FAO TRADE POLICY TECHNICAL NOTES
on issues related to the WTO negotiations on agriculture

No. 12.   Rice: what do analytical model results tell us?

CONTENTS

1   Introduction

2004 was declared the International Year of Rice by the United Nations General Assembly, a tribute to a commodity that is the staple food for about half of the world's population and also a major income earner in developing countries. Because of its strategic importance, rice has been subject to a host of policy interventions that have made it feature among the most distorted of all agricultural commodities. For this reason, rice is frequently specified in models that analyse the effects of trade liberalization. The objective of this technical note[1] is to review and compare the various analytical tools employed to assess such impacts, with the ultimate aim of shedding some light on critical issues under discussion in the current WTO Multilateral Trade Negotiations.

This note first outlines the characteristics of the rice commodity and of the international rice market. It then reviews the global quantitative models that have been utilized to simulate trade liberalization, examines the way they represent policies, and suggests a number of reasons why outcomes might differ, before summarizing and discussing their findings. Drawing on their results but also taking into account the shortcomings of the various analytical tools, this note highlights a number of issues to be borne in mind when interpreting the results from policy reform analysis.

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[1] This technical note benefits from discussion at an informal expert consultation held at FAO Headquarters in Rome on 22-23 November 2004.

2   Characteristics of the international rice market and implications for modelling

Rice provides about 20 percent of the global average calorie intake. Although produced and consumed across the five major continents, the crop is concentrated overwhelmingly in Asia, which accounts for some 90 percent of global production and consumption, with China and India alone responsible for about half of the world total. Rice is mostly consumed in the country where it is produced, so trade in rice is small, both in absolute terms and as a proportion of global production. With an average of 26 million tonnes in 2000-2003, the size of the international rice market is only one quarter of that of wheat and little over one third of trade in maize. Since the early 1990s, the volumes of rice exchanged internationally have risen quantity-wise, but also in relation to production, resulting in a "deepening" of the international rice market. Nonetheless, the world rice market remains much thinner than is the case for the other two major cereals, as rice traded on world markets only represented 7 percent of global production between 2000 and 2003, compared with 18 percent for wheat and 13 percent for maize. Likewise, rice imports or exports by large producing and consuming countries are generally very small compared with the volumes sold domestically. In those countries, relatively small changes in production or consumption might cause a switch in their net trade status, a potential source of international price instability and a major difficulty for models to capture.

The directions of international rice flows are fairly well-established, with Asian rice often

precluded from reaching markets in Latin America and the Caribbean where the United States and exporting countries in the region find their major outlets. Conversely, rice from the United States, Argentina or Uruguay has made few inroads in Asian markets, with the exception of Japan.[2] In recent years, however, the pattern of rice trade has shown a tendency to be less rigid, with rice from South America reaching markets in the Near East and rice from Thailand gaining access to Brazil. While transportation costs partly explain the pattern of trade flows, these are also influenced by phyto-sanitary measures, which have been adopted especially by several countries in Latin American and the Caribbean in relation to paddy rice imports of Asian origin. The relations between rice exporters and importers are also rooted in tradition. For instance, East African countries have historically been supplied with rice from Pakistan, while West African countries have been open to more diversified sources, importing rice from China, India, Thailand or Viet Nam. The entrenched nature of rice flows can only be reasonably depicted in spatially-structured frameworks that model the sources and destinations of rice trade among countries.

The thinness of the international rice market is a result of, but also a reason for, highly protective policies. Indeed, nations - especially those accounting for a large share of global production - are reluctant to rely on a thin world market, perceived as too small to provide a "dependable" source of supplies.[3] There are other reasons why government rice policies have traditionally been oriented towards self-sufficiency rather than self-reliance strategies. These are concerned with the frequently entrenched consumer preferences for locally produced varieties, which are not always available on world markets, but also with a host of benefits connected with rice cultivation extending beyond the availability of food or the generation of earnings to producers, associated with the preservation of complex agro-ecosystems, the conservation of landscapes and habitats and the cultural inheritance.[4] The food security aspects together with the "multi-functional" character of rice have been used as a justification for maintaining a high degree of intervention along the commodity chain from production to consumption. The complexity and the frequency of changes in national rice policies make the rice sector particularly difficult to model.

The particular characteristics of the commodity and the different degrees of protection applied across countries have also resulted in a segmented international rice market. Two major varieties of rice are traded: Indica rice, a long grain variety, which accounts for about 75 percent of total trade and is subject to relatively low tariffs, and Japonica rice, a medium grain variety, which accounts for another 12 percent of the world market, on which much higher levels of border protection are applied. The remainder is mostly accounted for by aromatic rice varieties (Basmati and Hom Mali), and a small fraction by glutinous rice, the tariffs on which also tend to be much lower than for Japonica rice.

Tariffs on rice products also tend to rise with the level of processing, with rates on husked or milled rice products generally higher than for paddy rice, as governments strive to protect their milling industry. Supply and demand responses also vary widely according to rice varieties. Failure to take account of those characteristics by not differentiating rice into Indica and Japonica considerably reduces the ability of models to assess satisfactorily the implications of the removal of policy distortions.

3   Approaches to quantitative analysis of policy reform in the rice sector

At the core of quantitative policy reform analysis lies a model, typically resting on either a partial-equilibrium (PE) or computable general equilibrium (CGE) approach, or variants of these, such as those that relax the assumption of perfect competition. In addition, PE or CGE models may adopt a dynamic specification (to examine how a particular sector adjusts over time), a comparative static specification (comparing one equilibrium point to another, assuming full adjustment has taken place) or a spatial specification (modelling trade flows among countries). In undertaking analysis, simulations are performed over the removal or modification of a set of policy variables and the results compared to a base model simulation.

• *Partial equilibrium (PE) models*

Agricultural PE models consider the various commodity sectors in isolation from the rest of the economy, largely by-passing linkages with other sectors and taking macro-economic variables such as income, factor prices, etc. as exogenous. PEs typically estimate the effects of changes in policies through their impacts on world prices, volume of trade, domestic production, consumption and (net) trade and use them to calculate welfare effects.

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[2] Because these countries have managed to compete successfully in medium grain rice tenders opened by Japan.

