) surveyed several developing country experiences with agricultural insurance schemes and found that there are cases where informal mechanisms as well as micro-insurances have been crowded out by public intervention. Conforti divided country cases studies into three categories: those cases where government assume minimum role providing no more than contract regulation and information disclosure; those cases involving government contribution to re-insure against covariate risks and extreme events; and those cases where government directly contribute to premium subsidization. In country cases where farm insurance is privately supplied as in Argentina, Ukraine and India, their coverage has been extremely small (no more than 1% of all farms) and typically covering larger farms and high value products only. Examples of government premium subsidization from Mauritius, India, Morocco and the Philippines, were found to be plagued with inefficiency and misuse. Even in schemes using index-based insurances, only few successes could be found, as in the case of Mongolia's livestock index based insurance where the government cover extreme events with assistance from World Bank loans. For other cases of government support to index-based insurance schemes such as in India (through microfinance) or in

Malawi (through farmers organizations), the verdict is rather negative on their performance.

Experiences learned from the above case studies indicate that governments tend to intervene mostly via premium subsidization and that these experiences have shown more failures than successes, due to widespread inefficiencies and sometimes misuse. Clearly, new and innovative approaches are needed. It is not enough to say we need to promote market-based insurance and other risk mitigation schemes. What is needed is to remove or correct for the underlying market failures preventing risk management solutions from becoming a normal component of farmers choice (and decision making) set. This begins with improving the critical agricultural service markets (credit, information, and other production and marketing smoothing options). Next, encouraging the emergence of fully private insurance system in poor rural areas, by involving pre-existing organizations (such as farm organizations, micro-finance institutions) and government, donor or NGO temporary support with "start-up" costs and help them develop building trust and consolidate relations. Where subsidized premiums to private insurance can be justified, this must clearly be carried out in a context of a clear exit strategy when benchmarks for transaction costs, market thickening, and coverage for small holders and producers of staple crops (not just high value crops) are attained.

1.2.5 Climate change, carbon offsets and developing country agriculture

Another emerging area with potential implication for agricultural growth and development in developing countries is the possibility of the use of carbon offsets in developed countries to promote carbon reducing but at the same time productivity enhancing agricultural technologies and investments in developing countries. Currently many developing countries governments are not willing to tackle agriculture–climate change linkage for fear that commitments to GHG reductions may undermine agricultural growth and food security. However, there may be considerable opportunities for investments in new GHG abatement technologies that may also offer new sources of investments with positive spill over effects for agriculture in terms of enhanced capacity and greater productivity. Such investments could well be financed by carbon offsets in developed countries and could provide a win-win type of carbon offset. However, to reverse the negative attitude of developing countries towards adding agriculture in carbon offsets, there is a need for technical work to specify the carbon emitting patterns of various agricultural production systems.

The market for carbon offsets is still at it infancy and there are lot of unknowns as to its implication and its ramifications. In the US, as there is a push to create a separate source of carbon allowances for farmers, who can opt for eco-friendly farming techniques or plant trees and would earn so-called offsets to sell alongside government permits on carbon markets. Such market is potentially huge given the scale of pollution coming from agriculture. Currently, the carbon-offsets market is at a pilot stage. At the Chicago Climate Exchange, a pilot program lets farmers supply credits for sale to companies, such as Ford Motor Co. and American Electric Power Co., which have agreed to voluntary emissions limits. Its sibling Chicago Climate Futures Exchange, in November 2008, began trading futures that can be used if a mandatory cap-and-trade law is enacted. Currently, U.S. legislation under proposals seek to subsidize emerging markets for environmental services, such as carbon sequestration, renewable energy production, and providing clean air, clean water, and wildlife habitat. If passed, such legislation will herald over time the emergence over time of a whole new industry based on carbon-offset system.

The implications for developing countries of these GHG reduction type programs whether incentivised by targeted subsidies or carbon offsets are not documented or understood. De Gorter (2009) argues that most of the mitigation potential in developing country agriculture will come from emission abatement activities resulting in changes in production practices and not in reducing fossil fuel consumption and output. Such changes can be facilitated with carbon offsets in the form of targeted subsidies for abatement activities. However, private agents cannot do it alone, and public investments in R&D, extension services and technology transfer packages are required. De Gorter also argues for new financing mechanisms outside the current CDMs which, as currently designed, have not proved of limited use in developing country agriculture. Moreover, this may also call for rethinking domestic agricultural policy in developing countries, such as input subsidies by rechannelling public interventions into production practices that also lead to reduced emissions. Still large financial aid to developing countries may be required given the large investment required to finance R&D and new institutions to deliver the altered production practices.

In summary, this chapter argues that while OECD farm support subsidies can be further reformed to return their negative distortionary effects on developing country agriculture, the latter can also be much more stimulated from actions developing countries can do themselves. This begins with a serious strategy for robust and sustained investments strategy for agriculture with for role for public, private and foreign direct investment. Also, improving agricultural productive capacity necessitates developing the infrastructure for input (seeds, fertilizer) supply and accessibility, and when necessary, promote effectively targeted input subsidies. Such investment strategy should also include the promotion of risk reduction and risk coping policies for poor producers. This includes market based safety nets designed as a supplement to other relevant domestic support measures.

Another area pregnant with potentially large flows of investments to developing countries (under largely unknown modalities) arises from the global efforts to tackle climate change and reduce GHG emissions. Such influx of investments could transform swats of developing country agriculture is they bring along new and improved technologies, more input use efficient and more productive. However, this is still largely a new area that requires further research and investigation. More work is needed at technical and institutional levels to understand how best to include developing countries in emerging carbon offset markets, and this could form a significant part of FAO technical work.

Finally, a new Doha Agreement would be highly desirable from developing countries perspective if it places significant ceilings on commodity-based distortionary domestic farm support and include major reductions in market access restrictions. Also, such an Agreement must allow developing countries sufficient flexibility, including a Special Safeguard and Special Products. These measures are necessary for many developing countries to successfully complete their agricultural transformation.

1.3 Summary: Options for non-distorting farm support

In the chapter the following types of policies have been identified as possibly non-distorting while at the same time meeting some of the policy objectives that are prevalent in today's world.

Encourage the further decoupling of farm policies in developed countries.

There is an overall tendency within OECD to move gradually to more decoupled forms of support and this should be encouraged. Overall, OECD commodity specific farm support has declined from over 80% in 1986 to about 50% in 2007. This reduces distortions and makes future reductions in support more politically feasible. It can also be justified as an exit strategy from farming for many developed country farmers.

OECD countries could offer compensatory financing for developing country producers.

Given the continued support to OECD farmers, fairer trade can be achieved by compensating developing country producers for distorting (amber and blue box type) support accorded developed country farmers. One option is to agree that a certain percentage of farm subsidies in OECD countries be put into a global development fund to be distributed to eligible developing country (especially LDC) farmers along established criteria for eligibility, such as the estimated distorting effect on them from developed country policies. The funds could be used for projects to raise production, ensure sustainability of productive resources, agricultural research, and improvement of local human capital that is tied to agriculture.

Promote decoupled policies to maintain agricultural production "reserve" in high income countries.

Such policies, which could include support for land set asides, support for technology and farm human capital skills, incentives to maintain set-aside land in production ready and environmentally sustainable condition, and other similar policies, could be a powerful alternative to physical and very expensive "commodity reserves" which are not only hard to organize, but also very questionable in their effectiveness.

Use carbon offsets in developed countries to promote carbon reducing but at the same time productivity enhancing agricultural technologies and investments in developing countries.

Currently in most developing countries governments are not willing to face up to the issue of including agriculture in the environmental debate, for fear that only the negative GHG contributing part of their agriculture will be emphasized. However, there is considerable room for promoting investments and technologies in developing country agriculture that will both increase productivity as well as reduce GHGs. Such investments could well be financed by carbon offsets in developed countries, and could provide a win-win type of carbon offset. However, to reverse the negative attitude of developing countries towards including agriculture in carbon offsets, there is a need for technical work to specify the carbon emitting patterns of various agricultural production systems.

Agricultural insurance in OECD should deal only with extreme and unpredictable agricultural risks that cause market failures.

As OECD farm support shifts from commodity based to decoupled measures, farm incomes have become more variable, and safety nets in the form of risk mitigation measures, such as revenue or weather insurance are been increasingly relied upon to provide protection from unpredictable low farm incomes. Existing publicly supported agricultural insurance schemes are inefficient, expensive, and distortive, as they entail high transaction costs and as they tend to increase the expected returns of covered products. In addition they crowd out private insurance companies. For insurance schemes to be non-distortive, they need to be more market based. Publicly supported agricultural insurance must concentrate on dealing with the so-called "market failure" part of agricultural risks, while leaving the other risks to be handled by the private market and farmers themselves. Hence more market-based agricultural crop insurance, that deals with market failures, must be encouraged as a way to providing non-distortive safety nets to OECD farmers.

Lower market access restrictions imposed by OECD countries on agricultural imports from developing countries, especially LDCs.

Such restrictions in the form of tariff barriers, standards, phytosanitary restrictions, etc. have an important negative impact on developing countries. Exports from developing countries still face high import barriers, except for countries that benefit from preferential tariff access such as those benefiting from GSP (Plus), AGOA or EBA. Recent analyses show that the beneficial effects for third countries of a complete removal of the CAP and other OECD trade restrictions stem mainly from the tariff dismantling. Everything But Arms (EBA) type of trade policies of developed countries versus LDCs seem appropriate.

Promote a Food Import Financing Facility (FIFF) to insure LIFDCs from sudden and adverse movements in their food import bills.

During last year's global food shock, many low income food deficit countries (LIFDCs) were unable to import enough food to maintain domestic consumption levels because of trade finance restrictions imposed by export financing institutions in developed countries. This problem is a recurring one and was supposed to be dealt with under the Marrakesh Decision of the Uruguay Round but was never tackled. The purpose of such a FIFF would be to provide additional trade financing to the agents of LIFDCs for the cost of excess food import bills, so as to maintain normal levels of quantities of imports in the face of price shocks, or to make it possible to import extra quantities in excess of normal commercial import requirements.

Promote a market based and more automatic compensation scheme for negative agricultural export earnings variations for commodity dependent low income countries.

The problems of the earlier EU STABEX scheme as well as its successor the FLEX scheme are well known, and they are due to the ex-post nature of their compensatory structure. The same is true of the IMF CFF facility. In the meantime, the underlying problem facing low income commodity dependent economies has not diminished. The idea behind the new type of policy is to link commodity related compensatory payments to index based financial products, so that compensation can be made automatically and objectively.

Promote public and private sector investment strategies.

This involves emphasis on public investments in various infrastructure and technology related areas of relevance to agriculture, as well as the promotion of public-private partnerships for the development of commodity value chains. Increased overall public investment must be combined with appropriate composition of such investments to promote growth. There is a need for appropriate guidelines for public sector investments in different groups of developing countries.

Promote the use of effective market enhancing subsidies.

These may include policies to create input and output markets where none exist, policies to promote fertiliser and other input use as part of a wider growth strategy, policies to promote competition in input supply, policies to promote pro-poor growth and food security, etc. Such policies are considered domestic support policies, and flexibility in their use could be allowed for developing countries and LDCs in the WTO agreements.

Use trade policies selectively to support and complement domestic investment programs.

The best policies to promote domestic agricultural investments are direct ones, targeted to the relevant sectors. Trade policies, however, should not undo or counter what domestic investment policies and strategies do. Hence policy space, perhaps in the form of tariff flexibility to allow for "development gaps", could be envisioned to allow developing countries to support domestic investments. In this context WTO may need to recognize and differentiate the developmental orientation of trade instruments in low income countries compared to the pure farm support nature of policies in developed countries.

Promote risk reduction and risk coping policies in developing countries.

DC agriculture is much more exposed to various natural and market risks. For lack of other instruments and safety nets, much of DC producers' savings capacity is spent in self insurance. In addition they often become trapped in low return but low risk production activities. Policies to reduce the risks faced by low income farmers and to help such producers cope with negative shocks could be instrumental in unleashing their own savings potential and moving them out of their poverty trap. Market based or publicly supported safety nets could be a useful supplement to other relevant domestic support measures, and must be allowed under the WTO agreement.

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2

OECD policy and distortionary effects: A review of the evidence

David Skully[1]

Introduction

This chapter contributes to the analysis of non-distortionary agricultural support by examining the distortionary effects of agricultural support policies in OECD member countries.

There are different forms of agricultural support and they are not equally distorting. Tariffs and domestic price supports that increase prices for both producers and consumers are generally the most trade-distorting form of support. This form of support has accounted for most of the producer support in the OECD. Removal of such policies accounts for almost all of the welfare gains from agricultural liberalization.

Since in the mid-1980s, when multilateral agricultural trade negotiations began, many OECD countries have reduced their reliance on market price supports and replaced them with direct payments to producers. Direct payments are less trade-distorting than price supports. Direct payments that are fixed and do not require recipients to produce agricultural commodities – commonly called decoupled payments – provide little or no incentive for production and consequently have almost no output- or trade-distorting effect.

Most of this chapter is concerned with decoupled payments. Decoupled payments differ fundamentally from conventional agricultural support policies. Because they do not directly influence incentives in commodity or factor markets the standard methods of agricultural policy analysis, which analyze markets, do not

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adequately represent how decoupled payments influence incentives facing recipient households. Thus decoupling presents an analytical and conceptual challenge: the research program is ascending a learning curve.

The chapter also provides a brief overview of the biofuel policies. These are not agricultural policies but they have an impact on agricultural output and trade; an impact that is likely to increase as biofuel production expands. Biofuel policies have the opposite effect of traditional market-price support policies: they effectively subsidize the consumption of biofuel feedstocks – maize for ethanol and oilseeds for biodiesel – this increases commodity prices and reduces net commodity exports. Thus biofuel policies tend to benefit net exporters of cereals and oilseeds and to reduce the real incomes of net importers. The latter effect has raised concerns about global food security.

The chapter is organized as follows. Section 2.1 reviews the evidence on the aggregate impact of OECD agricultural support on global welfare. Section 2.2 examines how OECD agricultural support has transformed in form and magnitude in the last two decades. Section 2.3, examines the distortionary impact of the major forms of agricultural support. This is the longest section; its primary concern is the analysis of decoupled support. Section 2.4 examines biofuel policy and Section 2.5 concludes.

2.1 OECD agricultural support and global welfare

Agricultural support has gained a bad reputation in popular media, particularly in the context of the Doha Development Agenda. Agricultural support in OECD countries is costly; it distorts international commodity markets; it disproportionately benefits wealthier households that own large amounts of agricultural land and, in many countries, it raises food costs, which disproportionately reduce the real incomes of lower-income households. Thus its image in popular media is not undeserved. However, agricultural support is not uniformly distorting: some forms of agricultural support are less trade-distorting than others. This distinction is often ignored in non-technical generalizations about agricultural support; indeed, many commentators appear unaware of the distinction. This section highlights three recent studies that examine the trade and welfare impacts of the different general forms of agricultural support. The objective is to provide a global perspective on OECD agricultural support before examining specific kinds of support policies in greater depth.

The WTO Agreement on Agriculture defines three pillars of agricultural support: market access, export subsidies, and domestic support. Market access includes policies that limit imports, in particular tariffs and quotas. Domestic support includes payments to producers (whether or not they are coupled to production) but that do not directly inhibit imports. Anderson, Martin and Valenzuela (2006) calculate the global welfare benefits (and costs) of full agricultural liberalization and decompose the proportion of total impact attributable to each of the three pillars of the Agreement on Agriculture – the values in each row sum to 100%. The three pillars have been combined for non-OECD countries because import market access is the source of almost all of non-OECD-generated agricultural trade distortion.

Table 2.1

Full agricultural liberalization and reform by WTO Agreement on Agriculture pillar

Contribution to economic welfare in:	OECD Market Access	OECD Export Subsidies	OECD Domestic Support	Non-OECD All pillars
		percent		
OECD countries	78	5	6	11
Non-OECD countries	84	-10	2	24
World	79	2	5	14

Of the three pillars, liberalization of market access is by far the greatest source of welfare gains. Abolishing OECD export subsidies reduces non-OECD country welfare; some agricultural exporters gain from the abolition, but many importing countries face higher import prices because of subsidy removal. Finally liberalizing OECD domestic support makes a small positive contribution to Non-OECD welfare.

This table does not provide absolute magnitudes of the welfare changes in OECD and non-OECD countries: the rows are comparable only in the distribution of benefits across columns. OECD countries benefit much more than non-OECD countries from OECD liberalization: this is to be expected, the welfare losses and tax burden of agricultural support is borne mostly by OECD consumers and taxpayers; therefore they stand to benefit the most.

Tokarick (2005) provides monetary values for these welfare changes: he considers developed country (effectively OECD) policies as either tariff-based or subsidy-based. Tariffs include market-price support policies. Everything else is classified as subsidy. Subsidy removal results in a welfare loss to developing countries; the gains to developing countries derive from removing tariffs. The bulk of the gains from developed country liberalization accrue to developed countries. See Table 2.2.

Bouët (2008) simulates a full liberalization of tariffs (agricultural and non-agricultural) and removal of domestic agricultural support and export subsidies. The results are reported as percentage changes from a baseline scenario for world trade in 2015. The indicators are the change in value of world agricultural trade, the change in value of world trade, and the change in world welfare – measured as real income. See Table 2.3.

Table 2.2

Welfare gains from developed-country agricultural liberalization, $US Billion 1997

	Tariffs	Subsidies
Developed Countries	78.6	14.1
Developing Countries	12.5	-4.7

Table 2.3

Decomposition of full liberalization by instrument, 2015

	Market Access	Export Subsidies	Domestic Support	Total
		percent		
World Agricultural Trade	39.5	-5.6	-8.2	33.7
World Trade	9.0	-1.0	-6.1	5.3
World Welfare	0.23	-0.10	-0.04	0.33

Aggregated at the global level, the only source of welfare gains or positive stimulus to trade is the liberalization of import market access. Removal of export subsidies and domestic support reduces world welfare and trade volumes. Recall that this simulation is for the liberalization of tariffs on all products, not just agricultural products. Even so, the percentage change in agricultural trade is several times that of total world trade (which includes agricultural trade): this follows from the higher rates of protection on agricultural products than on non-agricultural products. Removal of domestic support reduces agricultural trade because domestic support tends to increase production, reduce prices and encourage exports; unlike tariffs, it usually does not discourage consumption or increase prices.

That market access matters greatly and that domestic support, decoupled or not, is relatively unimportant is the consensus. Diao, Somwaru and Roe (2001), Francois, van Meijl and van Tongeren (2003), Hoekman, Ng and Olarreaga (2002), and Hertel and Keeney (2006), among others, report similar findings. Charlton and Stiglitz (2005) provide a comparative overview of this literature and place agriculture in a larger WTO context. The implications of these findings for developing countries are forcefully summarized by Dimaranan et al. (2003:17):

> [W]e conclude that developing countries will be well advised to focus their efforts on improved market access to the OECD economies, while permitting these wealthy economies to continue – indeed even increase – domestic support payments. Provided these increased domestic support payments are not linked to output or

variable inputs, the trade-distorting effects are likely to be small, and they can be a rather effective way of offsetting the potential losses that would otherwise be sustained by OECD farmers.

The welfare calculus is that if OECD expansions in import market access necessitate full or partial payment of decoupled compensation to OECD producers, it still remains a welfare improving outcome globally, and for OECD and non-OECD countries.

Before moving on to examine OECD agricultural support in greater detail, it is important to note some issues not taken into account by the modeling efforts reviewed above. Liberalization scenarios are limited to the subset of policies under negotiation, and to those policies that can be quantified and modeled. Several kinds of policy relevant to agriculture are beyond the scope of agricultural trade negotiations; among them biofuel policies – which are energy policies – as well as most non-tariff barriers.

Traditionally, non-tariff barriers referred primarily to quotas and quantitative restrictions. As a result of the Uruguay Round most quotas for agricultural products were converted to tariffs or to tariff-rate quotas and then subjected to liberalization. Such policies can be plausibly represented in simulation models. Liberalization of conventional agricultural trade barriers has revealed (and may have stimulated) other non-tariff barriers. These include customs and administrative procedures; sanitary and phytosanitary measures; technical barriers to trade (e.g. technical standards, testing and certification, labeling and packaging requirements); as well as anti-dumping duties and other so-called "trade remedies." Such barriers are often difficult to identify, and are challenging, once identified, to quantify or represent in a trade model. Thus, the model results reviewed in this section tell most of the story, but not all of it: non-tariff barriers are increasingly important[2].

2.2 Typology and trends in OECD agricultural support

We employ the typology of agricultural support developed by the OECD. (OECD 2008b) Policies are distinguished and categorized by the "transfer basis" of support. The primary transfer bases are output, input use, area planted, animal numbers, receipts, income and non-commodity criteria. The table below reports the major categories of agricultural producer support and OECD estimates of support in $ billion (OECD 2008a: 19, Table 1.1)

[2] OECD (2005) provides an excellent survey of non-tariff barriers; it includes Fliess and Lejarraga (2005) which is especially relevant for developing countries. Linkins and Arce (2002) is an accessible discussion of the challenges of quantifying non-tariff barriers; while Deardorff and Stern (1998) is the standard reference. Kee, Nicita, and Olarreaga (2009) is an important quantitative and comparative assessment of the trade restrictiveness of non-tariff barriers in 78 countries.

There is not an exact concordance between the three pillars of the WTO Agreement on Agriculture and the OECD typology. In general, market price support policies belong under Market Access as well as under Export Subsidies because export subsidies are usually a by-product of market price support programs. Other forms of support belong under Domestic Support because they are not reliant on border measures; they are financed by domestic taxes.

Table 2.4 contrasts the value of production and level and distribution of support in 1986-88, at the start of the Uruguay Round, with the most recent values available, 2005-07. In these two decades, the nominal, dollar value of agricultural production increased 53 percent; while total producer support increased 10 percent. There has been a substantial decline in the ratio of producer support to the value of production: from 40 to 29 percent. This decline merits keeping in mind when considering the general disappointment about the Uruguay Round and the supposed lack progress in agricultural trade liberalization and reform. One must consider the counterfactual: what would producer support have been in 2005-07 without an Agreement on Agriculture? We cannot observe this alternative world, but it is unlikely that there would have been such a significant decline in the support ratio in the absence of the Uruguay Round Agreement on Agriculture. [See Cunha and Swinbank (2009)] Budgetary pressures in the United States and the European Union curbed increases in domestic support, but the Agreement on Agriculture facilitated larger mutual reductions in support.

TABLE 2.4
OECD agricultural support, $ Billions

Form of Support	1986-88	2005-07	Change
Total value of agricultural production	592	903	+53%
Total (all forms of Producer Support)	239	263	+10%
Support based on commodity output	197	145	-26%
Market Price Support	184	135	-27%
Payments based on output	12	10	-17%
Payments based on input use	20	30	+50%
Payments based on current A/An/R/I*	19	32	+68%
Payments based on non-current A/An/R/I*			
Production required	<	1	-
Production non-required, fixed (*decoupled*)	2	48	+2400%
Production non-required, variable	<	3	-
Payments based on non-commodity criteria	1	4	+400%

*A/An/R/I = area, animal numbers, receipts, income

The distribution of support across kinds of support has also changed significantly. Market price support and payments based on output have decreased. Combined, support based on commodity output accounted for 82% of total support in 1986-88; in 2005-07 it accounted for slightly more than half of total support, 55%. The shift from output-based payments to payments based on area, animal numbers, revenue, or income preceded the Uruguay Round; but the disciplines of the Agreement on Agriculture further induced this shift. The greatest increase has been in payments based on non-current farm attributes and that do not require agricultural production – also known as decoupled payments. These payments are based on past, non-current, characteristics of the recipient or the recipient's farm operation. Decoupled payments are not contingent on producing agricultural output or employing factors in agricultural production; nor are they contingent on receipts, income, or current prices. From less than $2 billion in 1986-88 this form of producer support reached $48 billion in 2005-07. Decoupled payments are now the second most important means of support to agricultural producers in OECD countries.

The change in the composition of support has reduced the average level of trade distortion caused by OECD agricultural support. An OECD (2001) study [also see Dewbre, Anton and Thompson (2001)] uses an equilibrium displacement model to simulate the production-distorting and trade-distorting effects of different forms of OECD agricultural support. The distortion caused by a change in the level of market price support is the standard of measure. The trade-distorting effects of other support policies are measured relative to market price support. The impact of a policy instrument is contextual and dependent on too many varying factors to have a fixed value. The simulations are designed to capture such variations; a distribution of trade-distortion coefficients is generated for each kind of support. Table 2.5 reports the approximate median values for each kind of support. These are called "illustrative coefficients" to underscore that these values should be viewed as rough or approximate relative indicators rather than concrete point estimates. These coefficients are used to construct an aggregate trade-distortion coefficient for all OECD agricultural support. This aggregate indicator is a weighted average: each trade-distortion coefficient is multiplied by the corresponding value share of total support[3].

Figure 2.1 plots three indicators of OECD agricultural support 1986-2007. The bold black line plots the aggregate trade-distortion coefficient of OECD agricultural support. It declines from 0.96 in the 1986 to 0.74 in 2007. This reduction in OECD trade distortion is one reason why the simulated global welfare gains from OECD agricultural reform and liberalization have diminished since the Uruguay Round period. The grey line plots an index of the total (nominal dollar) value of OECD

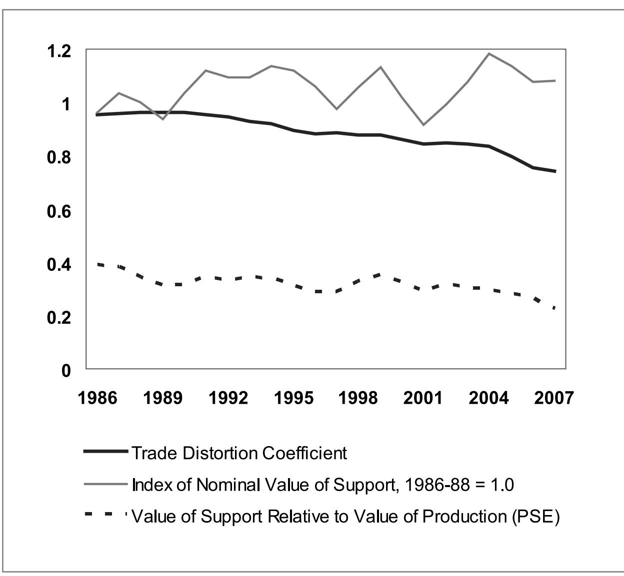
[3] Formula: Index = $\sum w_i t_i$, where w_i = value of $support_i$ / total value of support and t_i is the trade-distortion coefficient for support of type i.

agricultural support[4]. The dashed line plots the OECD's calculation of the Producer Subsidy Equivalent (PSE) for all OECD agricultural support: it declines from 0.39 in 1986 to 0.23 in 2007.

TABLE 2.5
Illustrative trade-distortion coefficients

Support Policy	Illustrative Trade-Distortion Coefficient
Market price support	1.00
Output-based payments	0.90
Input-based payments	1.30
Current A/An/R/I	0.40
Non-current A/An/R/I, fixed payment	0.10
Other, non-commodity based	0.05

FIGURE 2.1:
OECD agricultural support, 1986-2007



[4] Using the U.S. GDP deflator, a 2007 dollar is worth $0.70 1986 dollars; using the consumer price index it is worth $0.53 1986 dollars. Similarly, the trade-weighted U.S. dollar exchange index (major currencies) declined from a 1986 base of 100 to 59 in 2007.

The subsequent section considers the categories of support in the order presented in the table. The exposition is proportionate to the volume of support and the novelty of the policy. Familiar coupled policies get brief review, reserving the bulk of attention for decoupled payments. Not included in the OECD typology, but addressed here, are bio-fuel and bio-energy policies. These are considered last. The analytical framework employed follows that of OECD (2001), which is in the analytical tradition initiated by Floyd (1965) and elaborated by Gardner (1987). This market-level approach identifies the initial incidence of a policy, whether in the product or factor market, and examines how initial changes in relative prices induce changes in outputs and factor employment. Policies decoupled from output and factor markets require a different analytical framework; the relevant unit of analysis is the recipient household: thus the section on decoupled support starts with a discussion of household-level models.

2.3 The distortionary impact of OECD agricultural policies

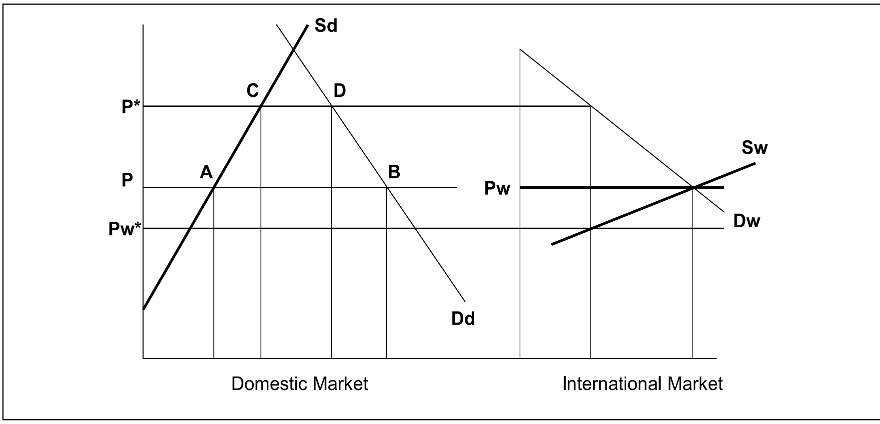
Support based on commodity output

Support based on commodity output is the primary means of producer support in the OECD. The OECD typology distinguishes between market price support and payments based on output.

Market price support encompasses any intervention that creates a market price differential between the domestic market price and the border price for a given commodity, allowing for transportation and quality differences. Tariffs are the predominant form of border measure in the OECD. Import licenses, import bans, quotas and tariff-rate quotas are also employed as are exports taxes, export controls or bans and export subsidies. Domestic price support measures include intervention purchases, administered prices and domestic production and marketing quotas. Border measures and domestic price support measures operate through markets; the market price is raised or lowered for both producers and consumers of the affected commodity.

Figure 2.2 illustrates market price support by tariff. With no tariff the domestic price, P, equals the world price, Pw; and B-A units are imported. A tariff of P*-Pw is imposed to increase the domestic market price to P*. This increases domestic production from point A to point C. The higher domestic price reduces domestic consumption from point B to point D. Thus imports are reduced to D-C units. If the importing country is a “small country” in the international trade sense, changes in its imports are too trivial to influence the international market: the world price, Pw, is unchanged. A large country can influence international prices; the reduction in imports reduces the world price to Pw*. To sustain the same domestic price, P*, a large country must impose a higher tariff (P*-Pw*) than a small country to offset the decline in the world price.

FIGURE 2.2
Market price support by tariff



Payments based on output do not directly influence prices paid by consumers. An output-based payment is usually paid directly to the producer from public funds. Most output-based payments involve a normative or target price; when market prices fall below the normative price output-based payments are generated to compensate (wholly or partially) for the short-fall.

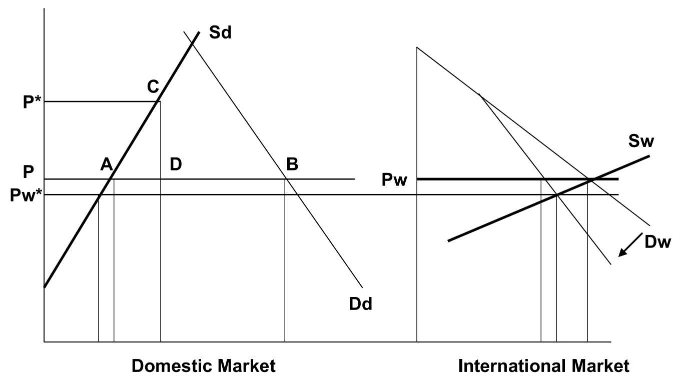
Figure 2.3 illustrates market price support by means of output-based payments. Paying producers P*-P per unit of output induces an increase in production from point A to point C. Consumer prices are not directly influenced; consumption is unchanged at point B[5]. However, the increase in domestic production displaces imports: imports decline from B-A units to B-D units. For a small country, this reduction in imports has no influence on international prices. For a large country, the international price is reduced to Pw*. The decline in the world price from Pw to Pw* results in a marginal increase in imports. It also forces the domestic government to increase output-based payments from P*-P to P*-Pw* if the target price of P* is to be sustained - as in a deficiency payment scheme.

Comparing the two illustrations and focusing on the large-country effects, it is evident that to achieve the same level of producer price support – at support price P* – a tariff causes more trade distortion than an output-based payment. Both

5 Direct payments necessitate taxes, reducing disposable income and thus consumer demand. However, the effect on demand for a particular commodity is typically infinitesimal. General equilibrium analysis is required to gauge the impact.

policies increase domestic production, but the tariff, in addition, reduces domestic consumption. Thus the tariff causes a larger reduction in imports and a larger decline in the world price of the commodity.

Figure 2.3
Output-based payments, no tariff



The economic analysis of this form of producer support is non-controversial. There is an extensive literature on the topic and a general consensus about their costs, market effects and welfare or distribution impact. One variant that merits mention is output-based payments that are contingent on producers reducing the area that would otherwise be planted to the supported commodity or contingent on limiting output. Such conditions are usually imposed to reduce the budgetary outlay. Because these conditions usually result in a smaller increase in domestic production than in their absence they also reduce the trade-distortion effects. In terms of the previous figure, production is inhibited from expanding to C; the domestic supply curve is steepened beyond point A and the import demand curve rotates rightward commensurately.

Export subsidies belong or are directly related to output-based support, although they do not formally appear in the OECD rubric. Export subsidies are usually the by-product of domestic price support policies. A government or state marketing organization is sometimes obligated to purchase commodities deemed surplus to the domestic market; such purchases maintain the domestic market price at or above the normative minimum. If there is insufficient domestic demand or lack of other means of domestic disposal (military, prisons, low-income channels), then the accumulated stocks are often sold on the international market. To operate effectively, the commodity being subsidized must be prevented from being re-imported to the exporting country. The difference between the purchase price P* and the world price Pw* (assuming a large country) is the unit export subsidy. Surplus stocks are also donated as food aid. After excessive use in 1980s, OECD recourse to export subsidies and foreign surplus disposal is now relatively minor. The Uruguay Round placed limits on the allowable level of export subsidies. At issue in the Doha Round is a ban on export subsidies.

Payments based on input use

OECD distinguishes between three kinds of input-based payments and, in addition, notes whether input constraints are imposed. Table 2.6 shows the amount of support for each.

TABLE 2.6

Payments based on Input Use, $ Billions 2005-07

Payments based on input use (total)	29.8
Based on variable input use	11.7
Based on fixed capital formation	9.9
Based on on-farm services	8.1

Payments based on input use were found by OECD (2001) to have the largest relative production- and trade-distorting impact of all kinds of producer support. This is not an entirely intuitive result. But consider the logic. There is an equivalence of input and output subsidies. A one-percent output-based subsidy has the same production effect as a one-percent subsidy on all inputs used to produce a commodity. In the OECD model there are two inputs, land and a second factor composed of all non-land inputs. The supply of land is relatively inelastic and the production distortion coefficient for current area (land) payments is about 0.40, considerably less than one. This means that the production distortion coefficient for non-land inputs must be greater than one. Otherwise, the weighted[6] sum of the two factor distortions would not sum to one, as required by the equivalence of input and output subsidies.

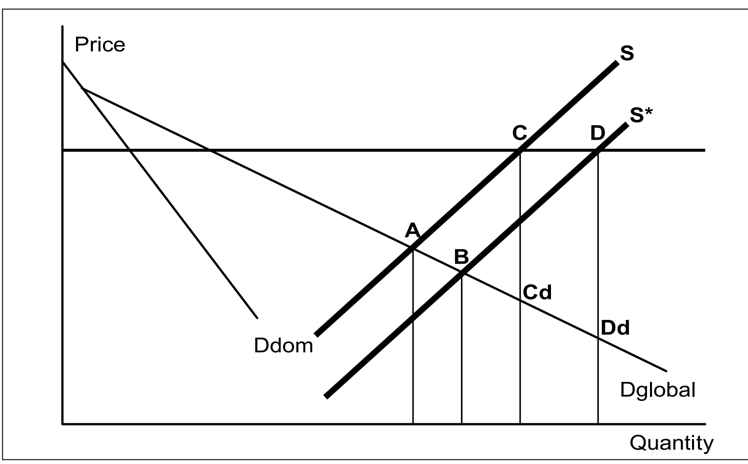
Input subsidies are often observed in conjunction with market price support or output-based payments. Figure 2.4 contrasts the production effect of an input subsidy with and without market price support, in this case output-price support. It shows a large, exporting country. Point A represents market equilibrium without input or output support policies. Point C is equilibrium for production with output-based price support – assume a target-price, deficiency payment scheme:

[6] Weighted by factor shares. The factor share of land is about 0.2. Multiplying by the illustrative distortion coefficient, 0.4, gives 0.08. This implies that the production distortion coefficient for purchased inputs must be about 1.15 = 0.92/.80 = (1-.08)/(1-.20) See Gardner (1987): 109-112.

consumption (domestic and export) equilibrium is at point Cd. A per-unit subsidy on input use causes a downward shift in the industry supply curve from S to S*. The production effect of the input subsidy alone is the horizontal difference B-A; with output-based price support the production effect is larger: D-C. The D-global demand curve includes the consumption of domestic consumers; the difference cannot be attributed to consumption changes. Rather, the deficiency payment effectively insulates domestic producers from changes in the market price of the commodity, domestic or international. The increase in production results in consumption equilibrium at point Dd. For a given elasticity of demand, an input subsidy combined with output price support causes a greater reduction in consumption prices than an input subsidy alone.

Figure 2.4

Input subsidy with and without market price support



A variety of inputs are subsidized within the OECD. Fuel, energy, freight, fertilizer, pesticide, and water, among others are considered as variable inputs. Crop insurance is sometimes included in this category; however, some kinds of crop insurance are categorized as output-based support[7]. The on-farm services category includes veterinary services, extension services, and pest and disease control. Certain preferential tax rates or rebates and subsidized loans (for example, for young farmers or for certain structures or improvements) fall into the fixed capital formation category; as do more traditional forms of investment – incentives for machinery purchase, livestock improvement, soil improvement.

[7] OECD (2009) provides an overview of risk-related policy measures for agriculture.

Payments based on current area, animal numbers, receipts, income

Payments based on current area and current animal numbers (headage payments) are a form of input subsidy and can be visualized in terms of the previous figure (inputs). Area payments result in a downward shift in the supply curve, however, because the supply of land is relatively inelastic, the vertical displacement of the supply curve results in a smaller increase in output than an equivalent subsidy for non-land inputs, the supply of which is more elastic. Because such payments tend to be a fixed amount per unit; the effective subsidy varies inversely with the productive quality of the underlying land or animal. The European Union accounts for the bulk of OECD current area payments and a high proportion of EU area payments involve input constraints, which limit the potential output response; moreover, these payments are not crop-specific; the fixed payment to planted area has the same monetary value for a range of crops. Cahill (1997) presents evidence that set-aside and other land use restrictions rendered some EU area payments decoupled: they negated the incentive to expand output. Sckokai and Anton (2005), examining a later period, find that EU area payments encourage an increase in area but also a decrease in yield, as greater land use substitutes for non-land inputs. Combined, the output response is less than the effect of price support, usually less than half the magnitude. Finally, the ultimate incidence of area payments depends on whether the recipient is the landowner, a cash tenant, or share tenant. EU headage payments involve restrictions on the number of eligible animals and other input constraints, reducing the incentives to expand herds and yields.

Table 2.7:
Payments based on current A/An/R/I, $ Billions, 2007

Payments based current A/An/R/I (total)	27.7
On Area (A) or Animal Numbers (An)	23.9
With input constraints	[18.3]
On Receipts (R) or Income (I)	3.8

As with input subsidies, if area-based or animal number based payments are combined with market price support (and no auxiliary restrictions on input or output) then whatever portion of the payment realized by the producer as a reduction in the cost of production is not transmitted to domestic consumers: consumers do not benefit because domestic prices do not fall. Rather, the incremental output is valued at or above the support price. In the absence of market price support, the increment in output reduces the domestic consumer price and encourages increased domestic consumption.

Payments based on non-current area, animal numbers, receipts, income - production required

This form of policy accounts for a small share of OECD agricultural support, less than one percent, or $US 1.5 billion. It is exists in a handful of countries (Canada, Iceland, Mexico, Norway, and Switzerland) for a variety of purposes. The most common form is support paid on the basis on non-current animal numbers. In some cases there is a limit to the number of animals per payment recipient and the limit is lower than most herd sizes. Thus the payment provides no marginal incentive, in terms of animal numbers, and this makes the payment effectively non-current. However, Canada and Norway report payments on the basis of non-current receipts, and Norway also reports payments for cultural landscape under this rubric.

This diversity challenges generalization. But, to the extent that one is required to continue to own dairy cows, for example, if the payment is based on non-current dairy animals, then there is a risk of some subsidization of dairy production proportionate to the ratio of non-current to current animal numbers.

Decoupled payments - payments based on non-current area, animal numbers, receipts, income - production not required

Payments in this category of support are commonly called decoupled payments. The distinction is that these payments are based on past, non-current, characteristics of the recipient or the recipient's farm operation. Decoupled payments are, by design and definition, not contingent on producing agricultural output or employing factors in agricultural production; nor are they contingent on receipts, income, or current prices. The payments are financial transfers to individuals; such payments do not provide a direct incentive to produce a particular output or, indeed, any output; similarly there is no direct incentive to employ any productive factors.

Decoupled payments cannot be directly represented in the analytical models of the Floyd-Gardner tradition because their initial incidence is not on product prices or on factor prices, rather the initial incidence is on household income and wealth. The challenge for agricultural policy analysts is to identify whether and how an increase in household income or wealth influences the household's agricultural commodity production decisions.

Box 2.1 provides a brief chronology of decoupling in OECD countries. Decoupled policies appear absurd when taken out of context. Why would governments transfer public funds to selected recipients and require, apparently, nothing in return? This would be an appropriate question if decoupled payments were initiated in the absence of pre-existing agricultural support. In fact, decoupled payments *always* replace other support policies: they are a means of compensation for the reduction or termination of other forms of support; they provide a potential exit

Box 2.1
A brief chronology of decoupling

In agricultural policy discourse the idea of decoupling antedates the term decoupling; the term came into common usage during the Uruguay Round negotiations. We note major policy innovations in the direction of decoupling. Baffes and de Gorter (2005) discuss the pre-history of decoupling and provide a richer chronology.

The MacSharry reforms of 1992 initiated a gradual reduction in commodity price support within the EU. Price support reductions were compensated by direct payments based on area or animal numbers, contingent on production and set-aside requirements. Effective in 2006, these direct payments were consolidated into Single Farm Payments (SFP). EU member states have some discretion over how SFPs are administered. In general, the payments are fixed and not contingent on commodity production and therefore qualify as decoupled.

Mexico in 1994 initiated PROCAMPO, a set of programs designed to facilitate farm household adjustment to NAFTA, the North American Free Trade Agreement. One PROCAMPO program is a fixed, decoupled income transfer based on area planted to nine basic crops in the three-year base period ending 1993. The payments did not require current production and were paid for 15 years; the final payments were disbursed in 2008.

In the United States, the 1996 Freedom to Farm Act introduced fixed, direct payments, not contingent on commodity production. These AMT (Agricultural Market Transition) payments accounted for a modest share of U.S. producer support; price-contingent and output-based support remain more important than decoupled support. The 2002 Farm Security Act converted part of the fixed payments into variable, price-contingent (counter-cyclical) payments. The 2008 Food, Conservation, and Energy Act maintained both fixed and variable direct payments, expanding the latter.

Switzerland introduced direct payments in 1993. Somewhat like the EU, Switzerland has reduced market price support (although from much higher levels) and made non-product specific payments based on area or animal numbers. In June 1996, a referendum amended the Swiss constitution; it allows direct payments for specifically defined public services provided by agriculture, subject to environmental compliance. In principle, these services do not necessarily involve commodity production, but facilitate ecological stewardship and the generation of other multifunctional amenities. [Federal Office for Agriculture, 2004] from agricultural support. Decoupled payments can have a limited lifespan, such as PROCAMPO in Mexico, but this is the exception. The U.S. and EU decoupled payments have been open-ended; the payment flow is relatively secure until the next farm act or CAP reform. Thus, the transition period of compensation payments could be prolonged indefinitely.

Does decoupled imply non-distorting?

The assertion that decoupled payments are truly decoupled—that they have no production effect—was, and is, viewed skeptically. The literature on decoupling emerged around efforts to identify causal channels that could link decoupled payments to commodity output decisions and to find evidence to reject the hypothesis that the causal coefficient equals zero.

Researchers have made significant progress in meeting the challenge of decoupling. Many empirical studies reject the hypothesis that decoupled payments have zero production effect. However, the non-zero effects tend to be small and often insignificant – statistically and economically. This was to be expected. Consider the problem in terms of orders of magnitude. First, decoupled payments represent a relatively small increase in the recipient household's wealth, between 0.1% and 10%. Second the causal channel linking the income or wealth effect of a decoupled payment to output can be collapsed into an elasticity or coefficient, the value of which is less than 1.0 and typically less than 0.1. The product of the wealth effect and the causal coefficient yields a total effect often less than 0.01 and certainly less than 0.10[8]. In contrast to output-based and input-based support, which can be characterized as first-order effects, the lengthy causal chain linking decoupled payments to output results in second-order or third-order or an even higher-order effects.

Because U.S. decoupled payments have been paid since 1997 most empirical studies have been U.S.-based where payments are low relative to recipient household income and wealth. It is an open empirical question whether the small effects observed to date will remain small as the ratio of payments to income/wealth increases. EU Single Farm Payment studies are likely to answer this question as well as allow an examination of a more diverse set of farm household responses.

Decoupled payments, as currently defined in the WTO Agreement on Agriculture, are exempted from domestic support reduction commitments. If one accepts the

[8] Two excellent literature surveys, Abler and Blandford (2005) and Bhaskar and Beghin (2007), include annexes that present, in tabular form, the impact coefficients of decoupled payments. These coefficients are usually expressed in reduced form – as the elasticity of output or area with respect to the value of decoupled payment. The values do not exceed 0.10. The household approach, adopted here, suggests expressing the impact as the product of two effects: 1) the impact of payments on household income or wealth and 2) the income or wealth effect on household decisions regarding time/effort allocation, investment allocation, risk-bearing, and farm production activities.

proposition that a decoupled payment must have a strictly zero production effect; then the logical corollary is that a non-zero production effect implies the "so-called decoupled" payment is coupled. This line of reasoning suggests that a positive finding of non-zero effects could have immense political implications: decoupled payments could be re-classified as coupled and counted toward domestic support reduction commitments. The abstracts, introductions and conclusions of many decoupling studies are expansive about the implications of their theoretical or empirical findings for the classification of "so-called decoupled" support. But the text of the Agreement on Agriculture (Box 2.2) is not binary at zero: the fundamental requirement is "that they have no, or at most minimal, trade-distorting effects or effects on production."

The phrase "or at most minimal" has not been assigned an empirical value, and it is unlikely that a WTO dispute settlement panel or appellate body will set an empirical upper bound for the distortion rate allowed for exempt decoupled support. Law is categorical: it classifies policy based on its rules and administration, not on its realized effects. It is the form of support that matters. The dispute settlement process is designed to avoid having to judge among competing econometric estimates of some behavioral parameter, such as an elasticity. For example, part of WTO dispute DS267, United States: Subsidies on Upland Cotton, concerns restrictions on planting fruits and vegetables on area eligible for otherwise decoupled support payments. The issue was not empirical: the question was not whether the restrictions are effectively binding and influence planting decisions or even about the magnitude of the production effect. The issue was categorical: Are there restrictions on planting? If there are restrictions, then the otherwise decoupled payments are *per se* distorting. This is the test implied in Annex 2, paragraph 6(b) of the Agreement on Agriculture.

As in the development of competition law, empirical studies of the effect of policies can influence subsequent law or agreements. Preponderant evidence that a particular policy attribute is non-distorting could lead to its removal from the set of *per se* distorting practices. The converse also holds: empirical research could result in additions to the set of *per se* distorting policies. The logic of the Agreement on Agriculture (Annex 2) is to define as decoupled and minimally trade distorting those support policies that embody attributes that plausibly ensure minimal production- and trade-distorting effects: such policies are *per se* minimally trade distorting. This logic is consistent with the order-of-magnitude argument presented earlier. Policy attributes that pose a risk of inducing first-order production effects are proscribed; attributes that plausibly ensure only small, higher-order production effects are exempt from reduction commitments.

Analysis and discussion of decoupling and of decoupled payments often shifts between WTO-legal arguments and economic arguments. The two are frequently conflated: it is important to keep them distinct. The distinction advanced in this

Box 2.2
WTO Agreement on Agriculture, provisions related to decoupled payments

Annex 2: Domestic Support – The Basis for Exemption from The Reduction Commitments back to top

1. Domestic support measures for which exemption from the reduction commitments is claimed shall meet the fundamental requirement that they have no, or at most minimal, trade-distorting effects or effects on production. Accordingly, all measures for which exemption is claimed shall conform to the following basic criteria:
(a) the support in question shall be provided through a publicly-funded government programme (including government revenue foregone) not involving transfers from consumers; and,
(b) the support in question shall not have the effect of providing price support to producers;
plus policy-specific criteria and conditions as set out below.
…
6. Decoupled income support

(a) Eligibility for such payments shall be determined by clearly-defined criteria such as income, status as a producer or landowner, factor use or production level in a defined and fixed base period.
(b) The amount of such payments in any given year shall not be related to, or based on, the type or volume of production (including livestock units) undertaken by the producer in any year after the base period.
(c) The amount of such payments in any given year shall not be related to, or based on, the prices, domestic or international, applying to any production undertaken in any year after the base period.
(d) The amount of such payments in any given year shall not be related to, or based on, the factors of production employed in any year after the base period.
(e) No production shall be required in order to receive such payments.

paper is that the WTO definition of decoupling is categorical and economic analysis of decoupling is empirical[9]. Support is decoupled, in WTO-terms, if it conforms to the primary administrative requirements specified in the Agreement on Agriculture. Economists, in contrast, are interested in how support payments influence recipient behavior and decision making: this is an empirical matter. Coefficients representing

[9] The author emphasizes this distinction to clarify empirical and normative/legal arguments. WTO Dispute Settlement Body deliberations are not exclusively categorical, empirical evidence can matter, but categorical distinctions frame the arguments and predominate.

area and yield responses to decoupled support are required for simulation and forecasting. Economists are characteristically more concerned with what policies do than what policies are called. That these coefficients are sometimes called the "degree of coupling" or "coupling factor" risks conflating legal and economic arguments.

Core problems in the economics of decoupling

The research program on the economics of decoupled payments is sufficiently advanced that a few core questions or problems are evident. We suggest a typology of questions; it has two dimensions as illustrated in Table 2.8. There is a household/market dimension and a normative/positive dimension. These are not crisp dichotomies, as studies often embody both elements.

TABLE 2.8
Typology of decoupling research objectives

	Market models	Household models
Positive Problems	Calibrate "coupling" parameters for simulation and forecasting	Identify causal channels; estimate differential household responses
Normative Problems	Policy design; best practices; Targeting; Regulatory reform (Agreement on Agriculture)	

The household/market dichotomy appears obvious: the unit of analysis is either the household, using household or farm-level models and observations, or the unit of analysis is the market (commodity and factor market) – this includes representative farm models. This dichotomy corresponds to the distinction between agent optimization and market equilibrium. In this paper we emphasize household models that examine a wider range of household allocation decisions than just crop area allocation. This means considering time allocation, life-cycle influences, and off-farm income, assets and investments. Most decoupling studies use pseudo-household models. These are variants of the farm production optimization problem central to agricultural economics: maximize profit by allocating land and inputs given technology, input and output prices, and some resource constraints. This basic model is often recast as a household utility maximization problem, but the household's choice set is limited to how to allocate land among crops. These are not household models: they are models of commodity production units and such models may not be adequate for examining farm household responses to decoupled policies. May is used deliberately in the previous sentence: it may be the case that most farm households can be adequately represented as commodity production units. This is an empirical question; one that can only be answered by examining whether household models identify otherwise obscured causal relationships.

At the market or national level it is necessary to find parameter values to represent decoupled policies for simulation and forecasting purposes. Estimating an equation with acreage on the left-hand side and decoupled payments as one of several variables on the right-hand side is a reasonable way to find a degree-of-coupling parameter. It does not identify how or why decoupled payments are correlated with area, yields, or output; it only estimates whether there is a correlation and its magnitude. Gohin (2006:416ff) notes that major simulation models differ widely in the value assigned to this coupling parameter: FAPRI uses 0.0; AGLINK 0.14; GOLD 0.5; and CAPRI 1.0. Since this parameter is bounded between zero and one, there appears to be ample opportunity for some convergence in these values[10].

Household models are the best means available for understanding how and why decoupled payments influence commodity production and for understanding whether and how different kinds of households have different responses to decoupled payments: this is the positive household research agenda for the analysis of decoupled payments. The results of household research also inform the normative analytic agenda. Normative in this context means addressing questions of policy design: what characteristics must a decoupled policy have to ensure minimal production-distortion and trade-distortion effects? Answers to this question have implications for WTO negotiations and policy reform. The exemption allowed to minimally-distorting decoupled payments in the Agreement on Agriculture provides an incentive to satisfice in policy design. Ideally, policies could be distortion-weighted similar to the Basel II Accord on risk-weighting assets for determining capital adequacy for financial institutions. In practice such systems are difficult to administer and enforce. Setting the question of incentives for marginal reductions in distortion aside, the research agenda should be able to identify a set of best practices, or better practices that could make minimally-distorting policies even less distorting.

The positive household research agenda is also necessary for informing the design of targeted policies. As commodity policy (market price support and output-based support) comes under increased scrutiny – fiscal and WTO-related – there is a corresponding movement toward targeting payments to narrow objectives with greater public legitimacy; for example, to households on the basis of need and disadvantage or for the production of environmental amenities and landscape stewardship. This transformation requires extensive micro-level information for efficient administration and monitoring.

Household models and decoupled support

Because decoupled payments are a different kind of policy instrument than output-based and input-based support policies they require a different method of

[10] Bureau and Gohin (2008) provide a lucid analytic exposition of the "coupling factor" in area and yield response models. Balkhausen et al. (2008) provide a survey of simulations of CAP decoupling.

analysis. What is required is a model of the optimization problem of the decoupled-payment recipient's household. The household model needs to encompass the household's time allocation decisions, its consumption decisions and its savings and investment allocation decisions. The commodity production optimization problem is one of several optimization problems faced by and coordinated by the household; agricultural production is not necessarily the most important of the household's activities or its primary source of income. In fact, the recipient household may own farmland entitled to decoupled payments but lease its use to a farm operator; it may have no direct involvement in commodity production.

The first incidence of a decoupled payment is to increase the recipient's income or wealth. How does an increase in wealth influence a household's time, consumption and asset allocation decisions? The answers are considerably more complicated than the comparative statics of models of the Floyd-Gardner variety where the signs of the coefficients are almost always known. Farm profit or production functions have fewer degrees of freedom than the multi-period utility optimization problem of the household; moreover, there fewer relevant independent variables. For example, the age of the farm operator is not likely to influence the adjustment of factor use to a change in relative factor prices. But operator age is very likely to influence household savings-consumption decisions and asset allocations given an exogenous increase in wealth – Deaton (1992), Gollier (2001) Campbell and Viceira (2002).

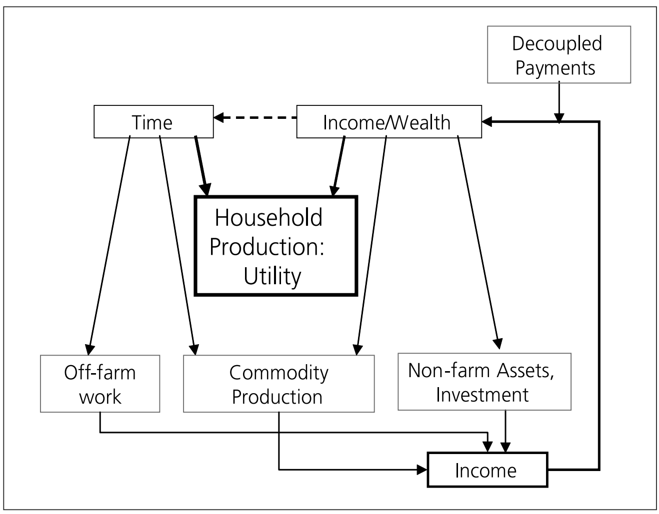
The paradigm-shifting insight of the economic theory of the household is the concept of household production. The household is not viewed as a consumption unit, rather it purchases goods and services from outside the household as inputs for household production. Household members combine their time with purchased inputs to create utility-generating activities. Preparing and consuming a family meal mixes household time and material inputs. Reproducing and raising children is the canonical example of household production: the outputs, children, are ends in themselves – sources of utility; they are not a means to increasing household income.

The objective of the household is the maximization of utility over its life-cycle. Utility is produced with time and money, or what can be purchased with income. Household production is the large bold rectangle in the center of figure 2.5: all other household activities are inputs into household production; there are no arrows leading out of the household production rectangle.

In a farm household the allocation of household time is between household production and market activity; market activity is divided between on-farm work (commodity production) and off-farm work. Both are sources of income. The allocation of household income is between current expenditure for household production and market investment – this includes inputs and investments for commodity production and off-farm investments (life insurance, residential property, retirement, non-farm businesses). In this framework, decoupled payments are just another source of income, effectively equivalent to dividend income from a stock portfolio and as fungible. There is no reason to believe that decoupled payments are earn-marked for commodity production[11].

FIGURE 2.5

Household model



From the perspective of agricultural policy analysis, the full household, life-cyclical optimization problem presents multiple opportunities for fixed decoupled payments to "leak out" of farming. Indeed, if the household were at an optimal allocation before the injection of decoupled payments, one would expect the subsequent rebalancing to distribute a proportion of the increment in wealth from farm to non-farm investments. Taking time allocation first: the increment in wealth can be absorbed in greater leisure (or less time devoted to remunerative activities), in a reallocation of time to less remunerative, but more fulfilling activities or even in human capital accumulation through training or education. Second, consumption: It can be employed to increase current consumption or for the purchase of durable consumption technology. Third, savings and investment: The increment could be neutrally allocated across asset classes in proportion to existing portfolio shares[12].

[11] Whitaker and Effland (2009) and Whitaker (2009) find that farm households employ psychological accounting: they treat farm income differently than non-farm income although the two are perfectly fungible. They also find that decoupled payments are treated more like non-farm income than farm income while output-based support is treated as farm income.

[12] This corresponds to Constant Relative Risk Aversion (CRRA) – that the proportion of one's portfolio devoted to a specific risk class remains constant despite changes in wealth.

Or, analogous to normal and inferior goods, some asset shares may be increasing and others decreasing in wealth. Finally, it is possible to observe discrete or lumpy investments. The increment in wealth may shift the household across a threshold and facilitate a major structural re-allocation of household wealth and effort – for example, retirement, change of primary occupation, liquidation of a major asset. Thus the increment in wealth could be used to expand farming operations or to exit the sector. These effects are difficult to determine deductively.

The contemporary economic model of the household is a synthesis of several distinct research programs. The allocation of time by and within the household finds its origins in the work of Reid (1934), later formalized in Becker (1965). Formalization of the savings-consumption problem of the household can be attributed to Friedman (1957), Modigliani and Ando (1957) and Yaari (1965) with the life-cycle savings hypothesis, the permanent income hypothesis, and the origins of the bequest motive. The investment allocation of the household emerges in the work of Merton (1969, 1971) which builds on the seminal contributions of Markowitz (1952), Arrow (1953/65), and Tobin (1958).

The pioneering work of Reid (1934) was based largely on studies of time allocation on farm households. Becker's (1965) neo-classical formalization of the problem diffused rapidly; first to the study of household fertility decisions – Becker 1981, Schultz 1975 – and to the analysis of agricultural households in developing countries, for which Singh, Squire and Strauss (1986) is the key reference; Taylor and Adelman (2003) is a recent survey. The model integrates time allocation with consumption activities and production activities. The farm household presents a challenge because the distinction between consumption (including leisure) activities and production activities is not as distinct as for salary or wage-earning urban households.

In a recent survey of positive household finance – of how households actually allocate their financial assets – Campbell (2006: 1554) notes that observed household portfolio allocations are often difficult to reconcile with normative household finance, what theory suggests or predicts households should or will do. He notes two challenges. "First, positive household finance requires high-quality data that are hard to obtain. Second, normative household finance requires significant extensions of textbook financial theory."

Household data

Availability of appropriate, high-quality data is the usual binding constraint in empirical economics. As Leontief (1971, 1982) argues, empirical economic research too rarely employs primary data; it typically relies on secondary data, often government statistics collected for reasons unrelated to the economic hypothesis in question. The development of experimental economics has attempted to address the Leontief challenge, but its application is limited—experiments are expensive and, as they involve human subjects, involve ethical, legal and regulatory restrictions.

There are several major survey research programs in OECD countries examining individual and household income dynamics. The best are panel surveys; they track respondents through a series of consistent periodic surveys. They allow the construction of consistent life-cycle profiles and facilitate causal inference. (McGonagle and Schoeni 2006, McNeil and Lamas 1989). More common are cross-sectional surveys; these usually involve random (stratified) sampling from a population. Periodic cross-sectional surveys allow one to make plausible inferences about changes in the characteristics of the underlying population, and even some sub-strata of the population. But individual and household effects cannot be observed. Because farm households constitute a very small share of total households in most OECD countries, national-level household surveys do not provide a very large sample of farm households and this limits the scope of statistical inference.

Agricultural economists have developed specialized surveys to study farm management and production decisions at the farm household level. These can be very informative but their emphasis, understandably, is on the commodity production activities of the farm. Coverage of off-farm time allocation, off-farm investment and life-cycle and estate planning are often not considered or are not addressed in detail. The profession is well-aware of the data challenge. Offutt (2002), in a presidential address to the American Agricultural Economics Association, argues that agricultural policy analysis will become increasingly dependent on household-based models, particularly because the locus of intervention is shifting from commodity markets to household characteristics and local environmental externalities and amenities[13]. Precision in targeting requires precision in data, measurement and monitoring. [See Moreddu and Poppe (2004) on farm households and Moreddu (2007) on targeting agricultural policies.]

Household models and wealth effects

Wealth effects are difficult to study because there is no uniform method of measuring wealth. Juster et al. (1999) show how the two primary U.S. data sources, the Panel Study of Income Dynamics (PSID) and the Survey of Consumer Finances (SCF) differ considerably in the measurement of household wealth. The differences vary among classes of asset. Second, wealth effects appear to differ by asset class. Juster et al. (2005), using PSID data, find that an increase in wealth from appreciation of equities results in a greater increase in consumption than an increase in real estate or business asset values. There is an active debate about whether the consumption increase correlated with appreciation of real estate

[13] See also the proceedings of the Workshop on the Farm Household-Firm Unit: its importance in agriculture and implications for statistics, April 2002. http://household.aers.psu.edu/Default.htm

(pre-2006) is a direct effect of wealth or indirect via the credit channel - Aron, Muellerbauer and Murphy (2006) provide a good summary of the debate. Thaler's (1985) concept of mental accounting, that people mentally segregate funds that economists and accountants would view as perfectly fungible, has gained sufficient empirical support to be accepted as a stylized fact. Goodwin and Mishra (2005) find that U.S. farmers report (in the 2003 ARMS) that they use about two-thirds of decoupled payment receipts for farm operations and about one-third for home (non-farm) use. But these magnitudes do not correspond with observed increases in farm budgets. Households may be reallocating funds from farm to home operations in other household accounts, fully or partially offsetting the inflow of payments reported as allocated to farm operations.

Our discussion of decoupling research builds on earlier critical literature surveys – Burfisher and Hopkins (2003), Abler and Blandford (2005), Bhaskar and Beghin (2007) – which have identified the primary causal channels between wealth effects and farm production decisions. These are the effect of changes in household income/wealth on: 1) Time allocation and 2) Money, the allocation of household financial resources because of changes in a) credit and credit-worthiness and b) risk aversion and risk bearing. Because U.S. and EU decoupled payments are linked to land they are not pure financial transfers; therefore we examine briefly studies of the impact of decoupled payments on the markets for land ownership and land rental.

Time allocation channel: Labor/leisure, on/off farm

The economic theory of the allocation of time predicts that time will be allocated so that its marginal utility is equalized across activities. The opportunity cost of an hour of leisure, at the margin, equals the individual's marginal wage rate; and, if an individual works multiple jobs, work time will be allocated to equate marginal wages (adjusted for the relative disutility of effort). A coupled payment, for example an output-based payment, increases the unit value of the output and the value of the marginal product of its inputs, including farm labor. Thus coupled support provides an incentive to adjust the allocation of time toward on-farm work and away from either leisure or off-farm work. Decoupled support, in theory, does not directly influence relative output or input prices and therefore provides no direct incentive to reallocate time (no substitution effect). Because decoupled support increases the recipient household's wealth and current income, a wealth or income effect may induce time reallocation.

The standard prediction is that greater wealth is likely to result in more time allocated to leisure. Imbens et al. (2001) provide an empirically clean and concrete example. They analyze the work and savings-consumption responses of lottery winners and provide a review of research on similar "natural experiments." Lottery earnings are a form of decoupled payment, stochastically contingent only on having purchased a lottery ticket and not contingent on current employment or consumption. The lottery winnings studied are paid over a 20-year period, and the analysis uses a discounted life-time utility model. Lottery winners increase time allocated to leisure: post-winning labor earnings decline about 11 percent; the effect is substantially greater for winners 55 and older.

There are several studies that use ARMS (Agricultural Resource Management Survey of USDA) data to explore the labor time response to decoupled payments. ARMS is a stratified cross-sectional survey; it is not a panel and cannot track household responses across years.

Ahearn et al. (2006) examine whether government payments influence recipient households' off-farm work hours using 1996 and 1999 ARMS data and find a very small, but statistically significant reduction in off-farm hours worked. The study does not examine on-farm hours, nor does it include off-farm employment earnings in the analysis. El-Osta et al. (2004) examine the off-farm and on-farm household labor response to the expected receipt of government agricultural program payments using 2001 ARMS data and find that both coupled and decoupled payments are associated with a reduction in off-farm employment and a slight increase in on-farm employment. Curiously, the impact of decoupled payments is greater than for coupled payments, but the effects are small – about an additional week of on-farm work for the average decoupled payment. The authors suggest that "the positive impact of on-farm hours worked implied that payments, in total, are viewed as synonymous with an increase in the farm wage rate, rather than as a decoupled lump-sum subsidy." [381] That is, they suggest that recipients somehow mentally re-couple the decoupled payment as an increase in the relative value of farm effort.

Dewbre and Mishra (2007) use 1998-2001 ARMS data and find that decoupled payments received by farm households that do not engage in any off-farm work are associated with an increase in leisure hours, while coupled payments result in an increase in on-farm work hours. Both effects are small. For households that do work off-farm, decoupled payments are associated with a small increase in on-farm hours, but less than the effect for coupled payments. The study also estimates the transfer efficiency of payments. This is measured as the proportion of the payment that is retained as net household income. About 97 percent of decoupled payments are transmitted to household income. Coupled payment transmission ranges between 49 and 83 percent. The differences between the coupled and decoupled transfer efficiencies are statistically significant. The reasoning is that a portion of coupled payments are absorbed in expenditure on farm production costs.

Key and Roberts (2009) provide an interesting reinterpretation of these earlier ARMS-based studies. They estimate a large wage differential between on-farm work and off-farm work for farm operators: off-farm work pays substantially more, as reported in ARMS (2002-04) and calculated in the paper. The calculated median hourly wage for farm work (imputed based on net income from farming) is *negative* \$1.32; the corresponding off-farm wage is \$19.69. Key and Roberts argue that this difference can be interpreted to indicate large non-pecuniary benefits from farm work; otherwise the revealed preference for on-farm work is economically irrational. This re-frames the standard labor-leisure model: on-farm labor is quasi-leisure as it is apparently generates utility, while off-farm work hours involve normal labor dis-utility. This revealed preference for on-farm over off-farm work may provide an alternative explanation of the results of the three studies reviewed above. It follows that decoupled payments or any exogenous increase in income will lead to an increase in on-farm hours (as work-cum-leisure) and a decrease in off-farm labor supplied by the farm household. The authors also assert that this increase in on-farm labor could be substantial and therefore generate large production effects with potential WTO implications. They provide no evidence of this magnitude, but the increase in on-farm hours must approximate that found in the other ARMS studies: small. Indeed, the low (negative) returns to on-farm labor reported by Key and Roberts indicate that additional hours "working" on-farm have a very low or negative value marginal product. Findings of a revealed preference for on-farm work are not unique the United States. Fall and Magnac (2004) find comparable gaps between on-farm and off-farm hourly earnings for French farm households.

The Single Farm Payment has not been in effect sufficiently long for much empirical work to come to light. Douarin (2008) surmounts this data barrier by surveying French farmers about their likely time allocations under three policy scenarios: Agenda 2000, SFP as applied currently in France (this includes some coupled payments for specific crops and livestock), and "full decoupling" defined as flat-rate area payments. Respondents' time allocations are relatively invariant to the scenarios. The comparison of interest is between SFP as currently administered and full decoupling. A shift to decoupling reduces the proportion of respondent stating they would increase on-farm time from 28% to 24% and the proportion reducing on-farm time increases from 23% to 28%; the third alternative is no change. As for off-farm work decoupling raises the "increase off-farm" response from 16% to 18% and reduces the "decrease off-farm" rate from 9% to 8%. The results are consistent with the other studies: the effects are small and there is a bias toward more leisure. The results also underscore the importance of controls and counterfactuals in empirical policy work. Roughly one-quarter of respondents are planning to increase on-farm time regardless of the policy. It is difficult to identify the proportion of the increase, ex post, that is induced by the policy change.

Latruffe and Mann (2009) compare how direct payments in France and Switzerland influence off-farm work time. Swiss direct payments are largely for environmental public amenities and do not require commodity production; environmental amenity production (or management) requires less labor input than commodity production. French Single Farm Payments remain relatively coupled to commodity production.

Ceteris paribus, French payments require more farm labor time than Swiss payments. The study finds that the share of off-farm income is positively correlated with the amount of direct payments in Switzerland; this correlation is negative in France. Because it is not a time allocation study the results cannot be expressed in terms of changes in hours work on- or off-farm.

This brief survey of recent studies indicates that effect of decoupled payments on the allocation of recipient household time remains a puzzle. Part of the puzzle is that the effects, to date, appear to be small, so small that they are hard to distinguish from the ambient noise in the data. Another part of the puzzle is that data tend to be, in Leontief's terms, second-hand: our observations are based on questions and measurements made for other ends than measuring household time allocation – this suggests devising new and improved measures and questions. Finally, there is the perennial farm household problem – there is not a clear distinction between production and consumption and between work and leisure, particularly in the mind of the respondent. It would likely require a Tayloristic time-and-motion study to determine whether the marginal hour of self-described "on-farm work" has a marginal physical (commodity) product.

Financial channel: credit

Decoupled payments may influence a recipient household's decisions through credit. The receipt of a decoupled income transfer by a net creditor household may simply be deposited into savings or invested in other financial assets; it increases household net worth but does not relax any binding financial constraint on the household. In contrast, a decoupled transfer to a credit-constrained household can relax the binding credit constraint and expand its feasible choice set. There are at least two ways decoupled payments can relax the household's financial constraint. The direct effect is that the payment increases current cash flow. The indirect effect may arise because the entitlement to a stream of decoupled payments may improve the recipient's credit rating. A loan officer may be willing to provide more credit based on the expected security of the payment stream. (But see the section below on capitalization and policy risk). Phimister (1995) provides an analytical exposition of how a decoupled transfer could have positive output effects for a debt-constrained household; he finds no causal channel for un-constrained recipient households. Phimister's farm household maximizes inter-temporal utility, but it is decision variables are limited to farm production activities, specifically on-farm investment. By foreclosing other means of income generation the farm household model can implicitly re-couple decoupled payments into on-farm investment.

Roe, Somwaru, and Diao (2003, 2004) indirectly simulate the credit effect of decoupled payments in an intertemporal CGE model. They draw on Stiglitz's concept of credit rationing and imperfect credit markets and compare the impact of a fixed decoupled payment paid in perpetuity in a model with and without integrated capital markets. The payment value is based on the direct payments of the 1996 U.S. Farm Act. When capital markets are integrated there is efficient capital arbitrage between sectors. When capital markets are segregated, there is imperfect arbitrage between agricultural and other sectors of the economy: farms face higher interest rates and payments made to farm household are assumed to remain with the agricultural sector. The experiment is deliberately designed to induce coupling via the credit channel in the segmented capital markets scenario. Their summary follows:

> We find that, in the short to intermediate run, direct payments tend to cause capital deepening, to increase the employment of labor, and to increase agricultural output. However, these effects are extremely minimal. They cause aggregate agricultural production to rise by less than 0.2 percent in the short run. In the long run, payments cause no resource allocation and output effects. The only long-term effect of payments is to increase land values and land rental rates.

Thus, even with a stylized assumption of sector-wide credit rationing, the impact of decoupled payments on output is minimal and only in the short run. When markets adjust payments are capitalized into land values. The assumption of segmented capital markets exaggerates the imperfections, if any, of credit availability for farm households in most OECD countries. But it might be a reasonable assumption for the Mexican *ejido* sector in the 1990s. Sadoulet, et al (2001), using household data, find that *ejido* (cooperative land reform community) households that received PROCAMPO direct payments reduced significantly their use of formal credit. (The focus of the study is the income multiplier of the payment, not its impact on commodity production.) This appears contrary to the concept that payments would allow more credit; however, it is likely that recipient households prefer to rely on internal financing. The reduced use of external credit is consistent with reducing finance costs.

Girante et al. (2008) use Kansas Farm Management Association data, which allows one to track individual commercial farms over time. They use a Chavas-Holt (1990) framework (discussed in the next section) in which the farm operator seeks to maximize expected wealth through planted area allocation. There is no time allocation decision (between on- and off-farm) or non-farm financial decision; it is an acreage allocation model with farm wealth, farm leverage (farm liabilities divided by farm assets) and government payment variables added – this is a pseudo-household model. The study uses leverage as a proxy for being credit-constrained; there is no information on whether farms are actually credit-constrained, however. They find that decoupled payments have a small, positive and significant effect on area planted: the area elasticity with respect to payments ranges between 0.05 and 0.08 for fixed effects specification. The leverage-payment interaction term is not significant, which indicates no significant credit-constraint effect. One should note that the data set is of relatively wealthy, well-capitalized commercial farms, and may lack sufficient representation of credit-constrained farm households.

Briggeman, Towe and Morehart (2009) use individual-level data from ARMS and the Survey of Consumer Finances (SCF) to measure the incidence of credit constraints for farm and non-farm sole proprietorships. They find that the incidence of credit constraints on farm sole proprietorships is substantially lower than for non-farm sole proprietorships. Only 5.3% of farm versus 23.5% of non-farm proprietorships can be considered credit constrained. 36% of farms did not apply for credit, having no need, as opposed to 15% of non-farm proprietorships. The authors note that the low relative observed incidence of credit constraints for farm proprietorships may be in part due to agricultural support programs. They add that livestock farms, which, in the United States, receive proportionately fewer farm benefits than crop farms, are relatively more credit constrained than crop farms.

Kropp and Whitaker (2009) examine 2005-2007 ARMS data to estimate the relationship between base acres operated (on which decoupled payments are based) and the interest rate paid on operating loans by payment recipients. They find a significant negative relationship. However, the value of the coefficient is small. For a farm that operates mostly base acres the reduction in interest paid on a one-year load of \$100,000 is \$306. They argue that "such a small savings relative to the size of the loan may not be sufficient to cause a farmer that would otherwise leave the market to remain in production." Because recipients receive both direct (decoupled) and counter-cyclical payments the value reported in the study probably overstates the impact of the direct payment entitlement alone.

The analysis of farm household finances benefits from the comparison to other kinds of entrepreneurs. Entrepreneurs as self-employed persons exhibit different characteristics from employees; farmers share many of these characteristics. Acs and Audretsch (2007) and Parker (2006) provide recent surveys of the field. Cressy (1995, 1996) and Cressy and Olofsson (1997) are particularly relevant contributions for understanding farm entrepreneurs. They show that entrepreneurs value control and exhibit a strong preference for internal over external financing. They wish to limit scrutiny of their business operations and planning from creditors, such as bank loan officers; consequently, they often appear credit constrained, when in fact, the constraint is largely voluntary.

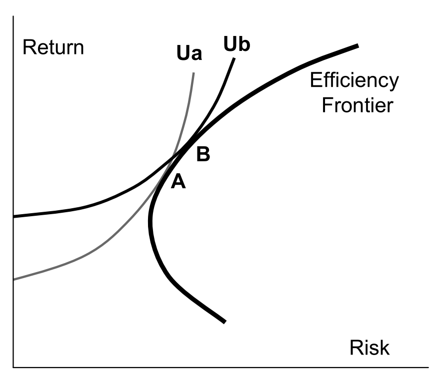
The incidence of credit rationing or severe credit constraint appears to be very low among commercial farms in the United States. This is hardly surprising given the depth of financial intermediation in U.S. agriculture. Because commercial farms account for the bulk of commodity production, it follows that there is minimal scope for decoupled payments to influence production via relaxation of credit constraints. This low incidence of credit rationing cannot be generalized to all farm households in the United States or in the OECD. Financial deepening is not uniform. Most OECD countries have well-developed farm credit institutions, farm cooperatives benefit from tax advantages and other exemptions and support, but access is not universal. The right-skewed distribution of output across farm households suggests that most of the 10-20 percent of farm households that accounts for vast majority of output is unlikely to be credit-constrained. If there are significant output effects via the credit channel, they are likely to be limited to marginalized farm households that encounter extensive credit-rationing, these farms generally account for a small share of output[14].

Financial channel: wealth and risk

A decoupled payment increases the recipient's income and wealth. A change in wealth can change how one views risk and risk-bearing. There is a vast literature on this topic, but Hennessy (1998) is the logical place to start[15]. Hennessy shows that for a decoupled payment to have no impact on production the payments must be fixed and the recipient must have Constant Absolute Risk Aversion (CARA), that is, changes in one's wealth do not influence one's willingness to bear or take risks.

Hennessy does not use a figure, but the Figure 2.6 illustrates his argument. It shows a standard portfolio allocation problem. Point A is the point of tangency of a relatively risk-averse indifference curve (Ua) and the efficiency frontier of a set of investment opportunities or, in a farm production context, a set of area allocations. B represents the tangency for a less risk-averse indifference curve (Ub).

FIGURE 2.6:
Wealth and insurance effects



[14] It is possible that a decoupled payment that relaxes the credit-constraint on a credit-rationed farm household would be considered output- or trade-distorting, but a policy that remedies credit-rationing (as a market failure) might not be considered output- or trade-distorting, even if the output effects are identical.

[15] Moschini and Hennessy (2001) is an excellent survey of the literature on risk aversion in agricultural production.

A decoupled transfer can have a wealth effect only if the recipient has Decreasing Absolute Risk Aversion; that is, an increase in wealth increases one's willingness to bear risk[16]. This changes the curvature of the indifference curve – it becomes less steeply sloped – and results in a new tangency point such as the shift from A to B along the fixed efficiency frontier. This represents a reallocation towards a riskier portfolio.

If a decoupled payment is not fixed it can generate what Hennessy calls an insurance effect. This can only happen if the payment varies inversely with the recipient's other sources of income. If the payment, for example, goes up when wheat prices go down, it makes the expect return to producing wheat less risky. It is a form of insurance and can encourage the recipient to plant more wheat than otherwise. The insurance effect could be illustrated by a leftward shift in the efficiency frontier.

How likely are we to observe these effects? The insurance effect depends on policy design. As long as decoupled payments are fixed, the insurance effect will not occur. Box 2.3 examines U.S. counter-cyclical payments which do vary inversely and do generate an insurance effect. The wealth effect depends on recipients' risk preferences. The consensus is that most decision makers, human and non-human, exhibit some form of risk aversion. In a Darwinian sense, selective risk-bearing enhances one's survival and reproductive success, so it is not surprising that risk-averse decision algorithms are integral to human cognition. The short answer, then, is that wealth effects exist; however, they are difficult to observe and measure. The empirical findings of economic psychology, also known as behavioral economics, challenge the deductive framework that economists have employed to analyze decisions involving risk and uncertainty. The anomalies in expected utility theory found by Kahneman, Thaler and Tversky, among others, are no longer peripheral curiosities: they are central to the search for a new paradigm. McFadden (1999) provides a concise survey of this research program; Just and Pope (2003) critique the representation of risk in agricultural economics: there are now more questions about risk than answers.

The decision algorithms humans employ instinctively are more complex, varied and contextual than the measures and models derived from expected utility theory predict. The general consensus is that Constant Relative Risk Aversion (CRRA) provides the best approximation to observed behavior. CRRA implies that portfolio shares of risk-free and of risky assets do not change as wealth changes. For example, someone with CRRA preferences would always invest about 5 percent of their portfolio in high-risk assets regardless of their level of wealth. If wealth increases, the absolute investment in high-risk assets also increases. Thus CRRA

[16] In theory increasing absolute risk aversion (IARA) is also possible: when getting richer makes one less willing to take risks.

Box 2.3

The insurance effect: U.S. counter-cyclical payments

U.S. counter-cyclical payments account for the majority of OECD domestic support provided by variable direct payments, not requiring current production; Australia and Canada also provide support under this OECD rubric through income or revenue averaging accounts. Variable payments in the OECD averaged $3 billion in 2005-07 compared to $48 billion for fixed direct (decoupled) payments. U.S. Counter-cyclical payments [CCPs] were introduced in 2002 farm legislation and were extended in 2008 legislation. Skully and Plato (2004) and Plato et al. (2007) show that CCPs are equivalent to a bear option spread on the underlying program commodity. Simply stated, in a high-price year the counter-cyclical payment is zero; in a low-price year it pays the maximum statutory value; and in an average-price year the payment is between zero and the maximum. Thus the payment is counter-cyclical, although within bounds. The 2008 legislation increased the value of CCPs by increasing the price range covered: target prices were increased and loan rates were lowered.

The exempt status of these payments was examined by the WTO (DS 267 – U.S. Subsidies on Upland Cotton). Because counter-cyclical payments are based on current-year prices they do not comply with Annex 2, paragraph 6(c) of the Agreement on Agriculture (see Box 2.2) and the WTO determined that they are non-exempt. [Schnepf 2009] This is a categorical, per se, determination.

Skully and Plato (2004) find that CCPs provide an effective, although limited hedge against lower prices. Most payment recipients are entitled to a portfolio of direct and counter-cyclical payments. For example, a typical Midwestern farm has corn, soybean and a small amount of wheat payment base, and usually produces these commodities. The portfolio of CCPs payments varies inversely with the receipts from the portfolio of crops produced. Because the prices of these crops are positively correlated, the CCPs provide a hedge for grain and oilseed production generally. In Hennessy's terminology, CCPs provide an insurance effect in addition to a wealth effect: they provide negative covariance and reduce the variance of farm income and increase its mean. This insurance effect is distinct from, in addition to, the wealth effects discussed above; for CCPs to influence production or investment decisions the recipient only needs constant absolute risk aversion. No change in risk-aversion is required as in the wealth-risk aversion channel. Note, for farms that are net buyers of grains and oilseeds, such dairy and livestock operations, CCPs provide positive covariance and increase the variance of farm income – this is a negative insurance effect.

Makki et al (2005) simulate the impact of CCPs for a representative farm in conjunction with other farm payments and subsidized crop insurance. They find small insurance effect for CCPs. CCPs are also found to have a greater impact in low-price years, which follows, ex post. Antón and le Mouël (2004) simulate the impact of CCPs assuming the representative producer has CRRA preferences with a coefficient of risk-aversion equal to 2. They find that CCPs have a modest insurance effect, equivalent to a 1 to 3 percent increase in market prices. But recall that CCPs account for a modest share of U.S. commodity support; an immodest increase in CCP expenditure would likely generate significant production effects.

implies DARA – decreasing absolute risk aversion – that the absolute amount of wealth invested in risky assets increases with wealth.

The early survey-based studies of Friend and Blume (1975) and Siegel and Hoban (1982) found that CRRA is a good approximation and that, if a single value is required, 2.0 is a reasonable value for the coefficient of relative risk aversion. Barsky et al (1997) confirm that most households conform to CRRA, and that there is a wide variation in willingness to bear risk: households relative risk aversion coefficients are usually between 1 and 10. Brunnermeier and Nagel (2006, 2008) examine PSID (Panel Study of Income Dynamics) data on household asset allocations. They find that CRRA provides a reasonable approximation but that household portfolios exhibit high levels of inertia. That is, CRRA portfolio rebalancing occurs, but with considerable delay. Behavioral economics finds that people are decision and regret averse in addition to risk averse. [Loomes and Sugden, 1982]

A further complication in the representation of risk aversion stems from a paper by Rabin (2000) showing that the levels of risk aversion elicited from choices involving relatively small stakes imply absurdly high levels of risk aversion for decisions involving large stakes. This result was later found to hold only if utility is defined in terms of terminal wealth; this has been the default assumption in expected utility theory. However, if utility is defined in terms of income, the absurd levels of risk aversion for high stake choices do not follow. The issue is far from settled. Harrison et al. (2007) provides a good discussion of this literature. These findings underscore the fragility of measurements of risk aversion. The sensitivity of risk aversion to whether income or terminal wealth is used is compounded by the difficulty in measuring income and particularly wealth.

The classic contribution to crop production response to risk is Chavas and Holt (1990) which models a farm household's area allocation decision under price and yield uncertainty. The initial import of this article was to demonstrate the empirical importance of price support policies in truncating the distribution of crop prices. Even if expected market prices are above support levels, the existence of a lower bound on the distribution of potential outcomes influences area planting decisions by modifying the distributions of relative returns. The Chavas-Holt household seeks to maximize expected utility given non-farm, exogenous income, a set of crop production technologies, an area endowment and expectations about yields, input and output prices. It seeks to maximize expected income and minimize the expected variance of income. However, the only choice variable is allocation of area among crops; there is no household labor allocation, or non-farm income and investment choices. The model is not applied to household or farm-level data; rather it is applied a 1954-85 time series for U.S. national-level data for corn and soybeans: the area allocation decision has two alternatives. The country is treated as if it were the decision of a single farm household. This blurs the distinction between household and market. It is an excellent example of a pseudo-household model. The import of the paper is that presented empirical evidence of risk aversion by producers. Chavas and Holt reject CARA and CRRA and argue that DARA fits the data best; although, as Hennessy 1998 points out, DARA does not fit their data particularly well.

When turning to farm household and payment recipient households the question arises whether farmers are different from non-farm households. Farming, like other forms of self-employment, involves greater variability than most forms of wage and salary employment. Sckokai and Moro (2006) examine the relative risk aversion of farm households using Italian farm household survey data. They find that the estimated risk aversion coefficient decreases with the size of farming operation. This is a cross-sectional result. It does not imply that increasing farm size reduces risk aversion, but it is consistent with the interpretation that individuals with greater risk tolerance choose to bear the greater risk involved in operating a larger farm. For small farms the coefficient of risk aversion is about 5.5, for medium size farms (20-40 ha) it is 0.5; and for large farms it is 0.05, virtually risk-neutral. Sckokai and Moro estimate the wealth, insurance and total effects for EU area payments. The output elasticities range between 0.014 and 0.087; the area elasticities range between 0.014 and 0.088. These are modest effects but larger than those found by similar studies of direct payments in the United States[17].

Problems with linking decoupled entitlements to land ownership or rental

> "Corn is not high because a rent is paid, but a rent is paid because corn is high. And it has been justly observed that no reduction would take place in the price of corn, although landlords should forego the whole of their rent."
>
> --Ricardo (1817) Principles of Political Economy, Vol. 1: 74-75

The ideal decoupled payment is a pure transfer payment – a direct deposit or government check that requires no action on the part of the recipient (beyond cashing the check). Existing decoupled payments are almost always linked to land, either owning farmland or leasing farmland; thus, existing payments are impure and the question is whether this deviation from the ideal matters, theoretically and empirically.

Two complementary forces help explain why governments choose to link decoupled payments to land: inertia and political economy. Consider inertia first. Decoupled payments are a means of compensating the recipient for the removal or reform of coupled forms of support. Official records of former support payments are organized on a farm and area basis and it is a simple matter of administrative ease

[17] Burfisher et al. (2000) find output elasticities of 0.010 for wheat and 0.022 for oilseeds. Goodwin and Mishra (2006) estimate acreage elasticities with respect to decoupled payments of 0.025 for soybeans and 0.034 for grains, however these elasticities are not statistically significant. Goodwin and Mishra also find no significant relationship between wealth and risk aversion, consistent with CRRA.

and continuity to administer the new decoupled payments in the same manner. The political economy of agricultural support also predicts linking decoupled payments to land. Much of the benefit of coupled farm support is capitalized in the value of (eligible) farmland. Linking decoupled payments to farmland ownership or use prevents or moderates the decline in farmland values when coupled payments are reduced or abolished. There are examples of successful payment terminations: Mexico's PROCAMPO limited compensatory decoupled payments to a 15-year transition period; Australia used decoupled payment to terminate dairy supports; and the United States bought out peanut quota rights with decoupled payments. But decoupled payments are often open-ended: with no explicit sunset, the payment flow continues until the next reform or negotiation of agricultural policy. Unless there is a sufficient deterioration in the relative political influence of farmland owners and payment recipients, it is likely – but far from certain – that the flow of payments will be perpetuated in subsequent agricultural legislation and regulations.

Capitalization of benefits: One strand of research on decoupled payments examines the capitalization of benefits into land prices. When payments are tied to particular parcels of land, whether or not the land is cultivated or whether anything is produced, the payment entitlement should be reflected in the resale value of such land. In theory, the increase in land value should equal the present discounted value of the benefit payment stream. The assumption, usually implicit, is that if payments are not observed to be fully capitalized in (higher) land values, then the portion not capitalized might be re-coupled somehow. Bureau (2008) notes that a Belgian capitalization study (Duvivier et al 2005) finds the same marginal degree of capitalization as recent U.S. studies (Roberts et al 2003): it ranges between 0.30 and 0.40. So, where do the non-capitalized benefits go?

There may be a simple answer to this question: the actual and prospective buyers of farm land entitled to payments are not fully confident about the durability of the future policy benefit stream. Governments often change agricultural policies and the stream of future policy benefits embodies considerable policy risk; thus it cannot be valued as if it were as certain as the flow of payments from a 30-year Government Bond: it will be valued at a discount proportionate the subjective perception of policy risk[18].

Policy risk is commonly acknowledged. For example, the U.S. Farm Credit Administration (2003: 48) makes the follow assessment regarding the use of farmland as loan collateral. "Two factors are increasing the risk that government

[18] Johnson (1991:202) reviews an earlier literature on capitalization of agricultural program benefits that focuses on policy risk; it includes the value of tobacco production quota in the United States (Seagraves 1969, Shuffett 1969, Hedrick et al. 1970) and dairy quota in Canada (Barichello 1996). Sumner and Wilson (2005) contribute to this literature with an analysis of the capitalized value of California dairy quota. They find the (ex post) rate of return on purchasing dairy quota to be 27%. They argue that such a high return is only plausible if there is a correspondingly high policy risk (ex ante).

payments may decline: (1) the pressure from the World Trade Organization (WTO), developing countries, and environmental groups to reduce agricultural subsidies in industrialized countries and (2) the surging budget deficit." Another factor increasing perceived policy risk is the greater transparency of agricultural support within the OECD. The research effort to measure producer support has contributed to its heightened visibility; so too have legal cases brought by civil society organizations to force governments to make agricultural support payment data publicly available. In the United States, the Environmental Working Group maintains an online "Farm Subsidy Database" from which one may access detailed payment data at the recipient level. Farmsubsidy.org is developing a similar service for Common Agricultural Policy payments, coverage varies by country[19].

Rental rates: When payment entitlements can be separated from specific land units – if they can be traded independent of land – the payments will become capitalized into the tradable entitlement right, not into farmland values. The tobacco, peanut, and dairy quota studies discussed above are examples[20]. In the land rental market the relative supplies of entitlement units and land units determines whether payments are reflected in land rental rates. When the supply of arable land exceeds the number of tradable entitlements landowners must compete for entitled tenants; this reduces the likelihood that payments are captured in rents. In the limit, tradable payments have no impact on land rents. However, when entitlements exceed land area, entitled tenants compete for land, this bids payments into rental rates. An excess of entitlements and a perfectly inelastic supply of land are necessary for complete payment capture. Courleux et al. (2008) provide a formal model of this market in the context of 2003 CAP reforms. Kilian et al. (2008) apply a variant of this model to Bavarian data and find evidence of a surplus of Single Farm Payment entitlements relative to land, and a higher rate of payment capture in rents after implementation of the 2003 Reforms. Kirwan (2008) uses Herfindahl indexes of renter and landowner concentration in the United States and finds the expected relationship between local market power and rental rates. This line of research suggests that policy design can influence the landlord/tenant benefit split. Allowing resale and geographic portability of entitlements will allow arbitrage to reduce local imbalances between land and entitlements. Limiting the quantity of area payment entitlements to less than the quantity of land will favor tenants; granting excess entitlements will favor landowners.

Compliance conditionality: Decoupled payments come with conditions. Usually the recipient must maintain the land (on which the payment entitlement is based) in good agricultural and environmental condition. It is theoretically possible for such conditions to "re-couple" decoupled payments by inducing recipients who would otherwise refrain from commodity production to produce. Consider an extra-marginal farm: it expects to lose $-\pi$ if it produces and to lose -C if it does not

[19] http://farm.ewg.org/farm/ and http://farmsubsidy.org/, respectively.