[3] For illustration purposes, when, in 2002, India incurred a 21 million tonne contraction in output in the wake of a poor monsoon season, the country covered the shortfall out of its own reserves. It is difficult to imagine how India could have secured those supplies on the international market, which only traded 28 million tonnes of rice, without triggering sharp increases in international prices.

[4] See: FAO 2004a.

Among the PE frameworks, AGLINK (OECD), IMPACT (IFPRI) and the Arkansas Global Rice Model (AGRM-FAPRI) commonly feature in liberalization studies dealing with rice. Both AGLINK and IMPACT are similar in construct, in that each is multi-commodity, structured as a set of country or regional sub-models that are linked through trade and world reference prices that clear international markets.

AGLINK and IMPACT aggregate rice across quality and types, while the AGRM segments rice sectors according to long grain and medium/short grain. All three models are dynamic and policy specific with respect to domestic support and trade interventions. In particular, AGLINK focuses on detailed representation of OECD policies that include, for example, automatic policy responses based on trigger levels (e.g. floor prices), interaction of domestic policy and border measures (e.g. export subsidies used to maintain internal market price support) and limits on policies that may be binding (e.g. the Uruguay Round Agreement on Agriculture (URAA) commitments).

The Agricultural Trade Policy Simulation Model (ATPSM), developed jointly by UNCTAD and FAO, is a comparative-static, multi-commodity, multi-region, partial-equilibrium world trade model for agricultural products. It is designed primarily for simulating agricultural trade policies, notably in the context of the URAA. The model produces a wide range of outputs, from impacts of policy reforms on world prices, volumes of trade and production, to welfare measurements.

The FAO World Food Model (WFM), a dynamic, multi-commodity model, the maintenance of which has been discontinued, was a global model treating individually virtually all countries in the world. Currently, projections and outlook within FAO are based on a global model known as the Commodity Simulation Model (COSIMO) - a multi-commodity, multi-country model based on the OECD AGLINK framework, but with much greater disaggregation by countries than AGLINK.

Early PE models that were employed to assess rice liberalization include the Static World Policy Simulation Model (SWOPSIM) developed by the United States Department of Agriculture (USDA). This model is flexible with respect to country and commodity coverage, by permitting the user to define the level of aggregation of each. Policy analysis is typically conducted on the basis of adjusting policy wedges. SWOPSIM was later provided with a dynamic specification, for example, the Lincoln Trade and Environmental Model (LTEM) of Lincoln University (New Zealand) and VORSIM of Roningen (1996, 1998).

Other dynamic applications of PEs to investigate agricultural liberalization include the Grains, Livestock and Sugar (GLS) model

developed by Tyers and Anderson (1988). The model is a multi-region, multi-commodity, global dynamic PE. Unlike other PE models, it allows for uncertainty in production, and stock-holding behaviour is endogenous in the model.

To date, there have been few applications of spatial PE models to examine policy reform in the global rice sector. An important contribution of models in this class is RICEFLOW, developed and maintained by the University of Arkansas. It is a static model for international rice trade subject to transaction costs including transportation, national policy interventions and bilateral, regional, and multilateral trade agreements. A novel feature of the model is that it is disaggregated by rice type, degree of processing, and quality. Reform analysis is conducted in a comparative static framework and limited to that pertaining to border protection. In contrast with the other PE models, which model the interactions among various agricultural commodity sectors, RICEFLOW deals with rice only.

• *Computable general equilibrium (CGE) models*

CGE models have also been widely utilized in the analysis of rice liberalization. Although they allow the effects of the non-agricultural sectors and of the macro-economic environment to be captured, their specification of rice policies is usually very simple, ignoring the multifaceted and non-homogenous nature of the commodity and the complexity and variety of rice policy instruments.

Among CGE models, the Global Trade Analysis Policy (GTAP) model and its variants, such as MIRAGE (Bchir *et al*, 2002) and GTAPEM (OECD), have been popular platforms. GTAP includes an economy-wide representation of major countries and regions. GTAP relies on the assumption that goods made in different countries are imperfect substitutes, consequently bilateral trade is identified and there is no single world price. It represents policies as price wedges and applies a uniform structure to represent the sector, but with varying parameters (to all 57 sectors in 66 countries). An attempt is made to tackle one type of market segmentation by separating paddy rice from processed rice (but not long versus medium grain rice).

Other CGE models typically employ the GTAP database. For instance MIRAGE is a multi-sector, multi-region computable general equilibrium (CGE) model, targeted towards policy analysis. Agricultural sectors are assumed to be perfectly competitive, but industrial and service sectors are not. An attempt is made by MIRAGE to model detailed agricultural polices in several OECD countries and also preferential trade regimes operated by certain OECD countries.

The Dynamic Global CGE model (Diao, Somwaru and Roe, 2001) is based on the GTAP data set. It allows for inter-temporal optimization such that capital accumulates in a given

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country/region over time endogenously. This feature implies that the model not only considers bilateral trade flows, but the financing of such flows. The model also introduces technology "spillovers" which captures the benefits of "learning" through trade - that is, countries which become more open to trade are likely to adopt technological advances embodied in the process of trade, which will enhance the country's own factor productivity.

Early attempts to examine rice policy reform using CGE frameworks include the Basic Linked System (BLS) model, the Rural/Urban North/South (RUNS) model, and the WARLAS model.

The BLS model of the International Institute for Applied Systems Analysis (IIASA) developed by Fischer, *et al.* (1988) is a dynamic general equilibrium model, accounting for approximately 80 percent of world agricultural production, trade, land availability and population through a system of 20 detailed national models. The remaining part of the world agricultural system is accounted for by 14 simplified models each representing a specific region. These sub-models have nine agricultural sectors and one non-agricultural sector. The analysis of trade liberalization is restricted to the removal of distortions between trade and domestic prices of the agricultural commodities.

The RUNS model is also a dynamic general equilibrium model. Developed by the Free University of Brussels and the World Bank, the model is global, disaggregated into 22 regions, and comprises 15 agricultural and five non-agricultural commodity sectors. Policy sensitivity analysis is conducted on agricultural input subsidies, price transmission elasticities and tariffs. A noteworthy feature of the model is that it allows differential responses in the rural and urban labour forces.