[20] A "bond scheme" – see Swinbank and Trantor (2004) is another example.

produce, as $-C > -\pi$ it is better not to produce. A decoupled payment of M does not change the decision because $M-C > M-\pi$. Adding a constant to both alternatives does not change the decision – indeed, this is the essence of decoupled payments: they have no effect at the margin.

Now suppose receipt of a decoupled payment obligates the recipient to incur an additional compliance cost of A and that commodity production would satisfy these compliance conditions at no additional cost. If the additional compliance cost is sufficiently great then $M-\pi > M-C-A$ and commodity production dominates not producing. The compliance conditions reduce the net decoupled benefit (M-A) to the non-producer, whereas a producer receives M. This changes incentives at the margin; thus, compliance costs could induce production, given these assumptions and relative magnitudes. This inducement is a significant increase in output for an individual extra-marginal farm, but the incidence of this re-coupling effect is likely rather small in aggregate as it involves a small shift outwards of the margin of commodity production. It has no impact on prime productive farmland where $\pi > 0$.

2.5 Biofuel policies

Policies that encourage domestic production beyond the level that would result from market-based incentives lower international prices and impair competing producers in other countries. However, when a country implements a policy that encourages consumption, its trading partners typically do not object. Biofuel policies induce a mixed reaction because they simultaneously subsidize production and consumption. They encourage (or mandate) the production and use of biofuels and this increases the demand and disappearance of feedstocks. The two most important OECD examples are subsidies (tax credits) for maize-based ethanol in the United States and subsidies (tax credits) for oilseed-based bio-diesel in the European Union. The global impacts of these policies are to reduce slightly the demand for and thus the price of oil and other fuels and to increase the prices of the feedstocks. To date biofuel policies have not faced concerted opposition from petroleum exporting countries. But concerns have been voiced about whether biofuels are an alternative means of subsidizing farmers and evading the disciplines of the WTO Agreement on Agriculture. And, particularly during and after the commodity price surge of 2006-2008, there is concern that biofuel policies caused or exacerbated the price surge and that expansion of biofuel production will absorb a growing share of grain and oilseed output and threaten global food security.

Biofuel policies belong to the set of public policies designed to increase demand for agricultural commodities viewed as being in surplus: increased demand, if market-driven, raises prices and reduces public expenditure on output-based commodity support. The critical qualification is market-based. Of current biofuel production, only ethanol derived from sugarcane in Brazil is regularly economically profitable. The U.S. maize-based ethanol and EU oilseed-based bio-diesel industries are unviable without substantial public support. Only at high ratios of the price of crude oil to the price of maize (as occurred briefly during the price surge of 2006-2008) is maize-ethanol production profitable without subsidy[21]. Thus biofuel policies reduce budget outlays on commodity support but the reduction in commodity support comes at a high cost in budgetary and welfare terms. As Gardner (2007) and de Gorter and Just (2009) demonstrate, subsidies (tax credits) for U.S. ethanol production are a costly and inefficient means of transferring income to maize producers[22]. Poor transfer efficiency is characteristic of many forms of agricultural support; what distinguishes biofuel policies is that they create or mandate additional demand. The output- or trade-distortion is a reduction rather than an increase in net exports. This changes the usual trade dispute calculus. Such "box shifting" – shifting the means of support to recipients from a disciplined box (e.g., Amber-box, coupled policies) to an undisciplined policy (biofuel or environmental policies) – might provide a basis for complaint if it resulted in an increase in net exports; but with biofuels this not the case.

The decease in net exports is alarming to many food importing countries. As biofuel mandates are phased in and new mandates enacted, will feedstock demand crowd out global food supplies? Preliminary answers are provided in two recent studies: Bouët et al. (2008) examines the implications of the EU biofuel mandate, and Westcott (2007) examines how the U.S. agricultural sector will adjust to higher mandated use of ethanol. Both studies find that the mandates induce major shifts in crop area allocation.

EU mandates for biodiesel have already resulted in an increase in area allocated to oilseeds (particularly rapeseed) in the EU-27 and this expansion will continue. The EU mandate for ethanol will induce a significant expansion in the area planted to sugar beets in the EU-27. Guindé et al. (2008), focusing on France, find that bio-diesel expansion is likely to induce a doubling or trebling of the area planted to rapeseed in France – from 8% to 16-23% -- and similar expansion for sunflower seed, from 3% to 6-8%; most of the expansion would come from a reduction in area planted to cereals. Bouët et al. (2008), looking at the entire EU-27, do not forecast a reduction in wheat or maize area. The study also examines the impact on global prices and likely area adjustments globally; these results depend on trade policy scenarios: whether greater market access will be allowed for imports of ethanol, biodiesel and feedstocks. All scenarios reveal moderately higher international prices for cereals and sugars, and significantly higher prices for vegetable oils.

[21] Steenblik (2007) and FAO (2008) report cost, profit, and support data.

[22] De Gorter and Just (2009) show that the ethanol tax credit results in "rectangular deadweight costs" and that the existence of commodity price supports (loan rates) amplifies the welfare losses of the tax credit. Steenblik (2007) provides a concise and quantitative survey of the biofuel policies in Australia, Canada, the European Union, Switzerland and the United States. Westcott (2007: 15-16) includes baseline forecasts of the influence of ethanol mandates on price-contingent support outlays.

Area planted to corn has increased in the United States because of mandated ethanol use. The increase is expected to continue as more ethanol capacity becomes operative. Most of expansion in corn area comes from reductions in soybean area, signifying a change in rotation patterns. Biodiesel production, less important in the United States than in the European Union, but expanding via mandate, is forecast to increase soybean prices and intensify production. As in the scenarios for the European Union, vegetable oil prices will increase with greater biodiesel production. The various tax credits and blending mandates employed to induce greater biofuel production and consumption result in a highly inelastic demand for biofuel feedstocks. Westcott (2007: 9) explains the implications:

> Ethanol demand is very inelastic (unresponsive to price changes) over the range of prices projected for the next decade, and is more inelastic than other major demands for corn, such as feed use and exports. Thus, overall demand in the corn sector is expected to become more inelastic as ethanol production expands. At the same time, carryover stocks of corn are expected to be maintained at relatively low levels. … Relatively low stocks can provide only a limited buffer to shocks. And with demand for corn becoming more inelastic, a greater change in market prices would be needed in response to a shock to adjust uses and bring the market to equilibrium. Thus, overall price variability and market volatility in the agricultural sector are likely to increase.

The impact of expanded biofuel production (through mandates, subsidies and credits) is to raise agricultural commodity prices generally (but especially vegetable oil prices) and, by making feedstock commodity demand more inelastic, increase commodity price variability as well. Thus, there are legitimate grounds for concern about the adverse effects of biofuel policies on global food security.

There is potential good, or at least mitigating, news that there is a second generation of biofuel feedstocks that may replace current, first-generation feedstocks. Maize, for example, is not a particularly good feedstock for ethanol production: it is used because it is widely produced, because maize genetics are well-understood, because of the bias of agricultural research toward the major subsidized or protected crops, and because of political support for a supposedly "green" infant industry. Starchy crops, such as maize, may be replaced in ethanol production by cellulosic materials and cellulosic plants are unlikely to compete directly for prime crop land. So increased use of second-generation feedstocks is likely to reduce if not reverse the risks current biofuel policies pose for global food security. The primary problem with this otherwise optimistic scenario is that the technological (or biotechnology) needed to covert raw cellulosic feedstock into a commercially viable fermentation stock has yet to be developed. A second potential problem is that large investments have been made (usually with tax credits or other public subsides) in first-generation biofuel production capacity. The owners of these facilities are as well-organized as commodity producers in protecting the value of their assets, the value of which is almost entirely dependent on the continuation of first-generation feedstock use. So the generational substitution, if it becomes technically feasible, may prove politically difficult. [FAO (2008) provides a clear overview of the second-generation feedstocks and of biofuels generally.]

2.6 Conclusions

This chapter provides an overview of the impact of OECD agricultural support policies on world agricultural markets. Overall, current OECD agricultural support encourages production and discourages consumption of agricultural products within the OECD; this reduces the volume of global agricultural trade and tends to reduce commodity prices on the world market. It reduces returns to non-OECD agricultural producers and thus inhibits investment and agricultural development.

Restrictions on market access (such as tariffs) by OECD countries account for almost all – over 90 percent – of these distortions; and aggressive agricultural tariff reduction would eliminate most these distortions. Since the mid-1980s, when multilateral agricultural trade negotiations began, many OECD countries have reduced tariffs and other impediments to market access. This exposes formerly protected producers to global competitive forces. To mitigate political opposition to agricultural trade liberalization many OECD countries introduced direct payments to producers; these tax-financed payments partially compensate for the loss of tariff protection. Direct payments distort output and trade, but to lesser degree than tariff protection.

The economic model of the farm household is logically the best way to analyze decoupled payments. However, household models require data that we usually do not have or do not have in sufficient quality or scale to yield robust empirical results. Empirical analysis with standard models, such as treating the entire agricultural sector as if it were a representative farm, treat the household as a black box and cannot identify causal processes within the household. Moreover, aggregation across households masks their underlying diversity and cannot detect differential household responses.

Despite the analytical challenges and variety of approaches the emerging consensus is that decoupled payments are minimally output- and trade-distorting; in many cases no significant output effect is observed. This indicates that the Annex to the WTO Agreement on Agriculture that specifies what shall constitute a minimally-distorting direct payment is well-designed: payments that comply with the rules have little or no output effect. This is good news; but there is potential to design even less-distorting policies. For example, most decoupled payments are currently linked to agricultural land, even though no production is required. This linkage is not necessary and it increases the risk of inducing some recipients to produce more output than otherwise; this effect appears to be minor, but it could be eliminated by severing the linkage to land.

Research on decoupling, particularly at the household level, can and should inform improved policy design. Indeed, if, as seems likely, agricultural support shifts from distortionary commodity market intervention to direct payments targeted to specific kinds of households or to specific areas and for environmental amenities, more household and site-specific data and analysis will be required.

The small production impact we observe from decoupled payments in large part comes from recipient household with low incomes or that cannot obtain credit: additional income can influence output in such cases. But the incidence is low, the share of agricultural output produced by such households is small in OECD countries. The bulk of agricultural output in the OECD is produced by households that are much wealthier than the average household. If decoupled support had been distributed in 1950, when farm households were typically poorer-than-average and when credit markets and supply chains much were relatively undeveloped, it would have had substantial production effects: recipients would have bought inputs and machinery, otherwise unaffordable. Similarly, decoupled support would likely have significant production effects in many developing countries today. With relatively complete markets and higher farm household incomes the scope for production effects diminishes.

Finally, the chapter examines biofuel policies, which are not agricultural policies but influence agricultural output and trade. Biofuel policies effectively subsidize the consumption of biofuel feedstocks – maize for ethanol and oilseeds for biodiesel. Feedstock use is expanding rapidly and has raised concerns about global food security, particularly during the 2007-08 surge in commodity prices. In the short and medium-run grain and oilseed prices are likely to be higher and more variable than in the absence of biofuel programs. It appears likely, however, that alternative feedstocks will become economically viable, replacing maize and oilseeds, and reducing the growing diversion of farmland to energy use.

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3

Farm support policies of the United States: Review and prospects for minimizing production and trade distortions

David Orden and David Blandford[1]

Introduction

The adverse effect of agricultural support and protection in developed countries on agricultural production and the prospects for alleviating rural poverty in developing countries is internationally contentious. The difficulty of coordinating developed-country commitments to reduce agricultural support and border protection has been central to a stalemate in the Doha Development Agenda (Doha Round) World Trade Organization (WTO) negotiations. The benefits of such commitments would be to reduce distortions in world market prices, eliminate subsidized exports, and expand market opportunities for low-cost developing-country and other agricultural producers.

This chapter provides a review of the farm support policies of the United States from the creation of the WTO in 1995 through the five-year U.S. "farm bill" enacted in June 2008, which specifies planned support policies through 2012. The first purpose of the chapter is to describe the evolving objectives and instruments of key farm programs and sources of policy change and continuity in the United States. The second purpose is to review the various policies in light of available assessments

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of the extent of the distortions they create, discuss likely future policy directions, and examine what opportunities exist for moving towards less distortive policy.

The chapter is organized as follows. In the next section we outline the rationale and goals of U.S. farm programs to provide context for the subsequent analysis and conclusions. In a third section, we focus on the farm support polices that have been articulated in the three U.S. farm bills enacted since 1996, concentrating on the Food, Conservation and Security (FCE) Act of 2008. We highlight three policy components and their shifting relative importance over time: commodity price and income support, long-term land idling and other conservation and environmental (agri-environmental) programs, and crop and revenue insurance and disaster relief. The patterns of expenditures on these programs during 1995-2007 are summarized using U.S. notifications of domestic support to the WTO. Section four turns to assessments of the impacts of U.S. farm policies, particularly the degree to which certain commodity-related policies create distortions in production and trade. We briefly examine policies aimed at increasing productivity and achieving environmental goals, whose effects are related to those of the commodity programs. We also highlight the effects on production and trade of tax credits and mandates for the production of biofuels. These policies are largely outside WTO disciplines on farm support and their effects on world markets are quite different from the support programs that have been the center of attention in the Doha Round and related policy debate of the last eight years.

A final section brings these threads together in a forward-looking manner. We examine whether the draft December 2008 Doha Round modalities for domestic support might constrain expenditures on some of the most market-distorting U.S. policies, including an optional new state revenue guarantee program (ACRE) enacted in 2008. We are realistic in noting limitations in the design and effectiveness of WTO rules, recognizing that the United States will inevitably continue to devote public resources to the support of agriculture. We discuss the political economy of U.S. farm policy in the context of a bipartisan consensus to provide a safety net for farmers and examine some options for moving toward less distorting support.

3.1 Rationale and goals of U.S. policies

The underlying rationale and specific goals of agricultural support policies in the United States have long been subject to political debate. This policy churn is reflected in multi-year farm support legislation, nearly annual decision reconsiderations by Congress, and continuous adjustments to program administration by executive branch agencies. The most recent farm bill was incubated in the legislative process for more than two years and the final act runs to nearly 700 pages.

The degree of consensus reached about farm policy can be glimpsed in the 2008 election-year national platforms of the Democratic and Republican parties. The Democrats titled their agricultural plank "Real Leadership for Rural America" and the Republicans "Supporting our Agricultural Communities." These planks shared several core themes. The Democrats called for a "strong safety net for family farms;" the Republicans for a "sensible economic safety net for farmers." The Democrats noted American farmers' unrivaled capacity to produce and called for "expansion of agricultural research;" the Republicans argued that farmers must have the technology to generate higher yields with fewer inputs and that "USDA must remain the international leader in agricultural research."

Beyond these two common touchstones of providing a safety net and investing in agricultural research, the two statements diverged in ways both specific to agriculture and reflecting ideological differences. The Democrats highlighted supportive government interventions (promoting economic development and investing in renewable energy, infrastructure and schools). The Republicans promised non-intrusive government (opposition to inheritance taxes and heavy-handed mandates while supporting incentives for conservation). The Democrats promised to balance an emphasis on agricultural trade with policies that "promote sustainable and local agriculture." The Republicans asserted that agriculture should meet the surging demand for food and biofuels but also that the government should "end mandates for ethanol and let the free market work."

Gardner (2002) articulates the conceptual and historical framework that underpins these centrist but differing party platforms. He traces two fundamental developments of American agriculture in the 20th century: the evolution of production agriculture as an enterprise and the evolution of farm household incomes. He argues that the driving force that explains agriculture's development is a quadrupling of multifactor productivity growth from about 0.4 percent annually before the mid 1930s. The long-term decline in real agricultural prices attributable to the subsequent more rapid technical change has had many benefits but has also caused many difficult adjustments. Gardner traces the consequent developments through a declining number and increased size of farms, decreased labor use, and increasing concentration of production. He describes agriculture as a production enterprise that became more divergent, not more convergent, over the 20th century. But not so for farm household incomes, where the data suggest convergence to nonfarm incomes and increased equality among farm households within and across regions.

The virtue of taking a long-term view is evident in Gardner's analysis. The pervasiveness of government involvement in the agricultural economy emerges through infrastructure investments, research, taxation, and numerous dimensions of market regulation. Gardner provides positive assessments of the emergence and impacts of these policies but is critical of the distortionary effects of interventions to support product prices, which he calls a "more nakedly political area of agricultural policy." He concludes tentatively that the case is not strong that enhanced productivity growth was an outcome of the commodity market interventions whose effects he criticizes.

Gardner's far-reaching assessment of the transformation of American agriculture over the past century provides the intellectual foundation that undergirds centrist arguments on the objectives of current U.S. policy. Yet, there remain competing visions of the technologies and behaviors that will emerge to address modern health, energy and climate challenges[2]. Shorter-term agricultural policy operates in this context of unknown developments that are likely to prove as far reaching in the 21st century as those of the previous one.

3.2 Specific policy components

The modernization of American agriculture has created a trimodal farm sector. A small number of highly-efficient commercial farms produce the bulk of food and fiber; small farms account for most of the enumerated units but only a small share of output; and a group of mid-sized farms are caught in the dynamics of modernization. American agriculture is also trimodal in terms of the protection and support it receives from government. A few commodities are highly protected by tariffs and import restrictions (dairy, sugar, peanuts, and tobacco). Another group of commodities receives most of the subsidy payments (grains, oilseeds, and cotton). A third group of commodities (fruits and vegetables, livestock, and poultry) receives relatively little protection or government support.

Reforms of U.S. farm policy have been undertaken as production and the income of farmers have undergone change. The basic direction of reform has been a shift away from supply controls combined with prices supported above market-clearing levels to less supply intervention and more direct income support, at least for crops that are exported. Support payments increased from less than 6 percent of farm income in the 1950s to more than 20 percent in the 1960s, but farm programs remained dependent on idling land to control supply and boost market prices. A global market boom briefly eliminated many government interventions in commodity markets in the early 1970s, but farm support proved impossible to terminate in the inflationary era that followed. A second shift came in the mid-1980s, when payments that required production but were based on fixed area and yields were again offered to farmers in lieu of higher prices.

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[2] A broad critique of modern agriculture is laid out by Pollan (2008). "Whatever we may have liked about the era of cheap, oil-based food" he writes, "it is drawing to a close." He calls his big idea to replace it with "energy of the sun." Essentially, Pollan argues for reversing the transformation from a solar-based to fossil-fuel-based agriculture that Gardner concludes is basically a story of success over the 20th century.

The 1996 Federal Agriculture Reform and Improvement (FAIR) Act initiated three additional changes in U.S. farm support programs for wheat, feedgrains, oilseeds, cotton, and rice. Farmers who received government support were given the flexibility to plant whatever crops they chose (except for most fruits and vegetables) on their base acreage[3]. The authority of the U.S. Department of Agriculture (USDA) to require annual idling of acreage to limit crop supplies was terminated. Farmers received fixed income transfers, known as production flexibility contract (PFC) payments, which were based on past production and independent of current market prices. These fixed direct payments replaced the earlier deficiency payments that had required production of the crop on which they were made. By 1996, mechanisms had also been put in place that allowed farmers to receive a cash payment for most supported crops when prices fell below levels guaranteed by commodity loan rates. Farmers received these cash payments instead of forfeiting their crops into government-owned storage. Thus loan rates continued to support prices for producers, but market prices were freed from a floor level and the government was extricated from cumbersome commodity stockpiling.

Changes to farm policy in 1996 moved further in the direction of providing direct income transfers instead of using land idling or government stockholding to keep prices above free-market-clearing levels. An upward spike in crop prices in 1995-1996 helped prompt the reforms but as prices fell sharply starting in 1997 the combination of PFC payments and the built-in expenditures for loan-rate price guarantees under the FAIR Act provided less support to farmers than would have been the case under earlier programs. Congress stepped in with "emergency" legislation, providing supplemental annual crop market loss assistance (MLA) payments, and new disaster relief and crop and revenue insurance subsidies.

The next farm bill, the Farm Security and Rural Investment (FSRI) Act of 2002, was written with farm commodity prices still low. This Act took few constructive steps toward the reduction of subsidies. MLA payments were institutionalized as countercyclical payments based on target prices, but farmers retained the planting flexibility legislated in 1996. As a result, payments were more decoupled from production decisions than in earlier legislation under which production of specific crops was required.

3.2.1 Buyouts as a reform mechanism

A more radical policy reform option in the form of buyouts (Orden, Paarlberg and

[3] Base acreage refers to the acreage on which payment eligibility is determined; deficiency payments refer to subsidies provided on a fixed amount of base-acre output when market prices are below a legislated target price, and loan rates refer to price guarantees for all output of the covered commodities. The 1990 farm bill provided limited flexibility under which farmers could shift part of their base acreage among crops without that land permanently losing payments eligibility, but deficiency payments were suspended on that acreage during years when alternative crops were grown.

Roe 1999) has been used for peanuts and tobacco. These commodities provide evidence about the conditions conducive to a buyout and its cost. Restructuring of the peanut program in the FSRI Act included a buyout of production quota rights and lower prices for the edible-peanut domestic market, together with new fixed direct and countercyclical payments and a higher loan rate for previously non-quota peanuts used in processing or exported. A tobacco buyout under separate legislation in 2004 ended production quotas and completely eliminated price support without implementing new payment mechanisms.

The peanut and tobacco buyout payments have provided quite lucrative compensation, especially given the declining benefits to quota owners that triggered the reforms. For peanuts, buyout payments of $0.55 per pound of existing uota were equivalent to an average of past rental payments, discounted at a 5 percent rate, for a period of 24 years (Orden 2007). Payments to quota owners for flue-cured and burley tobacco were equivalent to discounted average quota rental payments for 15-20 years. The buyout payments exceeded these potential future payment streams to the extent that domestic prices or the quantities eligible for the peanut or tobacco quotas under the earlier programs would have declined under their continuation.

3.2.2 Conservation and environmental programs

Conservation and environmental programs play an important role in U.S. agricultural production decisions. The United States has enacted conservation-oriented land idling as a supply control measure during times of low prices (the 1930s, the 1960s, and again in 1985) and let these programs expire when market demand was relatively strong. The Conservation Reserve Program (CRP) enacted in 1985 has a supply-depressing effect as well as providing environmental benefits. It is estimated that roughly two-thirds of the enrolled acreage would return to crop production if the program were ended (Heimlich 2006). The FSRI Act raised the authority for the CRP to 39.2 million acres, compared with 36.4 million under the FAIR Act. Other agri-environmental programs offer technical assistance, cost sharing, and incentive payments to assist livestock and crop producers whose resources remain in production.

There have been several refinements in the implementation of agri-environmental programs and a shift in policy objectives over time (Cox 2007). Modifications mirror the movement toward less intrusive commodity support programs. Land idling has become more targeted toward acreage that provides identifiable environmental benefits. There has been a shift from on-farm productivity-enhancing conservation measures toward managing off-farm environmental damage and promoting off-farm environmental benefits. These reforms increase the efficiency of agri-environmental programs and limit production distortions. Estimates are that non-market benefits from the CRP, primarily from improved water quality and wildlife habitat, roughly equal the direct cost of the payments made to landowners (Heimlich 2007). Still, just as commodity program reform has not brought an end to the government's involvement in providing support to producers of the basic crops, in the conservation and environmental area farmers continue to receive preferential treatment (Kuminoff 2006) through exemptions from environmental regulations, substantial expenditures through voluntary incentive-based programs to address adverse environmental impacts of production, and paid idling of nearly one-tenth of U.S. crop acreage. Critics of the U.S. agri-environmental programs (e.g. Heimlich, Cox and Kuminoff) argue that they have not been reformed enough to increase cost effectiveness and environmental gains.

3.2.3 Crop and revenue insurance and disaster relief

A third key dimension of support for U.S. agriculture arises from subsidized crop and revenue insurance and annual disaster relief assistance. These subsidies and assistance are targeted toward risk-sharing related to localized adverse within-year shocks to yields or revenue. In the mid 1980s, crop insurance subsidies averaged less than $500 million annually even while commodity support expenditures rose dramatically and the CRP was launched with a goal of idling 40 million acres. Crop and revenue insurance subsidy costs had more than doubled by the time of the 1995-1996 commodity price boom. Subsequently, insurance subsidies and disaster relief expenditures combined averaged roughly $3 billion annually during the 1999-2007 period.

Tension has existed over expenditures on crop and revenue insurance versus disaster relief. Disaster relief was criticized in the 1970s as being costly and leading to distorted production incentives in marginal cropping areas. Crop insurance programs suffer from adverse selection and moral hazard problems that stifle the development of private insurance markets. These problems are not unique to agricultural risks, and farmers have other risk management strategies available, but again agriculture has benefitted from preferential treatment. As Glauber (2006) put it, the policy debate has focused "not on whether" to provide subsidies "but rather on the form the assistance should take."

The 1980 Federal Crop Insurance Improvement Act was designed to replace the annual relief expenditures with more systematic subsidized insurance as the main form of disaster protection. However, sign-up rates and levels of coverage remained low with the levels of subsidies provided and in several years (particularly 1989 and 1994) Congress appropriated substantial disaster relief expenditures. The Crop Insurance Reform Act of 1994, and then the Agricultural Risk Protection Act of 2000, increased premium subsidies. Coverage availability for losses of yields or revenue expanded to over 350 commodities and over 80 percent of insurable acreage became enrolled (Glauber 2006). Political support for the programs has increased among farmers, even though insurance subsidies are a relatively inefficient instrument for delivering income transfers. Yet, the fundamental issue of policy instrument choice has never been resolved. Despite the expanded insurance coverage, Congress has continued to approve substantial annual disaster relief expenditures.

As with the commodity and agri-environmental support programs, there has been a progression of modest reforms in the implementation of the insurance programs that has improved their efficiency. Delivery was transferred under the 1980 Act from government agencies to private companies (generating their political support for the programs). Diversity has emerged in available contracts. Experience, accumulation of data and policy design decisions have improved loss ratios from averaging over 2 to near 1, although there remain regional differences in the extent to which premiums have covered indemnities. Critics remain concerned about double indemnity (Glauber 2006) arising from overlapping insurance and disaster relief programs and the underlying problems of adverse selection and moral hazard that have required large subsidies for crop insurance to be viable.

3.2.4 Continued support under the Food, Conservation, and Energy (FCE) Act of 2008

The FCE Act of 2008 was legislated during a period of relatively high farm commodity prices. It mandates expected expenditures for fiscal years 2008-2012 similar to levels anticipated under the 2002 legislation. Total expected outlays were increased by $5 billion and spending was shifted among categories at the margin, as shown in Table 3.1, so that the FCE Act attracted a broad coalition of supporters.

TABLE 3.1

Aggregate anticipated expenditures under the 2008 FCE Act

Category	Projected baseline under 2002 FSRI	Projected FCE Act expenditures
	(US$ billion)	
Commodity support	43.3	41.6
Conservation	21.4	24.1
Crop insurance	25.7	21.8
Energy	0.0	0.6
Nutrition	186.0	188.9
Other	7.9	12.0
Total	284.0	289.0

Sources: Congressional Budget Office 2008 and Johnson 2008

Because of strengthened world agricultural commodity prices by 2007 there was an anticipated squeeze down of traditional commodity subsidies under the FCE Act with countercyclical payments and loan-rate-related price support expected to fall sharply. Commodity program spending of $41.6 billion was projected (mostly for fixed direct payments), whereas commodity support during the previous five fiscal years had been projected to be $78 billion when the 2002 FSRI Act was written (Chite 2007). Authority for the CRP was reduced to 32 million acres in 2008, but total expected expenditures for agri-environmental programs increased to $24.1 billion, equivalent to almost 60 percent of the sum for projected commodity support. In the event of continued high prices, a substantial relative shift toward agri-environmental programs will take place in support outlays.

One cause of the boom in commodity market prices in 2007-2008 was the U.S. ethanol fuel tax credit and ethanol use mandates designed to promote corn-based fuel production. These product-specific policy instruments are reinforced by a high import duty. Initiated in 1978, the tax credits had only induced a modest level of ethanol output (less than 2 billion gallons in 2005) until oil prices rose and new ethanol use mandates were enacted. The Energy Policy Act of 2005 mandated that production reach 7.5 billion gallons by 2012 and the Energy Independence and Security Act of 2007 expanded the mandate for biofuels to 36 billion gallons by 2022, of which 15 billion gallons were to come largely from corn-based ethanol production. A model-based estimate of the effect on corn market prices (de Gorter and Just 2007) suggested an increase of 25 percent ($0.74 per bushel) in 2006 due to the tax credit, assuming the mandate was not binding (see also Babcock (2008) and FAPRI (2008)).

With high commodity prices, the fixed direct payments to farmers came under scrutiny in the domestic debate over the FCE Act. While decoupled income support is exempted from expenditure constraints under WTO rules, with the fixed direct payments being so large a share of anticipated farm support the proponents of other initiatives eyed a reduction in those payments as a potential source of funding. The direct payments were retained only after a rancorous domestic dialogue, particularly over income eligibility limits for recipients.

The sharp rise in prices in 2008 also shifted policy toward one new policy instrument, as rising prices had in 1996. In the FCE Act, however, the shift was not toward greater decoupling but toward a program closely tied to production and market prices. The Act includes an optional Average Crop Revenue Election (ACRE) program which is product-specific, trade-distorting support. Starting with the 2009 crop, farmers electing ACRE for all covered commodities for the duration of the FCE Act incur a 20-percent cut in their fixed direct payments and a 30-percent cut in their loan rates. In exchange, they secure a revenue guarantee, adjusted to their farm, of 90 percent of an amount derived from applying a two-year national average of lagged prices to the five-year Olympic average of state average yields per acre. Unlike loan-rate price support levels, there is no legislated floor on the ACRE revenue guarantee. However, the guarantee per acre cannot vary by more than 10 percent from year to year, potentially moderating any sharp revenue downturn from high levels, such as those in 2007 and 2008.

Subsidies for traditional crop and revenue insurance were also projected to be higher during 2008-2012 than the average under the FSRI Act due to higher crop prices[4]. And the FCE Act included mandatory funding for five disaster relief programs, ensuring at least partial availability of funds without requiring annual congressional appropriations.

Farmers also remain well protected if prices turn out to be lower than projected. Slight increases in loan rates and target prices contained in the FCE Act strengthen policy instruments coupled to production. These will prove ineffective (with the exception of an increase in the sugar loan rate) if market prices remain well above loan-rate levels as projected[5]. Yet, the argument made, and which will be extended if farm price and income conditions deteriorate from their 2008 levels, is that higher energy prices and related production costs render inadequate the safety net that was lauded by many farm groups from 2002 to 2007. Traditional price and income support levels that were raised only slightly in 2008 could be increased further in the future. Just such an adjustment occurred in 2009 when USDA announced temporary increases of about 15 percent in dairy price supports after market prices fell sharply.

Despite these considerations, the high world prices that were straining the global food system in mid 2008 had only modest effects on the commodity support provisions in the latest U.S. farm bill. The veto-proof majorities assembled in Congress for the FCE Act demonstrated the ability of the farm lobby to secure a continuation of support programs that largely serve the same purposes and benefit the same interest groups as earlier legislation. Still, the farm sector did not avoid, at least for the time being, a projected squeeze down of most anticipated subsidy payments under the price-linked support programs.

3.2.5 WTO notifications of U.S. domestic support

Data on the timing and comparative magnitude of the U.S. farm support expenditures during 1995-2007 is provided in notifications to the WTO under the Agreement on Agriculture. The main notified components of U.S. support for agricultural producers include fixed direct payments and agri-environmental payments in the green box; market price supports for dairy and sugar and

[4] Most of the claimed five-year savings shown in Table 3.1 were achieved simply by postponing the timing of some insurance payments past 2012. The FCE Act also stipulated that total premiums be adjusted slightly to equal anticipated total indemnities (resulting in an expected loss ratio equal to one) and it reduced delivery cost reimbursements to insurance agents.

[5] The loan rate for raw cane sugar rises from \$0.18 per pound to \$0.1875 by 2012. The Secretary of Agriculture is required to set domestic marketing allotments at no less that 85 percent of estimated quantities for domestic human consumption and to purchase sugar to produce biofuels if necessary to avoid forfeitures of sugar to the Commodity Credit Corporation.

substantial price-linked, loan-rate-related subsidy expenditures in the product-specific (PS) Aggregate Measurement of Support (AMS); and crop MLA payments, countercyclical payments, and crop and revenue insurance subsidies notified as *de minimis* non-product-specific (NPS) support. Most U.S. disaster assistance has been notified as meeting the criteria of the green box. Table 3.2 shows the aggregate expenditures in each category. Blue-box support was eliminated by the FAIR Act.

Green-box support

Table 3.3 shows that the largest and most rapidly growing category of green-box expenditures is for domestic food aid. Public research expenditures funded at both the federal and state levels fall into the general services category. In 2007, the most recent year for which notification data are available, the U.S. notified $2.9 billion in federal expenditure on agricultural research, education and extension and an additional $4.3 billion on a range of state programs for agriculture including research and extension.

Decoupled income support has been the most important component of payments to farmers notified in the green box. This support is composed mostly of the fixed direct payments initiated in 1996, but also includes peanut and tobacco buyout payments. Conservation (resource retirement) and environmental payments have also been important green-box agricultural expenditures and disaster relief has been substantial in some years. Together these categories total roughly $11 billion annually in recent notifications. Some leeway is accorded from the fundamental green-box criterion that payments have no or minimal impact on production or trade through the specific criteria for environmental programs. Agri-environmental payments can be linked to production methods and inputs, but the amount of payment must be limited to the extra costs or loss of income involved in complying with clearly defined conservation or environmental objectives[6].

Product-specific support

Table 3.4 provides a breakdown of the product-specific AMS (before the application of *de minimis*) by type of measure[7]. The market price support (MPS) component

6 While not all U.S. agri-environmental programs (or indeed those in other countries) conform exactly to these criteria most do. Several U.S. programs provide grants for environmental improvements based on a cost-sharing approach and the FCE Act makes specific reference to payment for costs incurred or income foregone in respect of several programs. Land is accepted into the CRP on the basis of a benefit-cost assessment, i.e., what a producer is prepared to accept for placing a parcel of land in the reserve in comparison to the environmental benefits that are expected to result.

7 Product-specific *de minimis* has not been a major factor in reducing notified support. It has been less than $250 million except in 2002-2004 and never more than $1.6 billion (2002). However, this exclusion has reduced significantly the number of years for which AMS support has been notified for a wide range of commodities. For example, an AMS applied to barley in 12 of the 13 years from 1995-2007, but after the application of *de minimis* less than half of these years have a barley AMS included in the U.S. Total AMS.

TABLE 3.2

Summary of U.S. domestic support notifications, 1995-2007

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						(US$ billion)							
Total AMS	6.21	5.90	6.24	10.39	16.86	16.80	14.41	9.64	6.95	11.63	12.94	7.74	6.26
De minimis[a]	1.48	2.27	0.80	4.74	7.43	7.34	7.04	6.69	3.24	6.46	5.98	3.60	2.26
Blue	7.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Green	46.04	51.83	51.25	49.82	49.75	50.06	50.67	58.32	64.06	67.43	71.83	76.04	76.16
Total support	60.77	59.99	58.29	64.95	74.05	74.20	72.13	74.65	74.25	85.51	90.75	87.38	84.68
						Share of total support (%)							
Total AMS	10	10	11	16	23	23	20	13	9	14	14	9	7
De minimis[a]	2	4	1	7	10	10	10	9	4	8	7	4	3
Blue	12	0	0	0	0	0	0	0	0	0	0	0	0
Green	76	86	88	77	67	67	70	78	86	79	79	87	90
Total support	100	100	100	100	100	100	100%	100%	100%	100%	100%	100%	100%

Source: WTO notifications and authors' calculations.
[a] Includes product-specific and non-product-specific *de minimis*.

TABLE 3.3

U.S. green-box notifications

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						(US$ billion)							
General services	6.42	6.55	6.80	7.23	7.69	8.55	9.21	10.26	10.94	11.20	11.35	10.78	10.75
Public stockholding/food security	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic food aid	37.47	37.83	35.96	33.49	33.05	32.38	33.92	38.01	42.38	45.86	50.67	54.18	54.41
Decoupled income support [a]	0	5.19	6.29	5.66	5.47	5.07	4.10	5.30	6.49	5.27	6.16	6.14	6.13
Income insurance/safety nets	0	0	0	0	0	0	0	0	0	0	0	0	0
Disaster relief	0.10	0.16	0.16	1.41	1.64	2.14	1.42	2.12	1.69	1.96	0.17	1.07	0.93
Producer retirement	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource retirement	1.73	1.73	1.69	1.69	1.43	1.48	1.62	0	0	0	0	0	0
Investment aids	0.08	0.09	0.09	0.09	0.13	0.13	0.11	0.12	0.11	0.09	0.08	0.14	0.12
Environmental payments	0.23	0.28	0.27	0.26	0.33	0.31	0.29	2.51	2.45	3.04	3.40	3.73	3.83
Regional assistance	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	46.04	51.83	51.25	49.82	49.75	50.06	50.67	58.32	64.06	67.43	71.83	76.04	76.16

Source: WTO notifications.
[a] Subtracting peanut and tobacco buyout payments, fixed direct payments are $5.27 billion in 2003, $5.26 billion in 2004, $5.22 billion in 2005, and $5.18 billion in 2006 and 2007.

Table 3.4
Composition of the Total AMS by type of measure (before the application of de minimis)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Type of measure							*(US$ million)*						
Market Price Support	6,213	5,919	5,816	5,776	5,921	5,840	5,826	5,771	5,758	5,832	5,908	6,154	6,238
Dairy	4,693	4,674	4,455	4,332	4,437	4,377	4,483	4,509	4,515	4,646	4,794	4,882	5,011
Peanuts	412	308	315	350	303	330	311	0	0	0	0	0	0
Sugar	1,108	937	1,045	1,093	1,180	1,133	1,032	1,262	1,242	1,186	1,114	1,272	1,227
Emergency payments	0	0	0	331	697	1,526	6	1,409	1	41	90	56	5
Price-linked subsidies	88	6	578	4,106	9,706	9,042	8,429	3,525	1,141	5,549	6,616	1,357	8
Other support [a]	10	12	80	338	567	498	446	523	487	853	447	347	245
Total	6,311	5,938	6,475	10,550	16,891	16,906	14,706	11,227	7,386	12,275	13,061	7,913	6,497
Type of measure							*% of total*						
Market Price Support	98	100	90	55	35	35	40	51	78	48	45	78	96
Emergency payments	0	0	0	3	4	9	0	13	0	0	1	1	0
Price-linked subsidies	1	0	9	39	57	53	57	31	15	45	51	17	0
Other support	0	0	1	3	3	3	3	5	7	7	3	4	4
Major price-linked subsidies							(US$ million)						
Certificate exchange gains	0	0	0	6	175	619	1,975	317	307	1,453	1,173	967	0
Commodity loan forfeit	0	0	-2	6	642	20	20	658	1	11	5	0	0
Loan deficiency payments	38	0	3	2,723	6,062	6,192	5,588	538	468	3,688	4,794	217	1
Marketing loan gains/payments	0	0	161	1,092	1,830	813	615	193	135	348	272	16	7
Cotton user marketing payments	35	6	416	280	446	237	182	0	0	0	0	0	0
Mik income loss contracts	0	0	0	0	0	0	0	1,795	221	9	352	157	0
Oilseed payments	0	0	0	0	460	921	0	0	0	0	0	0	0
Other [b]	15	0	0	0	100	274	49	23	9	40	21	0	0

Source: Computed from WTO notifications.

[a] Includes commodity loan interest subsidies and storage payments, cotton user marketing (Step 2) payments, bioenergy program payments and assorted others.

[b] Includes adjustment assistance payments, support payments for mohair and wool, and miscellaneous payments for cotton, dry peas, sugar and wheat.

of the AMS is based on administered (loan rate) support prices that exceed fixed reference price levels set in the U.S. Uruguay Round schedule. Support prices and production for the two main commodities with MPS (dairy and sugar) have remained relatively stable, thus the notified MPS shows little year-to-year variation. Since the WTO notified MPS is not responsive to changes in domestic or world prices that enter into standard calculations of nominal assistance or protection, the notified MPS figures do not provide the best estimates of the support given annually for these commodities.[8] The 2008 FCE Act made an important technical change in how dairy support is defined so that it applies only to certain processed dairy products instead of all fluid milk. This redefinition may allow the United States to reduce its notified dairy MPS by as much as two-thirds.

Those components of the product-specific AMS based on support payments (emergency payments, price-linked subsidies, and other support in Table 3.4) can be highly variable from year to year. Expenditures tend to vary inversely with domestic market prices. One reason is that existing price-linked subsidy programs (the loan-rate-related payments) are triggered when prices fall. Between 1997 and 1999, for example, loan deficiency payments for crops rose from less than $3 million to more than $6 billion. Another reason is because Congress has responded to price declines by providing emergency payments to farmers that have been notified as product-specific AMS (as with the oilseed payments in 1999-2000, emergency payments made to livestock producers in 2002, and milk income loss contracts introduced in 2002). Thus, in comparison to many other countries the United States is particularly vulnerable to sharp swings in its notified support under the product-specific AMS because of the nature of its programs and the willingness of Congress to provide emergency assistance to farmers. Cotton, which has been particularly contentious in the Doha Round WTO negotiations, accounts for as much as 19 percent of the U.S. Total AMS in several years.

Non-product-specific support

Several important forms of support are included under the non-product-specific AMS category (Table 3.5), which the United States has excluded from its notified Total AMS as being *de minimis* in all years. The crop MLA payments from 1998 to 2001 and countercyclical payments initiated in 2002 exceeded $4 billion in five years. Crop and revenue insurance subsidies fluctuate but are somewhat higher after 2000. Variability in the total annual NPS support is apparent in Table 3.5 and again is related to price movements. Since 1998, when crop MLA payments were first introduced, price-linked emergency and countercyclical support has varied

[8] The OECD measure of market price support reflects domestic and world price variability. For sugar, the WTO and OECD measures for the U.S. are fairly similar for 1998-2004 but OECD reports less market price support during 1995-1997 and 2005-2007. For dairy, the OECD measure varies substantially across years, ranging from a low of $4.8 billion in 1995 to a peak of $12.9 billion in 1998. The OECD measure exceeds the WTO notified level in all years except 2006, with the values similar in 1995, 2003 and 2005.

TABLE 3.5

U.S. non-product-specific AMS

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						(US$ billion)							
Irrigation projects	0.38	0.38	0.35	0.35	0.32	0.32	0.30	0.30	0.30	0.27	0.27	0.24	0.24
Livestock grazing	0.04	0.05	0.05	0.05	0.05	0.05	0.07	0.05	0.04	0.05	0.04	0.04	0.04
Crop and revenue insurance	0.91	0.64	0.12	0.75	1.51	1.40	1.77	2.89	1.86	1.12	0.76	1.61	0.80
Crop market loss assistance (MLA) payments	0.00	0.00	0.00	2.81	5.47	5.46	4.64	0.00	0.00	0.00	0.00	0.00	0.00
Countercyclical payments	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.54	4.29	4.75	1.49	0.89
Other	0.05	0.05	0.05	0.63	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05
Total	1.39	1.11	0.57	4.58	7.41	7.28	6.83	5.10	2.80	5.78	5.86	3.43	2.02

Source: WTO notifications.

between $0.5 and $5.5 billion.

The NPS de minimis exclusion has proved to be important to the U.S. notifications. Table 3.6 presents several alternative summations of the notified U.S. support. The size of the de minimis exemption has been equivalent to more than 40 percent of the notified Total AMS (after de minimis) on average, and it almost reached 70 percent in 2002. If the United States had not been able to use this exemption, it would have exceeded its Total AMS commitment in 1999-2001.

A notification issue for the United States is the status of some of its programs in light of the Brazilian cotton case (WTO 2005) and subsequent challenges to its support payments by Brazil and Canada (WTO 2007a, 2007b). The cotton case ruling casts doubt on whether U.S. fixed direct payments qualify as green-box decoupled income support[9]. Had they been notified as amber support, the United States would have violated its Total AMS commitment in a number of years. Table 3.6 shows that if direct payments were notified as non-product-specific support (following the approach used by the United States for countercyclical payments) the Total AMS binding would have been exceeded in 4 of the 13 years for which notifications have been made. If crop MLA, countercyclical and fixed direct payments were counted as product-specific support (based on the precedent of the cotton case ruling) the United States would have exceeded its commitment in 5 of the 13 years.

However these notification issues are resolved, in the aggregate government payments have played a discernible countercyclical role in stabilizing U.S. farm income. Figure 3.1 shows the relationship between prices received by farmers, total payments received under government farm programs, and farm cash income for the period 1996-2006. When prices decline government payments account for an increasing share of both gross and net farm income, as demonstrated by the period 1996-2000. The opposite relationship applies when prices increase, as demonstrated by the period 2002-2004. Payments have ranged between 10 percent and 40 percent of farm annual net cash income.

3.3 Effects of support policies

The principal focus of attention in terms of potential production and trade distortions has been on those programs that act to support prices received by U.S. farmers. This is because these are the elements of policy that are likely to have the

[9] This finding rests largely on exclusion of fruit and vegetable production from base acreage. The FCE Act included only a small pilot program to allow base-acreage production of certain fruits and vegetables (for processing on 60,000 acres in seven Midwestern states). Any such acreage planted is ineligible for support payments during that year. Blandford and Orden (2008), Blandford and Josling (2007) and Sumner (2006) provide additional discussion of potential WTO challenges to the U.S. notifications.

TABLE 3.6.

Alternative summations of notified U.S domestic support, 1995-2007

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						(US$ billion and %)							
URA AMS Binding	23.08	22.29	21.49	20.70	19.90	19.10	19.10	19.10	19.10	19.10	19.10	19.10	19.10
Total amber [a]	7.70	8.17	7.04	15.13	24.30	24.14	21.46	16.33	10.19	18.09	18.92	11.34	8.52
As percent of binding	33	37%	33%	73%	122%	126%	112%	85%	53%	95%	99%	59%	45%
De minimis/total AMS	24	38%	13%	46%	44%	44%	49%	69%	47%	56%	46%	47%	36%
De minimis/total amber	19%	28%	11%	31%	31%	30%	33%	41%	32%	36%	32%	32%	27%
Total AMS+NPS (with DPs) [b]	6.21	5.90	6.24	20.63	29.74	29.15	25.34	20.04	6.95	11.63	12.94	7.74	6.26
As percent of binding	27%	26%	29%	100%	149%	153%	133%	105%	36%	61%	68%	41%	33%
Total AMS + CCPs + DPs [c]	6.21	11.08	12.52	18.86	27.80	27.33	23.15	16.74	12.76	21.18	22.91	14.41	12.33
As percent of binding	27%	50%	58%	91%	140%	143%	121%	88%	67%	111%	120%	75%	65%

Source: WTO notification

[a] Total amber is defined as total AMS + *de minimis*.

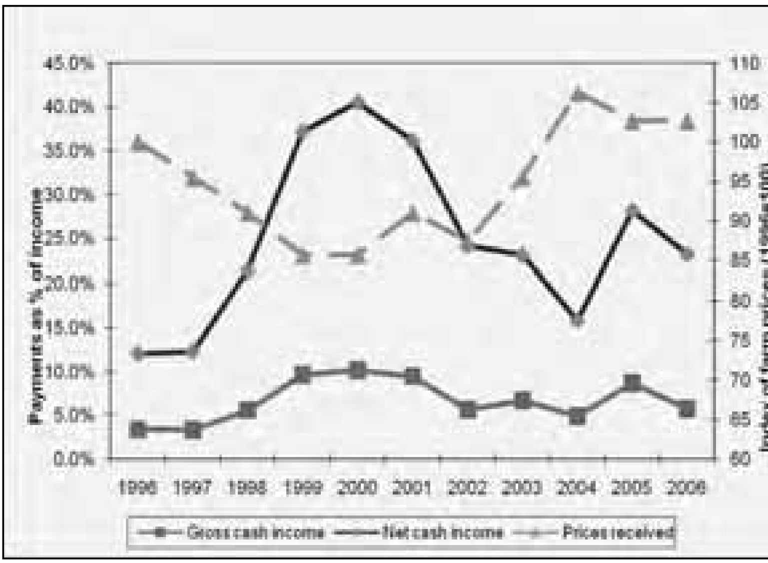
[b] Fixed direct payments (DPs) only count against the total aggregate measure of support (AMS) limit (and are added to the total AMS), if their inclusion in the non product-specific (NPS) causes this to exceed the *de minimis* level. Fixed direct payments exclude buyout payments for peanuts and tobacco included in notified green box decoupled income support.

[c] Assumes that crop market loss assistance (MLA) payments, countercyclical (CCP) payments and fixed direct payments (excluding buyout payments) are re-classified as product-specific support.

greatest impact on the total output of U.S. agriculture and to influence the mix of products. There is also interest in the potential effects of non-product-specific measures that are not linked to current production or reduce risk, and to certain

FIGURE 3.1

U.S. farm prices and importance of government payments for farm income



Source: Computed from data from ERS (USDA) and NASS.

categories of policies notified in the green box, in particular, fixed direct payments and to a lesser extent agri-environmental and disaster payments.

Among the price support policies, the dairy and sugar programs are likely to be the most trade distorting, other things being equal. The United States is a net importer of these commodities and the price support programs rely upon import tariffs and TRQs to limit supply and to keep domestic prices at or above legislated levels. Domestic supply and demand for sugar have been kept roughly in balance such that the government has not accumulated stocks. When domestic supplies of milk have been large the U.S. government has acquired stocks of dairy products, which have been disposed of through domestic food assistance programs, food aid programs, or the use of direct export subsidies. The United States has notified significant market price support for both of these commodities to the WTO as shown in Table 3.4, but the extent that this reflects the impact of current programs on the market or producer incomes is somewhat obscured, particularly in the case of the dairy program.

The other main price support programs rely primarily on payments to producers when domestic prices fall to loan-rate levels. The fact that support payments linked directly to current production and prices are likely to be trade distorting, since they exert a direct impact on U.S. production and exports of agricultural products, is reflected in these programs being notified to the WTO in the product-specific AMS category[10].

The effects of payments based on current output are illustrated by Skully (2009, chapter 2 of this report). Empirically, Westcott and Price (2001) analyzed the impact of marketing loan/loan deficiency payments for the period 1998-2005, using projected data for 2000-2005. They estimate that as a result of price support, planted acreage for major crops was increase by 2-4 million acres during the period 1999-2001, when commodity prices were low and the level of loan-rate-related government payments was high. Projections of higher commodity prices and lower government payments result in smaller effects on planted acreage in subsequent years. Higher returns generated increased exports and the effects were most pronounced for rice and upland cotton. Export prices for rice were estimated to have been reduced by 10 to 20 cents per hundredweight and cotton prices by 1 to 5 cents per pound due to the marketing loan programs. Because land can be reallocated among various crops depending on relative returns, Westcott and Price find that the prices of some crops were increased by the program; for example, corn prices were increased by 3 to 4 cents per bushel in 2001-2003 due to a shift of acreage into soybeans in response to higher returns for that commodity created by the support program.

3.3.1 Distortionary impact of direct and countercyclical payments

Producers are likely to adjust their production plans in response to government payments if these affect the relative profitability of alternative crops. In order for such effects to be apparent, the amount of payment received from the government must increase with the volume of production. The fixed direct and countercyclical payments are determined on the basis of past production of individual commodities, so the level of payments to a producer does not depend on current production on the land upon which the calculation of payments is made.

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[10] As a net exporter of these commodities other explicit measures also have been used to stimulate exports. These measures, for which full discussion lies beyond the scope of this chapter, have been declining in importance, although dairy export subsidies reemerged in 2009. The Export Enhancement Program (EEP) provided direct export subsidies for grains and oilseeds, but was eliminated in the 2008 FCE Act. Export credit programs are also used to stimulate exports to certain markets. Following the 2005 WTO panel ruling in the Brazilian cotton case the United States took action to address such effects with respect to cotton export subsidies, in particular, and credit guarantee programs, more generally. The new structure responds to a key finding of the WTO panel that the fees charged by the programs should be risk based. Strengthening commodity prices have also led to a decline in the use of in-kind food aid (e.g., P.L.480) to dispose of surpluses. See Blandford, Laborde and Martin (2008) for further discussion of U.S. export subsidies.

Given this decoupling, it might seem unlikely *a priori* to find evidence of an effect of these payments on production. However, there are several mechanisms through which such an effect might occur. Skully (2009) develops these arguments in depth and provides an extensive review of the empirical evidence on their magnitude.

An earlier review of the evidence on the impact of the PFC and MLA payments examined the results obtained using a variety of analytical approaches (Abler and Blandford 2005). These included producer surveys, synthetic models, and econometric studies of the impact of direct payments, as well as related studies on the impact of capital constraints, risk response and risk aversion, and producer entry/exit and structural change. Abler and Blandford concluded that empirical studies support the view that the decoupled payments had some impact on production, but that it was difficult to disentangle the relative importance of the possible mechanisms that led to this effect. Empirical studies indicated that the payments may have influenced planted area and possibly the use of variable inputs, particularly farm household labor, but the estimated impacts were generally modest. In the econometric studies reviewed, direct payment variables were sometimes statistically significant, but when they were they implied in most cases that each type of payment increased planted area and on-farm work hours by less than 5 percent. The empirical estimates suggested that the payments had a significant effect on land values and rental rates. Given the importance of the rental market for land in the United States, it appeared that there was a relatively high pass-through of the additional income generated by the payments to landowners, many of whom are not the actual operators of the land. In as much as increases in land costs distort the overall cost structure, the payments may act to reduce the international competitiveness of U.S. agriculture over the medium to long term.

Since the Abler and Blandford review was published there have been further studies of the impact of direct payments. Goodwin and Mishra (2005, 2006) extend their earlier work based on farm level survey data to include payments under the 2002 FSRI Act. The results support the conclusions summarized above about the impact of the payments on acreage decisions. Their estimates are of acreage elasticities with respect to the payments in the range of 0.01 to 0.03 for the major crops. They find higher effects for payments linked to prices, for example, an elasticity of 0.1 for corn. They find evidence that the payments allow farmers who are highly leveraged to overcome credit constraints and to maintain output at a higher level than otherwise. De Gorter, Just and Kropp (2008) present theoretical arguments that fixed and countercyclical payments can have substantial effects by deterring exit and affecting choice of output levels. They provide empirical evidence of substantial effects from the U.S. milk income loss contract payments, especially in their short-run analysis. Kirwan (2009) concludes that less of the value of fixed direct and countercyclical payments is passed through to landowners than earlier studies have implied. He finds that 75 percent of the values of these payments are retained by operators of rented land, with only 25 percent reflected in rental rates. While Kirwan does not address the production effects of these payments, retention of the subsidies by farm operators could enhance their production effects along the lines discussed above.

3.3.2 Distortionary impact of crop and revenue insurance

Crop and revenue insurance programs provide additional, risk-based subsidies. Schnepf and Heifner (1999) argue that subsidized insurance can affect production through three principal mechanisms: by increasing expected returns per acre it provides an incentive to expand the area in production; by providing higher premium subsidies for riskier crops on riskier land; and by encouraging production in unfavorable areas.

Young, Vanderveer and Schnepf (2001) analyze the projected impact of crop insurance subsidies for 2001-2010 by converting estimated county-level, crop-specific subsidies on premiums, indemnities, and liabilities into regional commodity-specific price wedges and incorporating these into a model that accounts for intra- and inter-regional shifts in acreage and cross-commodity price effects. Due to riskier production conditions, the price wedges tend to be higher in the Plains States. They are as high as 16 percent for cotton and 14 percent for wheat with respect to farm-level prices in 2000/01. The national average subsidy for cotton is estimated to be roughly 4 cents per pound or 7 percent of the season average price. The authors project that crop insurance subsidies would increase annual plantings over 2001-2010 by roughly one million acres (0.4 percent). Additional wheat plantings account for almost 500,000 acres, more than half of the increase in total plantings, and higher cotton acreage accounts for about a fourth of the total increase. Insurance subsidies are estimated to reduce prices for wheat, cotton and rice by roughly 3 percent. The effect on feedgrain prices is a more modest 0.5 percent, and there is a negligible impact on soybean prices. Smith, Goodwin and Glauber (2003) review econometric evidence on the impact of crop insurance subsidies on area planted to major crops. They also conclude that this evidence supports the conclusion that subsidies have a positive effect on area planted but that the effect is relatively small.

There have been fewer assessments of the production effects of recent disaster assistance payments. Young and Westcott (2000) note that since most disaster payments are made after production decisions have been taken, they are not likely to affect producers' current decisions. However, they also observe that if such payments are provided on a regular and consistent basis, as was the case in the late 1990s, they may influence production decisions by truncating the lower tail of the revenue distribution. Producers may be encouraged to keep riskier land in production and average production might be increased. They argue that the effect will be more pronounced the closer the linkage between disaster payments and losses associated with individual commodities, but do not provide empirical estimates of the impacts.

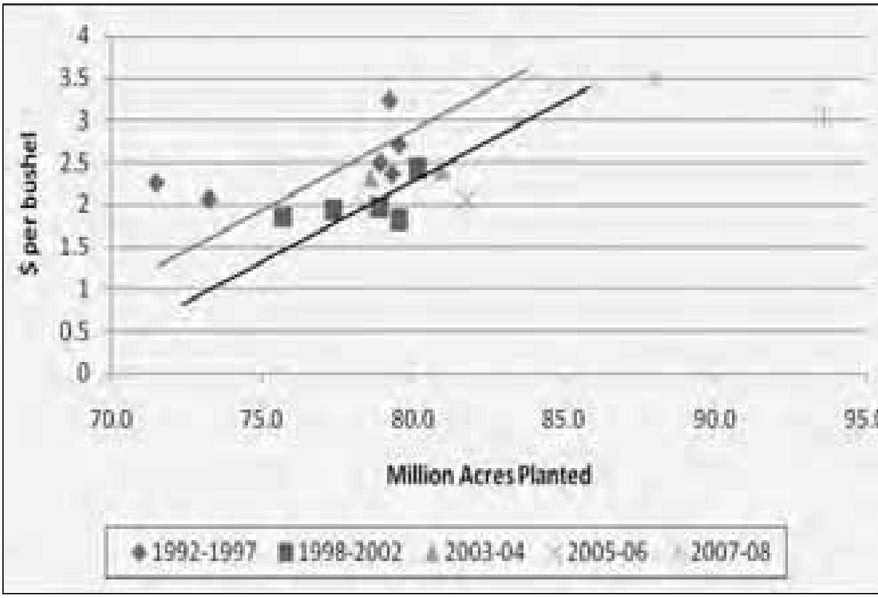
3.3.3 Overview of distortion levels

Gardner (2008) gives an illustration of how the effects across multiple subsidies might add up for national corn production, which we replicate and extend in Figure 3.2. The basic argument is that the supply curve of corn (planted acres plotted against lagged average annual price) appears to have shifted downward when the period 1998-2006 is compared to 1992-1997. Part of this shift is attributed to lower costs due to technical change, part to loan-rate-related payments during 1998-2006 providing farmers with higher per-unit revenue than market prices, and part to a residual that may capture the effects of various other support policies through the FAIR Act and subsequent payments. In rough terms, the vertical shift of about sixty-five cents per bushel, (roughly 25 percent of the 1992-1997 average price) may be explained up to one half by technological change and 40 percent by price support payments, leaving a residual that can be attributed to the effects of other support policies of 10 percent (with maximum cost-reducing technical change) to an implausible 60 percent (assuming no technical change). If Westcott and Price are right that loan-rate-related support payments and the removal of base acreage planting restrictions led acreage to shift from corn to soybeans, then the supply curve for corn would have shifted even further downward than shown in Figure 3.2 without the cross-commodity effects.

Another perspective on the distorting level of U.S. farm program expenditures comes from constructing a weighted distortion-effect index of payments by year. We constructed such an index for the U.S., applying weights along lines suggested by Skully (2009) to the key support expenditures. Based upon work by the OECD, Skully proposes that "illustrative coefficients" of the relative distorting effects of various policies would be:

- 1.0 for market price support (applied for dairy and sugar);
- 0.9 for payments based on current output (applied to price-linked and "other" product-specific AMS shown in Table 3.4);
- 1.3 for production-enhancing, non-land input-based payments (applied to non-product-specific AMS other than MLA and countercyclical payments and crop and revenue insurance subsidies);
- 0.4 for payments based on current area, animal numbers, revenue or income (A/An/R/I), applied to environmental payments for working lands and livestock operations, crop and revenue insurance subsidies and disaster payments;
- 0.1 for payments based on non-current A/An/R/I (applied to decoupled income support); and
- 0.05 for other, non-commodity payments (not included in our index).

FIGURE 3.2
Shifting corn supply curve



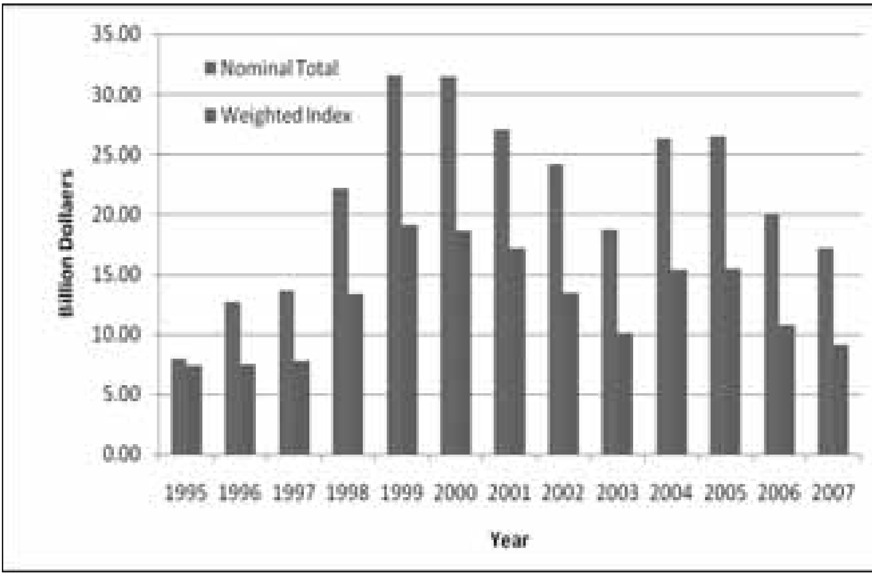
Source: Adopted and updated from Gardner (2009).

We also apply a weight of 0.25 to MLA and countercyclical payments, reflecting a distorting effect assumed to be somewhat larger than for fixed direct payments for the reasons discussed by Skully and above.

Figure 3.3 shows the aggregated nominal value of the included support and the distortion-effect index constructed for the U.S. over 1995-2007 using the assumed weights and the MPS and expenditures reported in the WTO notifications. The nominal total of support follows a generally similar pattern to the other measures shown in Table 3.6. Annual values are independent of a binary decision whether non-product-specific AMS exceeds the de minimis threshold (a factor affecting the measure "Total AMS+NPS (with DPs)" shown in the table). The nominal support values shown in Figure 3.3 also exceed those in the measures shown in Table 3.6 because additional support from the green box is included. The index dampens the values and variability of the nominal support. The two measures are similar in 1995 then a larger gap arises when PFC payments were introduced in 1996. The gap increases in 1998 and again in 1999 as MLA and other additional non-product-specific support was added. The gap narrows between 2000 and 2001 for multiple reasons: reductions in decoupled income support and disaster payments, and price-linked and emergency product-specific AMS, each explain about 40 percent

FIGURE 3.3

Nominal value and weighted distortion-effect index for U.S. domestic support



Source: Authors' calculations.

of the decline in the difference between the nominal value of the support and the weighted distortion-effect index with the remaining 20 percent due to lower MLA payments and crop and revenue insurance subsidies.

The value of the index also exceeds the U.S. notified Total AMS (Table 3.2) in all years. This difference increases through 2002 due to rising contributions to the index from green-box and non-product-specific components, then fluctuates from 2003-2007. Expenditures on the included environmental payments rise steadily but contribute only a small part of the index values. The index component from non-product-specific AMS declines after 2001. Variability in disaster relief expenditures dominates these two trends. Overall, were the index rather than Total AMS subject to the U.S. Uruguay Round commitment, its value just exceeds that limit in 1999 and comes within $1 billion in 2000, but otherwise is well within the commitment of $19.1 billion. The index is a useful overall indicator of the net distorting effect of U.S. support across various programs weighted by their relative distortionary effect. However, it does not provide evidence of the extent of distortion to production or prices in an absolute sense, since the effects of various programs are measured only relative to the effects of market price support.

3.3.4 Increasing productivity and efficiency

For the most part, the discussion above leaves out three components central to U.S. farm support: policies aimed at raising productivity (shown in the Gardner analysis to be critical to evaluating effects of support policies even over relatively short periods), conservation and environmental programs, and the recent expansion of support for ethanol production. Policies designed to increase productivity in U.S. agriculture center on the provision of public funding for agricultural research and extension, which is reinforced by private sector activities in these areas. Data on private sector research expenditures are difficult to obtain. However, according to estimates by USDA's Economic Research Service (ERS 2009a) the private sector's share of total agricultural research and development expenditure, which was less than 50 percent in the early 1970s, had risen to almost 60 percent by the late 1990s. In addition to the commercial return that may accrue from the development and diffusion of new products, such as seed varieties, investment in private sector research and development (R&D) is influenced by a generally favorable tax and regulatory environment in the United States.

There is some concern that the rate of innovation may be slowing in U.S. agriculture and that productivity growth has declined. Some recent data suggest nearly a halving in average annual productivity growth (to 1.11 percent from 1990-2002 compared to 2.01 percent from 1950 to 1989). Alston and Pardey (Farm Foundation 2007) attribute this drop in productivity growth to declining public-sector investment in agricultural research and redirection of that research from productivity to issues related to the environmental, health and food safety. Nevertheless, recent estimates by the ERS (2009b) indicate continued productivity growth. The data show that total factor productivity has tripled since 1948, increasing at an annual rate of 1.7 percent between 1999 and 2006. These figures tend to support the view that R&D policy for agriculture, broadly defined, continues to be successful in promoting increased productivity in the sector.

In addition to support for research and extension, government support for infrastructure, particularly transportation, is important for U.S. agriculture. Recent estimates indicate that this constitutes a major part of total federal government support for rural areas in the United States (Hill and Blandford 2008)[11]. The construction and maintenance of roads and highways and locks and dams for inland waterways are important in maintaining an efficient food and agricultural system by reducing input costs at the farm level and the cost of transporting agricultural commodities to markets.

[11] With the exception of some support provided for irrigation infrastructure, which is included as non-product-specific support, infrastructural support expenditures that benefit agriculture are not included in U.S. support notified to the WTO.

Public support for R&D and infrastructure enhances the international competitive position of U.S. agriculture. Even so, these forms of support are rarely criticized either domestically or internationally[12]. Most analysts would argue for the public good aspects of R&D and similar expenditures—that consumers in the United States and elsewhere are the ultimate beneficiaries and that many technological advances are ultimately transferred to other countries. With these public good dimensions, any competitive advantage accorded to U.S. agriculture is likely to be short term in nature. Increased productivity in the food system and lower distribution costs tend to translate into welfare-enhancing lower food prices.

One policy issue that arises is whether there is a causal linkage between U.S. farm support programs, particularly price and income support, and the adoption of new technology. The logic for such a linkage is that since support programs increase and stabilize the returns to farming, they may affect both the supply of new technology to the sector and the demand for such technology by the sector. There is certainly evidence that farmers are more willing to spend on inputs (particularly land and capital inputs, such as machinery) when their incomes are high. Many agribusiness firms that supply inputs to farmers have supported the continuation of commodity programs in recognition of this fact. However, as reviewed by Gardner (2002), the empirical evidence does not show a strong linkage between agricultural support policies and the adoption of new technology and the rate of technological change[13].

3.3.5 Addressing environmental objectives

There can be little doubt that many agri-environmental measures affect production. However, competing producers are unlikely to object to land-idling measures that reduce production levels, even though trade may strictly speaking be distorted as a result. In contrast, agri-environmental programs for working lands and livestock operations may increase output by helping farmers to use more intensive production methods while reducing the environmental footprint of their activities.

Central to the international policy debate on the use of agri-environmental payments is the extent to which these payments correct for market failure by internalizing externalities or promoting the supply of public goods. In as much as they achieve these goals, U.S. agri-environmental programs act to correct market

[12] A recent analysis of U.S. green-box expenditures was critical of the potential impact that R&D has on the international competitive position of U.S. agriculture (UNCTAD 2006).

[13] Ahearn et al. (2005), using panel data for farms in 48 states across four years from 1982 to 1986, find a small but statistically significant positive relationship between the amount of commodity payments received by farms and their total factor productivity. They find a much stronger relationship between state-level expenditures on R&D and productivity. Key et al. (2005) find that commodity payments tended to increase scale and farm size in U.S. agriculture over the period 1987-2002.

distortions, rather than creating them (Blandford 2006). Since the level of payment is typically related to the costs of correcting for market failure, it is difficult to talk about the distortionary impact of these policies since markets would be distorted in their absence. Still, the history of resorting to long-term land idling to prop up low market prices has to be taken into account. The current mix of policies probably does not achieve maximum environmental benefits for the level of expenditures made.

3.3.6 Ethanol

Issues related to ethanol subsidies and mandates are increasingly germane. The United States currently notifies its ethanol tax credits to the WTO as an industrial subsidy under the Subsidies and Countervailing Measures (SCM) Agreement, not as an agricultural subsidy. However, ethanol is included in the set of products defined as agricultural under the Uruguay Round agreements. The tax revenue forgone could be appropriately notified in the Total AMS on this basis. At issue would be whether the tax credit is a "measure directed at processors" that is subject to inclusion in the AMS under Annex 3 "to the extent that such measures benefit producers of the basic agricultural product." Because ethanol policies affect corn prices, the fuel blender's tax credit might alternatively be judged to be a measure directed at producers and affecting the price of corn as a basic agricultural product. This would correspond to the way the United States formerly notified Step 2 payments to processors of domestic cotton as part of the cotton product-specific AMS[14].

The use of mandates versus tax credits also raises an issue of what policies are judged included among "all of its domestic support measures in favour of agricultural producers" that are subject to disciplines under the Agreement on Agriculture. As shown by de Gorter and Just (2007), when there is no binding mandate, the tax credit adds substantially to the level of production of ethanol, its price, and the price and output of corn. When there is a binding mandate, the effects of the tax credit itself are minimal or zero. In the latter case, it is the binding mandate that has the main effect on ethanol and corn production and prices and, one can argue, should be disciplined under the AMS.

A few calculations from the simplified de Gorter and Just empirical model demonstrate the impact of ethanol policies. They examine the situation in 2006 with a base-scenario corn price of $3.03, corn production of 10.5 billion bushels, an ethanol price of $2.32, and ethanol use of 6.7 billion gallons. The base case incorporates the existing tax credits and assumes there is no binding mandate. The elimination of the tax credit results in a corn price of $2.29, corn production of 9.4

[14] While the Step 2 payments were eliminated after being found inconsistent with WTO rules in the Brazilian cotton case, the FCE Act created new subsidies to processors of both domestic and imported cotton. It will be interesting to observe how the United States next decides to report these subsidies to see whether an analogy between cotton processor subsidies and ethanol processor tax credits can continue to be drawn.

billion bushels, an ethanol price of $2.06, and zero domestic ethanol production. With a binding mandate to increase ethanol production by 3 billion gallons, the corn price rises to $3.55, corn production to 11.2 billion bushels, the ethanol price to $2.51, and ethanol use to nearly 10 billion gallons.

Beyond determining the effects of alternative ethanol policies there is again the question of who potentially suffers injury from these policies. Mandates and tax concessions themselves do not harm potential exporters of ethanol or corn. Instead, it is net food-importing countries or livestock producers facing higher costs that may be adversely affected. There is no remedy under the SCM Agreement for importers who are affected by higher world prices due to subsidy policies, so this agreement would not be applicable to disciplining ethanol subsidies and mandates except to the extent that world gasoline prices are depressed.

3.4 Future policy directions

Are there viable avenues for U.S. farm policy to become less distortionary than in the past given it rationale and goals, its specific programmatic components, and assessments of their effectiveness and distortionary effects? To address this question, we briefly examine the possible constraints on future domestic support (including the new ACRE program) under the WTO and the political economy of U.S. policy decision making.

3.4.1 WTO constraints

The WTO provides one set of possible constraints on U.S. policies. These constraints can be evaluated under the existing Agreement on Agriculture or under the December 2008 draft modalities in the Doha Round negotiations (WTO 2008). Either assessment rests on a projection of future market conditions and support expenditures. We utilize a spreadsheet-based domestic support simulator developed by Blandford and Josling (2007) to make these assessments. Projections were derived for the major categories in the U.S. notifications through 2016, using program parameters from the 2008 FCE Act and the USDA's commodity baseline for prices and quantities (USDA 2009). Despite the deep 2008-2009 recession, overall the commodity prices used in the projections are relatively high due to a range of factors, including domestic demand for biofuels and strong overseas demand for U.S. commodities resulting from income growth, dietary change, and a weak dollar.

Green-box support is projected to increase steadily from the last officially notified amount of $76 billion in 2007 to roughly $92 billion in 2016, primarily due to increased expenditures on domestic food assistance programs projected on the basis of their recent growth rates. Expenditures on agri-environmental programs are projected to increase from a notified value of $3.8 billion in 2007 to over $6 billion in 2016. Our estimates incorporate continuation of fixed direct payments adjusted for possible participation in the ACRE program discussed below.

The projected product-specific AMS varies from year to year, but relatively high commodity prices foreseen by USDA and other analysts imply that the projected support expenditures for major crops are extremely modest, typically averaging less than $0.3 billion per year. The notified product-specific AMS commodity payments would qualify as *de minimis* if there are no ACRE state revenue guarantee expenditures. On the basis of these projections, the Total AMS (after *de minimis*) would amount to roughly $3.4 billion in 2016, composed entirely of market price support for dairy and sugar. This would leave an unused leeway of $15.7 billion under the current Total AMS commitment of $19.1 billion.

There are also only modest countercyclical payments for peanuts and more significant but declining payments for cotton with the commodity prices assumed in the projections. Crop and revenue insurance subsidies are expected to be relatively high, averaging roughly $4.7 billion per year[15]. The projected non-product-specific support averages roughly $5.0 billion annually. With a projected value of production of roughly $266 billion by 2016, this leaves room for about $8.5 billion of additional NPS spending without crossing the *de minimis* threshold. Thus, combined expenditures in the Total AMS (after *de minimis*) and NPS *de minimis* categories could increase by more than $24 billion in 2016 over their projected level without violating any U.S. Uruguay Round WTO obligations.

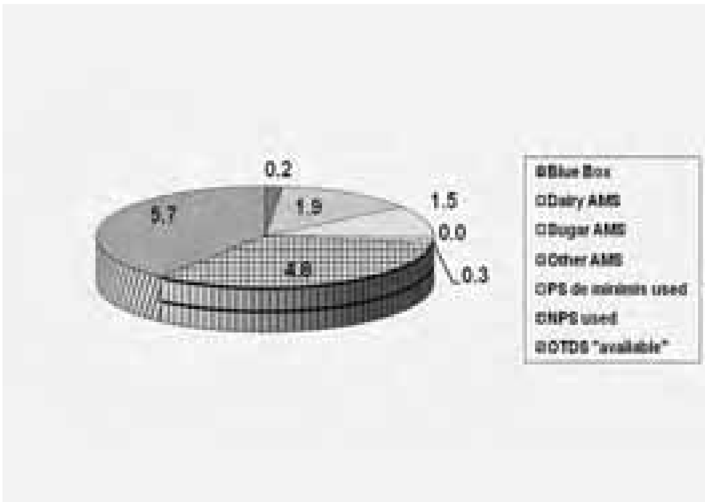
The strengthened disciplines of the Doha draft modalities would reduce the U.S. leeway for providing trade-distorting support. When fully phased in, which we assume in our analysis to occur by 2016, the Doha Round draft modalities imply a final U.S. Overall Trade Distorting Support (OTDS) constraint of just under $14.5 billion. A 60 percent reduction in the Total AMS commitment reduces its limit to $7.6 billion. The product-specific and non-product-specific *de minimis* thresholds would be reduced immediately from the current 5 percent to 2.5 percent of the value of production. Total blue-box payments would be limited to a maximum of $4.8 billion, with expansion of the eligibility criteria to include U.S. countercyclical payments. New product-specific AMS and blue-box caps would impose additional constraints. The product-specific AMS for cotton would be cut to roughly $143 million under special rules.

Figure 3.4 shows the projected blue-box, Total AMS, and product-specific and non-product-specific *de minimis* expenditures for 2016. Their sum is compared with the potential limit on OTDS by showing unused spending within that constraint.

[15] Subsidies were lower in 2007 despite relatively high prices because the loss ratio proved to be only 0.55. The loss ratio is assumed to be 1.0 each year for projected crop and revenue insurance subsidies.

FIGURE 3.4

Projected composition of support in 2016 and “available” OTDS (US$ billion)



Source: Authors’ estimates.
Note: difference of sum in figure from OTDS limit is due to rounding error.

Sugar is the principal commodity that appears to pose a problem in terms of meeting the proposed U.S. commitments. Its projected AMS of $1.5 billion in 2016 exceeds the Doha draft modality cap on support for that commodity by almost $0.4 billion[16]. The projections also suggest that cotton countercyclical payments could cause the Doha blue-box cap on that commodity to be violated in some years[17].

More generally, with the relatively high projected prices there is still some flexibility for other forms of support. If the economic environment that is foreseen in USDA’s price projections materializes, the projected support leaves room for various additional OTDS expenditures of $5.7 billion. More than half of the estimated latitude available reflects the redefinition of the dairy support program in the FCE Act, which is assumed to reduce the projected dairy AMS by as much

[16] The inclusion of a provision in the 2008 FCE Act to divert government purchases of sugar to the production of ethanol opens up the possibility that the sugar program (or some part of it) could be defined as a bioenergy program. This might also be used to relieve any pressure on sugar protection that arises from product-specific domestic support constraints or changes in market access (tariffs and TRQs) under a new WTO agreement.

[17] These results assume the U.S. does not exercise an option to increase its blue box product-specific caps by reducing its product-specific AMS caps. See Blandford and Orden (2008) for discussion of this option.

as $3.6 billion. Otherwise, the projected U.S. dairy market price support would exceed the final product-specific cap under the proposed rules and would nearly exhaust the final proposed U.S. Total AMS commitment in 2016. Dairy support prices were temporarily increased by about 15 percent in July 2009 and milk market loss contract payments were expected to exceed $1 billion for that year. Without the redefinition of dairy support in 2008 the U.S. would likely have exceeded the proposed Doha binding if it had been fully implemented in 2009. The temporary increase in support prices would have made the excess larger. With the redefinition of dairy market price support in the FCE Act, the U.S. is able to increase support prices and market loss payments for dairy products (as in 2009) under the Doha rules without violating its commitments, assuming relatively high projected prices for other commodities materialize.

The continuation of current legislation with relatively high prices leaves room in our assessment for 2016 for the U.S. to raise various target prices or loan rates, increasing blue-box or product-specific AMS expenditures from projected levels of $0.2 billion and $3.4 billion, respectively, to the limits of $4.8 billion and $7.6 billion, providing that support remained under product-specific caps for each commodity. However, pushing both of these categories of support to their limits simultaneously would reduce allowed *de minimis* NPS support to only about $2 billion given the OTDS commitment, which is less than the projected NPS support level. An alternative would be to expand the use of non-product-specific support up to the limit imposed by the *de minimis* threshold of $6.6 billion in 2016, which would leave room for product-specific AMS and blue-box support totaling $7.9 billion. The product-specific constraints under the Doha Round draft modalities could impose some additional limits beyond the flexibility at the aggregate level. As noted, sugar poses problems for the product-specific AMS commitment even if world sugar prices are high because of the way MPS is calculated and notified. The stringent modalities for cotton create an issue in terms of meeting blue-box commitments, particularly if projected high cotton prices do not materialize. Other product-specific caps, such as the AMS for corn, would limit expenditures to levels well below those observed in the current decade.

3.4.2 The new ACRE program

ACRE state revenue guarantee payments triggered by market variability could affect the assessment of the possible effects of strengthened Doha Round disciplines on U.S. domestic support shown in Figure 6. The optional ACRE program only makes payments when revenue in a state for a crop falls below a moving average of past levels. ACRE payments can be triggered by a decline in the U.S. price, state yields, or a combination of the two[18]. Price and yield projections largely reflect recent trends and exhibit limited variability, so ACRE payments tend not to be triggered in the

[18] Payments to individual farms also depend on those farms demonstrating a loss of revenue.

projections, but historical data for prices and yields inevitably prove more variable. The level of state revenue guarantee payments will depend on the levels of per-acre crop revenue in the reference period, revenue variability from its initial values, and the percentage of farmers signing up for the ACRE program in place of the more traditional support options.

The potential magnitude of ACRE payments is illustrated for corn, soybeans and wheat by Zulauf and Orden (2009). Assuming for illustration that all acreage were enrolled in the ACRE program, they examine the annual payments that would have been made during 1996-2006 given prices, yields and acreage of that period and compare those payments to the expenditures made under the actual programs in effect. They then apply the same sequence of percentage variations in prices, yields and acres to the higher revenues forecast by USDA for the 2009-2012 crops and examine ACRE payments from this higher revenue base if the variability of the 1996-2006 period were repeated. The 1996-2006 period includes sharp declines from initial high prices totaling 44 percent for corn (1995-1999), 40 percent for soybeans (1996-2001), and 45 percent for wheat (1995-1999). Yields per planted acre were calculated for 42 states individually, accounting for over 99 percent of U.S. acres planted to the three crops.

Aggregate results for the two periods are shown in Table 3.7. Had corn, soybean and wheat acreage all been in an ACRE program during 1996-2006 instead of the programs that existed, there would have been no loan-rate-related price support payments and fixed direct payments of $34 billion for these three crops would have been 20 percent lower than they were. The state revenue guarantee payments would have totaled $15.6 billion. The bulk of the guarantee payments would have occurred when prices fell during 1997-1999. A marked difference between the ACRE program and the existing programs is that countercyclical and price support payments for corn totaled $12.8 billion during the 2004 and 2005 crop years because of relatively low prices. Corn yields were also relatively high in this period and revenue did not decline sharply. Had all acreage been in ACRE, the state revenue guarantee payments for corn would have been only $0.5 billion for these years. Overall, had ACRE been the support program, and had Congress not enacted additional support, total payments would have been $49.6 billion compared to $90.2 billion that occurred under programs actually in place[19].

Payments under ACRE are higher when the variations from 1996-2006 are applied to forecast average prices, yields and acreage for 2009-2012. With higher prices and yields compared to the earlier period, crop revenues were projected to be 50 percent to 90 percent higher per acre. ACRE payments are larger when

[19] Of course, farmers anticipating these lower payments would not have opted for an optional ACRE program in 1996-2006, but the point here is to illustrate the hypothetical levels and timing of payments had such a program been the only support option.

TABLE 3.7

Cumulative estimated expenditures under ACRE for two periods using percentage deviations in prices, yields and acreage observed during 1996-2006

Period	Corn	Soybeans	Wheat	Total
		(US$ billion)		
1996-2006 Prices, Yields and				
Acreage	20.1	2.4	11.5	34.0
Direct payments	0.0	0.0	0.0	0.0
Loan-rate related	5.9	6.2	3.5	15.6
Countercyclical	26.0	8.6	15.0	49.6
Total				
2009-2012 Forecast Average Prices,				
Yields and Acreage				
Direct payments	20.1	2.4	11.5	34.0
Loan-rate related	0.0	0.0	0.0	0.0
State Revenue Payments	12.9	10.2	4.7	27.8
Total	33.0	12.6	16.2	61.8

Source: Zulauf and Orden (2009).

revenues fall from these higher levels. State revenue payments increase to $27.8 billion and total payments to $61.8 billion. In contrast, with these same variations in prices, yields and acreage, countercyclical and loan-rate-related payments under the traditional programs would remain below $1 billion with the 2009-2012 forecasts and the target prices and loan rates in the 2008 FCE Act.

The relatively low ACRE payments illustrated by Zulauf and Orden for 1996-2006 would not have caused the U.S. Total AMS to exceed its Uruguay Round commitment in any year had this program existed rather than traditional programs. The ACRE program would have faced some constraints, and the traditional programs even more so during 1996-2006, if the Doha Round draft modality final commitments had applied during this period. Moreover, while the traditional programs with the support parameters of the FCE Act do not appear constrained by the Doha draft final commitments, ACRE payments exceed the final product-specific AMS caps (for corn and soybeans in three years and wheat in five years) and the Total AMS commitment is exceeded in two years when the percentage deviations from 1996-2006 are applied to the forecast average 2009-2012 prices, yields and acreage. While the ACRE program is legislated to come into effect in 2009, the level of sign up by farmers remained low through July 2009. Even with full sign-up assumed, concern that ACRE payments could cause U.S. support to exceed limits other than the Uruguay Round Total AMS commitment remains hypothetical unless a new WTO agreement on agriculture is concluded and new commitments take effect.

Beyond this, generally, the optimistic price environment foreseen in early 2009 and incorporated into our projections may not materialize in terms of average levels of prices, as well as in terms of a sharp price decline that would trigger ACRE revenue guarantee payments at market prices above the target prices and loan rates of the FCE Act. In the case of lower prices, even without ACRE payments, the Total AMS constraint and some product-specific limits could well be exceeded under the Doha draft modalities, unless some other alternatives to current support policies were found. That is, if prices were to fall substantially, so that major countercyclical, price-support, or state revenue-guarantee payments under the ACRE program were triggered, it would become difficult for the U.S. to meet the proposed Doha Round WTO commitments on domestic support under a continuation of its existing programs.

3.4.3 Political economy of future policies

Our analysis of post-Uruguay Round U.S. farm policy suggests the continued ability of the farm sector to extract support in the political arena through a number of programs. Yet there have been some substantial changes in policy in each of the key areas: commodity support, agri-environmental programs, and crop and revenue insurance and disaster relief.

The absence of significant reform to existing commodity programs in 2008 was due in part to political differences reflected in the election-year platforms of Democrats and Republicans. In contrast to the overarching call for deregulation and scaling back of social welfare programs by the 1996 congressional Republican majority, the Democratic majority in 2008 championed new government help for constituents in financial trouble and the inclusion of additional funds for food stamps and other nutrition programs as the economy slowed. In this political environment, certainly among Democrats and even among many Republicans in Congress, there were few calls for eliminating the farm safety net that both parties have long endorsed.

There was also less need for changes in farm policy in 2008 than in 1996 because the increased flexibility achieved through the earlier reforms had been retained for large segments of agriculture. Radical buyouts such as those for peanuts and tobacco were hardly representative of broader reform options. Declining quota rents for peanuts and tobacco had been conducive to buyouts, but this had little relevance for other commodities.

Differences in macroeconomic circumstances between 2008 and 1996 also dampened interest in reform. The short-lived farm commodity boom in 1995-1996 occurred when the U.S. dollar and world oil prices had been stable in preceding years. There was little concern at the time about either excessive inflation or an economic downturn and recession. In contrast, macroeconomic stress in 2008 had its origins in low interest rates, the substantial depreciation of the dollar that ensued after 2001, and rising oil prices after 2003. This gave the farm commodity price boom in 2008 a precarious dimension. The farm sector knew from past experience that retaining price-linked support programs, even with few anticipated payouts, provided a structure of support whose nominal parameters could be ratcheted up if the sector were to fall on hard times through rising costs or declining revenues. This sentiment was reinforced (and dairy price support increased) once commodity prices that peaked in mid 2008 fell sharply as the full dimensions of the global financial crisis and recession became evident later in the year.

Despite the continuation of farm support programs through 2012, there are several uncertainties about the political alignments that have allowed U.S. farm subsidies to endure. The nutrition title has come to dominate total expenditures in farm bills and is projected to increase its share further. Likewise, when prices are relatively high conservation and environmental spending is a substantial part of total expenditures on agriculture. Nutrition and environmental interests might at some stage decide that their objectives could be better served outside the context of the farm bill, or by imposing more regulation or costs on agriculture. That fixed direct payments were a focus of domestic controversy in a high price environment is also indicative of limits to the political power of the farm sector. International rules provide room for this domestic debate but acrimony over the direct payments in the U.S. reduced their attractiveness to farm groups seeking minimum controversy over the support they receive.

The deepening entrenchment of the domestic ethanol sector during the oil-price boom of the mid 2000s both constitutes a substantial intervention coupled to production and, in contrast to the points above, demonstrates the continued political strength of production agricultural. In addition, restrictive land-use policy was never completely abandoned—the CRP has always been a supply-reducing policy. If biofuel demand persists under ethanol mandates and tax credits, conservation spending may decline as farmers voluntarily abandon the CRP. This would shift the political balance within farm bill deliberations back towards the commodity interests, but it could also provoke a break in the political alliance that forged the 2008 FCE Act.

A Doha Round agreement that reduced the Total AMS commitment and *de minimis* thresholds and for the first time set limits on OTDS, product-specific AMS and total and product-specific blue-box expenditures would be a valuable check in the event that traditional U.S. programs are ratcheted up or agricultural prices return to the downward trend that has characterized most of the past half century. In such circumstances, an option for U.S. policymakers would be to expand green-box support for farmers under the environmental category or fixed direct payments that

[20] Arguments can also be made that the WTO green box rules may need some modification to allow countries to pursue environmental objectives—see Cox (2007) and Blandford, Josling and Arha (2007).

are modified as necessary to meet any WTO challenges. If U.S. policy moves further toward recoupled instruments with greater emphasis on energy crops, disaster assistance or environmental programs for working land and livestock operations, scrutiny for consistency with the green box will provide a bulwark against new forms of production- and trade-distorting programs[20]. But as policy stood in 2009, it is unlikely that the WTO will affect ethanol tax credits and mandates or long-term land idling under the CRP. These instruments, largely outside WTO expenditure disciplines, work to drive agricultural prices up and arguably have become, along with other environmental payments and crop and revenue insurance subsidies, the most important elements of U.S. farm policy. The boom-related optimism in the agricultural sector in the late 2000s arose in part because demand augmentation through "food, fiber and fuel" reinforced environmentally-rationalized supply control as a mechanism for keeping farm commodity prices higher than otherwise. The WTO has little ability to limit these latter distortions.

All of these considerations are relevant in a world economy that has been shaken recently by both a sharp commodity price boom, which has caused anxiety about global food supplies and affordability, and a larger financial crisis and recession, that as one consequence dampened the commodity price boom and as another raised fears of a long slowdown in economic growth. Some U.S. support policies tend to drive down world market prices for agricultural commodities—such as its domestic price support payments, countercyclical payments and insurance subsidies, and to a lesser-extent even fixed direct payments. These effects have been the concern of developing countries that are either competing exporters or fault low world prices for undermining long-term investments in their own agricultural sectors. But other U.S. policies, such as conservation land idling and biofuels mandates, have the offsetting effect of reducing U.S. production or raising demand for basic crops such as corn. These policies come under sharper scrutiny when world food prices increase and low-income food importing countries face difficulties. The 2008 FCE Act did little to lessen these conflicting policy impacts.

We introduced the U.S. farm policy issues with Gardner's assessment of the long-term developments of the 20th century. We conclude by referring to his views (Gardner 2009) on the prospects for future reforms that would lessen market distortions. Gardner concluded that the best prospects for reform pressure arise from the WTO Doha Round negotiations, from a combination of environmental/taxpayer interests that would shift agricultural support spending toward public good provision, or from the resurrection of a general predisposition to economic liberalism. Our assessment of the three post-Uruguay Round farm bills implies each of these pressures is a weak reed upon which to rest prospects for reform.

Were the reform pressures nonetheless to progress in a substantial way, Gardner argued that there could be a politically salient case for one-time buyout payments. He noted that the direct payments in the 1996 farm bill were a step in that direction, but the buyout did not subsequently materialize, as we have described. Any such proposals were summarily rejected in Congress and the buyout idea remained far from the center of the farm bill debate in 2008. Nor do we anticipate a large-scale buyout happening in the foreseeable future.

So what can be done to improve U.S. farm policy and make it less production- or trade-distorting in a political environment where both major political parties endorse government involvement in providing an extensive safety net for farmers and public investments in agricultural productivity, while far-ranging critics question whether the modern form of agriculture has been a desirable development or can be sustained? Our analysis shows that securing a Doha Round agreement on domestic support rules along lines of the December 2008 draft modalities is an essential step. Both developed- and developing-countries policy makers need to seek to lock in such domestic policy restraint commitments.

We conclude further that a good argument can be made that there is a continuum of policies in terms of their production- or trade-distorting effects. It is clear that decoupled income support as defined in the green box is less distorting as a policy instrument than the price-linked measures included in the Total AMS. We concur that commodity support and insurance policies that the U.S. has notified as non-product-specific fall between these other two categories in their distortionary effect. Thus the architecture of the WTO domestic support rules is broadly sound. A caveat arises from the latitude that countries have to redefine market price support in ways that leave more room for other subsidies in the Total AMS. And of course there is nothing in international agreements to prompt countries to spend less than their commitments allow.

Nor are the green box rules a full guide to optimal policies. As we have emphasized about the CRP, the rules do not preclude an environmental or resource retirement program that has significant effects on production. Our brief review of conservation and environmental programs suggests more can be done to achieve a mix of domestic policies that achieves environmental gains at a lower cost.

The green box also allows latitude for policies that may not distort trade but certainly shift countries competitiveness over time and enhance agricultural production. Among these, we would argue—for the United States and elsewhere—in favor of research investments that raise agricultural productivity and infrastructure investments that lower transaction costs. In the broad scope of history, we believe these investments hold the key to addressing the challenges that face agriculture in the 21st century. In short, we complement Gardner's assessment for the past century in seeing a success in the development of American agriculture that can be extended with thoughtful policy design.