WARLAS is a comparative static general equilibrium model developed at the OECD. The model focuses on key interactions between the agricultural and non-agricultural sectors, and attempts to quantify the efficiency and welfare effect of OECD policies on OECD countries themselves. A total of 13 sectors are used to specify the whole economy. Policy simulation is accomplished by altering levels of policy support wedges and through other quantitative restrictions such as set aside and production quotas.

Although a number of models, based either on a PE or a CGE model approach, have been used to simulate the effects of policy changes in a particular country[5], they have been excluded from

this review, unless the analysis has considered wider liberalization scenarios.

4   Treatment of rice policies in quantitative models

With the possible exception of the dairy sector, there is hardly any other agricultural commodity exposed to a set of policy interventions as pervasive as is the case for rice. To illustrate the range and complexity of rice government policies, a short review of the principal instruments used by the major rice players is provided in the Annex. Treatment of those policies in models is critical to the outcome of analyses of liberalization.

• *Domestic support*

Support to the domestic rice sector has been channelled through a wide range of subsidies, applied along the cycle of the commodity's development, from infrastructure to marketing of the final product. Models which attempt to incorporate domestic support tend to do so in a crude and aggregated manner, generally without specifying the extent to which single support measures (e.g. input subsidies, market interventions or direct payments to producers) are linked to output, a critical issue for assessing the effects of market liberalization.

Part of the problem faced by modellers lies in the complexity of rice policies and with the pace at which governments change and report their nature and emphasis:

- High-cost rice producers, including the European Union, Japan, the Republic of Korea, the Chinese Province of Taiwan and the United States have run programmes to guarantee a <u>minimum price</u> to producers, usually at levels well above those prevailing on international markets. Since the implementation of the URAA, however, all have passed reforms that have switched the focus of their policies from indirect price support to direct income support, in the form of producer payments. The shifts have been associated with the introduction of <u>supply management programmes</u>, which have imposed ceilings to the level of production. Adherence to these schemes is usually a condition for producers to qualify for price support or <u>compensatory payments</u>. From a WTO perspective, the effects of the reforms implemented by the five countries above have been to cut indirect price support, classified as market distorting in the "amber box", while raising support to production-limiting programmes falling into the "blue box", or minimally distorting forms of assistance categorized as "green box".

- Governments, especially in the developing countries, have traditionally funded large <u>investment projects on land reclamation,</u>

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[5] For instance, IFPRI 2000 looks at the effects of liberalization at the national level in Viet Nam. Other studies focused on the opening of the rice market in Japan (Taniguchi 2001).

irrigation, drainage or flood controls in their thrust towards rice self-sufficiency. Subsidies on inputs and basic services are still widely employed, for instance as a means to promote the cultivation of hybrids or improved rice varieties. Although they tend to benefit the more technologically modern rice producers, who rely most on irrigation and chemical applications, input subsidies are often essential to help traditional rice producers to get access to the new technologies. Moreover, in most irrigated schemes, the water, energy and infrastructure maintenance costs are only partly covered by producers, with the rest being subsidized. Governments also grant subsidies on basic services such as processing, transportation or storage.

- Traditionally, major rice producing developing countries set a minimum price level for the crop and conducted interventions through state-controlled agencies, responsible for procuring rice when prices fall below the minimum level or for releasing rice from state-owned reserves (or to import), to keep rice prices within the reach of consumers. Over the past three decades, the number of developing countries granting statutory power to an institution to conduct rice market interventions has fallen substantially. Often, the disengagement of governments took place within the context of structural adjustment programmes and was associated with the dismantling of the commodity boards responsible for administering price support programmes. Even when such agencies are still in place, their status has changed, and it is often unclear to what extent they function along the same economic principles as a private enterprise or have to meet specific social goals, such as food security or price stabilization, as is the case of BERNAS in Malaysia, BULOG in Indonesia, the Food Corporation of India (FCI) or the National Food Authority (NFA) in the Philippines.

- In the past, developing countries tended to deliberately keep rice producer prices low relative to international levels, to keep rice affordable to the population, and to facilitate exports. The sector also used to be taxed in order to support national development objectives. This was historically the case of major rice exporting countries, such as China, India, Pakistan, Thailand and Viet Nam. The long run tendency for world rice prices to fall in real terms combined with sustained economic growth fostered a radical shift in those policies, to the point that several of these now appear to be in transition from taxing to subsidizing their rice sector (IFPRI, 2004 and 2004a). This is seldom the case in the least developed countries, with Myanmar,

for instance, still implicitly taxing paddy growers by setting compulsory low selling prices to the state trading agency. However, it is noteworthy that often, in the endeavour to reduce the budgetary cost of market interventions, several developing countries are progressively abandoning market interventions while moving to border measures to protect their sector and avert large domestic prices fluctuations. A few[6] have also turned to direct payments to support farmers' incomes.

Two principal measurements, in the form of price wedges, provide the basis for modelling domestic support. The Aggregate Measurement of Support (AMS), derived from the WTO definition, and the Producer Support Estimate (PSE), which is calculated and updated regularly by OECD. Other models, e.g. AGRM, rely on a mixture of other calculated wedges (non-PSE) and multiplicative factors, typically embodied in producer price and supply equations, to capture the effects of domestic support. The inclusion of individual policy measures for the purpose of calculating those wedges is often based on judgement regarding their effects on production. For instance, not all models treat payments to farmers falling in the blue box or green box categories as production-neutral, especially because they are perceived to reduce the risk faced by producers. The OECD employed a "Policy Evaluation Matrix" (PEM, see Dewbre, Antón & Thompson, 2001; OECD, 2001) to estimate the extent to which decoupled payments affect production.[7] Other models that attempt to assess the impact of decoupling include the AGRM. This assumes for the United States a 25 percent response of output to direct payments and a 50 percent response to Counter Cyclical Payments. Similarly Bouët *et al.* (2003) in their MIRAGE model treat the decoupled payments as having an impact on production equal to 30 percent of that of an input subsidy.

The use of the AMS (e.g. by ATPSM) presents various problems. Among its shortcomings, AMS is computed on the base of the 1986-88 reference prices and includes only the production-coupled support classified as "amber box". For these reasons, models that assess the impacts of liberalization (e.g. AGLINK, IMPACT, WALRAS and GTAP) often use other measurements of support, in particular the PSE. However, the PSE not only reflects the direct budgetary transfers from the government to a particular commodity sector or to the agriculture overall, but embodies

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[6] Mexico, China and Turkey.

[7] Results from this analysis, which include a decoupling parameter and a fixed risk factor derived from estimation of a truncated price probability distribution, have been fed into the AGLINK model.

the positive effects of trade policies on producer incomes. It may therefore differ widely from the AMS as illustrated by the case of Japan. The latest AMS notifications by Japan to the WTO show no crop-specific AMS for rice, in contrast with the OECD rice PSE for Japan which, in 2003, was assessed to be in the order of US$14 billion. On the other hand, PSEs, though encompassing blue box and green box types of support, also present some limitations, the most serious of which is that they are calculated only for OECD and a few non-OECD countries.

• *Market access*

Trade measures have become of growing importance. Despite the tariffication process undergone with the implementation of the Uruguay Round Agreement (URAA), there is still a wide array of trade measures that shield domestic rice markets from foreign competition, including tariffs, variable levies, minimum import/export prices, import/export quotas, state trading controls, special safeguards, market preferences, phyto-sanitary standards and outright import/export bans. Specification of those particular trade features is often problematic for modellers, with many resorting to price wedges to estimate the implicit tariff rate equivalent.

Because of the importance of rice for many countries, tariffs on rice have generally been bound at very high levels, with the simple average of ad valorem bound rates reaching 99 percent in 1994, falling at the end of the URAA implementation periods to 57 percent. Those averages, however, do not take into consideration the specific tariff rates. Models often convert these into an ad valorem equivalent by simply establishing the relation between the specific tariff and the average unit value of rice imports, although they seldom explicitly state how they handle the issue. Models either use WTO bound tariffs or the applied tariffs as the base for their projections. The second option, while more realistic, raises difficulties for result comparison, as models do not always use the same initial tariff level before simulating border trade liberalization. Furthermore, multilateral negotiations are presently considering non-linear reduction of tariffs in order to address tariff peaks, e.g. the Swiss type cuts. Few models embody non-linear tariff cutting formulae (e.g. ATPSM). As many governments undertake to protect their milling sectors, tariff escalation is a phenomenon of relevance also for rice, with higher rates applied on the most processed rice products.

Most quantitative tools treat rice as either a homogeneous commodity, subject to a unique tariff rate[8], or distinguish between paddy[9] and

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[8] Calculated as the simple or weighted average of the different rice products tariffs.

[9] Rice in the husk, whether gathered or still in the field.

processed rice, a categorization typical of CGE models using the GTAP framework. This distinction, however, barely improves the representation of the international rice market because paddy rice accounts for a small fraction of international trade, while the "processed rice" aggregate lumps together husked and milled rice, which normally face very different tariff rates.

Moreover, models often fail to take into consideration the division of the world rice market into Japonica rice and Indica rice segments. Given the large differences in tariffs for the two different rice varieties and the different responses by producers or consumers, models dealing only with "rice" as a homogenous commodity may wrongly assess the impacts of a removal of trade distortions or market support. Among the different PE models reviewed, only AGRM and RICEFLOW look at the effects of trade liberalization on the rice sector from a disaggregated commodity perspective that distinguishes Japonica from Indica rice.

Eighteen countries have tagged rice as a product subject to the Special Safeguard (SSG). In recent years, the WTO price or volume special safeguards have been invoked on rice by the Chinese Province of Taiwan, Costa Rica, Nicaragua and Japan. Trade safeguards against rice imports have also been raised within the framework of regional trade agreements, in particular NAFTA and the Andean Pact. Because safeguards are triggered in response to temporary shocks, models typically do not deal with them.

State trading enterprises (STEs) are often the main if not the sole entity to import rice. They play a key role in regulating rice imports in China, Malaysia, the Philippines, Indonesia and Sri Lanka but also in Comoros, Cuba and Kenya. Although STEs are increasingly required to operate on a commercial basis and to be financially self-sustaining, they do not always pursue pure profit maximization objectives, as they have been mandated to fulfil social-oriented functions, such as domestic price stabilization and food distribution to the poor. Given the diverse, often complex operations of STEs, it is not surprising that models have made no attempt to incorporate their functions explicitly into their frameworks, which means that models implicitly assume that STEs conduct their market operations along the same principles as private trading corporations. However, a study by FAO (2002a) estimated that as much as 40 percent of global rice transactions involved the participation of STEs. Consequently, the implicit assumption in most liberalization analyses that all trade is conducted under competitive conditions could lead to misleading results.

Seventeen countries committed to open tariff rate quotas (TRQs) or minimum access quotas under the WTO, most of which impose high out-

of-quota bound tariffs. In addition, preferential access has been granted under regional agreements, which have multiplied over the past ten years. Given the proliferation of such agreements, not all countries face the same access conditions to the various rice markets, a difficulty for models that can only be overcome through spatial frameworks. However, some non-spatial models attempt to deal with TRQs through conditional statements that would allow for discontinuity in the import function.

Modelling trade preferences also raises problems. In the case of rice, low tariff access is mostly granted under the General System of Preferences (GSP) of the United States and by the EU, for instance under the Cotonou Agreement and the Everything-but-Arms Initiative. Among the Cotonou countries, the major rice exporters to the EU are Guyana and Suriname, which have small and highly specialized rice economies developed under preferential access to the EU. The ending of these preferences, or even the erosion of the preferential margins which would follow a multilateral decrease in tariffs, are deemed to have a significant negative impact on such countries. As with TRQs, trade preference are best modelled in a spatial framework. Given the complexity of administering preferential access agreements, only a few models have made an attempt to conceptualize them (e.g. ATPSM, MIRAGE and RICEFLOW).

- *Export competition*

Officially, only the EU still appears to make use of export subsidies to sustain rice sales abroad, subject to the WTO quantity and expenditure limits of 133 000 tonnes in milled equivalent and €36.8 million respectively. In 2002/03, the EU notified a level of subsidized exports of 127 700 tonnes corresponding to an outlay of €24.9 million, or €195 per tonne. Other forms of assistance to rice exporters have been granted in the form of export credit guarantees, in particular by the United States, but difficulty to assess the subsidy element in the credit has generally prevented these from being explicitly considered in liberalization scenarios.