3.5 Conclusions

This chapter examines continuity and change in the farm support policies of the United States from 1995 to the most recent legislation for 2008 that defines domestic support programs through 2012. We highlight three interacting components of recent policies: commodity price and income support; long-term land idling and other agri-environmental programs; and crop and revenue insurance and disaster relief. We also assess the implications for support of an optional new state revenue guarantee program (ACRE) and recent biofuel mandates whose effects interface with the more traditional programs.

U.S. farm policies continue to provide substantial economic support to producers but there have been significant reforms that improve their efficiency and reduce market-distorting effects. Commodity price and income support programs now comprise fixed direct, market loss and countercyclical payments that are more decoupled from current production decisions and prices than in the past. Long-term land idling has become more targeted toward providing identifiable environmental benefits and there has been a shift in the focus of other agri-environmental programs toward managing environmental damage from agricultural production. Diversity has emerged in crop and revenue insurance contracts and experience and accumulation of data has improved their actuarial basis.

The relative importance of various policy instruments has also changed. Biofuel mandates and tax credits that augment demand play a role in this regard, resulting in higher crop prices and, consequently, lower commodity support payments, a relative shift in transfers toward fixed direct income support and agri-environmental payments, and increased subsidies for crop and revenue insurance. During 1999-2001 product-specific support under the most distortionary U.S. policies came close to the Uruguay Round commitment under the WTO Agreement on Agriculture and additional non-product-specific support used up most of the available *de minimis* allowance. In contrast, with relatively high prices anticipated through 2016, the existing commitment and *de minimis* rules leave considerable latitude for increasing subsidies above levels we project under an extension of the current legislation.

It seems inevitable that the United States will continue to devote public resources to support agriculture. There is a bipartisan political consensus for an economic safety net for farmers and investments in agricultural research that can be traced to the successful modernization of agriculture since the 1930s. The improved efficiency of various policy instruments and their changing weight in the policy mix matter in this context. We concur with recent assessments that there is a continuum of policies in terms of distorting effects on production and trade. Drawing on recent work by the OECD, we construct a weighted index of distorting support provided by U.S. policies that are likely to depress market prices. The index follows a similar pattern during 1995-2007 to other measures of support but with a dampened level and variability compared to their unweighted values. This provides a useful indication of the potential net distorting effect of various forms of support, using market price support as a base of comparison. However, it does not provide a measure of the absolute effects of U.S. policies on production or prices.

Strengthened disciplines in the 2008 draft agricultural modalities under the Doha Round WTO negotiations would reduce the U.S. leeway for providing trade-distorting support. Proposed product-specific caps on the Aggregate Measurement of Support (AMS) when fully implemented might prove limiting for some politically sensitive commodities such as cotton and sugar. The U.S. has increased its support latitude under the WTO rules by redefining its dairy support program in 2008, which could reduce the dairy AMS by over $3 billion. Without that change, projected U.S. dairy and sugar market price support would both exceed the Doha product-specific caps and absorb the entire Total AMS commitment by 2016. The redefinition of the dairy program means that the United States would be able to increase support prices for dairy products (as it did in 2009) under the Doha rules without violating its commitments, assuming prices for other commodities remain relatively high.

The continuation of current legislation leaves room with relatively high prices for additional total expenditures above projected levels of roughly $5.7 billion under the proposed commitment on Overall Trade-Distorting Support (OTDS). The U.S. would retain the option to raise target prices or loan rates, increasing blue-box or product-specific AMS expenditures from projected levels of less than $0.1 billion and $3.4 billion, respectively, to their proposed limits of $4.8 billion and $7.6 billion, as long as support remained under product-specific caps for each commodity. Pushing both of these categories of support to their limits simultaneously would reduce allowed *de minimis* non-product-specific support to only about $2 billion given the OTDS commitment, which is less than the projected level. An alternative would be to expand the use of non-product-specific support up to the limit imposed by the *de minimis* threshold. We estimate that in 2016 this would leave room for blue-box and product-specific AMS support of roughly $8 billion. More constructive than increasing any of these subsidies, we argue, would be to expand green-box programs that raise productivity, improve the environment, or enhance rural infrastructure.

The new ACRE program could make it more difficult for the United States to meet the proposed Doha commitments on support since payments can be triggered even when prices are high. The program makes payments when crop revenue in a state falls below a moving average of past levels. Projections of prices and yields lack the variability to trigger significant ACRE payments. However, if the relative variability in prices, yields and acreage that occurred during 1996-2006 were to be repeated using average forecast levels of revenue in 2009-2012 as a base, ACRE payments for corn, soybeans and wheat could exceed the Doha Round draft modality final commitments in future years, if a large number of farmers sign up for the program.

All of these considerations are relevant in a world agricultural economy that has been shaken recently by both a sharp commodity price boom and by financial crisis and recession. Some U.S. farm support policies tend to increase production and drive world market commodity prices down—such as the domestic price support payments, countercyclical payments and insurance subsidies, and to a lesser extent, fixed direct payments. This has been a concern to developing countries that are either competing exporters or fault low world prices for undermining long-term investments in their agricultural sectors. But other U.S. policies, such as conservation land idling and biofuels mandates, have the opposite effect by reducing U.S. production or raising demand for basic crops such as corn. These policies come under sharper scrutiny when world food prices increase and low-income food importing countries face difficulties.

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4

Farm support policies in the European Union: an appraisal of their non-distortionary effects

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Introduction

The purpose of this chapter is to review the empirical evidence of production and trade distortion impacts of the European Common Agricultural Policy (CAP). This policy is complex, targeting many objectives and involving interrelated instruments. Moreover, the policy has dramatically changed since its conception in the 1960s. In order to understand these changes, we briefly review the objectives and historical developments of the policy in section A of this chapter. We then provide an overall assessment of the efficiency of the CAP in meeting the stated objectives in section B. Section C is devoted to the production and trade-distorting impacts of the CAP. Methodological challenges are discussed before turning to empirical studies. A distinction is made between *ex post* studies and prospective ones. Finally the last section looks at the possible evolution of the CAP.

4.1 The EU farm policy

Objectives

In the European Union (EU), the goals that can be considered as the official objectives of the CAP are still those stated in the 1957 Rome Treaty, i.e. to increase agricultural productivity, to increase the individual earnings of persons engaged in agriculture, and to ensure stable markets as well as regular supplies at reasonable prices (Article 39). In practice, the emphasis on increasing both production and farm incomes combined with the decision-making procedure within the Council during

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the 1970s and 1980s resulted in a high level of support to farmers. This support combined public intervention, border protection and export subsidies that ensured high guaranteed prices for major agricultural products. Because of the success of the early CAP in boosting production, the depressive effects of high prices on demand, and the accumulation of surplus and the budgetary cost of the intervention system, the initial objectives of the CAP needed to be amended in the 1980s. Meanwhile, socio-economic changes in the population as well as the negative externalities of modern agriculture led to a questioning of the "productivist" form of agriculture. Successive reforms in 1992, 1999 and 2003 curbed the original orientation of the EU farm policy. A major inflexion of the CAP came from the recognition of the "multifunctional" role of agriculture, i.e. the fact that it provides not only foodstuffs but also a range of amenities and public goods (OECD 2008a). This recognition meant that some of the CAP budget was channelled towards the "second pillar", i.e. a set of measures designed to encourage the preservation of environment, the development of quality food and more generally anything included under the broad term of "rural development". These reforms were also motivated by the World Trade Organization (WTO) negotiations and by internal pressures, namely the enlargement of the EU and the resulting budgetary consequences. Without having ever been drawn up as formal objectives, the new orientations changed the CAP.

Despite various reforms, the original objectives of the CAP have never been formally redefined. Both the Commission and the European Council have produced statements that we can understand as some kind of official, if not formal, reconsideration of these objectives. They emphasise in particular that strong economic performance must go hand in hand with managing natural resources and levels of waste sustainably, maintaining biodiversity, preserving ecosystems and avoiding desertification. In addition, the CAP should contribute to encouraging healthy, high-quality products and environmentally sustainable production methods, including organic production, renewable raw materials and the protection of biodiversity[2]. If we refer to the Commission's Communications preparing the 2003 reform and the 2008 Health Check, the CAP is supposed to achieve:

- a competitive agricultural sector;
- production methods that support environmentally friendly, quality products that the public wants;
- a fair standard of living and income stability for the agricultural community;
- diversity in the forms of agriculture that maintain visual amenities and support rural communities;

[2] Here we refer particularly to the decisions of the European Summits of Berlin (1999) and Göteborg (2001), as well as different regulations, directives and Commission documents, namely EEC (1985), EEC (1992), EC (1999), EC (2006a) EC (2006b).

- simplicity in agricultural policy and shared responsibilities among Commission and member states;
- justification of support through the provision of services that the public expects farmers to provide.

To sum up, the objectives of the CAP are still the ones that were formulated at the outset. In practice, the increasing concerns of EU citizens regarding "multifunctionality", the challenges of enlargement, trade negotiations and budget issues gain importance in the definition of policy instruments.

Original instruments

The initial CAP objectives led the first six members of the European Community to create one single budget for the CAP and Common Market Organisations (CMOs) in order to manage markets, stabilise prices and ensure a stable product supply. From the beginning, the CAP was designed to be a centralised policy, restricting the possibility of national governments to define their own policy instruments so as to avoid distortions of competition. The CMOs were progressively extended to basically all sectors. By setting administrative prices, and sometimes quantities, some CMOs largely substituted public intervention for market mechanisms. Others, like horticulture or pork, rather parsimoniously used public instruments designed to smooth the functioning of markets. For the major staple crops, beef and dairy, the administrative price was set at a level in general higher than the world price, and public purchases (intervention) ensured a guaranteed outlet for all quantities produced at this pre-determined price. Subsidies were used to export or to destroy excess supply that would have caused the internal price to fall below this administrative price.

Aside from the "Guarantee" section of the CAP budget that funded the expenditures relative to CMOs, the "Orientation" section of the fund was devoted to the improvement of production structures, the transformation and marketing of agricultural products and the funding of rural development. However, only a small share of the budget, which rapidly became absorbed in market management costs and then in direct payments to farmers, was eventually devoted to "orientation".

The CAP provisions succeeded in increasing the Community's self-sufficiency in food and in stabilising prices for consumers, albeit at a high level in some sectors that enjoyed high border protection (beef, sugar, sheep meat). Overall, the CAP has contributed to making Western Europe less depending on foreign food imports. It also provided the conditions for modernisation of the sector. Income support and predictable prices made it possible to invest in equipment. A major accomplishment of the CAP was also to have successfully accompanied of one of the most dramatic economic transitions in Western Europe, i.e. the rapid shift from an agrarian society to an economy of industries and services, without social trauma.

However, because of the incentives provided to producers and the high prices that deterred demand, in particular for cereals, market imbalances appeared as early as the late 1970s. Storage and export refunds costs increased dramatically, and budgetary problems led to considerable tensions within the EU. It proved impossible to reach a political consensus for reform, and meanwhile the costs of the CAP became unbearable. Under the pressure of the net contributing countries, the principle of capping CAP outlays was adopted in 1984. That same year, production quotas were implemented to control the supply of milk. However, the Council did not implement the price cuts that would have led to a significant decrease in production in spite of the persisting market imbalances throughout the 1970s and 1980s. In spite of the (limited) measures taken in the 1980s, surpluses were piling up in "mountains" of beef and grains and "lakes" of milk purchased by the intervention system.

By 1992, a more fundamental reform could no longer be delayed. The main pressure came from budgetary expenses stemming from the growing imbalance between supply and demand. The cereal sector raised particular problems, since high prices of EU wheat and corn had led the feedstuff industry to look for cheaper substitutes. Pig and poultry producers who had access to cheap imports, especially those in Northern Europe located close to main ports, were using only marginal quantities of EU grains but increasing quantities of cereal substitutes such as cassava or corn gluten feed, a by-product of the US isoglucose and ethanol industry. The situation was such that taxpayers had to subsidised exports of products that were so expensive they could not find an outlet in the EU market, while consumers imported substitutes. The international trade negotiations were also instrumental in the radical shift brought about since the 1990s.

The path towards market orientation

Since 1992, successive reforms have dramatically modified the CAP towards a greater market orientation of the farm sector and direct income compensation for farmers. The new objectives set by the Commission were to:

- adapt quantities being supplied to demand;
- restore the competitiveness of EU products by bringing producer prices closes to world prices;
- increase the sales of domestic products in the EU (grains);
- limit the increase of budgetary expenses and use them in a more efficient way; and
- contribute to a better geographic repartition of the production and to the preservation of the environment (EC 1999).

Radical changes began with the 1992 reform which led to a cut in support prices for grains by 35% over three years. Area-based payments on acreage devoted to cereals, oilseeds and protein crops were designed to compensate for the price decrease. Direct payments were attributed on a per ton basis, the reference production level being determined on the basis of the acreage devoted to arable crops and the reference (regional) yield, but it remained coupled to the acreage in production. Beyond a certain farm size, these payments were conditional to farmers setting aside a portion of their arable land, in a proportion that, in practice, turned out to be set annually, between 5% and 15% depending on the world market. In the beef sector, existing premiums per head of cattle were increased as a compensation for a progressive reduction in support prices. Eligibility conditions to these beef premiums were strengthened without completely removing production incentives. The reform was fully implemented in 1996, the last year of the progressive decrease in intervention prices and increase in direct payments.

At the end the 1990s, talks with the Central and Eastern European countries reached the point where the CAP needed to account for future enlargement. The Agenda 2000 agreement reached in 1999 led to another fundamental adjustment of the CAP. On the market side, it included further cuts in intervention prices for cereals and beef, again (this time partially) compensated by direct payments. CMOs were simplified in the sector of beef, dairy, wine and arable crops.

Over 10 years, the guaranteed prices for cereals were cut by half and the price support for beef was virtually eliminated, keeping only a safety net at a very low level (it is noteworthy, however that the sector is still highly protected by tariffs). Direct payments to farmers as “compensatory payments” became the largest of the CAP outlays. The Agenda 2000 also set the principles for the application of the CAP in future/new member states. The exact modalities of support (i.e. progressive convergence in direct payments with other member states until 2013, simplified schemes for direct payments, as well as the possibility for some “top up” payments funded by national budgets) were defined before the accession of new EU member countries in 2004 (2007 for Bulgaria and Romania).

The 2003 reform pursued the 1992 and 1999 reforms towards greater market orientation. The Council rejected further cuts in intervention prices proposed by the Commission for cereals. However, guaranteed prices for milk powder, butter and rice went down, and intervention for rye and maize was subsequently abolished. In addition, a central proposal of the Commission, i.e. the decoupling of direct payments from production and inputs, was implemented starting in 2006. Since that date, farmers no longer need to produce to receive the direct payments, which have been consolidated into a “single farm payment” (SFP) with no link to a particular crop or type of livestock produced. In practice, the SFP is an entitlement to receive payments. In some countries it has been calculated for each individual farmer on a historical basis. That is, a farmer benefits from a particular level of entitlement if he/she has produced particular crops eligible to payments in the past (grains, oilseeds, beef and fallow land – corresponding to land set-aside; the list was then expanded to fodder and to products whose CMOs were subsequently reformed, such as potatoes for starch, durum, dried fruits, rice, dairy products, sugar, etc.). In other countries, this entitlement is a flat amount per hectare, identical between all farmers in a given region or in the whole country. There is no need to produce in order to receive this payment, but the entitlement must be "activated" by certain conditions to receive the actual payment (see Box 4.1 for details). This payment is also conditional to a set of good agricultural and environmental practices.

A revision of the reformed CAP took place in 2008, known as the "Health Check". It led to a series of adjustments in November 2008, mostly on six issues:

- Continuation of the move toward market orientation, with barley, sorghum and rice no longer eligible to public purchases to support price (in addition to pork, rye and maize decided earlier). Quality wheat is now de facto the only cereal that is still supported by intervention, and automatic purchase is limited to 3 million tons every year.

- End of compulsory land set aside.

- End of the system of dairy quotas in 2015, with a progressive increase of quota limits.

- Increase in the rate of compulsory modulation to 10 percent, all farmers receiving less than €5,000 in direct aid will continue to be exempted, as are all producers in the twelve new member states. Progressive modulation, i.e. farms receiving more than €300,000 in direct support every year, face an additional 4 percent shift in funds.

- Further decoupling of the direct payments that remained tied to production, in particular full decoupling of direct payments in the arable crop sectors (some member states had used the flexibility to maintain some payments coupled after the 2003 reform).

- Member States are encouraged to move their SFP model towards a flat-rate per hectare payment (per region) and away from a historically based model.

A gradual shift towards the second pillar

While the EU agricultural policy moved progressively towards a combination of more market orientation and a large amount of direct payments to producers, it also moved progressively towards the remuneration of amenities and public goods.

BOX 4.1

Main provisions of the 2003 and Heath Check reforms

Single payment. On the basis of the direct payments provided in the past, a ceiling for direct payments to farmers was defined for each member state. This ceiling has been used to calculate a unit value for the single farm payment (SFP) and the number of hectares eligible to this payment. In countries that have adopted a regional basis, e.g. Denmark, the unit value is similar for all hectares eligible. In other countries that have used an individual basis, e.g. France, the unit value may vary significantly between two farmers and between two regions. Farmers can request the payment up to the number of rights they are entitled to. This number of entitlement is equal to the number of hectares of the surface of reference. The payment is therefore the product of the number of entitlements and the unit value of the payment right. However, for each entitlement, the farmer must show an eligible hectare in order to "activate" the entitlement. The eligible hectares include all arable crops and pasture. That is, farmers do not have to produce in order to benefit from the payment. They also have the freedom to produce (almost) whatever they wish without the decision affecting the payment.

Flexibility. After the Health Check, each member state can maintain a link with production only for suckling cows, sheep and goats up to a certain ceiling. Each member state has the freedom to define the single payment on a per hectare basis or on another basis, either national, regional or individual. A member state can keep up to 10% of the national ceilings of direct payments and allocate the corresponding amount to other farmers for environmental or quality improving objectives and, since the Health Check, support fragile production, less-favoured areas or risk management as well as pest control programmes (Article 68). New resources coming from the decoupling of arable crops payments in 2008 can also be used with some domestic latitude (Article 63).

As a result, the different modalities for the implementation of the CAP reform have led to a great complexity in the national situations, and a CAP that appears less and less "common".

Conditionality. The SFP is conditioned to the respect of EU Directives on environment (conservation of wild birds; protection of groundwater from chemical substances; use of urban sewage; protection of water against nitrates; conservation of natural habitats; etc.); traceability of animals and meat; and health issues and animal welfare. The payments are also conditional to the respect of a set of good practices, such as protection against erosion, soil protection and so on defined at the local level. In addition, there is an obligation not to reduce the surface in permanent pasture, relative to a 2003 benchmark (a provision that does not seem well-enforced in practice). In case of infringement of these directives or good practices, payments can be cut.

In the mid-1970s the idea that farmers in less-favoured areas deserved to be supported by public policy led to a series of payments to livestock producers in mountainous as well as other less-favoured areas. The motivation was twofold. The idea of "compensation for natural handicap" was one of them. The idea that extensive livestock production participates in rural development and avoids desertification and destruction of rural communities in these areas was another one. Further reforms in 1985 and 1992 targeted the environment and afforestation on farmland. The 1996 Cork conference on rural development triggered a significant inflexion in the role devoted to the CAP. The Cork declaration listed ten points that should structure rural policies, including integrated approaches, sustainability, subsidiarity and adaptation to local situations, etc. In 1997, the Luxembourg European Council stated that EU agriculture should be "multifunctional", sustainable, and spread over the entire territory in a harmonious way.

The Agenda 2000 laid the foundations for a rural development policy that supplements market-focused policy. It has become known as "the second pillar" of the CAP. In spite of its limited budget share, the expression intends to show that rural development is now considered to be of equal importance to market support in the CAP. The "Rural Development Regulation", which came into force in 2000, emphasises the multifunctional role of agriculture and forestry, environmental aspects, and an integrated approach to the rural economy through multisectoral development (see Box 4.2). While the concept of second pillar has become a tangible reality, the set of measures covered still looks quite heterogeneous. In the "rural development" measures, support to less-favoured areas and areas subject to environmental constraints as well as agri-environmental measures and forestry account for the largest part of the budget. But the term "rural development" seems to have been left rather vague on purpose, so as to include a cornucopia of measures, including aids to investment and settlement of young farmers; training; early retirement; improvement of processing and marketing of agricultural products in rural areas; aids to the adaptation, development and diversification of rural areas; land improvement; reparceling; setting up farm relief and farm management services; basic services for the local economy and rural population; renovation, development and protection of the rural heritage; diversification of activities to provide alternative incomes to agriculture; agricultural water resources management; etc.

Both the Agenda 2000 (i.e. 1999 reform) and the 2003 reform rationalised the various measures encompassed under the term "rural development". All of them are now subject to one regulation, the Rural Development Regulation, and funded by a single budget, the European Agricultural Fund for Rural Development (EAFRD), which includes the former "orientation" section of the CAP budget (the "guarantee" section has led to the creation of a specific budget, the European Agricultural Guarantee Fund (EAGF) dealing with markets and direct payments, i.e. what is still included in the term "first pillar"). The new Rural Development Regulation for 2007-2013 aims to reinforce rural development policy and simplify

BOX 4.2

Rural Development Measures: the new objectives of the CAP

The Rural Development Regulation focuses on three major objectives, which are reflected in thematic "Axes":

Axis 1. Increasing the competitiveness of the agriculture and forestry sector. This includes measures for human resources (early retirement; young farmers; training and information and farm advisory services); physical capital (investments; processing and marketing; infrastructure improvements); quality of agricultural production and products (support for farmers participating in food quality schemes); and transitional measures (support for semi-subsistence farmers in the new member states; setting up of producer groups).

Axis 2. Improving the environment and countryside through support for land management. This Axis includes measures for sustainable use of agricultural land (mountainous and less-favoured areas; other areas with natural handicaps; support for non-productive investments; agri-environmental measures; animal welfare payments; and support for Natura 2000 – measures to preserve biodiversity); and for sustainable forestry (afforestation; agro-forestry; Natura 2000 forest areas; restoring forestry production potential; and support for non-productive investments).

Axis 3. Enhancing the quality of life in rural areas and promoting diversification of economic activities. This covers three groups of measures: quality of life (basic services for rural areas and population; renovation and development of villages; protection and conservation of the rural heritage); economic diversification (diversification to non-agricultural activities; support for micro-enterprises; agri-tourism); and training skills acquisition (training and information).

These thematic Axes – and particularly the third one – are complemented by support for Local Action Groups (public and private partnerships) under the Leader programme. The Leader approach, which supports both agricultural and non-agricultural activities, is integrated into the mainstream of rural development programmes and each programme will contain a Leader axis.

Member countries are required to spend a minimum of 10% of their EARDF funds on Axis 1, 25% on Axis 2, and 10% on Axis 3: 5% (2.5% in the new member states) of the EARDF funds must be devoted to Leader initiatives and all projects are to be co-financed. The co-financing comes from several sources – EU, national, local and municipal government, as well as private funds. Depending on the Axis, the EU budget provides between 20–55% (75% in "convergence regions") financing of eligible costs.

Sources: EC Commission and OECD.

its implementation, with the general aim of reinforcing the coherence between agricultural policy and rural development.

The 2003 reform and the 2008 Health Check also provided extra funding for second pillar measures. The "modulation" of payments, which consists of siphoning off some of the SFP for the largest recipients, channels some money towards second pillar measures. A mechanism for financial discipline introduces a cap for payments at the national level so as to ensure that the farm budget fixed until 2013 is not exceeded.

In addition, the 2003 reform and the 2008 Health Check strengthen the linkage between first pillar payments and the respect of the environment, by linking the conditionality of the payments to a set of good practices, including environmental (see Box 4.1, under Conditionality). This is designed to increase the environmental impact of the new measures without increasing the corresponding budget. Another feature of the 1999, 2003 and 2008 reforms is that, concomitantly with the shift towards a rural policy (which is not subject to the provisions of the Rome Treaty designed to avoid distortions of competition by ensuring a single level of payments across the EU), a degree of decentralisation was introduced in the CAP. The executive responsibility over programming and implementation is devolved to member states. In the rural development area, national authorities can choose options in a menu of policies and may apply those more appropriate to local conditions. In the area of direct payments, modulation is partly optional and can be used for locally defined measures, while member states can choose the modalities for allocating SFPs as well leaving some payments coupled to production or not. EU support to agri-environmental measures contributes to covering a maximum of 85% of the cost in areas covered by "Objective 1" and 60% in other areas. Note that the 2003 reform modified the co-financing of EU rural development measures and introduced a financial discipline mechanism ensuring that farm budget was not exceeded.

The role of external pressures

Many of the pressures for reforming the CAP came from the budget. The increasing expenditures devoted to storage and export refunds in the 1980s played a major role in the 1992 CAP reform, whose main purpose was to reduce market imbalance. The need for changes in the CAP also stems from new demands from the civil society, i.e. for the environment. However, foreign pressure has been at least as important a catalyst. This is particularly the case of the pressure that was expressed through multilateral channels, as explained below.

The 1992 reform of the CAP took place during the Uruguay Round of multilateral trade negotiations. Although the Commission denied any formal link with the trade negotiation, the reform clearly helped the negotiations by meeting some of the fiercest criticism to the CAP. Without the external pressure of the WTO negotiations, it is likely that the reforms would have been more oriented towards supply control.

The Uruguay round capped some direct payments. The pressure on the CAP was limited, thanks to the fact that a large share of the payments was eligible for "blue box" status (and therefore exempted from compulsory reduction) before being decoupled and hence (likely) eligible for "green box" status. The tariff cuts only put limited pressures on the CAP. They followed a phase of tarification which had led to set tariffs at a level that was sometimes higher than the previous level of protection (the "dirty tarification" issue, see Ingco and Hathaway, 1995). The WTO limit on export subsidies proved to be a major constraint on the CAP, since public intervention would now mean acquiring stocks that would become impossible to sell on the world market. This constraint clearly played a role in the decrease in intervention prices that took place under the 1999 reform.

More generally, the 1994 Agreement on Agriculture bound the definition of agricultural policies. A shift towards higher intervention prices, as requested by some farmers' organisations, seemed out of the question. The possible conclusion of a WTO agreement under the Doha round was also anticipated during the 2003 reform. The decoupling of direct payments was motivated by EU internal reasons, namely the need to move away from "compensation" logic. However, the decoupling of the direct payments also aimed at lowering the actual Aggregate Measure of Support (AMS) and to anticipate the fact that the "blue box" category of payments is likely to disappear or be dramatically reduced under a potential WTO agreement. Thanks to the 2003 reform, a large cut (roughly 75%) in the EU AMS ceiling could be achieved without significant further reforms of the CAP (Butault and Bureau, 2006). The likely ban of export subsidies (whose principle was agreed in the 2004 Framework agreement, reiterated in the 2005 Hong Kong declaration, even though the EU indicated that it was subject to a full Doha agreement) is also binding for the design of the future CAP.

The market access provisions of a potential Doha agreement also constrain the design of the future CAP. The draft modalities that have been tabled at the end of 2008 would involve considerable cuts in tariffs. As a result, it is likely that, except for a limited number of tariff lines considered as "sensitive", most EU products will no longer be significantly protected. With the size of cuts that are being discussed, a market management scheme such as intervention would no longer be sustainable since public purchases would be flooded by imports. In the case of sugar, but also bananas, the pressure for reform also came from WTO panels. Even without an agreement, the recent WTO jurisprudence (Canada Dairy and EU Sugar panels) suggests that many aspects of the CAP could be challenged, not only under the Uruguay Round Agreement on Agriculture, but also under the (potentially broader scoped) Subsidies and Countervailing Measures Agreement.

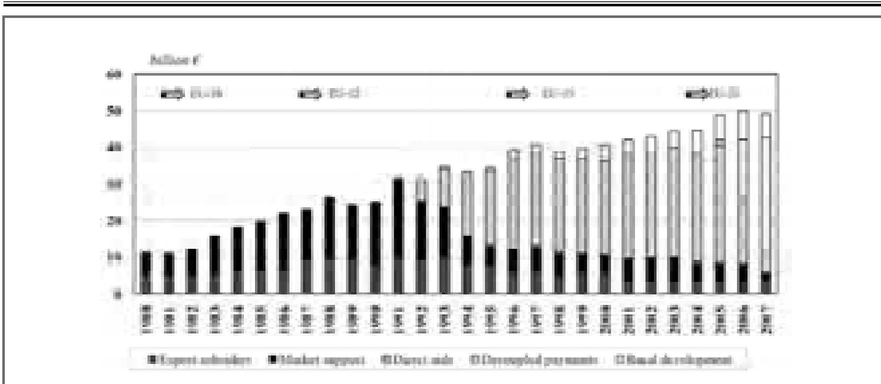
The provisions of the Uruguay Round Agreement and a potential Doha agricultural agreement are not the only multilateral pressures that have pressed for changes in the CAP. In the case of the sugar sector, the 2006 reform was driven by internal pressures but also by the new conditions created by the "Everything but Arms" initiative, i.e. a EU decision to open borders without restrictions to exports originating in the least developed countries (LDCs). This is also the case of the reform of the rice sector. Because of the export potential of LDCs in these sectors, the respective CMOs had to be dramatically modified. In the future, the pressures on the CAP coming from bilateral or regional agreement are likely to be significant.

The rationale of these policy changes in light of stated objectives

With the series of reforms that have taken place since 1992, the CAP has followed a consistent path. This path is in accordance with standard economic theory that recommends ensuring supply and demand through prices rather than supply control that generates rents, which capitalize in asset values and make changes difficult because of inheritance effects. Channelling taxpayers' money towards direct payments to producers rather than using it for policies such as storage costs or export refunds that have only an indirect effect on producers' income and are characterised by a low transfer-efficiency ratio, is also consistent with the targeting principle which remains a useful guideline for policy-making (Bhagwati, 1971). Direct payments are now the main component of the EU agricultural support provided to farmers, even though this total support is notoriously difficult to measure. Within 15 years, the considerable changes that took place in the CAP have led to a major shift of the farm support burden from consumers towards taxpayers. It has also led to changes in the composition of the EU budget (Figure 4.1), with the decoupled payments now representing the bulk of the EU farm budget.

FIGURE 4.1

Composition of the EU agricultural budget over time



Source: EC Commission figures

4.2 Effectiveness of farm policies in meeting their stated objectives

In spite of reforms, questions remain regarding the effectiveness of the "new CAP" for meeting stated objectives such as making the agricultural sector more productive, supporting farmer's incomes and enhancing the multifunctional role of agriculture.

Efficiency in meeting productivity objectives

The initial CAP had strong ambitions regarding the increase in productivity. The "guidance" section of the early CAP budget was designed to improve structures, while the guaranteed prices intended, among other objectives, to provide a stable and predictable environment that would foster innovation. Productivity gains were considerable between the 1960s and the 1990s. This contrasts with the finding of studies over the recent period, which suggest that gains in total factor productivity of EU agriculture has slowed down (see Butault, 2008, for France; Newman and Matthews, 2007, for Ireland). It is unclear to what extent the EU productivity slowdown has been caused by the recent CAP reforms. Productivity figures might reflect the slower adjustment in inputs to the policies that have provided disincentives to increase output, such as the recent decoupling of direct payments, but the observed trends may also reflect a decreasing rate of technical change. One should not overestimate the contribution of the "old CAP" to productivity growth. However, the reforms of the CAP have focused on balancing supply and demand, on income support and on promoting non-conventional outputs (multifunctionality). As a result it is hard to find instruments in the "new CAP" intended specifically to increase productivity, even though this remains a stated objective of the CAP.

Farmers complain that regulations, such as restrictions to the use of genetically modified (GM) seeds and animal welfare regulations, the conditionality of payments and all of the administrative requirements for receiving payments reduce their competitiveness. One can argue that direct payments largely cover the costs induced by the conditions on environment, food safety and animal welfare that are requested. However, not all sectors affected by these restrictions/regulations perceive these direct payments (for the case of pig and poultry negatively affected by GMO regulations, see EC, 2008). Moreover the payments themselves have an ambiguous effect on productivity. In some sectors, direct payments now represent a considerable share of farm income (above 100% in some countries in the beef and sheep sectors, for example). That is, the CAP acts as a way to support incomes, rather than helping consolidation and building a more competitive sector. By providing financial security, the payments alleviate some of the credit constraints that reduce the adoption of innovation. On the other hand, they may also delay the exit of ageing farmers (Baum et al., 2006). It has even been suggested that they might have a negative impact on the restructuring of production structures in the new member states (Ciaian and Swinnen, 2006).

Efficiency in transferring income

Regarding the objective of increasing individual earnings, the "old CAP" showed poor transfer efficiency. By shifting to a system of decoupled payments, some of the deadweight losses associated to drawing resources artificially into the production of a supported commodity and deterring consumption of such a commodity because of higher prices have been reduced. Compared to the structure of the spending that was in place in the 1980s, where storage costs and export refunds represented the bulk of the expenditures, more of the taxpayers' money now reaches producers. However, the move towards targeted payments to an individual farmer, overall, might have increased some of the management costs, which are not only borne by the EU budget but also by member states and by farmers themselves. These costs are often neglected by economists recommending a shift from market intervention to "lump sum" payments. The opportunity costs of public funds also need to be taken into account. This issue is particularly worrying in the case of direct payments under second-pillar programmes, where management costs are a significant share of the payments received by farmers. Even though the overall efficiency of these schemes should be measured with supplementary criteria (since their environmental impact is positive, rather than negative as is often the case with intensive agriculture), one should keep in mind that they perform poorly in terms of transaction costs and informational rents (Falconer and Whitby, 2000; Bonnieux, 2007; Bonnieux et al., 2008; Mettepenningen et al., 2008).

Leakages to unintended beneficiaries

The high level of direct payments also raises the issue of their macroeconomic effect and the fact that, through price adjustment, they may not fully benefit the intended beneficiary. Arguably, active farmers are the population group targeted by farm support. When an input is inelastic, payments to producers are often passed to the input supplier through an increase in price. The capitalisation of the payments (or other type of farm support) in assets such as "land" or "entitlements" is such that a large share of the support is passed to the asset owner, i.e. an unintended beneficiary (at least not in the stated objectives like the ones mentioned in the Rome Treaty). With asset values inflated by payments, young farmers must finance a higher initial investment and face the risk that future policy changes may affect the return on that investment. Even in countries where farmers own most of the land they cultivate (e.g. Poland, Italy, Greece), the leakage has a negative impact on structural change, since the most dynamic farmers are generally younger while land ownership is typically concentrated in older rural households. A share of the benefits of the CAP is transferred out of the sector each time a farmer has to make payments to siblings entitled to inheritance, or purchase of quotas or land from farmers leaving the sector. Retiring farmers are often the main beneficiary (in some EU countries, the EU milk quota, an asset with an implicit value that always finds a way to meet the market in spite of national regulators who sometimes set up rules for limiting transferability, has almost become a substitute for low pensions for retiring farmers).

The extent to which such leakages take place varies across member states. Consider the case of direct payment land prices. The degree to which support is capitalised into land rents is a function of three main factors: (1) how the policy is implemented, specifically its initial incidence (targeted to land, inputs or labour); (2) the ease with which land can be shifted to alternative uses (the elasticity of supply); and (3) the ease with which land can be substituted with other factors of production (OECD, 2008b). In particular, there are countries where a market for premium entitlements is quite separate from the market for land and where support improbably leads to higher land prices. Matthews (2008) even points out that, given that the number of SFP entitlements is less than the number of eligible hectares in most member states, the value of the SFP should not be reflected in the price of land, and given that the direct payments which the SFP replaced were coupled payments, the 2003 decoupling should lead to a fall in the price of land. More generally, there is evidence that, even before the 2003 reform, not all payments were capitalised into land prices (Gohin 2006). Land prices are affected by a range of factors other than policy support, including planning regulations and expectations of capital gains. Changes in land rents since 2006 would be a better indicator of capitalisation, but data are scarce. Land rents seem to have increased significantly in new member states over the past 3 years, while they have tended to decrease in countries such as the UK and Ireland (Matthews, 2008). In the case of France, for example, specific legislation on land tenure has introduced a considerable viscosity in the pass-through of prices and payments to land rents and hence land values.

In the reformed CAP, most payments are still tied to land, i.e. the least mobile asset. In practice, the value of the SFP capitalised into land rents seems to depend on the ratio of the number of entitlements to the number of hectares of agricultural land as well as on the payment model (historic, regional or hybrid) in place (Isermeyer, 2003; Kilian and Salhofer, 2007). The pass-through of farm support to asset owners seems to be an issue in new member states, in particular in countries like Slovakia and Hungary, where farmland is rented to a large degree.

Efficiency of the "new CAP" in meeting new challenges

Since the 1990s and the debates on multifunctionality, the CAP has clearly been reformed so as to tackle new challenges such as providing amenities and reducing negative externalities. It is unclear, however, how well the CAP has performed in this area. The responsibility of the CAP in the poor environmental record of the EU agricultural sector is subject to controversies, and whether or not the recent reforms have made things better is unclear. There is little doubt that public policies have encouraged negative externalities.

In the past, high prices provided incentives to use larger amounts of fertilisers and pesticides. Ill-defined direct payments have encouraged the reduction of permanent grassland and the irrigation of some arable crops. Subsidies to land consolidation, drainage or irrigation have made things worse, contributing to the destruction of habitats such as wetlands (ECA, 2000). The reformed CAP has not fully managed to reverse these incentives in spite of repeatedly stated objectives. The 1992/1999 reforms have not led to visible diminution of the negative externalities over the 1990s. The 2003 reform, by introducing decoupling and eco-conditionality as part of cross-compliance, has reduced the incentives to increase yields by using larger amounts of chemical inputs. However, a link between payments and land has been maintained. By making risk-averse farmers wealthier, direct payments still provide an incentive to produce more with more variable inputs (Hennessy, 1998). In addition, the overall effects of decoupling are sometimes unclear. They seem to have ambiguous effects in areas such as Scotland, where the livestock sector has contracted in some extensive areas, but tended to concentrate in others. It seems that farmers have also anticipated future regulations by accelerating some degradation of habitats (the ploughing of permanent pastures, draining of wetlands in France) before the 2003 reform.

Agri-environmental schemes have been presented as a powerful way to curb the negative environmental impacts of the CAP since 1992. After more than 10 years of implementation, the various assessments suggest that they have benefited mainly producers who had low opportunity costs for implementing the environmental efforts. In most cases, these are also the farms where the environmental benefits are limited. The schemes that attracted contractors were often those with relatively lenient terms of references. That is, the pro-environment instruments of the CAP seem to offset only partially the environmentally negative consequences of the broader policy.

Meeting other rural development objectives

The Rural Development Regulation and the EFARD have brought some consistency among the various measures included under the term "rural development". However, it remains difficult to assess the efficiency of a policy that is so broadly defined. Overall, for the period 2000–2006, the second pillar supported a menu of 22 measures, from which member countries are free to choose. The total second pillar budget for 2000–0206 was €60 billion for the EU (25 members) – just over 10% of the total CAP budget. For the 2007–2013 period, the second pillar budget is expected to account for around 20% of total EU spending on agriculture.

Evaluations of rural development schemes suggest a mixed balance in areas other than strict environmental issues (AgraCEAS, 2003; ECA, 2005; EC, 2004). One of the major conclusions drawn from the mid-term evaluations of the 2000–2006 RD programmes was that many programmes lack focus, a clear strategy and coherence between them. The EC (2004) report questioned the co-ordination between rural development programmes and other European or national support schemes, and pointed out that a large number of available measures seemed to include contradictory objectives. On the practical side, funding provisions and delivery mechanisms were shown to be complex, and the management of the programmes leads to administrative burden.

Efficiency in providing stable prices and incomes

The stabilisation of agricultural markets is one original objective of the CAP. Following the succession of reforms, European markets are now less regulated, and with the dismantling of intervention in some sectors and the cuts in intervention prices in others, producer prices fluctuate now more than in the past. On the other hand, the introduction of direct payments provides a stable source of revenues for farmers. This evolution suggests a gradual shift in the objectives from stabilisation of prices to stabilisation of farm incomes.

CAP reform seems to have resulted in an increase in the variability of the prices faced by individual producers (Thompson et al., 2004). Indeed, statistical evidence on the coefficient of variation of domestic agricultural prices has doubled during the 10 years following the 1992 reform compared to the previous ones, while it has remained roughly the same on the world market over the same period. However, extra volatility in the price faced by producers has been offset by a larger share of income coming from the stable direct payments. As a result, income variability has not increased over the same period (Table 4.1). In the case of French arable crops farms, farm income variability was also greatly reduced by the changes in the composition of support over 1992–2001 period compared to a benchmark situation with no CAP (Jacquet et al., 2004). One important point is that without the CAP, the income of the stylised farm studied by these authors would have been negative in 6 years over the 10 years considered in the analysis (note that the endogeneity of the production costs was not accounted for, however). Simulations by Van Asseldonk et al. (2008) show that the variability of farm incomes is greater if the CAP is removed: twice for a representative Hungarian farm and up to 6 times higher for a representative Spanish farm. The impact of the CAP on stabilising income far exceeds the situation brought about by yield, revenue and index insurances schemes (at least under their assumptions, where strike levels at 80% of the mean yields). That is, in spite of greater price variability, the new CAP performs better than the old one at "cushioning" farm incomes.

If the reformed CAP seems to be effective in stabilising European farmers' incomes, it is mainly because of a reliance of farm revenues on direct payments, whose proportion in farmer's incomes is now very large, often exceeding 100% in particular sectors.

TABLE 4.1
Impact of the CAP on price and income variations

	Period 1986-1992	Period 1993-2000
With the CAP		
Price		
Average	180.3	131.4
Standard deviation	10.3	16.3
Coefficient of variation	0.06	0.12
Income		
Average	881.3	1056.5
Standard deviation	49	56.5
Coefficient of variation	0.06	0.05
Without the CAP		
Price		
Average	101.3	114.1
Standard deviation	20.0	22.2
Coefficient of variation	0.20	0.19
Income		
Average	318.6	418.2
Standard deviation	135.5	132.7
Coefficient of variation	0.43	0.32

Source: Thompson et al. (2004).

Distributional effects

In addition to correcting market failures, public intervention can be justified by redistribution purposes. It is nevertheless quite difficult to assess the effectiveness of the CAP in meeting such objectives. The first reason is that there is no clear objective stated in this area. Typically, the vision of what should be a "fair" distribution of incomes among farmers is something on which no consensus has ever been met in the EU. It is true that if governments want to achieve social objectives, there are better instruments for redistributions than a sectoral policy in developed countries. However, one can safely consider that public policies should, at least, not increase "natural" disparities.

Save for, perhaps, the exception of payments for less-favoured areas, the CAP has never had as an objective to reduce existing "natural" disparities. Market price support under the "old" CAP tended to exacerbate initial differences, in the sense that it benefited larger and more profitable farms (Tarditi and Zanias, 2001). However, the distribution effects are quite complex, involving differences between types of farms (Allanson, 2007; Latruffe et al., 2008). In addition, because the CAP delays exit of ageing farmers, it is unclear what the overall impact of the payments is, once the dynamic effects are taken into account (Elsholz and Haarsche, 2008). Finally, the distributive impact of the second pillar payments are significantly different from those of the first pillar (Langstaff et al., 2008)

Well-publicised cases of wealthy aristocrats or large corporations receiving direct payments have contributed to turning the public opinion against the CAP. Beyond anecdotal evidence, however, the concentration of the CAP benefits is genuine. Because they result from the compensation of past cuts in gross incomes (in most countries the payments have been based at least partly on individual historical references), the largest amounts of money transferred through SFPs go to large farms in relatively well-endowed areas. Figures on the direct payments only (to say nothing of the market price support) show that the 880 largest beneficiaries, i.e. 0.02% of the EU farms, received more than €500K, or 2.5% of the payments. At the other end of the distribution, more than 50% of the beneficiaries, or 2.5 million farms, received less than €1250, and 77% of beneficiaries (3.74 million farms) received less than €5000. Among farmers themselves, some new fractures have developed. While the 1993 "compensatory" payments could be seen as a compensation for the rupture of an implicit contract between farmers and society, decoupling now raises the longer term issue of the legitimacy of these payments.

4.3 The CAP and distortionary effects on production and trade

Most of the CAP budgetary expenditures now take the form of direct payments, but border protection and some remaining price support persist, as well as supply control in dairy and sugar. If there is a relatively wide consensus on the modelling of traditional farm policy instruments (tariffs/export subsidies, production quotas) modelling the features of the reformed CAP, i.e. a mix of decoupled and semi-decoupled payments, is still subject to controversies. One puzzling problem is to assess how much the current direct payments have on production and input use. We first review the different approaches to model direct payments before moving to review the evidence on the effect they have on production and trade.

4.3.1 Review of analytical approaches for modelling CAP direct payments

In terms of modelling, one can distinguish simulation models from what can be called "econometric" models. In simulation models, e.g. calibrated general equilibrium models, the working of direct payments is assumed and parameters are calibrated so as to replicate reality. In "econometric" approaches, e.g. supply response models, one attempts to find the best specification of how direct payments work, based on the past impacts of these instruments. In the latter group, some studies on arable crop direct payments resulting from the 1992 and 1999 CAP reforms are available, but little can be said on the functioning and the impact of decoupled payments, which are too recent to carry out econometric analysis. Another useful distinction is between studies that rely on a static/certain framework and those (there are actually few of them) that introduce risk and/or dynamic considerations. Clearly, the second group accounts for more complex effects, including the role of direct payments in the formation of producer's expectations. However, even in the simplest case without risk and dynamics, the effects of direct payments on production are not obvious, as we illustrate in the next sections.

A general theoretical framework

Consider a conceptual framework that makes it possible to represent stylised effects of CAP direct payments on input demand and production. A standard approach for modelling direct payments is to assume a particular technology and derive the demand for land.

The technical specification varies according to economic (econometric or simulation) models, but land demands can be viewed as a special case of the following general structure:

$$l_i = l_i(p_i, r_i, z_i) = l_i(p_i, w_i - cf_i . a_i, z_i)$$

where i is the index of the arable crop, p_i the output price, r_i the rental price of land net of the direct payment, z_i a vector of other variables (for instance prices of fertiliser, pesticides, seeds, etc.), w_i the rental price of land, a_i the per hectare direct payment and cf_i a coupling factor. Land demand can be derived from the profit maximisation programme of farmers. Consequently land demand depends positively of the output price and negatively of the net land rental price under standard assumptions on the technology. That is, crop-specific land demand increases with direct payments.

The introduction of a coupling factor allows representing the various assumptions made in the literature, which largely determine the magnitude of the impact of direct payments on input use and production. This coupling factor is generally assumed to be constant across arable crops in simulation models and varies between 0 and 1. It is also generally assumed to be constant across farmers, although they may exhibit different risk aversion. In such cases, the value is assumed to encompass the various effects of direct payments identified in the literature (i.e. risk related effects, dynamic and financial effects, etc.) in a synthetic representation. Indeed, the degree of complexity of simulation models, in particular in a general equilibrium framework, does not make it possible to detail all of the economic mechanisms at stake, and the coupling factor is used as a parameter to calibrate the overall impact of direct payments.

A value of 0 implies that direct payments have no effects on area allocations and, more generally, no production effects at all, given that yields are generally assumed to be independent of direct payments. This zero-value was considered as an extreme option for the post-1992 CAP payments, which were classified in the “blue box” category because their overall production impact was difficult to assess (given the strings attached to these payments and the obligation of supply control such as fallow land). At the other hand of the spectrum, a value of 1 for this coupling factor implies that producers must engage in production in order to receive payments, and that these payments influence the factor allocation across activities and consequently have production effects.

Typically, the various simulation models rely on a rather fragile calibration of this parameter. As examples, the FAPRI model (developed by a consortium of US universities including Iowa State University) relies on a specification that corresponds to specifying a value of 0 for this parameter cf_i , the AGLINK model (developed by the OECD) a value of 0.14, the GOLD model (developed by the University of Missouri) a value of 0.5 and finally the CAPRI model (from the university of Bonn) a value of 1.

The measurement of decoupling also depends on other important modelling assumptions about the land market. In most economic models, the mobility of land across arable crop sectors is assumed to be nearly perfect, while the mobility of land is assumed to be more limited between these sectors and other farm sectors (pasture). In order to limit the number of parameters and notations in this description, let us assume, without a great loss of generality, a perfect mobility of land across arable sectors. We have:

$$w_i = w \quad \forall i \in ac$$

$$\sum_{i \in \boldsymbol{a}} l_i = L(w)$$

where ac is the set of arable crop sectors and $L(w)$ is the supply function of land to these sectors, which positively depends of the land rental price. In this framework, the impacts of direct payments are obtained from the following comparative statistics:

$$dl_i = cf.\frac{\partial l_i}{\partial r_i}.\left(-\frac{-\sum_{i\in ac}\frac{\partial l_i}{\partial r_i}.da_i}{\frac{\partial L}{\partial w}-\sum_{i\in ac}\frac{\partial l_i}{\partial r_i}} - da_i \right) \qquad dw = cf.\left(-\frac{-\sum_{i\in ac}\frac{\partial l_i}{\partial r_i}.da_i}{\frac{\partial L}{\partial w}-\sum_{i\in ac}\frac{\partial l_i}{\partial r_i}} \right)$$

From these equations, it appears that a high coupling factor is not sufficient to ensure large acreage (and production) effects of direct payments. For instance, if these direct payments are reduced by the same amount ($da_i = da$) and the mobility of land between the arable crop sectors and other farm sectors is zero ($\frac{\partial L}{\partial w} = 0$), then there is no impact on acreage and one simply obtains a decrease of the land rental price. On the other hand, if this mobility parameter is strictly positive and the reduction of direct payments is not uniform across activities, this will result in both an effect on land allocations and on the land rental price. In other words, the amount of new land which can be allocated to arable crop farming is also an important driver. Unfortunately this information is not always available (nor are the exact specification and underlying assumptions always made clear in simulation models). An extra complexity for modellers is that the CAP restrains the amount of total land through the definition of base areas. This, again, is poorly taken into account in most models.

The impact of direct payments on production occurs not only through the allocation of land, but also through their impact on yields. Here, too, are some methodological challenges. With the exception of a few general equilibrium models, a standard specification is to assume that the output is the product of a yield function and an area function (a typical approach in partial equilibrium models). Yields per hectare are often specified as functions of own producer price and a trend capturing the impact of technical change. Using a stylized example, we show that even under a simple framework (a mono-product firm using three inputs), the assumption that direct payments do not affect yields requires strong assumptions on the technology, assumptions that seem to be contradicted by empirical evidence. Indeed, unless there is no substitution between land and other inputs and the marginal productivity of land is constant, yields will be affected by direct payments and the overall impact of these payments on production results from both drawing more land into production and an indirect effect on yields. The magnitude of the respective effects is uncertain. An extreme case is if direct payments do not affect yields and where total land devoted to, say, arable crops, is fixed. In such a case, the impact of direct payment on production level would be zero. If we introduce an extra complexity, i.e. the fact that direct payments are *de facto* conditioned to a set-aside requirement, direct payments could end up having a negative effect on output. That is, there is at least a theoretical possibility for the distortion resulting from direct payments to have the opposite effect from what is commonly believed.

The interaction of direct payments with set-aside requirements

The 1992 CAP reform had conditioned direct payments (corresponding to arable crops) to the obligation of setting aside a certain percentage of land that was devoted to grains, oilseeds and protein crops. For the bulk of the payments that are now decoupled, the 2003 reform has ended the distinction between direct payments corresponding to various productions, but there was still a *de facto* obligation of setting land aside to get the SFP until the November 2008 adoption of the Heath Check. That is, from 1993 to 2009, direct payments interacted with supply control.

Gohin and Guyomard (2000) developed a static micro-economic model where crop acreage allocations, production supplies and yields are endogenous, taking into account the interaction between the set-aside requirements and the direct payments. Producers choose area allocation, output supply and yields per hectare by maximising their profit subject to market and technical constraints (the main instruments of the CMO for arable crops, i.e. intervention prices, direct aids to cultivated land, direct aids to land left fallow, set-aside commitments, base areas, etc., can be taken into account within a programming model). Simulations of the level of production with and without the CAP payments in France suggested that the 1992 and 1999 type of payments (i.e. a package combining direct payments subject to setting aside land devoted to arable crops) actually reduced both the acreage and the production of arable crops (cereals, oilseeds and protein crops) in the EU. This means that the blue-box type of payments provided as a compensation for a price decrease in the 1990s reduced the distortion effects on production and trade compared to the previous CAP, as expected. However, less intuitively, simulations suggest that, because of the joint effect of the semi-decoupling (remember that the 1992 and 1999 payments were provided on a per hectare basis, not a per tonne of output basis), of the capping of the overall surface eligible and the compulsory set-aside to receive payments, the overall impact of getting rid of the 1992 payments would have been a larger EU production. Clearly, this result is caused by the set-aside provision. And it will no longer hold after 2008. However, it suggests that the overall distortions of the 1990s CAP on world markets was perhaps overestimated by analysts, who often focused on the production-incentive effect of these payments, which was actually offset by the mandatory set-aside provisions of the whole package.

The decoupling when land markets are heavily regulated

Most analyses of the production effects of direct payments implicitly assume that land markets are not regulated. Accordingly, direct payments can be freely capitalised in land values. However, as underlined by Gohin (2006), this assumption is at odds with reality. European data on land markets show that the land rental prices are still much lower than the per hectare direct payments. For instance, in the case of France, Germany and the United Kingdom, it appears that land rental prices represent between one-third to two-thirds of the per hectare direct payments. According to these figures, the full capitalisation assumption is inapplicable for recent years for those member states. Of course not all land is rented, but figures from farm accounting data (in particular the Farm Accounting Data Network) also suggest that, on farmer-owned land use farms, Agenda 2000 arable crop direct payments are not fully capitalised in land either. In addition to the observed statistic, econometric analysis on the degree of capitalisation of direct payments in land values also challenge this view of perfect land markets. To our knowledge, there are only two studies applied to EU agriculture. One is an unpublished French study (Meze, 2003) which did not find that 1992 CAP arable crop direct payments capitalised in land rental prices. The other is a Belgian application of the land value model (Duvivier et al., 2005) where the authors find that, during the period 1993 to 2001, the elasticity of arable farmland price to compensatory payments ranges from 0.12 to 0.47. This elasticity is not directly comparable to the coupling factor referred above, but that it is lower than 1 implies that the assumption of full capitalisation of direct payments into land rental prices is not supported by econometric studies. Without providing formal evidence for the EU case, these studies tend to challenge the full capitalisation usually assumed in simulation models.

If one is willing to accept the idea that CAP arable direct payments are not fully capitalised in the land rental prices, then one needs to explain why and where the "non-capitalised" part goes. There are two possible explanations: 1/ there exist some rigidities/imperfections in agricultural factor markets, and 2/ capitalisation takes time (Gohin, 2006). More specifically, CAP arable crop direct payments were initially introduced as compensatory payments for price decreases in order to support farm revenues. It might be the case that farmers perceive these direct payments as a reward for their labour and thus resist the full transmission of these payments to landowners. This assumption makes sense given the strong opposition of farmers in some EU member states to the CAP reform and the SFP, because this instrument further breaks the link between support and production. In addition, land leasing arrangements depend heavily on member states, but it is not uncommon to see very long contracts, with only slight possibilities of renegotiation. This may explain a slow capitalisation of direct payments in the land rental prices. Finally, there exist some national regulation laws on farm land uses which also prevent full arbitrage and thus full capitalisation.

Gohin (2006) introduced a new way to model CAP direct payments that were implemented after the Agenda 2000 for arable crops. Part of the direct payment is perceived as a labour/capital subsidy. In addition to the arguments provided above, this allocation of the non-capitalised part can also be justified by the residual nature of farm labour and capital incomes. When this new specification is introduced in a general equilibrium model that details the EU agricultural sector, the "decoupling" impacts are quantitatively very sensitive to this modelling assumption. More precisely, if one adopts the standard assumption of full capitalisation of direct payments in land values, then the 2003 CAP reform leads to a small reduction of EU soft wheat production (by 1.6%). By contrast, assuming an incomplete capitalisation, the same reform leads to a significant reduction of EU soft wheat production (by as much as 7.3%).

Impacts of direct payments on yields: econometric evidence

Since the 1992 CAP reform, total land allocated to arable crop production – and thus eligible to direct payments – faces ceilings. Hence, at the aggregate level, it is useful to analyse the impacts of the new policy instruments on yields. Several econometric analyses have been performed regarding the recent evolution of arable crop sectors, with the objective of identifying the impacts of price and direct payments on yields and production. This includes Moro and Sckokai (1999) who estimate the land/yield/production decisions of arable crop producers located in the north of Italy. This estimation is performed on individual data with a standard specification (no risk/no dynamic) including the effects of intervention prices, direct payments and set-aside requirements. Gohin (2001) retains the same framework using the generalised maximum entropy approach to impose regularity conditions on aggregate data. Arnade et al. (2002) ignore the direct payment and set-aside requirements in their estimation of national supplies and areas, but examine the evolution of price impacts. Benjamin and Houée (2005) also consider aggregated data, but use reduced form equations when specifying yield equations. Sckokai (2005) allows risk and dynamic effects occurring through farm investments. Serra et al. (2005) examine in particular the impacts of the 1992 CAP reform on pesticide use by French farmers. Compared to the standard (static/certain) framework, their contribution is to allocate pesticides among crops and to measure the elasticity of production and pesticide uses with respect to CAP instruments. Sckokai and Anton (2005) estimate reduced-form equations of yields and areas with respect to CAP instruments for individual farms of 5 EU member states (France, Germany, Italy, Spain and UK). Sckokai and Moro (2006) develop a structural estimation framework with risk aversion, which is applied to Italian arable crop farms.

As usual, the results of these econometric studies are rather fragile, as a result, for instance, of the multi-co-linearity between explanatory variables or the endogeneity of set-aside land. Despite these usual caveats, it is interesting to learn from the results of these estimations. Tables 4.2 and 4.3 below report the average and standard deviation of yield elasticities inferred from these studies. It appears that on average, producer prices positively influence yields for all crops. Own price elasticities of yields are, however, relatively low (from 0.09 to 0.19 on average). The impacts of direct payments appear to be limited: the estimates are slightly positive in the case of wheat and slightly negative for coarse grains and oilseeds.

These results suggest that the CAP reform adopted since 1992 effectively reduces the production incentives of the CAP by reducing yields. But they also suggest that this effect has been small on overall arable crop production (we do not report cross-price elasticity below, which tends to be negative).

TABLE 4.2
Elasticities of yields with respect to price, from available econometric studies

	Wheat (17 points)	Coarse grains (26 points)	Oilseeds (15 points)
Average	0.188	0.167	0.088
Standard error	0.340	0.209	0.070

Source: authors, average of several econometric studies on EU countries available in the literature.

TABLE 4.3
Elasticities of yields with respect to direct payments, from available econometric studies

	Wheat (14 points)	Coarse grains (18 points)	Oilseeds (13 points)
Average	0.023	-0.016	-0.019
Standard error	0.082	0.054	0.051

Source: authors, average of several econometric studies on EU countries available in the literature.

Wealth effects of direct payments and production impacts

In addition to the relative price effects of direct payments discussed above, there are several micro-economic mechanisms establishing a link between these direct payments and the farm production. Payments affect:

- agricultural labour supply by modifying the labour/leisure arbitrage of farm households;
- the capital invested in agriculture by relaxing the potential constraints on credit markets (Vercammen, 2007);
- the number of farms by covering their fixed costs (Chau and de Gorter, 2005);
- the wealth of farmers and thus the incentive to produce for risk-averse farmers (Hennessy, 1998);
- the real wages and the employment level in different sectors through a

general equilibrium effect linked to the public funding of these payments (Chambers, 1995).

Moreover, direct payments can theoretically modify farm production through their technical efficiency, provided that this efficiency depends on the input levels and also that one of the above mechanisms applies. For instance, Serra et al. (2007) consider the case where direct payments have a wealth effect on risk-averse producers leading them to increase their input use, which in turn has an impact on their technical efficiency.

However, from an empirical point of view, the literature suggests that above effects of direct payments on quantities actually produced are small (Bhaskar and Beghin, 2007). The survey conducted by these authors concern mainly cases in the US, and there are few studies devoted to those in the EU. Sckokai and his co-authors, who are the only ones to account for the risk aversion effect, find that small- and medium size farmers are risk averse but not the large ones, and that direct payments do not have a significant impact of production through wealth and risk aversion. Gohin and Bureau (2006), in the case of the sugar sector, show that the argument that direct payments could “cover fixed costs” was unconvincing given the possibility for adjusting fixed factors through, for example, service labour and equipment. All these studies suggest that EU direct payments therefore have a limited impact on supply.

The “wealth effect” might nevertheless be underestimated in the literature. Féménia et al. (2008) argue that the observed wealth of an agricultural household depends, among other things, on the benefits that are expected from farming, and therefore on future payments. The wealth of an agricultural household, observed at a given time, depends on the expectations concerning the durability of direct payments. This implies that the initial wealth should not be considered as fixed as this is currently done in econometric analysis or in simulation models. In other words, their suggestion is that one must also modify the initial wealth of a risk-averse agricultural household when identifying the decoupling of farm programmes in general and of direct payments in particular. This “actualised wealth” effect obviously depends on the structure of farm household wealth. In particular, this effect is zero if the farm household does not own farmland at all, which is the usual factor capturing the direct payments in the long run. In such case, benefits of farm programmes are completely passed to the landowners. On the contrary, if the farm household partly owns farmland, then it will capture part of the benefits of farm programmes. In that case, this farm household will be better off, might become less risk-averse (if risk aversion decreases with wealth) and will produce more. That is, the actualisation of the initial wealth modifies the measurement of the coupling effect of direct supports and more marginally than traditional instruments. Through the wealth effect there might be a significant impact of payments on production, which remains to be fully measured.

Synthesis on the overall distortionary effects of EU direct payments

Up to now, there has not been a fully satisfactory way to model direct payments. In simulation models, direct payments are often introduced in a reduced form and thus their impact as a whole are not captured (impacts on yields/land values). The fact that these direct payments are defined with additional conditions also increases the challenge of modelling. Econometric evidence on the effects of direct payments is rather limited and faces statistical issues (multi-co-linearity or endogeneity of explanatory variables). Clearly more research is needed to better understand their effects as well to improve the simulation models designed to analyse the impacts of the CAP on markets and agents welfare.

4.3.2 Production and trade impacts of the CAP: the evidence

Externalities for developing countries

The "old CAP" imposed considerable externalities on developing countries, in particular negative externalities on developing-country producers (the effects on urban consumers in developing countries tend to be much more positive, at least in the short term, see Bureau et al., 2006). Indeed, it is well-documented that EU export refunds resulted in significant distortions of competition and drove farm prices down in countries where producers were fully exposed to world markets (Tyers and Anderson 1992).

The combination of guaranteed prices, border protection and export refunds has enabled the EU to sell products at artificially low prices, effectively dumping export surpluses by selling below the costs of production. Non-governmental organisations (NGOs) have documented cases of damage involving EU wheat and sugar exports to Africa, export of dairy products to Jamaica, poultry and beef dumping in Gambia, Zimbabwe and Namibia, and job losses in the canning industry in South Africa due to export of subsidised canned tomatoes, to name but a few. In addition, the EU used food aid in a form of surplus disposal (though arguably less than the United States); this practice contributed to distorting local markets and can act as a disincentive to production.

NGOs have also accused the CAP of discouraging developing countries from adopting an agriculture-based development strategy, which has contributed to the overall neglect of agriculture and rural areas in these countries. Finally, developing countries have repeatedly stressed that tariff escalation in the EU tariff structure discouraged the development of processing industries among developing-country food exporters. At the same time, the changing basis of EU agricultural support makes EU value-added food exports more competitive, and this could have helped take away markets from developing-country producers, according to some other NGOs (ActionAid, 2002).

Obviously, not all these criticisms are pertinent. In addition, many of these issues have disappeared with the reformed CAP, given that exports refunds now represent very small budgets (see Figure 4.1), and that EU domestic support provides much less incentive to produce than the price support mechanisms that characterised the CAP until the 1990s. Some authors still question whether these reforms have fundamentally changed the impact of the CAP on world markets, or whether they have merely reduced to some extent the magnitude of these impacts (Anderson and Josling, 2008). However, the overall distortions for developing countries are much more limited than with the previous forms of support. It is worth noting that that the CAP was recently accused of encouraging the current world food crisis by not encouraging production, by the same organisations that, a few months earlier, had accused the CAP of ruining developing world farmers by dumping excess production (Berthelot, 2008).

The remaining market distortions in EU agriculture obviously still affect developing countries. Although expenditure on export subsidies has fallen sharply in line with the increased level of world prices, they remain important for individual commodities and potentially important if world prices were to fall again. In 2008, for example, NGOs highlighted the adverse impact of the reintroduction of EU pig meat export subsidies for pig production in some West African countries. However, it has been shown that the elimination of the remaining EU export refunds would have little impact on world prices (Bouët et al., 2005). Even on the basis of the export refunds that existed in the mid 2000s, the impact of export refunds on world prices was very small.

Criticisms that high agricultural protection has prevented poor countries from benefiting from their comparative advantages in agriculture also seem exaggerated (Bureau et al., 2006). Indeed, exports from the poorest countries face few tariff barriers, even though EU agricultural protection hurts emerging economies. The combination of the Generalised System of Preferences and the Cotonou Agreement provides generous access to the EU market for African, Caribbean, Central American, Andean and Pacific countries, while the Everything but Arms initiative provides duty free treatment to the 50 poorest countries regardless of their location.

An issue that is often overlooked is the adjustment of EU trade policy according to world markets. In 1996, when world prices for cereals reached very high levels, the EU introduced an export tax. During the 2007-2008 increase of grain prices, the EU suspended tariffs on cereals for several months. The overall consequences for developing countries of this policy have not been fully assessed. However, they seem to have exacerbated the increase in world prices and put a significant burden on food importing countries. In brief, in these two cases, the EU policy generated a significant externality by stabilising its own domestic prices at the expense of net food importing countries.

The net impact of CAP provisions on developing countries

Overall, what would be the consequences of a removal of the CAP for developing countries, given the ambiguous effects of the combined direct payments, price support, dairy quotas and land set-aside described above? Many studies, using either partial or general equilibrium models have attempted to provide a synthetic image of the contradictory effects of dismantling the various provisions (see Gohin and Moschini, 2006, for a review). Most of these studies were based on the old CAP prevailing before the recent reforms and are therefore seriously outdated. Some of the most recent studies were made in the context of Doha negotiations, but not necessarily with a view to isolate the real impact of the CAP.

Gohin and Levert (2006) simulate the effects of a complete suppression of the arable crop policy in the EU. They assess the impact of the current CAP provisions for arable crops, and incidentally compare it with the impact of US support in this sector. The analysis uses two simulation models. One is the agricultural version of the GTAP (Global Trade Analysis Project), i.e. a computable general equilibrium model. The other is a partial equilibrium model that focuses on arable crops (named OLEOSIM), which includes a detailed representation of the EU system of arable crops payments. Both models are used to perform the same experiments and they provide similar quantitative and qualitative results. As we will discuss later for the GTAP approach, we focus here on the partial equilibrium model results.

Simulations suggest that removing the EU policy provisions that support the arable crop sector, and in particular direct payments, would have a significant impact on farm incomes, even when accounting for adjustment in input costs. The production impact would also be significant, but not as high as it was often found in the literature. For instance, removing the CAP would decrease EU production of wheat, corn and rapeseed by 4%, 11% and 8%, respectively.

Given that the EU is now a much smaller actor on world markets than it used to be (the EU became a net importer of agricultural and food product in the early 2000s and large exports of subsidised wheat or dairy products have disappeared), the consequence of removing all CAP provisions on world market prices are more limited. World prices would move only by between 0 and 10%, with most of the effects in the 2–4% range (the world price effects are reported in Table 4.4 below). Interestingly, even though the arable crop sector is less supported according to indicators such as the OECD Producer Subsidy Estimate, the US policy seems to have a greater impact on world price and foreign producer welfare than that of the EU (for instance, see the case for wheat in Tables 4.4 and 4.5). This supports the idea that the externalities of the CAP provisions for arable crops, including those of direct payments, are limited for developing countries.

Table 4.4
Impacts on the world price of removing EU/US arable crop policy (in %)

	Suppression of the EU policy	Suppression of the US policy
Wheat	2.10	2.59
Barley	3.13	2.35
Corn	4.24	3.60
Rice	1.96	2.27
Other cereals	6.15	3.19
Rape seed	4.54	3.95
Rape oil	4.61	3.21
Rape meal	2.34	3.70
Sunflower seed	3.94	3.62
Sunflower oil	4.02	3.11
Sunflower meal	1.22	3.54
Soya beans	1.67	5.78
Soya oil	3.61	4.50
Soya meal	0.59	5.20
Cotton	0.42	9.67

Source : Gohin and Levert (2006)

If we now turn to the simulation results using a general equilibrium framework, the results appear to be particularly sensitive to the way CAP payments are modelled. Féménia et Gohin (2008) have devoted a particular attention to the representation of the CAP instruments in their own version of the GTAP model, adapted for agriculture.

Table 4.5
Impacts on profits of EU/US policy.

Removal of the EU policy				
Farmer profits	Europe	US	Other countries	World
GTAP model	-20503	11	4283	-16209
Oléosim model	-16041	-1	4643	-11399
Removal of the US policy				
GTAP model	564	-15183	5313	-9306
Oléosim model	508	-13368	6867	-5993

Source: Gohin and Levert (2006)

They first conduct simulations removing EU agricultural tariffs and subsidies, based on the agricultural version of the GTAP described in Keeney and Hertel (2005), where direct payments are calibrated on OECD Producer Subsidies Estimates and introduced mostly as input subsidies. When relying on this rather standard framework, simulations suggest that the EU agricultural policy has a major impact on the welfare gains of developing countries. In particular, developing countries as a whole would benefit from dismantling the CAP, or at least strongly reducing EU agricultural protection and subsidies such as the ones discussed under the Doha negotiations.

Féménia and Gohin then compare these results to those obtained with the same model but with a more detailed representation of CAP instruments (production quotas, the new version of direct payments, intervention price regimes, land market regulation, etc.). Simulation results change significantly when one corrects some of the most obvious simplifications in the modelling of the CAP instruments. Specifically, when EU agricultural production control measures are introduced, the working of the support price regime and direct payments are alternatively modelled, and the initial level of policy instruments and for the bias in trade elasticities are corrected, two main results emerge. Firstly, the impact of the EU farm policy on developing countries is considerably reduced (Table 4.6 reports these welfare effects). For the developing countries as a whole, the benefits they can expect from a removal of the CAP shrink from 5.7 billions dollars with the standard approach to 0.4 billion dollars in the alternative approach. Furthermore, the relative contributions of the export competition and domestic support pillars greatly expand to the detriment of the EU market access pillar. This suggests that if the negative externalities of the CAP on developing countries are difficult to assess, the large number of simulations that have been carried out with standard general equilibrium models have exaggerated the negative impact of the CAP as a whole on developing countries.

External effects of the CAP in a dynamic framework

Market conditions for agricultural products have changed over recent years because of many temporary causes (such as production shocks, financial crises) and some more structural causes (like EU sugar reforms or biofuel policies, see Trostle, 2008). The impacts of a dismantling of the CAP obviously greatly depend on the situation that would prevail in a given time context. Previous figures relate to the past and may not hold for the future.

Several prospective analyses have been conducted which include some structural shifts in their baseline. In particular, the Scenar 2020 initiative (Nowicki et al., 2006) examines the effect of different liberalisation scenarios on the EU agricultural sector in 2020. This study combines different modelling frameworks, designed from the farm level to the world level. Unfortunately, quantitative results are sparsely provided, and CAP instruments (especially direct payments) are not modelled in the same way in all these frameworks. Gohin (2008) uses a general equilibrium model focusing on EU agriculture, and he obtains results that are, for some sectors, rather comparable to those of the Scenar 2020 study.

Table 4.6

Sensitivity of welfare effects of removing EU agricultural policy instruments to modelling choices (equivalent variation in income, 2001 $US million)

	EU15	US	Japan	Other developed	Total developed	Brazil-Argentina	China	India	Other developing	Total developing	World
Initial modelling											
Export subsidies	2115	-79	-277	327	2086	74	-87	14	-1098	-1097	989
Domestic support	4605	87	-74	189	4806	331	-89	-6	-55	180	4986
Market access	2425	60	-344	978	3118	3611	3	774	1775	6164	9282
Total	7881	25	-717	1421	8610	4345	-213	938	634	5704	14314
Alternative modeling											
Export subsidies	1979	18	-181	277	2093	308	-68	23	-1011	-748	1345
Domestic support	3453	116	-148	244	3665	341	-83	18	-61	215	3879
Market access	-347	183	-113	301	24	323	290	-22	131	722	746
Total	4589	281	-474	870	5266	1073	144	16	-791	422	5709

Source: Féménia and Gohin (2008)

Using this model for a more precise assessment of the effect of the CAP on world prices, the suppression of the CAP is compared to a situation (2015) with full implementation of the recent CAP reforms (including sugar) and full implementation of the EU biofuel directive. Market impacts are reported in Tables 4.7 and 4.8. It appears that dismantling the CAP would have a large effect on coarse grains (corn production would decrease by as much as 33%). Production of wheat would decrease as well due to the loss of EU ethanol production. The impacts on the animal sectors are also significant, especially on beef. Trade and world price impacts are significant in the case of corn, ethanol, sugar, beef and butter. Interestingly the world price of wheat decreases at the end of the simulation following a great expansion of EU exports on the world markets. On the other hand, impacts are much more modest in the oilseed, pork and milk sectors.

Overall, the results suggest that the external effects of the CAP cannot be assessed independently from the EU biofuel policy, more generally from the development of market conditions. The combination of the CAP and the EU target for ethanol reduce EU exports of wheat, but the CAP encourages production of corn and therefore to a reduction of imports and the world price of corn. The CAP also encourages EU production of sugar and beef even after the reforms, and therefore it reduces imports as well as depresses the world price. These effects come mostly from border protection factors, and it is difficult to assess what would be the impact of the CAP on developing countries in the case of a Doha agreement.

Table 4.7
Impacts on the crop markets of dismantling the CAP (in 2015)

	Soft wheat	Corn	Oilseeds	Vegetable oils	Oil meals	Sugar	Bio-ethanol
Production (000 T)							
Baseline	98816	34479	14691	7491	9094	13862	7300
Without CAP	85237	23227	14582	7450	9042	11410	0
Difference %	-13.7	-33.2	-0.7	-0.6	-0.6	-17.7	-100
Imports (000 T)							
Baseline	991	2509	2699	1118	498	1724	0
Without CAP	1332	16623	2699	1127	-1362	2106	7300
Difference %	33.3	562.5	0	0.8	-373.7	22.2	
Demand (000 T)							
Baseline	91552	37104	18729	8336	10204	13114	7300
Without CAP	66462	39645	18627	8346	8445	13166	7300
Difference%	-27.4	6.8	-0.5	0.3	-17.2	0.4	0
Exports (000 T)							
Baseline	7829	196	140	342	0	2120	0
Without CAP	20671	204	138	323	0	0	0
Difference %	164.1	4.4	-1.7	-0.8	--	-100	
EU price (€/T)							
Baseline	121	146	300	735	90	404	599
Without CAP	114	120	303	743	94	332	549
Difference %	-6.5	-17.5	1.1	1.1	4.1	-18.1	-8.3
World price ($/T)							
Baseline	146	118	360	882	107	285	430
Without CAP	137	144	364	891	112	398	659
Difference %	-6.5	22.5	1.1	1.1	4.1	37.8	54.1

Source: Gohin (2008)

TABLE 4.8

Impacts on the animal markets of dismantling the CAP (in 2015)

	Raw milk	Butter	Skimmed milk powder	Whole milk powder	Beef	Pork	Poultry
Production (000 T)							
Baseline	116	1738	1034	771	6532	19447	8869
Without CAP	110	1412	632	709	5028	18549	7822
Difference %	-5.0	-18.8	-38.9	-8.0	-23.0	-4.6	-11.8
Imports (000 T)							
Baseline		0	0	0	462	13	544
Without CAP		122	43	0	2694	18	1311
Difference %					483.1	53.1	141.2
Demand (000 T)							
Baseline	116	1538	920	382	6859	18621	8840
Without CAP	110	1537	699	379	8131	18195	8848
Difference %	-5.0	0	-24.0	-0.7	18.5	-2.3	0.1
Exports (000 T)							
Baseline		201	138	394	48	791	501
Without CAP		0	0	346	90	327	138
Difference %		-100	-100	-12.1	85.6	-58.6	-72.5
EU price (€/T)							
Baseline	239	2462	1973	2035	2843	2747	2913
Without CAP	245	2091	2142	2055	1934	3013	3020
Difference %	2.7	-15.0	8.5	1.0	-32.0	9.7	3.7
World price ($/T)							
Baseline		1978	2367	2442	3955	3296	3275
Without CAP		2509	2472	2466	4894	3615	4292
Difference %		26.9	4.4	1.0	23.8	9.7	9.2

Source : Gohin (2008).

4.4 Prospective look at the future of the CAP: Dealing with emerging issues

4.4.1 A prospective view of the CAP in the short run: Prospects after the Health Check

The November 2008 decisions that are most likely to modify the findings of the different models described in the previous section include the removal of dairy quotas, the ending of compulsory set-aside, the full decoupling of arable crops payments and the ending of public intervention buying for barley, durum wheat and sorghum in addition to maize. The Health Check will only marginally tackle new objectives. Indeed, the need to address new issues such as price volatility, water and climate change was acknowledged, but did not lead to any ambitious policy. But the Health Check decisions are likely to lead to a greater reliance of market orientation and a better targeting of the multifunctional role of agriculture.

The Health Check should involve only limited changes for developing countries. The main impact will be in the dairy sector, where production concentration is to be expected, but where supply will respond to price signals that up to now have been quite unpredictable. With the end of intervention for coarse grains, the feedstock sector will be even more integrated to the world market. Changes in the modulation system will only involve redistribution of payments within each member state. And until now the decisions for rural development have been so vague that one can hardly assess the potential consequences.

The Health Check exercise is only intended to make adjustments to the CAP that was implemented in 2003, adjustments that are supposed to apply to the 2009–2013 period. The Health Check clearly did not intend to address the issue of the future of the CAP in the longer run. While the CAP budget is more or less protected until the end of the current financial framework, there is a much greater uncertainty about what the CAP will become over time.

4.4.2 The CAP after 2013

No one knows what the CAP will become at the end of the current financial framework, i.e. after 2013. The successive lack of consensus for adopting a EU constitution, and subsequently the Lisbon Treaty, resulted in considerable institutional uncertainty. If several "Eurosceptic" governments were to be elected, this would only strengthen the pressures for fiscal re-nationalisation. In practice, this could lead to "cherry picking" bits of the different treaties, even perhaps a dismantling of the EUs core policies while members opt out from major institutions. The CAP budget in the future financial framework could be reduced dramatically, and it is even unclear whether any "common" policy will remain.

Budgetary discussions and the lack of consensus on whether agriculture needs to be a common policy are likely to be the main driving forces shaping the future CAP, i.e. after 2013. However, new challenges also need to be taken into account. The general context for the CAP reforms since 1992 was one of excess EU production, in an international environment characterised by low or sluggish world prices. The ongoing discussions regarding the future of the CAP take place in a set of very different circumstances (Bureau and Mahé, 2008). There are pressures to meet a growing demand now, rather than for the EU to limit its production. Agriculture is now being asked to produce energy, and the alternative use of agricultural goods as fuels could limit the need for an interventionist policy (oil prices could *de facto* set a minimum price for the grain, oilseeds and sugar market, for example). At the same time, concerns from citizens and consumers are putting pressure for more regulation in the areas of food safety, environment and ethical issues such as animal welfare. This suggests not only that public intervention will still be needed in the agricultural sector, but also that the CAP will have to be redefined, under the constraints of domestic budgetary pressures and a more rigid international framework due to WTO and other EU trade commitments.

The impact of international constraints

International commitments bind the definition of the future CAP. Any reform must be consistent with what is expected to be a future agreement under the WTO, regardless of how close the agreement might be. Because the conclusion of a WTO agreement was largely anticipated during the 2003 reform, the clauses on domestic support are unlikely to prove very binding. A large cut in the Aggregate Measures of Support ceiling (roughly 70%) could be achieved without significant further reforms of the CAP. Further reforms such as a change in the fruit and vegetable entry price regime would give some degrees of freedom for further cuts (Butault and Bureau, 2006). However, international commitments restrict the scope for defining new policies. Should the EU maintain market management policies, they have to fall within the likely limits of the amber box, the Overall Trade Distorting Support and the product specific Aggregate Measure of Support (see IPC 2005 for a synthesis). This rules out "recoupling" of subsidies for example. The end of the "blue box" and very low "amber box" ceilings would remove any possibility for a "target price" policy that would be implemented through direct payments linked to production. It would also make it difficult for the EU to index direct payments on world prices, should the EU consider such an option.

The future CAP will have to be designed without the possibility of disposing of surpluses on world markets through export refunds, due to EU commitments on export competition (even though the commitments of ending export refunds taken in 2005 are subject to a general WTO agreement). In practice, this would rule out the possibility for public intervention to guarantee prices structurally higher than world prices. The only intervention prices that could be maintained are "safety nets", i.e. mechanisms that might only work to smooth out market fluctuations. In the medium run, intervention stocks would have to be sold without subsidy. In practice, it requires that the gap between the minimum price and the average world price be very small.

The market access provisions of a potential Doha agreement constrain the design of the future CAP more than the other two "pillars" of the negotiation. The different proposals on the table involve considerable cuts in tariffs, between 60% and 90% for the most protected commodities. As a result, it is likely that, except for a limited number of tariff lines considered as "sensitive", most EU products will no longer be significantly protected. With the size of cuts that are being discussed, a market management scheme such as intervention will no longer be sustainable since public purchases would be flooded by imports.

The practical consequences of EU agriculture being much more exposed to imports will depend greatly on the world market situation. In most sectors, an agreement might be rather painless if world prices remain steady. However, unless world prices reach previously unheard of peaks, there will be some significant problems in other sectors if tariffs experience large cuts. These sectors include beef, which may affect a large number of farmers. Other sectors with a more concentrated regional impact include poultry, fruits, vegetables and sugar. If prices or exchange rates turn out to be less favorable than expected, sectors such as grains or dairy will also be affected.

The world market situation

According to most institutions that specialise in market analysis, the very high prices observed in 2007 are unlikely to be the rule. However, market fundamentals suggest that the world prices for agricultural commodities should fluctuate around an average level that is higher than the one observed in the 1990s and early 2000s for the next few years. There is, obviously, no certainty, and in the longer run the situation is largely unknown, but the potential prospect of a reversal in the historical trend of declining prices introduces a new environment for the CAP itself and alters the economic and political rationale behind future reforms. Indeed, if world prices remained high, most market support and border instruments would become non-operant or meaningless except in structurally importing sectors with tariffs. Direct payments to commercial agriculture would lose any remaining claim to legitimacy. These new conditions would provide new justifications for government interventions. For example, high prices could boost demand for land and threaten conservation and environmental programmes, requiring more ambitious conservation policies than the present ones. The burden of high food prices could become serious even within the EU, and require new poverty alleviation mechanisms.

Biofuels

The CAP provides incentives for producing crops for energy use, and framework directives set targets on incorporation rates of biofuels in road transport fuel. The main driving force has nevertheless been the measures taken at the member state level aimed at increasing the use of biofuels through tax exemptions, subsidies and, increasingly, mandatory incorporation in transport fuel. This, together with significant import barriers, at least for ethanol, has led to a considerable increase in production over the recent past. Meanwhile, concerns related to the overall environmental effect of biofuels and potential competition for land with food production have led to a strong erosion of the public image of biofuels. The overall use of biofuels still represented less than 3% of transportation fuels in 2007. Nevertheless, they have already had a significant impact on markets, driving up the price of rapeseed oil, for example (Bamière et al., 2008). The costs for member states have become significant, up to the point that several countries are now moving towards decreased levels of tax exemptions and more constraining targets for mandatory blending of biofuels in fuels used for road transport. An intense debate is now taking place both within EU institutions and within member states regarding the setting of targets in terms of percentage of transport fuel filled by renewable fuels. The combination of budgetary pressures as well as environmental concerns is such that one can now consider that support to biofuels in the EU will have to pass both cost benefit analysis and sustainability impact assessment to be continued. There will be a need to keep public support consistent with major market forces, or at least with the valuation of the actual positive externalities.

More practically, either biofuels will have to compete with fossil fuels in terms of cost (either by reducing the production costs of biofuels or because oil prices will be higher), or the subsidies should be in line with what can be considered as a reasonable price for the Greenhouse Gas (GHG) emissions avoided. This raises several questions, about which there is still a considerable degree of uncertainty in the EU. The first one is the extent of the actual positive externalities as far as GHG emissions are concerned. The second one is the actual degree of competitiveness of EU biofuels, compared to fossil fuel and biofuel produced in other countries. All these elements play a crucial role in the cost benefit analysis of the EU programme.

If EU biofuel production were to rely on its own domestic production only, meeting the 10% incorporation target included in the proposed directive would require a considerable amount of land, i.e. roughly 26.2 million hectares or approximately one-third of the current arable land surface in the EU25 (Bamière et al., 2008). This would have a major impact on market equilibria and prices. The production of ethanol could increase significantly in the EU, provided that more resources are devoted to cereals or beets for energy use. However, actually accomplishing this level of production would necessarily entail a reduction in grain exports. It would also require that a high degree of public support is maintained as well as the current (high) level of border protection, as wheat/sugar-beet ethanol could hardly compete with the Brazilian sugarcane ethanol. The expansion of biodiesel production is more limited. The needed rapeseed acreage that would be consistent with a 10% target would be three times the area currently cropped (both for food use and biodiesel). This increase will not be possible without taking into consideration the harsh environmental concerns that will be voiced due to the intensive-type of agricultural practices needed to grow rapeseed.

The EU budget

At the same time that it conducted the Health Check, the EU started a budget review of all aspects of EU spending, including the CAP and its resources, as well as the rebates earned by several countries after their contribution to the budget. Even though the economic crisis in 2009 has interfered with and somewhat delayed the conclusion of this review, the consequences could be important for the CAP. Preliminary studies have shown that there is no consensus across member states to maintain large agricultural budgets. The search for European added value in EU expenditures will certainly be the key goal of the budget review. Agriculture is seldom mentioned as a sector whose externalities between member states justify large common funding, based on an argument of public goods and fiscal federalism. The financial difficulties of many member states could also exacerbate the pressures for trimming the EU budget, and in this respect, the large CAP direct payments could be a likely target for cuts.

In discussions regarding the future of CAP, there are many sources of uncertainty. Economists have so far been of limited help for shedding light on the costs and benefits of alternative policy scenarios. The methodologies that allow quantitative assessments in these areas are not always conclusive, data are scarce and, overall, these issues clearly fall under the category of “work in progress”. Efforts must be developed in order to provide policy makers with more quantitative analyses of policy scenarios, so as to further the discussions that will take place regarding the debate on the future of the CAP. The design of a new CAP for the post-2013 period would be facilitated if member states could first agree on revised objectives and principles that a common policy should pursue, and for this purpose, they need analytical and quantitative results. Indeed, without a clear assessment of the various policy scenarios, the debate on the CAP that must take place before the next changes in financial perspectives could risk being excessively driven by financial considerations. The debate might also be excessively contingent on market conditions prevailing at the time.

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Risk Management in OECD Agriculture: From a holistic approach to the reality of support measures

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Introduction

Managing risk is an important part of farming. Improving risk management strategies is a concern for governments for which managing risk is an agricultural policy objective. This chapter presents the OECD framework for the analysis of risk management in agriculture[2] and an application to measure the magnitude of risk-related measures in the Producer Support Estimate (PSE).

The framework is presented in section 5.1 and could be used for the analysis and efficient design of policies in this area. It has a holistic approach as opposed to a linear approach. A linear analysis which deals with only a specific source of risk, a specific farmer's strategy, or a specific type of policy measure is likely to lead to inefficient policy choices. Risk management should be analysed as a system in which there is interaction between many elements. The framework organises these elements according to three axes: the sources of risk, farmers' strategies and government policies.

Policy and support related to risk management in agriculture, present difficult problems for decision makers. Section 5.2 identifies four important trade-offs that need to be analyzed for good policy design. These are: *ex ante* measures are

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[2] This framework is defined in chapter 1 of OECD (2009). The analysis of PSE risk related measures is presented in chapter 2, while chapter 3 is devoted to existing evidence about risk exposure of agriculture.

sometimes said to substitute for *ex post* disaster assistance; government support measures can potentially crowd out other market or on-farm strategies which would reduce their effectiveness to improve risk management; risk-related measures have the potential to improve farmers' welfare, but other measures can be more efficient for this purpose; and finally, risk related measures also have an impact on production.

Although the reality of agricultural support goes well beyond risk management, recent changes in agricultural policy legislation, such the US 2008 Farm Act, have significant risk related provisions. The last section of this chapter uses the information in OECD's Producer Support Estimate (PSE) database to analyze the extent to which support has moved towards more risk-related measures over the last decade. The results depend strongly on the inclusion of market price support, which is the main risk-related measure in most OECD countries. Market price support has been reduced in many countries, while the share of risk-related measures, other than price support, increased in most OECD countries.

5.1 A holistic approach to risk management in agriculture

The meaning of a "holistic approach"

Agricultural production is subject to many uncertainties. Any farm production decision is typically associated with multiple potential outcomes with different probabilities. Weather, market developments and other events cannot be controlled by the farmer but have a direct incidence on the returns from farming. In this context, the farmer has to manage risk as part of the general management of his farming business.

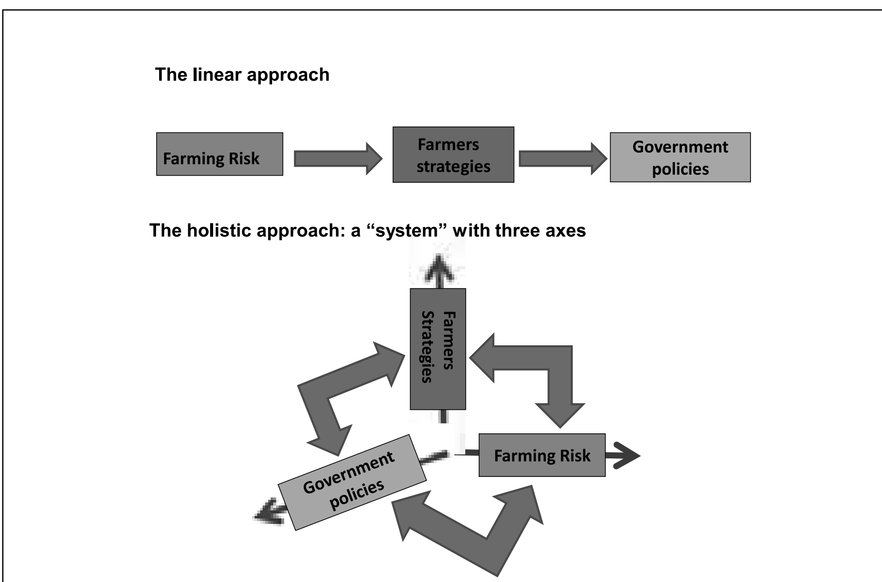
In response to the potential impact of uncertain events, farmers implement diverse risk management strategies in the context of their production plans, the available portfolio of financial, physical and human capital, and the degree of aversion to risk. These risk management strategies may include on-farm decisions, changes in portfolio structure, use of market instruments, government programs, and diversification to non-agricultural sources of income. Many general agricultural support policies have risk management implications and influence risk management decisions. Because of the complexity of these interactions, governments need to make significant efforts to achieve coherence, particularly among different policies and between policies and market strategies. Agricultural risk is an interrelated "system" in which markets and government actions interact with risks and farmers' strategies. Government programs may underpin the development of market strategies, but they may also crowd out market developments or on-farm strategies. The result of these interactions is the set of risk management strategies and tools that is available and used by farmers.

There is a growing literature that tackles risk-related issues from a governance angle. It focusses mainly on risks with significant consequences for society or the economy that go well beyond consequences for the individual. These "systemic risks" can also be relevant to agriculture. This literature covers risk management as part of a broader risk governance framework that typically includes at least three stages: risk assessment and evaluation; risk management; and risk communication (e.g. International Risk Governance Council, 2008).

A risk management system is composed of many sources of risk that affect farming, different risk management strategies and tools used and available to farmers, and all government actions that affect risk in farming. The old fashioned approach in analysing risk management policies involved three linear steps: 1. measuring the risk or variability faced by farmers; 2. use this information to analyse the optimal risk management tool for a given farmer, accounting for his endowments and risk preferences; and 3. decide on appropriate government policies to improve risk management strategy (top of Figure 5.1).

Figure 5.1

Two approaches for the analysis of agricultural risk management



The linkage among these three sets of elements, however, is not linear in nature and the analysis cannot flow unidirectionally from the sources of risks to the available tools to deal with each risk, nor from the availability of tools and markets, to the optimal government policies. There are many examples that illustrate these links. If, for a specific farmer, prices are strongly negatively correlated with production, revenue can be relatively stable and there may be less need to manage price risk; diversifying output production can, in some cases, be a good strategy to reduce risk and it act as a substitute for some of the demand for insurance; measures that stabilize domestic prices are likely to crowd out the development of futures markets.

Links move in all directions therefore, and the system is better represented by the three dimensions or axes of a cube (second part of Figure 5.1). Continuous interaction amongst the elements in all axes leads to a simultaneous determination of risks, risk management strategies and policies. The availability, development and use of each instrument or strategy is determined to a great extent by the whole system that includes the nature of all farm risks, the extent to which they are correlated, farmers' preferences and endowments (including off-farm), market developments, and all government actions. A holistic approach is needed for policy making in such an integrated system.