Food aid in rice has hovered around 1.4 million tonnes in recent years, representing about 5 percent of world trade in rice. The principal donors have been the United States, Japan and countries in the EU. In 2002 and 2003, large volumes were donated by the Republic of Korea and China.

State control over rice exports is less frequent, but still dominant in China, Viet Nam and Myanmar. Typically, sales by the state trading enterprises are not only driven by market conditions but also by political considerations and concerns over food security. Similarly, non-economic motivations often dominate government-to-government transactions, popular among developing countries. Information on

prices, credit and other terms of the deals concerning exports by state trading agencies and government-to-government transactions is often unavailable to analysts. This is also the case with single-desk rice trading agencies, such as the Rice Marketing Board for the State of New South Wales (RMB), which is responsible for much of Australia's rice exports. The nature of the support granted by state trading enterprises is often unclear. Between 2001 and 2003, for instance, the Food Corporation of India (FCI), the government food agency responsible for procuring, storing and distributing rice, sold rice at exceptionally low prices to exporters only, stating it did not resort to export subsidies *per se*, but rather assisted exporters by covering their transportation and storage costs.

Especially where trade is under state control, rice export bans/taxes are sometimes triggered as a means of preventing domestic prices from increasing. Taxes on rice exports are also applied by a few countries as a source of government income. Permanent export bans on paddy rice are also in place in a number of countries to ensure an adequate supply of raw rice for the milling industry. Indeed, export bans or taxes are often used in the same manner as tariff escalation, with the aim to enhance the country's ability to produce higher value-added products.

With the exception of the subsidies/taxes or permanent bans, export-related policy measures, including export credits, state trading, government-to-government transactions, food aid, etc. are seldom explicitly considered in models. However, all have been selected as themes for further disciplines in the proposed July 2004 Framework for Establishing Modalities in Agriculture, as they are deemed to play an important role in influencing the patterns of trade. By not conceptualizing them formally, models are ignoring important forces that drive the rice sector.

5   Modelling policy reform in the rice sector

The central argument of those advocating global liberalization is that reductions in border tariffs, export and internal subsidies would result in a fall in domestic prices such that, at the world level production would decrease and consumption rise. Consequently, excess demand in the liberalizing countries would foster higher international prices and, in most situations, an expansion in trade volumes.

There are numerous studies that have employed modelling frameworks to examine the impact of varying degrees of policy reform. These studies range from those that model the effect of reform in a particular country to those that assess the impact of a particular WTO proposal and, ultimately, to studies that gauge the effects of complete global policy liberalization. Notwithstanding fundamental differences in

modelling approaches, such divergences in what is being modelled and also what is being reported, can render interpretation a perplexing exercise.

• *Review of existing liberalization studies*

Despite the wide range of frameworks that have been employed and the wide range of assumptions and simplifications that have been made, there is broad consensus concerning the main impacts of policy reform on international markets, at least in the direction of the effects. Table 1 summarizes the findings of the major studies that have been undertaken to date.

Results show, for instance, that under full global liberalization under different model approaches,[10] where "full liberalization" is defined as the removal of both domestic and trade distortions, international (export) prices would increase in the order of 10 to 14 percent with concomitant trade expansions ranging between 29 and 47 percent. Results from studies that have examined scenarios that involve less than full liberalization are far more divergent. For example, under global free trade, export price increases vary from less than 1 percent to around 11 percent, while under partial liberalization scenarios, such as policy reform in industrialized countries only, international prices are shown to respond by -3 percent to +21 percent.

As can be seen in Table 1, studies that employ partial equilibrium and general equilibrium frameworks have dominated research in rice policy reform.[11] Scenarios that have examined the removal of distortions in industrial countries as a group and those that have assessed the impact of global free trade together with complete global liberalization have been popular scenario choices in research. It is noteworthy, however, that scenarios that involve either trade-only liberalization or domestic-only reform are conducted mainly for illustrative purposes, as it is virtually impossible for the two sets of reforms to be implemented independently in a sustainable manner. Depending on the approach adopted but also on the assumptions they make regarding the linkages of policies with production, models sometimes differ in their appraisal of the relative importance of the three policy pillars (market access, domestic support and export competition) in their effects on the international market. In most cases, however, both General Equilibrium (GE) and Partial Equilibrium (PE) models have tended to identify trade policies as the major source of

market distortion, as opposed to domestic support.

• *PE model results*

Differing scenario designs make comparisons difficult. Assessments of full liberalization in the global rice market have been conducted by IMPACT (IFPRI, 2001), AGRM (FAPRI, 2002) and AGRM (Wailes, 2005). Reference prices are projected to rise by 14 percent in the IFPRI study and just over 10 percent in FAPRI analysis. However, in the AGRM/Wailes research, prices of long grain rice are predicted to rise by 22 percent and medium grain rice by 80 percent. The AGRM/FAPRI analysis foresees global rice trade expanding by as much as 29 percent, with much of the expansion in exports accounted for by China, India, Viet Nam and Thailand, while, because of the removal of domestic support in the United States, rice exports by the country are predicted to decline to the extent that the country switches to becoming a major rice importer. On the import side, full liberalization leads to much larger rice inflows to the Republic of Korea, Japan, the EU and the Philippines, while those directed to Brazil fall substantially. AGRM/Wailes, however, identified a smaller global trade expansion of 15 percent.

AGRM/FAPRI and the AGRM/Wailes also analysed the impact of trade-only liberalization and found similar results in the direction and magnitude of global price and trade impacts to their respective full liberalization scenarios. At the single country level, however, results differ according to scenario. For instance, removal of border protection only in the EU boosts the Union's imports, consumption and stocks, with little impact on area while, under full liberalization, production falls dramatically. Both studies concluded that trade barriers were the main distortion to the international rice market.

OECD (2002) employed their AGLINK model to examine the continuation of the URAA export subsidy reductions and URAA market access expansion. The impact of both sets of reforms on international rice prices was found to be very small, from 0.2 percent in the first scenario to 0.5 percent in the latter. OECD (2004) simulated the effect of a 50 percent cut in all forms of OECD policy intervention (domestic payments and trade protection). The analysis resulted in a 1.5 percent increase in the global rice price and confirmed that trade liberalization measures contributed more to higher prices than other types of reform. Marginal impacts on global rice prices were likewise identified by FAO (2002a) using ATPSM. Two WTO-modality based scenarios were conducted (see Table 1), the first resembling a continuation of all commitments stipulated by the URAA, with the second involving somewhat deeper cuts in commitments (e.g. the use of Swiss formula in tariff rate cuts). In the first

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[10] In the case of CGEs, liberalization will encompass all sectors, agricultural and non-agricultural. In the case of PEs, liberalization may concern either selected agricultural commodities or rice alone.

[11] Another approach that can be employed to model policy reform includes econometric-based models, such as Vector Autoregressive Models.

scenario, international rice prices were foreseen to rise by 1.3 percent and trade to expand by around 5 percent, while in the second, rice prices and trade were anticipated to increase by 3.7 percent and 15 percent, respectively.

Roningen and Dixit (1989) and Krissoff, Sullivan and Wainio (1990) using SWOPSIM, examined agricultural liberalization in industrialized countries. Both studies predicted large rises in international rice prices, but again it must be kept in mind that models were simulated in the pre URAA era, when greater scope for liberalization existed. The GLS model, in addition to finding an increase of 4 percent in global rice prices, also estimated a 9 percent reduction in rice price instability stemming from reform in industrial countries combined with tariffication, the only study among those reviewed that dealt with variability in prices. A more recent study employing a dynamic PE model can be found in Agbenyegah (2001). The author used LTEM, a dynamic modification of SWOPSIM. In contrast to many other studies, Agbenyegah identified decreases in global rice prices under a host of free-trade scenarios. The author concluded that higher consumer supports vis-à-vis producer supports were the reason for the perverse results. However, the magnitude of price changes was found to be exceptionally small bringing into question the significance of the findings.

The importance of the segmentation issue is again highlighted in a recent study using the spatial PE model - RICEFLOW. The results of this study appear strikingly consistent with those from the segmented rice PE model – AGRM. Under a scenario of free trade, RICEFLOW identified large differential price effects according to rice type, quality and the relative degree of distortion. For instance, the medium grain market, in which initial protection was the highest, experienced the largest export (import) price increases (decreases). By contrast, in the long grain sector, which is subject to far less protection, price impacts were much smaller. A significant expansion in imports was identified in the low quality long grain markets, such as Bangladesh, Indonesia, and the Philippines. The RICEFLOW study also estimated a net increase in economic welfare of more than US$7 billion per year through liberalization in the global rice sector. Most of the gains are achieved by eliminating tariffs on imports, where consumers gain US$33 billion, while producers in importing countries lose US$27 billion. By contrast, in exporting countries, producers gain US$70 billion and consumers stand to lose US$68.8 billion. In addition, Governments are estimated to lose US$3 billion in tariff revenue but gain a similar amount in eliminating domestic supports.

- *CGE model results*

Scenario design in CGE models has been diverse, reflecting the significant flexibility of this modelling platform. OECD (2002) used GTAP to simulate the continuation of the URAA export subsidy reductions and of the URAA market access expansion. The impact of both sets of reforms on international rice prices was found to be very small, at 0.5 percent in the first case and 0.7 percent in the latter. The study also considered four alternative liberalization scenarios, namely reform in: OECD agriculture, all OECD sectors, global agriculture and global multi-sectoral reform. Again, the effects on the price of rice were found to be no greater than 1 percent in any of the simulations.[12]

Antimiani, Conforti and Salvatici (2005) used a standard GTAP model to assess the impact of the various proposed WTO modality frameworks, in particular, the Harbinson and Girard (a Swiss type formula for tariff cuts) proposals on the reform of agricultural markets. The latter proposal, which assumes deeper cuts in member country commitments, resulted in simulated impacts on domestic paddy prices of up to 14 percent, compared to 11 percent under the Harbinson scenario. Similar effects on paddy prices of modelling the Harbinson proposal were identified by Bouët *et al.* (2003). The authors used a variant of GTAP termed MIRAGE, which relaxes the assumption of perfection competition.

Bouët *et al.* also considered alternative scenarios including free trade and a 50 percent reduction in domestic support. In all simulations the effect on milled rice prices, while positive, remained very small. Trade-only liberalization resulted in much lower global price impacts. However, under the domestic support reduction scenario, paddy prices increased by up to 12 percent, with negative trade effects in paddy observed in the EU and the United States. Both countries also lose market shares in paddy trade in the Harbinson scenarios, with the Cairns group of countries recording major gains. Exports of milled rice, under the free trade and Harbinson simulations, rise dramatically in percentage terms for many countries/regions, with the African, Caribbean and Pacific Group of States (ACP) experiencing the largest expansion. The study also reported changes in preferential access to the EU(25) and United States markets under the Harbinson scenario. Imports of all rice by the EU(25) from Cotonou countries were not affected by Harbinson liberalization, but for milled rice, these countries experienced small preference erosion in the United States market.

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[12] It is interesting to note that OECD reached similar price impacts from both liberalization scenarios under a PE framework, using AGLINK.

In a subsequent study, Bouët *et al.* (2004) simulated the impacts of the Doha Round again using MIRAGE. The effects of reform of the "three pillars" were examined individually and also in aggregate. The total impact on prices of aggregate reform was stronger for paddy rice at around 9 percent, compared to 1 percent for milled rice. Reductions in domestic support were identified as the largest contributory factor in the price changes, with almost 90 percent in the case of the paddy price rise, and 60 percent for milled rice.

The OECD (2004) employed a variant of the GTAP platform, GTAPEM, which takes into account product differentiation, to assess the influence of a 50 percent cut in all forms of policy support. Under this scenario, international rice prices were estimated to rise by as little as 3 percent. However, unlike the MIRAGE analysis, the study found that trade reform measures contributed to over 80 percent to the change in the rice price. Dimaranan, Hertel & Keeney (2004) examined a similar scenario using a standard GTAP model. Negligible or small price impacts in this study were also identified.

By contrast, Diao, Somwaru & Roe (2001) used a dynamic CGE model to simulate policy reform under various scenarios, including the removal of all distortions (full liberalization), of all export subsidies, of all tariffs and of domestic support in the developed countries only. The impact on prices, trade and production volumes was most pronounced under the full liberalization and tariff removal scenarios, while liberalization under the other scenarios had only minor impacts. Under full liberalization, prices increased by 10 percent, global trade expanded by 47 percent and overall production contracted by around 2 percent, while under tariff removal, these figures were 6 percent, 53 percent and 1 percent respectively. Under both scenarios, rice production in developed countries was estimated to fall by 6 to 8 percent, while increasing by around 1 percent in the developing countries.