Diversity of sources of risk: characteristics and correlations

The risks and sources of risks relevant to agriculture have different characteristics and can be classified in very different ways [Baquet *et al*. (1997), Hardwood *et al.* (1999), OECD (2000), World Bank (2000), Holzmann and Jogensen (2001), Musser and Patrick (2001), Moschini and Henessy (2001), Huirne *et al.* (2004), Hardaker *et al.* (2004)]. It is not necessary to opt for a particular classification of risk, different ones can be used for different purposes. However, some technical characteristics of risks apply across different classes and can be significant in terms of the appropriate and available strategies to deal with each risk. All classification of risks in agriculture underline the fact that an individual farmer may be facing very different risks at the same time. In these conditions, the optimal choice of a strategy requires that correlations among risks must be accounted for. The chapter by Coble in OECD (2009) makes an in depth review of the literature on the sources of risk in agriculture, correlations among them, and their relative importance.

In all possible classifications, the boundary between different types of risk is blurred. Price or production risk is often associated with different singular events (e.g. droughts) that are also denoted as risks. Table 5.1 proposes a presentation of agricultural risks that combines four types of sources of risk identified in Hardwood *et al.* (1999) (Markets / prices, Production, Financial, and Institutional / legal) with the systemic characteristics from Holzmann and Jorgersen, covering most of the categories of risk identified by different authors. This table singles out events that could occur with some uncertainty and affect a farm household's welfare. Idiosyncratic risk such as personal hazards, e.g. illness of the operator or the employees, are specific to individual farms or farmers and may actually be more important than systemic risks. Some weather-related events, e.g. hail and frost, can be idiosyncratic. Risks of a macroeconomic nature are typically systemic and are often correlated across farms in a country and across sectors in the economy. Droughts and floods tend to be systemic, affecting whole regions or nations. Output price risk is typically systemic with high price correlations among domestic markets due to trade. The price of land, however, is determined more locally.

TABLE 5.1

Some risks in agriculture: types of risk and idiosyncratic / systemic characteristics

Type of risk	**Micro (Idiosyncratic) Risk affecting an individual or household**	**Meso (Covariant) Risk affecting groups of households or communities**	**Macro (Systemic) Risks affecting Regions or Nations**
Market / Prices		Changes in price of land, new requirements from food industry	Changes in Input / output prices due to shocks, trade policy, new markets, endogenous variability…
Production	Hail, frost, non-contagious diseases, personal hazards (illness, death) assets risks	Rainfall, landslides, pollution,	Floods, droughts, pests, contagious diseases, technology
Financial	Changes in income from other sources (non-farm)		Changes in interest rates / value of financial assets / access to credit
Institutional / legal	Liability risk	Changes in local policy or regulations	Changes in regional or national policy and regulations, environmental law, agricultural payments

Source: OECD (2009), adapted from Hardwod *et al.*. (1999) and Holzmann and Jorgersen, 2001.

There are some characteristics of risk that are very important in order to understand the possibilities for developing appropriate market instruments. Four can be singled out:

1. The systemic nature of the risk: risks that are highly (positively) correlated across farmers are difficult to pool, while more independent risks can be pooled more easily.
2. The availability of information on the true distribution of the risk: if the information is not available (because there is little record of past events or because there is reason to believe that information on the past is not

relevant or misleading about the future), it is hard to imagine that a market instrument could be developed with an appropriate price. An extreme situation of information scarcity is denoted as cognitive failure.

3. The degree of asymmetry in the distribution of information: if significant information is not shared between the producer and other agents, or certain risk-relevant producer actions can be hidden, the likelihood of market failure increases.
4. The existence of potential buyers of the farmers' risk who face a risk of the opposite sign (highly negatively correlated with the risk faced by the farmer).

Climate change is a reality that is likely to have an impact on agricultural risk. According to the Inter-governmental Panel for Climate Change (IPCC, 2007a), there is evidence that temperatures at the surface of the earth have risen globally, with important regional variations. This is likely to result in an increase in the frequency of extreme events such as floods and droughts. At the same time, risk awareness amongst farmers and in society as a whole may be increasing. The extent to which farm revenue variability will increase and where and whether this will imply more difficulties to manage risk in agriculture is not yet known.

A wide range of risk management instruments and strategies

The farmer is the agent who is best positioned to know the extent, characteristics and correlations of the risks that affect his farm, and the suitability of different instruments or strategies to deal with them. It is the farmer's responsibility as manager of his own farming business to take the appropriate decisions to manage the risk associated with his economic activity: farming. The basic principles behind the generic strategies to reduce risk (risk sharing, risk pooling and diversification) are simple and well known to economists and have been extensively used by farmers.

Actual risk management strategies can be grouped into three categories (Holzmann and Jogersen, 2001): *prevention* strategies to reduce the probability of an adverse event occurring; *mitigation* strategies to reduce the potential impact of an adverse event; and *coping* strategies to relieve the impact of the risky event once it has occurred. Prevention and mitigation strategies focus on income smoothing, while coping strategies focus on consumption smoothing. Strategies can be based on arrangements made at different institutional levels: farm household or community arrangements, market based mechanisms and government policies. The main groups of tools and strategies available to the farmer are presented in Table 5.2. These vary from country to country and for different farmers; for example, due to their size, location or availability of information, some farmers may have more difficult access to market instruments than other farmers.

Table 5.2

A menu of possible farm risk management instruments and strategies

	Farm / household / community	**Market**	**Government**
Risk Reduction	Technological choice	Training on risk management	Macroeconomic policies Disaster prevention (flood control…) Prevention of animal diseases
Risk Mitigation	Diversification in production Crop sharing	Futures and options Insurance Vertical Integration Production / marketing Contracts Spread sales Diversified financial investment Off-farm work	Tax system income smoothing Counter-cyclical programs Border and other measures in the case of contagious disease outbreak
Risk Coping	Borrowing from neighbours / family Intra-community charity	Selling financial assets Saving / borrowing from banks Off-farm income	Disaster relief Social assistance All agricultural support programs

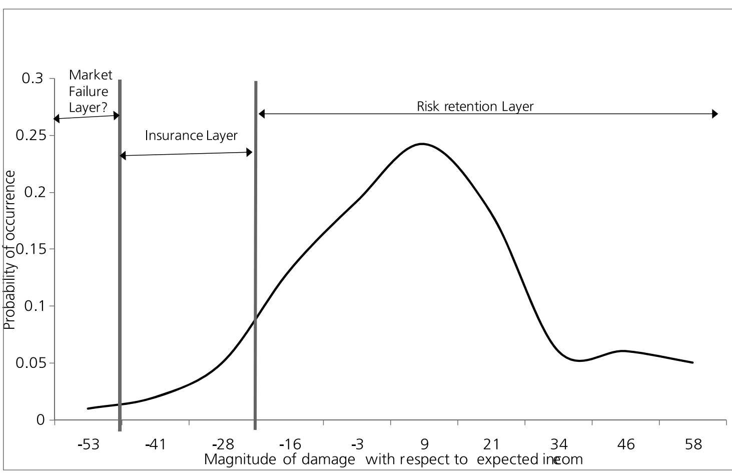
Source: OECD (2009), based on Holzmand and ogersen (2001) and OECD (2001).

Farmers face price risk because there are biological lags that require that decisions about what and how to produce have to be taken far in advance of harvest. The simpler instrument available to deal with price risk is a "forward contract". In such a contract the farmer and a buyer of the agricultural output agree in advance on the terms of delivery, including the price. A *futures* contract is essentially a standardised forward contract traded on an organized exchange such as the Chicago Board of Trade. The contract is standardised in terms of quantity, quality, and time and location for delivery. The possibilities for covering price risk have been expanded with the use of *options* on futures for some commodities.

Economics textbooks typically give a standard solution to manage uncertainty: using and developing markets –namely insurance markets- that facilitate the exchange of risk with other agents, realizing the potential gains from pooling or sharing the risk. However not all risks that affect agriculture have a corresponding insurance market. It may be that not all risks are insurable: insurance contracts for some risks do not exist because the insurance premium covering all the costs would be prohibitive. There are some conditions that are required — at least to a certain extent — for the insurability of a risk. They are not always expressed in the same terms (Skees and Barnett, 1999), but could be grouped as: independence of risk for different agents, availability of information about the distribution of probabilities, symmetric information, and probability of occurrence in a "medium" range (not too rare, not too frequent).

But there are some risks that may be difficult to insure through market mechanisms, which may require segmenting risks into different layers to manage each layer with different tools and strategies. This segmentation is a basic risk management technique that may help to match each set of risks with different "buyers" of risk or available management mechanisms. It is frequently argued that markets are more likely to fail in the case of catastrophic risk (World Bank, 2005). Therefore the layers could be defined in terms of the probability of occurrence and the magnitude of the losses, and therefore, the extent to which risk is catastrophic (Figure 5.2).

Figure 5.2
Probability density function and risk layers



There are losses (or gains) that are part of the normal business environment; they are very frequent but cause relatively limited losses. Farmers should themselves manage this type of "normal risk" that corresponds to the *risk retention layer*[3]. The *market or insurance layer* corresponds to risks that have more significant impacts but are less frequent. Both frequency and magnitude are in the middle of the respective ranges and there is scope for farmers to use specific market instruments such as insurance or options. The third layer includes risks that are catastrophic in nature because they generate very large losses, even if their frequency is low. This type of risk is more difficult to share or pool through the market mechanism, particularly if it is systemic. This is the "catastrophic risk" or the *market failure layer*.

[3] This terminology is taken from World Bank (2005).

The distinction of risks with respect to two different criteria -their frequency of occurrence and magnitude of losses- could be contradictory if big losses were not associated with low probabilities. But many risks or combination of risks lead to a distribution of impacts where larger losses have lower probabilities, with a shape similar to that of a normal distribution (Figure 5.2). We can then define three different layers that are ordered at the same time from higher to lower probability of occurrence and from smaller to larger magnitude of production loss. Most of the outcomes will be in the first layer where it is deemed that the risk should to be retained by the farmer. Only a minority of outcomes will be in the third, market failure layer. This distinction would be easy to implement to the extent that we had well defined boundaries among layers. This is not usually the case.

What role for government?

Standard results from welfare economics are not very promising nor directly applicable when analysing risk management due to the extent of missing markets. The market outcome may not be Pareto optimal, and we cannot be sure about the direction of the bias. In this context two questions are relevant in terms of the role to be played by the Government. Does the economy provide the "correct" set of markets that allow risk to be traded efficiently? If this is not the case, the government may try to establish or develop the basis for the creation of new risk related markets. And, given the existing markets, are resources efficiently allocated? If not, there may be some role for government improving welfare.

The main potential for market failure in risk related markets is due to the existence of information asymmetries and transaction costs associated with the access to market relevant information. In general, the farmer knows better than any other agents (including insurance companies) the degree of risk exposure associated with his own production decisions (hidden information that may generate adverse selections). Farmers also have less incentive to avoid risk once they are insured (hidden actions that generate moral hazard). Those situations can generate market failure in the related risk markets. Asymmetries of information affect different types of risk in different ways. For instance price related risk does not usually generate information asymmetries since market prices are known by all agents at the same time. On the contrary yield/production related risk may have associated information asymmetries because the farmer has better knowledge about his own production risks than any other agent. The existence of "cognitive failure" can also contribute to generate information asymmetries. In these contexts, there is a potential role for government to help to establish, regulate and supervise risk markets, and to provide risk instruments when markets are constrained or fail. But it is also possible that "asymmetric information applies also to the relation between the citizen and the government leading to government failure and political risk" (Holzmand and Jorgensen, 2001). The capacity of the government to improve resource allocation depends to a great extent on its access to information and its capacity or efficiency in creating or transferring this information.

Government may have objectives other than increasing efficiency. It is common to have redistribution objectives, especially in the case of events that put particular economic stress on specific agents, inter alia, farmers. In more political economy terms, government's objective may be to react with some relevant action when farmers "suffer" or are seen as "vulnerable". Therefore, both efficiency and equity objectives could potentially drive government action on risk management in agriculture.

The "role of government" can be analysed in a strict normative framework in terms of advising about the economic effects and implications of alternative policy measures. This will imply the selection of policy measures that are best in terms of improving efficiency and redistribution (normative approach). But, particularly in an area with as many uncertainties as "risk management", a positive political economy approach is also needed to understand the policy making process (Innes, 2003) and the risk governance implications (Renn, 2006). The social perception of risk events that require policy responses and the political pressure on governments result from the whole institutional and governance framework. Table 3 presents a set of policy actions on agricultural risk management that are observed in reality. The table does not evaluate whether these measures are appropriate. It distinguishes between measures that are taken and implemented before the risky event takes place *(ex ante)*, and measures that are taken or implemented *ex post* after the event has occurred (Cafiero *et al.*, 2007).

All efforts by government in support of market creation or in modifying market incentives will be, by definition *ex ante* measures. In the areas of risk reduction and mitigation, and coping with risk, both types of measures, *ex ante* and *ex post*, are possible. Most of the government actions described in Table 5.3 relate to efficient risk management in agriculture. Equity considerations are likely to play a more important role as we move towards *ex post* interventions in which individuals have no margin of action, and risk coping strategies for consumption smoothing are needed.

Market creation

If there are missing markets for risk management, the government may have a role in helping the development of new markets. Markets, including risk management markets for agriculture, develop much more easily in the context of a stable macroeconomic and business environment. Providing this environment is an important role for government. It is known that information weaknesses are the main causes of market failure in agricultural risk management. Government could play a role through direct research and production of the missing information or

Table 5.3

Potential roles of government in risk management in agriculture, based on observed policy measures

	Market creation	Modifying market incentives	Risk reduction and mitigation (income smoothing)	Coping with risk (consumption smoothing)
Ex ante	• Stable macroeconomic policies and business environment • Risk management training and information to farmers • Facilitating the production and sharing of information on risks • Increase competition in the insurance market • Law and institutions for futures and options markets • Defining the limits of government and farmers responsibility in risk management • Private / public partnerships	• Subsidies to insurance • Subsidies to reinsurance • Subsidies on futures contracts • Participation in mutual funds • Incentives on saving accounts • Facilitate access to credit • Output Market interventions / Regulations (price stabilization) • Border measures (tariffs…)	• Disaster prevention (flood control…) • Prevention of animal diseases (domestic and border measures) • Legal form of farms Research and Development of new varieties or breeds • All agricultural support programs	• All agricultural support programs
Ex post - *triggered ex post*			• Countercyclical programs • Tax system for income smoothing	• Social assistance •
- *decided ex post*			• Border and other measures in case of contagious disease outbreak • Ad hoc payments for quick economic recovery	• Disaster relief (payments, subsidised credit…) • Other Ad hoc ex post payments

EFFICIENCY

EQUITY

Source: OECD (2009)

facilitating arrangements for sharing information. On the demand side, farmers' risk management skills could be improved through training and information about different risk management instruments. On the supply side, enforcement of fair competition among insurance companies should make products more attractive for farmers. In some particular markets (such as futures and options) government may need to provide the appropriate legislation and institutions, to facilitate the development of the market.

Modifying market incentives

In any case government action will not be able to generate a complete set of risk markets. In this imperfect world, government may have a role in trying to alter incentive prices –through taxes and subsidies- in order to bring the economy to a more efficient outcome, or just to achieve some specific risk coverage objective. Several OECD countries subsidize crop insurance (the United States, Canada, Mexico, Spain, France, Japan…) to different extents and with different arrangements. Some countries provide some re-insurance subsidies, normally through re-insurance arrangements with government participation. It is less frequent to subsidize futures contracts, but there are some countries like Mexico that provide such support. Farmers may create mutual funds to insure some types of risk and these funds receive some government financial participation in some countries.

Risk reduction and mitigation

Governments are sometimes seen as having some responsibility for carrying out the appropriate works and implementing the appropriate legislation to reduce the probability and / or the adverse impact of hazardous events. This is often argued to be the case for catastrophic events. One example is flood control for which public works can help to reduce the probability of a flood but actions on the farm to reduce water run-off can also reduce and/or mitigate flood risks. Some of these actions may generate externalities that could require some appropriate incentives. In the area of prevention of animal diseases possible measures include both domestic and border measures when there is a risk of a disease being imported from abroad. Once the risky event has occurred, the tax and social security system also provides some mitigation of effects.

Coping with risk

Once all available measures or instruments to reduce or mitigate risk have been exhausted, only consumption smoothing strategies are available to cope with any remaining problem. Of course, all agricultural support programs contribute, to some extent, to consumption or income smoothing. Coping with risk refers to ensuring minimum consumption requirements of farmers or their families and they are, by definition, related to equity considerations. Once a risky event has occurred, government may have strong political incentives to provide some assistance. *Ex post* government actions may include social assistance, disaster relief (payments, subsidised credit…) and / or *ad hoc ex post* payments. If the purpose is to help to adjust from a hazard that may reduce household consumption towards poverty (equity concern), the criterion for such aid should be proximity to the poverty line, and equity considerations would suggest that in a first best policy option all farm household income and/or wealth should be included in the assessment.

5.2 Some policy dilemmas

Do ex ante measures substitute for ex post disaster assistance?

There is no single precise way of defining a catastrophic event, in general, and in agriculture in particular: it has to be infrequent and severe for individuals. But to be catastrophic for a government it needs to be also systemic, that is correlated across farmers and, therefore, severe also for a country or a region as a whole. From a political economy perspective, an event is catastrophic if it triggers some special catastrophic or disaster aid or program. Most governments provide disaster assistance at some moment. The *ex post* reaction of governments to "catastrophes" is, in this sense, part of the risk management system which farmers take into account when planning their own decisions and strategies. The distinction between risk and crisis is sometimes made for policy analysis (Cafiero *et al.,* 2007; European Commission, 2005). It is argued that a crisis is "unforeseen" and it exceeds the individual capacity to cope. This idea of exceeding the capacity to cope is obviously only applicable *ex post*. Once the event has occurred, all *ex ante* decisions, strategies and measures are found to be insufficient to cope with the situation and smooth consumption to acceptable levels. The inability to cope with risk *ex post* calls for an equity or "social solidarity" action. The very existence of this inability, its probability and scope depend, however, crucially on *ex ante* decisions and strategies.

The trade-off between measures *ex ante* and *ex post* is an essential part of the policy discussion on managing catastrophic risk. Innes (2003) underlines the political economy dimension of this debate: "because *ex ante* insurance coverage diminishes the political will for ex post emergency relief, government insurance programs may be designed, in principle, to deter disaster relief". The argument is the following: insurance is not supposed to cover for non-insurable risks like most catastrophic risks, but if government provides insurance subsidies, they could be designed to minimize the need for *ex post* disaster aid. Some anecdotal studies on EU member countries suggest that insurance subsidies may have deterred ad hoc disaster payments (Garrido and Bielza, 2008; JRC 2006), but there is no rigorous empirical evidence. For example, Spain provides strong ex ante insurance subsidies but much smaller ex post disaster aid, while the opposite occurs in the United Kingdom.

The same trade-off between *ex ante* insurance subsidies and *ex post* disaster assistance is discussed for the United States by Glauber (2004). Crop insurance is considered preferable to *ex post* disaster assistance because it provides *ex ante* risk protection. However, it is argued that despite the expansion of insurance subsidies since the Federal Crop Insurance Improvement Act of 1980, they have failed to replace disaster assistance. His explanation is the existence of asymmetric information. A new role is therefore proposed for government in managing catastrophic risk, in the development of area-yield and weather index insurance contracts that minimize both adverse selection and moral hazard. Governments are aware of this trade-off, which is why, in some cases, disaster payments are reduced for insured farmers by the amount of the indemnities, or/and in other cases, eligibility for disaster payments is limited to the insured (Goodwin *et al*., 2007). The impacts and incentives created by these provisions deserve further investigation.

Do government measures crowd-out market and on-farm strategies?

All agricultural support measures affect risk in some way. OECD (2004) estimates the impacts on variability of aggregate receipts of different categories of PSE support measures. It was found that most PSE categories reduce aggregate revenue variability. In particular, market price support was found to reduce variability in all the cases that were analysed. However, variability reduction is not proportional to the amount of support and therefore there are payments and programs that are more risk related than others. If a measure reduces risk, there will be a risk related response with impacts on production and on the use of other risk management strategies.

Interaction among policy measures has been shown to be very significant (OECD, 2005, Coble *et al.*, 2000). In particular there is scope for crowding out market measures that cover the same type of risk as government programs: deficiency payments or price stabilization schemes tend to crowd out price hedging through futures and options. There is also evidence that insurance subsidies may increase specialization of the farm (O'Donoghue and al, 2009), and therefore crowd-out diversification strategies. This effect of crowding out other strategies diminishes the capacity of such mechanisms to reduce variability and improve welfare.

There are also concerns about the interactions between risk management instruments such as insurance of futures and environmental outcomes (Babcock *et al.,* 2003). Some argue that insurance programs and agrochemicals are substitutes and farmers who purchase insurance are likely to reduce the application rates of fertilizers and pesticides. On the contrary other argue that risk management instruments induce farmers to increase output, including through further use of agrochemicals.

The three layers of risk represented in Figure 5.2 illustrate the interaction between measures and strategies. If government actions cover risk layers 1 (catastrophic) and 3 (normal risk retention layer), the scope for insurance markets to develop and be viable is reduced. If government action takes the form of insurance subsidies and they expand too much, there may be little space for developing instruments for the third layer that, in principle, should be retained by the farmer. Defining and limiting the boundaries of government responsibility leaves room for markets and for on-farm strategies developed and implemented by farmers themselves.

Does risk mitigation imply increased farmers' welfare?

Different policy instruments have different relative efficiency in achieving different policy objectives such as risk reduction and increasing farmers' welfare. Some policy measures contribute to reduce risk and can be effective for this purpose, particularly if they are targeted to farmers' main sources of risk and variability. For instance, crop insurance subsidies can potentially be effective in inducing farmers to buy insurance and –therefore- reduce the variability of their returns. If farmers are risk averse, as is generally assumed, this mitigation of risk will improve also their welfare. Other policy measures can be highly efficient in transferring income to farmers. This is the case of area payments, particularly if based on historical based area: if the farmer owns the land, compared to other forms of support, area payments reach the farmer's pocket with smaller efficiency losses and leakages to other agents (OECD, 2006). It is most likely that the income improvements derived from these area payments will also contribute to facilitate risk management and mitigate the negative implications of risk exposure.

Figure 5.3 illustrates this situation with an example based on a set of micro model simulations extracted from Antón and Giner (2005). It compares the impacts of a given amount of support provided in the form of insurance subsidies or area payments. The outcomes are compared in terms of risk (measured as variability of profits) and welfare (as measured by expected utility of a risk averse farmer). Both insurance subsidies and area payments contribute to reduce risk and to improve welfare, but to different extent. Minimizing risk exposure would require providing a big share of the support in the form of insurance subsidies. On the contrary, farmers' welfare maximization would be achieved when all support was given in the form of area payments. The choice of the policy mix is likely to face a tradeoff between these two potential objectives related to the farmers: reducing their risk exposure and maximizing their welfare.

Do risk related measures have production effects?

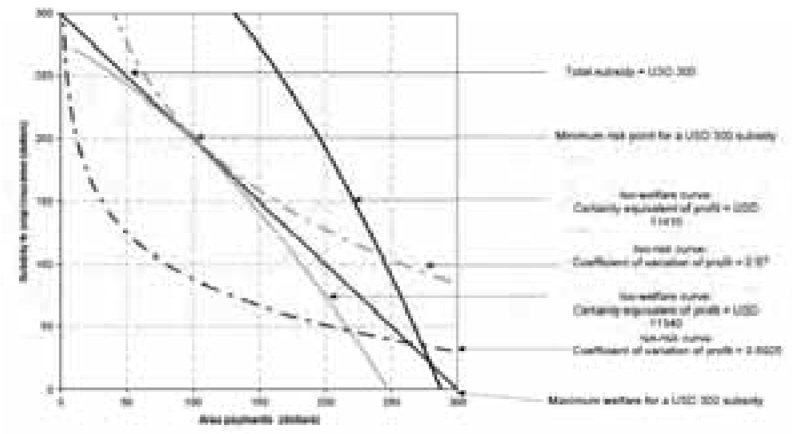
All agricultural support measures have some impact on production; but there can be large differences in the size of these impacts (OECD, 2001). Risk related measures will have a risk-related impact on production if farmers are risk averse. This effect can be large if the policy instrument is well targeted to commodity specific main risks. Table 5.4 illustrates these effects for the same amount of payments. These comparisons need to be taken with caution since typically the total amount of payment on crop insurance is much lower than for area payments, and the results depend on the degree of risk aversion.

All risk related subsidies and payments in Table 5.4 show an impact on production decisions of risk averse farmers. Furthermore, often the production response is larger the larger the reduction of risk. This is particularly true for the most risk averse farmers. On the contrary, a risk neutral farmer would not change its production decisions in response to an insurance subsidy: they would not buy insurance in any case. These impacts on production are relevant for the efficient functioning of commodity markets.

FIGURE 5.3

Crop insurance subsidies and area payments: Minimizing risk exposure or maximizing welfare?

Simulated iso-risk and iso-welfare curves for a hypothetical farmer



Source: Anton and Giner (2005)

5.3 Are OECD countries moving towards more risk related agricultural support?

Some OECD countries have implemented significant new agricultural policy legislation or frameworks that sought to reinforce measures related with risk management. In the United States, the 2008 Farm Act increases target prices for most commodities and gives farmers the opportunity to change to the revenue-based countercyclical programme ACRE, confirming a commodity-specific risk management approach that now allows price and yield risk to be combined into a revenue programme. Canada's Growing Forward agreed programmes take a whole-farm approach to risk management with measures that cover several risk layers, from small frequent reductions in margins to catastrophic risks. Finally, the Health Check of the European Union expands the possible uses of article 68 "Assistance to sectors with special problems" to include co-financing of subsidies to national crop insurance programmes and mutual funds for animal diseases. Other countries have increase their expenditure in risk related measures; for instance, Mexico has increased eight-fold in three years the outlays on its price hedging programme, which subsidises the price of options. But does this mean that OECD countries are moving toward more risk related agricultural support? This is not so easy to

TABLE 5.4

Comparison of impacts of a payment to risk reducing policies. An example based on micro model simulations for a hypothetical farmer

Impact for the same amount of payment given through different programmes

	Risk averse farmer		**Risk neutral farmer**	
Strategy	Change in expected production (%)	Change in coefficient of variation of profit (%)	Change in expected production (%)	Change in coefficient of variation of profit (%)
Crop insurance[1]	0.24%	-5.53%	0.00%	0.00%
Price hedging	0.12%	-2.36%	0.00%	0.00%
Deficiency payments	0.12%	-0.88%	0.09%	-1.66%
Area payments counter-cyclical with yields	0.05%	1.66%	0.02%	-2.67%
Area payments counter-cyclical with prices	0.05%	-1.01%	0.02%	-1.80%

[1] Econometric studies such as OECD (2002), estimate small but significant production effects of insurance subsidies, even smaller than for area payments. But further work is required for a definitive conclusion about the relative production effects of insurance subsidies as compared to other forms of support (OECD, 2006).
Source: OECD (2005)

conclude without a systematic estimation of risk related support measures. The Producer Support Estimate (PSE) database from the OECD is used for this purpose (OECD, 2009)

Risk related measures

All agricultural policy measures have an impact on risk[4]. Some measures, however, are specifically designed to reduce price, yield or income variability, or to smooth consumption, and thus help farmers manage risk, either because they prevent or reduce the occurrence of risk (risk reduction), or because they limit the effect of risk on income (risk mitigation) or consumption (risk coping). Risk reduction measures would be, for example, disease control measures such as vaccination, which aims to limit the occurrence and spread of animal diseases and thus prevent/reduce potential losses in livestock receipts. Market price support (MPS) measures, which stabilise domestic prices, also reduce domestic price risk. Risk mitigation and coping can operate through established (*ex ante*) mechanisms such as insurance schemes

[4] The risk effects of various measures have been estimated in a series of OECD studies on decoupling (notably OECD, 2004), whose main results are summarised in OECD (2006).

or income stabilisation programmes, or through *ex post* interventions such as *ad hoc* assistance to compensate income losses.

Following the framework defined in OECD (2009), the policy measures that are specifically designed to reduce price, yield or income variability, or to smooth consumption are referred to as "risk-related" measures. They are classified as either contributing to risk reduction or risk mitigation/coping. Among risk reduction measures, MPS is identified separately as it dominates any other risk reduction measure in many countries in terms of support level. Other support measures that provide a stable (fixed rate) transfer to income can also have risk impacts and enter into farmers' risk management strategies.

Risk reduction measures reduce the occurrence of risk as they increase domestic price stability, limit production losses, reduce marketing uncertainties, and encourage the adoption of risk management techniques. Government intervention in risk reduction includes price stabilisation; inspection and food safety measures; and support to production and marketing techniques. A number of specific measures to reduce the occurrence of risk are identified in OECD countries and selected emerging economies. These are: market price support measures, through price stabilisation[5]; market interventions such as private storage or non-marketing of agricultural products; support to production techniques such as water management (irrigation, drainage, flood control and other); purchase of certified seeds and animal breeds; pest and disease control; technical assistance and extension; and inspection of agricultural products and food safety measures.

Risk mitigation and coping measures contribute to smoothing income or consumption by helping farmers to get insurance against drops in price or yield and by providing assistance in the event of income losses. We can distinguish between ex ante mechanisms for mitigating the consequences of risk and ex post interventions, such as ad hoc payments. However, the distinction is sometimes difficult to make, for example in the case of disaster payments made after the damage has been registered but using established mutual funds. The main types of ex ante measures for smoothing farm household income are: payments with a variable rate (or countercyclical payments) compensating for all or part of the income losses suffered according to a pre-established formula; subsidies for risk management tools such as insurance systems or futures markets; income tax smoothing systems; and income diversification support. The main types of ex post measures for smoothing income or consumption are: disaster relief payments; ad hoc assistance; and other measures such as debt relief, social assistance or labour replacement services.

[5] Deficiency payments are considered as a risk mitigation measure, typically as payments based on output with a variable rate. While they stabilise prices faced by producers in much the same way as MPS, this occurs in reaction to a change in market prices.

Risk related measures in the OECD indicators of support (PSE database)

Tables 5.5 and 5.6 identify support associated with measures used respectively for risk reduction, and for risk mitigation and coping, and including both support to producers (PSE) and general services (GSSE). Overall, risk-related measures accounted for two-thirds of support to OECD producers in 2002-07, compared to three-quarters a decade earlier (Table 5). Their share exceeds 50% in all OECD countries (except Norway, where it was slightly below). In emerging economies, the share of risk-related measures in total support has also been above 50% in most recent years. Countries with a share of risk-related measures over 80% include Japan, Korea, Russia and South Africa, where MPS accounts for close or over 90% of the total of those measures, as well as Canada and New Zealand, where over half of risk-related support comes from non-MPS measures.

The importance of MPS in OECD countries is confirmed. While its share in the OECD PSE decreased from 70% in 1992-07 to 56% in 2002-07, its share in risk-related support decreased from 92% to 86%. In 2002-07, MPS accounted for over 40% of the PSE in all OECD countries except Australia, where it was slightly over 10%, and the United States where it was slightly below 30%. *Ex ante* Support for measures helping farmers deal with the consequences of risk is negligible in a majority of OECD countries. It is significant as a share of producer support in Australia, Canada, Mexico, New Zealand and the United States. *Ex post* measures, which include disaster relief, *ad hoc* assistance, social assistance and debt relief, are mainly used in Australia, Canada, New Zealand and emerging economies.

Risk reduction support other than MPS includes mainly government expenditures on pest and disease control, extension and water management. It is significant in Australia, Mexico, the United States, where support to technical assistance dominates, and particularly important in New Zealand, where support for pest and disease control measures is of the same magnitude as MPS. In New Zealand, risk-related measures, which include MPS, pest and disease control and some disaster payments, make up for almost all support to producers, which is 1% of farm receipts. In the emerging economies considered, risk reduction measures other than MPS are particularly significant in Chile, where they consist of technical assistance to farmers. Government support to technical assistance provided to individual farmers is also significant in Brazil and China, but does not exist in Russia, South Africa and Ukraine.

Some risk reduction measures are included in general services to agriculture as they benefit farmers collectively: this is the case of inspection services, some pest and disease control measures and water management infrastructure assistance. The latter account for a notable share of GSSE indicator in Chile, Japan, Korea and Mexico. In other countries, the aggregate for infrastructure assistance may include support for irrigation systems, but it is not possible to identify it separately. Inspection services account for a growing share of GSSE in many countries.

TABLE 5.5

Transfers from risk-related policies in OECD countries, 1992-97 and 2002-07

Million EUR	Australia		Canada		European Union*		Iceland		Japan		Korea	
	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07
Risk reduction measures in PSE	**772**	**298**	**1 876**	**2 513**	**58 005**	**51 308**	**67**	**85**	**44 592**	**32 484**	**16 734**	**16 498**
-- MPS	***633***	***145***	***1 852***	***2 485***	***56 773***	***49 454***	***64***	***81***	***44 228***	***32 224***	***16 681***	***16 405***
-- Other risk reduction measures	***139***	***152***	***25***	***28***	***1 232***	***1 854***	***3***	***4***	***364***	***261***	***53***	***93***
Private storage/non marketing	0	0	0	0	0	0	0	0	0	0	0	0
Water management[1]	0	34	0	0	205	187	0	0	206	118	48	65
Certified seeds/breeds	0	0	0	0	0	77	0	0	0	0	0	0
Technical assistance/extension	81	57	22	3	163	401	1	3	134	104	5	27
Pest and disease control	57	61	3	26	863	1 189	2	1	24	39	0	0.5
Risk reduction measures in GSSE	**33**	**83**	**239**	**483**	**164**	**605**	**1**	**2**	**4 106**	**2 671**	**569**	**1 073**
Water management[2]	0	6	0	0	0	0	0	0	4 033	2 604	504	969
Inspection (GSSE)	33	78	239	483	164	605	1	2	73	66	64	104
Ex ante risk mitigation/coping measures in PSE	**70**	**319**	**930**	**1 191**	**359**	**465**	**0**	**0**	**1 790**	**1 263**	**0**	**39**
Variable rate payments based on output[3,4]	0	0	135	0	210	157	0	0	1 176	751	0	0
Variable rate payments based on current A/An/R/I[3,5]	0	0	587	1 011	0	0	0	0	0	24	0	0
Variable rate payments based on non-current A/An/R/I, production required[3,6]	0	0	0	87	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, prod. not required[3,7]	0	138	207	94	0	0	0	0	0	0	0	0
Insurance subsidies[8]	0	0	0	0	149	308	0	0	615	488	0	39
Futures markets subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Income tax smoothing schemes	70	181	0	0	0	0	0	0	0	0	0	0
Ex post risk mitigation/coping measures in PSE	**97**	**181**	**11**	**1 012**	**418**	**1 131**	**1**	**1**	**40**	**23**	**35**	**41**
Disaster relief payments	96	177	4	536	337	940	1	1	40	23	35	41
Ad hoc assistance[9]	0	0	7	475	0	0	0	0	0	0	0	0
Social assistance/labour replacement	0	3	0	0	80	191	0	0	0	0	0	0
Debt rescheduling/write-off	0	0	0	1	0	0	0	0	0	0	0	0
Total PSE	**1 246**	**1 256**	**3 337**	**5 255**	**91 397**	**104 094**	**117**	**167**	**48 736**	**36 644**	**17 611**	**17 973**
Total risk-related measures in PSE	**939**	**797**	**2 817**	**4 717**	**58 782**	**52 904**	**68**	**85**	**46 422**	**33 770**	**16 769**	**16 578**
% share of risk-related measures in PSE	*75*	*64*	*84*	*90*	*64*	*51*	*58*	*51*	*95*	*92*	*95*	*92*
% share of risk-related measures other than MPS in PSE	*25*	*52*	*29*	*42*	*2*	*3*	*3*	*3*	*5*	*4*	*0*	*1*
%share of MPS in PSE	*51*	*12*	*55*	*47*	*62*	*48*	*55*	*48*	*91*	*88*	*95*	*91*
%share of MPS in risk-related measures	*67*	*18*	*66*	*53*	*97*	*93*	*95*	*95*	*95*	*95*	*99*	*99*
Total GSSE expenditures	**272**	**561**	**1 271**	**1 775**	**8 484**	**11 348**	**12**	**16**	**14 519**	**8 876**	**2 352**	**2 662**
Risk related measures in GSSE	**33**	**83**	**239**	**483**	**164**	**605**	**1**	**2**	**4 106**	**2 671**	**569**	**1 073**
% share in GSSE	*12*	*15*	*19*	*27*	*2*	*5*	*8*	*13*	*28*	*30*	*24*	*40*

A/An/R/I: Area/Animal number/Receipts/Income

* EU12 for 1992-94; EU15 for 1995-2003, EU25 for 2004-06 and EU27 in 2007.

1. Subsidies to water use and investment assistance in irrigation and drainage systems on the farm.
2. Infrastructure assistance for water management off the farm.
3. Payments of this PSE category that have a variable rate label, except those included in the disaster relief payments or insurance subsidies items in this table.
4. Includes for example the EU production aid for banana; and the Farming Income Stabilization Programme (JRIS) and the Sugar Cane Farm Income Stabilization Programme in Japan.
5. Includes the Canadian Agricultural Income Stabilisation (CAIS) programme, The Ontario Risk Management programme, the Assurance-Stabilization des revenus agricoles (ASRA), NISA and crop insurance payments in Canada; and the Rice Farmers Management Support in Japan.
6. Includes the AgriInvest Kickstart Program and the Canadian Farm Families Options Program in Canada.
7. Includes the Australian Dairy Industry Restructure Package; and the Western Grain Transition Program in Canada.
8. Includes subsidies to national insurance schemes in the EU; and insurance subsidies in Japan. In Canada, payments from insurance programmes are considered under variable rate payments.
9. Includes the Alberta Farm income Assistance Program, the agricultural Policy Framework Transition Funding, the Cost of Production Payment, the Farm Income Payment, the Grains and Oilseeds Payment Program, and Provincial CAIS enhancements.

Source: OECD, PSE database 2008.

TABLE 5.5

Transfers from risk-related policies in OECD countries, 1992-97 and 2002-07 (continued)

	Mexico		New Zealand		Norway		Switzerland		Turkey		United States	
	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07	1992-97	2002-07
Risk reduction measures in PSE	**2 861**	**2 862**	**52**	**62**	**1 107**	**1 111**	**3 252**	**2 231**	**3 607**	**6 674**	**14 109**	**13 352**
-- MPS	**2 506**	**2 496**	**27**	**33**	**1 088**	**1 101**	**3 238**	**2 217**	**3 531**	**6 501**	**11 476**	**9 240**
-- Other risk reduction measures	***355***	***366***	***25***	***29***	***18***	***10***	***14***	***14***	***76***	***173***	***2 633***	***4 113***
Private storage/non marketing	0	0	0	0	9	0	0	0	0	0	0	3
Water management[1]	224	62	0	0	0	0	0	0	48	38	334	238
Certified seeds/breeds	5	6	0	0	0	0	0	0	24	128	0	0
Technical assistance/extension	97	97	0	0	0	0	12	6	0	0	1 902	3 005
Pest and disease control	29	201	25	29	9	10	1	9	4	6	397	866
Risk reduction measures in GSSE	**121**	**234**	**14**	**54**	**1**	**0**	**9**	**8**	**121**	**87**	**713**	**928**
Water management[2]	113	93	4	17	0	0	0	0	0	0	267	237
Inspection (GSSE)	8	140	10	38	1	0	9	8	121	87	446	691
Ex ante risk mitigation/coping measures in PSE	**35**	**378**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**28**	**2 948**	**5 879**
Variable rate payments based on output[3,4]	6	291	0	0	0	0	0	0	0	0	211	2 650
Variable rate payments based on current A/An/R/I[3,5]	0	0	0	0	0	0	0	0	40	26	2 325	0
Variable rate payments based on non-current A/An/R/I, production required[3,6]	0	0	0	0	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, prod. not required[3,7]	0	0	0	0	0	0	0	0	0	0	0	1 930
Insurance subsidies[8]	29	37	0	0	0	0	0	0	0	3	412	1 298
Futures markets subsidies	0	51	0	0	0	0	0	0	0	0	0	0
Income tax smoothing schemes	0	0	0	0	0	0	0	0	0	0	0	0
Ex post risk mitigation/coping measures in PSE	**9**	**204**	**1**	**5**	**26**	**31**	**0**	**0**	**0**	**10**	**553**	**856**
Disaster relief payments	3	94	1	5	21	12	0	0	0	10	553	856
Ad hoc assistance	0	0	0	0	0	0	0	0	0	0	0	0
Social assistance/labour replacement	6	13	0	0	5	19	0	0	0	0	0	0
Debt rescheduling/write-off	0	97	0	0	0	0	0	0	0	0	0	0
Total PSE	**4 080**	**5 421**	**53**	**67**	**2 476**	**2 487**	**4 594**	**4 336**	**5 145**	**8 932**	**24 089**	**31 860**
Total risk-related measures in PSE	**2 905**	**3 444**	**52**	**67**	**1 132**	**1 142**	**3 252**	**2 231**	**3 647**	**6 712**	**17 610**	**20 087**
% share of risk-related measures in PSE	*71*	*64*	*99*	*100*	*46*	*46*	*71*	*51*	*71*	*75*	*73*	*63*
% share of risk-related measures other than MPS in PSE	*10*	*17*	*48*	*51*	*2*	*2*	*0*	*0*	*2*	*2*	*25*	*34*
%share of MPS in PSE	*61*	*46*	*50*	*49*	*44*	*44*	*70*	*51*	*69*	*73*	*48*	*29*
%share of MPS in risk-related measures	*86*	*72*	*51*	*49*	*96*	*96*	*100*	*99*	*97*	*97*	*65*	*46*
Total GSSE expenditures	**688**	**683**	**75**	**122**	**131**	**194**	**377**	**327**	**1 313**	**1 139**	**24 317**	**31 411**
Risk related measures in GSSE	**121**	**234**	**14**	**54**	**1**	**0**	**9**	**8**	**121**	**87**	**713**	**928**
% share in GSSE	18	34	18	44	1	0	2	2	9	8	3	3

A/An/R/I: Area/Animal number/Receipts/Income

1. Subsidies to water use and investment assistance in irrigation and drainage systems on the farm.
2. Infrastructure assistance for water management off the farm.
3. Payments of this PSE category that have a variable rate label, except those included in the disaster relief payments or insurance subsidies items in this table.
4. Includes for example Ingreso objetivo payments in Mexico and various payments in the United States such as loan deficiency and market loss payments.
5. Includes potato, sugar and tobacco compensation payments in Turkey; and former deficiency payments in the United States.
6. No measures in this category in the countries above.
7. Includes Countercyclical payments introduced in the 2002 Farm Bill in the United States.
8. Includes ANAGSA/AGROASEMEX insurance subsidies in Mexico; and Crop insurance and Adjusted gross revenue insurance payments in the United States.

Source: OECD, PSE database 2008.

TABLE 5.6

Transfers from risk-related policies in selected emerging economies 1992-97 and 2002-05

Millions EUR	Brazil		Chile		China		Russia		South Africa		Ukraine	
	1995-97	2002-05	1992-97	2002-06	1993-97	2002-05	1992-97	2002-05	1992-97	2002-05	1994-97	2002-05
Risk reduction measures in PSE	**-3 911**	**603**	**325**	**201**	**-2 702**	**12 488**	**-4 652**	**4 433**	**892**	**577**	**-3 021**	**-667**
-- MPS	**-4 019**	**526**	**308**	**164**	**-3 073**	**11 147**	**-4 680**	**4 333**	**891**	**577**	**-3 021**	**-667**
-- Other risk reduction measures	***108***	***77***	***17***	***37***	***371***	***1 341***	***28***	***101***	***1***	***0***	***0***	***0***
Private storage/non marketing	0	1	0	0	0	0	0	0	0	0	0	0
Water management[1]	0	0	2	7	0	0	0	0	1	0	0	0
Certified seeds/breeds	0	0	0	0	0	0	15	33	0	0	0	0
Technical assistance/extension	108	76	15	22	275	1 218	0	0	0	0	0	0
Pest and disease control	0	0	0	8	96	122	13	68	0	0	0	0
Risk reduction measures in GSSE	**565**	**131**	**19**	**49**	**202**	**454**	**100**	**324**	**28**	**78**	**29**	**147**
Water management[2]	477	96	19	42	0	0	0	22	1	14	9	66
Pest and disease control	44	22	0	0	96	122	0	0	0	0	16	13
Inspection (GSSE)	44	13	0	7	106	331	100	302	26	64	3	69
Ex ante risk mitigation/coping measures in PSE	**93**	**117**	**0**	**1**	**0**	**0**	**7**	**44**	**0**	**0**	**623**	**204**
Variable rate payments based on output[3,4]	61	42	0	0	0	0	0	0	0	0	623	204
Variable rate payments based on current A/An/R/I[3]	0	0	0	0	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, production required[3]	0	0	0	0	0	0	0	0	0	0	0	0
Variable rate payments based on non-current A/An/R/I, prod. not required[3]	0	0	0	0	0	0	0	0	0	0	0	0
Insurance subsidies[5]	33	75	0	1	0	0	7	44	0	0	0	0
Futures markets subsidies	0	0	0	0	0	0	0	0	0	0	0	0
Income tax smoothing schemes	0	0	0	0	0	0	0	0	0	0	0	0
Ex post risk mitigation/coping measures in PSE	**926**	**635**	**4**	**2**	**772**	**2 559**	**1 660**	**139**	**15**	**26**	**186**	**12**
Disaster relief payments	0	0	4	2	329	871	11	4	15	26	0	0
Ad hoc assistance	0	0	0	0	0	0	2	0	0	0	0	0
Social assistance/labour replacement	0	0	0	0	443	1 688	0	0	0	0	0	0
Debt rescheduling/write-off	926	635	0	0	0	0	1 648	135	0	0	186	12
Total PSE	-2 284	2 377	341	291	311	25 535	235	5 759	924	687	-1 435	178
Total risk-related measures in PSE	**-2 892**	**1 355**	**329**	**204**	**-1 930**	**15 047**	**-2 984**	**4 617**	**907**	**603**	**-2 212**	**-452**
% share of risk-related measures in PSE	*n.a.*	*57*	*96*	*70*	*n.a.*	*59*	*n.a.*	*80*	*98*	*88*	*n.a.*	*n.a.*
% share of risk-related measures other than MPS in PSE	*n.a.*	*35*	*6*	*14*	*n.a.*	*15*	*n.a.*	*5*	*2*	*4*	*n.a.*	*n.a.*
%share of MPS in PSE	*n.a.*	*22*	*90*	*56*	*n.a.*	*44*	*n.a.*	*75*	*96*	*84*	*n.a.*	*n.a.*
%share of MPS in risk-related measures	*n.a.*	*39*	*94*	*80*	*n.a.*	*74*	*n.a.*	*94*	*98*	*96*	*n.a.*	*n.a.*
Total GSSE expenditures	2 364	1 050	39	92	5 713	13 794	1 065	794	453	441	300	353
Risk related measures in GSSE	**565**	**131**	**19**	**49**	**202**	**454**	**100**	**324**	**28**	**78**	**29**	**147**
% share in total GSSE	*24*	*12*	*49*	*53*	*4*	*3*	*9*	*41*	*6*	*18*	*10*	*42*

n.a.: not applicable because of negative numbers; A/An/R/I: Area/Animal number/Receipts/Income

1. Subsidies to water use and investment assistance in irrigation and drainage systems on the farm.
2. Infrastructure assistance for water management off the farm.
3. Payments of this PSE category that have a variable rate label, except those included in the disaster relief payments or insurance subsidies items in this table.
4. Includes Marketing loans subsidy from preferential interest in Brazil; and deficiency payments for crop and livestock products in Ukraine.
5. Includes PROAGRO insurance payments, Rural insurance premium and Insurance payments Garantia Safra in Brazil; Agricultural Insurance Programme COMSA, CORFO, MINAGRI in Chile; and Compensation of insurance payments and Crop insurance subsidies in Russia.

Source: OECD, PSE database 2006.

Support to *ex ante risk mitigation* systems includes payments with a variable rate, although some disaster payments with a variable rate are classified as *ex post* in Tables 5.5 and 5.6. This is because disaster payments are granted after the disaster has occurred and damage has been estimated. However, the frontier between *ex ante* and *ex post* measures is not always clear. Insurance and futures options subsidies are also classified as *ex ante* risk mitigation measures. *Ex ante* risk mitigation support is particularly significant in Canada and the United States, and to a lesser extent in Australia and Mexico.

Subsidies to purchase futures option contracts are only available in Mexico and they have gained importance in recent years. Most risk mitigation payments are, however, *Ingreso Objetivo* payments, which are paid per tonne with a variable rate. Brazil also subsidises risk premium for private options contracts for cooperatives and agro-food industries so government expenditures on these subsidies is included in the consumer support estimate (CSE).

Insurance subsidies are relatively common in the countries examined. They exist in 17 EU member states, 5 non-EU OECD countries (out of 11) and 5 emerging economies out of the 8 examined. However, the level of subsidies varies greatly by country, depending on the development of insurance schemes. In most countries, subsidies to insurance schemes are included in the PSE as payments based on variable input use, insurance being considered as a variable input. In these cases, government expenditures transferred every year to insurance companies operating insurance schemes are considered. However, in several countries (Brazil, Canada, Turkey and the United States), insurance subsidies are reported as a share of the payment received by farmers from insurance schemes in the year the payment is granted, and are thus considered as payments with a variable rate. Insurance payments are paid per hectare in the case of crop insurance, or based on receipts or net income in the case of revenue/income insurance.

In Australia, government transfers to income tax smoothing schemes[6] are included in the PSE. The tax system of other countries also allows for spreading taxable income over several years, but the transfers they may generate are not included in the PSE, either because the system is not specific to farmers (Netherlands) or because, while the option is only available to farmers, the value of the tax concession is not estimated.

Payments with a variable rate other than insurance payments and disaster relief payments include various deficiency and stabilisation payments paid per tonne, per hectare, per animal head or based on receipts or income. When based on current parameters (e.g. current area), they meet the difference between current receipts/income (per hectare) and a reference, often historical, level.

[6] These are the Income Equalisation Deposits Scheme, replaced in 1999 by the Farm Management Deposit Scheme, as well as the Income Tax Averaging Scheme for primary producers.

Payments based on output with a variable rate are found mainly in Japan (e.g. price stabilisation for fruits and vegetables, payments for rice, manufacturing milk, sugar cane), Mexico (*Ingreso objetivo* payments), Ukraine and the United States (loan deficiency payments, marketing loan gains, storage payments). Most payments based on current area, animal numbers, receipts or income with a variable rate are in Canada, where they include crop insurance payments (based on area) as well as various federal and provincial revenue insurance payments such as the Net Income Stabilisation account (NISA) and the Canadian Agricultural Income Stabilization (CAIS), the "assurance stabilisation du revenu agricole"(ASRA) in Quebec and the Ontario Risk Management Program. They are operated by the federal government and/or by provincial governments, with contributions from farmers. As such, they are considered as government programmes and payments are not identified as insurance subsidies in Table 5.6. Canada and the United States also make variable rate payments based on non current parameters for which production is not required (respectively the CAIS Inventory Transition Initiative in Canada, and the Countercyclical payments introduced in the 2002 Farm Bill and Crop market loss assistance in the United States).

Support to *ex post risk mitigation* systems considered here includes disaster relief payments, *ad hoc* assistance, social assistance specific to farmers and debt management measures. While *ad hoc* assistance payments are mainly found in Canada, disaster relief payments are more widespread. Disaster relief payments are negligible in countries with high support levels, as well as in New Zealand and Turkey. Conversely, they account for a significant share of support in Australia, where support levels are relatively low at around 5% of farm receipts. In recent years, disaster relief mainly came from the "Exceptional circumstances" programme, which provides short-term assistance to long-term viable farm businesses to cope with rare circumstances that are beyond the scope of normal risk management practices[7]. In the EU, disaster relief payments are funded at the national or regional level and many member states have granted such payments over the period. Among emerging economies considered, China is the only one with significant levels of disaster relief assistance (Table 5.6). In countries which use disaster relief assistance to a larger extent, the level of these payments has increased in the 2000s compared to the previous decade.

Social assistance includes short term relief assistance to help farm households cope with emergency situations and poverty alleviation measures. In Australia, the

[7] To qualify as exceptional circumstances, "the event must be rare (it must not have occurred more than once on average in every 20 to 25 years; it must result in a rare and severe downturn in farm income over a prolonged period of time (e.g., greater than 12 months); it cannot be planned for or managed as part of farmers' normal risk management strategies; and must be a discrete event that is not part of long-term structural adjustment processes or normal fluctuations in commodity prices" (DAFF, 2005). OECD (2007) summarises the process for defining exceptional circumstances and the conditions for receiving support.

Farm Family Restart Scheme (or Farm Help) provides short term financial assistance in the form of income support and investment grants to re-establish outside agriculture (as well as training and advice) to help farmers with financial problems, either by improving the financial performance of their farm enterprise, finding alternative sources of off-farm income or re-establishing outside farming. In Mexico, agricultural producers or workers are paid the minimum wage to participate in community work in extremely poor areas during the period of low agricultural activity. This could be considered as a measure to diversify income sources rather than a safety-net in case of temporary problems as in the Australian case.

Labour replacement assistance provides subsidies to replace the farmer in case of illness or accident. Such assistance has been available over the period considered (1986-2007) in a number of EU member states, in Iceland and in Norway. Debt rescheduling or write-off has generated significant levels of support during the two periods considered in Brazil and Russia and to a lesser extent in Mexico and Ukraine.

WTO notifications and risk management

Since the Uruguay Round Agreement on Agriculture in 1995, member countries notify their domestic support to the WTO. These notifications report annual levels of agricultural domestic support, whether subject to reduction commitments or not. Support under measures subject to the reduction commitment is reported as the current total Aggregate Measurement of Support (AMS), often referred to as Amber Box. Measures exempt from the reduction commitment include: measures exempted because they qualify under the criteria set out in Annex 2 to the Agreement (often referred to as Green Box measures); measures respecting conditions for exemption set for direct payments under production-limiting programmes (often referred to as Blue Box measures); and for countries with developing country status, measures notified under "development programmes" as part of Special and Differential Treatment (often referred to as Development Box measures). Moreover, product-specific and non-product specific AMS support that accounts for less than 5% of the value of production (referred to here as *de minimis* support) is exempted from the current total AMS.

As OECD indicators of support, WTO notifications on domestic support commitments include information on transfers associated with risk-related measures. These measures can be found in all categories of support (referred to here as boxes). Price support is reported as AMS support, while support to general services, including government expenditures on inspection services, pest and disease control, or training, extension and advisory services, is notified in the Green Box. The Green Box includes two categories of measures specifically designed to include insurance subsidies, income safety-nets and disaster relief payments with strictly defined implementation criteria (Annex 2, paragraphs 7 and 8 of the Agreement on agriculture)[8]. However, as these categories are defined by strict implementation criteria to ensure they are minimally distorting, many insurance subsidies do not qualify.

Depending on implementation criteria, stabilisation and insurance payments can be either in the AMS support, the Blue Box or the Green Box. Deficiency payments or stabilisation payments based on output are generally notified in the Amber Box. Some payments such as crop insurance subsidies are notified as non-product specific AMS support. For many countries, non-product specific AMS support is exempted under the *de minimis* provisions and is therefore not counted towards the ceiling commitment. In Mexico, subsidies on insurance premiums, available to all producers, including AGROSEMEX, are notified in the Development Box. In Japan, the rice farming income stabilisation programme is notified in the Blue Box. Payments made in case of financial hardship such as the AAA Farm help programme in Australia[9] or agricultural social programmes in Argentina and Korea are notified in the Green Box as decoupled income support (Annex 2, paragraph 6 of the Agreement on agriculture).

Table 5.7 identifies the share of some risk-related measures in different WTO categories of support. In Japan, the rice farming income stabilisation programme is the only programme included in the Blue Box. Most crop and revenue insurance subsidies are notified as non product specific support in Canada, the EU and the United States, where they account respectively for 36%, 58% and 29% of support in this category. Other stabilisation or compensation payments such as NISA and CAIS payments in Canada, and 2002 Farm Bill countercyclical payments in the United States, are also in this category. Canada and Australia are the only countries, where support from income insurance and income safety-net programmes accounts for a significant share of the Green Box, while payments for relief from natural disaster are significant in more countries.

Support to general services forms the main part of the Green Box in many countries. The highest shares for pest and disease control and/or inspection services are found in Argentina, Australia, Canada and Mexico. Research, which is only an important component of expenditures in the Green Box, might also include a risk-related dimension.

[8] These are "Government financial participation in income insurance and income-safety-net programmes" (Annex 2, paragraph 7 of the Agreement on agriculture) and "Payments for relief from natural disaster" (Annex 2, paragraph 8 of the Agreement on agriculture).

[9] This programme provides a short-term welfare safety net for low-income farmers experiencing financial hardship and who cannot borrow further against their assets. The support is provided while they decide whether to improve their farms' financial position, obtain off-farm income or exit.

TABLE 5.7
Share of risk-related support in WTO notifications

	Argentina	Australia	Chile	Canada	EU	Japan	Korea	Mexico	Norway	United States
	2000/1-2003/4	2000/1-06/7	2000-06	2000-04	2000-05	2000-06	2000-04	2001-04	2000-04	2000-05
% share in current total AMS of:										
- MPS[1]	0	0	--	47	88	64	100	0	95	49
- Deficiency or stabilisation payments[2]	0	0	--	52	1	22	0	64	--	51
%share in product-specific *de minimis* of:										
- Deficiency or stabilisation payments[3]	0	0	--	82	0	87	4	80	0	79
%share in non product-specific AMS[4] of:										
- Deficiency or stabilisation payments[5]	--	0	0	26	0	0	0	0	0	64
- Insurance subsidies[6]	--	0	0	36	58	100	0	0	0	29
% share in the Blue box of:										
- Deficiency or stabilisation[7]	--	--	--	--	--	100	--	--	--	--
% share in the Development box of:										
- Insurance subsidies	--	--	0	--	--	--	0	4	--	--
%share in the Green box of:										
- income insurance and income safety-net programmes	0	8	1	22	0	0	0	0	0	0
- Payments for relief from natural disasters	1	17	0	0	2	2	8	0	1	3
- General services	81	54	97	55	21	79	58	28	21	17
. Pest and disease control	41	9	0	2	6	1	2	7	6	n.a.
. Training services	0	2	22	3	1	0	1	0	1	n.a.
. Extension and advisory services	4	7	4	8	1	11	1	0	2	n.a.
. Inspection services	1	4	19	20	1	0	2	0	0	n.a.

n.a.: not available separately; -- no support notified in this category or not applicable.
1. MPS (and equivalent measurement of support in the EU).
2. Market Revenue Program, ASRA, Ontario Grain Stabilization Payments and Provincial Direct Payments in Canada; Direct aid for banana in the EU; price-related payments and deficiency payments in Japan; Ingreso Objetivo payments in Mexico; ; and loan deficiency payments, marketing loan gains, trade adjustment assistance, certificate exchange gains, commodity loan forfeit in the United States.
3. Same as above, for different commodities depending on the year; beef deficiency payments in Korea.
4. Non-product specific support is often excluded from reduction commitments on de minimis grounds.
5. NISA and CAIS in Canada; Crop market loss assistance before 2002 and from 2002 countercyclical payments in the United States.
6. Crop insurance and production insurance in Canada; National insurance subsidies in the EU; Agricultural Insurance Scheme in Japan; Crop and revenue insurance subsidized by the Federal Crop Insurance Program in the United States.
7. Rice farming income stabilisation programme in Japan.
Source: WTO notifications on domestic support commitments.

5.4 Ongoing OECD work

Risk management policy measures are likely to remain an important part of agricultural support in the years to come. This offers a good opportunity to apply the holistic framework to both policy analysis and policy design. The ongoing OECD project on risk management in agriculture will attempt to respond to this challenge via two avenues: a thematic review of risk management policies in agriculture in specific countries and an analysis of risk management policies and strategies using micro models. The Thematic review will analyze the availability and use of different risk management instruments in five OECD countries, with a particular emphasis on the interaction between policy measures and market and on-farm strategies. The micro model analysis will focus on the measurement of risk exposure at the individual farm level, and the use of calibrated micro simulation models to study farmers response to policies, markets and on-farm instruments.

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6

Market access versus domestic support: Assessing the relative impacts on developing countries' agriculture

Antoine Bouet and David Laborde Debucquet[1]

Introduction

It is commonly believed that market access restrictions imposed by countries of the Organization for Economic Co-operation and Development (OECD) on developing countries' agricultural trade have greater impact on world welfare than domestic support policies. Market access restrictions may also limit new agricultural, food or biofuel production opportunities.

This policy conclusion should apply to developing countries, although to vastly different degrees. Agricultural exports from developing countries still face high import barriers, but the impact of market access restrictions varies widely across developing countries. First, most favoured nation (MFN) regimes do not actually apply to all countries and commodities: for example, many developing countries that benefit from preferential access under the Generalized System of Preference (GSP), the African Growth and Opportunity Act (AGOA) or the Everything but Arms (EBA) schemes face lower restrictions on eligible products than do other developing countries. Second, developing countries form a heterogeneous group in terms of income, product specialization and net trade flows: for example, some developing countries may specialize in a few agricultural products, making them more vulnerable to policies in OECD countries that are restrictive in agriculture; also market access restrictions may impact developing countries that are net food exporters differently than those that are net food importers.

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This study addresses these issues and draws several conclusions from a review of literature and an original modelling exercise, undertaken with the MIRAGE model of the world economy[2] and with the help of the MAcMAP-HS6 database on market access for 2004. In particular it shows that market access to agricultural trade is still restrictive for developing countries. Amongst the countries where agricultural exports are most restricted in the world by border protectionism when they penetrate foreign markets are Guyana (for which 2004 agricultural exportations faced an average import duty of 107.2 percent) Fiji (56.3 percent), Armenia (52.7 percent), Saint Kitts and Nevis (50.8 percent) and Swaziland (50.6 percent). The 70 countries most penalized by agricultural protectionism are developing countries. Market access restrictions are not uniform across products, countries or groups of countries, as they are dependent not only on developing countries' income and development levels but also on whether countries are subject to MFN or preferential tariffs, on countries' product specializations, and on their net trade position. This clearly means that the structure of market access restrictions significantly affects the composition of agricultural trade and production possibilities of developing countries.

This study provides an overview of the type and extent of market import barriers facing developing countries' agriculture: tariffs under either ad valorem or specific forms and tariff rate quotas (TRQs). It then provides an overview of model-based assessments of the relative impacts of market access versus domestic support on world welfare and agriculture in developing countries and a summary of the salient findings from trade models in trade liberalization studies. Finally, we present our own analysis of global trade liberalization using a database of bilateral tariffs applied at the HS6 level and integrated in a Computable General Equilibrium (CGE) model in order to clearly isolate the effects of market access from the effects of domestic support policies.

The study is structured as follows: Section 2 details the agricultural trade and market access characteristics of developing countries; Section 3 reviews the literature on the potential impact of market access and domestic support on developing countries; Section 4 presents the results of various liberalization scenarios on the level of border protection and on agricultural trade and welfare in developing countries; and Section 5 provides conclusions.

6.1 Agricultural trade and market access in developing countries

In this section we develop indicators of trade and trade policy in order to illustrate the heterogeneity of developing countries in terms of agricultural trade and

[2] MIRAGE is a multi-sector, multi-region Computable General Equilibrium Model devoted to trade policy analysis, initially developed at CEPII, Paris. See Decreux and Valin, 2007 for further information.

impact of agricultural protection. Two distinctions are considered relevant for this study: first, we separate the group of developing countries into least-developed countries (LDCs), as they are defined by the United Nations today, and middle-income countries (MICs). This first distinction enables us to highlight the potential implications of agricultural trade liberalization on the poorest countries, the LDCs. Second, food products are separated from other agricultural products in order to address the concern of numerous countries regarding the effect of trade liberalization on food security.

6.1.1 Protectionism applied on and faced by developing countries

We first examine trade policies in developing countries illustrated by the protection they apply on imports and the protection they face on exports with respect to the world. The average applied tariffs in agriculture calculated from the last release of the MAcMap-HS6 database for 2004 (Boumelassa, Laborde, and Mitaritonna, 2009) are displayed in Table 6.1 (more details are provided in Annex 6.1)[3]. The average Ad Valorem Equivalent (AVE) tariff combines the protection implemented under *ad valorem* and specific tariffs adjusted for the preferences given through regional agreements, North-South preferential schemes, and tariff rate quotas (column Total). Other columns detail these adjustments: column 'TRQ_MARG' indicates how market access concessions given through TRQs reduce the total protection applied in agriculture; column 'PREF_MARG' provides the same information for regional agreements and North-South preferential schemes; and column 'AD_VAL Comp' evaluates the impact of *ad valorem* duties and therefore allows the evaluation of the *ad valorem* equivalent of specific tariffs by comparing it with the column 'APPLIED/ FACED AVE'. Agricultural products definition follows WTO guidelines.

TABLE 6.1

Average protection faced by and applied on developing countries on agricultural products

	Protection faced by developing countries' exports				Protection applied on developing countries' imports			
Partner	Total	TRQ_ MARG	PREF_ MARG	AD_VAL comp.	Total	TRQ_ MARG	PREF_ MARG	AD_VAL comp.
World	19.84%	2.54%	2.35%	11.22%	20.32%	2.77%	1.83%	18.58%
HICs	17.98%	2.42%	3.35%	4.88%	18.42%	2.82%	2.62%	17.26%
MICs	23.02%	2.91%	0.97%	20.47%	22.64%	2.83%	0.96%	20.23%
LDCs	13.89%	0.00%	0.78%	13.78%	18.17%	0.57%	1.05%	16.29%

Source: Authors' calculations based on MAcMapHS6-v2.1.
Note: Reference group weighting scheme.
HICs stands for High Income Countries, MICs for Middle Income Countries and LDCs for Least Developed Countries.

[3] Methods of calculation are explained in Bouet et al., 2008.

Two technical remarks are important: first, average figures are computed using the reference group weighting scheme (see Bouet et al. 2008) that allows tariff peaks to be captured and endogeneity of trade flows to tariffs at the bilateral level to be reduced without losing exporter specificities; second, all intra-European union (EU) trade relations are discarded from the analysis in this paper and therefore do not impact EU-specific or worldwide aggregate figures. Globally agricultural exports by developing countries are highly taxed (19.84 percent), in particular when they export towards MICs. Preferential duties given either through TRQs or preferential schemes by rich countries have substantially reduced the average duty faced by developing countries' agricultural exports (2.42+3.35=5.77 percent). The significant protectionist impact of specific duties in rich countries is noteworthy. Developing countries globally tax more LDCs' agricultural exports (18.17 percent) than LDCs tax developing countries' agricultural exports (13.89 percent), and the impact of specific duties in developing countries' agricultural protection is minor.

We then present four maps on protection in the world: Figures 6.1 and 6.2 show a world map of applied protection to imports globally (agriculture and industry) and to agricultural imports, respectively. Figures 6.3 and 6.4 illustrate protection faced by exports globally and by agricultural exports, respectively.

At the global level, high-income countries (HICs) are generally more open than developing countries, even if some countries of the latter group have low national averages: for example, Chile, Guatemala, Myanmar and Madagascar[4]. The African continent offers a very contrasting picture of applied protectionism while the Middle East and South Asia regions are highly protectionist (in particular, Iran, Pakistan, India and Bangladesh). Protectionism in the South American continent is concentrated around the 10 percent level (Figure 6.1).

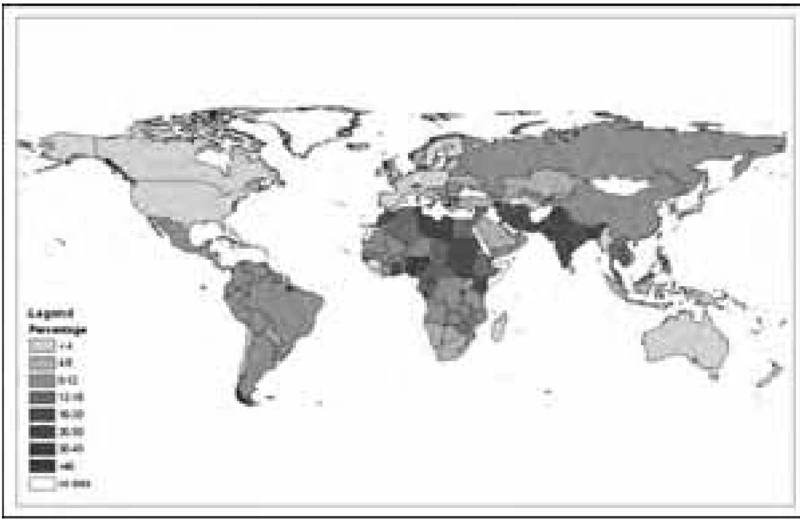
Agriculture offers a much more contrasting picture, with peaks of protection in HICs such as Iceland (63.6 percent), Israel (33.4 percent), Japan (28.2 percent), Norway (74.4 percent), South Korea (36.8 percent), Switzerland (54.0 percent), and in MICs such as Egypt (41.5 percent), India (58.4 percent), Morocco (40.8 percent), Nigeria (42.6 percent), Thailand (38.8 percent), Tunisia (46.3 percent) and Turkey (35.3 percent)[5]. Dispersion of agricultural protection across countries is high in Africa and Asia, but low in South America. In Africa, agricultural protection is relatively low in Western Sub-Saharan Africa, higher in the South African region, and even higher in the Central African and North African regions (see Figure 6.2).

[4] See Boumelassa, Laborde, and Mitaritonna (2009) for a presentation of the 2004 release of the MAcMap-HS6 database.

[5] See Annex 1 for country details.

Figure 6.1

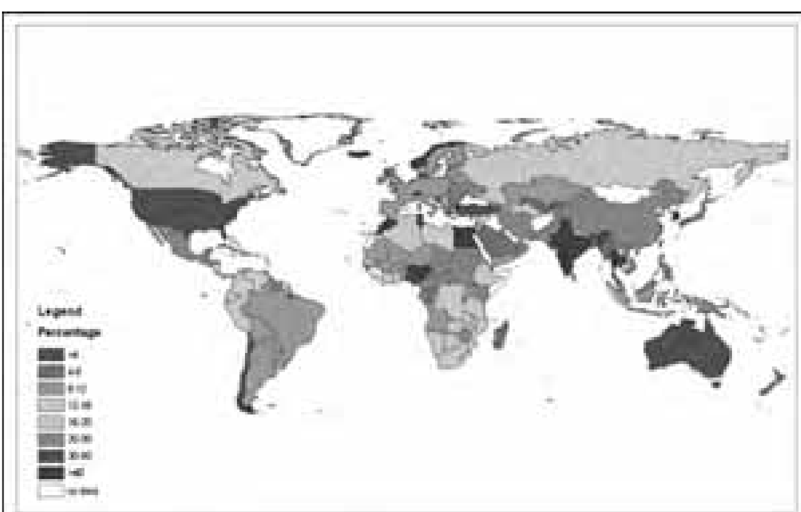
Protection applied to imports – 2004



Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

Figure 6.2

Protection applied to agricultural imports – 2004



Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

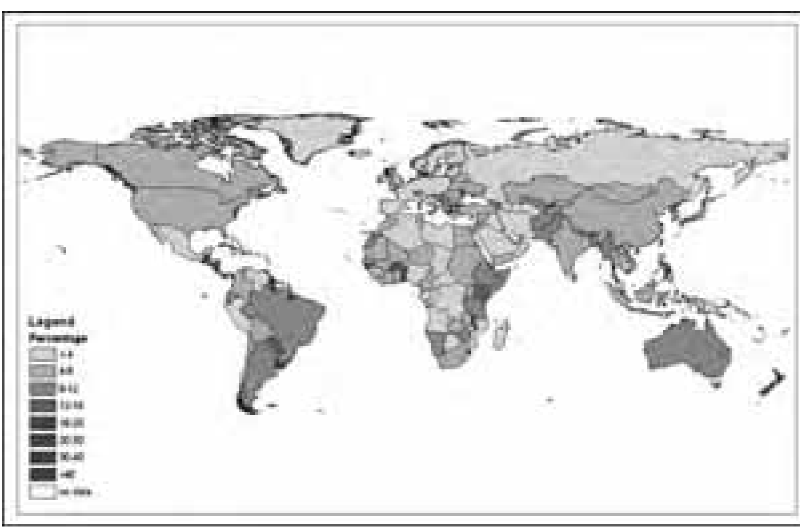
At the global level only a few countries face very restricted access to foreign markets: Guyana, Fiji, Moldova, Belize, Malawi, Uruguay, Swaziland, and Guatemala (see Figure 6.3)[6]. They tend to be small countries very specialized in highly protected products such as sugar, meat and tobacco.

Once again, at the agricultural level, protection faced by exports differs vastly across developing countries. Protection faced by agricultural exports ranges from a very low level for Comoros (1.6 percent) to an amazingly high level of 107.2 percent for Guyana (see Annex 6.1).

The agricultural exports of 107 countries out of 179 are restricted by average tax rates of more than 15 percent. Twenty-nine countries face average tax rates of more than 30 percent and five countries face an average protection of more than 50 percent: Armenia (54.6 percent), Fiji (77.2 percent), Guyana (107.2 percent), Mauritius (53.0 percent), Saint Kitts and Nevis (53.6 percent)[7]. The dispersion of protection faced by agricultural exports within each continent is high (Figure 6.4).

Figure 6.3

Protection faced by exports – 2004



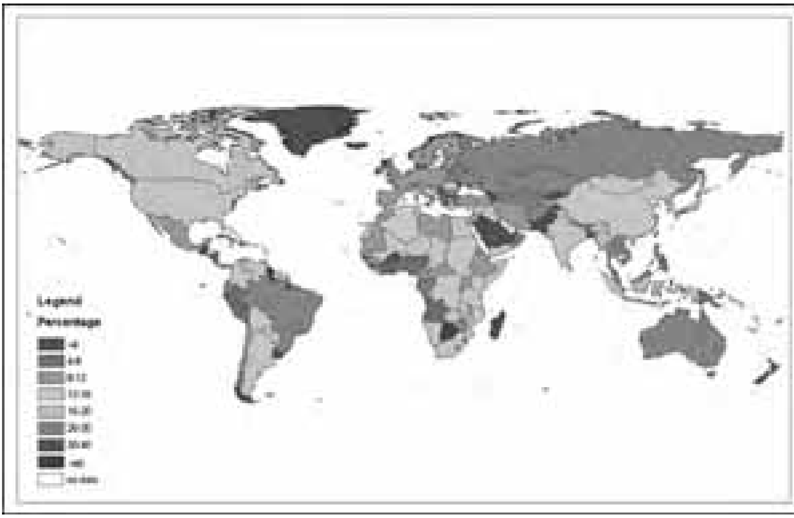
Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

6 See Boumelassa, Laborde, and Mitaritonna (2009).

7 See Annex 1 for country details.

Figure 6.4

Protection faced by agricultural exports – 2004



Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

Of course import tariffs are not the only barrier to trade. Non-tariff barriers can substantially impede trade and are often more severe in the agricultural sector. Disdier, Fontagné and Mimouni (2008) show that Sanitary and Phyto-Sanitary (SPS) and Technical Barriers to Trade (TBT) measures are prominent in the OECD agricultural sector and negatively influence total OECD imports. Their estimations also suggest that SPS and TBT significantly reduce developing countries' and LDCs' exports to OECD countries while having no significant impact on trade between OECD members.

Table 6.1 and Appendix 6.1 show clearly that both TRQs and preferential access, either under regional agreements or non-reciprocal preferences, substantially decrease the level of applied protection in agriculture: for example at the world level the average applied tariff of 18.9 percent is the result of an average initial MFN tariff of 24.7 percent adjusted down by TRQ (3.1 percent) and preferences (2.7 percent) margins. This is the case in OECD countries in particular, such as Canada, Switzerland and Japan (Annex 6.1).

At the world level, specific tariffs represent about 43 percent of agricultural protection. While for more than three-fourths of countries for which protection is assessed the share of specific tariffs in total protection is nil, many rich countries such as in the EU, and Iceland, Israel, Japan, New Zealand, Switzerland, Norway and the

USA, use specific tariffs extensively (Annex 6.1). The restrictive impact of a specific duty varies with the level of import prices. This means that the restrictiveness of agricultural protectionism changes from one year to the next, adding a new source of cost for agricultural exporters.

Of course the average duty placed on a country' exports depends on the composition of exports (which itself depends on the structure of protection faced). Table 6.2 gives the level of protection for 24 agricultural sectors corresponding to the HS2 classification. The column 'World average' is the world protection calculated using the MAcMap-HS6 methodology, and the column 'Simple average' is the arithmetic average of national average protection. The last two columns provide the percentage of countries where average protection is higher than 20 percent and 40 percent, respectively.

Protection is very high for 'Sugar and sugar confectionary', 'Meat and edible meat offal', 'Dairy products' and 'Tobacco and manufactured tobacco substitutes' corresponding to HS2 chapters 17, 2, 4 and 24, respectively. For a few HS2 chapters, 'Meat and edible meat offal', 'Dairy produce', 'Cereals' and 'Sugars and sugar confectionery', the World average, which takes into account the trade importance of the importing country, is higher than the Simple average, indicating that globally large countries tax these products more than small countries. But in the case of 'Beverages, spirits and vinegar', for example, the Simple average is higher than the World average, indicating that globally small countries tax these products more than rich countries.

Table 6.2 also shows that protection is higher on meat and animal products than on live animals, higher on products of the milling industry than on cereals, and higher on processed food than on raw commodities. In Table 6.3, which aggregates products according to their degree of transformation, processed products are taxed at a higher level than semi-processed products, and unprocessed products have the lowest protection. Both tables point to the presence of substantial tariff escalation, which hurts all groups of exporting countries.

TABLE 6.2

World protection of agricultural products at the HS2 level

HS2 chapter #	Sector description	World average[1]	Simple average[2]	>20 percent	>40 percent
			(percent)		
1	Live animals	12.6	12.9	12.3	4.1
2	Meat and edible meat offal	38.5	27.7	41.8	13.7
3	Fish and crustaceans	6.7	15.8	30.8	4.8
4	Dairy, eggs, honey and ed. products	37.4	23.2	30.1	15.1
5	Products of animal origin nsp.	4.6	10.2	17.8	2.1
6	Live trees and other plants	7.7	20.0	16.4	6.2
7	Edible vegetables and certain roots and tubers	13.6	20.2	28.8	7.5
8	Edible fruits and nuts, peel of citrus/melons	14.7	21.0	40.4	8.9
9	Coffee, tea, maté and spices	6.4	15.4	23.3	4.1
10	Cereals	25.4	13.9	15.1	6.8
11	Milling industry products	27.4	16.4	21.2	6.2
12	Oil seeds/misc. grains/med. plants/straw	5.6	7.5	8.2	1.4
13	Lac., gums, resins and other veg. saps and extracts	4.5	7.3	7.5	0.7
14	Vegetable planting materials	5.9	8.1	6.8	1.4
15	Animal or vegetable fats, oils and waxes	19.3	16.0	25.3	6.2
16	Edible preparation of meat, fish, crustaceans, etc.	14.4	22.9	39.7	8.9
17	Sugars and sugar confectionery	47.8	22.9	43.8	10.3
18	Cocoa and cocoa preparations	6.4	17.1	29.5	4.8
19	Preparations of cereals, flour, starch or milk	15.7	17.2	28.8	2.1
20	Preparations of vegetables, fruit, nuts, etc.	16.5	22.9	41.8	8.9
21	Miscellaneous edible preparations	15	18.3	28.8	4.8
22	Beverages, spirits and vinegar	23.6	55.7	65.1	33.6
23	Residues from food industries, animal feed	10.4	8.7	8.2	0.7
24	Tobacco and manufactured tobacco substitutes	30.1	54.1	52.1	21.2

Source: Authors' calculations based on MAcMAP-HS6 version 2. Year 2004.

Notes: [1] Average tariff computed following the MAcMap-HS6 methodology (see Boumelassa, Laborde, and Mitaritonna 2009).
[2] Simple arithmetic average.

Table 6.3

Tariff escalation: applied tariffs evaluated

Sectors	Group of exporters: High-Income Countries	Middle-Income Countries	Least-developed Countries	World
	(in percent)			
All	18.2	20.0	14.5	18.9
Beverages and spirits	16.1	23.0	29.4	18.1
Candies processed	11.8	16.3	33.8	13.6
Chemicals, semi-finished manufactures	9.9	16.9	18.8	11.0
Cocoa semi-processed	4.5	3.9	3.1	4.2
Dairy processed	38.7	42.4	24.4	39.2
Eggs, honey, nuts and spices unprocessed	16.3	11.8	3.9	12.7
Fish unprocessed	7.2	6.0	n.a.	7.1
Flours and groats semi-processed	22.3	26.9	20.2	23.6
Flowers, plants, vegetable materials, etc.	6.9	6.1	6.6	6.6
Fruit and vegetables fresh or dried	11.0	16.1	18.5	13.8
Fruit and vegetables prepared or preserved	15.5	14.3	9.1	14.9
Fruit and vegetables semi-processed	11.0	13.7	4.2	12.6
Grains	19.6	31.9	32.2	24.7
Live animals	12.4	13.2	10.4	12.5
Meat, prepared or preserved and other meat products	31.1	40.8	18.1	33.6
Milk unprocessed and semi-processed	41.3	42.3	22.0	41.4
Oils and fats processed	9.8	14.7	18.9	13.1
Oilseed unprocessed and semi-processed	5.0	6.7	12.6	5.9
Other agricultural products processed	14.9	14.1	11.5	14.8
Other agricultural products semi-processed	5.5	5.1	1.4	5.3
Other agricultural product, unprocessed	5.0	6.9	4.6	5.6
Starch, flour products, condiments processed	15.8	18.2	23.4	16.3
Sugar semi-processed	38.1	57.9	50.7	51.0
Tea, coffee and cocoa processed	16.1	17.1	12.4	16.3
Tea, coffee and cocoa unprocessed	6.5	4.5	6.7	4.9
Tobacco manufactured	27.6	29.6	43.5	28.2
Tobacco unmanufactured	24.9	31.0	25.5	28.3

Source: Authors' calculations based on MAcMap-HS6 version 2. Year 2004. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

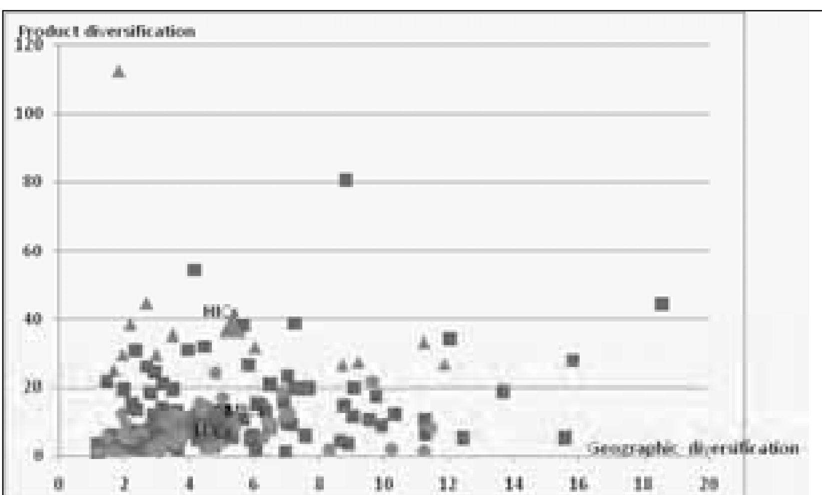
6.1.2 Some agricultural trade characteristics of developing countries

The group of developing countries brings together economies with vastly different potential in agriculture. We characterize developing countries' agricultural trade with the help of two trade indicators.

The first one is an indicator of agricultural export diversification represented by the inverse of the Herfindahl index computed at the HS6 level so the higher the index the more diversified the exports. Figure 6.5 plots the degree of agricultural export diversification in terms of products exported (vertical axis) and geographic destination (horizontal axis) for three groups of countries classified by income levels: HICs are represented by triangles, MICs by squares and LDCs by circles. The simple average for a group of countries is represented by a larger-size shape of the corresponding group (averages for MICs and LDCs are close to their acronyms).

FIGURE 6.5

Agricultural product and market export diversification indicators – by country and group of countries – 2002-2004



Source: Authors' calculations based on BACI database (www.cepii.fr)[8].
Notes: Triangles represent HICs; squares represent MICs; and circles represent LDCs

[8] These statistics include intra EU-trade. Excluding this trade lowers the indicator of sector diversification of the EU, which remains the most diversified region in terms of products exported.

While all groups of countries are characterized by a large dispersion of the geographic diversification index, HICs and MICs are also relatively diversified in terms of products. LDCs' main feature is a low product diversification. This is true with respect to all products (LDCs rich in oil – Angola, Chad , Equatorial Guinea, Nigeria, Sudan, Yemen, Guinea-Bissau, Rwanda[9] -- or in precious metals – Central African Republic, Congo DR, Mali, Burundi[10] -- or metals –Mozambique in aluminum, Zambia in copper) but also for agriculture. In 2002-2004, 59.4 percent of Burkina Faso's total exports were cotton and 53.8 percent of Malawi's total exports were tobacco and manufactured tobacco substitute. In the same period three countries were highly specialized in the exportation of coffee: Ethiopia (32.4 percent of total exports), Madagascar (22.2 percent) and Uganda (25 percent); and of cacao: Sao Tome and Principe (27.8 percent), Ghana (34.1 percent) and Cote d'Ivoire (36.1 percent). Two were specializing in fish and crustaceans: Senegal (23 percent) and Namibia (20.1 percent), while 38 percent of total exports from Benin were cotton.

The second trade indicator is the net trade balance. Most trade distortions are imposed on the agricultural sector such that global liberalization would benefit net exporters and hurt net importers of agricultural commodities. Moreover, the food trade balance is an important indicator of the dependence of countries on the rest of the world for their food supply. Table 6.4 indicates net trade balances in agriculture and food for LDCs averaged over the 2002-2004 period, and Table 6.5 provides the same information for MICs.

About half of the LDCs are net importers of agricultural products (24 out of 49 LDCs represented in Table 6.4). Among net importers, 14 have a deficit greater than 3 percent of their Gross Domestic Product (GDP) and 5 have a deficit higher than 10 percent of GDP: Yemen, Maldives, Mauritania, Eritrea and Djibouti (ranked in increasing order)[11]. On the surplus side only five countries have a significant surplus in agriculture (greater than 5 percent of GDP): Guinea-Bissau, Gambia, Comoros, Malawi and Sao Tome and Principe (ranked in increasing order).

In the case of LDCs, the net food trade balance reflects patterns that are similar to the net agricultural trade balance except for Malawi, which massively exports tobacco and tobacco products, and Burkina Faso, which exports cotton.

MICs exhibit the same heterogeneity: 56 out of 109 countries experience a net agricultural trade deficit and 24 have a deficit greater than 3 percent of GDP. For 12 MICs this deficit is higher than 5 percent of GDP: Albania, Dominica, Grenada,

[9] Most of these countries' exports are concentrated in HS2 chapter 27: "Mineral fuels, oils, waxes and bituminous sub".

[10] Most of these countries' exports are concentrated in HS2 chapter 71: "Pearls, stones, precious metals, imitation jewelry, coins".

[11] It is expected that a small country will experience a large deficit in agriculture and/or food because presumably it is more specialized.

Georgia, Armenia, Mongolia, Saint Lucia, Suriname, Seychelles, Bosnia and Herzegovina, Jordan and Saint Kitts and Nevis.

Conversely, 23 MICs have a net agricultural trade surplus greater than 3 percent of GDP. This surplus is especially high for Ecuador, Papua New Guinea, Belize, Uruguay, Uzbekistan, Fiji, Argentina, Moldova, Costa Rica, Guyana, Zimbabwe, Paraguay, Côte d'Ivoire and Swaziland.

Among net agricultural exporters, some countries have a very small net food trade surplus (Swaziland, Moldova, Uzbekistan) and some countries are food-deficit (Zimbabwe and Tajikistan).

Table 6.4

Net agricultural trade balance – LDCs (2002-2004 average)

Country	Food Trade Balance	Agriculture Trade Balance	Country	Food Trade Balance	Agriculture Trade Balance
Afghanistan	1.4	1.9	Liberia	2.0	4.3
Angola	-3.9	-5.3	Madagascar	4.7	4.4
Bangladesh	-2.8	-3.9	Malawi	0.5	16.7
Benin	-6.6	-2.8	Maldives	-11.5	-13.6
Bhutan	-1.9	-1.9	Mali	-2.3	3.3
Burkina Faso	-1.5	4.8	Mauritania	-17.8	-21.9
Burundi	-2.0	-2.1	Mozambique	-4.3	-3.0
Cambodia	-1.8	-4.6	Myanmar	1.3	0.6
Cape Verde	0.2	0.3	Nepal	-1.4	-2.1
Central African Republic	-2.0	-1.2	Niger	-2.8	-4.0
Chad	-0.5	0.7	Rwanda	-0.3	-0.7
Comoros	8.6	9.9	Samoa	2.7	3.3
Congo (Democratic Rep.)	-3.0	-3.3	Sao Tome and Principe	17.3	18.0
Djibouti	-24.3	-30.6	Senegal	-7.1	-7.0
East Timor	1.0	1.1	Sierra Leone	1.5	2.5
Equatorial guinea	-1.1	-2.2	Solomon islands	-0.2	-1.4
Eritrea	-23.5	-24.4	Somalia	3.6	4.1
Ethiopia	0.6	1.0	Sudan	-1.0	-0.7
Gambia	7.9	9.0	Tanzania	0.0	1.2
Guinea	1.3	1.4	Togo	-4.8	-5.1
Guinea-Bissau	9.5	7.7	Uganda	1.1	2.8
Haiti	0.6	0.8	Vanuatu	1.8	0.8
Kiribati	3.1	3.4	Yemen	-10.1	-10.7
Lao People's Democratic	-1.4	-3.5	Zambia	-0.6	1.4
Lesotho	-0.7	-1.4			

Source: Authors' calculations based on BACI and CHELEM databases (CEPII, Paris).
Note: Net trade balance as a percentage of GDP=100*(Total exports – total imports)/GDP).

Table 6.5

Net agricultural trade balance – MICs (2002-2004 average)

Country	Food Trade Balance	Agriculture Trade Balance	Country	Food Trade Balance	Agriculture Trade Balance
Albania	-4.3	-5.2	Croatia	-1.7	-1.8
Algeria	-4.1	-4.5	Cuba	-1.5	-1.0
Anguilla	2.7	4.2	Dominica	-4.0	-5.5
Antigua and Barbuda	-3.7	-3.5	Dom. Republic	-1.1	-0.9
Argentina	6.7	9.3	Ecuador	6.0	5.8
Armenia	-6.1	-6.4	Egypt	-2.7	-3.1
Aruba	2.3	4.1	El Salvador	-1.7	-2.4
Azerbaijan	-3.7	-3.6	Fiji	6.7	8.4
Bahamas	-2.9	0.8	French Polynesia	0.5	0.6
Bahrain	-4.0	-4.9	Gabon	-2.1	-2.5
Barbados	-3.9	-3.7	Georgia	-6.5	-5.9
Belarus	-0.2	-1.3	Ghana	2.6	1.2
Belize	7.8	6.5	Gibraltar	0.5	0.7
Bermuda	-1.4	-2.3	Grenada	-4.3	-5.7
Bolivia	1.0	3.6	Guatemala	2.8	2.5
Bosnia and Herzegovina	-7.6	-10.1	Guyana	15.4	14.0
Botswana	-1.7	-2.2	Honduras	4.6	4.3
Brazil	2.7	3.4	India	0.3	0.4
Brunei Darussalam	-3.2	-4.1	Indonesia	1.4	1.1
Bulgaria	0.6	0.8	Iran	-1.2	-1.5
Cameroon	1.3	1.8	Iraq	0.9	1.1
Chile	2.2	2.7	Jamaica	-3.0	-2.9
China	0.1	0.0	Jordan	-9.6	-11.4
Colombia	1.8	1.5	Kazakhstan	0.3	0.5
Congo	-4.0	-4.5	Kenya	4.3	4.3
Costa Rica	10.6	10.3	Korea, D. P. Rep.	0.3	0.4
Côte d'Ivoire	17.7	18.2	Kuwait	-2.0	-2.2

Source: Authors' calculations based on BACI and CHELEM databases (CEPII, Paris).
Note: Net trade balance as a percentage of GDP=100*(Total exports – total imports)/GDP).

In this section, we have been able to give evidence that developing countries form a very heterogeneous group in terms of protection and trade patterns. Regarding protection, some regions have a pattern of high protection while others are more moderate or highly diverse. Agriculture is usually more protected than non-agriculture, and this is particularly true in OECD countries. A significant number of developing countries face very high protection on their agricultural exports, and it can be all the more negative that these countries are usually highly concentrated in their exports. Furthermore, developing countries can be hurt by the presence of substantial tariff escalation. While a large number of LDCs and MICs are net agricultural and food importers, few countries have a trade deficit that exceeds 5 percent of GDP and nearly a fourth of MICs experience a trade surplus in agriculture and food.

6.2 The relative impacts of market access versus domestic support on agriculture in developing countries: An overview of model-based assessments

Economic literature on the potential impact of agricultural liberalization on developing countries has been prolific since 2000. In particular, assessments of the effects of trade liberalization using CGE models have multiplied. Increased access to economic data, increased efficiency in calculation time, and development of the Global Trade Analysis Project (GTAP) network explain this proliferation.

Without being exhaustive, our survey reviews 13 CGEM assessments of the impact of full trade liberalization on the world from 1999 to 2005 (Table 6.6)[12]. In spite of substantial differences between the models, it is possible to extract from these studies various conclusions of key importance:

i. Full trade liberalization is beneficial although the gains are modest. The world welfare gains estimated by these studies range from 0.2 percent (Dessus, Fukasaku, and Safadi 1999) to 0.9 percent (World Bank 2002 scenario 1). When the CGE supposes that trade openness is linked to total factor productivity, the gains are even higher, ranging from 1.4 percent (World Bank 2004 scenario 2) to 3.1 percent (Dessus, Fukasaku, and Safadi 1999). Although they show that welfare increases at the world level, not all countries or economic agents benefit. For example, in the Cline (2004) study, Malaysia, Mexico and China are potential losers; in Hertel and Keeney (2005) study, the Philippines, Bangladesh and Mozambique, as well as the regional groups labeled rest of Latin America and rest of Sub-Saharan Africa, are potential losers of full trade liberalization.

[12] This section is largely inspired by Bouet (2008).

ii. Liberalizing agriculture is the main source of expected gains, accounting for about two thirds of global gains. This stems from the fact that a major part of current trade barriers and nearly all export subsidies and domestic support are in agriculture[13]. The studies in Table 6.6 show that, in most cases, agriculture liberalization contributes to two-thirds of the gains from trade.
iii. Tariffs are by far the main source of distortions. Consequently, they account for more than 90 of expected benefits from full liberalization (Van der Mensbrugghe and Beghin 2005; Anderson, Martin, and Van der Mensbrugghe 2005, Francois, Von Meijl, and Van Tongeren 2005; and Hertel and Keeney 2005).
iv. Developing countries could be significant beneficiaries of these reforms. Given their relatively small GDP, the percentage change in real income is higher than for richer countries. Thus, trade reform can be seen as progressive because it relatively benefits the real income of poor countries more (The World Bank 2002 and 2004; and Van der Mensbrugghe and Beghin 2005).
v. Liberalizing trade policies of developing countries is a major issue and is predicted to contribute about half of expected benefits (The World Bank 2002 and 2004; and Francois, Von Meijl, and Tongeren 2005).

Table 6.6

Results from CGE model-based assessments of trade liberalization: percentage contribution to world welfare gains.

	Dessus, Fakasaku and Safadi (1999)	Dessus, Fakasaku and Safadi (1999)	Anderson et al. (2000)	The World Bank (GEP 2002) 1	The World Bank (GEP 2002) 2	The World Bank (GEP 2004) 1	The World Bank (GEP 2004) 2	Cline (2004) 1	Cline (2004) 2	Van der Mensbrugghe and Beghin (2005)	Anderson, Martin and Van der Mensbrugghe (2005)	Francois, Von Meijl and Tongeren, (2005)	Hertel and Keeney (2005)
							(in percent)						
Role of agriculture in total gains	na	na	65	69	71	66	69	57	na	69	63	65	66
Role of tariffs in total gains	na	na	na	Na	na	Na	na	na	na	99	93	91	95
Share of developing countries in total benefits	22	38	43	52	65	55	67	38	47	56	30	8	26
Role of developing countries policies in total gains	na	na	45	55	66	62	62	44	na	na	45	58	na

Source: Bouët 2008.

[13] Large gains in world welfare are expected from liberalization in services, but these estimates should be viewed with caution.

The most convergent conclusion of these studies is the role of tariffs: tariff liberalization contributes by more than 90 percent to an increase in world welfare. Other types of analysis confirm this point of view. For example, Hoekman et al. (2003) assess the relative impact of tariffs and domestic support policies on the exports and welfare of developing countries through a partial equilibrium model in which the impact of a 50 percent global reduction in agricultural tariffs is compared to a 50 percent cut in domestic support. They find that in welfare terms, tariffs matter significantly more than subsidies: tariff reductions generate welfare gains that are substantially greater than reductions in support policies.

Similarly, a more recent study by Tockarik (2005) estimates that world welfare gains from agricultural liberalization by developed countries are nearly 10 times greater when tariffs are removed than when subsidies are removed. Developing countries would reap 88 percent of the world welfare gains generated by their own agricultural policy liberalization.

Different explanations of the relative prominent role of market access vs. domestic support can be provided:

i. Tariffs directly hinder trade. They are implicitly a distortion affecting consumption and production; the economic theory of protectionism underlines that it is equivalent to the combination of a consumption tax and a production subsidy (Corden 1977, Vousden 1990). On the other hand, domestic support is for the major part only a production subsidy;
ii. Tariff is a distortion more prominently adopted in agriculture.

> «most countries apply tariffs to all agricultural products, not just those that are subsidized…" and "because of high tariff peaks in OECD countries and because developing countries also use tariffs to protect domestic production", it follows that "any comparison of the effect of reducing tariffs on all agricultural goods with a reduction in support policies would conclude that tariffs are more important for developing countries » (Hoekman et al., 2003).

According to the GTAP database estimates of support to global agriculture and processed food in 2001, direct domestic subsidies amounted to $US 97 billion, import barriers to $US 691 billion and export subsidies to $US 61 billion. It follows that in 2001 import barriers represented 81.4 percent of total support to agriculture in all countries (see Anderson et al., 2006). Furthermore, because domestic support is partly decoupled it is less distortive;
iii. Tariff dispersion is high not only in terms of products but also in terms of partners (because of regional agreements, preferential schemes and tariff rate quotas). According to the Harberger Triangle effect, the welfare loss due to a tariff increases with the square of the tariff rate, so the cost of protection would increase with the level of dispersion;

iv. The relative cost of market access vs. domestic support increases the higher the demand elasticity and the lower the supply elasticity. In agriculture, demand elasticity is low, but supply elasticity is also low because of many inhibiting factors. In many studies the elasticity of demand for agricultural products is overestimated. This leads to an overestimation of the market access gains. Indeed, taking the example of Japan, a large, heavily protected market, model results lead to import surges driven by increase in demand. However, the probability of seeing such a rise is limited due to saturation effects of the food markets. The liberalization of this market will still benefit the local consumers and will lead to market share reallocation across exporters, but will have limited trade creation effects.

Nevertheless, the modelling techniques used to represent both pillars (tariffs and domestic support) are different and subject to different limitations. Modelling tariffs in a CGEM are straightforward, in most cases using an *ad valorem equivalent* very close to the real policy. Treatment of specific tariffs and TRQs may be tricky, but improvements in the quality of data have helped to tackle these issues. On the contrary, modelling domestic support policies is much more challenging. Agricultural policies use different tools and are very heterogeneous. They combine statutory and contingent measures and cover various form of subsidies (on factors, inputs, production), with or without conditionality. Their representation in most CGE models, in particular worldwide models, is incomplete and imperfect. For instance, the degree of coupling of some direct payments is still a source of intense debate among academics (see de Gorter, 2009 and Skully, 2009 on this issue), and therefore the effective level of distortions of the WTO "green box" payments, assumed to be non-distortive, is delicate to assert. In particular, none of the usually adopted CGE models include the incidence of these policies on the production decisions of the farmers through wealth effects and risk behaviour. Last, the interaction between domestic support and border protection is poorly represented. Simulating trade liberalization scenario without considering production quota, linked to "blue box" payment for instance, will overestimate the gains of trade liberalization: partial liberalization will only reduces domestic prices and quota rents without creating new trade flows and reallocation of factors. Femenia and Gohin (2007) illustrate these different issues and show that, depending on the assumption made, the hierarchy between domestic support and market access pillars can be reversed.

Most of the recent CGEM studies reviewed in this section on the effects of full trade liberalization conclude similarly on a number of points. They all show that world welfare increases from liberalization, although the benefits are small. The gains are not distributed evenly across countries and some countries may lose. More relevant to this paper, they maintain the relative importance of tariff removal over domestic support reforms in generating welfare gains from trade liberalization at the world level and for developing countries.

6.3 Alternative scenarios and methodology

Building on the evidence presented, we analyse the impact of market access restrictions vs. domestic support using the MIRAGE CGE model of the world economy, with protection data coming from the MAcMap-HS6 database. We simulate a Doha Development Agenda (DDA) scenario, first as it has been defined through the July 2008 agenda, and second by excluding domestic support from the liberalization process. The same approach is applied to a full trade liberalization scenario. The remainder of this section offers a methodological overview followed by a detailed description of each scenario.

6.3.1 Methodology

Tariff reform is implemented at the HS6 product level using the MAcMap-HS6v2.1 database (Laborde, 2008) of bound and applied tariff data for 2004 (for 5,113 products, 170 importing countries, and 208 exporting countries)[14]. We add several updates to take into account all major changes that occurred up to 2008, the starting date of our simulation, including major regional trade agreements (RTA), new WTO members (such as Ukraine), and the trade policy consequences of ongoing domestic reforms (such as the EU sugar trade reform). All trade policy scenarios are implemented on a yearly basis according to their respective timeline.

The political economy model developed by Jean, Laborde, and Martin (2008) is used, in which sensitive products are selected for implementing the Doha scenario. The model is extended to define the binding strategy of developing countries in the DDA scenario. Indeed, for a particular scenario, when we combine tariff increases with the DDA implementation, it is very important to have a theoretical basis for defining the new bound tariffs, in particular for countries that benefit from wide flexibilities to achieve their new binding coverage goal (for example, Small and Vulnerable Economies-SVEs, LDCs and initially low-binding countries). In such cases, we replace the applied tariff in the base year, 2004, by the highest tariff during the period 1995-2006 to compute the political cost of any new commitments (see equation 6 in Jean, Laborde, and Martin 2008). In this case, the DDA modalities (WTO 2008) define the overall constraints faced by each country. Finally, when WTO members liberalize under the DDA, market access remains unchanged for non-WTO members.

Tariffs at the HS6 level are aggregated according to the geographical and sectoral aggregations listed in Annex 6.2 and using the reference group weighting scheme methodology (see Boumellassa, Laborde, and Mitaritonna, 2009) before

[14] Slight modifications have been made to the MAcMapHS6-v2.1 dataset: Malaysia's tariffs on tobacco products have been updated (lowered), marginal protection on Chinese cereal TRQs reduced and protection faced on sugar and banana by African, Caribbean and Pacific (ACP) countries in the EU market modified to better capture preference erosion mechanisms.

being implemented in the MIRAGE multi-country, multi-sector dynamic model. We assume perfect competition across all sectors. Based on standard and robust assumptions, it should be noted that the model may underestimate the positive effects of trade reform, particularly when such reform drives new investments, technology improvements, or important trade or production diversification.

In each country a representative consumer maximizes a CES-LES (Constant Elasticity of Substitution – Linear Expenditure System) utility function under a budget constraint that allocates income across goods. The calibration procedure aims to reproduce reasonable price and income elasticities; the latter is a particularly important feature in a dynamic model to control the changes in demand for agricultural commodities led by economic growth. The origin of goods is determined by a CES (Constant Elasticity of Substitution) nested structure following the Armington assumption. In addition, Northern countries are supposed to produce higher-quality industrial goods than those supplied by Southern countries. On the production side, value-added and intermediate goods are complements under a Leontief hypothesis. The value added is a CES function of unskilled labour and a composite of skilled labour and capital, applying less substitutability between the last two production factors. In agriculture and mining, production also depends on land and natural resources. Investment is savings-driven and the current account is assumed to be constant in terms of world GDP. The dynamics of the model come from both exogenous sources (increase in labour force and technical progress) and endogenous forces (capital accumulation and variation in land supply).

Macroeconomic data (such as world trade flows, production, consumption and intermediate use of commodities and services) are provided by the GTAP 7 database. Thirty-three countries are identified in the model, including seven high-income regions (Australia-New Zealand, Canada, EU – 27 countries, European Free Trade Association, Japan, Korea-Taiwan, USA), which map the main trade blocks. We focus on developing countries and isolate 26 developing regions/countries, in particular two LDCs (Bangladesh and Cambodia), and one region only composed of LDCs (called African LDCs: Madagascar, Malawi, Mozambique, Senegal, Tanzania, Uganda and Zambia; see Annex 6.2 for details).

The sectoral decomposition is highly detailed in terms of agriculture and agrifood business (13 sectors), since most of the protection is concentrated in these sectors (in particular in cereals, meat products and sugar). Non-agricultural sectors include ten industrial sectors and two service sectors[15].

The model generates a baseline from 2008 to 2025, which depicts the world without any new multilateral agreement. In order to reflect the trade reforms implemented since 2004, the baseline data is updated with the following:

[15] Sector and geographic decomposition are presented in Appendix 1, with correspondence to GTAP sectors.

- Full free trade agreements (FTA) for ASEAN (Association of South East Asian Nations), CEMAC (Communauté Economique et Monétaire de l'Afrique Centrale – Monetary and Economic Community of Central Africa), COMESA (Common Market for Eastern and Southern Africa) and SADC (Southern Africa Development Community).

- Economic Partnership Agreements (EPA) between ACP (Africa, Caribbean Pacific) countries and the EU;

- Implementation of the EU-India, EU-ASEAN, US-Colombia, US-Oman, US-Bahrain, US-Morocco, US-Australia, Mercosur-Colombia, and China-Chile FTAs.

- All ongoing WTO accession commitments, including those of most recent members (Ukraine, Cape Verde, Viet Nam);

- Updated GSP (Generalized System of Preference) scheme of Japan in favour of LDC countries;

- Modified bound tariffs on EU poultry;

- EU enlargement to Romania and Bulgaria in 2007;

- The end of the EU EBA (Everything But Arms) transitory regime is implemented for protocol products (sugar, banana, and rice).

Simulation results from various scenarios are reported for the year 2025 as percentage changes from the baseline. The analysis does not account for the surge in world prices of energy and food products between 2004 and 2008.

5.3.2 Alternative trade scenarios

The analysis in this study includes four scenarios:

(i) DDA: Doha with domestic support reform
(ii) DDAwoDS: Doha without domestic support reform
(iii) FTL: Full trade liberalization with elimination of domestic support
(iv) FTLwoDS: Full trade liberalization without elimination of domestic support

The DDA scenario represents a successful Doha outcome based on July 2008 modalities. Even if the general philosophy of progressive tariff-cut formulas for both agricultural and nonagricultural goods is simple, various flexibilities have been introduced with different degrees of special and differential treatment for different groups of developing countries. Following previous research (Laborde, Martin, and van der Mensbrugghe 2008; and Berisha et al. 2008), this scenario implements all the details of these modalities in terms of market access, including tariff-cutting formulas, country and product flexibilities (sensitive and special products) as well as special provisions for tariff escalation, tropical products and long-standing preferences[16]. The scenario does not account for any changes in the sectoral initiative due to the lack of agreement on this issue.

For the duty-free-quota-free market access initiative for LDCs and OECD countries (excluding South Korea but including Mexico and Turkey), we assume a 3 percent exemption clause in terms of products[17]. Export subsidies are phased out by 2013 for developed countries. Concerning domestic support, this scenario includes the overall constraint on Overall Trade Distorting Support (OTDS) for the USA and the EU. In contrast to most traditional exercises where domestic support commitments are translated in *ad valorem* or specific subsidy caps for current applied policies, we explicitly introduce the OTDS as an overall limit for domestic support spending for each year. In the dynamic context and due to the growth of production in the baseline, the initial agricultural subsidy rates, based on 2004 prices, may lead to a violation of the new commitments. In our simulation, it appears that only the USA will face a real constraint, forcing it to modify its production-distortive programmes[18]. With the reduction scheme of the OTDS on one hand, and the increasing production on the other, we estimate that subsidy rates of production and on some primary factors could start to decrease by 2011 to 50 percent of their original value by 2025 in order to be consistent with the final $US 16.4 billion limit. Any domestic support reduction will impact all sectors in a uniform way. Since this paper focuses on tariffs and tariff changes across scenarios, we have neither introduced a programme-specific modelling of domestic support policies, nor a political economy model aimed at explaining how domestic support reduction across commodities will be handled.

Due to the complexity of integrating other elements of the DDA agenda in the simulations, other sources of potential gains are omitted, such as liberalization in services, WTO rules, trade facilitation and intellectual property rights.

6.4 Results

6.4.1 Impact on protection and market access

At the world level, the DDA scenario reduces overall protection by 22 percent relative to the baseline, from 4.6 percent to 3.6 percent (Table 6.7).

[16] A full description of the modalities implemented in this study is provided in Laborde, Martin, and van der Mensbrugghe (2008). This scenario is based on the July 2008 Modalities (WTO documents TN/AG/W/4/Rev.3, TN/MA/W/103/Rev.2).

[17] This scenario mimics Scenario F in Berisha et al. (2008).

[18] The recent CAP reform allows the EU to largely reallocate the domestic programme to the green box.

Table 6.7 compares by groups of countries the protection applied on imports and faced by exports between the baseline and the DDA scenario. Under the DDA scenario, applied protection is cut by one-third for HICs and one-tenth for MICs, a significant achievement when compared to previous GATT rounds.

Table 6.7

Protection applied on imports and faced by exports by groups of countries

	Protection applied on imports		Protection faced on exports	
	Baseline	DDA	Baseline	DDA
High-Income Countries				
Agricultural products	15.6	10.3	16.1	11.9
Industrial goods	2.2	1.4	3.8	3.0
All sectors	3.0	1.9	4.6	3.6
Middle-Income Countries				
Agricultural products	18.3	17.6	17.1	13.8
Industrial goods	7.9	7.0	4.0	3.0
All sectors	8.6	7.8	4.6	3.6
Least-Developed Countries				
Agricultural products	11.6	11.6	9.9	8.2
Industrial goods	9.2	9.2	3.9	2.7
All sectors	9.8	9.8	4.0	3.2
World				
Agricultural products	16.4	12.6	16.4	12.6
Industrial goods	3.9	3.0	3.9	3.0
All sectors	4.6	3.6	4.6	3.6

Source: MAcMap-HS6v2.1, TRAINS, and authors' calculations (reference group weighting scheme).
Note: Figures in the baseline column may differ slightly from Table 5.1 and Appendix 1 figures due to the trade policy changes implemented in the baseline.

Implementation of the July 2008 package gives better access to HICs markets: from 3.0 percent down to 1.9 percent in all sectors, but from 15.6 percent to 10.3 percent in agriculture. On the other hand, the change in applied protection by MICs, from 8.6 percent down to 7.8 percent in all sectors and from 18.3 percent down to 17.6 percent for agricultural products, is small. It is nonexistent for LDCs.

It is worthwhile examining which groups of countries are most severely affected by this scenario in terms of access to foreign markets. In relative terms, the DDA scenario manages to deliver homogeneous market access gains, with an average decrease of about 20 percent of the tariffs faced by three groups of countries: from 4.6 percent to 3.6 percent for both HIC and MIC countries, and from 4.0 to 3.2 percent for LDCs. But in absolute terms in agriculture the DDA scenario gives more to HICs (-4.2 percent, from 16.1 percent down to 11.9 percent), then to MICs

(-3.3 percent, from 17.1 percent down to 13.8 percent), while the gain in access to foreign agricultural markets for LICs is minor (only -1.7 percent, from 9.9 percent down to 8.2 percent). This is a key element to be taken into consideration when evaluating how this agreement could boost poor countries' agricultural exports.

6.4.2 Economic impacts

The MIRAGE CGE model is used to assess the economic impact of the various scenarios by 2025 and identify the role played by tariff reductions and domestic support.

Economic impacts at the global level

Table 6.8 presents the global results from all scenarios expressed as percentage changes relative to the baseline in 2025. Under the DDA scenario, which includes only the tariff liberalization and domestic support discipline components of the DDA agenda, world trade increases only slightly, by 1.94 percent (US$ 319 billion), and world real income by US$ 51 billion in 2025. This confirms the findings in Decreux and Fontagné (2006) and in Bouet, Mevel, and Orden (2006). In the current study the gains are slightly lower because it starts from a baseline with already reduced tariffs resulting from the numerous RTAs implemented before the DDA. It is noteworthy that developing countries' agro-food exports are less favoured by this liberalization than rich countries' agro-food exports (+4.3 percent vs. +6.1 percent). This is a direct consequence of the more pronounced improvement in access to foreign agricultural markets for HICs, as noted earlier.

The impact of domestic support liberalization is assessed by comparing the results on trade and welfare between the DDA (with domestic support reform) and the DDAwoDS (without domestic support reform) scenarios. The contribution from domestic support liberalization under the DDA scenarios is very small in the case of welfare, and is negative in terms of trade: world exports increase more when domestic support is not removed. This is explained by the maintenance of export subsidies that clearly support agro-food exports[19].

Welfare is not affected by domestic support reform under the Doha scenarios, which looks normal as the Doha Round does not succeed in significantly cutting the applied level of subsidies, while under full trade scenarios, the world experiences small gains from liberalizing domestic support (Table 6.8): under this scenario domestic support is effectively cut, contrary to what happens under the DDA scenario. The share of tariff removal in total welfare benefits from liberalization

[19] In our scenarios a trade reform, either DDA or FTL, consists of cuts in tariffs, domestic subsidies and export subsidies, while the sensitivity analysis, either DDAwoDS or FTLwoDS, consists only of cuts in tariffs.

TABLE 6.8.

Global results under various scenarios: changes relative to the baseline in 2025

Changes from baseline	DDA	DDAwoDS	FTL	FTLwoDS
		(in percent)		
Exports (vol) [(a)]				
World	1.94	1.97	13.59	13.52
Agro-food	5.05	5.65	52.26	54.30
Industry	2.07	2.07	13.37	13.22
North agro-food	6.13	7.68	39.09	49.10
South agro-food	4.27	4.20	61.89	58.06
North industry	2.43	2.41	10.75	10.32
South industry	1.75	1.76	15.78	15.89
Welfare				
World	0.08	0.08	0.58	0.55
North	0.08	0.08	0.61	0.59
South	0.08	0.09	0.49	0.43
		(in $US billions 2004 constant)		
Exports				
World	319	323	2227	2217
Agro-food	42	46	430	447
Industry	267	266	1719	1699
Welfare				
World	51	51	378	361
North	36	39	288	280
South	16	17	97	87

Source: Model simulation results.
Notes: [(a)] excludes EU-Trade and includes services.

is very high (0.55/0.58=95 percent), which confirms the review of literature undertaken in Section 3. However, it is important to recall that the diversity in domestic support programmes from one sector to the other is not well taken into account in this kind of evaluation.

Implementation of full trade liberalization contributes to a substantially higher increase in developing countries' agricultural exports than in rich countries' ones (+62 percent vs. + 40 percent). It is related to MICs' high performance due to initial protection faced by their agricultural exports. Domestic support does not have a significant impact on industrial trade, while removing these distortions increases the rate of growth of poor countries' agricultural exports and decreases that of rich countries. This was widely expected, as domestic support is concentrated inrich countries and agriculture. However the contribution of a removal of domestic support to poor countries' agricultural exports is about 15 times less -58.06/(61.89-58.06) than a complete tariff liberalization.

Economic impact at the country level

In this subsection we focus on the impact of various scenarios on countries' macroeconomic variables. In order to simplify the presentation, we focus on 20 countries/zones instead of 33.

Table 6.9 illustrates how various scenarios affect countries' exports in value. The impact of the Doha agreement is not substantially different from results obtained in previous assessments.

Under DDA, most countries increase exports, with the exception of Bangladesh, Rest of South Asia and Rest of Sub-Saharan Africa. Domestic support liberalization has very little effect on the changes, although it is slightly more beneficial for most countries, except Canada, EFTA, and Mexico.

Table 6.9

Effects on exports by countries under various scenarios: changes relative to the baseline in 2025

Regions	DDA	DDAwods	FTL	FTLwods
		(in percent)		
Argentina	0.64	0.62	8.61	7.64
Australia and New Zealand	2.90	2.77	15.67	14.89
Bangladesh	-4.20	-4.18	44.10	44.43
Brazil	2.34	2.28	24.20	22.91
Canada	0.56	0.59	3.46	3.64
China	3.81	3.81	17.26	17.08
EFTA	0.41	0.50	7.37	7.64
EU 27	2.65	2.72	12.84	12.74
India	1.77	1.76	44.58	43.81
Japan	2.52	2.53	10.34	10.32
Korea and Taiwan	3.17	3.18	16.47	16.46
Mexico	0.98	1.01	8.66	8.46
Middle East and North Africa	0.76	0.79	11.35	11.32
Rest of East Asia	1.01	1.02	15.27	15.22
Rest of LAC	0.86	0.88	20.17	19.84
Rest of South Asia	-2.29	-2.24	21.45	20.95
Rest of Sub-Saharan Africa	-0.35	-0.30	30.67	29.56
Thailand	3.18	3.17	20.31	20.15
Turkey	0.60	0.59	9.57	9.23
United States	1.81	1.83	7.78	7.85

Source: Model simulation results.
Note: Intra-zone trade excluded.

Under FTL, all countries show increases in exports and the gains are much higher than under the Doha scenarios. Here, the contribution of the domestic support reform in export gains is more evident, in particular for countries Argentina, Australia and New Zealand, and Brazil. Still, most of the gains in exports are due to the tariff component of the liberalization.

In terms of product, full trade liberalization has a particularly strong impact on world exports of meat products, rice, sugar and dairy products (in relative terms). Most of the impact is once again obtained through tariff liberalization, while the contribution of domestic support reform is negative in the sugar and dairy products sectors. Other products that are significantly more exported under free trade are vegetable and fruit, wheat and vegetable oils and fats, but the increase is smaller than the first group of products.

Table 6.10 points to the negligible impact of domestic support under DDA in terms of affecting the welfare gains from trade liberalization. This is not surprising because the tariff cuts under the Doha scenarios (with and without domestic support reforms) are implemented on bound tariffs, so the economic impact is small, if any. On the other hand, under the full trade liberalization scenarios (FTL and FTLwoDS), tariff cuts are implemented on actual applied tariffs, leading to higher changes.

Table 6.10

Effects on welfare by countries under various scenarios: changes relative to the baseline in 2025

Regions	DoDS	Doha	FreeDS	Free
Argentina	0.05	0.05	0.62	0.20
Australia and New Zealand	0.07	0.05	0.76	0.61
Bangladesh	-0.30	-0.30	-1.51	-1.50
Brazil	0.23	0.22	1.10	0.84
Canada	0.01	0.02	0.18	0.13
China	0.09	0.09	-0.10	-0.12
EFTA	0.21	0.18	1.63	1.42
EU 27	0.09	0.09	0.67	0.65
India	0.03	0.03	1.11	1.01
Japan	0.19	0.19	1.13	1.17
Korea and Taiwan	0.23	0.23	2.17	2.28
Mexico	0.01	0.02	-0.21	-0.22
Middle East and North Africa	0.04	0.05	-0.05	-0.04
Rest of East Asia	0.16	0.16	0.31	0.25
Rest of LAC	0.10	0.10	0.17	0.06
Rest of South Asia	-0.23	-0.22	-0.15	-0.18
Rest of Sub Saharan Africa	-0.07	-0.05	0.84	0.50
Thailand	0.55	0.55	2.65	2.31
Turkey	-0.04	-0.04	0.99	0.88
United States	0.02	0.02	0.25	0.22

Source: Model simulation results.

As with exports, under full trade liberalization scenarios, the large agricultural exporters such as Argentina, Australia and New Zealand, and Brazil gain the most in welfare when domestic support is eliminated. The elimination of both import tariffs and domestic support raises the world price of agricultural products due to higher demand on the part of former protected countries (mostly rich countries), resulting in the large agricultural exporter gains from increased agricultural exports and income.

Table 6.11 indicates how countries' agro-food production in volume is affected by various scenarios. While the DDA does not entail very significant changes in agro-food activity and while the inclusion of domestic support reform only implies marginal changes, the level of activity in agro-food sectors is much more pronounced in the case of full trade liberalization. Those that gain most are Brazil (+13.7 percent), Australia/New Zealand (+9.5 percent) and Thailand (+7.2 percent), while the main losers are Japan (-20.1 percent) and the EU (-11.6 percent). In the case of full trade liberalization, the inclusion or not of domestic support becomes a key issue.

The results under full trade scenarios clearly confirm, in accordance with earlier studies, the dominant contribution of tariff liberalization over domestic support in terms of exports and welfare gains.

Table 6.11

Effects on agro-food production in volume by countries under various scenarios: changes relative to the baseline in 2025 (percent change)

Regions	DDA	DDAwoDS	FTL	FTLwoDS
Argentina	-0.1	-0.1	2.4	1.7
Australia and New Zealand	2.0	1.7	9.5	8.2
Bangladesh	0.0	0.0	-5.3	-5.7
Brazil	1.9	1.8	13.7	12.6
Canada	0.2	0.4	-3.9	-2.0
China	-0.3	-0.3	-1.8	-1.4
EFTA	-0.9	0.1	-2.8	4.8
EU 27	-1.7	-1.5	-11.6	-10.1
India	0.2	0.2	2.3	2.7
Japan	-4.1	-4.2	-20.1	-19.6
Korea and Taiwan	0.9	0.8	4.0	4.7
Mexico	0.6	0.5	-1.7	-0.4
Middle East and North Africa	0.5	0.5	2.4	2.1
Rest of East Asia	0.0	0.0	1.6	1.0
Rest of LAC	0.7	0.7	5.2	4.4
Rest of South Asia	-1.8	-1.8	-5.3	-5.6
Rest of Sub Saharan Africa	0.1	0.0	1.7	1.1
Thailand	0.0	-0.1	7.2	6.1
Turkey	0.6	0.5	-2.1	-1.7
United States	0.3	0.2	-0.8	0.9

Source: Model simulation results.

6.5 Conclusion

Market access restrictions have been shown to be more distortive than domestic support on world welfare and on developing countries' agricultural trade. An import tariff is equivalent to a production subsidy and a consumption tax so it is more distortive than domestic support, especially if the latter is decoupled from production. Import tariffs are more widely used than domestic support, especially in developing countries, because in addition to providing protection to domestic producers, they contribute a large share of government fiscal revenue. Finally, tariff dispersion is more pronounced than domestic support dispersion, resulting in a higher level of economic inefficiency in the trade system.

We verify these premises focusing on agriculture and developing countries. First, this study provides an overview of the market access restrictions facing developing countries' agriculture. Market access restrictions vary across countries, and greatly impair nearly 30 developing countries. In rich countries, they are concentrated in the meat, dairy products, sugar and tobacco sectors, and in developing countries, in the beverage and tobacco sectors. Consequently, the composition of exports plays an important role in market access restrictions faced by developing countries ,and diversification indicators show that LDCs have low product diversification, especially in agriculture. The trade status of countries also impacts on whether they will benefit from trade liberalization: about half of LDCs are net importers of agricultural and food products.

Tariff escalation is still sizeable and the importance of the "specific tariff" component makes protectionism volatile.

Last, this study tests the conclusions from recent studies regarding the potential impact of an agreement concluded through the Doha agenda. In particular, the dominance of tariff protection relative to domestic support is assessed using MIRAGE, a multi-country multi-sector dynamic CGE model. To separate the effects of the two kinds of protection, we simulate the latest modalities of the DDA and full trade liberalization, both with and without domestic support reform.

At the global level, trade liberalization is beneficial but the benefits measured by changes in welfare are very small and at the national level not all countries benefit. In terms of market access, some countries lose preferential access from the current DDA, and welfare worsens for several countries.

More importantly, our findings support earlier assessments that tariffs are by far the main source of distortions and account for most of the expected benefits from trade liberalization. Leaving domestic support untouched barely changes the gains from trade liberalization, especially under the DDA. Although small, the impact of domestic support is more pronounced under full liberalization and at the national level as this scenario really cut into the applied level of domestic support. This conclusion is valid both in terms of world welfare and of developing countries' agricultural exports.

Nevertheless, it should be noted that over the years, CGE global models have been instrumental in tracing the effects of trade liberalization, in great part because they have been able to capture the complexities of tariff protection. However, they have not been as successful in modelling domestic support, especially when decoupled from production. Consequently, assessing the contribution of domestic support to the benefits of trade liberalization remains imperfect.

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Annex 1

Protection applied on agricultural imports and faced by agricultural exports in 2004[20]

Protection Applied (in percent)

Importers	APPLIED	TRQ_MARG	PREF_MARG	AD VAL comp.
World	**18.9**	**3.1**	**2.7**	**10.8**
Albaniia	9.4	0.0	0.0	9.4
Algeria	15.3	0.0	0.0	15.3
Angola	7.3	0.0	0.0	7.3
Antigua and Barbuda	16.2	0.0	0.1	16.2
Argentina	11.4	0.0	1.4	11.4
Armenia	4.9	0.0	0.2	4.9
Australia	1.8	0.0	0.1	1.5
Azerbaijan	10.6	0.0	0.5	8.2
Bahamas	26.5	0.0	0.0	25.8
Bahrain	19.2	0.0	0.1	19.2
Bangladesh	19.3	0.0	0.0	19.3
Barbados	46.9	0.3	0.4	36.7
Belarus	11.2	0.0	1.1	9.7
Belize	24.3	0.0	0.1	14.6
Bermuda	38.5	0.0	0.0	7.1
Bhutan	21.7	0.0	0.0	21.7
Bolivia	9.8	0.0	0.2	9.8
Bosnia and Herzegovina	4.1	0.0	1.2	4.1
Botswana	17.1	0.0	2.7	15.8
Brazil	10.1	0.4	1.2	10.1
Brunei Darussalam	19.6	0.0	0.0	0.0
Bulgaria	19.8	2.0	0.3	16.9
Burkina Faso	11.6	0.0	0.5	11.6
Burundi	25.8	0.0	2.0	25.8
Cambodia	13.0	0.0	0.0	13.0

[20]APPLIED (resp. FACED in case of the next table) refers to the average ad valorem equivalent of applied (resp. FACED) protection. TRQ_MARG is the ad valorem equivalent preferential margins related to Tariff Rate Quotas. PREF_MARG is the ad valorem equivalent preferential margin related to unilateral or reciprocal preferential schemes. Therefore APPLIED (or FACED)+TRQ_MARG+PREF_MARG gives the *ad valorem* equivalent tariff that would prevail if all trade relations were covered by MFN Tariffs.
AD_VAL is the ad valorem component of applied protection.
Therefore, APPLIED (or FACED) – AD_VAL equals the *ad valorem* equivalent of the specific component of protection.

Protection Applied (in percent) (continued)				
Cameroon	21.4	0.0	0.0	21.4
Canada	15.9	1.5	10.7	15.2
Central African Republic	21.4	0.0	0.1	21.4
Chad	20.6	0.0	0.1	20.6
Chile	3.7	0.1	2.7	3.7
China	11.1	14.8	0.0	10.8
Colombia	16.4	0.0	1.2	16.4
Congo	20.6	0.0	0.1	20.6
Congo Democratic Republic	11.9	0.0	0.0	11.9
Costa Rica	16.4	1.2	0.2	16.4
Côte d'Ivoire	11.4	0.0	0.3	11.4
Croatia	16.7	0.6	3.3	7.4
Cuba	9.7	0.0	1.6	9.7
Djibouti	16.6	0.0	0.6	16.6
Dominica	16.1	0.0	0.1	16.1
Dominican Republic	8.5	1.0	0.2	8.5
Ecuador	13.3	0.0	0.8	13.3
Egypt	41.5	0.0	0.3	87.5
El Salvador	10.2	0.0	0.2	10.2
Equatorial Guinea	18.8	0.0	0.0	18.8
Eritrea	6.9	0.0	0.4	6.9
Ethiopia	16.5	0.0	0.1	16.5
European Union	21.3	2.9	2.5	4.1
FYMOR	14.8	0.0	4.6	14.8
Gabon	18.8	0.0	0.0	18.8
Georgia	11.4	0.0	0.5	11.4
Ghana	18.9	0.0	0.0	18.9
Grenada	17.2	0.0	0.1	17.2
Guatemala	8.6	0.0	0.1	8.6
Guinea Bissau	11.6	0.0	0.6	11.6
Guyana	18.5	0.0	0.1	18.5
Honduras	10.5	0.0	0.2	10.5
Hong Kong	0.0	0.0	0.0	0.0
Iceland	63.6	16.7	2.7	11.2

Protection Applied (in percent) (continued)				
India	58.4	0.0	0.3	58.2
Indonesia	9.1	0.0	0.2	7.6
Iran	26.5	0.0	0.0	26.5
Israel	33.4	1.5	3.6	15.7
Jamaica	13.9	0.0	0.1	13.9
Japan	28.2	3.4	13.2	9.6
Jordan	14.6	0.0	0.4	14.2
Kazakhstan	8.9	0.0	0.4	8.9
Kenya	29.8	0.0	1.2	29.8
Korea	36.8	17.8	0.2	36.8
Kuwait	15.6	0.0	0.1	15.6
Kyrgyzstan	6.8	0.0	0.3	6.2
Lao People's Dem. Republic	14.7	0.0	0.8	14.7
Lebanon	8.7	0.0	0.2	8.7
Lesotho	15.4	0.0	1.2	13.5
Libyan Arab Jamahiriya	14.4	0.0	0.2	14.4
Madagascar	4.6	0.0	0.4	4.6
Malawi	12.3	0.0	0.9	12.3
Malaysia	26.9	0.0	0.3	3.3
Maldives	17.6	0.0	0.0	17.6
Mali	11.6	0.0	0.6	11.6
Mauritania	8.9	0.0	0.0	8.9
Mauritius	21.6	0.0	0.8	21.6
Mayotte	6.6	0.0	0.0	6.6
Mexico	22.6	0.1	13.0	22.6
Moldova Rep. of	10.8	0.0	0.4	8.5
Morocco	40.8	0.9	2.4	40.8
Mozambique	12.2	0.0	0.1	12.2
Myanmar	6.0	0.0	0.0	6.0
Namibia	15.5	0.0	2.1	14.1
Nepal	14.2	0.0	0.0	11.1
New Zealand	6.3	0.0	0.2	1.8
Nicaragua	12.0	1.0	0.2	12.0
Niger	11.6	0.0	0.5	11.6

Protection Applied (in percent) (continued)

Nigeria	42.6	0.0	0.0	42.6
Norway	74.4	1.4	4.3	5.6
Oman	22.0	0.0	0.1	22.0
Pakistan	22.7	0.0	0.0	14.6
Panama	15.8	1.9	0.0	15.8
Papua New Guinea	19.0	0.0	0.0	12.4
Paraguay	10.2	0.0	1.4	10.2
Peru	12.5	0.0	0.9	12.5
Philippines	9.8	0.5	1.1	9.8
Qatar	6.7	0.0	0.1	6.7
Romania	22.9	0.3	2.5	22.9
Russian Federation	12.1	0.0	1.2	10.7
Rwanda	10.5	0.0	0.3	10.5
Saint Kitts and Nevis	14.0	0.0	0.1	12.4
Saint Lucia	12.5	0.0	0.1	12.5
Saint Vincent	12.2	0.0	0.1	11.8
Saudi Arabia	7.7	0.0	0.1	7.7
Senegal	11.7	0.0	0.4	11.7
Serbia-Montenegro	15.4	0.0	0.0	15.4
Seychelles	42.2	0.0	0.0	42.2
Singapore	1.5	0.0	0.0	0.0
Solomon Islands	48.1	0.0	0.0	35.4
South Africa	15.0	2.9	2.6	14.0
Sri Lanka	19.7	0.0	0.0	17.6
Sudan	24.4	0.0	2.4	24.4
Suriname	19.2	0.0	0.0	19.2
Swaziland	15.5	0.0	2.4	14.1
Switzerland	54.0	29.7	11.5	1.9
Syrian Arab Republic	16.5	0.0	0.0	16.5
Taiwan	23.7	0.7	-0.2	17.2
Tajikistan	9.2	0.0	0.3	6.8
Tanzania	17.5	0.0	0.2	17.5
Thailand	38.8	0.0	0.3	38.3
Togo	11.7	0.0	0.4	11.7

Protection Applied (in percent) (continued)				
Trinidad and Tobago	16.9	0.0	0.1	16.9
Tunisia	46.3	5.1	2.1	46.3
Turkey	35.3	0.0	1.0	34.7
Turkmenistan	18.2	0.0	0.6	13.4
Uganda	9.8	0.0	0.2	9.8
Ukraine	26.3	0.0	0.3	5.4
United Arab Emirates	9.9	0.0	0.0	9.9
Uruguay	10.9	0.0	1.3	10.9
USA	8.9	1.1	0.6	3.1
Uzbekistan	7.4	0.0	0.2	7.4
Vanuatu	45.6	0.0	0.0	9.0
Venezuela	14.0	0.0	0.9	14.0
Viet Nam	19.8	0.0	3.3	19.8
Yemen	10.2	0.0	0.3	10.2
Zambia	13.3	0.0	1.0	13.3
Zimbabwe	20.5	0.0	0.5	20.0

Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).

Note: Intra-EU trade relations are excluded from the analysis.

Protection Faced (in percent)				
Exporters	FACED	TRQ_MARG	PREF_MARG	AD VAL. Comp
World	**18.9**	**3.1**	**2.7**	**10.8**
Afghanistan	19.5	0.0	0.1	18.7
Albania	9.1	0.9	2.8	7.4
Algeria	14.0	0.8	1.7	10.2
Andorra	12.3	0.1	8.9	7.4
Angola	14.5	1.1	0.9	13.7
Anguilla	36.4	0.0	0.8	38.7
Antigua and Barbuda	13.2	0.4	4.4	13.3
Argentina	13.4	5.6	1.6	10.1
Armenia	54.6	0.3	5.5	19.2
Aruba	35.4	0.0	18.9	16.1
Australia	23.3	9.2	1.3	10.9
Azerbaijan	16.2	0.3	1.4	12.4
Bahamas	5.9	0.0	-0.7	5.5

Protection Faced (in percent) (continued)				
Bahrain	18.9	0.7	2.4	13.4
Bangladesh	26.5	0.8	6.3	16.8
Barbados	32.2	6.0	1.5	14.1
Belarus	21.6	0.2	2.8	17.4
Belize	47.0	9.3	9.1	7.0
Benin	9.8	1.0	1.2	9.1
Bermuda	23.9	1.1	0.3	11.6
Bhutan	28.1	0.0	1.3	27.2
Bolivia	10.9	3.8	2.2	8.9
Bosnia and Herzegovina	14.0	0.0	6.3	10.2
Botswana	47.4	7.6	8.0	6.9
Brazil	23.6	4.8	1.0	11.7
Brunei Darussalam	13.1	1.3	0.8	11.8
Bulgaria	18.9	3.4	4.0	10.4
Burkina Faso	11.8	1.1	0.5	9.0
Burundi	13.5	0.0	1.1	12.6
Cambodia	24.1	1.9	12.8	12.3
Cameroon	9.1	0.5	5.0	4.9
Canada	16.2	5.0	2.0	6.4
Cape Verde	6.5	0.0	3.1	5.6
Cayman Islands	20.2	0.2	1.7	14.1
Central African Republic	5.2	1.2	1.7	3.8
Chad	3.2	1.2	0.0	1.6
Chile	12.2	0.8	2.8	8.5
China	19.7	2.1	2.2	10.5
Colombia	18.7	1.1	2.5	8.6
Comoros	1.6	0.0	2.8	1.6
Congo Democratic Republic	14.0	0.3	4.0	10.0
Cook Islands	8.4	0.0	4.7	6.4
Costa Rica	21.8	1.3	2.1	9.8
Côte d’Ivoire	6.6	0.4	2.0	4.8
Croatia	20.2	1.3	9.9	14.5
Cuba	25.7	4.6	5.9	13.1
Djibouti	12.6	0.1	4.0	12.5

Protection Faced (in percent) (continued)				
Dominica	20.3	0.1	8.4	11.9
Dominican Republic	22.5	3.7	9.4	4.7
East Timor	9.3	0.0	0.2	8.1
Ecuador	27.9	0.6	4.3	8.2
Egypt	15.9	2.7	3.2	11.4
El Salvador	26.9	1.6	1.8	13.8
Equatorial Guinea	2.1	0.0	0.3	1.9
Eritrea	11.2	0.4	7.9	8.6
Ethiopia	11.1	0.0	1.1	8.8
European Union	18.3	2.4	2.9	11.4
Falkland Islands (Malvinas)	4.3	0.0	2.8	3.6
Fiji	77.2	19.5	3.2	5.3
French Polynesia	5.1	0.0	7.9	3.7
Gabon	46.4	0.4	1.1	44.0
Gambia	15.0	1.6	3.7	13.4
Georgia	31.9	5.1	2.3	18.2
Ghana	4.7	0.7	1.0	4.2
Gibraltar	29.8	0.0	3.2	16.2
Greenland	4.2	0.0	4.1	3.2
Grenada	6.8	1.5	0.6	6.4
Guatemala	32.7	1.3	2.2	9.9
Guinea	5.8	0.6	2.0	5.0
Guinea Bissau	23.7	0.1	0.9	23.6
Guyana	107.2	3.1	6.7	9.2
Haiti	1.8	0.1	1.8	1.5
Honduras	16.9	0.9	3.2	8.3
Hong Kong	21.9	0.8	0.1	20.8
Iceland	13.5	3.4	1.2	5.6
India	18.9	3.0	2.2	10.7
Indonesia	20.4	1.1	1.4	17.4
Iran	10.2	0.1	0.6	8.6
Iraq	18.3	0.0	2.4	15.6
Israel	7.6	1.2	3.4	5.6
Jamaica	44.6	8.5	10.1	6.3
Japan	15.2	1.5	0.2	11.0

Protection Faced (in percent) (continued)				
Jordan	13.8	3.4	3.8	10.3
Kazakhstan	24.8	0.4	1.6	20.2
Kiribati	18.7	0.0	1.6	17.1
Korea	16.5	0.6	0.5	11.5
Korea Dem. People's Rep.	15.4	0.0	-2.3	14.1
Kuwait	18.4	0.8	2.1	12.2
Kyrgyzstan	19.4	0.8	0.9	12.6
Lao People's Dem. Republic	9.6	0.0	1.8	8.6
Lebanon	15.9	0.2	3.3	13.0
Lesotho	9.0	0.6	8.8	7.4
Liberia	9.6	0.0	0.8	9.4
Libyan Arab Jamahiriya	8.4	0.0	0.6	7.0
Macau	22.2	0.1	0.6	20.0
Madagascar	4.9	0.6	3.0	2.4
Malawi	24.3	1.6	6.2	14.3
Malaysia	20.1	2.4	1.2	16.9
Maldives	21.5	8.2	0.5	18.6
Mali	6.9	0.9	0.5	6.0
Marshall Islands	6.9	2.4	3.0	3.5
Mauritania	18.3	0.1	2.1	12.8
Mauritius	53.0	0.3	1.8	5.8
Mexico	9.5	2.3	2.5	5.8
Micronesia Federated St.	19.6	0.7	0.6	18.7
Moldova Rep. of	46.6	1.6	3.2	13.9
Mongolia	8.6	0.4	0.1	8.2
Morocco	10.3	1.9	2.4	6.8
Mozambique	22.6	3.2	1.8	15.1
Myanmar	23.2	1.8	1.9	19.1
Namibia	38.8	2.9	2.6	18.3
Nauru	17.6	0.8	0.6	13.0
Nepal	26.3	1.0	7.8	18.4
Netherland Antilles	39.2	1.1	3.5	14.3
New Caledonia	27.7	0.0	0.4	27.0
New Zealand	27.1	5.8	1.9	11.6

Protection Faced (in percent) (continued)				
Nicaragua	37.0	2.2	1.8	14.8
Niger	18.0	0.1	3.6	17.6
Nigeria	4.6	0.1	0.5	3.8
Northern Mariana Islands	14.6	0.0	0.0	13.5
Norway	13.2	4.2	2.0	6.3
Oman	23.5	0.9	2.0	19.6
Pakistan	39.4	2.0	9.9	12.6
Palau	13.0	0.9	1.9	8.8
Palestinian territory	16.5	1.7	0.9	12.2
Panama	40.3	1.3	3.6	11.3
Paraguay	12.0	4.0	1.6	7.5
Peru	9.1	0.8	5.3	5.1
Philippines	24.5	1.1	1.8	9.7
Qatar	21.6	0.7	1.2	16.6
Romania	15.3	3.0	2.7	9.0
Russian Federation	25.6	0.1	1.7	19.9
Rwanda	18.0	0.0	2.1	18.0
Saint Kitts and Nevis	53.6	0.1	1.3	6.0
Saint Lucia	34.0	0.4	14.8	8.4
Saint Vincent	22.8	4.6	11.3	9.4
Samoa	6.8	0.1	6.6	3.7
Sao Tome and Principe	3.9	0.0	1.2	3.2
Saudi Arabia	38.1	0.9	5.3	10.3
Senegal	14.3	0.8	2.4	13.0
Serbia-Montenegro	41.3	0.3	11.8	11.8
Seychelles	30.8	0.7	1.0	28.2
Sierra Leone	5.7	0.4	2.5	4.4
Singapore	22.6	0.8	1.7	19.7
Solomon Islands	6.9	0.0	1.1	6.3
Somalia	11.4	0.0	8.1	9.5
South Africa	17.2	1.1	1.8	13.1
Sri Lanka	16.5	0.7	1.3	14.5
St. Pierre and Miquelon	21.1	0.0	-0.1	18.6
Sudan	10.7	0.0	1.5	7.2

Protection Faced (in percent) (continued)

Suriname	35.5	2.8	14.4	9.0
Swaziland	30.8	4.6	1.9	13.0
Switzerland	17.8	1.1	2.6	11.4
Syrian Arab Republic	14.5	0.1	1.1	10.9
Taiwan	13.3	1.3	0.4	9.2
Tajikistan	6.6	1.9	0.5	5.9
Tanzania	19.3	0.6	2.4	13.1
Thailand	34.9	5.7	3.8	14.6
Togo	12.4	1.2	1.6	11.4
Tonga	10.4	0.7	3.6	6.5
Trinidad and Tobago	23.0	2.2	1.9	16.2
Tunisia	22.0	0.8	1.6	7.6
Turkey	12.1	0.8	3.2	8.5
Turkmenistan	5.1	1.5	0.0	3.9
Turks and Caicos Islands	21.3	0.4	18.7	6.6
Uganda	10.4	0.2	3.5	8.7
Ukraine	24.0	0.5	3.2	14.5
United Arab Emirates	19.4	2.0	2.7	14.0
Uruguay	34.8	5.4	2.5	14.4
USA	15.4	4.1	4.2	8.4
Uzbekistan	8.8	1.0	0.3	7.2
Vanuatu	6.2	0.2	9.8	3.7
Venezuela	17.4	2.0	1.8	12.7
Viet Nam	18.4	0.7	0.9	14.9
Virgin Islands (British)	13.2	0.0	0.8	11.9
Wallis and Futuna Island	9.1	0.0	0.3	9.0
Yemen	16.4	0.0	4.7	12.6
Zambia	16.4	0.4	3.9	10.5
Zimbabwe	21.7	1.2	4.0	13.9

Source: MAcMap-HS6, version 2. Reference group weighting scheme (see Boumelassa, Laborde, and Mitaritonna, 2009).
Note: Intra-EU trade relations are excluded from the analysis.

Annex 2

Regional and sectoral aggregations in MIRAGE

Regional Aggregation

Region	GTAP7 code
African LDCs	sen, mdg, mwi, moz, tza, uga, zmb
Argentina	Arg
Australia and New Zealand	nzl, aus
Bangladesh	Bgd
Brazil	Bra
Cambodia	Khm
Canada	Can
China	Chn
EFTA	che, nor,xef, xer, xna
EU 27	rou, bgr, gbr, swe, esp, svn, svk, prt, pol, nld, mlt, lux, ltu, lva, ita, irl, hun, grc, deu, fra, fin, est, dnk, cze, cyp, bel, aut
Hong Kong - Singapore	hkg, sgp
India	Ind
Japan	Jpn
Korea and Taiwan	kor, twn
Mexico	Mex
Middle East and North Africa	irn, xws, egy, mar, tun,xnf
Nigeria	Nga
Other transition economies	alb, blr, hrv, ukr, xee, kaz, kgz, xsu, arm aze, geo
Pakistan	Pak
Rest of East Asia	xea, idn, lao, mmr, mys, xoc, phl, vnm, xse
Rest of Eastern Africa	Xec
Rest of LAC	bol, chl, col, ecu, pry, per, ury, ven, xsm, cri, gtm, nic, pan, xca, xcb
Rest of South Africa	xac, mus, zwe, bwa, xsc
Rest of South Asia	Xsa
Rest of South East Asia	xoc, xea, idn, lao, mmr, mys, phl, vnm, xse
Rest of Sub Saharan Africa	xwf, xcf, eth, xec
Rest Of the World	xoc, xna, alb, blr, hrv, rus, ukr, xef, kaz, kgz, xsu, arm, aze, geo
Russia	Rus
South Africa	Zaf
Sri Lanka	Lka
Thailand	Tha
Turkey	Tur
United States	usa,

Sectoral Aggregation

Sectors	GTAP7 code
Other crops	Ocr
Rice	pdr, pcr
Cereals	Gro
Food products	ofd, fsh, b_t
Dairy products	Mil
Cattle and other animal products	ctl, oap, rmk, wol
Oil seeds	Osd
Meat products	cmt, omt
Plant-based fibers	Pfb
Sugar	c_b, sgr
Vegetables and fruit	v_f
Wheat	Wht
Vegetable oils and fats	Vol
Chemical products	Crp
Electronic, machinery and transport equipment	ele, otn, ome
Forestry and minerals	frs, omn
Leather	Lea
Construction	Cns
Other manufactured products	nmm, fmp, lum, ppp, i_s, nfm, omf
Motor vehicles	Mvh
Other primary products	coa, oil,gas, p_c
Textiles	tex
Wearing apparels	wap
Other services	ely, gdt, wtr, trd, cmn, ofi, isr, obs, ros, osg, dwe
Transport and trade	otp, wtp, atp

7

Policies affecting agricultural incentives in developing countries

Kym Anderson[1]

Introduction

For many decades the earnings of farmers and associated rural businesses in developing countries have been depressed by agricultural protection and subsidies in today's high-income countries (Johnson 1991; Tyers and Anderson 1992). Those policies almost certainly added to inequality and poverty, since three-quarters of the world's poorest people depend directly or indirectly on agriculture for their main income (World Bank 2007)[2]. But in addition to this external policy influence on rural poverty, the governments of many developing countries have directly taxed their farmers over most of the past half-century. As well, many developing countries in the 1960s and 1970s chose to also pursue an import-substituting industrialization strategy, predominantly by restricting imports of manufactures, which indirectly taxed other tradable sectors in those developing economies, including agriculture (Krueger, Schiff and Valdés 1988, 1991). Thus the price incentives facing farmers in many developing countries have been depressed by both own-country and other countries' farm, food and trade policies.

During the past quarter-century, however, there have been substantial policy reforms in numerous developing countries, and even a few reductions in farm protection rates in some high-income countries. This chapter surveys the extent to which government policies at home and abroad are still distorting prices faced by

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[2] According to FAOSTAT data, there are less than 15 million relatively wealthy farmers in developed countries, with an average of almost 80 hectares per worker. They are being helped at the expense of not only consumers, taxpayers and producers of other tradables in those rich countries but also the majority of the 1.3 billion relatively impoverished farmers and their large families in developing countries who, on average, have to earn a living from just 2.5 hectares per worker.

developing country farmers this decade as compared with the previous four decades. It shows that, notwithstanding recent reforms, many price distortions remain in the agricultural sector of both developing and high-income countries. Estimates from a global economy wide model show how much could be gained by removing the interventions still remaining as of 2004, indicating what is at stake in the WTO's Doha Development Agenda. Those results also indicate how much that could reduce poverty in various developing country regions. The chapter concludes by pointing to the prospects for further policy reform in global agricultural markets.

7.1 How much have global agricultural distortions changed since the 1950s?

A recent World Bank study has estimated, for a sample of 75 countries (accounting for 90 percent of global agriculture) over the period from 1955 to 2007, the extent to which government-imposed distortions have created a gap between domestic prices of farm products and what they would be under free markets each year (Anderson 2009)[3]. Specifically, the study computed a Nominal Rate of Assistance (NRA) for each farm product, defined as the percentage by which government policies have raised gross returns to farmers above what they would be without the government's intervention (or lowered them, if the NRA is negative). A weighted average NRA for all covered products is derived using the value of production at undistorted prices as weights. To that NRA for covered products is added a 'guesstimate' of the NRA for non-covered products and an estimate of the NRA from non-product-specific forms of assistance or taxation. Since the 1980s some high-income governments have also provided assistance to farmers that is somewhat 'decoupled' from production and so in principle is less distortionary of resource allocation. Its NRA has been computed separately though, and is not included for direct comparison with the NRAs for other sectors or for developing countries. Each farm industry is classified either as import-competing, or a producer of exportables, or as producing a nontradable (with its status sometimes changing over the years), so as to generate for each year the weighted average NRAs for the two different groups of covered tradable farm products.

Also generated by that World Bank study is a production-weighted average NRA for nonagricultural tradables, for comparison with that for agricultural tradables via the calculation of a percentage Relative Rate of Assistance (RRA), defined as:

$$RRA = 100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$$

where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of

[3] The methodology used in that study is summarized in Anderson et al. (2008), and the full panel dataset of estimates is freely available on-line (Anderson and Valenzuela 2008). The detailed developing country case studies are reported in four regional volumes covering Africa (Anderson and Masters 2009), Asia (Anderson and Martin 2009), Latin American (Anderson and Valdés 2008) and Europe's transition economies (Anderson and Swinnen 2008).

the agricultural (including non-covered) and non-agricultural sectors, respectively[4]. Since the NRA cannot be less than -100 percent if producers are to earn anything, neither can the RRA (since the weighted average $NRAnonag^t$ is non-negative in all our country case studies). And if both of those sectors are equally assisted, the RRA is zero. This measure is useful in that if it is below (above) zero, it provides an internationally comparable indication of the extent to which a country's sectoral policy regime has an anti- (pro-)agricultural bias.

In addition to the mean NRA, a measure of the dispersion or variability of the NRA estimates across the covered farm products also is generated for each economy. The cost of government policy distortions to incentives in terms of resource misallocation tend to be greater the greater the degree of substitution in production. In the case of agriculture which involves the use of farm land that is sector-specific but transferable among farm activities, the greater the variation of NRAs across industries within the sector then the higher will be the welfare cost of those market interventions. High NRAs matter also because the welfare cost of a price distortion is proportional to the square of the rate of assistance. A simple indicator of dispersion is the standard deviation of the covered industries' NRAs.

For the purposes of the present study, the world economy is divided into high-income countries (Western Europe, the United States/Canada, Japan, and Australia/New Zealand) and several developing country regions (most notably Africa, East plus South Asia, Latin America, and the transition economies of Eastern Europe and Centra Asia plus Turkey). North America and Europe each account for almost one-third of the global economy but, when the focus turns to just agriculture, developing countries are responsible for slightly over half the value added globally, with Asia accounting for two-thirds of that lion's share. The developing countries' majority becomes stronger still in terms of global population and even more so in terms of farmers, almost three-quarters of whom are in Asian developing countries. Hence there is a vast range of national per capita incomes and endowments of agricultural land per capita, and thus agricultural comparative advantages, across those country groups, and a strong concentration of poor people in Asia (Sandri, Valenzuela and Anderson 2007).

The NRA estimates reveal that aggregate support for farmers in high-income countries rose steadily throughout the period from the 1950s to the late 1980s before declining slightly over the 15 years to 2004. On the other hand, the price and trade policies of developing countries heavily taxed their farmers in aggregate from the early 1960s to the late 1970s/early 1980s before gradually reducing that

[4] Farmers are affected not just by prices of their own products but also by the incentives nonagricultural producers face. That is, it is relative prices and hence relative rates of government assistance that affect producer incentives. More than seventy years ago Lerner (1936) provided his Symmetry Theorem that proved that in a two-sector economy, an import tax has the same effect as an export tax. This carries over to a model that also includes a third sector producing only nontradables (see Vousden 1990, pp. 46-47).

TABLE 7.1

Nominal rates of assistance to agriculture[a] in 75 focus countries, by region, 1955 to 2007[c]

(percent)

	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-07
Africa	-14	-8	-11	-15	-13	-8	-1	-9	-6	-7	na
Asia	-27	-27	-25	-25	-24	-21	-9	-2	8	12	na
Latin America	-11	-8	-7	-21	-18	-13	-11	4	6	5	na
Eastern Europe and Central Asia[b]	na	na	na	na	na	na	na	10	18	18	25
Western Europe	44	57	68	46	56	74	82	64	44	37	18
United States and Canada	13	11	11	7	7	13	19	16	11	17	11
Australia and New Zealand	6	7	10	8	8	11	9	4	3	1	2
Japan	39	46	50	47	67	72	119	116	120	120	81
Developing countries	-26	-23	-22	-24	-22	-18	-8	-2	6	9	na
High-income countries	22	29	35	25	32	41	53	46	35	32	17
All focus countries (weighted average)	3	5	6	0	2	5	17	18	17	18	na

Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009).

a.Weighted average for each country, including non-product specific assistance as well as authors' guesstimates for non-covered farm products (but not decoupled assistance), with weights based on gross value of agricultural production at undistorted prices. Estimates for China pre-1981 and India pre-1965 are based on the assumption that the nominal rate of assistance to agriculture in those years was the same as the average NRA estimates for those countries for 1981-84 and 1965-69, respectively, and that the gross value of production in those missing years is that which gives the same average share of value of production in total world production in 1981-84 and 1965-69, respectively. Developing country and world aggregates are computed accordingly.

b.Eastern European and Central Asian countries are not included in the high-income or developing country aggregates of this table.

taxation and, by the mid-1990s, switching to slightly positive assistance to them in aggregate (Table 7.1). Thus the contributions of the two groups to the global trend are additive in the 1980s but then offsetting from 1990 to 2004[5].

Figure 7.1 provides NRA estimates for two sub-groups of covered farm products, namely exportables and import-competing goods. Two striking points about that figure are worth noting. One is the marked difference in the levels of support to import-competing versus exportable farm products. Exportables in high-income countries have received relatively little support other than during the export subsidy 'war' of the mid-1980s, while in developing countries they were increasingly taxed from the late 1950s until the 1980s and then that taxation was gradually phased out over the past two decades (although a little remained in 2004, for example in Argentina, and considerably more was added temporarily by various developing countries in 2008 in response to concerns about the spike in international food prices). Importables, by contrast, have been assisted throughout the past five decades. The second point to note is that the long-run fitted trend line for the import-competing sub-sector has almost the same slope for both sets of countries (albeit with a lower intercept for developing countries). Two lessons can be drawn from this: first, there has been a strong anti-trade bias for agricultural goods in high-income and developing countries that got worse in the 1980s but has diminished somewhat since then; and second, growth in agricultural import protection appears to have accompanied economic growth in developing countries just as it has in high-income countries. True, the NRA for the agricultural sector has reversed slightly since the 1980s for Western Europe (Table 7.1), but less so when the decoupled payments are included (Figure 7.2)[6].

[5] In the 2005-07 period when food prices in international markets rose steeply (and spiked even more in 2008), transfers to farmers in high-income countries fell back considerably (as happened also in 1973-74). There are not enough estimates to show the change for developing countries, but their governments too have responded by reducing/suspending import tariffs and temporarily restricting export of food in 2007-08, so they may have added to, rather than offset, the high-income country downward trend in those most recent years.

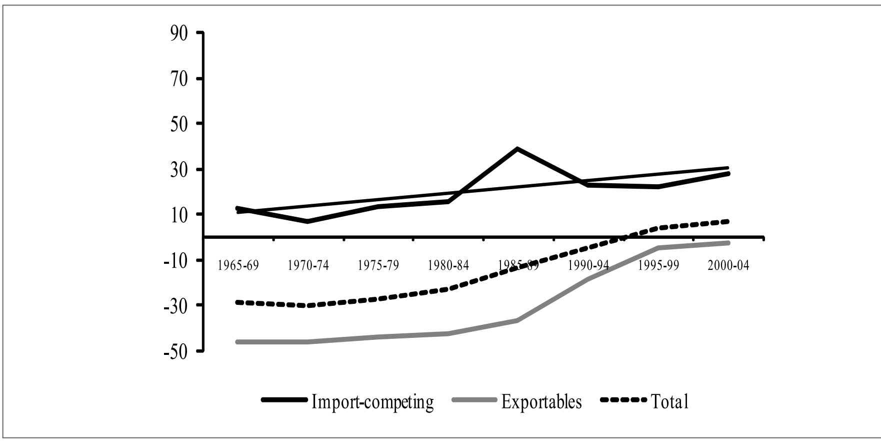
[6] NRA estimates for most developing countries go only to 2004, but those for OECD countries are available to 2007. Table 1 reveals that the NRAs tend to be lower in 2005-07 because international prices were rising over that period for food and other primary commodities (they peaked in mid-2008), and not all of those rises were being transmitted to domestic markets. In the case of the European Union, an additional force was at work: reform efforts by the EU's Agricultural Commissioner from 1996 to 2004, Franz Fischler, took a major step forward in 2003 (the so-called Mid-term Review of the EU's Agenda 2000 reform program). At that time it was announced that price supports for key farm products were to be cut severely, and replaced by a Single Farm Payment by way of partial compensation. Unlike with the MacSharry reforms of the CAP in 1992, pressure from WTO members was acknowledged within the EU as a contributing force for reform. Just how important that external influence was in contributing to the reform outcome is impossible to say, but see Swinnen (2008) and Josling (2009) for further details.

FIGURE 7.1

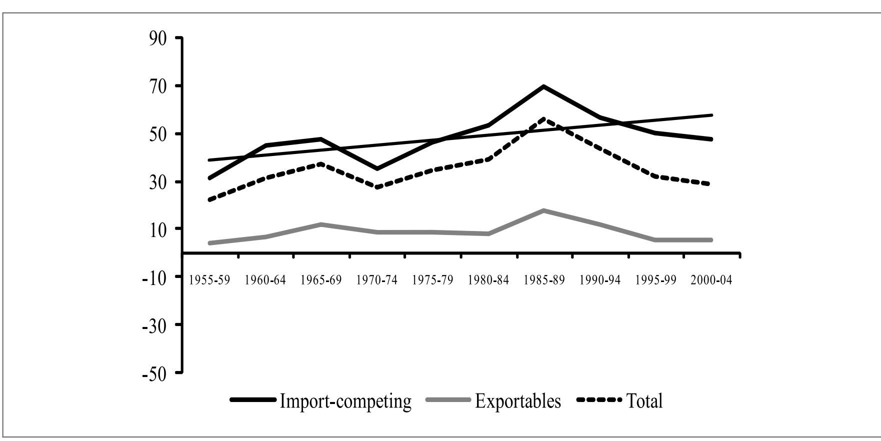
Nominal rates of assistance to exportable, import-competing and all[a] covered agricultural products, high-income and developing countries, 1955 to 2004

(percent)

(a) Developing countries (excluding Europe's transition economies)



(b) High-income countries plus Europe's transition economies



Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009)

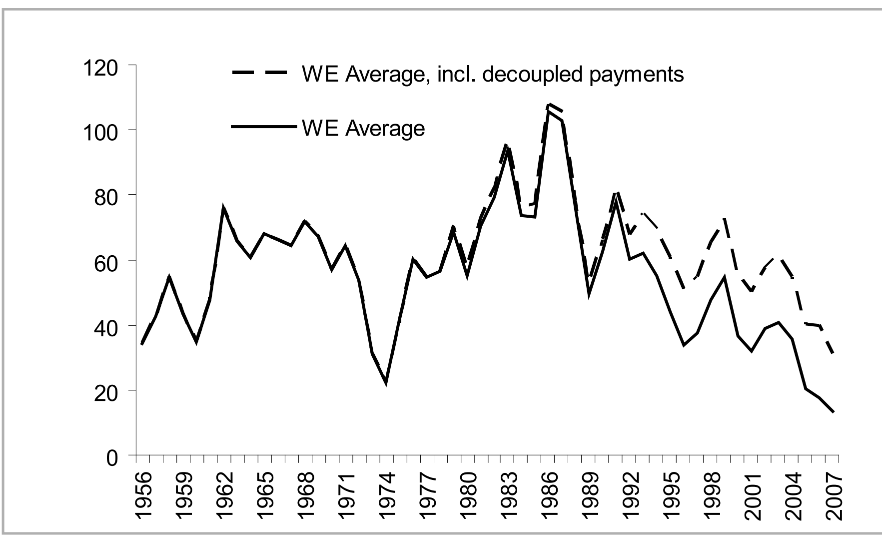
a The total also includes nontradable farm products.

That anti-trade bias means that the rates of assistance are not uniform across farm commodities, which indicates that the resources that are employed within the farm sector are not being put to their best use. The extent of that extra inefficiency, over and above that due to too many or too few resources in aggregate in the sector, is crudely indicated by the standard deviation of NRAs among covered products in each focus country[7]. This dispersion index, summarized for the 8 regions in Table 7.2, has fluctuated across time and varied between regions, but the global average has remained around 70 percent throughout the period, with no discernable trend.

FIGURE 7.2

NRA to agriculture without and with decoupled payments, Western Europe, 1956 to 2007

(percent)



Source: Anderson and Valenzuela (2008) as reported in Josling (2009).

Nor is the NRA dispersion randomly distributed across products. On the contrary, Figure 7.3 shows that rice, sugar and milk (the rice pudding ingredients) are by far the most assisted farm industries in both sets of countries, with beef and poultry meat next. Cotton has the next highest NRA in the high-income figure. This suggests tariff or subsidy peaks prevail within the agricultural sector, which means the welfare cost of these distortions is even higher than it would be if NRAs were equal for each farm industry within the sector.

[7] More-precise national, regional and global partial equilibrium indicators of the trade- and welfare-reducing effects of this dispersed set of NRAs (and associated distortions to consumer process of farm products) are provided in Lloyd, Croser and Anderson (2009).

TABLE 7.2

Dispersion of nominal rates of assistance across covered agricultural products,[a] focus regions, 1965 to 2007

(percent)

	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-07
Africa	31	30	37	36	36	31	25	25	Na
Asia	56	42	49	53	66	56	57	64	Na
Latin America	49	44	52	52	44	42	32	40	Na
Eastern Europe and Central Asia	34	33	41	26	39	56	39	45	44
Western Europe	119	85	112	98	122	86	69	74	64
United States and Canada	29	15	31	62	71	39	31	37	28
Australia and New Zealand	40	45	26	17	20	14	12	7	5
Japan	69	82	156	143	175	162	136	143	116
All focus countries (weighted average)	54	45	55	51	59	53	43	48	Na
Product coverage [b]	68	70	71	73	73	72	71	68	70

Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009).

a. Dispersion for each region is a simple average of the country-level annual standard deviations around a weighted mean of NRAs per country across covered products each year.

b. Share of gross value of total agricultural production at undistorted prices accounted for by covered products.

The global gross subsidy equivalent of those rates of assistance have risen very substantially in constant (2000) US dollar terms, from close to zero up to the mid-1970s to more than $200 billion per year at the farm-gate since the mid-1990s (Figure 7.4). When expressed on a per farmer basis, the gross subsidy equivalent (GSE) varies enormously as between high-income and developing countries. In 1980-84 the GSE in high-income countries was already around $8,000 and by 2000-04 it had risen to $10,000 on average (and $25,000 in Norway, Switzerland and Japan), or $13,500 when 'decoupled' payments are included. By contrast, the GSE in developing economies was -$140 per farmer in the first half of the 1980s, which is a non-trivial tax when one recalls that at that time the majority of these people's households were surviving on less than $1 a day per capita. By 2000-04 they received on average around $50 per farmer (Anderson 2009, Ch. 1). While this represents a major improvement, it is less than one percent of the support received by the average farmer in high-income countries.

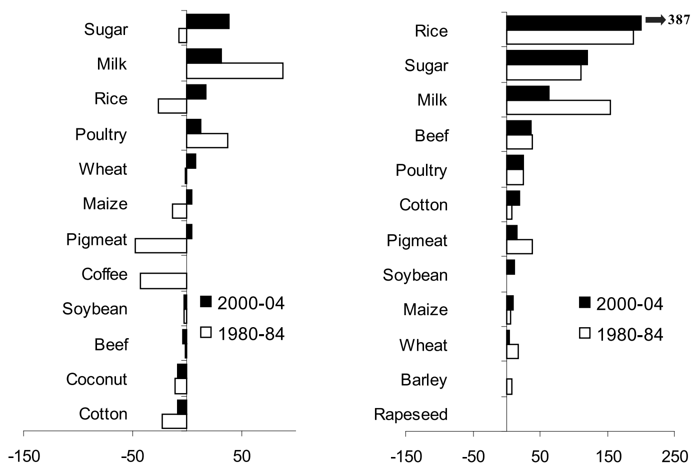
Table 7.3 shows the various contributions of different policy measures to the overall estimated NRAs as of 1981-84 and 2000-04. In both periods, trade measures accounted for around three-fifths of the total NRA for both developing

FIGURE 7.3

Nominal rates of assistance, key covered products, high-income and developing countries, 1980-84 and 2000-04

(percent)

(a) Developing countries (b) High-income countries



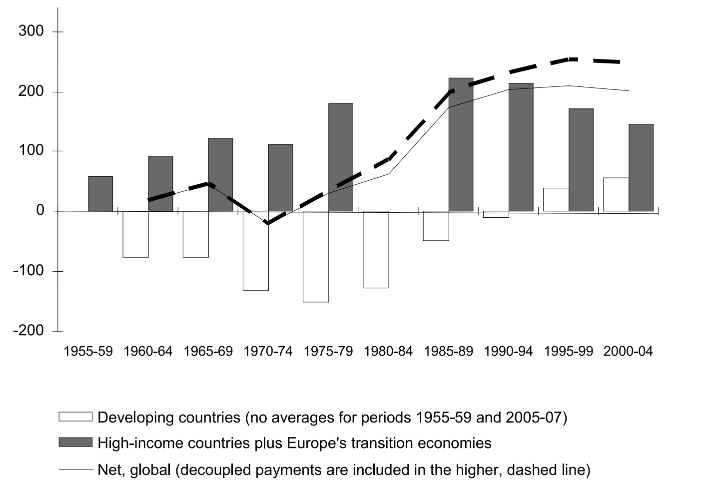
Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009).

and high-income countries[8]. Even when the relatively new decoupled payments to farm households are counted, it is still the case that trade measures at the border (export and import taxes or subsidies and their equivalent from quantitative trade restrictions and multiple exchange rates) are the dominant form of intervention. Leaving those decoupled measures aside, these estimates suggest import barriers are responsible for all but one-quarter of the NRA of high-income countries and all but one-ninth of the NRA of developing countries on average in 2000-04.

[8] If one assumes that the price elasticities of supply and demand for farm products are equal, and that there are no costs of collecting taxes and dispersing them as subsidies, then the trade-reducing effects of trade measures would be twice as high as for an equally high NRA provided by production subsidies – and an even bigger multiple of the effects of so-called decoupled payments, depending on the extent to which the latter are in practice truly decoupled from production decisions. Furthermore, since the welfare-reducing effects of trade measures are in proportion to the square of the trade tax-cum-subsidy, the border measures would be responsible for much more than three-fifths of the global welfare cost of distortions to agricultural prices, and possibly not much below the more-limited but widely quoted estimate for 2001 of 93 percent by Anderson, Martin and Valenzuela (2006).

FIGURE 7.4

Gross subsidy equivalent of NRAs in high-income and European transition economies and in developing countries, 1960 to 2004 (constant 2000 US$ billion)



Source: Anderson (2009)

The anti-agricultural policy biases of the past are due to not just agricultural policies. Also important in developing countries, according to Krueger, Schiff and Valdés (1988, 1991), was border protection to the manufacturing sector (the dominant intervention in the tradables part of non-agricultural sectors). Contributors to the Anderson (2009) study typically had to rely on applied trade taxes (for exports as well as imports) rather than undertake price comparisons for non-farm tradables, and hence they usually do not capture the quantitative restrictions on trade which were important in earlier decades but decreasingly so through recent times. Nor does that study capture distortions in the services sectors, some of which now produce tradables (or would do in the absence of interventions preventing their emergence). As a result, the estimated NRAs for non-farm importables are smaller and and probably decline less rapidly than in fact was the case – and likewise for non-farm exportables, except their NRAs in some cases would have been negative. Of those two elements of under-estimation, the former bias almost certainly dominates, so the estimates in Anderson (2009) of the overall NRA for non-agricultural tradables should be considered as lower-bound estimates, and more so in the past so that its decline is less rapid than it should be.

TABLE 7.3

Contributions to total agricultural NRA from different policy instruments,[a] by region, 1981-84 and 2000–04

	(percent)			
	1981-84		2000-04	
	All developing countries	High-income countries	All developing countries	High-income countries
Border measures				
Import tax equivalent	6	34	8	24
Export subsidies	1	2	1	1
Export tax equivalent	-20	0	-3	0
Import subsidy equivalent	-2	0	-1	0
ALL BORDER MEASURES	-15	36	5	25
Domestic measures				
Production subsidies	1	2	1	1
Production taxes	-5	0	-1	0
Net subsidies to farm inputs	1	3	2	2
Non-product-specific assistance (except to inputs)	1	1	2	5
ALL DOMESTIC PRODUCTION SUPPORTS	-2	6	4	8
Decoupled payments to farm households	0	6	0	11
NRA including decoupled payments	-17	48	9	44
Gross subsidy equivalent, in real 2000 US$ billion	-113	223	58	173

Source: Author's derivation, using distortion data in Anderson and Valenzuela (2008).

a. In the absence of data, the share of input tax/subsidy, domestic production tax/subsidy and border tax/subsidies for non-covered farm products are assumed to be the same as that for covered farm products. The first period begins in 1981 because that was the first year for which estimates for China are available.

b. All table entries have been generated by dividing the Gross Subsidy Equivalent of all (including decoupled) measures by the total agricultural sector's gross production valued at undistorted prices.

Despite these methodological limitations, the estimated NRAs for non-farm tradables are very sizeable prior to the 1990s. For developing countries as a whole, the average non-farm NRA has declined steadily throughout the past four or five decades, from around 45 percent in the 1960s to around 30 percent in the 1970s, 16 percent in the 1980s and less than 10 percent since the mid-1990s as policy reforms spread (see near bottom of Table 7.4). This has therefore contributed to a decline in the estimated negative relative rate of assistance for farmers: the weighted average RRA was worse than -50 percent up to the mid-1970s but improved to an average of -38 percent in the 1980s, -12 percent in the 1990s and just above zero (1 percent) in 2000-04. The trend in RRAs and their two component NRAs for developing countries is starkly illustrated in Figure 7.5, where the falling positive NRAs for non-farm producers can be seen to have contributed even more to the rise of the RRA than has the gradual disappearance of the negative NRAs

TABLE 7.4

Nominal rates of assistance to agricultural and nonagricultural tradables, and the RRA,[a] by region, 1955 to 2007

(percent)

	1955-59	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-07
Africa											
NRA agric.	Na	-13.3	-19.6	-25.0	-22.1	-13.5	-0.3	-15.4	-8.7	-12.0	na
NRA non-agric.	Na	3.7	2.7	1.5	5.7	1.6	9.2	2.7	2.0	7.3	na
RRA	Na	-15.2	-21.4	-26.0	-25.9	-13.1	-8.3	-17.1	-10.4	-18.0	na
Latin America											
NRA agric.	na	-11.4	-9.3	-23.0	-19.0	-12.9	-11.2	4.4	5.5	4.9	na
NRA non-agric.	na	26.9	31.3	27.8	23.3	18.5	16.8	7.3	6.6	5.4	na
RRA	na	-30.2	-30.9	-39.8	-34.2	-26.6	-24.0	-2.7	-1.0	-0.5	na
South Asia[b]											
NRA agric.	na	4.1	4.4	9.7	-7.7	1.8	47.1	0.2	-2.4	12.7	na
NRA non-agric.	na	114.4	117.8	81.7	57.8	54.6	39.9	18.6	15.0	10.1	na
RRA	na	-51.5	-51.9	-39.8	-41.6	-33.3	5.1	-15.5	-14.9	3.4	na
China and Southeast Asia[b]											
NRA agric.	na	-43.6	-42.6	-40.1	-35.7	-34.5	-27.8	-12.0	4.9	7.1	na
NRA non-agric.	na	36.5	36.5	33.7	30.8	20.6	23.3	19.8	9.6	5.5	na
RRA	na	-58.7	-58.0	-55.2	-50.8	-43.4	-41.6	-26.4	-4.2	1.5	na
Japan, Korea and Taiwan											
NRA agric.	30.1	39.9	48.8	51.3	75.5	78.8	124.3	129.9	130.5	138.1	126.1
NRA non-agric.	8.6	8.3	6.1	4.2	3.5	2.4	2.5	1.4	1.1	0.6	1.0
RRA	19.7	29.1	40.2	44.9	69.6	74.6	118.7	126.7	128.1	136.7	123.7
European transition economies											
NRA agric.	na	na	na	na	na	na	na	10.0	18.3	16.1	17.0
NRA non-agric.	na	na	na	na	na	na	na	9.8	5.5	4.6	2.7
RRA	na	na	na	na	na	na	na	0.1	12.2	11.0	13.9
Western Europe											
NRA agric.	43.8	57.0	67.5	45.7	56.3	74.4	82.0	63.4	43.6	36.8	18.5
NRA non-agric.	8.0	7.2	5.7	3.8	2.5	1.5	1.7	1.3	1.5	1.4	1.2
RRA	33.1	46.5	58.6	40.4	52.6	71.9	79.0	61.3	41.5	34.9	17.1
North America											
NRA agric.	12.5	10.5	10.9	7.5	7.6	13.8	20.2	16.1	11.4	17.3	11.2
NRA non-agric.	6.1	7.4	7.4	5.5	4.1	3.8	3.7	3.3	2.1	1.5	1.3
RRA	6.0	2.9	3.3	1.8	3.4	9.7	15.8	12.4	9.1	15.5	9.7
Australia and New Zealand											
NRA agric.	5.5	6.6	8.3	7.9	7.3	10.6	8.7	4.3	2.9	1.0	0.6
NRA non-agric.	20.0	21.5	24.0	19.7	14.3	13.5	10.3	6.4	3.4	2.4	2.4
RRA	-12.1	-12.2	-12.6	-9.9	-6.1	-2.6	-1.5	-2.0	-0.5	-1.4	-1.8
All developing countries[b]											
NRA agric.	na	-24.0	-27.3	-31.9	-25.5	-21.0	-15.6	-3.9	4.0	7.4	na
NRA non-agric.	na	58.3	60.0	45.8	37.3	34.6	27.0	16.7	9.8	6.3	na
RRA	na	-52.0	-54.5	-53.3	-45.8	-41.3	-33.6	-17.6	-5.3	1.1	na
All high-income countries											
NRA agric.	23.0	30.9	36.8	26.5	34.7	43.0	55.5	48.2	36.6	33.9	18.3
NRA non-agric.	7.5	8.5	7.7	5.4	3.6	3.4	3.2	2.5	1.7	1.3	-0.7
RRA	14.3	20.6	27.1	19.9	30.1	38.3	50.6	44.6	34.3	32.1	19.2
World[b]											
NRA agric.	na	5.6	7.6	0.8	2.6	5.7	18.7	19.7	18.4	18.6	na
NRA non-agric.	na	19.0	20.5	16.1	13.7	10.0	9.8	7.6	6.0	4.0	na
RRA	na	-11.3	-10.7	-13.2	-9.8	-3.6	8.1	11.3	11.8	14.0	na

Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009).

a. The RRA is defined as $100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$, where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

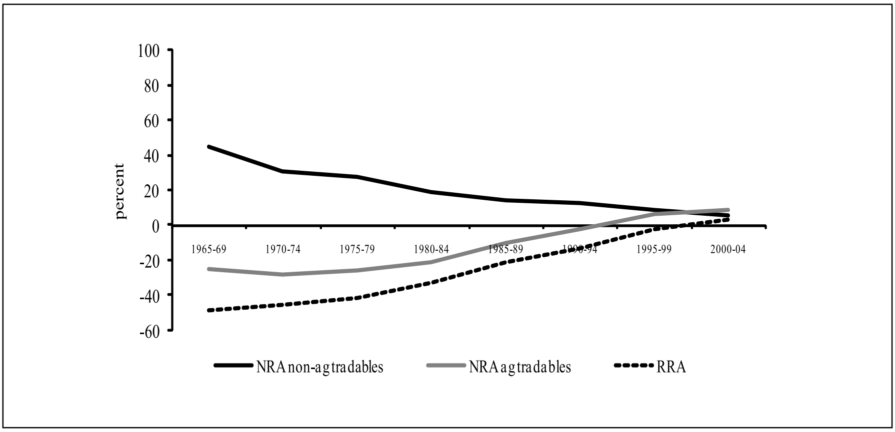
b. Estimates for China pre-1981 and India pre-1965 are based on the assumption that the nominal rate of assistance to agriculture in those years was the same as the average NRA estimates for those countries for 1981-84 and 1965-69, respectively, and that the gross value of production in those missing years is that which gives the same average share of value of production in total world production in 1981-84 and 1965-69, respectively. Developing and world country aggregates are computed accordingly.

FIGURE 7.5

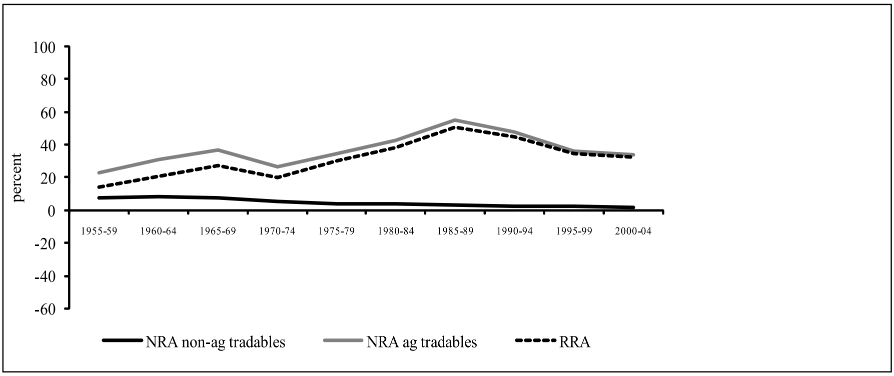
Nominal rates of assistance to agricultural and non-agricultural tradable products and relative rate of assistance,[a] all focus countries, 1955 to 2004

(percent)

(a) Developing countries (not including Europe's transition economies)[b]



(b) High-income countries (not including Europe's transition economies)



Source: Anderson and Valenzuela (2008), based on estimates reported in the national country studies summarized in Anderson (2009).

a. The RRA is defined as 100*[(100+NRAagt)/(100+NRAnonagt)-1], where NRAagt and NRAnonagt are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

b. Estimates for China pre-1981 and India pre-1965 are based on the assumption that the nominal rate of assistance to agriculture in those years was the same as the average NRA estimates for those countries for 1981-84 and 1965-69, respectively, and that the gross value of production in those missing years is that which gives the same average share of value of production in total world production in 1981-84 and 1965-69, respectively.

for farmers. When decomposed by region, it is clear that Asia has been the major contributor to this dramatic reform (Table 7.4) and, within Asia, it is China and India that contributed most to that outcome (Anderson and Martin 2009).

In summary, the above estimates reveal the following five features of distortions to global agricultural markets:

- Growth in agricultural protection from import competition as per capita incomes rise is as much a phenomenon of developing countries as it is of high-income countries;
- Most assistance to farmers – all but one-quarter in high-income countries and all but one-ninth in developing countries – is due to barriers to farm imports (so tariff reductions matter far more than cuts to production subsidies, although the latter also need to be disciplined, for example though the WTO, if re-instrumentation to that other coupled form of assistance to farmers is to be avoided);
- Within the import-competing part of the agricultural sector there are still high tariff peaks for some commodities (so larger proportional reductions in high tariffs and a commitment to place a cap on farm tariffs would be helpful) ;
- The improvement in incentives for farmers in developing countries has come as much from reduced tariff protection in manufacturing as it has from reforms to agricultural policies; and
- The contribution of farm policy reforms to the improvement in incentives for farmers in developing countries has come mostly from reduced export taxation.

7.2 Economy-wide effects of past reforms and of remaining policies

Before discussing implications of the above findings, it is helpful to assess the global trade and welfare effects of the agricultural and trade policy reforms of the past quarter-century, and to compare them with the effects of remaining distortions. Such an assessment is provided by Valenzuela, van der Mensbrugghe and Anderson (2009) using a global economy-wide model (the World Bank's Linkage Model – see van der Mensbrugghe 2005). Using a combined retrospective and prospective analysis, they show how far the world has come, and how far it still has to go, in removing the disarray in world agriculture. They quantify the impacts both of past reforms and current policies by comparing the effects of the above distortion estimates for the period 1980-84 with those of 2004.

Several key findings from that economy-wide modeling study are worth emphasizing. First, the policy reforms from the early 1980s to the mid-2000s improved global economic welfare by $233 billion per year, and removing the distortions remaining as of 2004 would add another $168 billion per year. This suggests that in a global welfare sense the world had moved three-fifths of the way towards global free trade in goods over that quarter century: a significant achievement, with the Uruguay Round contributing slightly in so far as it pressured the EU to lower farm price supports from the early 1990s and begin to replace them with more-decoupled payments.

Second, developing economies benefited proportionately more than high-income economies from those past policy reforms (a boost to national income that averaged 1.0 percent, compared with 0.7 percent for high-income countries), and they would gain nearly twice as much as high-income countries by completing that reform process (an average increase of 0.9 percent compared with 0.5 percent for high-income countries). Of those prospective welfare gains from global liberalization, 60 percent would come from agriculture and food policy reform. This is a striking result given that the shares of agriculture and food in global GDP and trade are less than 7 percent. The contribution of farm and food policy reform to the prospective welfare gain for just developing countries is even greater than for the world as a whole, at 83 percent.

Third, the share of global farm production exported (excluding intra-EU trade) in 2004 was slightly smaller as a result of those reforms since 1980-84, because of less farm export subsidies. Primary agriculture's 8 percent share in 2004 contrasts with the 31 percent share for other primary products and the 25 percent for all other goods – a 'thinness' that is an important contributor to the volatility of international prices for weather-dependent farm products. If the policies distorting goods trade in 2004 were removed, the share of global production of farm products that is exported would rise from 8 to 13 percent, thereby reducing instability of prices and quantities of those products traded.

Fourth, the developing countries' share of the world's primary agricultural exports rose from 43 to 55 percent, and its farm output share from 58 to 62 percent, because of reforms between the early 1980s and 2004, with rises in nearly all agricultural industries except rice and sugar. Removing remaining goods market distortions would boost the developing countries' export and output shares to 64 and 65 percent, respectively.

Fifth, the average real price in international markets for agricultural and food products would have been 13 percent lower had policies not changed over the past quarter century. Evidently the impact of the RRA fall in high-income countries (including the cuts in farm export subsidies) in raising international food prices more than offset the opposite impact of the RRA rise (including the cuts in agricultural export taxes) in developing countries over that period. By contrast, removing remaining distortions as of 2004 is projected to raise the international price of agricultural and food products by less than 1 percent on average. This is contrary to earlier modeling results based on the GTAP protections database (e.g. Anderson, Martin and van der Mensbrugghe (2006) which estimated they would rise by 3.1 percent, or for just primary agriculture, by 5.5 percent). The lesser impact in these new results is because export taxes in developing countries based on the above NRA estimates are included in the new database (most notably for Argentina), whose removal would offset the international price-raising effect of eliminating import protection and farm subsidies elsewhere.

Sixth, for developing countries as a group, net farm income (value added in agriculture) is estimated to be 4.9 percent higher than it would have been without the reforms of the past quarter century, which is more than ten times the proportional gain for non-agriculture. If policies remaining in 2004 were removed, net farm incomes in developing countries would rise a further 5.6 percent (of which 5.4 percent would be due to agricultural policies), compared with just 1.9 percent for non-agricultural value added. Table 7.5 shows, however, that the gain in farm income is concentrated in East Asia and Latin America. Since they are the most wealthy developing country regions, that might suggest such reform would not necessarily be poverty alleviating. However, also relevant to the poverty impact is what happens to unskilled wages. Table 7.6 shows that returns to unskilled workers in developing countries – the majority of whom work on farms – would rise more than returns to other productive factors from that liberalization, especially when deflated by the food and clothing consumer price index. The only region where that would not be the case is (marginally) South Asia.

Table 7.5

Effects on agricultural and non-agricultural sectoral value added of full global liberalization of agricultural and all sectors' merchandise trade poicies, 2004

(relative to benchmark data, percent)

	Agricultural policies		All sectors' policies	
	Agric value added	Non-ag value added	Agric value added	Non-ag value added
Developing countries	5.4	1.0	5.6	1.9
North Africa	-0.4	1.8	-1.1	0.8
Sub-Saharan Africa	0.3	0.3	-0.8	-0.5
East Asia	2.6	0.6	4.7	3.5
South Asia	-5.1	1.1	-6.7	-0.3
Latin America	36.3	2.8	37.0	2.3
Middle East	26.3	0.5	25.4	0.9
Eastern Europe & Central Asia	-4.4	0.3	-5.2	0.3
High-income countries	-13.8	0.2	-14.7	0.1
World total	-1.0	0.4	-1.2	0.5

Source: Anderson, Valenzuela and van der Mensbrugghe (2010).

TABLE 7.6

Impacts of full global merchandise trade liberalization on real factor prices, 2004 (relative to the benchmark data, percent))

	Nominal change deflated by aggregate CPI			Real change in unskilled wages deflated by:		
	Skilled wages	Capital[a] user cost	Land[a] user cost	Aggregate CPI	Food CPI	Food and clothing CPI
High-income countries	1.0	0.5	-17.9	0.2	3.3	3.3
Australia	0.4	0.8	9.4	1.3	0.0	1.6
New Zealand	-1.2	1.5	34.8	5.9	6.2	7.3
Canada	0.5	0.4	6.3	0.4	1.7	2.7
United States	0.2	0.1	-2.9	-0.1	-2.0	0.0
EU 15	1.7	0.6	-39.5	-0.1	4.2	3.6
Other Western Europe	3.1	3.1	-50.6	0.8	19.3	14.0
Japan	1.7	1.2	-29.3	0.9	6.5	6.0
Developing countries	3.0	2.9	1.6	3.5	5.5	5.9
North Africa	7.7	5.3	-0.5	7.0	9.3	10.4
Sub-Saharan Africa	3.2	3.8	0.2	3.2	4.4	5.3
East Asia	3.4	3.3	1.9	4.0	6.9	6.9
South Asia	2.3	1.2	-6.2	-0.6	-2.5	-1.9
Latin America	1.4	1.9	21.1	4.5	2.4	4.1
Middle East	2.9	4.7	43.8	8.3	17.0	16.5
Eastern Europe & Central Asia	3.2	2.6	-4.5	1.7	4.2	4.5
World total	1.3	1.2	-3.1	0.9	3.6	3.8

[a] The user cost of capital and land represents the subsidy-inclusive rental cost.
Source: Anderson, Valenzuela and van der Mensbrugghe (2010).