Table 1: Quantitative policy reform analysis in the rice sector - results from selected studies

Model	Source	Equilibrium Type	Base Year	Projection	Liberalization Scenario	Rice Type	Effect on Price (percent)	Other Effects
AGLINK	OECD (2004)	Partial dynamic	2003	2013	50 percent cut in tariffs, export subsidies and domestic support	Milled	1.50	55 percent contribution by trade measures to change in world price
AGLINK	OECD (2002)	Partial dynamic	2001	2011	URAA export subsidy reductions - continuation in OECD countries	Milled	0.20	
					URAA market access improvement - continuation in OECD countries	Milled	0.50	
AGRM	FAPRI (2002)	Partial dynamic	2001/02	2011/12	Full	Not specified	10.30	Trade expansion of 29 percent
					Free Trade only		10.60	Trade expansion of 27 percent
AGRM	Wailes (2005)	Partial dynamic	2001/02	2011/12	Domestic support	Long grain	negligible	
						Medium grain	negligible	
					Free trade	Long grain	19.00	Trade expansion of 16 percent
						Medium grain	102.00	
					Full	Long grain	22.00	Trade expansion of 15 percent
						Medium Grain	80.00	
IMPACT	IFPRI (2001)	Partial dynamic	1997	2020	Full	Milled	14.00	
WFM	FAO (1996)	Partial dynamic	1986/90	2004	URAA	Milled	8.00	Negligible effects on production and consumption. Small increase in trade, accounted for mostly by developing country exports
LTEM/VORSIM	Agbenyegah (2001)	Partial dynamic	2000	2013	Free Trade	Milled	-1.00	Global welfare increase of US$40.5 billion (US$13.6 billion in developed and US$26.9 billion in developing countries)

Model	Source	Equilibrium Type	Base Year	Projection	Liberalization Scenario	Rice Type	Effect on Price (percent)	Other Effects
					Free trade in developed countries	Milled	-0.50	Global welfare increase of US$13.6 billion (US$13.5 billion in developed and US$0.04 billion in developing countries)
					URAA continuation	Milled	-1.00	Global welfare increase of US$6.2 billion (US$2.5 billion in developed and US$3.7 billion in developing countries)
					Free trade in Japan and the Republic of Korea	Milled	-1.00	Global welfare increase of US$20.3 billion (US$13.6 billion in developed and US$6.7 billion in developing countries)
ATPSM	FAO (2002a)	Partial static	1996-98	n/a	36 percent cut in tariffs, 20 percent increase in TRQs, no change in in-quota tariff, 20 percent cut in AMS, 21 percent cut in export subsidies	Milled	1.30	Trade expansion of 5.1 percent
					Swiss formula tariffs cuts (parameter of 0.25), 50 percent increase in TRQs, 0 percent in-quota tariff, 80 percent cut in AMS, elimination of export subsidies	Milled	3.7	Trade expansion of 15 percent
SWOPSIM	Roningen & Dixit (1989)	Partial static	1986-87	n/a	Liberalization in OECD	Milled	18.3	
SWOPSIM	Krissof, Sullivan & Wainio (1990)	Partial static	1986	n/a	Liberalization in industrialized countries	Milled	11	
Ziets and Valdes	Ziets & Valdés (1990)	Partial static	1987	n/a	Liberalization in industrialized countries	Milled	-2.8	

Model	Source	Equilibrium Type	Base Year	Projection	Liberalization Scenario	Rice Type	Effect on Price (percent)	Other Effects
GLS	Anderson & Tyers (1992)	Partial dynamic	1991	2000	Liberalization in industrialized countries	Milled	4.1	9 percent fall in price instability resulting from combined tariffication and 50 percent cut in industrialized country protection rates
RICEFLOW	Wailes (2005)	Partial spatial static	2000	n/a	Free trade	Paddy Long Grain	Export price: 3.7, Import price: -10	Trade expansion of 4.4 percent
						Low Quality Long Grain	Export price: 6.6, Import price: -14.1	Trade expansion of 13.2 percent
						Fragrant	Export price: 0.7, Import price: -41.5	Trade expansion of 0.7 percent
						All Long Grain	Export price: 1.8, Import price: -17.7	Trade expansion of 7 percent; US$1.1 billion increase in welfare
						All Medium/Short Grain	Export price: 90.6 Import price: -27.4	Trade expansion of 58.6 percent; US$4.3 billion increase in welfare
						All rice	Export price: 32.8, Import price: -13.5	Trade expansion of 15.4 percent
GTAP	GTAP (2005)	General static	2001	n/a	Harbinson	Paddy & milled	less than 11	
					Swiss type (Girard)	Paddy & milled	less than 14	
GTAPEM	OECD (2004)	General static	2001	n/a	50 percent cut in tariffs, export subsidies and domestic support	Milled	3	70 percent contribution by trade measures to change in world price

Model	Source	Equilibrium Type	Base Year	Projection	Liberalization Scenario	Rice Type	Effect on Price (percent)	Other Effects
GTAP	OECD (2002)	General static	1997	n/a	URAA - continuation in OECD countries	Milled	0.5	
					URAA - global continuation	Milled	0.7	
					Multi-sector OECD reform	Milled	0.9	
					Multi-sector global reform	Milled	0.8	
GTAP	Dimaranan, Hertel & Keeney (2004)	General static	2001	n/a	50 percent cut in OECD support	Paddy & milled	Paddy: 0.26 Milled: 0.27	
					50 percent cut in OECD support and re-instrumentation	Paddy & milled	Paddy: 0.711 Milled: -0.209	
Dynamic Global CGE Model	Diao, Somwaru & Roe (2001)	General Dynamic	1997	2012	Full	Paddy	10	Global trade expansion 47 percent, global production contraction 2 percent (production falls 8 percent in developed countries, production rises 1 percent in developing countries)
					Free trade	Paddy	6	Global trade expansion 53 percent, global production contraction 1 percent (production falls 6 percent in developed countries, production rises 1 percent in developing countries)
					Domestic support	Paddy	2.5	Global trade contraction 1 percent, global production contraction less than 1 percent (production falls 1 percent in developed countries, production rises less than 1 percent in developing countries)