Seventh, under the full merchandise trade reform scenario, Table 7.7 reports that extreme poverty (the number of people surviving on less than US$1 a day) in developing countries would drop by 26 million relative to the baseline level of just under one billion, a reduction of 2.7 percent. The proportional reduction is much higher in China and in Sub-Saharan Africa, each falling around 4 percent. It is even higher in Latin America (7 percent) and South Asia other than India (10 percent). By contrast, the number of extreme poor in India is estimated to rise, by 4 percent[9]. Under the more moderate definition of poverty—those living on no more than US$2 per day—the number of poor in developing countries would fall by nearly 90 million compared to an aggregate baseline level of just under 2.5 billion in 2004, or by 3.4 percent (notwithstanding the number in India below $2 a day still increasing, but by just 1.7 percent).

[9] The rise in India is partly because of the removal of the large subsidies and import tariffs that assist Indian farmers, and partly due to the greater imports of farm products raising the border price of those imports.

TABLE 7.7

Effects of full global merchandise trade liberalization on the number of extreme poor, using the Linkage model, by region

	Average unskilled wage change, real[a]	Baseline headcount		New levels, $1/day		New levels, $2/day		Change in number of poor from baseline levels		Change in number of poor from baseline levels	
		$1/day	$2/day	Headcount	Number of poor	Headcount	Number of poor	$1/day	$2/day	$1/day	$2/day
	(%)	(%)	(%)	(%)	million	(%)	million	million	million	%	%
East Asia	4.4	9	37	8	151	34	632	-17	-52	-10.3	-7.6
China	2.1	10	35	9	123	34	440	-5	-12	- 4.0	-2.7
Other East Asia	8.1	9	50	6	29	42	192	-12	-40	-30.1	-17.1
South Asia	-1.9	31	77	32	454	78	1124	8	8	1.8	0.7
India	-3.8	34	80	36	386	82	883	15	15	4.2	1.7
Other South Asia	4.0	29	94	26	68	92	241	-8	-7	-9.9	-2.7
Sub Saharan Africa	5.3	41	72	39	287	70	508	-11	-14	-3.8	-2.7
Latin America	4.1	9	22	8	44	21	115	-3	-6	-6.8	-4.7
Middle East & North Africa	14.3	1	20	1	3	13	40	-2	-19	-36.4	-32.7
Above developing countries	5.9	18	48	18	944	46	2462	-26	-87	-2.7	-3.4
Developing, excluding China	6.5	21	52	20	820	50	2022	-21	-74	-2.5	-4.7
Eastern Europe & Central Asia	4.5	1	10	1	4	9	43	-0	-4	-6.8	-8.0

[a] Nominal unskilled wage deflated by the food and clothing CPI

Source: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

7.3 Prospects for further reductions in price distortions

The above review of estimates of policy indicators could lead one to view developments from the early 1960s to the mid-1980s as an aberrant period of welfare-reducing policy divergence (negative and declining RRAs in low-income countries, positive and rising RRAs in most high-income countries) that has given way to welfare-improving and poverty-reducing reforms during which the two country groups' RRAs are converging. But closer inspection of the NRAs for exporting and import-competing sub-sectors of agriculture (figure 7.1) makes clear that the convergence of NRAs to near zero is mainly with respect to the exporting sub-sector, while NRAs for import-competing farmers are positive and trending upwards over time at the same rate in both developing and high-income countries – notwithstanding the Uruguay Round Agreement on Agriculture which was aimed at tariffying and reducing import protection. True, applied tariffs have been lowered or suspended as a way of dealing with the international food price spike in 2008, but this, and the food export taxes or quantitative restrictions imposed that year by numerous food-exporting developing countries, may be only until international prices return to trend (as happened after the price hike of 1973-74 and the price dip of 1986-87).

The indications are very mixed as to why some countries appear to have reformed their price-distorting agricultural and trade policies more than others in recent decades, and why some have stubbornly resisted reform. Some reforming countries have acted unilaterally, apparently having become convinced that it is in their own national interest to do so. China is but the most dramatic and significant example of the past three decades among developing countries, while among the high-income countries only Australia and New Zealand are in that category. Others may have done so partly to secure bigger and better loans from international financial institutions and then, having taken that first step, they have continued the process, even if somewhat intermittently. India is one example, but there are numerous examples also in Africa and Latin America. Few have gone backwards in terms of increasing their anti-agricultural bias, but Zimbabwe and perhaps Argentina qualify during the present decade – and numerous others joined them in 2008, at least temporarily, in response to the sudden upward spike in international food prices. And some have reduced their agricultural subsidies and import barriers at least partly in response to the GATT's multilateral Uruguay Round Agreement on Agriculture, the European Union (EU) being the most important example (helped by its desire also for otherwise-costly preferential trade agreements, including its recent expansion eastwards).

The EU reforms suggest agricultural protection growth can be slowed and even reversed if accompanied by re-instrumentation away from price supports to decoupled measures or more direct forms of farm income support. The starker examples of Australia and New Zealand show that one-off buyouts can bring faster and even complete reform[10]. But in the developing countries where levels of agricultural protection are generally below high-income levels, there are fewer signs of a slowdown of the upward trend in agricultural protection from import competition over the past helf-century.

Indeed, there are numerous signs that developing country governments want to keep open their options to raise agricultural NRAs in the future, particularly via import restrictions. One indicator is the high tariff bindings that developing countries committed themselves to following the Uruguay Round: as of 2001, actual applied tariffs on agricultural products averaged less than half the corresponding bound tariffs for developing countries of 48 percent, and less than one-sixth in the case of least-developed countries (Anderson and Martin 2006, Table 1.2).

Another indicator of agricultural trade reform reluctance is the unwillingness of many developing countries to agree to major cuts in bound agricultural tariffs in the WTO's on-going Doha round of multilateral trade negotiations. Indeed, many of them believe high-income countries should commit to reducing their remaining farm tariffs and subsidies before developing countries should offer further reform commitments of their own. Yet modeling results reported in Valenzuela, van der Mensbrugghe and Anderson (2009) suggest that if high-income countries alone were to liberalize their agricultural markets, such a sub-global reform would provide less than two-thirds of the potential gains to developing countries that could come from global agricultural policy reform.

More than that, the current negotiations have brought to prominence a new proposal for agricultural protectionism in developing countries. This is based on the notion that agricultural protection is helpful and needed for food security, livelihood security and rural development. This view has succeeded in bringing "Special Products" and a "Special Safeguard Mechanism" into the multilateral trading system's agricultural negotiations, despite the fact that such policies, which would raise domestic food prices in developing countries, may worsen poverty and the food security of the poor (Ivanic and Martin 2008).

To wait for high-income country reform before liberalizing the farm trade of developing countries is unwise as a poverty alleviating strategy, not least because the past history revealed in the NRAs summarized above suggests such reform will be at best slow in coming. In the US, for example, the most recent two five-year farm bills were steps backwards from the previous regime which at least sought to re-instrument protection towards less trade-distorting measures (Gardner 2009). Nor have the world's large number of new regional integration agreements of recent

[10] For a detailed analysis of the buyout option versus the slower and less complete cashout option (moving to direct payments), as well as the uncompensated gradual squeeze-out or sudden cutout options, see Orden and Diaz-Bonilla (2006).

years been very successful in reducing farm protection. Furthermore, for developing countries to postpone their own reform would be to forego a major opportunity to boost theirs and (given the size and growth in South-South trade of late) their neighbors' economies. As Anderson and Winters (2009) argue, it would be doubly wasteful if, by being willing to commit to reform in that way, they would be able to convince high-income countries to reciprocate by signing on to a more-ambitious Doha agreement, the potential global benefits from which are very considerable.

Developing countries that continue to free up domestic markets and practice good macroeconomic governance will keep growing, and typically the growth will be more rapid in manufacturing and service activities than in agriculture, especially in the more densely populated countries where agricultural comparative advantage is likely to decline. Whether such economies become more dependent on imports of farm products depends, however, on what happens to their relative Rates of Assistance (RRA). The first wave of Asian industrializers (Japan, and then Korea and Taiwan) chose to slow the growth of food import dependence by raising their NRA for agriculture even as they were bringing down their NRA for non-farm tradables, such that their RRA became increasingly above the neutral zero level (Table 7.4). A key question is: will later industrializers follow suit, given the past close association of RRAs with rising per capita income and falling agricultural comparative advantage? Developing countries' RRA trends of the past three decades have been on the same upward trajectory as the high-income countries prior to the 1990s, so unless new forces affect their polities, the governments of later industrializing economies may well follow suit.

One potential new force is disciplines on farm subsidies and protection policies of WTO member countries following the Uruguay Round. Earlier industrializers were not bound under GATT to keep down their agricultural protection, and the legal constraints on developing countries have been even less constraining. For India, Pakistan and Bangladesh, for example, their estimated NRAs for agricultural importables in 2000-04 are 34, 4 and 6 percent, respectively, whereas the average bound tariffs on their agricultural imports are 114, 96 and 189 percent, respectively (WTO, ITC and UNCTAD 2007). Also, like other developing countries, they have high bindings on product-specific domestic supports of 10 percent and another 10 percent for non-product specific assistance, a total of 20 more percentage points of NRA (17 percent in China's case) that legally could come from domestic support measures – compared with currently 10 percent in India and less than 3 percent in the rest of South Asia.

Hopefully developing countries will choose not to make use of the legal wiggle room they have allowed themselves in their WTO bindings to follow Japan, Korea and Taiwan into high agricultural protection. A much more efficient and equitable strategy would be to instead treat agriculture in the same way they have been treating non-farm tradable sectors. That would involve opening the sector to international competition, and relying on more-efficient domestic policy measures for raising government revenue (e.g., income and consumption or value-added taxes in lieu of trade taxes)[11] and to assist farm families (e.g., public investment in rural education and health, rural infrastructure, and agricultural research and development). Investments in public agricultural R&D in developing countries as a group are currently equivalent to just 0.3 percent of the gross value of farm production (about one-third the intensity of high-income countries). Given the extremely high rates of return at the margin to such investments (see, e.g., Fan 2008), expenditure on that would be far wiser than providing farm price supports as middle-income economies develop.

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[11] Developing countries are becoming less and less reliant on trade taxes as a source of government revenue, with even very poor countries realizing that a tax imposed at the border, if called a consumption tax rather than a tariff, does not induce protected domestic production and yet can raise the same revenue at the same collection cost as a tariff.

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Review of public support to agricultural insurance

Piero Conforti[1]

Introduction[2]

Farmers operate within a highly uncertain environment characterized by long production cycles. The amounts and quality of products that will become available several months ahead, the price that will materialize in output markets, the institutional framework that will prevail, and even technologies, are subject to wide changes during the production cycle. Such a high degree of uncertainty implies a number of risks[3].

Risks in agricultural production are among the justifications for extensive public support to the sector by certain countries, along with the importance attached to securing food supplies and access to adequate levels of consumption. As recently observed by the Organisation for Economic Co-operation and Development (OECD, 2009b), many domestic support measures have a significant impact on risk. Income support measures granted to farmers in some OECD countries have been widely analyzed in terms of their impact on risk, both theoretically and empirically (Sckokai

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[3] There are several classifications of the sources of uncertainty and risks in agriculture; reference is made here to the one proposed by Moschini and Hennessy (2001), which takes into account sources, and proposes four of them: production, prices, technology and policies. Other classifications divide idiosyncratic risks, affecting individuals, from co-variant risks, which affect groups; and systemic risks, which affect entire countries or regions. A wide discussion is in OECD (2009a). The two concepts of "risk" and "uncertainty" can be differentiated in several ways. Normally risk implies knowledge of a probability distribution, while uncertainty does not. We concur with OECD (2009a) that the distinction is not particularly useful, given that in most cases uncertainty implies some risk and *vice versa.*

and Moro, 2006; Koundouri et al, 2009).[4]

In many developing and least-developed countries, agriculture is less generously supported than in OECD countries. In these countries farmers mitigate risk and prevent excessive income and consumption fluctuations mainly by resorting to a plethora of more or less formal strategies and practices. Despite being effective in many instances, in developing countries such mitigation mechanisms can hinder investment, innovation and agricultural development (Alderman and Paxon, 1992), or even perpetuate poverty traps (Dercon, 2004, 2005; Barrett et al, 2008). Promoting the ability to manage risk can be an important element to foster agricultural development in poor countries. The World Bank (2008) has recently indicated that this requires a number of combined actions, among which the reduction of exposure to risks can play an important role.

Insurances are among the tools which can help managing risk in agriculture. They are private services, which can be exchanged in a market. In principle, this warrants more efficient use and better targeting, in managing farmers' risk, compared to price and income support policies. Among agricultural policy measures, schemes involving private insurance are considered less distortionary. In terms of the World Trade Organization (WTO) classification, support to insurance can be notified within the green box measures, implying no or minimal impact on trade; however, some support has been notified as an amber box, under the *de minimis* provisions. In developing countries, the insurance market tends to be incomplete, as for services in general.

Public intervention in agricultural insurance is frequent. Some insurance schemes are directly operated by the public sector or by paratsatals. In other cases, private insurance companies are supported by governments through different channels. Governments themselves seem to be looking with growing interest towards market-based tools to hedge their financial positions in case of extreme adverse events affecting both agriculture as well as the rest of the economy.

The record of a number of publicly backed agricultural insurance schemes is mixed, especially in terms of financial sustainability and farmers' participation. Many have been abandoned, and there are reported cases in which informal mechanisms as well as micro-insurance are deemed to be crowded out by public intervention (Skees and Hess, 2003). But there are also many examples in which governments have played a positive role in the development of the agricultural insurance market (Angelucci, 2008). There are also cases in which even informal mitigation strategies

[4] Risk reduction is one of the channels through which subsidies which are classified as "decoupled" from production decisions – for instance those granted under the Common Agricultural Policy of the European Union – do in fact affect farmers' investment decisions.

may exclude the poorest, and hence call for some kind of public intervention (Santos and Barrett, 2006).

Based on a review of experiences with agricultural insurance, this chapter seeks to shed light on the role being played by the public sector in this market. Section 2 draws from the literature on risk management in agriculture to understand if and how governments need to intervene in agricultural insurance. Starting points in this area are the work of the World Bank (2005) on risk layering, and the holistic approach to risk management proposed by the OECD (2009a). Section 3 compares the indications which can be derived from such frameworks with the evidence provided by case-studies. A number of agricultural and non agricultural insurance described in the literature are reviewed, summarized and organized, with reference to public intervention. Concluding remarks are in section 4.

8.1 Risk layering, policies, and the role of governments

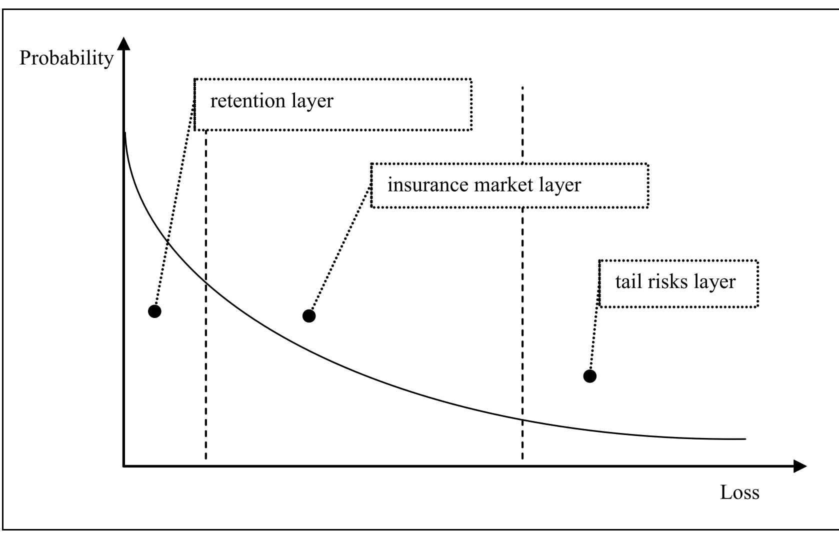
Insurance is a service which enjoys the properties of excludability and rivalry. Hence, the role of the public sector in the insurance market should be limited, in principle, to providing regulations and information. A legal framework needs to be in place to enforce contracts and ensure competition among insurance companies. Governments should also ensure that the information required for actuarial calculations and defining contracts is available to the involved parties. Data on risk exposure and, possibly, on expected damages are needed on the supply side. On the demand side, information can reduce so-called cognitive failure, which is the tendency to underestimate the probability of unlikely events. Since private agents would have no incentive to collect and disclose some of this information, government intervention is necessary. Especially in poor communities, agents may be unfamiliar with the concept and characteristics of insurance, especially those of the more innovative products. If so, training may play a useful role.

However, not all risks are insurable. Highly frequent and small-size risks are usually not insured because the associated losses are smaller than the transaction costs involved in insurance. At the other extreme of the spectrum, private companies cannot directly insure the so-called covariate or systemic risks, such as large-scale droughts or floods, which involve very large damages. Insurance companies would be unable to pay indemnities in case of adverse events affecting a large number of insured (Sawada, 2006).

Risk layering is one way of logically separating insurable from non-insurable risks, and defining the respective role of private companies and governments (World Bank, 2005; OECD, 2009a). Layering is the identification of areas in a probability distribution of potential losses associated with adverse events (Figure 8.1). Three "layers" can be identified:

- a "retention layer", including losses associated with the normal or expected variability in uncertain outcomes, and which are normally retained by entrepreneurs;
- an "insurance market layer", which includes losses that are large enough to disrupt normal business practices, but can be pooled in an insurance product sold by a private company; and
- a "tail risks layer", comprising catastrophic events that insurers are unwilling to cover, and only public intervention can address.

FIGURE 8.1
Risk layers



Source: adapted from World Bank (2005)

While layering is a useful concept, quantifying losses and probabilities associated with risky events is not easy in agriculture. This is one of the reasons why commercial insurance tends to have a more limited circulation compared to other sectors (FAO, 2005). It is interesting to consider what can affect the ability of agents to behave as expected in the above framework. The probability distribution of expected damages is primarily determined by the specific risks of each environment. But the ability of farmers to retain small risks, and the possibility for private insurances to operate, depend upon a number of other elements. Insights on these are described in the two sub-sections that follow.

8.1.1 What affects the ability of farmers to retain small and frequent risks?

As seen, losses in the retention layer are highly frequent and of limited size. In most rural contexts, they are normally addressed through income diversification and other consumption smoothing mechanisms, as well as through the use of a number of services. Credit and finance, the availability of storage and transport facilities, extension and technical assistance all contribute to counteract the negative impact of production variability. Farmers often require credit even to bridge the time lag between sowings and harvests, given that revenues are usually collected at the end of the production cycle while inputs need to be purchased from the beginning. Storage, and the purchase of financial assets, when accessible, can serve to manage the expected variability in price and yields. If the physical characteristics of production and the institutional context allow hedging, even unexpected price variability can be dealt with by farmers directly. The availability of updated and location-specific technical information is another element that helps farmers reduce their risk exposure. For instance, the application of agronomic techniques can reduce the impact of pest attacks, or other sources of yield variability. The extent to which markets for these services work effectively and meet farmers' demands affects their ability to retain small risks.

Where the service markets are incomplete or uncompetitive, the ability to retain risks is hindered. This is frequently true in developing countries and, in general, for households close to subsistence conditions. In these cases, farmers are forced to rely exclusively on mitigation strategies and other informal ways to smooth incomes and consumption. Examples range from crop and income diversification to informal networks of relatives and friends; from social safety nets to contracts, such as share tenancy or credit contracts, or business contracts along a production chain (Alderman and Paxon, 1992).

While some of these strategies are common to all agricultural environments – for instance crop and income diversification or the different types of vertical integration – there are contexts in which they result in the perpetuation of subsistence conditions and hinder specialization and productivity improvements. Farmers may easily reject technical change, such as improved seeds or new cultivation techniques, due to the need to increase income through diversification and reduce the exposure generated by costly inputs. Hence, risk may prevent the development of agricultural productivity, leaving potential resources idle (Carter, 2008). Income risk can be at the origin of the poverty traps and constitute a key constraint to agricultural development and the improvement of living standards of poor households (Dercon, 2004, 2005; Barrett et al, 2008).

Policies also play a part in shaping the ability of farmers to retain risks.[5] Price subsidization, border protection and direct income support are likely to increase farmers' ability and willingness to retain individual risks directly. In turn, this affects their ability to invest in and purchase technical and financial services that can smooth income variability. In developing countries, support to agriculture is usually limited, if not negative, and farmers can be directly exposed to world price variability, as well as to large swings in traded volumes. This reduces their ability to retain small risks and increases their reliance on informal mitigation and smoothing strategies. As mentioned above, such strategies may prevent investment and perpetuate low productivity and poverty traps.

8.1.2 What affects the emergence of a market for agricultural insurance?

Insurable risks, falling within their relative layer, are those which can be pooled within a market. Private companies will be able to determine the relative premiums on the basis of a probability distribution of insurable events. Traditional commercial insurance in agriculture includes those covering specific risks, such as hail. These normally imply differentiated damages across groups of farmers, which can be pooled. Multi-peril policies have also been developed in the past.

One significant product innovation in this field is the so-called index-based or parametric insurance (Skees et al, 1999; World Bank, 2005; Skees et al, 2006; Varangis and Lewin, 2006). Indexed insurance is based on the idea that a pre-determined indemnity can be triggered by changes in an objective indicator – the index or parameter – which is expected to affect individual policy subscribers to a pre-determined extent. Damages, and the related indemnities, are computed on the basis of their statistical association with the index[6]. After an initial investment in design and data gathering and processing, indexed contracts allow costly *ex-post* damage assessments, which are required in traditional insurance, to be avoided. This can reduce the asymmetry of information, and the related potential for moral hazard. Due to these potential advantages, indexed insurance has also been proposed as a means to provide and manage safety nets for poor farmers in developing countries (Chantarat et al, 2007; Barnett and Mahul, 2007; Skees et al, 2007). Against these advantages, indexed insurance requires that the insured assumes the so-called basis risk. Since indemnities are pre-determined, no compensation is paid for damages which exceed – or fall short of – what is predicted by the correlation between the

[5] The OECD (2009a) has recently emphasized the need to analyse risk management in agriculture by considering simultaneously all the elements that shape the risk profile of farmers, including policies and farmers' mitigation strategies.

[6] Indemnities are computed on the basis of the correlation between the parameter or index, say millimeters of rain at one gauge, and the damage suffered by farmers of the area around the gauge. When the millimeters of rain reach the established trigger point, indemnities are paid to the subscribers of the insurance, based on the statistically computed expected damage and without individual damage assessment.

index and the expected damage (Berg and Schmitz, 2006).

Weather parameters are the most widely applied indexes, consistent with the notion that yield failures arising from climatic variability are the most important reason for vulnerability, especially in the agriculture of developing countries (Barnett and Mahul, 2007; OECD, 2008). Yields are also employed as indexes, as well as expected revenues (in the USA, for example). Other indicators can be used to design insurance and safety nets, including food security indicators in developing countries (Chantarat et al, 2007).

Similar to what happens with respect to the ability of farmers to retain small losses, the possibility to develop a market for private insurance in agriculture is affected by the agricultural policy frameworks. Where agriculture is extensively supported, farmers' incentives to purchase an insurance policy may be reduced, given their enhanced ability to retain risks individually (OECD, 2009b; Roth et al, 2007). Support to agriculture, in other words, can crowd out private insurance, unless premiums are subsidized as well. Subsidized premiums imply considerable distortions in production decisions, especially when they are granted for specific crops. This will change the distribution of expected revenues and encourage production on land that might not otherwise be used, as well as non-optimal investment in risky production (Young and Westcott, 2000). Moreover, subsidies may translate directly into rents for insurance companies, especially if the market is not competitive (Capitanio and Cafiero, 2006).

In addition, in poor developing countries, where agriculture receives less support, there seems to be limited space for the operation of private insurance. On the demand side, premiums may be expensive for poor and subsistence farmers, who may value them more then the worst possible insurable outcome. Poverty may result in a high rate of discount on the future,[7] and make more unlikely the decision to spend money to counteract future uncertain events. This may contribute to scarce knowledge and understanding of insurance contracts and to cognitive failures on risky events, thus reducing interest in purchasing insurance. From this perspective, poverty and subsistence conditions seem to reduce both the ability to retain small losses and the willingness to purchase insurance. A reduced ability to retain small losses seems unlikely to translate into more opportunities for commercial insurance.

On the supply side, high transaction and delivery costs in remote rural areas may result in high premiums, and the potential for moral hazard may undermine incentives for insurance companies to operate. Controlling contractual conditions

[7] Evidence on this point is not straightforward: empirical studies have shown that subsistence farmers, even under extreme conditions, make considerable efforts to preserve productive assets, showing reduced rates of time preferences; see, for instance, Moseley (2001). Also, risk perceptions can be extremely variable, depending upon contingent events (Doss et al, 2008).

may be difficult: companies may ignore the degree of exposure of farmers to different sources of risks, as data are seldom available for remote communities. Actuarial calculations may thus become difficult. For this reason, indexed insurance is seen as a promising alternative: it can tackle two major constraints to the operation of private insurances: transaction costs and the need to assess damages ex-post.

8.1.3 Tail risks

The so-called “tail risks” or “market failure” layer includes highly infrequent and damaging events which are usually not insured by private companies. The magnitude of the associated losses, on the one hand, and the cognitive failure, on the other, can reduce the willingness of farmers to insure against unlikely events, and prevents private insurance companies from operating. Farmers often develop expectations of receiving support from the governments in case of extreme events and large covariate damages, such as droughts, floods or earthquakes. This may reinforce cognitive failures and contribute to depress market demand.

Tail risks call for the establishment of public-private partnerships, allowing risks to be transferred to a higher level. The World Bank (2005) provides indications on the means that governments can use to transfer risk. This can be done either through direct transfer to the re-insurance market, or through the re-insurance of pooled risk. The second option will leave some basis risk at the lower level. Examples of such types of extended partnerships are: the Turkish Catastrophe Insurance Pool; the Andhra Pradesh micro insurance programme; index-based weather derivative for farmers facing drought in Malawi; and the Caribbean Catastrophic Risk Insurance Facility (CCRIF), co-financed by the World Bank.

To sum up, risk layering helps identifying the different levels of risk facing farmers, and distinguishing risks in which private insurance could play a role as well as potential market failures that prevent private or market-based insurance from developing and operating. It consequently points the why to where the public sector can intervene to correct for these market failures, promote risk-reducing insurance markets and foster more stable production and incomes.

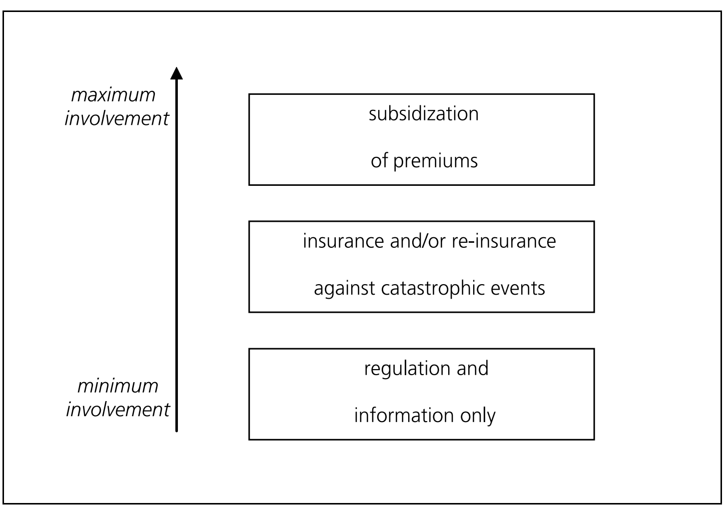
But how and where the governments can intervene is not a straightforward question. Equity considerations in the agricultural risk management of governments may warrant different choices, and these seem to be at least as important as those based on efficiency (OECD, 2009a). Typically, a government may want to provide support to more vulnerable farmers’ groups, or the production of goods that are considered strategic. In these cases a careful assessment would be in order, to understand whether supporting insurance is the best option to pursue this goal (Wright, 2006). The next section reviews several countries experiences with agricultural insurances, and the extent to which governments succeeded in addressing identifiable market failures and promote market-based insurance schemes to smooth production and incomes.

8.2 Experiences with government interventions in agricultural insurance

Public intervention in insurance markets takes different forms. The case studies reviewed here, which are far from being exhaustive, indicate that there are three broad types of public intervention (Figure 8.2). Firstly, public resources play a minimal role, comprised of regulation and the provision of information that is necessary to set up and enforce contracts. Secondly, public resources can be employed to re-insurance for covariate risks and extreme events. Thirdly, public resources can be employed to directly subsidize premiums, through State or private companies.

FIGURE 8.2

Types of government involvement in the agricultural insurance market



Source: Author

Examples of these three types of approaches are found in different countries, quite independently from the country's aggregate income level. Different organizations are also found within these three types, which are not mutually exclusive. Rather, they are incremental: premium subsidization is often implemented on top of the provision of a regulatory framework, and of financial support to public or private companies. It should be also noted that the distinction between the three types can be blurred, since the presence of a market failure justifying government intervention can often be questionable.

The literature reviewed in the remainder of this section classifies some cases as more "successful" than others. These judgments tend to reflect two main elements: firstly, the extent to which targeted farmers decided to purchase the insurance offered; and secondly, the financial sustainability of the insurance operations. It is worth noting that these are very crude indicators of the effectiveness of insurance in managing farmers' risks. A proper assessment has seldom been undertaken (Wright, 2006) and involves resolving a set of theoretical problems, starting from the identification of a relevant indicator (Cafiero, 2008). Detailed information on risks exposure and potential damages also needs to be collected. Such a sophisticated analysis is beyond the scope of this paper, and can only be applied to a few cases of agricultural insurance. Moreover, the distinction between more and less successful insurance becomes quite evident from the descriptions offered by the literature, especially in developing countries.

8.2.1. Support to agricultural insurance in the OECD

In the OECD, several countries provide public support to agricultural insurance. In terms of the three types described in Figure 8.2, many governments seem to be highly involved in the market, by providing re-insurance and subsidizing premiums.

In the European Union (EU), for instance, 17 member countries provide direct support to premiums for a variety of agricultural insurance, in the framework of farmers' income stabilization programmes. Available insurance includes traditional products, such as policies covering specific risks, as well as combined products based on yields, and index-based policies. However, index-based insurance is far less widespread than others: it is available only in Spain, the United Kingdom and Austria (European Commission, 2008). The share of the premiums that is subsidized is estimated to vary between 2 percent and 67 percent. In five EU member countries, governments provide re-insurance for covariate risks through public insurance companies, which in some cases is mandatory (Bielza et al, 2007).

In the USA, several types of agricultural insurance benefit from subsidized premiums and support to re-insurance against catstrophic events. Insurance can be stipulated on yields, for multiple perils; on revenues for specific products; and on the revenue of the whole farming activity, under the Adjusted Gross Revenue scheme. Index-base insurance has been introduced. It is mostly sold by private companies, but the US Department of Agriculture Risk Management Agency subsidizes premiums and administrative costs. A recent comparison of the incidence of subsidies to agricultural insurance in the EU and the USA indicates that public intervention in the agricultural insurance markets accounts for about 32 percent in the EU and

58 percent in the USA (European Commission, 2008). However, estimates of the aggregate market impact of the US subsidies on agricultural insurance have shown that this may be limited, especially in terms of distortion in production choices and trade flows (Young and Westcott, 2000).

Agricultural insurance is also subsidized in other OECD countries, such as Japan, Mexico and Turkey. In Mexico, until 2001 agricultural insurance was supplied exclusively by the National Agricultural and Livestock Insurance Company, a State entity. Following the liquidation of this company, insurance has been managed though Agroasemex, another public entity which operates mostly as a re-insurer of private companies (Barnett and Mahul, 2007; Angelucci, 2008.) Since 2002, Agroasemex has also started piloting, and subsequently operating, parametric insurance, tied to drought, excessive rainfall, temperature and wind speed parameters, and later on to a vegetation index. Apparently, the switch to private companies has led to a considerable increase in farmers' demand and has also smoothed financial requirements in case of extreme events. Further expansions of the system are deemed to be constrained only by the availability of weather stations (Agroasemex, 2006).

8.2.2 Support to agricultural insurance in developing countries

A number of agricultural insurance schemes are being promoted also in developing countries. We summarize their main features here, with reference to the three types of intervention described in Figure 8.2.

<u>Minimum involvement</u>

Examples of this first type of intervention – involving the provision of regulations and information – are found mostly among traditional agricultural insurance schemes, such as those covering damages from hail, or multi-peril. They tend to concern insurance that is limited in scope and size.

For instance, in Argentina about 25 companies operate on a purely private basis, offering insurance against single and multi-risks (FAO, 2005). However, their market is quite limited: less than 1 percent of the total land of the country (IICA, 2008). Ukraine is another case in which traditional insurance, operating on a private basis, has never developed significantly due to lack of farmers' interest. Several companies are actively competing in the sector, offering a variety of products, including weather index-based policies (Angelucci, 2008). The reasons given for such low interest range from lack of transparency in the design of contracts, to expectations of protection from the government in case of extreme events (Barnett and Mahul, 2007). Private agricultural insurance also operates in India, on high value-added products. However, it covers only a small share of production and land (FAO, 2005; Skees and Hess, 2003).

Coverage of tail risks

This second type of public intervention is common among the more innovative agricultural insurance schemes. Several examples are found among indexed insurance. The idea is that governments mostly operate by addressing market failures in the area of "tail risks".

One reported case of effective design is that of the livestock insurance in Mongolia. Risk for herders is layered. Index-based privately operated insurance is sold in the market. However, the government covers part of the losses incurred by this operation, and provides coverage for extreme covariate risks. The World Bank, in turn, assists the government with a loan. In this case, the goal is to preserve market incentives, allowing private companies to operate within the "market layer", while calling upon the government to play its subsidiary role in the "tail risks" layer (Angelucci, 2008).

Another example is found in Ethiopia. The scheme covers the highly covariate drought risk through the World Food Programme, which purchases an indexed insurance from a foreign private company. In other words, the insurance covers the ability of the World Food Programme to intervene in case of drought, and provides a timely availability of financial means to support interventions. While innovative, the scheme is deemed to be financially unsustainable (Barnett and Mahul, 2007).

Macro-level support is also offered by the World Bank in India, for the operation of an agricultural index-based insurance. This scheme was started in 2003 to cover insufficient water availability, mainly in the State of Maharastra, on basic products such as rice and groundnuts. At the micro level, insurance is offered by the private company ICICI Lombard, through a microfinance institution called BASIX. However, policies remained unsold. This outcome was attributed to the crowding-out effect of another public yield insurance, the National Agricultural Insurance Scheme (NAIS), which is subsidized (Skees and Hess, 2003). Allegedly, farmers would have no incentive to purchase policies from BASIX, due to competition from those of NAIS.

Another example of this type of intervention is found in Malawi (Hess and Syroka, 2005). Since 2005, coverage has been offered by private companies operating in conjunction with a farmers' association, and with assistance from the World Bank and other international institutions. The scheme is deemed to have sold several thousand contracts in its first three years of operation. A macro-level scheme has also been designed, to cater for emergency relief in case of drought (Angelucci, 2008).

A similar type of index-based insurance could not take off in Morocco. A scheme was developed in 2004, with assistance from the World Bank, to insure farmers against inadequate rainfall. The scheme was based on an index showing a high degree of correlation with yields. Implementation was unsuccessful, as it started during a period of unfavourable rainfall, which generated losses in the first year and quickly made the programme financially unsustainable (FAO, 2005; Angelucci, 2008).

Subsidization of premiums

This third type of intervention is relatively common in many countries. One example, already mentioned, is offered by NAIS in India, which is a vast government programme whose objectives are primarily social. NAIS is estimated to cover some 10 million farmers, corresponding to about 15.7 million hectares of land, providing insurance against credit default risk for most crops at premium rates of 1.5 to 3.5 percent of the amount of the loan. Premiums and indemnities are deemed to be inequitably distributed across crops and States; and the programme is considered to suffer from inefficiencies, such as long delays in payments of indemnities, as well as fraud and lack of financial sustainability (Skees and Hess, 2003).

The experience of Morocco with subsidized premiums is similar, to some extent. The government's *Programme Sécheresse*, started in 1995, has been supplying yield insurance through a mutual company called MAMDA. The main goal of the programme was to secure loans on the asset portfolio of the *Caisse Nationale de Credit Agricole*, a public lending entity. Critiques pointed mainly to excessive administrative costs and lack of fiscal sustainability (Stoppa and Hess, 2003; FAO, 2005; Angelucci, 2008).

A more traditional approach has been adopted by the Mauritius Sugar Insurance Fund (MSIF), which is entirely managed by the public sector (FAO, 2005). The MSIF was launched in the 1960s to cover risks arising from cyclones. Later on it started covering other less catastrophic damages, such as fire and excessive rainfall. Subscribers are classified on the basis of the claims they submit, on a dynamic scale which praises reliability. Apparently, this system has ensured a sound and incentive-compatible use of public resources. The scheme is reported to be working effectively for farmers, and to be financially sustainable.

In the Philippines there is another example of traditional agricultural insurance, granted within a wider agricultural support programme, and directly operated by a parastatal, named the Philippine Crop Insurance Corp (PCIC). This is a subsidiary of the Land Bank of the Philippines, and supplies insurance policies in connection with credit. Subscription of policies covering potential damages from cyclones is mandatory in high-potential areas. Policies include traditional multi-peril, and can cover also risks of drought and pest attacks. They are deemed to be sold at heavily subsidized premiums, and high administrative costs (FAO, 2005).

Pilots and studies

Innovative insurance schemes are mostly founded on weather index-based insurances. This is the case of drought and flood indexes in Bangladesh; of a drought pilot index for vegetables in the Chinese province of Shangai; and of indexes in Thailand for drought and in Viet Nam for flood risks (Barnett and Mahul, 2007). Feasibility studies have been promoted to assess the viability of insurance in Syria, South Africa, and in Nicaragua in the past. Renewed efforts are underway in this last country, where a project piloting indexed insurance encountered resistance. Pilots are also being set up in Honduras and Guatemala (FAO, 2005). Studies have simulated insurance schemes in Ghana (Molini et al, 2006). Livestock insurance schemes have been assessed and proposed for Kenya, Cameroon (Otieno et al, 2006; Barrett et al, 2008) and Sub-Saharan Africa in general (Gautam, 2006). A pilot is underway in Peru, based on the ocean surface temperature, which can be used to insure against floods in the northern areas of the country (Skees et al, 2007). For many of these, the main limiting factor is the availability of information to reliably compute the relation between the index and the extent of damages.

8.2.3. Lessons from non-agricultural insurance

Useful indications on the conditions for the development of the insurance market and the role of governments can also be derived from non-agricultural insurance. A number of case studies on grassroots-level insurance have been promoted by the International Labour Organization (ILO). These operate within environments characterized by limited ability to pay premiums, high transaction costs and incomplete service markets, often in rural areas. In such contexts, the development of the insurance market encounters problems that are similar to those faced by agricultural insurance. Lessons learned are available on some 24 micro insurance schemes in developing countries. Table 8.1 below provides a summary of the major characteristics of the ILO case studies.

Insurance studied by the ILO offers policies covering health, death and disability risks, as well as funeral expenses. Government intervention is limited, and direct subsidization only occurs in two Indian insurance schemes – the Kuruna Trust and the Yeshavini Cooperative – while donor support is present in the VimoSewa and Kuruna Trust, also in India, in the AseF group in Benin, and in the Bangladeshi health insurances provided by the Brac, Grameen, Kalyan, and SSS groups. In some of these cases, the subsidization of premiums is associated with reports of inefficiencies, poor targeting and even fraud.

Other case studies concern organizations that are entirely private, and/or subsidiaries of large-scale national and international companies: for instance Tata-AIG in India or AIG-Uganda. Interestingly, most of these companies started operating on behalf of, or in relation to, microfinance institutions. This is the case

TABLE 8.1
Summary of ILO grass root-based insurance cases

Country	Name	Risk covered	Supplier	Government role	Remarks	Author (s)
Bangladesh	BRAC, GRAMEEN KALYAN, SSS	health, targeting rural poor	own network	donor-funded	potential costumers reluctant to pay premiums; no professional management: development people	U Ahmed et al. (2005)
Benin	Association d'Entraide des Femmes, or Women's Self-help Association (AssEF)	health;microfinance loan protection	microfinance arm of AssEF	support from ILO-STEP programme	success depends upon performance of microfinance; still in initial stage	Louis (2006)
Colombia	LA EQUIDAD SEGUROS	life; loan protection	microcredit institutions, acting as agents	none	good business	Almeyda and de Paula Jaramillo (2005)
Guatemala	COLUMNA	life	Credit unions	none		Herrera and Miranda (2004)
Guinea	Union des Mutuelles de Santé de Guinée Forestière (UMSGF)	health;	association of Mutual Organization	none	Support from International Centre for Development and Research (CIDR) as part of regional initiative; financially unsustainable	Gautier et al. (2005)
India	TATA-AIG		first tried through microfinance; then own network of micro-agents	none	scheme is recent; results still to be assessed	Roth and Athreye (2005)
India	microfinance: SPANDANA, SHEPHERD, ASA	SPANDANA; only life; SHEPHERD: life, health, assets; ASA: in between	microcredit perspective:	none	trade-off: many costumer with few mandatory products, or few with complex voluntary; price matters!	Roth et al. (2005)

TABLE 8.1
Summary of ILO grass root-based insurance cases (continued)

Country	Name	Risk covered	Supplier	Government role	Remarks	Author (s)
India	VimoSEWA	multirisk	NGO SEWA: women's group in Gujarat initially selling public insurance; begun own products to cope with inefficiencies	public insurances subsidized; GTZ supplying technical assistance	difficulties; need more assistance	Garand (2005)
India	KARUNA TRUST	health, drugs, hospitalization, wage and income losses	NGO piloting health insurance on behalf of National Insurance Company (NIC) in Karnataka	NIC is public; support from UNDP; subsidized premiums	decided to subsidize for the poor, to familiarize and create complementarities in view of financial sustainability; reported frauds	Radermacher et al. (2005a)
India	YESHAVINI COOPERATIVE FARMERS'HEALTH	Surgery in rural areas of Karnataka	own network	subsidized by the government	high premiums for high cost/low frequency events; lack of transparency and client orientation	Radermacher et al (2005b)
Malawi	MUSCCO	loan protection; life	Microcredit co-operatives initiated by the Catholic Church (SACCO)	none	highly decentralized delivery and control system	Enarsson and Wirén (2005)
Peru	SERVIPERU'	funeral, health care	SEGUROSCOOP, then SERVIPERU' own network	none	not tied to credit	Rodriguez and Miranda (2004)
Philippines	CARD-MBA	life, and later disability pensions	microcredit NGO; then independent	none	Both CUs and their members as costumers	McCord and Buczkowski (2004)
Poland	TUW SKOK	loan protection; later property and personal	Credit Union	none	decentralized managerial structure, with incentives for sales agents	Churchill and Pepler (2004)

TABLE 8.1
Summary of ILO grass root-based insurance cases (continued)

Country	Name	Risk covered	Supplier	Government role	Remarks	Author (s)
Sri Lanka	ALMAO	disability, hospitalization, death and maturity	Sanasa movement and credit cooperatives	none	democracy is needed for operating on a mutual basis; need public/donor support at the beginning	Enarsson and Wirén (2006)
Sri Lanka	YARISU	disability, hospitalization, death	NGO All Ceylon development Council, re-insured by Rabobank	none	democracy is needed for mutual basis; need public/ donor support at the beginning	Enarsson and Wirén (2006)
Uganda	AIG Uganda – GPA	personal accidents	microfinance institution (FINCA)	none	good business; could be expanded	McCord et al (2005)
Uganda Zambia Malawi Philippines Mexico	OPPORTUNITY INTERNATIONAL with 5 companies	mostly loan protection to microfinance institutions; some funeral (similar)	microfinance institutions	none	keep it simple and offer incentive to the microfinance institutions	Leftley (2005)
Viet Nam	TYM's Mutual Assistance Fund	life, some illness	microcredit institution	none	fixed benefits and premiums	Tran and Yun (2004)
Zambia	MADISON INSURANCE	loan protection to microcredit, funerals	MADISON treats microfinance institutions as policyholders under a collective contract, for a commission or profit sharing	none	customers don't like the idea that insurance is mandatory to get credit	Manje (2005)

in 17 of the 24 total cases reported. Insurance policies were started as a by-product of the operation of micro-credit, with the objective of protecting loans against risks of default arising from health problems or death of the members. Members were initially proposed to apply a surcharge on their loan repayments, to covering possible default risks. From this narrow base, the same organizations began differentiating policies and proposing coverage for a wider spectrum of risks. Coverage for loan protection and health was offered by microfinance institutions at very low cost, which also contributed to making them affordable.

This evidence is consistent with the observation, made in the previous section, that the availability of services which allow small losses – primarily credit – to be retained is an important catalyst for the development of insurance. From the ILO case studies, this may even appear as a necessary condition. In many of the case studies, grassroots microfinance institutions provided the basis for demonstrating the usefulness and the functioning of insurance, as well as the necessary trust among parties involved. In most cases this happened within non-governmental organizations, some of which bear a confessional or other group identity. This facilitated the building of a sense of ownership, increased mutual control across members, and ultimately lowered start-up and transaction costs.

8.3 Concluding remarks

The review provided in this paper indicates that very few agricultural insurance schemes work on a purely market basis. Even the more innovative schemes operate with support from the public sector or donors. This is the case in countries where agriculture enjoys extensive support, such as the USA and countries in the EU. Here, intervention seems to address the need for re-insurance, cognitive failures and other possible market failures, but also to stimulate a demand that may be crowded out by subsidies which reduce risk.

Support to agricultural insurance is also widespread in developing countries, where farmers are generally less protected. Foreign aid resources are employed to finance agricultural insurance schemes in many cases, and there is evidence that such resources have been crucial in shaping the fortune, or misfortune, of some schemes.

Compared to the indications provided by risk layering, governments seem to intervene beyond what would be expected. Subsidization of premiums and financial support to the operation of private companies or parastatals is widespread in many countries, beyond the correction of market failures generated by catastrophic risks, and the provision of regulations, information and the need to lower transaction costs.

Interventions seem to be mostly dictated by equity consideration. But the more direct types of intervention, such as premium subsidization, are in fact often associated with reports of inefficiency, lack of financial sustainability and poor targeting. Premium subsidization, in other words, does not seem to result in an advantage for poorer farmers, while it seems to be crowding out market-based insurances.

At the same time, it should also be noted that the relation between the extent of public involvement and the functioning of insurance is not straightforward. More or less successful outcomes can be found among insurance schemes having different forms and degrees of public intervention and partnership with the private sector; and to some extent even within different types of insurance, from the more traditional to the more innovative index based ones. Market incentives seem to work effectively for small farmers in Mongolia and Malawi, where interventions adhered to the principle of risk layering. However, this was not the case in Morocco or India. A directly publicly funded scheme such as the MSIF in Mauritius is reported to function effectively, without undermining incentives or running into financial problems, on the basis of a sound incentive structure. This indicates that the specific incentive structure which prevails in the organization of agricultural insurance, as well as the more general agricultural economic environment, can be very important in determining outcomes; perhaps as important as the extent of public support *per se.*

Looking outside agriculture, the case studies conducted by the ILO indicate that entirely private insurance in poor and remote rural areas can emerge when pre-existing organizations support start-up costs, and where the potential buyers of insurance have access to basic services such as credit. Where this is not the case, there may be scope for governments or donors to intervene and support the start-up costs.

The review also shows that, despite being classified as least distortionary and WTO-compatible measures, support to insurance is far from being a panacea, or a way to reduce governments' involvement and delegate functions to the private sector. Insurance is just one element of a wider risk management strategy, which can contribute to remove obstacles to agricultural investment. Hence the promotion of a market for agricultural insurance should be consistent with a broader effort to enhance farmers' ability to access services, and the functioning of the relative markets.

To conclude, given the extent of intervention in the agricultural insurance market, it is worth using the evidence summarized in the previous sections to discuss how to prevent some of the undesirable outcomes observed. Two main points can be made in this respect. Firstly, as a rule of the thumb, actions aimed at facilitating the spontaneous emergence of a market or protecting the financial sustainability of an insurance scheme should be preferred over the direct subsidization of premiums. Based on the experiences reviewed, it seems that the former is more likely to leave room for the emergence of market incentives, on both the demand and supply sides. Secondly, any form of public support to agricultural insurance may be framed and organized on a temporary basis, with some “graduation” system which can reduce government involvement. This may prevent the constitution of rents, both in agriculture and in the insurance industry.

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9

Rethinking agricultural input subsidy programmes in developing countries

Andrew Dorward[1]

Introduction

Recent years have seen a resurgent interest in large scale input subsidies, and particularly fertilizer subsidies, in agricultural development and food security policies in Africa. Very high global grain prices in the first part of 2008 appeared to make such subsidies even more attractive, but this was complicated by even more dramatic rises in fertilizer prices. While global grain and fertiliser prices have subsequently fallen back, high grain prices have persisted in many domestic markets, and future food and fertiliser prices are very uncertain.

This paper considers the roles of input subsidy programmes in poor rural economies in Africa in these difficult times. The paper begins with a brief review of historical changes in experience with and views of input subsidies, and of the factors behind resurgent interest in input subsidy programmes, particularly with a new generation of so called 'smart subsidies'. We then consider how the features of smart subsidies may demand a rethinking of economic analysis of the benefits of subsidies in different contexts. This provides the foundation for a conceptual framework for considering the key issues affecting the performance of subsidy programmes. This framework is then applied to discussion of recent experience of specific input subsidy programmes.

The final part of the paper considers how current grain and fertiliser prices, and uncertainty regarding future prices, impacts on subsidy programmes, and asks what

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roles input subsidy programmes may have under different price regimes in different contexts in the future, and what critical factors will determine their performance.

9.1 'Conventional' input subsidies in agricultural development - theory and practice

Large scale (so called universal) agricultural input subsidies were a common and major feature of agricultural development policies in poor rural economies from the 1960s to the 1980s. They were generally implemented as 'across the board' price subsidies accessible to all producers, or to all producers of a particular category. If they were sold through a state monopsony then there were commonly attempts at price discrimination, with, for example, only smallholder farmers allowed to purchase subsidised fertiliser and forbidden from selling it on[2]. Fertiliser subsidies were particularly expensive and made heavy and growing demands on government budgets as they stimulated increased fertiliser consumption (and hence increased volumes of fertiliser subsidy) while political pressures also led to pressures for the subsidy rate to increase, or at least not contract, in the face of growing fertiliser prices. For discussion of fertiliser subsidies in Asia see Fan et al 2007, Timmer 2004, Morris et al, 2007; Ellis 1992.

Conventional arguments for subsidies in agricultural development have focussed on the promotion of increased agricultural productivity through the adoption of new technologies (Ellis, 1992). Reduced costs of subsidised inputs increase their profitability and reduce risks perceived by farmers in adopting them in circumstances where farmers' limited knowledge first of input benefits and second of their correct usage inappropriately constrain their expenditure on input use. Together with credit and extension services, input subsidies were supposed to help farmers implement, benefit from and then, with the withdrawal of the subsidy, themselves fully fund economically and technically efficient input purchases and use: rapid learning with subsidies about input use and its benefits should mean that subsidies would be needed for only a short time and could be rapidly phased out. However subsidies were often subsequently implemented more widely with pan territorial pricing to support agricultural development in more remote areas, and to counteract taxes on agriculture through export tariffs, managed exchange rates and controls on domestic prices.

Economic analysis of price subsidies considers the costs and benefits of subsidies in shifting farmers' supply curves for agricultural produce (see figure 9.1). If there are no market failures then a subsidy of \$Z per unit output increases effective producer price above the market price by \$Z[3], causing a downward shift in the market price

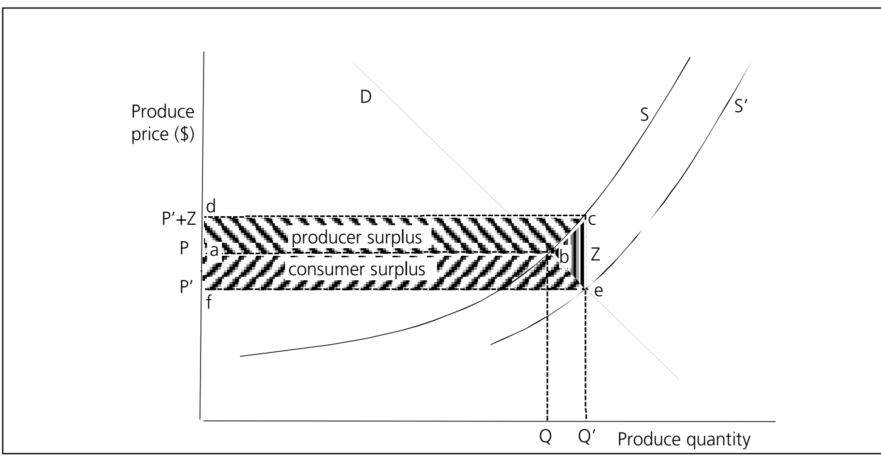
[2] We will discuss 'leakage' from subsidy sales later.

[3] If the subsidy is addressing a market failure then a subsidy of \$Z per unit output will increase effective producer price above the market price by more than \$Z (say \$Z')

supply curve (S to S' in figure 9.1) and this leads to an expansion in supply (from Q to Q') and a fall in market or consumer price of the product (from P to P' in figure 9.1, assuming that the good is a non-tradable with a downward sloping demand curve), with an increase in both producer surplus (shown in figure 9.1 by the shaded area *abcd*) and consumer surplus (shown by the shaded area *abef*[4]). The total cost of the subsidy is the total subsidy paid (new equilibrium quantity multiplied by the per unit subsidy, Q'.Z, shown by the shaded area dcef) plus administration costs. The total subsidy paid is greater than the sum of the increased consumer and producer welfare by a deadweight loss shown in figure 9.1 by the triangle *bce* (Siamwalla and Valdes, 1986). Under such circumstances, and even without allowing for administration costs, the subsidy would therefore lead to a net economic loss to the country and an income transfer from taxpayers to consumers and producers.

Figure 7.1

Input subsidy impacts on output supply, price and stakeholder welfare



Three related points emerge from this analysis.

First, a subsidy can only generate a positive net economic return to a country if there is some market failure which means that the downward shift in the supply curve is greater than the cost of subsidising production, including the costs of subsidy administration (that is Z, the per unit cost of the subsidy to the government, is less than Z', the effective increase in output price – or reduction in per unit costs - received by producers). This may occur where farmers' perceived private cost of inputs is higher than the true social or economic cost, and/or the farmers'

[4] The net gain in producer surplus can also be represented as the total increase in producer surplus represented by the area between the supply curves S and S' below price P' less the loss in producer surplus as the result of the price fall from P to P', represented by the area between P and P' and to the left of curve S.

perceptions of private benefits from increased input use are lower than the actual social or economic benefits[5]. Such situations can arise where (a) farmers' private costs of working capital for input purchase are greater than the social cost of capital, (b) farmers' lack of knowledge about the benefits of inputs means that their expectation of the production benefits from input use are less than the benefits that they will gain, (c) there are learning costs with input use such that initial farmer returns are low but these will increase with experience (see for example Ellis, 1992; Crawford et al, 2006; Morris et al, 2007)[6], and (d) farmers' risk assessment and aversion in investing working capital in input purchase and use is higher than society's risk assessment and aversion. These divergences between farmers' and society's perceptions should decline as farmers gain experience with input use, with increasing knowledge of the benefits and risks of input use, increasing knowledge of how to use inputs, and consequent increasing efficiency in their use.

Second, the size of the deadweight loss and the distribution of benefits between consumers and producers depend upon the elasticities of supply and demand as shown in table 9.1 (see appendix 1 for diagrams). This is important as (a) larger deadweight losses are associated with increasing inefficiencies, and (b) the distribution of income transfers between producers and consumers has equity and poverty reduction impacts depending upon the relative wealth and incomes of the producers and consumers concerned.

Table 9.1

Effects of demand and supply inelasticities on consumer and producer gains and on deadweights

	Perfectly elastic demand	Unitary demand	Perfectly inelastic demand
Perfectly elastic supply, shifts down	N/A	All gains to consumers, Large deadweight	All gains to consumers, No deadweight
Unitary supply, shifts down / to the right	All gains to suppliers Large deadweight	Shared gains, some deadweight	All gains to consumers, No deadweight
Perfectly inelastic supply (may shift to the right)	All gains to suppliers. No deadweight	Gains shared (depending on supply shift), No deadweight	N/A

Elastic demand or supply tends to be associated with larger deadweight losses, and demand or supply inelasticity tends to be associated with smaller deadweight losses. Similarly inelastic demand is associated with larger shares of consumer surplus benefits, while inelastic supply (both price elasticity and with regard to the subsidy) is associated with larger shares of producer surplus benefits. Staple food

[5] This can be shown using marginal value product and marginal factor cost analysis, see figure 9.2.

[6] This is effectively an infant industry argument

markets in land locked countries (with large import/export parity price differentials) tend to be associated with more inelastic demand by poor consumers (where prices lie between export and import parity prices). Demand tends to be more elastic for cash crops, and particularly export cash crops. It should also be noted that an implicit feature of this analysis is that it applies only to subsidies implemented on a large enough scale to affect output prices - small scale subsidies that do not significantly affect production and product prices are analytically equivalent to subsidies with highly elastic product demand: subsidy benefits are largely captured by suppliers / producers, and deadweight costs depend upon the elasticity of supply

Third, transfers to producers can be analysed in terms of inefficiencies associated with *economic rents*. Rents arise in three ways. First, if a general input subsidy is intended to deliver an economic gain by stimulating increased input use to increase production, part of the cost of the subsidy goes to reducing the cost of production for produce that would be produced anyway (this is the producer surplus on produce that would be produced anyway without the subsidy). Unless there is some social or economic benefit from transferring income to producers already using fertiliser, then the subsidy is an inefficient way of stimulating increased production and increased productivity, since the producer surplus to accruing to existing fertiliser use is not delivering any economic gain. Second, producer transfers often end up affecting the demand for agricultural land and labour, and bid up the demand for inputs, and hence apparent producer transfers may in fact be passed back to the suppliers of these factors of production as pure economic rents[7]. Third, where subsidised inputs are rationed (as is common), then such rationing leads to opportunities for those controlling subsidised inputs (politicians, government officials, fertiliser suppliers, farmer organisation office bearers, etc), to divert subsidised inputs from their intended beneficiaries for a side payment or to demand payments from beneficiaries in return for provision of subsidised inputs. The important point here is that even if there are net gains from a subsidy (as a result of divergences between farmers' and societies perceptions of costs and benefits from input use), much of the subsidy cost may be a straight transfer from the state (and hence from taxpayers) to producers and suppliers of land, labour and inputs without any economic gain (with the relative shares of transfers depending upon the elasticities of supply and demand).

Another major concern with input subsides concerns the extent of leakages and diversion of subsidised inputs away from their intended use. In the context of the supply and demand analysis above, this can be considered in three ways – (a) diversion between products, (b) diversion from intended beneficiaries to others within the country, and (c) cross border leakage.

[7] This is of course not a problem where the providers of land and labour benefiting from this are poor, indeed it can be an important way in which subsidies can promote pro-poor growth.

(a) Farmers are likely to apply inputs to the use from which they expect to get the greatest return. Fertilisers, for example, may be applied to a variety of crops. As we have seen, deadweight losses are reduced and benefits to poor consumers increased where subsidised inputs are used to expand production of products consumed by poor people with inelastic demand (these tend to be food staples). If returns to fertilisers are higher on other crops (for example cash crops) then farmers may apply subsidised fertilisers to cash crops which have much more price elastic demand and which are not consumed by the poor. Even if farmers do initially apply subsidised input to staple foods, with inelastic demand, a large scale subsidy will tend to reduce prices farmers receive for this crop, and this may in turn lead to fertiliser profitability and use switching to more demand elastic tradables – with increases in deadweights losses and reduced benefits for consumers. Switching of inputs between crops or products is not so directly possible for subsidised seeds[8].

(b) Input subsidies in developing countries have commonly been targeted towards smallholder rather than commercial farmers, with mechanisms directing subsidised inputs away from large scale commercial farms and regulations prohibiting sale of subsidised inputs by recipients. Where a general subsidy is applied it is difficult to channel subsidised inputs to smallholders unless there are a limited number of tightly controlled supply chains, clear ways of identifying intended beneficiaries, and a high degree of discipline and control of private fertiliser transactions. If subsidised inputs are used by larger scale commercial farms this is likely to lead to increased diversion away from staple food crop production to cash crops (as discussed above) and a greater share of transfers to less poor producers. Similar issues arise in subsidy access between richer and poorer smallholders.

(c) Cross border leakages arise when subsidised inputs are sold outside the country at a discount. The value of the discount represents a straight loss from the transfer of resources outside the country, with the loss of any chance of consumer benefits or economic gain from increased input use.

The final point to note from analysis of input subsidies' effects on product supply and demand is that the extent of supply shifts is critical in determining deadweight losses, the distribution of transfers between producers and consumers, and the extent of wider economic gains. The supply shift is itself determined by the technical efficiency of input use – determined by the quality and appropriateness of the inputs to the product they are used on, the timing of their delivery to farmers, the availability of complementary resources (for example seed and fertiliser together), and the technical skill or competence in the use of the inputs (in comparison with the without subsidy situation).

[8] Although some indirect switching may happen due to wider capital fungibility

The analysis above of product supply and demand impacts of input subsidies shows many of the things that can go wrong to undermine the economic benefits of input subsidies: the very large transfers to producers and consumers (reducing the efficiency of subsidies in achieving economic gains, and leading to dominance of political economy rather than economic considerations in subsidy policy, with tendencies for these transfers to be captured by elites and/or used for political ends[9]); the presence of deadweight costs (in addition to administration costs, which have not been explicitly considered thus far in the discussion); the dangers of diversion and leakage; and difficulties in clearly specifying economic gains, with the tendency for these to diminish over time. More positively, however, the analysis also helps in the identification of features of subsidies that are likely to yield more benefits and to face lesser dangers of things going wrong. This in turn provides insights about where subsidies are most likely to be useful, and about the ways that subsidies should be implemented. It suggests that inputs subsidies should be focussed:

- on those producers who are not using inputs because of market failure,
- on the use of inputs on products where they can induce a substantial supply shift (and this may also require, for example, complementary input supply, extension and output markets infrastructure and services), and
- on stimulating products with inelastic demand and supply (particularly inelastic demand) among poor producers and consumers: staple grain production tends to have these characteristics in poor large or land locked countries with suitable agro-ecological conditions.

It is noteworthy that although input subsidies are directed at producers and at changing production methods and producer behaviour, this analysis emphasises the importance of consumer in addition to (or rather than) producer benefits for maximising both economic and welfare gains from subsidies. Input subsidies should also be implemented in ways that (a) reduce deadweight losses and rents from straight transfers, (b) reduce leakages, and (c) have low administration costs. The analysis also suggests that subsidies may be less efficient instruments if they are primarily aimed at delivering income transfers to producers and remote areas, because of high deadweight and administration costs, generation of rents, and difficulties in developing / delivering complementary services needed for technically and economically efficient use of subsidised inputs. The distributional impacts and multipliers from expenditure on input subsidies therefore also need to be considered against alternative (tax and subsidy or transfer) instruments for changing income distribution and for stimulating growth.

The conclusions from the theoretical analysis above matches (and influenced) the conventional wisdom among most economists and northern policy analysts on

[9] This is a point made strongly by Bates (1981)

difficulties with input subsidy programmes. This also emphasised difficulties with:

- Controlling costs, both with general subsidies through, for example, fertiliser production or import subsidies and with quotas or targeted subsidies where there tend to be strong political pressures for the expansion of subsidies, and only weak pressures for their control.
- 'Exits': there is strong political resistance to scaling down or termination of subsidies.
- Effectiveness of targeting of input subsidies to particular farmer types, with problems of diversion and leakage noted above both expanding programme cost and reducing efficiency.
- Over use of inputs, or adoption of input intensive rather than more economically efficient labour intensive production methods, as a result of artificially low input prices
- Regressive benefits favouring larger farmers who can afford subsidised inputs (the poorest farmers may not be able to afford inputs even where they are subsidised).
- Market distortions, and particularly parastatal involvement in subsidised input delivery, tending to crowd out and inhibit private sector investment in input supply systems and provide opportunities for corruption, and hence impede sustainable development.

Although agricultural input subsidies have continued to a greater and lesser extent in a number of countries, conventional wisdom and dominant donor thinking in the 80s and 90s was that such subsidies had been ineffective and inefficient policy instruments in Africa and that they had contributed to government over-spending and fiscal and macro-economic problems.

From the mid 1990s, however, this conventional wisdom has increasingly been challenged with a resurgence of interest in agricultural input subsidies in Africa, new thinking about the historical and potential roles in agricultural development, and the complementary emergence of innovative subsidy delivery systems and instruments.

9.2 Rethinking input subsidies

New thinking on input (and particularly fertiliser) subsidies in Africa has arisen for a number of related reasons. The fundamental driver of this has been increased questioning by African politicians, by NGOs and by some policy analysts about the failures of liberalised policies in supporting broad based agricultural development, particularly sustainable intensification of staple food crop production. This has been accompanied by strong political demands for fertiliser subsidies in many countries; tensions among donors in resisting such demands (with increasing legitimacy of democratic governments in Africa and divergent donor views on subsidy merits); concerns about declining soil fertility, agricultural stagnation and rural poverty in Africa; and identification of input subsidies as a potential instrument for social protection policies. The Abuja conference marked a significant milestone in this.

These concerns have led to interest in the potential for input subsidies to deliver a wider range of (sometimes unstated) objectives than those formerly recognised in the conventional wisdom described earlier. These objectives include, in addition to those considered earlier[10]:

- Short term private input market development.
- Replenishment of soil fertility.
- Social protection for poor subsidy recipients.
- National and household food security.
- Meeting broad based political demands.

There has also been considerable interest in the development of new instruments and approaches in designing and delivering input subsidies, as so called 'smart subsidies'. Morris et al. (2007) describe 10 features of smart subsidies: 'promoting fertiliser as part of a wider strategy', 'favouring market based solutions' in input supply, 'promoting competition' in input supply, 'paying attention to demand', 'insisting on economic efficiency', 'empowering farmers', 'involving an exit strategy', 'pursuing regional integration', 'ensuring sustainability', and 'promoting pro-poor economic growth' (op.cit, p103-104). They recognise that 'in exceptional circumstances, poverty reduction or food security objectives may even be given precedence over efficiency and sustainability goals' (op.cit, p104-105). Instruments proposed for implementing smart subsidies include demonstration packs, vouchers, matching grants and loan guarantees. For all of these the details of instrument design and implementation are critical to their success. These instruments and design and implementation issues will be returned to later.

The interest in getting input subsidies to serve new functions and objectives, and the extent to which input subsidies are the most cost effective way of achieving these objectives continues to be controversial. The main text of the 2008 World Development Report on "Agriculture for Development", for example, recognises all the features of smart subsides outlined above, but its summarised position is more restricted and conventional, focusing on subsidy roles as being to provide "sustainable solutions to market failures, …through … 'market smart' approaches to jumpstarting agricultural input markets…., and underwriting risks of early adoption of new technologies to help achieve economies of scale … to reduce input prices …as part of a comprehensive strategy to improve productivity with credible exit options" (World Bank, 2008).

[10] Morris et al. (2007)

It is, however, possible to question how important some of these objectives were in successful Asian Green Revolutions (for example replenishment of soil fertility, and social protection for poor subsidy recipients) and to identify other, perhaps more important, outcomes from subsidy use in these green revolutions or in more recent input subsidy programmes. Such outcomes include:

- long term 'thickening' of supply chains and rural markets;
- lower staple food prices and higher wages;
- increased real incomes for poor non-recipients as a result of food price and wage changes; and
- longer term structural changes in livelihoods and the rural and national economy with expanded domestic demand for higher value livestock and horticultural products and for non farm goods and services together with expanded supply capacity, due to release of land and labour as a result of increased staple crop productivity.

These debates, together with new insights into development processes, require a revisiting of the conventional wisdom on subsidies:

- a re-examination of the empirical and historical and empirical record of success and failure;
- an examination of the various development opportunities and constraints facing African farmers;
- a re-examination of theoretical understanding of contributions and implementation modalities of agricultural input subsidies in such situations; and
- a more holistic conceptual framework for examining the roles, instruments and implementation of input subsidies

The remainder of this section addresses each of these issues to provide a basis for a review of recent experience with input subsidies in Africa in the subsequent section.

9.2.1 Revisiting input subsidies' historical successes and failures

A detailed examination of the empirical record of subsidies' historical successes and failures is beyond the scope of this paper. However we briefly consider first the Asian green revolution experience with input subsidies and then African experience up to the early 1990s.

The Washington consensus and then the Post Washington consensus on agriculture recognised the substantial success of the green revolution in Asian countries in driving growth and poverty and reduction but, implicitly or explicitly, considered this to have been achieved despite, rather than assisted by, input subsidies (and other subsidised services). This position was taken despite long standing work showing the importance of subsidies in Indonesia, for example, in promoting agricultural growth (Timmer, 2004) in precisely the types of situations where the analysis presented earlier suggests that such subsidies might have the greatest effect (food staples in large countries, with high physical returns from input use). Dorward et al (2004) in a review of green revolution experience in Asia argue that sustained (but not indefinite) input subsidies were a major part of successful Green Revolution packages, making a critical contribution to thickening and thus 'kick starting markets' first within staple food supply chains and then in the wider rural economy. Djurfeldt et al (2005) also argue that input subsidies were a critical element within green revolution policies, drawing on detailed policies reviews across a range of Asian countries. Fan et al (2007) provide empirical evidence on the contribution of input subsidies to growth and poverty reduction in India in the early stages of the green revolution but not later. This confirms an important point made by Dorward et al (2004), that later ineffectiveness and inefficiencies of input subsidies should not obscure their initial contribution in driving growth forward[11] .

Much of the Washington consensus pessimism regarding input subsidies was founded on later inefficiency of Asian subsidies and African experience of such subsidies. The Berg report criticised input subsidies as a major element in fiscally and economically unsustainable policies that were highly inefficient, ineffective and expensive in Africa. These policies distorted market incentives, blunted competitiveness and farmer incentives, and undermined the growth of private sector services. In this, subsidised input systems may have looked good for farmers (as regards services that were supposed to be provided), but the theoretical difficulties discussed earlier were compounded by diversion and inefficiency such that actual benefits to farmers were often very limited (World Bank, 1981). It should be noted, however, that there are countries that implemented input subsidy systems that had initial success in raising productivity but for varying political and economic reasons failed to sustain the fiscal investment and market systems necessary for sustained benefits (for example Zimbabwe and Malawi).

Dorward et al (2009) compare experience of state led and private market led development approaches in fostering widespread and sustained growth in smallholder food staples. They note that while there are egregious examples of failure with state led approaches, there are also examples of dramatic success (as noted above). Private market led approaches, on the other hand, have very few

[11] There are, ironically, parallels here with debates about the importance of agriculture itself as an initial driver of growth in poor rural economies: the later relative decline of agriculture in emerging economies should not obscure its earlier importance in getting broad based growth going.

examples of success[12], and many failures, but the failures of continued rural poverty are more hidden in rural areas and, to economists and policy analysts working with governments and businesses, consequent chronic humanitarian problems may be less obvious than macro-economic and fiscal crises.

9.2.2 Development opportunities and constraints facing African farmers

Successful investments in input subsidies in the Asian green revolution cannot, however, be simply transferred across to African countries – as experience in the 1970s and 1980s showed. It is important to identify the situations where input subsidies could work to take opportunities and overcome constraints facing African farmers.

Poulton and Dorward (2008) and Dorward, Chirwa and Poulton (2008) consider constraints and opportunities for growth for different agricultural products in different situations in Africa and southern Africa. These are summarised in table 1 overleaf (adapted from Poulton and Dorward, 2008, and from Dorward et al , 2008).

Drawing on insights from Byerlee et al. 2006 and Hazell et al. 2007, this table presents a typology that sets out first the major roles for increased productivity for different types of agricultural products in countries with different characteristics, and then the major challenges that need to be addressed to achieve increased productivity. Distinctions are made first between different types of crops and products (and implicitly between different agro-ecological zones associated with these). Maize, rice (notably NERICA) and possibly wheat (though this is a much less important crop in Africa) are cereals with potential high responses to significant investments in inorganic (and organic) fertiliser application. Millet and sorghum have generally lower yield potential, but there are still possibilities for significant yield responses in the context of integrated soil fertility management (ISFM) practices involving, for example, better water control, use of organic matter and micro-dosing with critical nutrients[13]. Root crops, particularly cassava, have the potential for significant yield increases with intensification but although with time this will require substantial increases in fertiliser inputs, there are initial opportunities for major yield increases from improved varieties. Non-staple products are considered in terms of non-tradables and tradables, the latter broken down between domestically

[12] It can also be argued that private market led approaches have never been properly tried – liberalisation of food markets has proved very difficult to consistently implement- and not just in Africa. This is, however, another challenge to private market led approaches. An exception to this has been the recent growth of smallholder fertiliser use in Kenya (Ariga et al, 2008) which, while aided by special conditions which prevent its wholesale application to other countries, nevertheless carries important lessons.

[13] Morris et al. 2007 present data suggesting that maize and rice tend to have higher fertilizer responses than sorghum and millet, but that for all crops the responses are highly variable and sensitive to rainfall, soils, fertilizer application methods and formulations, and complementary soil and other management practices.

consumed and exported tradables.

The high potential yields achievable with the 'high response cereals' and 'roots and tubers' suggests that these have the potential to make a major contribution to driving and supporting pro-poor growth in countries where these crops can be produced, depending on other potential drivers of growth in these countries.

The lower but still improved yields achievable with 'low response cereals' in more challenging agro-ecological conditions suggest that these will not be able to drive growth but they should have important roles in supporting growth and in providing a lower cost and more developmentally beneficial subsistence safety net (as compared with humanitarian relief). Again the role will vary between countries with opportunities for minerals, manufacturing industries and cash crops to drive growth (although the more challenging agro-ecologies where these crops are grown are also likely to limit cash crop and livestock development options[14]).

The lower part of the table lists major challenges faced by the different products (assuming that they are being produced in broadly suitable agro-ecological areas). All products face technical challenges and opportunities to increase productivity and stability, though the nature and extent of these challenges and opportunities varies between products and contexts. There is also common under investments in public goods provision (technical research and extension, market and institutions) particularly for staples where prices and value chain profits are limited. All products are also affected by uncertainty and variability in global commodity prices as they affect input and output prices. However the location of the text and thickness of arrows in table 9.2 also show that there are considerable differences between different products in the challenges they face.

The key points here as regards consideration of roles of input subsidy programmes are that while high response cereals are (with roots and tubers) the products with the greatest importance and potential for driving and/or spreading growth they are also the crops which are most affected by challenges and failures in complementary service coordination, price instability, the price/productivity tightrope[15], and seasonal input finance provision. These characteristics suggest that high response cereals fulfill many of the requirements identified in section 9.1 for well designed and implemented input subsidies to have a role to play in stimulating pro-poor growth:

[14] In such situations investment in increased staple productivity may be a least cost way of providing safety nets in a way that encourages economic activity rather than dependency.

[15] The price/productivity tightrope refers to the dilemma in poor agrarian countries where on the one hand high food prices are needed to stimulate investment in inputs but on the other hand such prices damage poor consumers who spend a large part of their income on staple foods, and thus undermine poor consumer welfare and wider pro-poor growth.

TABLE 9.2

Typology of agricultural products byr roles, countries and Challenges and Opportunities

	STAPLE FOODS			NON-STAPLE PRODUCTS WITH PRODUCTIVITY POTENTIAL		
	High response cereals Maize, rice?, wheat?	**Low response cereals** Sorghum, millet	**Roots/tubers** Cassava, (sweet potatos)	**Domestically consumed non-tradeables**	**Domestically consumed tradables**	**Traditional/non-traditional exports**
Broad Role	Pro-poor growth	Least cost welfare, growth platform	Pro-poor gorwth	Support growth, with staple spillovers	Support growth, with staple spillovers	Drive growth with staple spillovers?
Countries with minerals	Support & spread growth	Subsistence, support & spread growth	Support & spread growth	Support & spread growth	Support & spread growth	Minor deiver & spreads growth
Coastal, No minerals	Regional driver & supports growth	Subsistence & support growth	Regional driver & supports growth	Support growth	Support growth	Regional driver & supports growth
Landlocked, No minerals	Major driver & then supporter	subsistence	Major driver & then supporter	Support growth	support growth	Driver
Challenges	Technology					
	Irrigation?	Yield package?	Processing?	Various	Various	Various
	Public goods					
	(Research, infrastructure, institutional environment)					
	Policy coordination					
	Complementary service coordination					
	Global commodity & product prices (profitability, input affordability)					
	Price instability (intra & inter seasonal)					
	Price/productivity tightrope					
	Seasonal input finance					

- the complementary service coordination and seasonal finance challenges are market failures that inhibit input use, so that the gains from subsidies addressing input affordability problems have the potential to exceed deadweight and implementation costs;

- inelastic demand for food staples means that (a) deadweight losses should be relatively low and (b) many of the gains of producer subsidies should accrue to poor consumers - if subsidies increase production on a sufficiently large scale to lower prices – and in this way input subsidies can provide a means for addressing the food price/productivity tightrope.
- they can, in the right agro-ecological conditions and with proper management, lead to substantial productivity and production increase

This last point is important, in the context of arguments by Dorward et al (2004), in their review of successful and partly successful green revolutions, that state interventionist approaches (including input subsidies) will not be effective, or will be less effective, if they are implemented in situations where basic conditions necessary for development have not been established, with (a) technologies and management and soil, climate and pest conditions, that generate sufficient productivity gains and (b) complementary infrastructure and institutions to support extension services and market activities[16]. This ties in with earlier arguments regarding potentially large deadweight costs from producer oriented subsidies in remote areas to suggest that input subsidies are likely to be more effective in areas with more favourable agro-ecological conditions for high response cereals and with good market access and higher population densities. This approach is articulated in recent thinking regarding prioritising investments in 'breadbasket areas' in Africa (AGRA, 2008). This is not to say, however, that input subsidies will never be warranted for cash crops or outside breadbasket areas – there may be market failures inhibiting input led productivity growth which warrant input subsidies – but the nature of such subsidies are likely to differ from those aimed at stimulating input led productivity growth in staple crops for the principle benefit of poor food buyers.

9.2.3 Rethinking input subsidies - theory and practice

Rethinking of the role of subsidies and the introduction of smart subsidies requires a revisiting of some of the conventional thinking about input subsidies as set out earlier in section 9.1. This is not to suggest that the earlier analysis or the insights it yields are faulty, but that it does not adequately reflect the ways that different subsidy systems can work and impact on producers and consumers. We extend the analysis of section 9.1 by considering a number of features of current subsidy programmes that are not explicitly or adequately considered in the theoretical

[16] Dorward et al (2004) also note the need for implementation that is both effective and sustained long enough to achieve systemic structural changes in productivity and markets.

considerations outlined earlier:

- the role of subsidies in reducing input profitability problems;
- the role of subsidies in reducing input affordability problems;
- targeting of input subsidies to specific household types;
- rationing of input subsidies;
- impacts of subsidies on input supply systems;
- dynamic effects of subsidies on pro-poor growth;
- subsistence production and net deficit producers;
- leakages and secondary markets;
- entitlement and distribution systems;
- complementary investments, policies and instruments
- soil fertility replenishment
- the political economy of input subsidies.

9.2.3.1 The role of subsidies in reducing input profitability problems

We can identify four ways in which the profitability of input use may be improved, by:

1. Raising physical productivity of inputs – through adaptation of technologies and farmers' learning how to manage them, and when (and when not) to use them.
2. Reducing the costs of inputs by increasing efficiencies in (for example) fertiliser or seed production and/or delivery systems.
3. Reducing farmers' input costs through input subsidies.
4. Increasing output prices through market interventions (with either high consumer prices or with subsidies funded by tax payers).

Conventional thinking on input subsidies emphasises their role in improving the profitability of input use primarily through approaches 1 and 3 above in order to (a) address farmers' limited knowledge first of input benefits and second of their correct usage, (b) improve agricultural profitability in more remote areas, and (c) counteract taxes on agriculture through export tariffs, managed exchange rates and controls on domestic prices. While *profitability constraints* on input use on food crops continue to be important, the nature of these constraints has changed, and (as will be discussed later) at the same time *affordability constraints* have become more important.

We discuss these two changes in turn. We note that different analysis may be needed for different inputs and consider first issues related to fertiliser subsidies before briefly mentioning differences with seed subsidies.

On the changing nature of *profitability constraints* with regard to fertilisers, we consider first constraints to farmer purchases as a result of lack of knowledge of fertiliser benefits and of their correct usage. After many years in which fertilisers have been promoted through subsidies, it is generally no longer the case that most farmers are unaware of fertilisers' benefits, indeed lack of access to fertiliser is commonly cited by farmers as a major constraint on their agricultural production. The extent to which farmers have direct experience of fertiliser use will vary, but past subsidy, demonstration and hand-out programmes together with fertiliser purchases by less poor farmers for cash crop production mean that in most areas there are farmers with direct experience of fertiliser use, and observation and reports of fertiliser use are widespread. Farmers' ability to use fertilisers effectively and efficiently (through proper selection of fertiliser types, appropriate timing and method of application, and use of complementary investments in, for example, soil and water management and crop varieties) is more variable, and input subsidy programmes continue to have a potential role in helping farmers to learn from experience here. This is likely to be particularly the case with poorer farmers who do not have access to fertilisers for cash crop production and who are also less able to access improved seeds and extension advice. However if fertiliser subsidy programmes are to help farmers improve their use of fertiliser then this requires subsidised provision of appropriate fertilisers and timely implementation supported by complementary investments in extension services and in promotion of improved soil and water management and crop varieties. Seed subsidies have an important and more conventional 'profitability' role in promoting both achievement and knowledge of higher returns from fertiliser use and of higher returns from their own use in conjunction with fertiliser.

The high costs of fertilisers (as a proportion of crop production costs) mean that (perceived and actual) profitability of their use is strongly influenced not only by (perceived and actual) physical returns or responses to fertiliser use (discussed above) but also by relative fertiliser and crop prices. Relative global prices of crops and fertilisers have fluctuated over the last 40 years but do not show any systemic changes[17]. Relative domestic prices, however, will have changed in different ways in different countries: liberalisation policies from the 1980s will have generally led to higher food and fertiliser prices (due to exchange rate devaluations) but changes in relative prices will have been affected by continuing interventions in food markets, by differences in produce and input domestic market linkages to world markets, and by differences in import tariff rates. It is therefore not possible to generalise as regards declining or increasing profitability of unsubsidised fertiliser use over the last 30 years. However variability in food prices is a major issue in many countries. Risks of low food prices leading to low profitability of fertiliser use may depress fertiliser use in less poor farmers' production of surplus food for the market. While fears of high food prices may make fertiliser use more profitable for poorer food

[17] There are differences, however, for some specific fertilisers –phosphate prices, for example, increased much more than nitrogenous fertiliser prices in the recent price spike.

deficit farmers, use of fertiliser by such farmers is more likely to be constrained by *affordability* constraints arising from problems in accessing seasonal finance, to which we now turn.

9.2.3.2 The role of subsidies in reducing input affordability problems

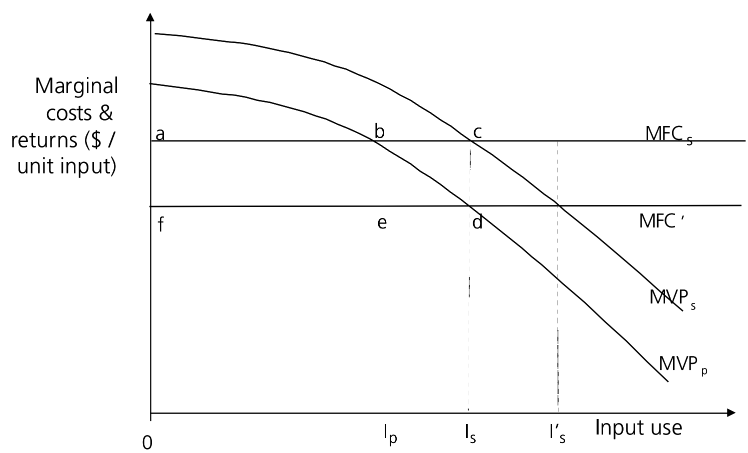
As noted in section 9.2.2 above, access to seasonal finance is widely considered to be a major constraint on input use on staple food crops, especially among poorer farmers. We describe this in terms of difficulties with the *affordability* of inputs. In theory farmers can finance input purchases from farm savings, from non-farm income sources or by borrowing (Poulton and Dorward, 2008). However (particularly poorer) small farm households are rarely able to save enough to fund significant intensification, and few have access to sufficient non-farm income sources for this purpose. Credit has therefore long been recognised as a priority to support input purchases and agricultural intensification (see for example Feder et al. 1985) and state provision of subsidised seasonal credit services were a significant part of the bundle of subsidised services, with input provision, in successful green revolutions (Dorward et al, 2004; Djurfeldt et al., 2005). Severe (and justifiable) criticism of agricultural credit programmes (for example Adams and Vogel 1986; Yaron 1992) as fiscally unsustainable (with a large subsidy component and major repayment problems), and regressive (with the majority of loans going to well-connected, wealthy borrowers and limited benefits to poor households) led to their demise. The abolition of these programme has not, however, led to their replacement by private sector and micro-finance services for staple food crop production, although there have been and continue to be successful models for delivery of seasonal finance to non-staple producers (where higher value crops give limited numbers of produce buyers incentives to invest in smallholder production).

The absence of complementary financial services allowing farmers to access credit to finance the significant costs of purchasing fertiliser means that only if subsidies lead to sufficiently large reductions in fertiliser prices will they lead to increased access to fertilisers by poorer farmers. If subsidies lead to smaller reductions in fertiliser prices which do not make them affordable by poorer farmers then they are likely to mainly benefit less poor farmers whose use of unsubsidized fertiliser is less constrained by lack of knowledge of how to use fertilisers or by inability to finance their purchase.

We examine this using analysis of input use comparing marginal value products and marginal factor costs. We begin by considering conventional analysis of the profitability impacts of a subsidy as shown in figure 9.2. The basic Marginal Value Product and Marginal Factor Cost of input use in the economy are shown by MVP_S and MFC_S respectively. The economically optimum use of inputs will be at the point where $MVP_S = MFC_S$, with input use I_S. A subsidy may be warranted, however, if information failures (lack of knowledge about inputs and their use) cause farmers to perceive that they will achieve a lower Marginal Value Product from input use (MVP_p) causing them to apply input use up to the point I_p, a suboptimal use of inputs. A subsidy which lowers the price of inputs and hence the MFC from MFC_s to MFC' would result in farmers increasing their input use to the point where MFC' = MVP_p, which is the economically efficient rate of input use, I_s.

Figure 9.2

Conventional marginal analysis of input subsidy impacts



Inefficiencies in the subsidy can be seen in two ways. First, if there are some farmers who have a correct understanding of the benefits of input use, then these will apply inputs up to the rate I_x, where MFC' = MVP_s, and this will be an inefficient over-use of inputs. Second, the total cost of the subsidy per farmer (assuming that all farmers apply inputs at I_s) will be the total amount of input used multiplied by the subsidy per unit input, represented by the rectangle *acdf*. However of this only the expenditure represented by the triangle *bcd* is actually stimulating increased input use, the remainder (represented by the area *abdf*) represents a transfer to producers (assuming no output price changes, ie perfectly elastic demand)[18].

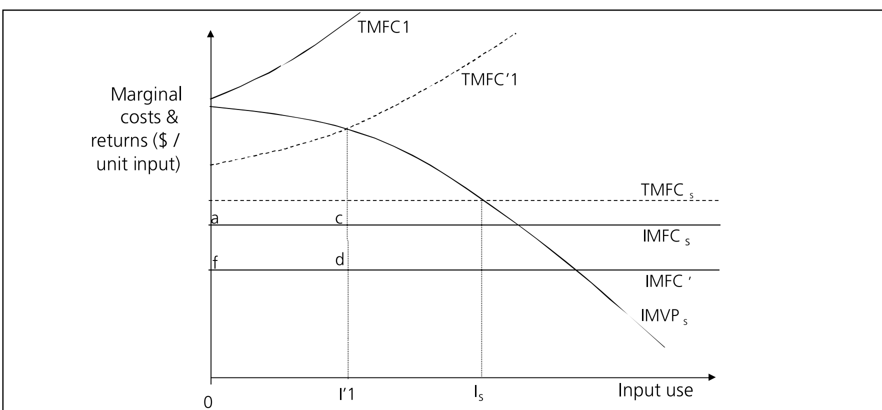
We now extend this analysis by introducing affordability constraints in figure 9.3 with steeply rising credit interest and transaction costs above the marginal factor cost of input purchases.

[18] If demand in inelastic then output prices will fall with some of the subsidy cost providing benefits to consumers.

The basic Marginal Value Product and Marginal Factor Cost of input use in the economy are shown in figure 9.3 by $IMVP_S$ and $IMFC_S$ respectively, but the total marginal factor cost of input use ($TMFC_S$) lies above $IMFC_S$ as a result of social costs of credit transactions and interest[19]. The economically optimum use of inputs will be at input use I_s where MVP_s = $TMFC_S$. Poor households, however, face very high interest and transaction costs when borrowing short term capital (and they have very limited capital of their own, with high opportunity costs) and therefore have a much higher total marginal factor costs, shown by TMFC1, leading to very much lower input use, which is often zero (as shown in figure 9.3). In such circumstances an input subsidy which substantially reduces the capital requirements and costs of input purchase can make input purchases possible for such households, as shown in figure 9.3 by a subsidised input marginal factor cost of IMFC′, leading to a lower Total Marginal Factor Cost (TMFC′1) and input use of I′1. Note that the cost of the subsidy for these households is represented in figure 9.3 by the area *acdf* (the quantity of input multiplied by the per unit subsidy) and a large proportion of this (the area between TMFC′1 and $IMVP_S$) is directly stimulating extra input use.

Figure 9.3

Input subsidy marginal analysis for capital constrained households



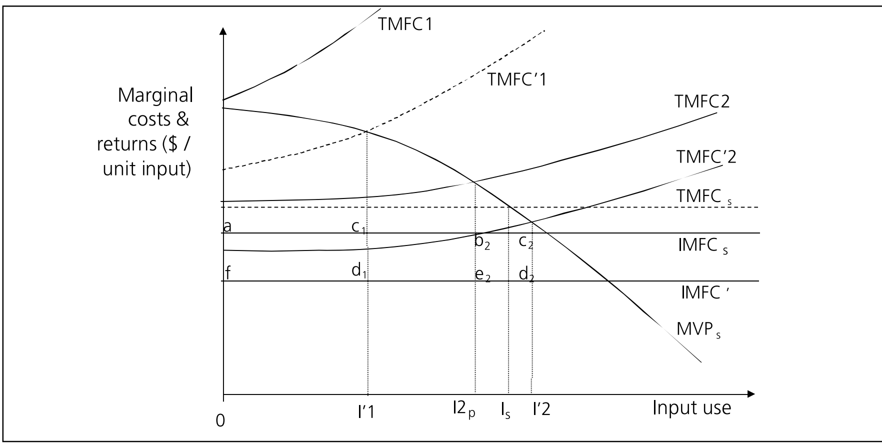
Not all households, however, are credit constrained and face high capital costs in the same way. The situation for such households is shown in figure 9.4: the Total Marginal Factor Cost curve without the subsidy (TMFC2) is only a little above society's Total Marginal Factor Cost ($TMFC_S$) so that for this household the subsidy

[19] Marginal transaction and interest costs (the difference between TMFCs and IMFCs) are shown as constant irrespective of amount of input applied. It could be argued that these would fall somewhat with increasing quantities of inputs applied but the broad analysis presented here would not be affected if this were the case.

leads to a new Total Marginal Factor Cost (TMFC'2) below $TMFC_s$ so that their optimal input use at I'2 is greater than the economic optimum I_s. The total cost of the subsidy to these households is ac_2d_2f, and of this only a very small proportion is directly stimulating extra input use (a part of $b_2c_2d_2e_2$, which is itself a small part of the total cost).

FIGURE 9.4

Marginal analysis for more and less capital constrained households



This analysis of the differential economic costs and benefits from directing input subsidies to farmers facing different constraints is important as it suggests that programme efficiency and effectiveness in stimulating increased input use can be improved by smart subsidies that reduce the quantities of input subsidies received by less constrained farmers. This can be achieved in two ways: by targeting and by rationing.

9.2.3.3 Targeting of input subsidies to specific household types

The analysis set out in figures 9.2 to 9.4 suggests that the efficiency of an input subsidy programme can be improved in two ways by targeting of the input subsidy to specific types of farmer, if this ensures that it is directed to farmers (a) who would otherwise (as a result of credit market or information failures) use very little or no inputs and (b) who will increase their input use substantially as a result of the subsidy. Condition (a) reduces the proportion of the input subsidy that is simply a transfer to producers who get cheaper inputs than they would have purchased anyway without the subsidy (with subsidised input purchases *displacing* unsubsidised purchases), while condition (b) means that those to whom the subsidy is targeted do use it to increase input use. The combination of condition (a) with (b) should also reduce incidences where a subsidy leads to overuse of inputs (beyond levels that are economically optimal).

The marginal analysis in figures 9.2 to 9.4 is however restricted in that it assumes that output prices are not affected by the subsidy, or, in terms of previous discussion, that output demand is perfectly elastic. This can be explored by introducing another (lower) MVP curve into figure 9.4 to represent the effects of lower output prices where a subsidy increases production and output demand is not perfectly elastic: this should have the effect of reducing input use (I'(1) and I'(2)) somewhat. The effects of subsidy targeting where output demand is not perfectly elastic are, however, more helpfully explored by investigating targeted subsidy impacts on output supply and demand and on consumers and different producers, as in figure 9.5.

Figure 9.5

Targeted subsidy impacts on output supply and stakeholder welfare

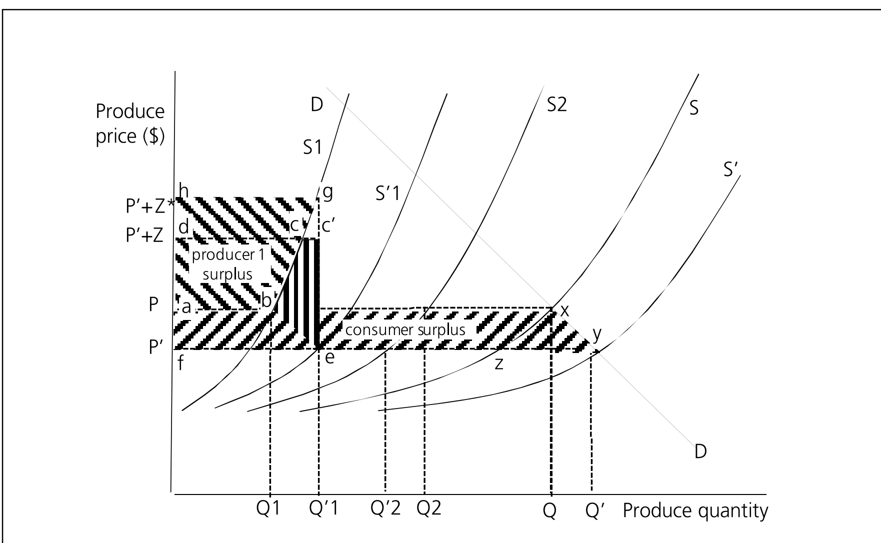


Figure 9.5 shows the effects of a targeted subsidy where the subsidy is provided to poorer, capital constrained producers with supply curve S1 which shifts to S'1 with an input subsidy which costs the government \$Z per unit output but which effectively reduces production costs by \$Z* per unit output (Z=Z* unless the subsidy addresses a market or information failure in which case Z<Z*, as shown in the figure). The result of this is an expansion of overall supply S to S' (S = S1 + S2 and S' = S'1 + S2, horizontal summation). The output price therefore falls, leading to a

gain in consumer surplus as shown by *axyf*. Subsidised producers also gain producer surplus, as shown by 'producer 1 surplus' (*abgh*). The gain in consumer welfare is achieved largely as a result of a transfer from producers who experience a fall in producer surplus as a result of lower prices (with a net welfare loss for unsubsidised producers). The total cost of the subsidy (represented graphically by *fec'd*) therefore leads to producer and consumer welfare gains equal to the area shaded as producer 1 surplus plus the extra consumer surplus less the transfer from unsubsidised producers (*xyz*): the net gain from the subsidy is then the extra gain in producer surplus 1 due the difference between Z and Z' (*dcgh* plus *xyz*) less the deadweight cost (*bec'c*) and this will be determined by the extent of the market/ information failure being addressed by the subsidy and on recipient and non recipient producer characteristics, and upon their relative numbers.

As compared with an untargeted subsidy (as represented in figure 9.1) it should be noted that not only is this likely to be more economically efficient and effective, it also involves a transfer from less poor producers and tax payers to poorer producers and consumers (assuming that the subsidy is increasing production of a staple food crop). It might be argued that less poor producers should be compensated for this – and allowing them access to the subsidy is one way of doing this. The extent to which less poor producers actually lose from a fall in producer prices depends upon alternative activities open to them (affecting elasticity of supply).

Much of course also depends upon the effectiveness of targeting and upon likely thresholds of minimum subsidy rates (or maximum input prices) for inputs to become affordable for poorer producers. These thresholds and political and power relations often result in smaller across the board subsidies being captured to a significant extent by less poor producers. In such circumstances poor consumers (some of whom may also be poor producers) will benefit if the subsidy leads to lower staple food prices, but any poor producers who are net produce sellers will lose from lower prices for their products.

The targeting of subsidized inputs to different groups or types of people is, however, a critical and sensitive issue, and there are significant costs and difficulties in targeting of subsidized inputs to different groups or types of people. In this it is helpful to distinguish between geographical targeting (between regions, districts and different geographically defined communities) and intra-community targeting (between different categories of people or households within communities). Geographical differences between areas and communities will often be correlated with socio-economic and cultural differences between these areas and communities. The distribution of subsidized inputs between different categories of people then depends upon the interaction of formal criteria determining geographical targeting and intra-community targeting together with 'informal' de facto criteria and mechanisms which are actually implemented. Costs of geographical targeting will generally be much lower than intra-community targeting. The relative effectiveness of these targeting approaches (in terms of inclusion and exclusion errors) depends upon inter- and intra- community differences and social, political and cultural factors. Targeting inevitably creates political tensions, with the relative threats posed by geographical and intra-community targeting again depending upon national, regional and local social, political and cultural factors. Targeting will also commonly lead to secondary markets for inputs where recipients sell subsidised inputs to non-recipients. The effects of such markets are discussed later in section 9.2.3.8.

The serious political, economic, welfare, and equity issues associated with targeting mean that targeting criteria and methods have to be constrained by political concerns and practicalities (at national, regional and community levels), by programme objectives (for example production, growth, or social protection objectives), and by the feasibility and costs of targeting. There may be arguments for comprehensive or area targeting that delivers smaller quantities of inputs (or of entitlements to inputs) to all households or farmers in a country or area.

A final comment on targeting is needed on the relative efficiencies of input use by poor and less poor producers. It is often thought that poorer producers make less efficient use of inputs than better off producers, and hence that targeting of input subsidies to poorer producers is less efficient than targeting them to less poor producers. It has been argued above that targeting poor producers has major benefits in terms of ensuring that subsidies address market failures (reducing displacement, and increasing welfare and distributional benefits). These arguments will, however, be undermined if poor producers make less efficient use of inputs than less poor producers. It is therefore important to note here that there is a very large literature examining the relative efficiency of large and small smallholder farms, where larger farms are generally less poor than smaller farms (see for example Hazell et al, 2007). There is no universal relationship between farm size and efficiency, in some circumstances smaller, poorer farms are found to be more efficient, in other circumstances to be less efficient. However there is substantial empirical evidence supported by a continually evolving body of theory that smaller, poorer farms tend to be more efficient in the cultivation of labour intensive staple crops in poor rural economies, and larger farms tend to be more efficient in the cultivation of capital and market intensive higher value cash crops. This suggests that where input subsidies are aimed at promoting staple food production (where input subsidies are most likely to address market failures and promote wider consumer benefits as argued in section 9.1) then targeting them at poorer producers will often lead to greater production efficiency in their use as well as more efficient wider benefits.

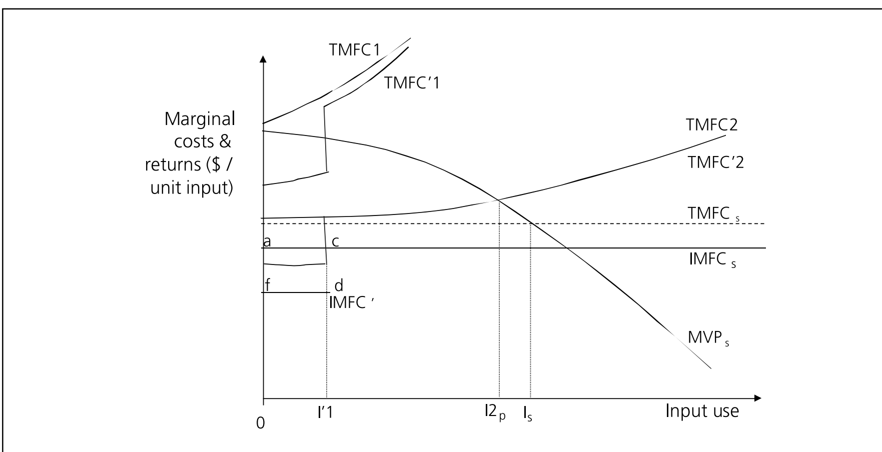
9.2.3.4 Rationing of input subsidies

Analysis in section 9.2.3.2 of the differential economic costs and benefits from directing input subsidies to farmers facing different constraints suggested that smart subsidies which reduce the quantities of input subsidies received by less constrained farmers could improve programme efficiency and effectiveness in stimulating increased input use by targeting and by rationing. Having analysed the effects of targeting in section 9.2.3.3, we now turn to consider the effect of rationing, with or without targeting. For this we return to the marginal analysis used earlier in section 9.2.3.2.

Figure 9.6 shows that a rationed input subsidy on I'1 inputs can stimulate input use and production for capital constrained households (raising input use from 0 to I'1) and that production by other households is unaffected (at $I2_p$), with receipt of subsidised inputs displacing inputs that would have been bought anyway without any subsidy. Figure 9.7, analysing produce supply effects of a rationed subsidy, also shows that a rationed subsidy does not affect input use or production by less poor producers (for whom it displaces unsubsidised purchases), it only leads to increased input use and production by capital constrained producers. This drives down prices to the benefit of consumers at the expense of producers. Producer losses from lower prices are, however, offset by gains from receipt of the subsidy.

Figure 9.6

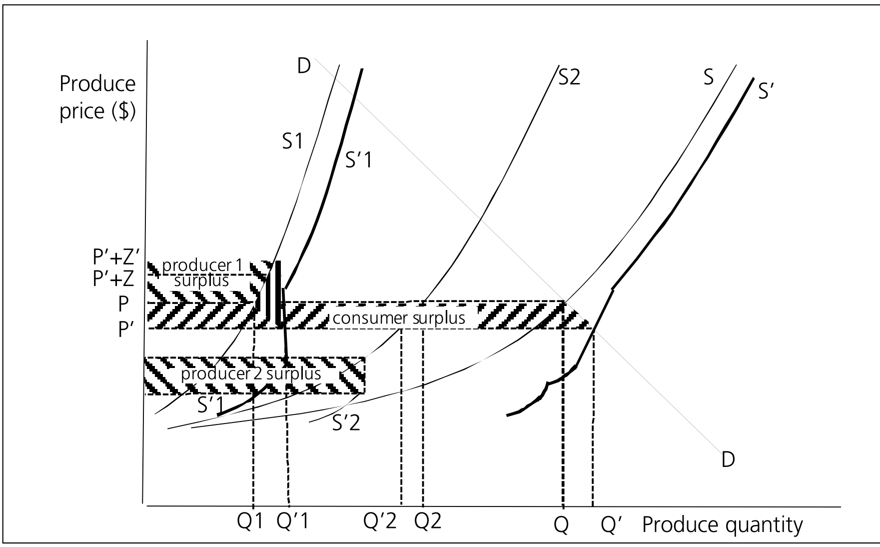
Marginal analysis of rationing of input subsidies



If the subsidy is targeted only to capital constrained producers this will lead to loss of welfare for other (less poor) producers, with substantial reductions in subsidy costs and limited impact on production or produce prices and hence increased economic efficiency of the programme (as compared with universal provision). There will, however, be political economy costs as less poor producers will be direct losers from the programme. We can also analyse contrasting situations where there is no explicit targeting of poorer producers and indeed poorer households have more limited access to the subsidy than less poor households in terms of de facto targeting to less poor households. This will lead to almost no incremental use inputs or production, no price changes or benefits to consumers, and effectively provide a straight income transfer from taxpayers to less poor producers.

Figure 9.7

Rationed subsidy impacts on output supply and stakeholder welfare



Rationing, whether targeted or universal, is only effective where there are no (or limited) secondary markets in which recipients sell subsidised inputs to non-recipients. The effects of such markets are discussed later in section 9.2.3.8.

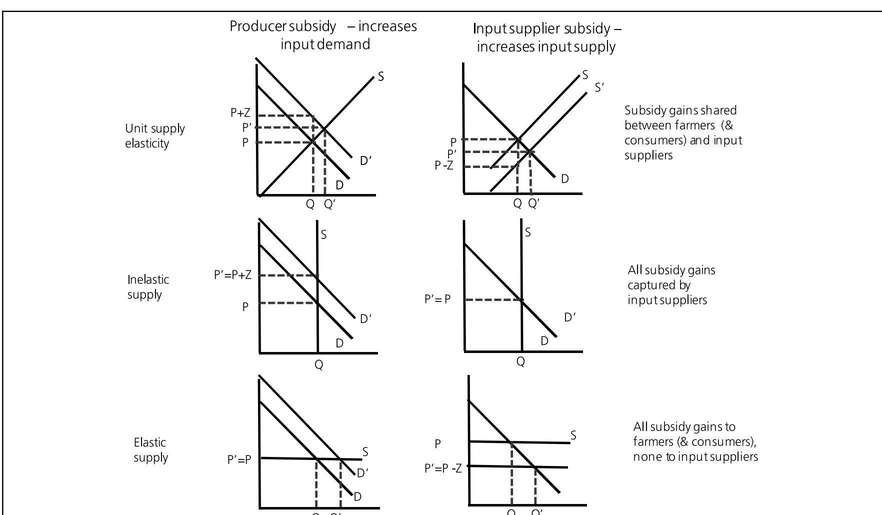
9.3.2.5 Effects of subsidies on input supply systems

Effective large scale input subsidies should lead to substantial increases in volumes of inputs purchased by farmers, and this can have a number of different impacts on input supply systems and markets. We consider three different beneficial processes and impacts, and two damaging process.

First, the short run effects of an input subsidy on the input market depend upon the nature of the subsidy and on the structure of the input supply system. If the subsidy is provided to farmers this has the effect of shifting input demand upwards. Alternatively input subsidies may be provided to input suppliers (India, for example, has used fertiliser subsidies to domestic producers to develop and protect its fertiliser industry, Fan et al 2007). The effects of this on the input market depend upon input supply elasticity, and this in turn will depend upon structure, conduct and performance in domestic production and imports. This varies between countries and between different kinds of inputs. Few African countries produce fertiliser, with local fertiliser suppliers either importing blends or blending particular formulations from imported raw materials. Price elasticities for imported fertilisers should be very high, unless there are either significant importation costs and limited importation capacity (as may be the case for land locked countries, in which case increased input demand will bid up importation costs and revenues (rents) in importation, for example transport) or limited competition between importers (in which case increased input demand will bid up revenues (rents) of importers). The situation is often very different with seed supply, where imports are impeded by national seed certification controls and there is limited domestic capacity in seed production, with long multiplication lead times. Short and long run supply elasticities also differ (with greater long run elasticity). More elastic input supply leads to more of a subsidy accruing to producers (see figure 9.8), with gains for producers (and/ or consumers, as discussed earlier). More inelastic supply, whatever its cause, leads to increased subsidy capture by input suppliers and reduced benefits to producers and/ or consumers. Clearly agricultural development benefits from input subsidies are increased by more elastic input supply and decreased by inelastic input supply.

Figure 9.8

Effects of different input supply elasticities



The second process by which input subsidies can impact beneficially on input supply systems involves first the realisation of economies of scale across the industry and within particular suppliers (as a result of increased volumes) and second the benefits of competition in increasing efficiency and reducing marketing margins where increased volumes attract new entrants into the input supply business. These benefits should accrue to both subsidised and unsubsidised supplies of the same inputs, and expand supply, pushing supply curves down and to the right, with increasing supply elasticity. These processes of realising economies of scale and competition of course depend upon the nature of the inputs and their supply systems, and upon the ways in which subsidised inputs are acquired and disbursed (for example through general price support, voucher systems or direct issue with distribution involving government institutions, input supplier cartels, or competitive input markets). It should be noted that government supply is not incompatible with realisation of economies of scale in subsidised input disbursement, but the spillovers to unsubsidised sales are likely to be limited (unless government also markets these) and lack of competition faced by government organisations (and by cartels) tends to undermine the achievement of such economies.

The third process by which input subsidies can impact beneficially on input supply systems results from the ways that increased input supply and transactions may promote the development of new relationships and forms of relationships among input sellers and buyers in poor rural areas with, for example interlocking arrangements for linking input sellers, seasonal finance providers and produce buyers. Again these processes are critically dependent upon the nature of the inputs and their supply systems, and upon the ways in which subsidised inputs are disbursed, as discussed above. This process can also contribute to wider economic and market activity as increased input market activities have potential spill-overs into other markets (for example expansion of a network selling subsidised inputs may also buy and sell other commodities).

The impacts of input subsidies on input supply systems are not, however, always beneficial. Damaging effects can arise in two main ways.

First, input subsidies may create considerable uncertainty and risks for input suppliers and directly undermine the incentives for private investment in input supply systems. This occurs most obviously when governments intervene directly in input markets through direct supply of subsidised inputs and/or through regulation of input markets. Direct supply of subsidised inputs by government may take away business from private suppliers if there is significant displacement of unsubsidised sales by subsidised sales (and, as discussed earlier, this is common), leading to unsold stocks and lower sales volumes to carry fixed costs[20]. Regulation of input markets may restrict prices or volumes, or require sales of unprofitable lines or in unprofitable locations – again restricting revenues and increasing costs and risks. .

[20] An extreme case of this can arise if access to subsidies is very uncertain or deliveries are very late, such that farmers do not purchase unsubsidised inputs because they expect to obtain subsidised inputs, but then cannot obtain subsidised inputs (either because they are deemed ineligible for the subsidy or because the subsidised inputs do not arrive on time, in sufficient quantities, or in good condition). In such circumstances a subsidy can not only displace unsubsidised inputs but can actually depress total input demand and use.

A second way in which subsidies may damage the development of input supply systems is by distorting incentives so that input suppliers are distracted from investing to compete to expand profitable sales and instead divert resources and investments into competing to expand government contracts to provide subsidised inputs[21]. Unless subsidies are carefully designed to address and indeed exploit this, such investments are unlikely to lead to the development of longer term sustainable supply systems.

The implications of this discussion are that subsidy programmes need to be carefully designed and implemented to promote supply system development in key areas where it needs development, and that long term stable relationships of trust need to be developed between governments and private sector – but these must also promote efficiency. Quick exits and unstable, changeable subsidy programmes are unlikely to induce the private sector investments necessary for supply system development.

9.2.3.6 Dynamic effects of subsidies on growth

Discussion of subsidy impacts in sections 9.2.3.2 to 9.2.3.4 has been largely concerned with 'static' impacts, considering the direct impacts of subsidies on producer costs and decisions, hence on produce supply and prices, and consumer welfare. 'Dynamic impacts' of subsidies on producer knowledge of input benefits and on more efficient use of inputs were mentioned in section 9.1 as a means by which input subsidies can overcome information failures to induce long term change in perceived and actual input profitability and use, allowing subsidies to be withdrawn as producers using subsidised inputs learn about the benefits of inputs and about their efficient use. Such dynamic effects are an important part of conventional thinking about subsidies, and continue to be relevant, though as argued in section 9.2.3.1 lack of knowledge of the benefits of some inputs (such as fertilisers) is less important now than it was in the past. Similarly section 9.2.3.5 considered some dynamic effects of input subsidies on the development of input supply systems alongside more static concerns about the distribution of subsidy benefits between input suppliers and producers.

There are, however, two important potential dynamic benefits of subsidies that have been given much less emphasis in conventional thinking about subsidies.

First, subsidies that are effective in raising land and labour productivity (with overall increases in on-farm labour demand) and in driving down food staples prices (as examined in consideration of output supply effects in sections 9.1 and

[21] There is anecdotal evidence that this may have affected input suppliers in Zimbabwe (concentrating on providing relief inputs subsidised by international donors in the early 2000's) and in Ghana (investing in relations with government for the 2008 subsidy). There is no suggestion that any of these involved corrupt behaviour, but such behaviour demonstrates more extreme incentive distortions.

9.2.3.1 to 9.2.3.4), will raise the real incomes of large numbers of poor consumers as well as raise the incomes of poor producers, and this should expand demand for locally produced non-staple foods (horticultural and animal products) and non-farm goods and services, driving up local labour demand and wages. At the same time increasing staple crop productivity can release resources for the production of non-staple foods (horticultural and animal products) and non-farm goods and services. Such growth multipliers were critical in driving growth in Asia (Hazell and Rosegrant, 2000) and need to be given much greater emphasis in analysis of input subsidy impacts, in particular this requires more emphasis on subsidy impact on food prices and poor consumers or net buyers. It also requires implementation of subsidies over a longer period, to achieve structural change rather than short term productivity gains.

Dorward (2009) describes three dimensions of development: the need for individuals and households, communities and wider economies to maintain their welfare (termed 'hanging in'), a process of advancement by 'stepping up' existing activities by expanding their scale or making them more efficient, and a process of advancement by 'stepping out' into new activities. Both 'stepping up' and 'stepping out' require coordination across and between different scales of economic organisation (so that necessary production inputs and services are available, and so that growing supply is matched by growing demand). They also require a reasonable expectation of ability to 'hang in', so that investment in stepping up and stepping out are not overly constrained by allocation of resources to low productivity hanging in activities. Where agricultural input subsidies contribute to raised land and labour productivity in staple food production, reduced food prices and raised producer incomes they are contributing to coordinated hanging in, stepping up and stepping out in low income rural economies, and thus can play a very dynamic role in promoting wider development, growth and poverty reduction.

The second way that input subsidies can have important potential dynamic benefits is through their stimulation of increased input and output and wider economic activity (as described above) then having positive spillover effects with 'market thickening'. This happens if the greater volume economic activity stimulated by the subsidy reduces coordination and transaction costs and risks and promotes institutional and communications and transport service and infrastructure development (see Dorward et al 2009, Dorward and Kydd 2004, Dorward et al 2004).

Both these potential dynamic benefits of subsidies require longer term and stable implementation of subsidies to induce behavioural and structural change.

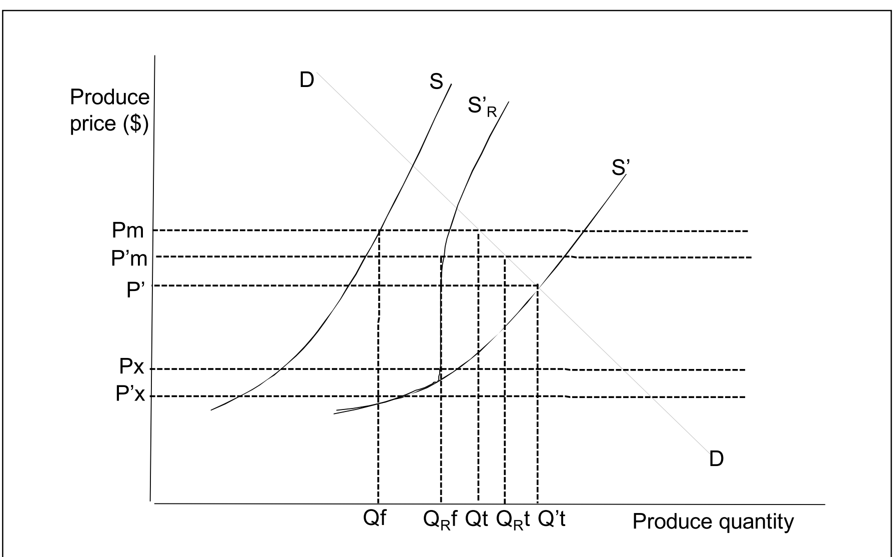
9.2.3.7 Subsistence production and net deficit producers

The analysis of input subsidy impacts on output supply and stakeholder welfare (for example in figures 9.1, 9.5 and 9.7) analyse separately subsidy impacts on output producers and consumers, linked by their interactions in the market. This analysis is, of course, highly stylised. While there is evidence that many staple food markets in southern and eastern Africa are generally reasonably well integrated (Abdulai, 2007), they also tend to be characterised by high margins which inhibit exchange and incentives for surplus production (eg Barrett 2008). This, together with variable staple food prices and limited off farm income opportunities, leads to substantial subsistence production and very large numbers of African farmers (around 50%) who are poor deficit staple food producers and net staple food buyers (Barrett 2008). Such farmers are both producers who can utilise an input subsidy and consumers who benefit from lower food prices.

Figure 9.9 presents a formal analysis of the within-household effects of subsidy receipt, showing the unsubsidised situation with domestic staple food demand D and own supply S, and market purchase price Pm and sales price Px. The household produces Qf from its own farm and purchases Qt-Qf. A widespread subsidy leads to a fall in purchase and sales prices (P'm and P'x) and own supply shifts to S'. The household now produces all it needs (Q't) at a cost of P' and neither sells nor buys staple food. There is a substantial increase in producer and consumer welfare (and demand may shift as a result of higher income).

FIGURE 9.9

Within household input subsidy impacts on food supply and welfare



The effects of a rationed subsidy are shown in figure 9.9 by the supply curve S'_R with own production of Q_Rf, total consumption of Q_Rt, and purchases of Q_Rt-Q_Rf [22].

The relative positions of D and S, the impact of the subsidy and situation of the household as autarchic or a net buyer or seller will differ between households according to household composition (consumers and workers), and access to land and capital. Subsidy impacts in production and consumption by many households will not be fully reflected by changes in quantities bought and sold in food markets, and this may dampen market effects of subsidies when measured in absolute terms. However the significant quantities of produce that are consumed within farm households without reaching markets also means that produce markets may be very thin, so that small % changes in production can lead to very large % changes in market supply and demand, making markets very unstable. This can be important for understanding the food market impacts of input subsidies (and indeed of any policy or natural events that affect smallholder production).

9.2.3.8 Leakages and secondary markets

Leakages were discussed earlier in section 9.1 in terms of cross crop, cross farmer and cross border leakages. These are closely related to the development of secondary markets where recipients of subsidised inputs sell their inputs to others, normally at prices that are discounted as compared with unsubsidised inputs. Such markets may arise with targeted and rationed subsidies, as subsidy recipients sell subsidised inputs to others as a result of differences in access to and needs for working capital (with poorer, capital constrained farmers selling inputs to less poor farmers) and/or differences in perceived marginal benefits to input use (with farmers with more land, for example, requiring larger quantities of inputs and looking for discounted prices).

It is often argued that secondary markets should not be impeded because (a) farmers generally know what is best for them and (b) attempts to limit secondary markets generally lead to (poorer) sellers of inputs into these markets getting lower prices while (less poor) buyers and middlemen get higher prices – with regressive distributional effects as less poor buyers and middlemen capture a large share of subsidy benefits. Such arguments lead on to a related question that is often raised with regard to input subsidies: would it not be better to give poor producers cash rather than an input subsidy and let them choose what to do with the money? This is an important question as social protection and welfare policy make increasing use of cash transfers which avoid the significant inefficiencies and leakages common in subsidy administration and secondary markets.

[22] Prices with the rationed subsidy are for simple exposition shown as P'm and P'x but in fact would not be expected to fall as much as with a full, unrationed subsidy and should be between Pm and P'm and between Px and P'x respectively.

These are important considerations. There are, however, other significant arguments that suggest that secondary markets can fundamentally undermine input subsidy programmes' wider benefits. At the heart of both conventional and more recent arguments for input subsidies are information and market failures and externalities, all of which cause individually optimising farmers to make decisions that are sub-optimal or inefficient in meeting the goals of wider society. A well designed and effectively implemented input subsidy programme can address four interacting sets of information and market failure and externality problems together:

- Farmers' under-valuation of the benefits of input use to themselves as individuals and to society, as a result of inadequate information on the effects of inputs when properly used and on efficient ways to use them – an information failure considered in sections 9.1 and 9.2.3.1;
- Poorer farmers inability to obtain seasonal working and consumption capital, or ability to obtain it only at much higher cost than the social opportunity cost of such capital – a credit market failure considered in section 9.2.3.2;
- Farmers not benefiting directly from economies of scale when increased input volumes reduce input supply costs and margins - a non-market externality that arises from increasing returns to scale, considered in section 9.2.3.5; and
- Farmers not benefiting directly from lower output prices and consequent dynamic pro-poor growth effects of subsidies which raise staple food production and productivity – a 'market externality'.

If cash transfers replace input subsidies, or secondary markets are encouraged, then welfare transfers can be delivered more efficiently to subsidy beneficiaries (subsidy recipients and/or staple food consumers) but cash transfers are unlikely to be able to address as efficiently at least three of the four information and market failure and externality problems described above[23]. This is because allowing people more unconstrained market choices cannot address those externality and information and market failure problems which arise precisely because private and social interests are misaligned. Policy choices between cash transfers and input subsidies with or without constraints on secondary market operation therefore need to take account of specific policy objectives; of the nature of the informational, market, externality and distributional problems that need to be addressed; and of alternative instruments and combinations of complementary instruments that may be used.

This discussion of the role of subsidies in addressing information and market failures and externalities has important implications not only for thinking and policies

[23]One would expect cash transfers to address seasonal credit market failures, but Gregory (2006) and Dorward (2006) suggest that this may not be the case as input subsidies may help with 'enforced savings' as money savings are too fungible.

on secondary markets but also on farmer choice within subsidy programmes. It is sometimes argued that voucher systems can and should be used to extend farmer choice, with fixed value vouchers being redeemable for different inputs which farmers may choose between. This empowers farmers, and allows them to use the subsidy to invest in inputs that they consider will make the largest contribution to their livelihoods. The effectiveness with which subsidies address information and market failures and externalities may, however, require some restrictions on farmer choice, to ensure that their choices align with wider social efficiency objectives.

9.2.3.9 Entitlement and distribution systems

Any targeting or rationing system requires a method for restricting access to subsidised inputs. This requires a list or specification of entitled beneficiaries with specification of their subsidised input entitlement and then a mechanism that allows them to access that entitlement. This mechanism may involve either physical distribution of inputs from a specified distribution point against a list of entitled beneficiaries held at that distribution point, with some form of secure identification, or separate distribution of evidence of entitlement which can then be 'redeemed' by the beneficiary at authorised input retail outlets. Evidence of entitlement is most commonly a paper voucher, but scratch cards and electronic systems involving bank cards, electronic 'smart' cards and mobile phones may also be used. Since entitlements have considerable financial value, vouchers or cards need to be very secure as regards prevention of counterfeit fraud (with secure printing processes and print features and/or real time, secure and centralised monitoring of allocated and redeemed entitlements). Different systems offer different potential benefits but pose different political, technical, administrative and social challenges within communities and households (the use of biometric information, for example, raises questions about intra-household control over input subsidy entitlements; electronic systems must be able to operate in areas with no electricity, and some require reliable mobile phone network access and expensive equipment).

Entitlements may be input specific (entitling the beneficiary to a particular quantity of a particular input on payment of a top up) or flexible (entitling the beneficiary to choose between a limited range of specified inputs on payment of a top up). They may also be fixed value (with the top up varying when used in different locations or outlets or, with flexible vouchers, when used for different inputs) or be associated with a fixed top up (where the top up paid by the beneficiary is constant but the value of the subsidy varies, when redeemed by the retail outlet). Flexible vouchers are normally also fixed value vouchers. There are important interactions between types of vouchers, secondary markets, recipient choice (of inputs and suppliers), control of fraud and of programme costs, and gendered access to and control of subsidised inputs within households.

9.2.3.10 Complementary integration, investments and policies

Positive impacts from input subsidies are determined by the on-farm physical productivity of inputs; by input supply system efficiency, transport and communication systems and costs; and by output market efficiency (as these affect marginal value products of input use, output supply curves and shifts, and output demand curves and elasticities) – as well as by the effectiveness and efficiency of implementation of the subsidy programme itself. Programme impacts can therefore often be enhanced by complementary investments in agricultural research and extension that can raise input productivity; by subsidies for complementary inputs (for example seeds and fertilisers); and by investments in road, communications, and market infrastructure and service development. Programme effectiveness and efficiency can also be improved by designing and implementing subsidy and other policy instruments in ways that are complementary (for example cash transfer or cash for work programmes may be linked to subsidy entitlement systems to facilitate participation by and benefit for very poor producers, or subsidy entitlements may be linked to and incentivise investments in soil and water conservation). Complementary development of staple food markets is an area of complementary policy that is particularly important given the way that major subsidy benefits involve consumers' accessing food at lower prices.

9.2.3.11 Soil fertility replenishment

As noted earlier, one of the reasons put forward for fertiliser subsidies is the need to combat the alarming decline in soil nutrients in many parts of Africa and the need for (and benefits of) their replenishment. Crawford et al 2006 summarise soil fertility problems in terms of declining fallows, rapid deforestation, land degradation, and declining nitrogen, phosphate and potassium levels in arable soils. Subsidies to promote the application of fertilisers may then be justified in terms of externalities from increasing fertiliser application where fertiliser use, higher soil fertility and higher farm yields provide a number of benefits to society rather than to individual farmers: reductions in soil erosion and downstream flooding and siltation, in deforestation and CO_2 emissions, and in soil and wider ecosystem and biodiversity loss as a result of reduced pressures to cultivate marginal and fragile land; and reductions in poverty and in rural-urban migration, and hence in wider social costs of addressing rural and urban poverty as a result of increased farm and rural incomes (Sánchez et al., 1997). It may also be argued that poverty and food insecurity cause many African farmers to place a higher value on short term income and food production and a lower value on longer term investments in soil fertility and other types of natural capital (as compared with their value to wider society), again leading to under investment in soil fertility and a justification for subsidies to promote investments in better soil management.

9.2.3.12 Political economy issues

Another important set of issues affecting the implementation and outcomes of input subsidy programmes concern domestic and international political contexts and processes. These are given increasing recognition in agricultural development policy analysis (see for example Birner and Resnick, 2005; Cabral and Scoones, 2006; World Bank, 2007) but detailed analyses of study of policy processes in input subsidy programmes are less common (Chinsinga, 2006, and Dorward et al, 2008 are exceptions). Political processes are, however, extremely important for input subsidy programmes.

Large scale input subsidy programmes are extremely costly, they represent very significant transfers to subsidy recipients, and they offer opportunities for very substantial captures of rents by a variety of stakeholders (politicians, programme administrators, input suppliers, traders, and less poor farmers).

As a result, political economy difficulties with large scale input subsidies are found in almost all countries where subsidies are implemented. Thus in OECD countries agricultural subsidies (not specifically input subsidies) are widely recognised to be inefficient but have continued because they serve particular political interests. Input subsidies (fertiliser and electricity for example) persist for similar reasons in many Asian countries after they have served their role of kick starting rural growth, despite being extremely costly.

Political economy difficulties can, however, be particularly problematic in poorer rural economies where (a) there are very substantial economic opportunity costs from the diversion of scarce fiscal resources to input subsidies and away from other productive investments (such as agricultural research or infrastructural development) and (b) potential personal and political gains from subsidy rents are very large relative to other income, patronage and rent seeking opportunities in the economy. A paradox arises in that while substantial political commitment is needed for large scale input subsidies to be implemented, the political objectives behind such commitment will often focus around or be shifted towards short term patronage opportunities. Unfortunately, however, pursuit of these opportunities tends to undermine the economic efficiency and wider pro-poor growth benefits of input subsidies - by directing subsidies to less poor recipients with more political voice, directing subsidies towards cash crops, undermining competition and efficiency in input delivery systems, and increasing leakages and non-transparent secondary markets. These difficulties are particularly prevalent in political systems with significant neo-patrimonial elements, as is common in many poorer rural economies, particularly in Africa (van de Walle, 1999).

A second paradox related to political economy also arises with regard to the importance of stable, continuing and longer term subsidies if they are to lead to supply system development and wider dynamic changes in rural economies (as discussed earlier in sections 9.2.3.5 and 9.2.3.6). While this carries important benefits it also carries important risks, as if subsidies are not set up with clear time limits and if they continue for long periods then already substantial risks of their being politically entrenched and 'hijacked' are increased. Similarly the longer subsidies are in place and the more stable the subsidy systems, the greater the opportunities for those wishing to perpetrate fraud and divert subsidies to find ways of doing so. There is therefore a substantial challenge in finding ways of promoting stability and trust for farmers and input suppliers while at the same time specifying clear exit mechanisms and rules (to reduce risks of political capture) and varying systems (to reduce fraud).

Understanding and addressing political economy issues in agricultural input subsidies is a difficult but very important issue. A key part of this is understanding the diverse legitimate and illegitimate interests and powers of different stakeholders (for example farmers with different livelihoods; produce buyers, sellers and consumers; tax payers; local and national politicians; technicians; donors; input supply businesses and employees; civil society; government and private organisations and their managers, traditional leaders), as they relate to personal, local, organisational and wider political, financial, economic and symbolic[24] constraints and objectives.

9.2.4 Rethinking input subsidies: conclusions and conceptual frameworks

The review in previous sections of new thinking and its implications allows us to identify new insights about the potential pitfalls and practice of smart subsidies and to draw out first the key elements of input subsidy programmes and second the major impacts that they may have. This then defines issues to be considered in evaluating them.

9.2.4.1 Key elements of input subsidy programmes

The 'success' of an input subsidy programme has to be judged against the objectives of that programme. Input subsidy programmes can and do have a wide range of different possible objectives as set out in table 9.3.

Most of these objectives are mutually complementary. . However our analysis suggests that objective (1) in table 9.3 (a contribution to wider, pro-poor, economic growth) should normally be important and using the terminology of Dorward (2009)

[24]'Symbolic' constraints and opportunities are those that while not apparently technocratically rational are pursued because they have significant symbolic importance. Examples include national food self-sufficiency – this may or may not be an economically efficient way of ensuring national food security, but in some countries it has significant symbolic political importance. Avoiding of weakness or devaluation of national currency is another example of a symbolic objective in some countries.

this will be supported by contributions to 'hanging in' from improved national and household food security (objective 3 in table 9.3); by contributions to 'stepping up' from increased input adoption, efficiency in use, attention to the price productivity tightrope, improved producer welfare, and input supply system development (4 to 8); by contributions to 'stepping out' from attention to the price productivity tightrope, improved producer welfare, and input supply system development (6 to 8); and by contributions to all three of these transformations from soil fertility replenishment and from political benefits that support commitment of resources to effective and efficient subsidy implementation (10 and 11). However some objectives in table 9.3 may also be to a greater or lesser extent mutually incompatible (for example 2 and 7 may in some cases be incompatible, and pursuit of 9 is generally incompatible with many of the other objectives – although some rents may be necessary for political economy purposes to allow a subsidy to be implemented). It is also important to note that stated formal programme objectives may differ from the objectives of individual stakeholders.

Table 9.3

Possible input subsidy programme objectives

1	Wider (pro-poor) economic growth
2	Consumer benefits - lower output prices, access (emphasis on poorer consumers?)
3	National / household food self sufficiency / security
4	Input adoption
5	Input use efficiency
6	Addressing the price productivity tightrope
7	Producer welfare (emphasis on poorer producers?)
8	Input supply system development & efficiency
9	Rents (supplier, producer, administrative, political)
10	Soil fertility replenishment
11	Political benefits (personal, party, etc)

Note: These objectives are not arranged in any order of priority or importance

Given that the identification and prioritisation of objectives will be different in different situations, the balance of programme objectives should then determine the key design and implementation elements of input subsidy programmes. These are summarised in Table 9.4.

These elements have all been discussed explicitly or implicitly in earlier sections, which have suggested that input subsidies will generally (but not always) yield the greatest returns where they focus on consumer benefits and on indirect gains to pro-poor economic growth from increased food staple productivity, where they operate at a large enough scale (in terms of the number of beneficiaries, the subsidy per beneficiary and the total subsidised volumes) to lower staple produce prices - but with rationing and targeting criteria and methods which direct subsidised inputs to producers whose productive input use is constrained by market failures which can be overcome or substantially reduced through the subsidy. Such rationing and targeting will normally be best achieved by various forms of voucher systems which enable cost effective and timely input distribution, which support sustainable unsubsidised (commercial) input supply system development, and which limit secondary market development and leakages. Effective implementation of these various elements will normally require coordinated complementary investments and policies supporting infrastructural development, agricultural research and development, and efficient output markets offering lower and more stable staple prices to consumers.

Table 9.4

Key design and implementation elements of input subsidy programmes

1	Basic subsidy system (focus on consumer or producer benefits, direct recipients)
2	Product focus – staple foods, cash crops, etc
3	Scale – beneficiary coverage
4	Subsidy per beneficiary
5	Total volumes subsidised
6	Voucher or other entitlement systems, distribution and input access systems and timing
7	Rationing – objectives, methods
8	Targeting (if rationing) – objectives, criteria and methods
9	Input supply systems (involvement of parastatal and /or private wholesale and retail suppliers) and timing
10	Secondary market and leakage policies (and enforcement mechanisms)
11	Complementary integration and investments and policies

However as should also be clear from these sections, these elements are also highly inter-related, with many synergies and trade-offs. These interactions are most easily identified around the themes of scale and scope: large scale subsidy programmes offer wider supply side benefits (in input supply system development, in consumer and dynamic pro-poor growth impacts) but make effective, timely and efficient programme management more difficult and can crowd out complementary investments needed for higher productivity of input use. Different entitlement, targeting and rationing systems are effectively attempts to control the scale of subsidy programmes by directing limited resources to their most productive uses – but these are themselves often difficult and costly to implement. Indeed there is something of a paradox here, that it is in the application of targeted subsidies to input use on staple foods in poor rural areas that such subsidies both offer the greatest potential benefits and pose the greatest implementation, resourcing and coordination challenges (Dorward et al, 2009).

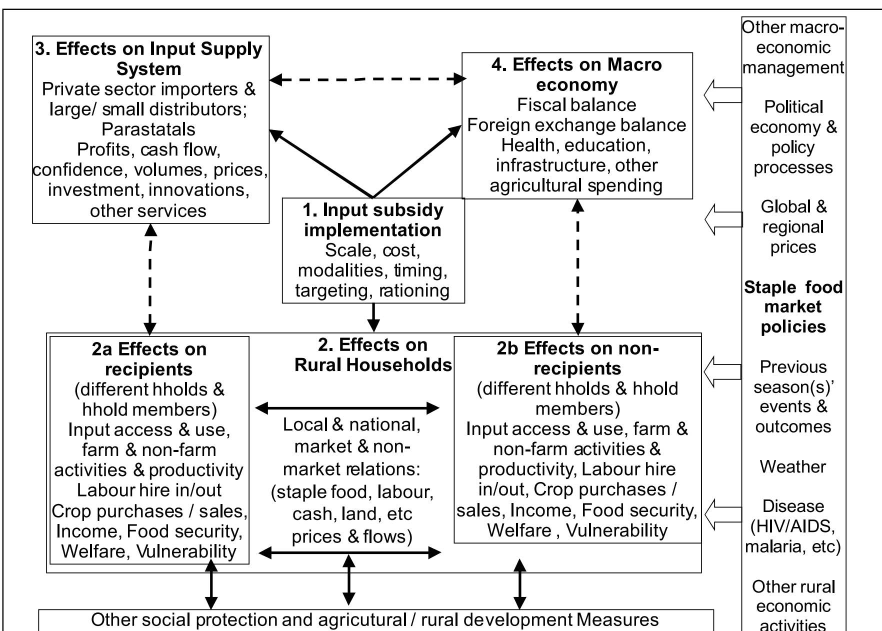
The list of subsidy programme objectives and elements in tables 9.3 and 9.4 provide a useful set of criteria for characterising and evaluating different types of subsidy adopted by different countries at different times.

9.2.4.2 Key input subsidy programme impacts

Identification of critical issues to be considered when evaluating input subsidy programmes must be informed by an understanding of (a) programme objectives and (b) the processes by which programme investments, activities and objectives are related. Figure 9.10 provides a conceptual framework that draws on the analysis and issues addressed in sections 9.2.3.1 to 9.2.3.12 to identify key variables and relationships affecting input subsidy programme impacts.

FIGURE 9.10

A conceptual framework for investigating agricultural input subsidies impacts



(adapted from SOAS et al, 2008)

This framework in turn helps to identify critical outcomes that subsidy programmes may (or may not) deliver. These are summarised in Table 9.5. Tables 7.3, 7.4 and 7.5 then define key issues to be considered in evaluating input subsidy programmes as regards their objectives, their design and implementation and their impacts.

TABLE 9.5
Potential outcomes of input subsidy programmes

1	Timing
2	Performance monitoring and audit systems
3	Input leakage, displacement
4	Incremental input use
5	Incremental production
6	Increased productivity
7	Output price changes (producer and consumer prices)
8	Input price changes
9	Labour market changes (hired labour demand, wages)
10	Programme cost / benefit analysis (fiscal, economic)
11	Welfare and growth impacts
12	Macroeconomic effects
13	Input supply system impacts
14	Soil fertility replenishment

7.3 Recent experience with input subsidies

Having considered key features of input subsidy programmes (their potential impacts, objectives and features) we now turn to examine recent experience with their implementation. As noted earlier, there has been resurgent interest in input subsidies, in particular 'smart subsidies' for fertilisers in Africa. High food and fertiliser prices in the first part of 2008 added to this, with many reports of new or expanding subsidy programmes in different countries around the world. IFDC, towards the end of 2008, reported new, expanding or continuing subsidy programmes in China, India, Philippines, Sri Lanka, Indonesia, Ghana, Nigeria and Malawi (http://www.ifdc.org/focusonfertlizer8.html). Other countries for which there are reports of new or expanded fertiliser subsidy programmes include Tanzania, Kenya, Rwanda, Mali, Senegal, and Bangladesh. Unfortunately there are very few detailed and rigorous evaluations of most of these programmes – indeed it is often difficult to find even very basic information about them: 'recent experience with input subsidies' is difficult to review. This lack of information is not surprising – given the ongoing emergence of many of these programmes and national rather than donor ownership.

We therefore summarise observations from an examination of 10 fertiliser subsidy programmes in Africa, all except one of these implemented since the turn of the century. These have been selected on the basis of (a) availability of information and (b) representation of a range of different approaches to and types of subsidy programme[25]. Table 9.6 lists the 10 programmes and summarises the information available on each against key issues identified earlier in tables 9.4, 9.4 and 9.5. Before considering the insights from this table and what it can teach us as regards general patterns of subsidy programme objectives, design, implementation and impacts we first briefly describe each of the programmes considered in table 9.6.

9.3.1 Programme descriptions

9.3.1.1 Ghana

In early 2008 Ghana faced high food prices and rising fertiliser prices and the government and large fertiliser importers (who had significant but high priced fertiliser stocks) discussed the potential and possible modalities for a national fertiliser subsidy programme. Press reports (Ghana News Agency 9th June 2008, 3rd July 2008) indicate that the programme was formally announced in June 2008 and operated from July to December. A total of 30,000 tonnes of four types of fertiliser was made available by three major importers, with pan territorial farmer prices representing an approximate 50% subsidy, at a total cost of around US$15 million[26]. Large numbers of vouchers (over 1 million) were printed against planned subsidy sales of 600,000 bags. Deliveries were late for the cropping season in the south of the country (April to July), but were more timely for the north, and this may account for lower uptake and fertiliser sales in the south and use on a wider range of minor crops as compared with the north where there was more substantial uptake and use mainly on maize.

Vouchers were distributed by Ministry of Agriculture staff, with wide variation in approaches, systems and numbers across different areas, and limited information to field level staff on the total number of vouchers that they would receive for distribution. Redemption prices varied geographically to provide pan-territorial farmer prices in district capitals, but this tended to discourage suppliers from supplying fertilisers outside district capitals as neither redemption nor farmer prices covered costs of transport outside district capitals. No subsidy sales were made by (smaller) distributors independent of the major fertiliser importers (indeed in the north unsubsidised sales were reported to be banned completely).

Information on the Ghana 2008 fertiliser is obtained largely from Banful (2008).

[25] A very large number of programmes and projects could be considered as providing some form of 'input subsidy' if this is interpreted in its widest sense as some form of public investment promoting input use, as, for example, agricultural research and extension, agrodealer development, market development and rural road building are all forms of public investment that may be intended to directly or indirectly promote agricultural input use. The programmes considered are restricted to those that provide some direct subsidy to input supply operations (beyond input supply system development, although they may – and hopefully will - contribute to input supply system development as well)

[26] Total budgeted subsidy cost was $25 million but only about $15 million was directly for the subsidy inputs and voucher costs (pers. comm.., Afua Branoah Banful)

9.3.1.2 Zambia fertilizer support programme (FSP)

Zambia has been implementing fertiliser subsidies for a long period, but the current programme was initiated in 2002, and disburses an average of over 66,000mt of subsidised fertiliser per year. This is imported by private companies under government tender and then distributed to farmers through cooperative societies (Xu et al, 2008). There is anecdotal, press and survey evidence that substantial quantities of subsidised fertilisers are diverted from cooperatives and smallholder farmers to fertiliser traders, who then sell it at unsubsidised prices. The subsidised fertiliser that does reach smallholder farmers tends to go to less poor farmers (who, on efficiency grounds, are explicitly targeted by the programme) and may lead to substantial displacement (Minde et al, 2008). Nevertheless the programme is estimated to yield an economic cost benefit ratio that is greater than 1, though this is lower than might be achieved by alternative investments in longer term research or infrastructural programmes (Jayne et al, 2007). There has been substantial political controversy regarding the implementation of the 2008/9 programme.

9.3.1.3 Kenya national accelerated agricultural input programme (NAAIP)

In 2007 the Kenya government decided to embark upon a National Accelerated Agricultural Input Programme to promote food security, agricultural input use, input market development, and agricultural productivity. Initially planned to subsidise fertilisers and maize seed for a limited number of districts, it has subsequently been expanded to national coverage with plans to provide 2.5 million farmers with maize seed and fertilisers for 0.4 ha each, with vouchers issued to targeted farmers (disadvantaged households with land) and subsequent redemption through private input sellers who would also be eligible for trade credit guarantees. Farmers will also benefit from linked extension, cereal banks, warehouse receipts, and participation in farmer groups (Sikobe, 2008). It has not been possible to access information on outcomes from the programme, but the programme is included in our review as an example of large scale programme design and implementation aspirations.

9.3.1.4 Malawi agricultural input subsidy programme (AISP), targeted input programme (TIP) and starter pack programme (SP)

Malawi has implemented a series of different national input subsidy programmes over the last 10 years, which have been supported by extensive monitoring and evaluation activities and have attracted considerable international interest.

In the 1998/99 and 1999/2000 agricultural seasons the Malawi Government, with donor support, implemented a large scale programme under which all farm households in Malawi received an input ‘starter pack’ comprising 15 kg of fertiliser, 2 kg of maize seed and some legume seed. With good rains, Malawi had large harvests these years. From 2000/2001 the programme was scaled down to the

TABLE 9.6

Key features of reviewed input subsidy programmes

		Ghana	Zambia FSP	Kenya NAAIP	Malawi AISP	Malawi TIP	Malawi Starter Pack	Sasakawa Global 2000 (Ethiopia)	Millennium Villages (Malawi, Kenya)	Malawi SPLIFA	Nigeria: DAIMINA
	Year	Jul-Dec 2008	2002 onwards	2007 onwards	2005/6 onwards	2000/1-2004/5	1998/9-1999/2000		2006/7 onwards	2003/4 - 2004/5	2004
	Source(s)		Minde et al (2009)	Sikobe (2008)	SOAS et al (2008)	Levy (2002, 2005)	Levy (2002, 2005)	Crawford et al (2006)	Buse et al (2008)	Gregory (2009)	Gregory (2009)
Stated Objectives											
1	Wider (pro-poor) economic growth							long run aspiration	long run aspiration		
2	Consumer benefits (lower output prices, access)										
3	National / household food self sufficiency / security	yes	latterly - increased maize production	hh food security/ availability	yes	targeted hh		long run	hh /village food security	hh food security	
4	Input adoption	yes	initially remote smallholders	yes	remote capital constrained farmers		yes	Yes	yes		
5	Input use efficiency			yes				Yes			
6	Addressing the price productivity tightrope										
7	Producer welfare (emphasis on poorer producers?)	yes (not apparent)	yes (not apparent)	yes	stated in later years	food insecure producers	food insecure producers	Yes	yes	food insecure producers	yes
8	Input supply system development & efficiency		yes	yes		increasingly recognised				yes	yes
9	Soil fertility replenishment								??		
10	Political benefits (not stated)	yes	yes	yes	yes	yes	yes				

Table 9.6
Key features of reviewed input subsidy programmes (continued)

		Ghana	Zambia FSP	Kenya NAAIP	Malawi AISP	Malawi TIP	Malawi Starter Pack	Sasakawa Global 2000 (Ethiopia)	Millennium Villages (Malawi, Kenya)	Malawi SPLIFA	Nigeria: DAIMINA
	Design & implementation										
1	Basic subsidy system (focus & direct recipients)	producers	producers, but significant supplier capture	producers, agro-dealers	producers	subsistence producers	subsistence producers	Producers	subsistence producers	subsistence producers & suppliers	producer (25%) & supplier (50% 60 day trade credit, training)
2	Product focus – staple foods, cash crops, etc?	staples intended but wide use	Staples	staples	mainly staples	staples	staples	Staples	staples	staples	
3	Scale?	national scale	National	36000 hh (2007) plan 2.5 million farmers	national programme, >1.5 million hh	targeted 25%+ hh	universal	max 650,000 farmers	project villages	100,000 hh	pilot
4	Subsidy / beneficiary?	50% costs	50% costs	100% on inputs for approx 0.4ha	60 to 90% on inputs for approx 0.4ha	100% on inputs for approx 0.08ha	100% on inputs for approx 0.1ha		100% on inputs for approx 0.4ha	100% on inputs for approx 0.4ha	25% subsidy on cash purchases
5	Volume subsidised?	30,000 tons of fertilizer, US$15 million	66,000mt average pa	plan 250,000mt fertiliser	130 to 220,000 tonnes fertiliser, US$50-200 million,	11,000 to 50,000 tonnes fertiliser	42,000 to 44,000 tonnes fertiliser				385 mt fertiliser
6	Voucher or other entitlement systems, distribution & input access systems	vouchers	subsidised sales by cooperatives	vouchers	vouchers	physical distribution initially, moved to vouchers	physical distribution initially, moved to vouchers	physical distribution	physical distribution?	vouchers for work	vouchers
7	Targeting – objectives, criteria and methods	None	farmers with 1 to 5 ha (less poor 60%)	resource poor with land; disadvantaged; potential group members	poorer productive farmers (highly variable in practice)	ineffective targeting of poor / vulnerable farmers	universal	more (potentially) productive farmers in more productive areas	geographical (site selection)	self / community targeting, food insecure	
8	Rationing	intended fixed quantity / hhold, not consistently enforced		fixed quantity per farm hh	fixed quantity per farm hh	fixed quantity per farm hh	fixed quantity per farm hh	fixed quantity per farm hh	fixed quantity per farm hh	fixed quantity per farm hh	
9	Input supply systems	Importer supply system	cooperatives supplied by private imports	private retailers/ agrodealers	mixed, mainly parastatal & large private importers / retailers	mixed, mainly private importers	mixed, mainly private importers	mixed - including part government owned importers/ distributors		small agrodealers, supplies arranged by IFDC	small agrodealers , 50% trade credit
10	Secondary market and leakage policies	formally prohibited			prohibited	prohibited	prohibited				
11	Complementary integration & investments & policies	no		extension, cereal banks, group work (planned)	some subsidised legume seed but supply shortages			credit, extension, floor prices	extension, health, education, community development	agrodealer extension training, road construction	

TABLE 9.6
Key features of reviewed input subsidy programmes (continued)

		Ghana	Zambia FSP	Kenya NAAIP	Malawi AISP	Malawi TIP	Malawi Starter Pack	Sasakawa Global 2000 (Ethiopia)	Millennium Villages (Malawi, Kenya)	Malawi SPLIFA	Nigeria: DAIMINA
	Outcomes										
1	Timing	voucher issues July to Oct, late in south	70% ok	n/a	last minute and later than optimum input delivery, has improved	sometimes last minute/ late	sometimes later than optimum input delivery	generally good though lower costs if earlier	good	late input deliveries	improved timeliness
2	Internal monitoring & audit systems	not reported	not reported	M&E planned	internal M&E, limited audit systems	independent & internal M&E	independent & internal M&E	some evaluation Howard et al 1999	yes	dealer & farmer surveys	dealer & farmer surveys
3	Input leakage, displacement	some leakage to other crops	substantial - ? 70% leakage in 2007/8, 40% displacement		limited leakage info, displacement with less poor beneficiaries & cash crop use: 20-40%	low displacement estimates	limited leakage info, low displacement estimates			limited; monitoring & transparency / accountability in community	
4	Incremental input use	in regions with timely delivery	variable - 60% if reaches smallholders?		60-80% for fertilisers, unknown for seeds	no specific estimates	no specific estimates	Yes	substantial incremental input use reported	yes	Yes
5	Incremental production		Yes - but could be more		approx 30-40% maize production increase?	40 - 350,000 mt maize?	350- 500,000mt maize?	Yes	substantial reported	yes, but poor weather& late deliveries	Yes
6	Increased productivity		Some		as above	40 to 125kg maize /hh	170 kg maize /hh	Yes	substantial incremental land & hh productivity reported	yes, see above	
7	Output price changes (producer & consumer prices)		modified by marketing policies		low prices only after 2005/6, modified by marketing policies	very limited - some high price years	Yes, also with good rains	large price fall led to credit defaults			
8	Unsubsidised input price changes		No		No	reduction in import costs / margins during implementation					
9	Labour market changes (hired labour demand, wages)				following 2005/6 subsidy					yes (limited scale)	
10	Programme cost / benefit analysis (fiscal, economic)		C:B ratio >=1.07		potential to be >1 depending on yield gains & input & output prices. Fiscal efficiency depends on displacement rates	range of food security benefits and savings of emergency imports		Economic CBA >1 if extra production reduces imports, but not for export. Doubtful in less favourable areas			
11	Welfare and growth impacts				productivity gain benefits but often consumer losses from higher maize prices	limited social protection, divisive targeting	lower maize prices		improved hh welfare reported	improved beneficiary food security (less for female headed hh),improved roads	
12	Macro economic effects				significant budget impacts in 2008/9	limited	limited	Limited	none	none	none
13	Input supply system impacts	negative except large importers	Negative		importers gain, agrodeales excluded from fertiliser supply, instability gives limited sustainable gains	private input suppliers (fertiliser importers, seed companies, retailers and agro dealers) grew during starter pack & TIP implementation		some crowding out of credit systems & independent distributors & retailers		increased trust from customers, dealer business benefits	expanded farmer demand, dealer profits, turnover & system sustainability
14	Soil fertility improved										

'targeted input programme' (TIP) with a smaller quantity of fertiliser (10kg) per beneficiary and targeted selection of beneficiaries. With poor rains and later delivery of inputs in some years, national production was very low with severe food shortages in 2001/2 and 2005/6 – and consequent large scale expansion of the number of TIP beneficiaries in these years. From 2005/6, however, the government has taken a different approach with a very large scale programme (the Agricultural Input Subsidy Programme or AISP) providing about 50% of farm households with vouchers for 100kg of fertiliser and small quantities of maize (and latterly legume) seed, with mainly privately imported fertilisers delivered principally, and in some years exclusively, by two parastatal input suppliers. Levy and Barahona (2002) and Levy (2005) report extensively on the TIP and its predecessor the starter pack programme, while SOAS (2008) and Dorward and Chirwa (2009) review the (ongoing) AISP and have estimated positive returns to the 2006/7 programme depending upon prices, and implementation effectiveness and efficiency, with potential for very large returns or losses. Dorward et al (2008) provide historical and political context to these programmes.

9.3.1.5 Sasakawa global 2000

During the 1990s the Sasakawa Global 2000 implemented a number of projects in different African countries under which farmers were given assistance in acquiring inputs on demonstration plots. We report here on experience in a major scaling up of this in Ethiopia as reported by Howard et al 1999.

9.3.1.6 Millennium villages

The Millennium Villages Project has established integrated projects in selected villages to demonstrate the substantial changes that are possible with significant investments in health, agriculture and community development. A major part of this is the provision of subsidised agricultural inputs (seed and fertiliser). Although the projects have only been established relatively recently, monitoring and evaluation systems are in place and we draw on reports from Kenya and Malawi (Buse et al, 2008; Denning et al, 2009). This approach has similarities with the Sasakawa Global 2000 approach in that it has invested in relatively small scale, localised input subsidy programmes with much wider objectives of national scaling up.

9.3.1.7 Malawi sustaining productive livelihoods through inputs for assets (SPLIFA)

For two years when the Targeted Input Progamme was being implemented in Malawi, IFDC and partners also implemented an innovative project (Sustaining Productive Livelihoods through Inputs for Assets or SPLIFA) under which food insecure households in particular communities were provided with input vouchers as payment for public works. These vouchers could be redeemed at local agrodealers, who were also supported with technical training, delivery of inputs, and a commission for voucher redemption (Gregory, 2006). This project is of interest as an early use of vouchers with specific objectives to simultaneously support both agrodealer (input supply) development and food security among poor subsistence producers.

9.3.1.8 Nigeria developing agricultural inputs markets in Nigeria (DAIMINA)

The Developing Agricultural Inputs Markets in Nigeria (DAIMINA) project, also implemented by IFDC, also used vouchers to pursue twin objectives of agrodealer development and increased producer access to and use of inputs (Gregory, 2006). Like the Malawi SPLIFA project, this was relatively small scale, but instead of providing free inputs to poor food insecure households it tested the use of vouchers within a much larger national fertiliser subsidy programme. The standard national programme purchased fertiliser from importers and then distributed to state level blenders and agricultural development programmes. This national progamme, however, undermined the development of private sector, commercial sales, and suffered from substantial leakages and non-payments from states to the federal government. DAIMINA trialled the use of vouchers to allow small agrodealers to deliver subsidised fertiliser to farmers.

9.3.2 Lessons from reviewed programmes

Table 9.6 summarised information available for each of the 10 reviewed programmes against the major issues identified as important for subsidy programme evaluation. We consider these under the main headings of programme objectives, programme design and implementation, and programme outcomes.

9.3.2.1 Programme objectives

The first part of table 9.6 shows for each of the 10 reviewed programmes the stated objectives of the programme[27]. Here we consider how far the different possible programme objectives are found in the different programmes and types of programme:

- food security (household or national), input adoption, and producer welfare are found as objectives of all or almost all programmes (with variation as regards particular emphasis on poorer or food insecure producers);
- not one of the programmes explicitly recognises the potential for producer subsidies to benefit poor consumers[28], except subsistence producers, and

[27] Political objectives were not stated but are inferred from context, design and implementation.

[28] It may be that inclusion of recent programmes in Mali or Senegal (if information were available) would have provided examples of programmes with an explicit objective to reduce consumer prices.

related to this there is no recognition of the potential role of subsidies in addressing the price-productivity tight rope and only in the Sasakawa 2000 and MVP is there a wider recognition of the potential role of subsidies in driving forward pro-poor growth: even here there is no explicit consideration of the mechanisms by which this may be achieved[29];
- input use efficiency, input supply system development and soil fertility replenishment are only explicitly considered as programme objectives for particular programmes or types of programme;
- political considerations are important for all of the large scale programmes (Ghana, Zambia, Kenya and Malawi).

9.3.2.2 Design and implementation

Design and implementation features of the different programmes are shown in the second part of table 9.6..

There is broad commonality across the different programmes as regards:

- the basic focus of subsidy systems on producers as major (and generally sole) direct subsidy recipients;
- a primary focus on subsidising inputs for staple food production (for subsistence production or for sale into domestic markets) ;
- very substantial subsidised input price reductions (of 50% or more for all programmes except DAIMINA), consistent with measures to address both affordability and profitability constraints to input use;
- all programmes rationing (or attempting to ration) the quantity of subsidised inputs to be received per household, with vouchers being a common (but not universal) means of achieving this; and
- use of private sector importers to provide basic fertiliser supplies.

There are differences across the programmes as regards:

- scale, with some national programmes and others piloting potential national programmes;
- targeting, with some programmes focussing on food insecure/ vulnerable households and others seeking to maximise production by focussing on less poor households (although this may be misguided if (a) smaller, poorer farms are more efficient (Hazell et al, 2007) or (b) displacement is higher with less poor households);

[29]Other programmes may also implicitly consider that increased productivity and producer welfare may drive forward growth, but consideration of the food price, non-staple and non-farm production and demand mechanisms is absent.

- use of vouchers for targeting, rationing, and/or supply system development;
- private sector involvement (and nature of involvement) in distribution;
- complementary policies, and their links to programme objectives.

9.3.2.3 Programme outcomes

Different programme outcomes – or information gaps about particular outcomes – are closely related to programme objectives. Thus limited examples of subsidies leading to output (food staple) price changes and the lack of information on labour demands and markets and longer term and wider welfare and growth impacts are not surprising. Similarly the lack of information on soil fertility replenishment is consistent with the lack of emphasis on this in programme objectives. There are, however, other similarities in outcomes that cut across differences in programme objectives, notably common (but not universal) problems with late input delivery in subsidy programmes (problems which are not confined to larger scale programmes) and common (and again not universal) lack of information on leakages (although such information is very difficult to collect and verify). Both of these are important for programme impacts, irrespective of programme objectives. Overall there appear to be large potential benefits from effective and efficient input subsidy implementation – but also the potential for large economic losses. However it is very difficult to estimate indirect benefits from lower food prices, but there Is little information on output price impacts for most programmes, and lower prices have ambiguous effects: lower food prices lower returns as estimated from conventional cost:benefit analysis but should increase the wider economic benefits from the programme if these lead to indirect benefits from growth linkages or multipliers; in Ethiopia lower output prices as a result of increased production led to farmer losses and the collapse of the programme.

There are also, of course, substantial differences across programmes, some of these related to differences in programme objectives, as noted above. Thus different welfare and growth impacts are related to differences in interest in these impacts, as are some differences in input supply system impacts. However programmes with the intention of developing supply systems may actually undermine them, if poorly designed and implemented: it appears that larger scales programme have tended to damage the commercial interests of local fertiliser distributors while offering benefits to fertiliser importers. Similarly differences in incremental input use, production, and productivity (fairly universal objectives) are determined more by differences in design and implementation effectiveness and efficiency.

While all the programmes have some have external reporting (otherwise they could not be included in this review), there are marked differences in reported performance monitoring and audit systems. There are also very few programmes for which information on economic or fiscal returns are estimated (and where these are available they were provided by external reviews). This may be linked to the emphasis on production in programme objectives – though again information on production does not seem to be universally important.

9.3.3 Conclusions from recent experience

A number of observations from the limited programmes reviewed here warrant particular emphasis:

First, it is notable how difficult it is to find comprehensive reviews of subsidy programmes, despite the substantial number of programmes that have been or are being implemented across Africa and the very substantial investments of public funds in these programmes. There is an important need for country studies to document country experiences, using the conceptual framework developed in this paper.

Second, there is a strong tendency for programmes to focus on production objectives and producer welfare, and to ignore the interests of consumers and the processes (and necessary conditions) for subsidy programmes to contribute to wider pro-poor economic growth. This is a critical omission, and is linked to the limited extent that the design and implementation of many programmes are integrated with complementary investments. Such integration is needed first for subsidy programmes to effectively deliver their stated objectives of incremental production, and then for them to contribute to wider processes of pro-poor growth. Recognition of the importance of consumer price benefits and of the price productivity tightrope is particularly important here.

Third, and related to the previous two points, there appears in some programmes to be an unfortunate lack of interest in improving effectiveness and efficiency. This is evident from the limited monitoring, evaluation and audit systems in some programmes, limited cost benefit and fiscal efficiency analysis, and limited attention to possible problems of displacement and leakage. This may be related to political economy issues (as discussed earlier in section 9.2.3.12). As will be discussed below (in section 9.4), growing challenges in a changing world will make it even more important that governments improve the efficiency and effectiveness of input subsidy programmes in both raising productivity and promoting wider pro-poor growth within and beyond agriculture.

Two notable commonalities observed across programmes are (a) the lack or limited focus on replenishing soil fertility and (b) a strong (almost universal) prevalence of heavy subsidies (50% to 100% subsidy rates) on rationed inputs. This commonality occurs despite differences between programmes as regards first relative emphasis on improving national food security (and total input use and production) as against improving household food security (and helping food insecure households) and second relative emphasis on supply system development.

9.4 Subsidy programmes in a changing world

At the time when this review was conceived, global food and fertiliser prices were at almost unprecedented high levels, and a significant focus of the review was to be on the way that high food and fertiliser prices affected the benefits and costs of input subsidy programmes. Global food and fertiliser prices have, however, fallen right back since then, as shown in figure 9.11, though domestic food and fertiliser prices remain high in many countries and international phosphate fertiliser prices have not fallen back as far as food and nitrogen fertiliser prices. The international credit crunch has also led to a global economic slow down. Looking back, the high food prices in mid 2008 are seen to result from the coincidence of a number of different processes and events: a steady decline in global agricultural investment, in production growth and in food stocks; weather events in some grain producing areas; changing agricultural and environmental policies in many developed economies (including subsidies for biofuels); high oil prices; and complex international commodity market behavior, including financial speculation, physical hoarding, and national protectionism. Similar processes affected fertiliser prices. Paradoxically, interactions of these same processes together with the financial collapse then caused prices to fall again. The principal lesson that needs to be drawn from this is that we appear to live in a world with increasingly volatile and unpredictable markets and, with climate change, changing and more unpredictable weather. What are the implications of this for large scale input subsidy programmes?

We address this question by first considering separately the effects of high food prices and of high fertiliser prices. We then examine the effects of interactions of price volatility between food and fertiliser prices, and conclude our discussion with consideration of the impacts of climate change.

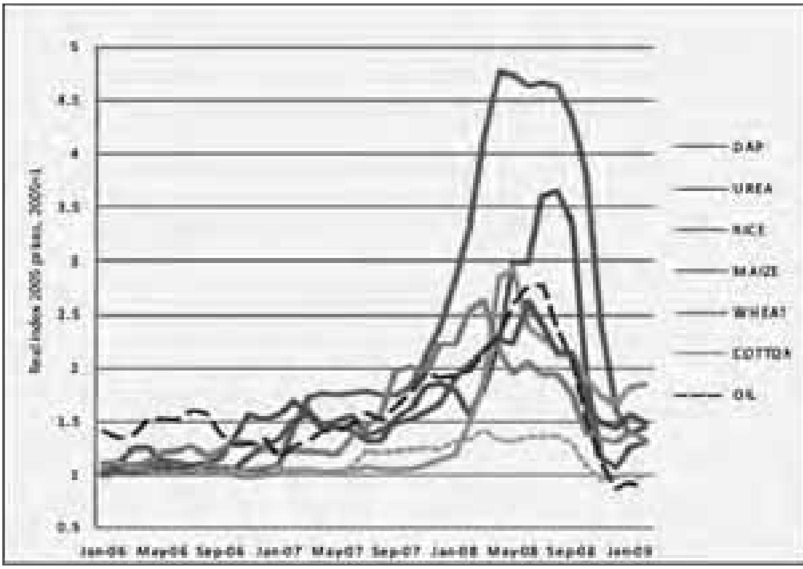
9.4.1 Impacts of high food prices

Before we examine the impacts of high food prices for agricultural input subsidies, we must first briefly consider the effects of high food prices on poor rural economies and the people within them. Impacts will vary for different people, and most obvious negative impacts will be on poor consumers who are connected to global markets – for example poor consumers whose staple food is imported grain of some sort. For consumers a rise in staple food prices leads to a fall in real income – the extent of the fall increasing with the importance of staple food expenditures in total expenditures, as illustrated in table 9.7.

Loss of real income has immediate effects on expenditures and consumption, welfare, and liquidity, and long term effects as a result of reduced expenditure on education, nutrition and health. In addition the reduced real incomes and expenditures of large numbers of poor people will reduce aggregate demand and economic growth.

Figure 9.11

Commodity price indices 2006 to February 2009 (2005 prices, 2005=1)



Source: World Bank data

Table 9.7

Effects of 100% increase in staple food prices on total expenditures for high and low income households (illustrative figures)

	Income	Initial expenditures			Expenditures after price rise			
		food expenditure		balance non-food	food expenditure		balance non-food	
		% initial hh expenditure	$		$	% initial hh expenditure	$	change
High	7500	10	750	6750	1500	20%	6000	-11%
Low	2500	30	750	1750	1500	60%	1000	-43%
Very low	1500	50	750	750	1500	100%	0	-100%
Extremely low	1000	70	700	300	1400	140%	-400	-233%

It is often argued that opposite effects will be experience by food producers, but this is not the case as most poor producers, and indeed around 50% of all producers in much of Africa, are net buyers of food (in that they do not produce enough food for their annual requirements, and hence rely on the market to purchase food, see for example Barrett 2008). Such people are affected in a similar way as the consumers described above with the added problem that the consequent liquidity problems affect their seasonal investments in agriculture, in food production – poor households often have a backward sloping supply curve (see for example Dorward, 2006). Less poor farmers may also suffer (or at least not benefit) from higher food prices as much of their income may come from cash crops and non-staple animal and crop products (rather than staple food crops) and demand and prices for these may be depressed.

These considerations suggest that the poverty impacts of the 2008 food price hike may be considerably greater than the 100 million (around 10%) estimated increase reported by Ivanic and Martin (2008) as their estimate was based on 2007 price increases and also ignored the liquidity effects discussed above, and balance of payment, inflation and other macro-economic effects. It also assumed that higher food prices lead to rural wage increases (whereas in the poorest economies with large numbers of food deficit producers high food prices can reduce rural wages – again see for example Dorward, 2006).

This analysis, together with the analysis of potential subsidy impacts in earlier parts of this paper, suggests that high food prices substantially increase the potential benefits of well designed and implemented agricultural input subsidy programmes. Such programmes should address the affordability problems of input use which (for poorer, food insecure producers) are exacerbated by high food prices (although profitability problems in input are of course diminished by high food prices), and increase the importance of input subsidies' potential contributions to addressing the food price – productivity tightrope and to stimulating dynamic pro-poor growth and structural change. Such situations may also improve the alignment between political economy and economic growth objectives of input subsidy programmes.

9.4.2 Impacts of high fertiliser prices

The impacts of high fertiliser prices on poor rural economies have been discussed by Dorward and Poulton (2008) and are summarised here. Again we need to consider different impacts on different types of people within poor rural economies.

Farmers are likely to be very exposed to high international fertiliser prices as most poor rural economies import fertilisers from the world market: they are then hurt by high fertiliser prices in terms both of the profitability of fertiliser use and the affordability of fertiliser purchases – the latter issue, as argued earlier in section 9.2.3.2, very important and easily overlooked. . Profitability problems may be offset by product price increases – but, for example, although food prices rose markedly in 2008 (though not as much as fertiliser prices), prices for cash crops (on which much fertiliser is used in Africa) were largely static - and average returns of fertiliser use on such crops were already not very high (Meertens, 2005). This may lead to political pressures for fertiliser subsidies for cash crops (from influential constituents) although the analysis earlier in this paper (in sections 9.1 and 9.2) suggested that input subsidies should yield higher returns when applied to staple crops as compared with cash crops. Here input subsidies may have a critical role to play as without them input use on food production may fall, increasing domestic prices, with all the attendant problems described above in section 9.4.1 – including further exacerbation of the affordability constraints to input use.

However, while high input prices may increase the need for input subsidies, they also undermine their short term returns (as measured by cost benefit analysis) and undermine a nation's ability to afford them. The former issue arises because high input prices reduce the profitability of input use, the latter issue arises because national economies may be undermined by reductions in growth as a result of reduced agricultural production while the foreign exchange balance may suffer from both more expensive inputs and reduced export volumes – these macro-economic problems will of course depend upon the importance in the economy of different forms of agriculture and of agriculture as a whole, and on the importance, performance and terms of trade of other sectors. However Ethiopia provides an example of a country where high fertiliser prices exacerbated foreign exchange difficulties which were then addressed by an IDA grant and credit totalling US$ 250 million to provide foreign exchange (but not domestic currency) for importation of fertilisers (World Bank 2008). There are, therefore, close parallels between the threats and paradoxes posed to individual farmers by high fertiliser prices and those posed to national economies.

Fertiliser suppliers may also be adversely affected by high fertiliser prices. While producers may enjoy large increases in profits if prices rise more than costs, the impacts on fertiliser traders and importers are more ambiguous and often negative. Traders with large stocks will gain if increasing fertiliser prices allow them to increase sales prices of existing stocks. However they may suffer from reduced sales volumes if higher prices lead to reduced demand by farmers (as discussed above) and they may also find it difficult to raise the working capital to buy more expensive fertiliser stocks. Traders may also suffer from falls in fertiliser prices if they have bought when prices are high and hold high price stocks while competitors can bring in lower price stocks.

Fertiliser prices have subsequently fallen back from the peak prices of mid 2008, but prospects for future prices are uncertain. Some observers predict increasing concentration among suppliers (Roy, 2009) and there are fears that carbon taxes and/or increasing oil prices may again push fertiliser prices up in the future.

9.4.3 Interactions of price volatility between food and fertiliser prices

What are the implications for input subsidy programmes of interactions of price volatility between food and fertiliser prices?

Food and fertiliser prices may interact in a number of ways over different time periods. First, changes in the global economy and in global markets may impact them both in similar ways – for example high oil prices may simultaneously push up fertiliser prices (as energy costs are a major component of nitrogen fertiliser production costs) and, through increased biofuel demand, also push up grain (particularly maize or corn) prices. Commodity speculation may also push up food and fertiliser prices together. Similarly, but over a different time span, credit difficulties may reduce both investment in fertiliser production plants and investment in fertiliser use for food production. High fertiliser prices may also lead to reduced food production in the subsequent season – and high food prices should push up fertiliser demand (if commercial farmers are not credit constrained) and hence fertiliser prices.

These positive interactions between fertiliser and food prices may, however, also be offset by normal supply and demand responses to high prices. These are also, on the other hand, affected by seasonal time lags, which complicate the planning and management of input subsidy programmes. This may be illustrated by Malawi's experience with input subsidies in 2007/8 and 2008/9. Rapid food and fertiliser price rises in international markets in late 2007 and early 2008 meant that relatively low priced fertiliser (bought in the middle of 2007) was used to produce maize harvested in mid 2008 when international prices were very high – yielding a very high estimate of economic returns from the input subsidy programme. For the 2008/9 programme, however, fertilisers were bought when prices were very high, but the maize produced by those fertilisers will be harvested in March to May 2009, when, based on current prices, international maize prices are expected to be very low – and as a result the 2008/9 programme may yield a very low estimated economic return (Dorward and Chirwa, 2009). Such temporal difficulties, together with the wider economic and balance of payments effects of fluctuating input and food prices, are likely to make management and control of input subsidy programme expenditures very difficult, and similar difficulties will be faced in attempts to stabilize food prices – while in section 9.2.3.6 it was argued that the complementary management of input programs and staple food price stabilization policies is critical for achievement of longer term economic growth benefits from input subsidy programmes.

As another complication, general uncertainty in fertiliser and other commodity markets, and the potential for this to increase the likelihood of political interventions, also increases fertiliser traders' and importers' risks Dorward and Poulton (2008).

9.4.4 Impacts of climate change

Climate change will have varied and difficult to predict impacts on agriculture in Africa. Average annual rainfall may increase or decrease in different areas, but in almost all areas will become more variable, with increased incidence of both droughts and floods. This will increase market instability and both production and price risks in input use. At the same time there will be global mitigation policies that may discourage and/or raise the price of inorganic fertiliser use (as a result of high fossil fuel energy intensity and hence high carbon foot print of the manufacture of nitrogen fertilisers, and possible CO_2 taxes or costs in reducing CO_2 emissions). Increased resilience and reduced vulnerability in the face of the indirect and direct threats of climate change can be achieved by greater natural, social, physical, human and financial capital and greater diversification of cops within farms and of farm and non-farm activities within local and national economies. Increased capital and diversification are intrinsic components of economic growth and development. The major implication of climate change for input subsidy programmes is therefore to increase the urgency and importance of such programmes' contributions to rapid broad based pro-poor growth through more effective design and implementation and through more effective integration with complementary policies and programmes in food markets and prices, in natural resource conservation soil fertility, and in wider non-farm diversification and development.

9.5 Conclusions

Countries considering the introduction of agricultural input subsidies can learn a number of points from the theory and experience summarized in this paper, recognising the different major benefits they can potentially yield, the conditions required for those benefits to be realized, and the possible very significant pitfalls from ineffective or inappropriate implementation. Key conclusions from theoretical and historical analysis are that:

- input subsidies have played an important role in successful agricultural development in the past, offering major potential gain when effectively applied to overcome market failures constraining growth in poor rural areas, but also carrying substantial risks of costly, ineffective and inappropriate design and implementation using large amounts of scarce government and national resources for little gain;
- they have greatest (but not exclusive) potential in contributing to wider growth when applied to the production of staple grains rather than to cash crops (as a result of both the greater contribution to overcoming producer constraints on input use in staple food production and the greater benefits to consumers from their stimulus to increased production of staples);
- a key contribution of input subsidies will commonly be their contribution to consumers' welfare and real incomes through lowering food prices, while also benefitting producers, but this requires very large scale implementation to bring prices down (perhaps below import parity) with substantial costs and risks and a strong emphasis on wider pro-poor dynamic growth objectives and complementary investment and output market development policies;

- the dynamic policy objectives of input subsidies are, like policy objectives in wider agricultural development, paradoxical – with investments in staple crop production and agriculture in order to stimulate diversification out of staple food and agricultural production;
- rationing and targeting are important features of effective subsidies – to limit costs and ensure that subsidies are largely delivered to producers whose effective input use is constrained by market failures – and smart subsidies use for rationing and targeting can substantially address conventional criticisms of subsidies;
- smart subsidies are nevertheless still subject to major political economy and implementation challenges and need further new thinking and theory, with ongoing action research seeking to constantly improve effectiveness and efficiency and to keep ahead of fraud and rent seeking.
- agricultural input subsidies are not a short term 'quick fix' –medium to long term investments in input subsidies are needed if they are to build up farmer knowledge and capital, supply systems and wider economic growth. However the risks of their diversion, capture and inefficiency also grow over time, and this poses major political and technical challenges.

A review of a limited number of current and recent input subsidy programmes in Africa shows that there is limited implementation of important aspects of smart subsidies, and weaknesses in design and implementation. There is also a lack of emphasis on improving programme effectiveness and efficiency and inadequate attention is paid to integration with complementary policies and programmes for improving achievement of both direct and indirect benefits of input subsidy programmes. There is also a mixed record as regards use of input subsidies to develop input supply systems. Some of these aspects of input subsidy programmes are associated with divergence between political economy and more technocratic interests. Nevertheless these programmes have the potential to yield very substantial short term economic and longer term growth returns.

Lack of information on subsidy programmes in Africa highlights a major need for country studies that report different countries' recent experience with input subsidies, using the conceptual framework presented in this paper to allow a more comprehensive review and lesson learning than is currently possible.

Consideration of the considerable challenges and threats posed by global market and climate change and volatility emphasises the importance and urgency of (a) improving the efficiency and effectiveness of input subsidy programmes in contributing to increased agricultural productivity, food security, and wider non agricultural development and structural change, and (b) of looking for ways to reduce fertiliser use (through greater field efficiency in their application and through use of complementary soil fertility management practices) and to reduce supply costs.

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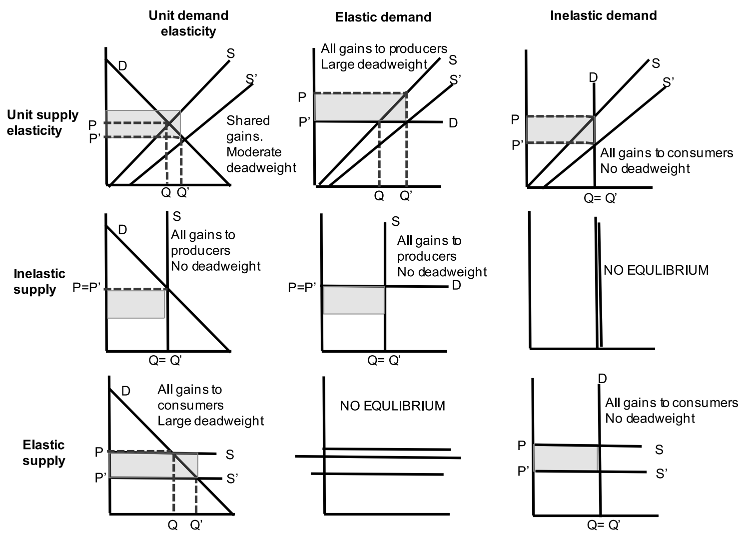
APPENDIX 1:

Effects of different output supply and demand elasticities on producer and consumer gains from input subsidies



10

Integrating developing country agriculture into global climate change mitigation efforts

Harry de Gorter[1]

Introduction

Becoming integrated with global efforts to reduce greenhouse gas (GHG) emissions represents a major challenge for the agricultural sector in developing countries. Current efforts revolve around carbon offset projects purchased under the Clean Development Mechanism (CDM) by parties to the Kyoto Protocol in lieu of abatement by developing countries. However, because of transactions costs related to implementation, monitoring and verification of emission reductions, agriculture has seen very limited use under the CDM. Up to July 2009, agricultural activities accounted for only 6 percent of all approved CDM projects and only 4 percent of the total emissions reduced.

Agriculture is not only a main contributor to GHG emissions, it also offers a considerable potential for GHG mitigation. Developing countries alone account for 74 percent of the technical mitigation potential of world agriculture (Smith et al. 2007). More importantly, GHG emissions from developing country agriculture increased 32 percent from 1990-2005 while emissions from developed country agriculture declined 12 percent (UNFCC 2008b). The potential role of the agricultural

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sector in climate change mitigation is one of the issues currently under discussion in the Copenhagen negotiation process[2].

Sources of agriculture's reduction opportunities include emission reductions (manure management, enteric fermentation and fertilizer practices); biological sequestration fluxes (tillage, crop rotations, cover crops and grazing practices); avoided fossil fuel emissions from substitution for fossil fuels (with liquid transportation biofuels, thermal biopower/bioheat or renewable electrical power); and from efficiency improvement. Because deforestation is the largest source of emissions (that occurs mostly in developing countries) and is primarily caused by land conversion to agriculture, activities in land use, land use change and forestry (LULUCF) are closely related to agriculture. Not only can GHGs be released through land use change, GHGs can be sequestered through avoided deforestation and land degradation (REDD), afforestation and reforestation (A/R), and forest management (FM).

An underlying theme of this paper is that most of the mitigation potential in developing country agriculture is not in directly reducing output and fossil fuel consumption but from emission abatement activities, namely, changes in production practices and technologies (e.g., REDD, soil carbon sequestration practices, midseason drying of irrigated rice, nutrient management to reduce nitrous oxide emissions and livestock management)[3]. The implication is that carbon offsets represent an appropriate mechanism to subsidize abatement activities in developing country agriculture, unlike a cap and trade regime or environmental taxes. Hence, we develop a model that distinguishes marginal abatement costs (central to developing country agriculture) from output reduction costs where reductions in fossil fuel consumption are the primary driver of emission reductions in the industrial sector (as in cap and trade economies). We show that carbon offsets benefit both the cap and trade economy and developing countries. Because offsets reduce the total costs of emission reduction for cap and trade economies, the latter now have an incentive to further increase their emission reduction targets. Therefore, a limit on carbon offsets (as is currently the case for the European Union and in proposed U.S. legislation) hurt cap and trade economies. Although developing countries would benefit from more offsets, the cost to them of limiting the number of offsets may be more than compensated for by the higher price received for offsets with the resulting higher permit prices in cap and trade economies.

[2] This provides a unique opportunity to combine low-cost mitigation and essential adaptation outcomes with food security, poverty reduction and sustainable development. The goal is to have agriculture fully integrated in the current system of GHG reduction mechanisms and relevant negotiation processes, thereby benefiting from the related financing facilities.

[3] Numerous studies have documented the many different ways the agro-forestry sector can mitigate GHGs (UNFCC 2008b; Smith et al. 2007; Nelson 2009; FAO 2009a,b, 2008).

The case for public subsidies for abatement activities is further strengthened by the resulting correction of multiple market failures, potentially generating significant co-benefits to agricultural producers and society at large. In addition to contributing to the public good of reduced GHG emissions, there are several "technical" externalities reflecting the multifunctional nature of agricultural production[4]. Multiple non-commodity outputs are produced (both positive and negative technical externalities) and the correction of these market failures provides an additional rationale for public subsidies of emission abatement activities. Furthermore, because of knowledge externalities in technological innovation and both learning-by-doing and learning-by-using externalities in the adoption of new technologies, there is an additional market failure in the innovation and diffusion of abatement technologies and production practices itself. This requires further public expenditures in R&D, extension services and technology transfer packages.

The paper also addresses the implications for global trade if not all countries are party to a global carbon trading system by analyzing "market" leakage (where emissions are shifted to another location or sector). Leakage is traditionally defined as the increase in emissions in other countries due to GHG emission mitigation policies (e.g., cap and trade or REDD). The emissions increase in unregulated economies because environmental policies generate changes in market prices, trade and location of production. Leakage has to be distinguished from "shuffling" (where neither the location nor costs of production change but the environmental policy is nevertheless ineffective) and from "technical" leakage (differences in emissions intensity between regulated and unregulated economies can magnify or dampen our definition of market leakage above).

Although the literature only recognizes the "international" component of leakage, we show that emission mitigation policies in the agro-forestry sectors may have "domestic" leakages as well. These domestic leakages in some cases can outweigh international leakage. This means carbon tariffs can be counterproductive and increase total leakage. Carbon tariffs should also be adjusted downwards because of both agricultural subsidies in OECD countries adopting cap and trade, and for the reduction in emissions in these countries due to increases in output in developing country agriculture with the correction of multiple market failures with an effective carbon offset program. Carbon tariffs can also cause international shuffling where products exported to cap and trade economies use low carbon inputs while other products not exported use high carbon inputs. Furthermore, we show that the interaction effects between supply-side leakages (due to cost increases) and demand-side leakages (due to reductions in fossil fuel prices) needs to be considered.

[4] For a more detailed description of the multifunctional characteristics of agricultural production, see OECD (2001) and FAO (2007).

Carbon offsets reduce emissions through the carrot of financial subsidies rather than the stick of emission limitations as with cap and trade. Targeted subsidies (e.g., subsidies for clean technologies) are less vulnerable to leakage and shuffling because they do not impose costs on firms (supply-side leakages) or changes in consumption prices (demand-side leakages), so firms (consumers) have no incentive to relocate production (consumption) or avoid costs, unlike with a tax on emissions like cap and trade. Carbon offsets provide such a mechanism for targeted subsidies.

Not only do public subsidies for abatement minimize leakages, they also complement the unique feature of developing country agriculture's mitigation potential being in altered production practices while overcoming the high transactions costs associated with implementing project-based carbon offsets. A tax or permit scheme will be too difficult to apply to emission reductions that result from the modification of production processes. The best method to deal with leakage therefore reinforces other rationales for targeted subsidies for abatement activities.

But because of low returns, high risk and high transaction costs to verify real, additional and permanent GHG remission reductions for developing country agriculture associated with project-based carbon offsets (as is currently under the CDM), different financing mechanisms must be found. Project-based CDMs may not allow for the breadth and scale of incentives required to generate widespread changes in agricultural production systems. There have been a number of proposals to scale up funding and delivery mechanisms including programmatic, sectoral and policy CDMs (FAO 2008; UNFCC 2008a). These new mechanisms would be more relevant for developing country agriculture while complementary public sector funding like a Climate Fund to finance critical changes in developing country policies and infrastructure deals will also be needed (Burniaux et al. 2009).

In terms of financial flows to developing country agricultural sector, the efficiency of emission reductions and agricultural growth strategies, we conclude that abatement subsidy programs can be a win-win-win situation. But it also represents an opportunity to reconfigure domestic agricultural policy in developing countries. For example, subsidies for input use should be transformed into subsidies for the way in which production occurs like land management techniques to reduce emissions while at the same time enhancing productivity and rural incomes. Because of the large investment required to finance R&D and new institutions to deliver the altered production practices, it will also require more financial aid to developing countries upfront and to integrate the efforts to adapt to climate change with GHG emission mitigation efforts, along with long standing international aid and financing mechanisms.

Abatement subsidies should not run afoul of WTO law regarding subsidies, just as carbon offsets currently do not. In many cases, agricultural output will increase, reducing international prices and developed country agricultural output, generating positive international leakage as production is more energy intensive and mitigation potential much lower than in developing countries[5]. Furthermore, reductions in developed country agricultural subsidies will also aid in the efficacy of GHG mitigation efforts in developing countries.

The focus of the paper is to develop a conceptual framework on the basic economics of carbon offsets and assess issues like leakage. This is to provide basic principles and general guidelines for policymakers as to what an ideal policy would look like. The paper is organized as follows. The next section summarizes agriculture's role in the CDM while Section 3 develops a general economic model of carbon offsets and cap and trade. Section 4 develops a general model of leakages while Section 5 explains how targeted subsidies are a very appropriate policy response to global climate change in developing country agriculture. The final section provides some concluding remarks.

10.1 Current status of agriculture and CDM projects

Despite its large mitigation potential, agriculture is nevertheless not fully integrated in the current system of GHG reduction mechanisms and relevant negotiation processes. For instance, until very recently, agriculture was not included in the Copenhagen negotiation process nor has it benefited greatly from the existing financial mechanism created under the Kyoto Protocol. Hence, agriculture does not fully participate in and benefit from the related financing facilities. This section shows how little agriculture has benefited.

CDM agricultural projects are considered small-scale projects which have simplified procedures aimed to reduce the cost of applying for CDM approval. Several experts have concluded that many small-scale activities cannot be implemented cost-effectively, because the transaction costs related to project design, validation and verification are too high to be compensated by the project revenues. Nevertheless, small-scale projects have only had a slightly lower success rate than the overall average (86.3 versus 95.5 percent). Simplified accounting procedures can be used for small-scale projects, thereby contributing to reduced transaction costs during the project (preparation, monitoring, validation and certification). As of February 2009, 46 percent of all the CDM projects in the pipeline (2,049 out of 4,474) were small-scale. These are expected to generate around 10 percent of the CERs (certified emission reduction units) through 2012 (UNCTAD 2009a).

[5] This may not be the case for livestock production where emissions per unit of output are much higher in developing countries. Abatement subsidies are meant to reduce emission intensity by increasing productivity but it is still possible that that total world emissions increase.

Experience shows that some CDM projects perform worse than expected, while some have outperformed expectations. In early 2009, the overall CER issuance success rate has been approximately 98 percent, but there are large differences between categories. HFC (hydrofluorocarbon) and N2O (nitrous oxide) emissions reduction projects have performed better than expected, while projects for agriculture, geothermal energy, landfill gas recovery, methane capture and the transport sector have had a success rate less than 50 percent of initially expected CERs.

China dominates the number of CERs issued as of February 2009 with 42.3 percent of the total. In China, 90 percent of the issued projects are industrial HFC projects, but the situation is changing. India is the second largest supplier of CERs with 22.8 percent of market share, followed by Korea with 14.5 percent, Brazil with 11.4 percent, Mexico with 1.8 percent, Viet Nam with 1.2 percent, Chile with 1.2 percent and Egypt with 0.9 percent.

The CDM has successfully created a dynamic carbon market. By April 2009 it had issued 277 million tons of CO2e[6], generating 2.7 billion Euros in CDM investment at 10 Euros per tonne/ CO2e. As of 1 September 2009, there are 4,631 projects in the CDM pipeline and only 10 host countries accounted for 87 percent of all CDM projects. Projects were mostly under the renewable energy category and were concentrated in the Asia- Pacific and Latin America regions. Falling oil prices and signs of worldwide recession have caused a general decline in carbon market prices. European Union carbon prices for EUAs (European Union Allowances) fell from 28 Euros in June 2008 to 14 Euros in early December 2008, but then recovered towards the end of December 2008 to around 20 Euros, and then fell again in early 2009, temporarily touching the 10 Euro level[7].

Until early 2009, afforestation and reforestation (A/R) activities, although eligible under the Kyoto Protocol (unlike avoided deforestation and land degradation (REDD) and forest management (FM), hardly participated in the carbon market. The principal reasons are that they are not accepted in the EU ETS (emitting trade scheme), the primary market demander of CERs, and that they generate only temporary credits. The challenge remains as to how to preserve the environmental integrity and economic soundness of CDMs, while speeding up and streamlining

[6] The greenhouse gases at issue are mainly CO2, nitrous oxides and methane, expressed in CO2 equivalent units and referred to as CO2e. In this paper, we refer to CO2e as "greenhouse gases."

[7] CER prices for December 2009 were being traded at 14 Euros. In India, CERs arising out of the CDM have been sold for much less - only 5-10 Euros. It is not clear why this price difference exists. Ishani Chattopadhyay, Director of Ecosecurities, India, a carbon credit trader that buys CERs from India for sale in Annex I countries indicates there are risks for operating in developing countries and dealing with small companies, while there is no "stock exchange" for CERs yet, since the first CERs have only just been issued for sale on October 20 2005. CER's are bought and sold in private deals where prices are not revealed, so a fair price is difficult to arrive at. Mukul Sanwal of the UNFCCC agrees that greater transparency would result in higher prices.

the CDM project cycle (financial support for project developers, technology transfer and capacity-building needs).

In 2008, the EU ETS continued to dominate the carbon markets, accounting for two-thirds of the total carbon market volume and three-quarters of its value. Around 3.1 billion CO2e allowances were bought and sold in the ETS during 2008, with total value of 67 billion Euros. With regard to United Nations-backed carbon credits generated from the Kyoto Protocol's CDM, some 1.6 billion changed hands in 2008, with a value of 24 billion Euros. The secondary market for CDM credits (known officially as certified emissions reductions (CERs)), totalled 1 billion tonnes in 2008, corresponding to two thirds of the total CER market volume. Overall, the value of the CER market in 2008 increased by 70 percent, compared to 2007.

So far, the CDM projects are primarily renewable energy projects, from hydroelectric and wind to solar and geothermal. In terms of projects types, by the end of 2008, renewable energy technologies had a leading share of the pipeline with 63 percent, methane emission reduction projects accounted for 16 percent, and supply-side energy efficiency accounted for 10 percent. Afforestation and reforestation accounted for 0.8 percent.

Hydropower was the dominant CDM project technology, accounting for over 25 percent of the projects (i.e. 1,174 projects). Two thirds of those projects were located in China. India hosted over 110 hydropower projects, and Brazil hosted 70 hydropower projects. Biomass-based energy projects had a 15 percent share and wind energy projects had a 14 percent share in the pipeline.

Table 10.1 shows the number of total CDM projects up to July 2009. According to the UNFCCC (United Nations Framework Convention on Climate Change), the total number of projects is 4,280 (after subtracting the 533 CDM projects rejected) and the number of projects registered is 1,760 while a further 234 are in the registration process. UNEP Riso[8] shows that most of the rejected projects are by the DOE (designated operational entities). DOE first checks the validation requirement and then finalizes the validation process after the CDM methodology is approved by the CDM's Executive Board.

Table 10.2 shows the agriculture projects according to the UNFCC. There were a total of 127 agricultural projects up to July 2009, or 5.8 percent of all projects at validation. We have 13 CDM sectors other than agriculture which include energy (industry, distribution and demand), manufacturing industries, chemical industries, construction, transport (metro system), mineral production, metal production, solvent use, waste handling and disposal and afforestation/reforestation.

[8] The CDM/JI Pipeline Analysis and Database contains all CDM/JI projects that have been sent for validation/determination. It also contains the baseline and monitoring methodologies, a list of DOEs and several analyses. Almost all information is from cdm.unfccc.int and ji.unfccc.int.

Table 10.1
Status of CDM projects July 2009 (UNFCCC versus UNEP Riso Data)

	UNFCCC	UNEP RISO
Number of CDM projects		
At validation*	2,124	2,633
Request for registration	115	81
Request for review	29	20
Correction requested	70	69
Under review	35	35
Total in process of registration	249	205
Withdrawn	31	31
Rejected by executive board	116	116
Rejected by DOE	na	480
Total rejected	147	1,750
Total number of projects	**4,280**	**5,215**

* Validation process is the submission of the design project to DOE

In Table 10.2, we classify agricultural projects into three categories: emissions reductions, biological sequestration fluxes and avoided fossil fuel emissions. The emissions reduction projects have mostly been associated with animal waste management and controlled combustion. No projects have been allocated to biological sequestration. The avoided fossil fuel emissions category refers to biomass fuel. Note that most projects are on emission reductions and more than 50 percent of agriculture projects are small scale activities. The total agricultural projects generated 8,389,299 tonnes of CO2e reductions per annum.

Some projects classified outside of the agriculture sector by UNFCC are common to agriculture with products such as bagasse and biomass residues (bagasse, corn, cotton and wheat straw, rice, maize stalks, etc.). We include these projects in the total number of agriculture projects in Table 10.3. As a result, there are 56 "agriculture" and 4 "forestry" projects, and a total of 813 energy industry registered projects. When the number of agriculture projects in Table 10.2 is added to the number of "agriculture" products in Table 10.3, there are 178 registered agricultural projects and 10 total forestry projects. Therefore, the total amount of agriculture CO2e reductions is approximately 11,910,915 tonnes per annum under our revised definition of agriculture, not 8,389,299 tonnes as described above. At current carbon prices of about 14 Euros per tonne, and given that the price of offsets are discounted due to various risks and transactions costs by approximately 20 percent, the total value of carbon offsets for agriculture at today's prices amounts to an approximately 133 million Euros, a paltry sum in the scheme of things.

The total amount of forestry CO2e reductions is approximately 696,612 tonnes per annum, not 281,431 for 6 projects as shown in Table 10.4. China hosts 59 percent of the CERs. China hosts 20 percent of CO2e reductions in agriculture compared to 31 percent for Brazil.

Table 10.2

Total CO2e reductions and the total number of agricultural CDM projects from 2005 to June 2009

Sources of Greehouse Gas Reductions	CO2e reductions (tonnes per annum)	Number of Projects	
		Total*	Rejected
Small Scale			
Emissions Reductions** 3	,525,637	67	1
Biological Sequestration Fluxes	-	-	-
Avoided Fosssil Fuel Emissions***	811,683	5	-
Large Scale			
Emissions Reductions	4,051,979	55	1
Biological Sequestration Fluxes	-	0	-
Avoided Fosssil Fuel Emissions	-	0	-
Total			
Emissions Reductions	7,577,616	122	2
Biological Sequestration Fluxes	-	-	-
Avoided Fosssil Fuel Emissions	811,683	5	-
Total	8,389,299	127	2
All other projects (excluding agriculture)			
Small Scale	23,678,127	872	50
Large Scale	328,756,677	1,207	6
Total	352,434,804	2,079	16

* Includes projects rejected and withdrawn.
** Emissions Reductions refer to animal waste management, avoidance of methane production from biomass decay through controlled combustion and methane recovery.
*** Avoided Fossil Fuel Emissions refer to biomass fuel for power generation such as wood residues, rice rusks and others (not bagasse).
122 agricultural projects registered with 8,279,205 tonnes of CO2e reductions per annum
Source: calculated

Table 10.3

Energy Industry CDM Projects from June 2005 to July 2009

	Reductions CO_2e per annum	Number of projects	
		Registered	Rejected
Registered and requesting registrations			
Large and small scale **			
Agriculture (bagasse and biomass)	3,521,616	56	7
Forestry (biomass)	415,181	4	2
Total all other projects from energy*	139,019,275	813	52

* Excludes 52 rejected and 11 withdrawn
** Five small scale projects (one agriculture)
Source: calculated

Table 10.4

Registered forestry CDM projects from November 2006 to June 2009

	Reductions of CO_2e per annum (tonnes)	Number of projects
Afforestation and reforestation		
Small scale	18,602	3
Large scale	262,829	3
Total	281,431	6

Source: calculated

There are many reasons given for why the CDM may not have successfully worked in agriculture[9]. Most of the reasons centre on the transactions costs of implementation including the ability to measure, control and monitor GHG emission reductions. The complexity of developing baselines and the concerns of being able to monitor in order to ensure additionality and permanence have plagued agriculture. Many papers have addressed this issue (Schneider 2007; UNCTAD 2009a,b; Muller 2009; Figueres 2009). Clearly, the project-based offsets approach under the CDM needs to be reformed in order to capture the full potential of agricultural mitigation. We delay our discussion of policy options being discussed in the literature.

[9] The CDM is one of three Kyoto protocol flexibility mechanisms, the others being the Joint Implementation and the International Emissions Trading mechanism. Joint Implementation is like the CDM but with projects in other Annex I countries instead of developing countries. These projects are expected to give CDM projects in developing countries serious competition. International Emissions trading provides each Annex I country with a certain number of emission allowances in line with its Kyoto reduction targets. If a country's GHG emissions are below their emission allowances (i.e., meeting Kyoto targets), they can sell these allowances to other Annex I countries that are emitting above the allowance (i.e., not meeting their Kyoto targets).

The next section first explains the economics of carbon offsets associated with a cap and trade regime.

10.2 The economics of carbon offsets with cap and trade

GHG emissions can be dealt with by either reducing fossil fuel use, thereby directly reducing output, or by investing in abatement activities that directly reduce emissions per unit output, or a combination thereof. Although society benefits from the reduced GHG emissions, society incurs curtailment costs in terms of a loss in social surplus due to output reduction, and direct resource costs associated with abatement activities. Abatement is defined here as changes in production practices (like using different technologies or ways in which inputs are used) with only indirect effects on output and fossil fuel consumption. For agricultural production, especially in developing countries, output could actually increase as a result of abatement activities. This is because agricultural commodities are jointly produced with technical externalities, be they positive or negative. Once these negative externalities are reduced or positive externalities realized, subsidies for abatement (e.g., through carbon offsets) can generate co-benefits that could increase output and improve rural incomes. However, it is not always the case that payments for environmental services increase agricultural output and rural incomes in developing countries (FAO 2007).

Co-benefits from abatement subsidies can also occur because of the public good nature of abatement activities itself: there are market failures with the innovation and diffusion of abatement activities (e.g., new technologies). Market failures associated with the sub-optimal provision of abatement activities interact with the market failures associated with not pricing public goods (or "bads" as in the case of GHG emissions) and technical externalities (either positive or negative like local water pollution from agricultural production)[10].

The realization that the process of abatement activities is itself characterized by market failures seemingly complicates the analysis but in the case of GHG emissions and developing country agriculture, it reinforces the efficacy of using abatement subsidies. Two mutually reinforcing sets of market failures are at work, both of which reduce the social optimal level of (1) abatement activities in developing country agricultural production; and (2) investment in the development and diffusion of new technology. There are therefore two sets of optimal policies: one to develop environmental policies that internalize both the negative and positive

[10]Because of non-excludability and non-rivalry, governments supply the public goods while negative (positive) technical externalities are dealt by taxes (subsidies). Because of transactions costs, taxes and subsidies for externalities are difficult to implement so subsidies for abatement activities are proposed here as an alternative.

externalities from agricultural production (e.g., emissions tax and amenity subsidy, or in the case for developing country agriculture we are proposing here, subsidies for abatement activities) that allow the private sector to choose the optimal mix of abatement activities and output reduction. The other is to implement policies that directly encourage the development and adoption of environmentally friendly production practices.

But because of the unique situation developing country agriculture faces, it is not always politically or administratively feasible to enact emissions taxes or a cap and trade regime. The transactions cost of implementing emissions taxes are too high (like often is the case for project based carbon offsets) while low rural incomes precludes the political feasibility of environmental fees. Meanwhile, emission taxes like a cap and trade regime are more relevant in situations where the biggest benefits in emission reductions is in reducing fossil fuel consumption directly. But most of the potential for mitigating emissions in developing country agriculture is not in the form of reducing fossil fuel use (e.g., reducing output) but by changing production practices (e.g., change in soil and crop management technologies and practices to increase soil carbon sequestration). Therefore, it is better to have subsidies for abatement activities that can directly correct both categories of market failures identified above simultaneously[11]. Hence, the optimal policy to correct the externality reinforces the correction of the second market failure of under-provision of innovation and diffusion for new production practices. Meanwhile, these abatement subsidies will increase agricultural productivity and production, generating pecuniary externalities through contributions to the economic and social viability of rural areas by underpinning food security, poverty reduction and economic development.

The discussion now turns to the sources of these two categories of market failures that result in the centrality of abatement activities as a correction mechanism. Then, the implications for carbon offsets are derived; namely, carbon offsets provide a means to subsidize abatement activities.

Market failures associated with jointness in commodity production

The overriding feature of agricultural production is its "multifunctional" character. Agriculture produces not only the private good (the food, fiber and materials that are the commodity outputs of agriculture) but also non-commodity outputs (OECD 2001). Non-commodity outputs of agriculture that are jointly produced with the commodity provide social values (or impose social costs) that are not reflected in the

[11]Because of transactions costs with the implementation of project-based carbon offsets, other approaches to transfer revenues for emission mitigation in developing country agriculture are recommended like a sectoral approach or a program based approach that induces farmers to employ different production practices (Burniaux et al. 2009; UNFCC 2008b).

market. Jointness in production can arise when non-allocable inputs are used in the production of multiple outputs (e.g., outputs are obtained from one and the same input). For example, the joint production of a commodity, landscape amenities and water pollution represents multifunctionality.

Rice production is one example where important multifunctional attributes result from non-allocable inputs used in the production of multiple outputs (Boisvert and Chang 2006). Several non-commodity outputs are jointly produced with rice, with some of them exhibiting characteristics of externalities or public goods. For example, the recharge of underground aquifers is an important multifunctional attribute of paddy rice production as well as the amelioration of land subsidence (the lowering of land-surface elevation from changes that take place underground). Furthermore, paddy rice production reduces flooding and soil erosion, changes the quality of the water and air, and provides landscape amenities. There are both positive multifunctional outputs (e.g., groundwater recharge) and negative multifunctional outputs (e.g., GHG emissions associated with the release of methane gas).

These non-commodity outputs are jointly produced with rice since groundwater recharge is directly related to total land planted to paddy rice and the intensity of the application of irrigation water. It is therefore impossible to disentangle the contribution of these two inputs to the production of rice from their contribution to groundwater recharge. Similarly, the contributions of land, water and fertilizer to rice production cannot be separated from their effects on the release of methane. For example, methane released during rice production depends on the water regime (e.g., deepwater rice fields generate significant amounts of methane). Methane emissions from rice fields also depend on several other factors like soil type, tillage management, residues, fertilizer practices and rice cultivar (Wassmann, Hosen and Sumflueth 2009; Boisvert and Chang 2006).

Because we cannot separate the contributions of the commodity, negative externalities and positive amenities, production is joint. But even with the joint, multifunctional production of commodity and non-commodity outputs like amenities and pollution, they are unlikely to be produced in fixed proportions with the agricultural commodity. This means policies should be directed to each externality directly. But it is difficult to observe and monitor the supply of environmental attribute associated with agricultural production. One cannot disentangle or separate out contribution of each input of each product. So subsidizing abatement activities through changes in production processes and input mix gets at the problem indirectly but in a more efficient manner. Furthermore, when there are positive and negative externalities simultaneously, one needs to subsidize the positive externality and tax the polluting input separately. One cannot calculate the net benefit and have a net tax (either negative or positive) – see Peterson, Boisvert and de Gorter (2002).

Production relationships underlying the multiple outputs of agriculture and their externality and public good effects can be released from this jointness (changes in farming technologies and practices can reduce the link between environmental outputs and commodity production). Technology widens the possibility of technical substitution between inputs. With changes in farming practices (e.g., from intensive to extensive) and optimization of non-commodity, productivity along with output is expected to increase. Subsidies for abatement technologies (e.g., technological change) and changes in agricultural production practices will be more efficient policies (not simply taxing or subsidizing the production of the commodity). Returning to our example of rice production, methane emissions can be reduced substantially by changing organic inputs and water management, the latter with midseason drainage and intermittent irrigation (Wassmann, Hosen and Sumfleth 2009; Nelson et al. 2009).

Market failures associated with the provision of abatement activities

Abatement activities improve social welfare because it reduces the cost of reducing GHG emissions while simultaneously providing co-benefits in the form of reduced negative externalities and increased positive externalities. But this assumes the optimal level of abatement technology exists. However, the social benefits from abatement activities can be greatly enhanced with public investment that generates new technologies and production practices (innovation through research) and the process by which new technologies are adopted (farmers have to learn about how to use them so, for example, extension activities must be a complementary policy). Independent of externalities from agricultural production, innovation and diffusion are both characterized by externalities as well as other market failures.

Innovation creates positive externalities in the form of new knowledge, which creates knowledge spillovers and so the market will not invest in the optimal level of innovation. There are also externalities in the adoption and diffusion of new technology. There is a benefit with the overall scale of technology adoption called "dynamic increasing returns" (Jaffe, Newell and Stavins 2005). Dynamic increasing returns can be generated by the user of new technology called learning-by-using (one user generates a positive externality to another user), or by the producer of the new technology through learning-by-doing (costs of production fall with experience). Network externalities can also exist where the benefits of a technology to an individual increases as other users adopt a compatible product (e.g., synergies in fertilizer application procedures with other land use practices that reduce emissions).

Both innovation and diffusion are characterized by additional market failures like incomplete information, and uncertainty (e.g., the uncertainty of the impacts of global warming on agriculture and the need for adaptation and the interaction effects with mitigation activities). New production practices are important for GHG emissions mitigation because with joint production, GHG emissions are generated at the same time as other negative and positive technical externalities, while abatement activities are underprovided. The subsidization of abatement activities is justified at the nexus of two distinct market failures; otherwise, abatement activities are doubly underprovided.

In many cases, and especially for developing country agriculture, abatement activities will only occur with public sector involvement through public good investments that change the technology (e.g., R&D expenditures) and public subsidies for programs that change production practices (e.g., expenditures for extension programs). Soil sequestration practices would be an example of abatement although indirect effects on output are inevitable. In some cases, especially for REDD activities and biofuel production, the market is directly affected: reducing the supplies of wood and shifting land into biofuels will have direct impacts on the market for wood products and land uses for agricultural products, respectively. There exists alternative abatement activities that reduce GHG emissions but also provide ancillary benefits in the form of improved productivity, lower cost (e.g., less water usage) and reduced pollution from agricultural production (e.g., pest control measures), thereby reducing social and environmental costs.

The central role of carbon offsets and abatement activities

Carbon offsets represents one mechanism to finance abatement activities. However, carbon offsets are designed to be implemented on a project basis. This means transactions cost in monitoring, reporting and verification of emission reductions. Additional complementary policies that finance abatement activities are required. In addition to the political and administrative difficulties of introducing carbon taxes in developing country agriculture, it is also more practical to subsidize abatement activities because the majority of GHG emissions mitigation is in the form of *changes in production practices* where most of the carbon emission mitigation potential exists in agriculture (not in reducing fossil fuel consumption). For example, most emissions from livestock is from enteric fermentation and manure, indirect emissions from manure storage, application and deposition, land use conversion for livestock grazing, and emissions related to pasture (94 percent of emissions are from production practices[12] while the remaining 6 percent of emissions are due to fossil fuel consumption in the life-cycle of livestock production – see Gerber and Steinfeld 2009). Abatement can be viewed as the biophysical outcomes generated by changes in the management of natural resources and the environment through

[12]This includes, however, "on-farm fossil fuel use" which we were unable to separate out and put in the category of fossil fuel consumption.

changes in agricultural production practices (the way in which you produce) and input mix (the type of inputs used)[13].

The technical potential for mitigating GHG emissions from livestock production varies among systems but subsidies to change production practices such as the capturing and burning of methane from manure management systems, and improving manure application techniques, fertilizer efficiency, rumen fermentation efficiency, feeding practices, livestock genetics, herd health and fertility, and land-use efficiency of livestock production (FAO 2009b).

As shown in the next section of this paper, carbon offsets also involve less leakage and shuffling because a carbon offset reduces emissions through altered production practices due to targeted subsidies, rather than reducing fossil fuel consumption directly. Abatement subsidies are therefore important for at least three reasons. First, the potential for GHG mitigation in developing country agriculture is mostly in terms of changing production practices; not reducing fossil fuel use although fossil fuel use per unit output will be reduced with enhanced productivity even though total output may increase. Second, there exists multiple co-benefits by altering production practices and so abatement subsidies, in addition to correcting for two key sources of market failures, also provide pecuniary externalities by being a key component for productivity improvement, poverty reduction and sustainable development. Third, a tax or permit scheme will be difficult to apply to emissions reductions that result from modification of production practices, especially for smallholder agriculture (like project-based CDMs).

In lieu of abatement (verifiable GHG emission reductions) by the unregulated sectors (e.g., developing country agriculture), parties to the Kyoto Protocol can purchase carbon offsets and therefore have unused allowances (or permits). Offsets are therefore subsidies to reduce pollution (unlike allowances in regulated economies that are a maximum on GHG emissions allowed and hence act as a tax on emissions). Offsets are therefore subsidies financed by either the public sector in regulated economies (if allowances are handed out to companies) or the regulated firms (if allowances are auctioned) through the international marketplace. Instead of having production limited by allowances, developing countries can mitigate GHG emissions through abatement activities. We now turn to the economics of carbon offsets with a cap and trade regime.

Economics of output reduction versus abatement

The objective here is to develop a framework that clearly distinguishes between abatement (e.g., generated by carbon offset revenues) and output reduction

[13]For an excellent summary of the agricultural science and technology needs for climate change mitigation and adaptation in developing country agriculture, see Nelson (2009).

(e.g., firms will reduce fossil fuel consumption directly when subject to an upper bound on emissions through the issuance of emission allowances or permits). We operationalize the methodology for analyzing carbon offsets for developing country agriculture[14]. The literature typically does not make a distinction between abatement and output reduction (Parry 2003; Bovenburg and Goulder 2002)[15]. But under our assumptions here, an emissions tax has the same effect as an output tax on efficiency. We will explain the implications of relaxing these assumptions later.

Consider the production of good Q which generates an externality (i.e., GHG emissions). Abatement activities A can reduce emissions without affecting the production of good Q (e.g., methane capture from a manure facility does not necessarily affect the level and mix of other inputs used in the production of that commodity). The production of the good generates *gross* GHG emissions E(Q). *Net* GHGs emitted (S) is defined as gross emissions minus abatement: S = E(Q) - A. Thus, emissions generated (referred to as gross emissions) is the sum of emissions released (referred to as net emissions) and emissions abated, all measured in identical units (Schamel and de Gorter 1996). Note that gross emissions may either be released in the environment inducing emissions damages or abated entailing abatement costs. Monetary external costs (damages) due to net emissions EC(S) = EC[E(Q) - A] are convex in S and marginal external costs are given by MEC(S).

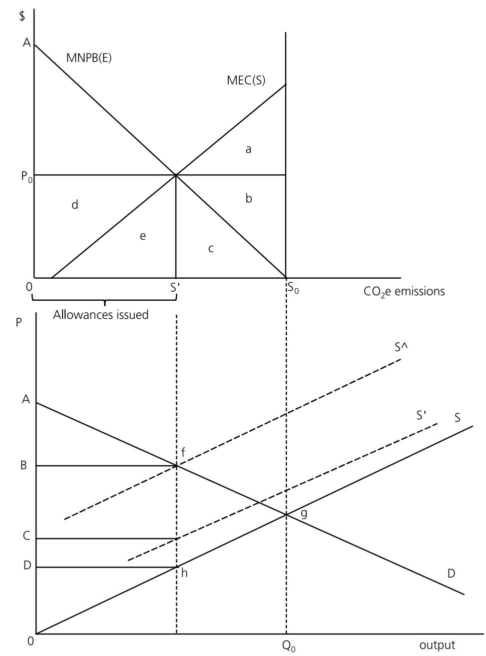
Figure 10.1 shows the traditional model of optimal GHG emissions for the regulated economies subject to cap and trade. The *vertical* difference in supply and demand for the commodity in the bottom panel defines the marginal net private benefits curve (MNPB) in the top panel (distance 0A are equal in each panel). The intersection of the MNPB and MEC curves gives the social optimum level of emissions S′. Introducing a cap and trade scheme that limits emissions to the quantity S′ generates a price for the allowances of P_0 in the top panel of Figure 10.1 (equal to the distance BD per unit output in the bottom panel). This price of emissions represents an opportunity cost to firms of an additional unit of emissions in terms of having to purchase it or of otherwise not selling it. One can think of this emissions tax as an output tax that shifts the supply curve up to S^ in the 2nd panel of Figure 10.1, moving along the MNPB curve to point S′. Emission reductions result in an increase in social welfare of areas *a* + *b* + *c*. The social costs of output reduction is given by area *c* (equal to area *fgh* in the bottom panel), for a net gain of areas *a* + *b*. The value of allowances is area *d* + *e* (these can be auctioned in which

[14]By distinguishing CO2e emissions reduction via output reduction and pollution abatement, the benefits and costs of abatement are integrated into conventional partial-equilibrium welfare analysis. This allows for a clear assessment of the social welfare implications of cap and trade with carbon offsets. In reality, some abatement will also occur with output reduction in a cap and trade regime, the implications of which are dicussed later.

[15]Schamel and de Gorter (1996) review the earlier literature that evaluates either abatement or output reduction, or excludes abatement by assuming the marginal costs of abatement exceeds the marginal social cost of reducing output over the relevant range of pollution reduction, or defines pollution as a function of pollution increasing and pollution decreasing inputs only.

FIGURE 10.1

Optimal emissions with output reduction only in regulated sector subject to Cap and trade



case becomes part of government taxpayer revenues or allowances can be handed out to firms; the market outcome is the same).

In developing countries, there is no incentive for the firm to invest in abatement technologies (e.g., methane capture), even though it may be the least cost way of reducing emissions, because of the public good nature of GHG emissions. Introducing the Clean Development Mechanism (CDM) allows regulated firms to purchase carbon offsets from developing countries in place of purchasing or using emission permits. Abatement activities A in developing country agriculture can reduce pollution levels *without* affecting production of good Q. For example, capturing methane from manure facilities is a situation where a farm would otherwise not reduce GHG emissions but a subsidy will induce it to. Installing methane capture facilities will therefore not directly affect agricultural output. Hence, GHG emissions are reduced through abatement only. Revenues from a carbon offset project that captures methane does not necessarily affect the level and mix of other inputs used in the production of that commodity[16]. This assumption is less realistic for carbon offsets designed specifically for REDD or biofuels where there is an impact on production and the market – the discussion of leakage is delayed until the next section of the paper.

The distinction between abatement and output reduction (and the interaction between the two) allows for a basic way to understand the global welfare implications of carbon offsets for developing country agriculture. The objective here is to determine the social optimal production and GHG emission levels simultaneous with the optimal combination of abatement activities and output reduction[17].

Since abatement is negative (net) pollution, MAC(-A) is equivalent to the marginal cost of reducing emissions in developing country agriculture via abatement only, as depicted in Figure 10.2. The marginal abatement cost curve link's emission levels and the cost of additional units of emission reduction. The marginal cost of reducing net emissions via output reduction and abatement simultaneously, termed marginal emissions reduction cost or MERC(S), is derived by adding MNPB (E) and MAC(-A) horizontally at S0 from right to left[18]. Note that MERC(S) is obtained by adding emissions reduction due to less output and emissions reduction due to abatement, analogous to deriving a total supply curve by horizontal summation of two individual supply schedules.

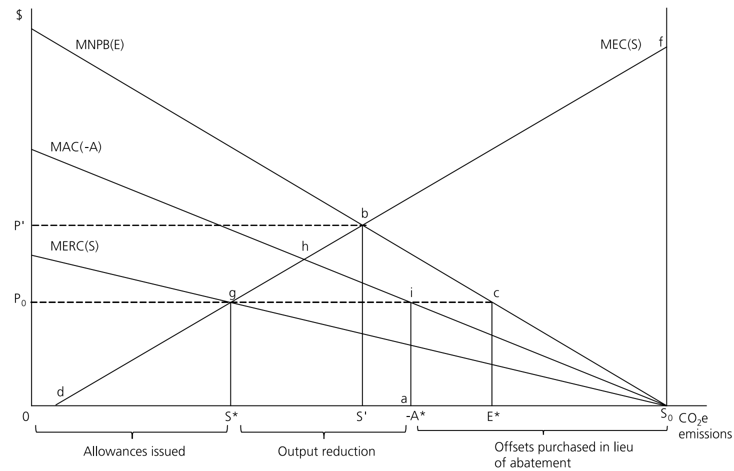
[16]Revenues for methane capture increases the effective price of output, thereby shifting the MNPB curve up in Figure 1 and increasing both output and the optimal level of emissions. Other issues not analyzed here are stacking (summing the value of each non-commodity output that is jointly produced) and the perverse incentive given to firms to overproduce because they are being paid not to pollute (versus tax if it does pollute). In chapter 5 of Baumol and Oates (1988), subsidies for pollution reduction are shown to be inefficient relative to pollution (production) taxes in a dynamic setting due to entry/exit of firms. The 'polluter pay principle' recognizes the possibility that getting paid not to pollute is not the same as taxing farmers when they pollute because of issues related to perverse incentives and exit/entry – see also Spulber (1985) and Ellerman (2008). In addition to deterring exit, de Gorter, Just and Kropp (2008) determine that infra-marginal subsidies can increase output through cross-subsidization. Abatement subsidies to pay farmers how to produce (not what or how much to produce) are decoupled but a farm cannot get paid in some cases without producing and so cross-subsidization can become relevant.

[17]Pearce and Turner (1990) define abatement as yielding only social benefits and are independent of private costs in reducing pollution via output reduction. We adopt this definition for the carbon offset market where regulated firms purchase carbon offsets in lieu of emissions abatement from unregulated countries. Abatement activities are defined as alternative production methods and practices capable of reducing emissions without directly affecting output levels.

[18]Note that the intercept of MNPB(E) on the horizontal axis defines S0, the amount of emissions corresponding to the private optimum without public policy action. The intercept of MAC(-A) on the horizontal axis is arbitrarily set at S0, but could be somewhere to the right of S0 in Figure 2, or in the case of co-benefits with abatement, to the left of S0, thereby increasing the social (and private) benefits from emissions abatement would imply at least some private benefits.

Figure 10.2

Optimal abatement of emissions with carbon offsets for the unregulated sector versus output reduction in the regulated sector



The optimal level of net emissions S* is determined by equating marginal external costs and marginal emission reduction costs. Optimal levels of abatement A* (due to carbon offsets in developing country agriculture in this case) and gross emissions E* defines the optimal level of output reduction (use of allowances in economies with cap and trade in this case) and are determined simultaneously. Abatement in Figure 10.2 is the distance aS0 while output reduction is given by the distance S*a (note that the distance E*S0 must equal the distance S*a)[19]. The price of permits is given by P0 and is equal between regulated economies and developing countries. Allowances can be either auctioned or given to the producing sector (or a combination as proposed in U.S. legislation). There is no difference in which method is chosen in terms of direct economic impact; only the distribution of income is affected.

Area S_0fgS^* below MEC(S) is the optimal reduction in emissions damages, implying that area *dgS** below MEC(S) depicts optimal emissions damages due to net emissions S*. The area S_0gS^* below MERC(S) is the minimum cost of reducing net emissions via an optimal combination of output reduction with permits and

[19]The level of allowances issued in Figure 2 is shown to be less than offsets purchased. This is impossible but think of the vertical axis shifted right arbitrarily for exposition purposes. In reality, offsets are 4 percent of allowances for the EU in 2008 (2.076 billion tonnes of CO2e allowances were surrendered while offsets (the sum of ERU and CER) were 0.082 billion tonnes of CO2e).

abatement with carbon offsets. Area S_0gS^* is equal to the sum of output reduction costs S_0cE^* and abatement costs S_0ia. Hence, area S_0fg depicts the maximum *net welfare gains* of reducing emissions below S_0.

The possibility of carbon offsets through the CDM increases total welfare. Without carbon offsets, the gain in emission reduction is given by area $fbS'S_0$. The social costs would be area $bS'S_0$. The net gain is fbS_0.

But the option of purchasing carbon offsets means fewer allowances are used and so less output reduction occurs in the regulated economies subject to cap and trade but there is more emission reduction overall. The gain in emission reduction is given by area fgS^*S_0 (more than without offsets by the area $gbS'S^*$). Social costs are given by area $cE^*S_0 + iaS_0$ which equals area gS^*S_0. Net social gains are given by area fgS_0. Total gains are higher than without offsets by the area bgS_0.

The equilibrium in Figure 10.2 is a characterization of abatement activities (in developing country agriculture with carbon offsets) and output reduction (in a country with cap and trade through reduced fossil fuel consumption). This framework of analysis provides a basis to analyze the economics of offsets in terms of costs and benefits to each of developing country agriculture and economies with cap and trade.

In reality, cap and trade will also induce firms to invest in abatement technologies (e.g., installing end-of-pipe equipment) and/or to change production practices (e.g., changes in input mix) so there will be a combination of abatement and output reduction in the regulated economies. The MNPB will shift in as a result. Instead of making Figure 10.2 more complex, we can represent the output reduction/ abatement combination for cap and trade economies in the bottom panel of Figure 10.1. Consider the increased costs of abatement to be reflected in the new supply curve S' in Figure 10.1[20]. This shifts the MNPB curve left (not shown). The new permit prices before the introduction of carbon offsets is distance BC in the bottom panel of Figure 10.1 (before, it was distance BD equal to P' in Figure 10.2). The analyses of MNPB in Figures 10.1 and 10.2 would be maintained except they would now be inclusive of any abatement activities induced by cap and trade.

Likewise, the marginal abatement curve MAC in developing country agriculture can include the marginal costs of reduced output (or the marginal benefits of increased output should co-benefits from abatement activities result). In this case, the marginal abatement curve MAC can be viewed as the total marginal social costs of abatement and shifts up (down) if there are increased costs (co-benefits) in production.

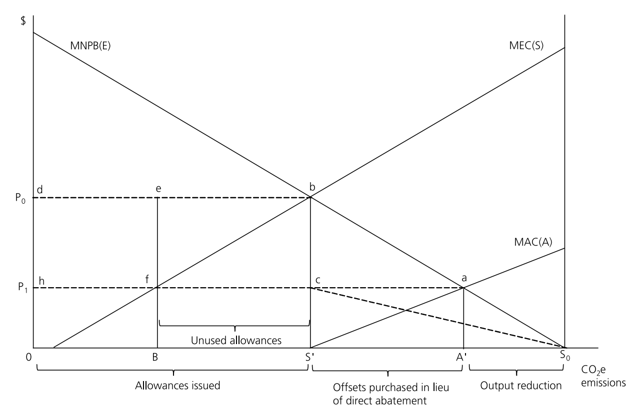
[20]A very recent paper by Goulder, Hafstead and Dworsky (2009) depict abatement exactly like this which is equivalent to the analysis in Figures 9.2-9.4 in this paper.

What if the number of allowances is fixed?

The analysis in Figure 10.2 assumes regulated economies take advantage of the option of carbon offsets by reducing the social optimal level of allowances. But this may not occur in reality so Figure 10.3 shows what happens when the number of allowances remains at their original level S′. The depiction of abatement is identical to that of Figure 10.2 except now abatement is shown in positive space. Again we arbitrarily put the intercept of MAC at S′; if co-benefits exist, the intercept is to the right of S′ and carbon offsets benefit developing countries and regulated economies even more.

FIGURE 10.3

Optimal abatement versus output reduction with fixed allowances and unlimited carbon offsets



By not adjusting allowances with the option of offsets, permit prices drop more than before (to P_1 in Figure 10.3 from point *h* in Figure 10.2). Before, the social cost was area bS_0S' but is now area cS_0S' in Figure 10.3. The net gain is area bS_0c. If allowances were reduced to point *g* in Figure 10.2 as before, then the value of offsets increase (or the financial flows to developing countries increase) by increasing both the price of permits (and hence the price of offsets) and the quantity of offsets (compared to the situation depicted in Figure 10.3). Without reducing allowances when taking advantage of carbon offsets results in a welfare loss for regulated economies as well as for developing countries.

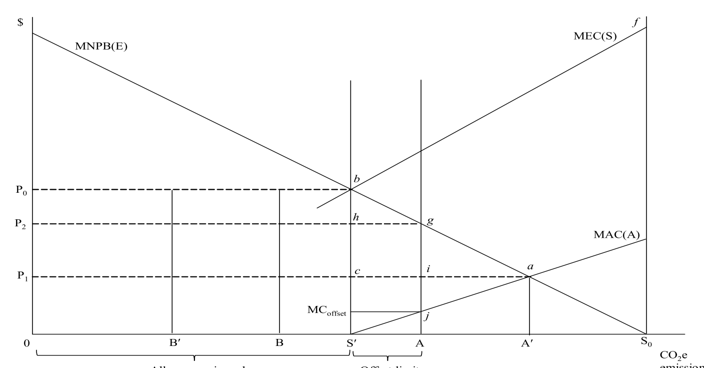
Figure 10.3 also allows us to calculate the welfare gains from having carbon offsets. The country with a cap and trade regime gains area *baA′S* but is required to pay area *caA'S'* for the carbon offsets, resulting in a net welfare gain of area *bac*. The level of unused permits in lieu of purchasing offsets is distance BS'. Developing countries selling the offsets gain area *caS'*. Because of the decline in the permit price from P_0 to P_1 in Figure 10.3, firms under the cap and trade regime save area *dbch* (area *fcS'B* are not savings because it equals the costs of offsets given by area *caA'S'*). Area *dbch* represents a cost to taxpayers (if permits are auctioned) or a decrease in asset values of permits owners (if permits handed out). There is no net gain to society due to lower permit prices other than that generated indirectly, depicted by area *bac*.

What if the number of offsets is limited?

Countries with cap and trade schemes normally restrict the number of carbon offsets available for developing countries. The effect of this is shown in Figure 10.4 where offsets are limited to the distance S'A (equal to the distance BS'). The price of offsets remains equal to the permit price which increases to P_2. The marginal cost of abatement is given by "MC_{offset}" in Figure 10.4. The regulated economy loses area *gai* due to the limit in offsets. However, developing countries selling the carbon offsets may gain or lose, depending on whether area *hgic* is greater or less than area *iaj*. The initial value of allowances (permits) is P_0S'. Afterwards, it is P_2A. The price of permits and carbon offsets are still equal.

FIGURE 10.4

Abatement versus output reduction with limited carbon offsets



Summary

Opportunities for GHG emission mitigation in developing country agriculture revolve around abatement activities, namely changes in production practices and technologies (e.g., REDD, soil carbon sequestration practices, midseason drying of irrigated rice, nutrient management to reduce nitrous oxide emissions and livestock management). Hence, it is important to distinguish marginal abatement costs from output reduction options where reductions in fossil fuel consumption are the primary driver of emission reductions. The case for public subsidies for abatement activities is further strengthened by the resulting correction of multiple market failures, potentially generating significant co-benefits to agricultural producers and society at large. In addition to the public good of reduced GHG emissions, there are multiple market failures in the form of technical externalities, reflecting the multifunctional nature of agricultural production. Multiple non-commodity outputs are produced (both positive and negative technical externalities), thereby providing an additional rationale for public abatement subsidies. Finally, because of knowledge externalities in technological innovation and both learning-by-doing and learning-by-using externalities in the adoption of new technologies, there will be underinvestment by the private sector in technological innovation and diffusion (Jaffe, Newell and Stavins 2005). This provides a further rationale for public expenditure programs in R&D of new agricultural production practices and technologies, and in the diffusion of this new knowledge (e.g., extension services).

The analysis shows how carbon offsets benefit both the cap and trade economy and developing countries. Offsets also provide an incentive for regulated economies to further increase their emission reduction targets. Limits on carbon offsets (as is currently the case and is proposed), however, hurt cap and trade economies while having an ambiguous impact on developing countries.

10.3 The economics of leakage with allowances and offsets

Carbon offset projects under the CDM must have at least the following characteristics:

Additionality: emissions are below that with no carbon offset revenues
Permanence: emission reductions are not simply shifted to another time period
No leakage: emissions are not simply shifted to another location or sector

The concepts of additionality, permanence and leakage have been the cornerstone concerns over project-based GHG mitigation policy with carbon offsets under the CDM. Much has been written on each of these three problems but this section of the paper focuses on leakage. The CDM has explicit language that requires leakages to be taken into account when assessing the viability of a CDM project for emission reduction. The Marrakech Accords' definition is "the net change of anthropogenic emissions by sources of greenhouse gases which occur outside the project boundary, and which is measurable and attributable to the CDM project activity."

Leakage is also a major concern for industries under a cap and trade regime. The response by parties to the Kyoto Protocol has been calls for legislation to implement 'carbon' tariffs against imports from countries with less stringent environmental legislation to guard against leakage due to cap and trade. This tariff may be in the form of the requirement that exporters purchase GHG permits in regulated countries before their product can be shipped. This is equivalent to an import tariff that accounts for the increased carbon costs due to cap and trade[21]. Hence, the issue of leakage is important because it affects developing countries in both directions: the ability to sell offsets and the restrictions imposed on exports to countries with cap and trade regimes.

Definition of leakage

"Leakage" is defined as the physical re-location of economic activity from the regulated country to another country with fewer or no environmental restrictions (or between jurisdictions within a country). "Market" leakage involves a change in market prices and hence affects economic decisions in other countries. Leakage arises from the increased cost imposed on the industry in the complying country due to environmental policies. The amount of direct carbon reductions in complying countries are undermined by carbon releases elsewhere. Therefore, leakage is also an issue for countries with cap and trade regimes; hence the call for carbon tariffs on imports from non-complying developing countries or for producer rebates to compensate the domestic industry for the higher input costs due to the cap and trade scheme.

Leakage is not to be confused with "shuffling" where the environmental policy can be circumvented and so has no impact on sales or prices (Bushnell, Peterman and Wolfram 2008)[22].This has also called primary ('activity shifting) leakage or 'displacement of emissions' in the literature (e.g., Wunder 2009). Furthermore, we assume for now that the emissions per unit output in the regulated country are equal to that of the unregulated economy; i.e., there is no "technical" leakage. Otherwise, leakage can be either compounded or reduced, perhaps even go negative (called reverse leakage)[23]. We allow for these possibilities later.

[21]Other proposals include producer rebates to compensate domestic producers for loss in international competiveness.

[22]As will be shown later, it is possible to have leakage through the market with no or little change in market prices when a country is "small" on world markets. Because the composition and location of production has changed (unlike with shuffling), it is still deemed leakage.

[23]For example, although domestic emissions decline, it is possible that increased production in unregulated economies are such that although production goes up - the per unit emission intensity is so low total emissions decline. See footnote 4 for a counter-example.

The literature to date defines leakage as the phenomena of offsetting increases in GHG emissions in non-complying countries and hence results in the undermining of carbon mitigation initiatives in complying countries. The key concept is "coverage": not all countries are subject to the environmental policy that is mitigating GHG emissions. For example, Stavins (1997):

"…leakage arises when abatement by cooperating countries alters world relative prices in ways that lead non-cooperating countries to increase their emissions[24]."

In the context of global climate change, leakage is "international"; it occurs in another jurisdiction with no environmental regulations. Stavins (1997) goes on to identify two primary channels of carbon leakage:

C1: costs of production for carbon-intensive products increase in complying countries, resulting in a market price increase that induces an offsetting increase in production and therefore emissions in non-complying countries ('supply' side leakage)

C2: as a result of the lower demand for fossil fuels, the (world) market price of fossil fuels decline and so the consumption of fuel (and hence emissions) increase in non-complying countries ('demand' side leakage)

This definition of leakage is somewhat restrictive because it focuses on the "international" component only; the changes in market prices in each channel identified above also affects domestic production and consumption. In the case of unregulated sectors like REDD and to some extent agriculture, one has to include a measure of "domestic" leakage as well; otherwise, not all emissions are accounted for. In other cases (e.g., a cap and trade for electricity production only), domestic leakage cannot occur because although the domestic supply curve shifts up due to a cap and trade regime (thereby increasing world market prices), any increase in domestic output in response to this price increase must buy permits so total domestic emissions are fixed[25]. Hence, in this case, the definition of leakage in the literature is appropriate[26].

Why is REDD and agriculture not like a cap and trade regime for electricity production? Forestry and agriculture are unregulated sectors within a cap and trade regime and so the upward shift in the forestry supply curve due to a policy that reduces deforestation (or in the agricultural supply curve due to higher fossil fuel

[24]This is in contrast to "free riding" where non-complying countries benefit from global abatement but do not contribute to it.

[25]However, as we will show later, in this case international leakage is higher than normally recognized.

[26]Because of emissions from land use change due to electricity produced from biomass, even electricity production now has domestic leakage.

prices resulting from the cap and trade policy) reduces emissions in two ways. First, there will be reduced purchases of inputs with carbon content (but potentially very little, especially with forestry). Second, much of the saved emissions in reduced forestry and agricultural output are not from the reduced purchased inputs with embodied carbon covered under the cap but from the production process itself. For example, in the case of fertilizer, not only will emissions decline due to the reduced use and hence production of fertilizer (carbon embodied in the production of fertilizer), but emissions also decline because of the emissions associated with the application of fertilizer. The latter emissions are uncapped. In the case of forestry and agriculture, we will argue that uncapped emissions are far more important than fossil fuel consumption and so domestic leakage becomes an important issue, just like for international leakage that only considers emissions escaping outside the country covered by a cap and trade scheme.

The key characteristic determining whether or not domestic leakage is important is how much of the emissions are due to fossil fuel consumption (embodied in the production of purchased inputs covered under the cap and trade regime) and how much are due to production practices and land use changes. Because deforestation is the largest source of emissions (that occurs mostly in developing countries) and is primarily caused by land conversion to agriculture, activities in land use, land use change and forestry (LULUCF) both remove (e.g., via sequestration) and release (e.g., land use change) GHGs. The main ways forestry can mitigate GHGs is through afforestation and reforestation (A/R), forest management (FM) and avoided deforestation and degradation (REDD).

Reducing forest land into agricultural production will cause food shortages unless complementary policies are introduced for new technologies that generate intensification in agricultural production. Induced land shortages are more pronounced with REDD than A/R which is often carried out on degraded land with low economic value (Wunder 2009). In fact, REDD induces an increase in the price of wood products, thereby creating an incentive for A/R, i.e., a good leakage (Murray, Lubowski and Sohngen 2009). Because it takes decades to grow a new forest and growth in the forest stock as well as sequestration potential, the outcome depends on the type of forest, its vintage and what you do with it (slash and burn or make wood products where CO_2 slowly emits over time) (Mendelsohn and Dinar 2009).

REDD are difficult to measure, monitor and verify the real reductions. To date, the CDM has had very limited success in the LULUCF sector, with a total of seven afforestation and reforestation projects (one in 2006 and six in 2009, with three large scale and four small scale projects) with 286,995 tonnes per year CO_2e

reductions. There are four registered projects that are indirectly related to A/R: biomass residues from forestry, with 415,181 tonnes per year of CO_2e reductions[27].

Apart from REDD, A/F and FM, sources of agriculture's reduction opportunities include emission reductions (manure management, enteric fermentation and fertilizer practices), biological sequestration fluxes (tillage, crop rotations, cover crops and grazing practices) and avoided fossil fuel emissions from efficiency improvement and from substitution for fossil fuels (with liquid transportation biofuels, thermal biopower/bioheat or renewable electrical power).

Experts generally agree that the five key areas of GHG mitigation potential in agriculture is in terms of production processes and not necessarily in reduced use of purchased inputs. These production processes that can reduce emissions substantially are REDD, soil carbon sequestration practices, midseason drying of irrigated rice, nutrient management to reduce nitrous oxide emissions and livestock systems.

Taking livestock as an example (which emits more GHGs worldwide that the entire transportation sector), 94 percent of GHG emissions are due to production practices (e.g., enteric fermentation, land use and land use changes, and manure and slurry management)[28]. The remaining 6 percent is due to fossil fuel use which would be capped under a cap and trade scheme. Overall, in the case of agriculture, the composition of production (crop type or number of livestock) and the type of production practices will be the key factors in reducing GHG emissions (including LULUCF).

Isolating international leakage only (as the literature does by defining leakage as that which occurs outside the countries "covered") implies that if all countries are part of the climate agreement, then no leakage occurs with changes in market prices. We will show that this will not be the case and so the current definition of leakage is very restrictive because domestic leakage occurs in the case of REDD and agriculture, even if all countries were party to a climate agreement.

We will show that domestic leakage can easily be greater than international leakage. This has implications for the proposed carbon import (export) tariffs (subsidies) on developing country trade and compensatory producer rebates or production subsidies in complying countries. Furthermore, the two channels identified in the literature are interdependent: the decline in oil prices in C2

[27]According to Zomer et al. (2009), agro-forestry is widespread, found on 46 percent of all agricultural land area globally, and affecting 30 percent of the rural population. Large scale tree cover patterns cannot be fully explained by aridity, population density or region, indicating the importance of other factors like tenure, markets, or other policies and institutions that affect incentives for tree planting and management, as well as initial conditions due to historical circumstances.

[28] On-farm fossil fuel use is included in this 94 percent figure, however, as we are unable to separate it out.

shifts the supply curves in both complying and non-complying countries, thereby augmenting both the domestic and international leakages in channel C1.

The issue of leakage is therefore very important and must be clearly understood. As it stands now, there is an asymmetry in the treatment of leakages: countries party to the Kyoto Protocol (or the successor agreement) are able to deny offsets from developing countries due to leakage (e.g., offsets under REDD) while at the same time imposing import restrictions on developing country exports because of international leakage originating in their own economies with cap and trade regimes (while conveniently ignoring domestic leakage).

We now develop a general theory of leakage to incorporate all of these considerations.

A general theory of leakage

Consider a country that is party to the Kyoto Protocol or successor agreement is an importer while the exporter is a developing country that is not a participant in the climate agreement[29]. But before we consider international trade, let us first define leakage under autarky (a hypothetical situation when there is no trade)[30]. The environmental policy shifts the home supply curve S up in the 1st panel of Figure 10.5 to S'. This shift can either be due to a cap and trade scheme increasing input prices or a policy that reduces deforestation by withdrawing forests from the market (Murray 2008). Assume the sector in the home country is unregulated; i.e., is affected by the increased costs of inputs using fossil fuels but is not part of the cap and trade scheme. The initial level of output reduction (and emission reduction as we assume a one-to-one relationship between emissions and output) is given by the distance *ab*.

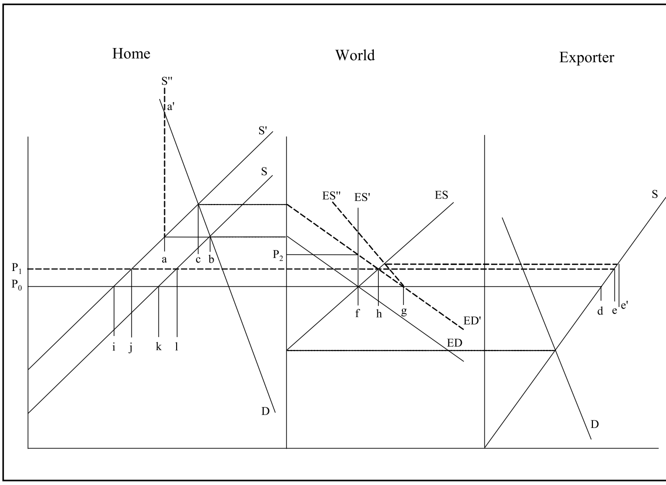
But even without trade, there is leakage as defined by Stavins (1997) and the literature in general where supply increases as a result of the market price increase. This also occurs in a market without international trade. The amount of leakage is given by the distance ac. We define this as "autarky" leakage. The more inelastic the home demand curve and the more elastic the home supply curve, the larger the leakage (Murray, McCarl and Lee 2004). "Autarky" leakage is 100 percent if the home demand curve is vertical or the home supply curve is flat.

It is important to note that we are assuming that the emissions in the unregulated sector in the 1st panel of Figure 10.5 are mostly from production practices (e.g.,

[29]The results that follow hold for either case of the complying country being an importer or exporter.

[30]Autarky is not so hypothetical, given the excessive levels of subsidies and protection for agriculture in OECD countries. The implications of the analysis to follow are that there is more domestic leakage because of these agricultural policies, thereby emphasizing the need for agricultural policy reform in developed countries to aid in the mitigation of GHGs.

FIGURE 10.5
Defining domestic versus international leakage



LULUCF) and we ignore the reduction in the carbon emissions due to fossil fuel consumption embodied in the purchased inputs whose purchases have now declined due to the environmental policy. This assumption is fairly realistic for forestry and is an empirical question as to how important it is for agriculture. If the cap and trade scheme was for electricity production only, then no autarky leakage is possible as the sector would be unable to expand production as no permits can be purchased from another sector. The supply curve in this case would be vertical, given by S" in Figure 10.5 (assuming fixed coefficients of production between fossil fuel and other inputs) and so the equilibrium price would be given at point *a'* in Figure 10.1[31].

Now that "autarky" leakage has been defined (which is by definition 100 percent "domestic" leakage), let us determine the outcome with international trade[32].

[31]If emissions for the unregulated sector are due to carbon embodied in the purchased inputs, then output could still increase as shown in the first panel of Figure 5 but no autarky leakage can occur because allowances or permits need to be purchased from other sectors. Therefore, net fossil fuel use and hence emissions are fixed. However, for agriculture and forestry, emissions are from the production practices and aspects related to LULUCF, and so a movement up the new supply curve S' increases emissions (e.g., more land is used relative to non-land inputs). This is exactly the same general model of leakages described in the literature (e.g., Murray 2008).

[32]Autarky leakage may be the only type of leakage if the domestic economy is not linked with world markets, as is the case in many developing country situations where local or subsistence agricultural production is not linked to world market prices.

Does domestic leakage disappear? If not, why is the focus in the literature on international leakage only? As we will show, not only does domestic leakage not disappear, it can be greater than international leakage. This has major implications for proposals that recommend carbon tariffs and production rebates to compensate for the so-called "international" leakage (while ignoring the possibility for and the implications of domestic leakage). It also has implications for denying carbon offsets to developing country agriculture because of leakage.

With international trade, the initial pre-policy equilibrium in Figure 10.5 is given where the home country excess demand curve ED intersects the excess supply curve ES of the foreign country exporter, generating an equilibrium market price P_0. Again, the environmental policy (e.g., removing forest from the market or a cap and trade scheme) shifts the home supply curve S up in the 1st panel of Figure 10.5 to S'. The initial level of output reduction (and hence reduction in emissions) is given by the distance *ik* (equal to the distance *ab* analyzed in the autarky situation above). However, the upward shift in the home supply curve S causes the excess demand curve ED to shift up to ED' (note that this vertical difference in ED' and ED is less than the upward shift in the home supply curve, the extent to which depends on the elasticity of home country domestic demand). The new world market price is given by P_1.

We are now in a position to identify domestic *versus* international leakage. Domestic leakage is given by the distance *ij* while international leakage is given by the distance *de*[33]. If the excess supply curve facing the home country importer is flat, then the level of international leakage is at its maximum and equals the maximum possible total leakage given by the distance *ik*[34]. Domestic leakage is zero in this case.

On the other hand, if the excess supply curve facing the home country is vertical (given by ES' in the middle panel of Figure 10.5), international leakage is zero and domestic leakage is at its maximum denoted by the distance *ac* (equal to autarky leakage because P_2 minus P_0 is equal to the vertical difference between ED' and ED). Hence, the two extreme outcomes can be determined: total leakage is at its maximum of the initial level of output/emissions reduction when the excess supply curve is flat, or equals autarky leakage when the excess supply curve is vertical. For all values of the excess supply elasticity between 0 and ∞, total leakage lies between the distance *ik* and *ac*. This difference could be quite small so emphasis on international leakages may be misplaced.

[33]Note that we assume the per unit emissions from foreign production equals that of home production.

[34]To prove that the horizontal shift in ED is identical to that of the horizontal shift in S, consider the horizontal difference between D and S' at the intercept of ED. This horizontal difference must equal the horizontal difference in the ED and ED' curves. Hence, distance fg equals distance ab

Note also that the level of domestic leakage *ij* can be greater than or less than international leakage *de*. The outcome depends on the relative elasticity of excess demand ED and excess supply ES. The factors determining the values of these trade curves are now discussed.

The question now becomes what determines the size of the excess supply elasticity facing the home country importer (or of the excess demand elasticity facing the home country if the latter is an exporter)? Consider two importing countries: country 1 is the home country with imports of M_1 and country 2 is the competing importer with imports of M_2. There is one exporting country with exports given by X. The excess supply (trade) elasticity facing the home country importer (country 1) is given by the following formula:

1. $$\eta_X\left(\frac{X}{M_1}\right)-\eta_{M_2}\left(\frac{M_2}{M_1}\right)$$

where η_X is the elasticity of excess supply of the exporting country defined as

2. $$\eta_X=\eta_X^S\left(\frac{Q_X}{X}\right)-\eta_X^D\left(\frac{C_X}{X}\right)$$

where η_X^S and η_X^D are the domestic supply and demand elasticities in the exporting country with levels of production Q_X and consumption C_X,

and continuing from equation (1), η_{M_2} is the elasticity of excess demand for the competing importing country defined as

3. $$\eta_{M_2}=\eta_{M_2}^D\left(\frac{C_{M_2}}{X}\right)-\eta_{M_2}^S\left(\frac{Q_{M_2}}{X}\right)$$

where $\eta_{M_2}^D$ and $\eta_{M_2}^S$ are the domestic supply and demand elasticities in the competing importing country with levels of consumption C_{M_2} and production Q_{M_2}.

From equation (1), two key properties of the excess supply curve facing the home country importer are:

- As the world market share of the home country's imports approaches zero, the elasticity of excess supply facing that country tends to ∞
- As the share of the competing country imports of world market approaches zero, the elasticity of excess supply facing the home country importer

approaches its minimum value, the elasticity of excess supply of the exporter η_X^S

Therefore, in general, the trade elasticity (export/import) facing a country (importer/exporter) becomes more inelastic as that country's share of world markets increase.

From equation (2), the elasticity of the excess supply curve facing the home country also becomes more inelastic with a more inelastic export supply of the exporting country which falls with:

- A lower domestic supply and demand elasticity in the exporting country
- A lower share of domestic production (consumption) to exports.

Likewise, from equation (3), the elasticity of the excess supply curve facing the home country also becomes more inelastic with a more inelastic import demand of the competing importing country which falls with:

- A lower domestic supply and demand elasticity in the competing importing country, and
- A lower share of domestic production (consumption) to imports.

What happens if there are domestic or border policies that put a wedge between the domestic and world prices (or sever the link with between the domestic and world prices) in any of the three countries? The effect of policies is to reduce the domestic-world price transmission and so make the trade elasticity even more inelastic.

To summarize, the "contributions" to the value of the price elasticity of excess demand (excess supply) <u>facing</u> an exporter (importer) are:

- Exporter (importer) market share of world exports (imports) - *higher the share, more inelastic* the excess supply (demand) curve
- Proportion of the rest of the world's consumption (production) that is imported (exported) – *larger the proportion, more inelastic* the excess supply (demand) curve
- Proportion of the competing exporter's (importer's) production (consumption) that is exported (imported) – *larger the proportion, more inelastic* the excess supply (demand) curve
- Domestic supply and demand elasticities in the competing exporting (importing) countries and importing (exporting) countries – *lower the elasticities, more inelastic* the excess supply (demand) curve
- Government policies in importing (exporting) and competing exporting

(importing) countries – *more policies, more inelastic* the excess supply (demand) curve

Combining the discussion of Figure 10.5 with that of equations (1)-(3) above, we can determine the factors that impact the effect of an environmental policy in the home country importer (exporter): a country has a bigger impact on world prices when the trade curve *of* the country is more *elastic* and the trade curve *facing* the country is more *inelastic*. The trade curve of the country is more elastic when the home importer – a large 'producer' (home exporter – a large consumer) has a small fraction of consumption (production) imported (exported). The trade curve *facing* the home country is more inelastic when it is a large importer (exporter) on world markets. Hence, we can distinguish 'large country' *versus* 'large trader' effects. For example, a country such as Canada may be a large trader on world markets for wheat (like the United States) but relatively a "smaller" country because a large share of home production is exported (unlike the United States).

As we showed in Figure 10.5, the magnitude of the total leakage and the share between domestic and international leakage is heavily dependent on the elasticity of the trade curve *of* the home country and the elasticity of the trade curve *facing* it. These elasticity values are also important in analyzing the effect of tariffs and production subsidies in response to international leakages (analyzed later).

Although the discussion of Figure 10.5 is in terms of leakage associated with a cap and trade regime, the analysis is equally applicable for carbon offsets. For example, a REDD program in a developing country suffers from leakage to countries with a cap and trade regime because REDD is limited in coverage as agriculture and forestry are unregulated sectors in countries with cap and trade (it also suffers from leakage between developing countries and because offsets are voluntary, there can be leakage within a country although the latter should not be confused with shuffling where reallocation of land occurs with no impact on costs or market prices).

An example of 'technical leakage" is U.S. ethanol tariffs that encourage corn-based ethanol production over sugarcane-based ethanol from Brazil. Although U.S. biofuel mandates and tax credits do not discriminate against trade, ethanol import tariffs and production subsidies do. By not allowing Brazil to export ethanol to the United States, CO_2e emissions substantially higher than otherwise (for same level of ethanol production) because (1) corn-ethanol obtains half the yield per hectare (so require twice the land area); (2) crops displaced now have to be produced elsewhere (e.g., corn yields in Brazil are 1/3 that of the U.S.); and (3) annual net sequestration per hectare is much higher in Brazil.

An example of "shuffling" is U.S. sustainability standards for ethanol where incentives are given for ethanol producers to use relatively "clean" inputs (e.g., natural gas) while the "dirtier" inputs (e.g., coal) that might otherwise have been used will simply be used by producers of other corn products not covered by the sustainability standard (e.g., bourbon). Sustainability standards reshuffle who is using what inputs with no net reduction in national emissions.

An important implication of the analysis of Figure 10.5 above is that international trade does not necessarily cause leakage nor does non-compliance by another country. Non-compliance is an issue but should not be synonymous with the term "leakage". Non-compliance also reflects free riding and less effectiveness of solving the global climate change problem. Even with 100 percent compliance, domestic leakage occurs at home and abroad. But even with international leakage because of less than 100 percent coverage, domestic leakage can still be greater than international leakage.

What if there is no autarky leakage?

Let us suppose the cap and trade regime is for electricity production only. There is no domestic sector that is unregulated and all emissions are accounted for. This means the supply curve is vertical (denoted by S") and the excess demand curve is now given by ED". This generates a higher world price and an increase in international leakage, now given by distance *de'*.

The effects of a carbon tariff

The standard response in the literature to deal with international leakage (domestic leakage is not recognized) in non-complying countries like developing countries is given in Stavins (1997):

"What can be done to reduce emissions leakage? If the coalition is a net importer (exporter) of carbon-intensive products in the absence of a carbon tax, then a tariff (subsidy) imposed on these net imports (exports) can reduce emissions leakage through the terms of trade."

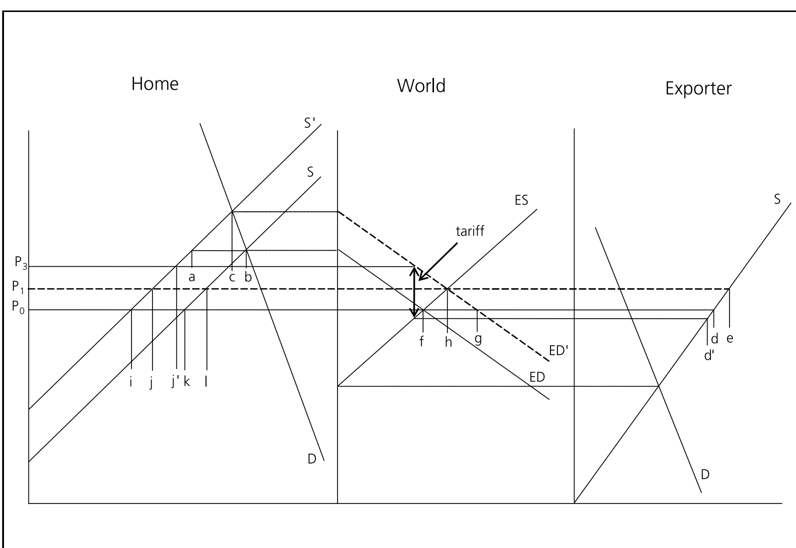
One way of implementing the tariff is to require the exporter to purchase permits according to the carbon content of the product[35]. One problem with this approach is that if there is domestic leakage along with international leakage, an import tariff (or export subsidy) can easily worsen total leakage, and in specific cases the increase in total leakage is beyond the initial reduction in emissions due to the environmental policy. Clearly this is counterproductive and contrary to the goals of any carbon import tariff (export subsidy). Although international leakage will go down and even become negative with a carbon tariff, total leakage can easily increase and

[35]There may also be a problem of international shuffling as exporters will use 'clean' inputs in the product exported (e.g., natural gas) and use 'dirty' inputs (e.g., coal) for production consumed domestically.

in some cases will automatically increase even with international leakage going negative.

This is shown in Figure 10.6 where a carbon tariff equal to the vertical difference in the S′ and S supply curves generates a negative international leakage (production in the exporting country goes below the pre-cap and trade policy level by the distance *d′d*)[36]. But domestic leakage will automatically increase by distance *jj′* which may be greater or less than the decrease in international leakage of distance *d′d* (even if the carbon tariff is limited to the vertical difference in the ED′ and ED curves). Therefore, not only will the carbon tariff not solve the problem, it may make the problem worse. It only solves the international leakage problem but makes domestic leakage worse, with the net effect being ambiguous. In fact, domestic leakage can easily surpass autarky leakage and approach the initial emission reduction of distance *ik* with the shift left in the supply curve S to S′. If the distance *cb* is relatively low, then a carbon tariff overcompensates.

Figure 10.6
Effects of a carbon tariff



[36]A tariff equal to the vertical difference in the ED′ and ED curves will exactly offset the international leakage.

Under what conditions will total leakage increase? The outcome depends on the relative elasticity of excess supply and demand. It can be easily shown that if the elasticity of excess supply (excess demand) facing the home country importer (exporter) is relatively more elastic than the excess demand (supply) of the home country importer (exporter), then total leakage declines with a carbon tariff (and vice-versa if more inelastic). Even if total leakage declines, the carbon tariff always overcompensates and is nowhere near the tariff that generates the minimal level of total leakage. All in all, calling for carbon tariffs may only be relevant in the cases where developing country agriculture is subject to a cap and trade regime (not the other way around). Perhaps carbon tariffs are not to reduce leakage but are a political means to increase protection to rich country industries, including agriculture which is already heavily subsidized and protected[37].

Implications for carbon tariffs

1. By ignoring domestic leakage and recommending carbon tariffs to reduce international leakage, total leakage could increase as a result. Therefore, the optimal carbon tariff may be negative.
2. Even if total leakage declines with a carbon tariff, the optimal carbon tariff is lower than the vertical shift in the supply curve S (as the literature recommends the tariff to be)[38.]
3. In the case of agriculture, it is well documented that OECD countries (that will likely make up the bulk of the countries party to any post-Kyoto Protocol climate agreement) have huge agricultural subsidies and protection relative to their developing country counterparts whose economies will not be subject to a stringent cap and trade regime. Hence, any carbon tariff or producer rebate to compensate for international leakage is likely not required, regardless if one does or does not recognize the importance of domestic leakage. This is because the home supply curve S has shifted down in the first place with subsidies and protection before a cap and trade regime is put in place. At a minimum, not only should domestic leakage be recognized but any relative advantage due to subsidies or trade protection should be incorporated in the analysis before any carbon tariff or producer rebate is considered.
4. As discussed in Section 3 above, carbon offsets should be purchased from developing country agriculture with co-benefits that will increase developing country exports. The co-benefits increase productivity and corrects for other market failures such that there is a reduction in international leakage as well (domestic leakage in complying countries) associated with carbon offsets

[37]Perhaps import tariffs (export subsidies) should be limited to the carbon-intensive products used as inputs to the agricultural production process and not on agricultural products per se (Frankel 2009). But then exporters could circumvent the cap and trade by exporting carbon in the final products.

[38]Stavins (1997) does however recognize that the gains in reducing international leakage might very well be lower than the loss in welfare due to the tariff but that is an entirely different issue.

because production in the rest of the world declines with the reduced world market prices. Therefore, there is a double dividend with carbon offsets: reduced emissions with the offset project and reduced international leakage provided the analysis is for an unregulated sector (i.e., leakage in the 'home' economy in Figures 5 and 6 that have a cap and trade regime but agriculture and forestry are unregulated sectors). Meanwhile, carbon tariffs or producer rebates in complying countries will therefore do the opposite of what is optimal not only for global climate change but also for economic welfare in both complying and non-complying countries.

5. Because OECD countries will implement cap and trade regimes, these countries as a group have a large share of key world commodity markets and hence will be facing relative inelastic supply curves. This coupled with the well known fact that developing country agricultural supply curves are more inelastic than their rich country counterparts; it is very likely that the analysis in Figure 10.5 has domestic leakage relatively more prominent. Analysis in Figure 10.6 indicates that total leakage may easily increase with carbon tariffs or producer rebates.

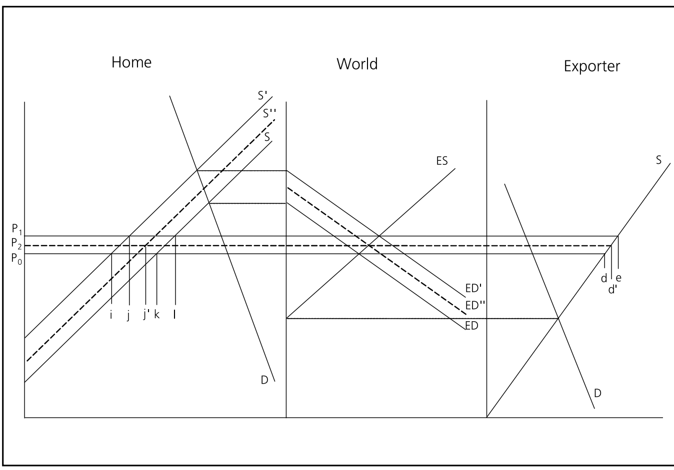
Implications of leakages in the fossil fuel market

The analysis so far on carbon tariffs in Figure 10.6 only assess leakage through channel C1, namely the international leakage that follows from the increased costs of production in the home country due to the cap and trade regime (so-called "supply-side leakage"). There is also the second channel C2 (so-called "demand-side leakage") where lower fuel prices due to the cap and trade regime will generate *international leakages* in higher fuel consumption in non-complying countries. The literature again ignores *domestic leakage* due to lower fuel prices. With lower fuel prices, the supply curves in both the home and foreign country shift down, generating more production. But the shift will not be equal. The stylized facts indicate that OECD country agriculture is more energy-intensive than their developing country counterparts so the supply curve S in the home country in Figure 10.6 shifts down more than developing country supply curves due to demand-side leakage. This means domestic leakage is even higher than international leakage compared to the analysis so far.

To show this, consider Figure 10.7 where the shift in the supply curve in the foreign country (3rd panel) is normalized to zero so the downward shift in S' in the home country reflects the net shift relative to the exporting country. Domestic leakage goes up by the distance *jj'* while international leakage declines by the distance *dd'*.

The implication of Figure 10.7 is that carbon tariffs, already shown to be too high (and possibly should be negative to minimize total leakage), should be even lower when taking into account demand-side leakage. Implementing even higher import tariffs against non-complying country exports due to demand-side leakage may therefore be counterproductive. Point *j'* can easily be to the right of point *k* in Figure 10.7, rendering domestic leakage to be higher than the initial shift in the supply curve to S' (i.e., *ij'* can easily be higher than the distance *ik*). Hence, it is important to include the link between demand-side leakage and supply-side leakage.

FIGURE 10.7
Effects of demand-side leakage on supply-side leakage



But carbon tariffs or domestic production subsidies will have home country market prices go up even further, increasing domestic leakage while reducing international leakage, likely to negative levels. Although the initial cap and trade regime shifts the supply curve up to S' and reduces the carbon intensity per unit output, gross output increases with leakages, resulting in far lower reductions in emissions than originally intended, and with carbon tariffs or producer rebates, can easily increase total emissions.

It also can be shown that a carbon tariff results in lower GHG emissions than a per unit production subsidy of equal value. Home and exporter production with a tariff is point *j'* and *d'*, respectively, in Figure 10.6, while a production subsidy will result in higher levels of production in each case (point *k* and *d* in the home and exporting country, respectively).

Summary

"Leakage" is traditionally defined as the increase in emissions due to GHG emission mitigation policies (e.g., cap and trade or REDD) outside the economy being regulated. These policies generate changes in market prices, trade and location of production, thereby increasing emissions in unregulated economies. Leakage has to be distinguished from "shuffling" (where neither the location nor costs of production change but the environmental policy is nevertheless ineffective) and from "technical" leakage (differences in emissions intensity between regulated and unregulated economies magnify or dampen our definition of market leakage above).

The literature only recognizes "international" leakage. We show however, that emission mitigation policies in the agro-forestry sectors may have "domestic" leakages as well, in some cases outweighing international leakage. This means carbon tariffs can be counterproductive and increase total leakage. Carbon tariffs should also be adjusted downwards for both agricultural subsidies in cap and trade economies and for the reduced international leakage due to the correction of multiple market failures with an effective carbon offset program. Carbon tariffs can also cause international shuffling where products exported to cap and trade economies use low carbon inputs while other products not exported use high carbon inputs. Furthermore, there are interaction effects between supply-side leakages and demand-side leakages (the latter in the fossil fuel market) that need to be considered. Hence, further research is required to determine how to handle leakage with carbon offsets and with carbon tariffs for countries with cap and trade.

The analysis in this section should ideally be integrated with discussion of marginal abatement curves in Section 3 earlier. Carbon offset programs that subsidize abatement activities will shift the MNPB curve in developing countries, thereby affecting international prices. This affects optimal emission allowances and prices, thereby affecting the analysis in this section on leakage.

Inferring from the analysis above in Figures 5, 6 and 7, economic conditions are such that leakage appears to be higher for permits in rich country agriculture subject to the cap and trade relative to offsets purchased in developing country agriculture, using stylized facts about developing country agriculture compared to OECD agriculture. Furthermore, more research must be undertaken to determine whether the current rules are such that leakage in the CDM must account for shuffling and for both domestic and international leakage due to increased production in both other non-complying developing countries and OECD countries party to the climate agreement.

Domestic leakage is particularly important with agriculture not only because it is uncapped but because much of the emissions are not from reducing fossil fuel consumption directly but from agricultural production process, when can be reduced through changed production practices. Under a cap and trade regime, the supply curve for agricultural products will shift up due to the increases costs of fossil fuels. For a fixed commodity price, this will induce a reduction in all inputs but less so for non-fossil fuel inputs like land. Once commodity prices increase due to the reduced supply, domestic leakage occurs with an increase in fossil fuel use and land (but more land per unit output now). Land conversion generates emissions. If agriculture is a large sector in the economy, permit prices will increase and land converted to agriculture accelerates even further.

10.4 The economics of targeted abatement subsidies

The analysis so far indicates that there is more leakage under cap and trade compared to carbon offsets in developing country agriculture. This is because carbon offsets are a subsidy for changes in production practices where most of the carbon emission mitigation potential exists in developing agriculture. The technical potential for mitigating GHG emissions from agricultural production varies among commodities, countries, and farm types. Total output may increase with enhanced productivity but emissions per unit output would fall, including from fossil fuel. The potential also exists for multiple co-benefits with altered production practices and so abatement subsidies can become a key component for productivity improvement and hence for poverty reduction and sustainable development.

Carbon offsets reduce emissions through the carrot of financial subsidies rather than the stick of emission limitations as with cap and trade. Bushnell, Peterman and Wolfram (2008) carefully show that targeted subsidies (subsidies for clean technologies etc.) minimize leakages and shuffling, unlike with a tax on emissions like cap and trade. The reason is that leakage stems from cost increases (supply-side leakages) or changes in consumption prices (demand-side leakages). For example, Key and Tallard (2009) find that two-thirds of the emissions reductions in a cap and trade scheme for livestock methane emissions are negated by leakages in non-complying countries. This emphasizes the potential of abatement activities in developing countries to minimize these leakages.

Instead of imposing costs on firms (or on consumption at the point of purchase), subsidies designed to reward production from non-emitting sources like subsidies for energy efficiency (subsidize clean behavior or technologies) are more effective. Indeed, subsidies may be the only way to go. Promotion of clean technologies can be more effective than limiting the use of dirty technologies. Targeted subsidies therefore are less vulnerable to leakage and shuffling because they do not impose costs on firms and so firms have no incentive to relocate production or avoid costs; in fact they have the opposite effects. Carbon offsets provide such a mechanism for targeted subsidies. However, the current method in the CDM with project-based carbon offsets presents a problem of monitoring, reporting and verification, requiring complementary approaches (discussed later).

Imposing costs on consumers at the point of purchase induces shuffling. Bushnell, Peterman and Wolfram (2008) explain how a consumption based cap and trade can also fall victim to the reshuffling of production, just like an emissions tax levied on consumers and not on producers. Bushnell, Peterman and Wolfram (2008) give examples where targeted subsidies to technologies and clean production are generally immune (less vulnerable) to leakages and shuffling (e.g., subsidies to install solar energy facilities). This theory is very relevant to harness developing country agriculture's ability or potential to mitigate GHG emissions, and minimize leakages and shuffling.

The implications of the Bushnell, Peterman and Wolfram (2008) analysis is that the only way to meaningfully impact emissions on *a local level or for non-complying countries* is with targeted subsidies like emission abatement subsidies. The carrot (rather than the stick) will also induce co-benefits and learning by doing etc. In addition, there will be political opposition in developing country agriculture to use policies that induce higher production costs (most poverty is in rural areas plus there will be fears of losing international competitiveness). Abatement subsidies therefore avoid situations directed at increasing costs of production or reducing consumption. Instead, policies that employ targeted subsidies for altering inputs and technologies towards 'clean' technologies will be more effective and politically acceptable.

Carbon offsets based on projects often do share problems with incentive-based schemes like cap and trade in terms of transactions costs of measuring and monitoring emissions, verifying compliance and administrating and enforcing policy. Polluter pay principle is in theory the accepted methodology (OECD 2005). But this is not relevant for developing county agriculture because of transactions cost in implementing penalties or taxes (monitoring, verification etc – like non-point pollution issues in developed countries – therefore, other institutional arrangements are needed). There is also the issue of equity – smallholder agriculture has low incomes and penalties will not work unless an alternative income strategy is implemented. It is therefore best to combine environmental policy with income generation policy. Here is where there are potential synergies between emission mitigation efforts and improving rural incomes and sustainable development.

Alternative methods of financing and implementing abatement subsidies

Project-based carbon offsets have the disadvantage of transactions costs of implementation. This requires a modified CDM for carbon offsets and additional complementary institutional arrangements to finance abatement activities for developing country agriculture. CDM reform options include the move from a project by project to a wholesale approach or to complement rather than replace the project-by-project approach. The three main CDM scaling up options include bundling, "program of activities" and geographic regions based programs. A range of alternatives to broaden participation by developing countries have been proposed including a "programmatic" CDM (through aggregation of individual projects into a "program of activities"), a "sectoral" CDM (with either a multi-project baseline for the sector or a national baseline), and a "policy" CDM (UNFCC 2008a; Burniaux et al. 2009; Schneider and Cames 2009; Baron and Ellis 2006; Baron, Buchner and Ellis 2009; Ellis and Kamel 2007).

Variations of the sectoral approach include a "sectoral no-lose target' and binding sectoral targets under which some developing countries could cap their emission levels or emission intensity. The latter has the advantage of reducing mitigation cost uncertainty (Burniaux et al. 2009) and of minimizing leakage (Holland 2009)[39].

A policy CDM is an option where specific government policies would deliver CERs. Eligible policies would be sectoral. These options would decrease transactions cost, but would not necessarily solve the problems of additionality, leakage and perverse incentives. Because of specific difficulties in dealing with REDD, experts recommend that REDD be implemented at a national rather than project based level. The same can be said for all emissions associated with agriculture and LULUCF. The FAO (2008) also calls for the funding of "Nationally Appropriate Mitigation Actions" - NAMAS (that account for differences in local conditions and that would be complementary to the CDM), the implementation of sustainable development policies and measures (SD-PAMs), and actions that link mitigation and adaptation.

Another option under discussion is to replace the CDM with a Fund to finance emissions reductions in developing countries (Burniaux et al. 2009; UNFCC 2008a). Such a policy would have the advantage of sheltering permit prices and giving direct control to parties the Kyoto over the amount of emissions abated, while allowing for the purchase of credits at different prices, depending on marginal abatement costs. This could increase developing country participation. Direct funding of mitigation efforts is also an option through the scaling up of Multilateral Funds or of bilateral initiatives. Efforts are also needed to encourage international transfers and deployment of climate related technologies and for developing countries remove policy distortions like barriers to trade and foreign direct investment, and the absence of or lack of enforcement of intellectual property rights. International cooperation is also likely easier to achieve in R&D than in mitigation efforts (Burniaux et al. 2009).

Wara and Victor (2008) and Ackerman (2008) are more skeptical of the CDM reflecting actual reductions in emissions and so argue for two additional elements: a Climate fund intended to finance critical changes in developing country policies;

[39]It is possible that intensity targets like California's low carbon fuel standard can increase GHG emissions (de Gorter 2009).

and infrastructure deals with the aim of shifting the longer term development trajectories that produce large reductions in GHG emissions. These two options would also be compatible with the argument in this paper for public subsidies of abatement activities for developing country agriculture.

Institutional considerations and capacity building

The bottleneck facing developing country agriculture's participation in GHG emissions mitigation is not always simply money. Efforts are also required to change institutions; there are not only infrastructural and technological barriers but also institutional barriers. Forest carbon sequestration projects face many formidable obstacles due, in part, to substantial transaction costs, large risk and uncertainties, long time horizons and high establishment costs. Gong, Bull and Baylis (2009) illustrate how social capital, property rights and contractual rules impact the local land users' willingness to participate. Uncertainties arise from ambiguous property rights, vague or rapidly changing government policies and unknown carbon market prices. Additionally, there is underlying risk from human-induced and natural disasters. The paper is a good example of how these three aspects affect the optimal design and implementation of a project, where they must not only provide sufficient financial incentives to land-users, but also need to incorporate the complex institutions in which they operate.

The FAO (2008) highlight four aspects of an enabling institutional and policy environment required to realize potential of emission mitigation for developing country agriculture (facilitate aggregation of carbon crediting; policies in agricultural, financial and environmental sectors that facilitate the flow of low carbon finance from private and public sectors; capacity building; and an agreed system of property rights to the carbon benefits that can be generated).

Implications for WTO rules

Issues surrounding WTO law and developing country agriculture with cap and trade and carbon offsets fall into broad two categories:

1. Because carbon offsets subsidize the reduction of GHG emissions in developing countries and runs contrary to the polluter pay principle developed by the OECD (2005), the CDM and this paper's call for more funding (with revenues from an expanded CDM beyond projects-only and complementary funds from other sources including the General Environmental Fund and traditional aid programs) seemingly violates subsidy rules under the WTO, namely the Agreement on Subsidies and Countervailing Measures (SCM) and the green box criteria under the Agreement on Agriculture
2. Import tax (export subsidy) adjustments for the effect of a cap and trade regime in taxing (increasing costs) to domestic producers is allowed under the WTO but with several provisos

The first category above deals with the validity of developing country policies while the second affects developing country export and import competing industries.

This paper argues abatement subsidies are superior for several reasons; not least because of the administrative and political infeasibility of levying taxes on developing country agriculture to reduce GHG emissions. Abatement subsidies correct two other distinct market failures, namely the public good nature of reducing emissions by altering production practices and technologies (rather than reducing fossil fuel consumption) and the public good nature of the innovation and diffusion of the requisite practices and technologies. Several co-benefits result. But there is a risk that such subsidies will be used to favor domestic production at the expense of imports (or competing exporters).

Governmental financing for the development and deployment of low-carbon goods and technologies may have an impact on the price and production of such goods. This leads to lower producer costs, leading to lower product prices. In turn, lower prices may reduce exporting countries' access to the market of the subsidizing country, or may result in increased exports from the subsidizing country. WTO rules are intended to constrain members' ability to adopt such protectionist subsidies while at the same time allow scope for legitimate subsidies (Tamiotti et al. 2009). There are various WTO rules on subsidies (including the now expired limited exception for environmental subsidies), impacting the ability to implement abatement subsidies.

Green (2006) identifies some potential reforms to the WTO rules that would permit policies that are more effective at addressing climate change while at the same time eliminating discriminatory policies. Tests for determining permissible subsidies are unlikely to be effective, so a broadened exception for environmental subsidies similar to Article XX of GATT, while not optimal, would be an improvement over the current rules.

Detailed rules on border tax adjustments (BTAs) exist in the General Agreement on Tariffs and Trade (GATT) and the WTO's SCM Agreement. These rules permit, under certain conditions, the use of BTAs on imported and exported products. The objective of a border tax adjustment is to level the playing field between taxed domestic industries and untaxed foreign competition by ensuring that internal taxes on products are trade neutral (Tamiotti et al. 2009). In the context of climate change, the debate has mainly focused on two aspects: the extent to which domestic carbon/energy taxes (which are imposed on inputs, such as energy) are eligible for border tax adjustments; and the extent to which BTAs may be limited to inputs which are physically incorporated into the final products.

The general approach under WTO rules has been to acknowledge that some degree of trade restriction may be necessary to achieve climate change goals, provided core principles of the GATT are respected (must not constitute a "means of arbitrary or unjustifiable discrimination" or a "disguised restriction on international trade"). If the BTA was found to be inconsistent with one of the core provisions of the GATT, justification might nonetheless be sought under the general exceptions for the environment to the GATT under Article XX.

10.5 Concluding remarks

It is well documented that developing country agriculture has a huge potential to reduce GHG emissions, mostly by altering production practices (not by reducing fossil fuel use directly). The sources of agriculture's reduction opportunities are many but mostly centre on altering production methods and technologies for soil carbon sequestration practices, midseason drying of irrigated rice, nutrient management to reduce nitrous oxide emissions, and management of livestock systems to reduce methane emissions. Because of the multifunctional nature of agricultural production, policies that mitigate GHG emissions can also correct for the market failures due to "technical" externalities of production (both positive and negative). In addition, there is a market failure in the innovation and diffusion of abatement technologies and production practices itself, requiring public expenditures in R&D and extension services. Correcting for these multiple market failures can be achieved most effectively through public subsidies of emission abatement activities, not with environmental taxes.

The efficacy of subsidized abatement activities are enhanced by several other considerations as well. For example, we show how targeted subsidies for abatement are less vulnerable to leakage and shuffling because they do not impose costs on firms, so firms have no incentive to relocate production or avoid costs, unlike with a tax on emissions. Carbon offsets provide such a mechanism for targeted subsidies, reducing emissions through the carrot of financial subsidies rather than the stick of emission limitations or environmental taxes.

In addition, public subsidies for abatement activities also help overcome the administrative infeasibility of employing emission taxes in developing country agriculture, reinforcing other rationales identified above for targeted subsidies of abatement activities. Meanwhile, these abatement subsidies have the potential to increase agricultural productivity, generating pecuniary externalities in the form of enhanced food security, poverty reduction and economic development.

However, agriculture's participation in the project-based CDM is also plagued with administrative infeasibility due to transactions costs related to implementation, monitoring and verification of emission reductions. As a result, agriculture has seen very limited use under the CDM. This requires a modified CDM for carbon offsets and additional financing mechanisms and institutional arrangements to finance abatement activities for developing country agriculture. Proposals have ranged from a scaled-up CDM (bundling, "program of activities" and geographic regions based programs) to a sectoral approach (sectoral crediting mechanisms and sectoral targets) to complementary public sector climate initiatives like a Climate Fund or the funding of "Nationally Appropriate Mitigation Actions". CDM reform options also include the move from a project by project to a wholesale approach like a "policy" CDM where specific government policies would be funded.

Abatement subsidy programs also represents an opportunity to reform domestic agricultural policy in developing countries where funds now used to subsidize inputs, for example, can be reconfigured to subsidize abatement activities. Reductions in developed country agricultural subsidies are also required to improve efficacy of GHG mitigation efforts in developing countries. Abatement subsidies should not run afoul of WTO law regarding subsidies, just as carbon offsets currently do not. In many cases, agricultural output will increase, reducing international prices and so reducing GHG emissions elsewhere as well (a positive leakage).

Because deforestation in developing countries is the largest source of emissions, caused primarily by land conversion to agriculture, activities in land use, land use change and forestry (LULUCF), reducing emissions in agriculture is interdependent with avoided deforestation and land degradation (REDD), afforestation and reforestation (A/R), forest management (FM) and biofuel production (which avoids emissions from fossil fuel consumption). Mitigation policies should be coordinated across all of these areas simultaneously, and because of the specific difficulties in dealing with these, be implemented at a national level.

The results in this paper show that carbon offsets benefit both the cap and trade economy and developing countries. Offsets also provide an incentive for regulated economies to further increase their emission reduction targets. Limits on carbon offsets (as is currently the case and proposed in U.S. legislation), however, hurt cap and trade economies while having an ambiguous impact on developing countries.

The paper also addresses the implications of distinguishing international from domestic leakages and from "shuffling" and "technical" leakage (differences in emissions intensities between countries). Domestic leakages in some cases can outweigh international leakage such that carbon tariffs can increase total leakage. The issue of leakage is shown to be important because it affects developing countries in both directions: the ability to sell offsets and the restrictions imposed on exports to countries with cap and trade regimes.

The conclusions of this paper are consistent with the Stern Review (2007) which emphasized complementary, non-market policies to create and adopt low-carbon technologies, leading to a new, green path to development. In addition to the market based carbon offset program under the CDM, public incentives, financial resources and investments for developing country agriculture to mitigate GHG emissions are needed to promote sustainable agricultural production practices and technologies.

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The recent world food crisis highlighted the critical issue of global food security and the need to enhance global agricultural production capacity to meet current and future food demand. Increased investment in agriculture and adequate incentives to farmers are required to meet this global challenge. A key challenge is how to shape and design support to farmers in both the developed as well as the developing world while minimizing those distortions to global markets that are potentially harmful to developing countries, and at the same time promoting global food supply adequacy, food security for the undernourished, and poverty reducing and growth incentives for the farmers in low income food deficit countries.

Developed countries provide support to farmers to increase farm income, reduce income variability, improve competitiveness of the agricultural sector, and provide for safe and quality food. Many farm support policies stimulate domestic production, but also create distortions in world markets, inducing disincentives in developing countries' agricultural production in the long run. These distortions have been the object of considerable debate within the World Trade Organization agreement on agriculture.

In developing countries farm policies have been driven largely by the need to accelerate a transition from low income agrarian structures to more developed industrialized and service oriented economies. The overall effects of such policies, have been largely to tax producers. In the process, the agricultural sectors in many developing countries have faced negative policy biases, low growth rates, and high poverty incidence, while inducing increasing import dependence.

The book provides a review of farm support in high income countries, and explores options for reshaping such farm support in a non-distortionary manner. It also addresses the responses needed in developing countries to ensure a long term and sustained faster growth in their agricultural sectors, enhanced food production, rising rural incomes, and lower poverty. The book is divided into two parts. In part one, it focuses on developed country farm support policies and their implications for market distortions in third countries, with particular focus on decoupled support and the complementary policies needed to support developed country farmers without creating market distortions. Other issues examined are risk mitigation and insurance related schemes, trade and market access reform under the Doha round, and biofuel policies.

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