Model	Source	Equilibrium Type	Base Year	Projection	Liberalization Scenario	Rice Type	Effect on Price (percent)	Other Effects
					Export subsidies	Paddy	1.5	Global trade contraction 2 percent, global production contraction less than 1 percent (production falls less than 1 percent in developed countries, production rises less than 1 percent in developing countries)
BLS	Fischer, et al. (1988)	General dynamic	1990	2000	Liberalization in EU	Paddy & milled	1.5	
					Liberalization in OECD	Paddy & milled	21	
WALRAS	Burniaux et al (1989)	General static	1986/88	n/a	Liberalization in OECD	Paddy & milled	17	
RUNS	Burniaux & van der Mensbrugghe (1990, 1991)	General dynamic	1985	2002	Liberalization in OECD	Paddy & milled	2.4	
MIRAGE/GTAP	Bouët et al (2003)	General static	1997	n/a	Free trade	Paddy & milled	Paddy: 3.8 Milled: 1.04	Milled exports rise: ACP 180 percent, US 98 percent, Cairns 34 percent, Developed Asia 37 percent, China 34 percent
					50 percent cut in domestic support	Paddy & milled	Paddy: 11.74 Milled: 1.29	Little change in milled rice trade. 71 percent and 52 percent fall in EU(25) and US paddy exports, respectively
					Harbinson	Paddy & milled	Paddy: 14.54 Milled: 2.29	Large falls in EU (25) and US paddy exports. Significant increases in milled trade observed for most countries
					Harbinson (doubled elasticities)	Paddy & milled	Paddy: 14.26 Milled: 3.06	
MIRAGE/GTAP	Bouët et al (2004)	General static	2001	n/a	Doha Round	Paddy & milled	Paddy: 9.4 Milled: 1.0	Reductions in domestic support largest contributory factor

6   Why do results differ?

It has already been mentioned that the basis of policy reform vastly differs when replicating the provisions of the URAA or when considering other types of liberalization. For instance, domestic support defined by the AMS indicator is not equivalent to the OECD PSE measure. The impact of cutting applied tariff rates would not be the same as that of reducing bound rates. In essence, the outcome of liberalization analysis depends largely on how models treat and measure policies.

Equally, variations in results can be largely explained by different model frameworks (e.g. in the chosen type of equilibrium, structure and specification), contrasting assumptions (e.g. in parameterization) and selection of base year. Critical to understanding model results is knowing not only what the model includes but also what the model excludes, from its analytical framework.

The following illustrates some of the more important issues:

• *PE versus CGE models*

PE models have the advantage of being less demanding in terms of data and of theoretical consistency, thus making them more amenable to conducting sectoral analysis. In contrast to CGE models, PE models generally ignore interactions between other sectors; the constraints linked to the equilibrium of factor markets and the macro-economic equilibrium of the economy; and possible feedback effects. While being acceptable in their use to approximate shocks of limited magnitude, PE models have potential drawbacks when fuller liberalization is considered. For instance, by not taking into account the economy-wide constraints, PE models are likely to overstate impacts on trade, prices and output. Accordingly, CGE models may appear to be a better choice among modelling frameworks. However, compared to PE models, they are typically short of commodity detail and hence represent only crudely the commodity and policy interactions within the agriculture sector.

• *Dynamic versus static*

Comparative static models provide an effective shortcut to assess the long run costs and benefits of policy reform. However, in doing so, static models fail to provide an insight regarding the long run fiscal sustainability of existing agricultural policies and the transitional costs of any reform.

• *Parameterization/exogenous variables*

Viewed from a modelling perspective, rice production is normally assigned low elasticities of supply, especially in those countries where the sector is heavily dependent on the monsoon pattern, as few crops can stand the flooding conditions under which paddy thrives. The large investments required to develop land, irrigation and basic infrastructure suitable for rice also tend to result in rather low long run supply elasticities. On the demand side, rice consumer responses to price signals are smaller than for non-basic food commodities, but they tend to react to changes in income and, especially, urbanization. Income elasticities are still positive in a number of poor developing countries, but have already turned negative in fast growing countries, such as China or Malaysia.

The solutions to the models are highly sensitive to the values of the parameters (e.g. elasticities) that have been used. While some studies have estimated parameters econometrically, others have assumed them using the judgement of the researcher or borrowing them from other studies. Such an approach could be problematic, since the information contained in the probability distribution associated with the parameter estimate is not known. On the other hand, econometrically estimated parameters may not take account of the fact that conditions and constraints facing producers in the future can be quite different from those influencing past supply responses. Whichever approach to parameterization is taken, it is important to state how they were selected to ensure that they have not been chosen to produce pre-determined results.

Similarly, assumptions concerning population, income, macroeconomic policy and factor endowments, typically exogenous in partial models, give rise to another source of model sensitivity. While these variables are usually left unchanged in scenario analysis, they nonetheless have an important role in steering the course and level of change.

• *Choice of base year*

Model results are also very sensitive to the choice of base year. It is standard procedure to select the most recent representative year at the time of the analysis, but differential progress of reform associated with one base year *vis-à-vis* another makes comparisons difficult. For example, results from studies that examine reform in a post URAA world would fundamentally differ from studies conducted within a URAA adjustment era, because impacts would be greater the greater the level of protection in the base year.

• *Commodity definition*

Rice in the various models is handled either as a homogenous product or separated into paddy or processed rice (GTAP). An attempt to break down the commodity by type, degree of processing or quality was only found in the AGRM and RICEFLOW models. The definition of the commodity is highly influential to the results, especially given large differences in policy interventions.

• *Significance of scenario outcomes*

Finally, it should be noted that the results generated by such models come without any level

of statistical significance, which is a consequence of their design. Nevertheless, without such indicators, it is not possible to gauge whether changes in variables are significantly different from zero, particularly in those cases when the projected effects are small.

7 Conclusions

Modelling frameworks may enhance our understanding of the impact of policies. However, the results of policy analysis are sensitive to model design, particularly with regard to the type of equilibrium considered, the way in which parameters have been selected, the choice of the base year, the disaggregation of the commodity and policy space.

It should be emphasized that models are rarely correct in their projections and are not intended to be so, but, as a tool to guide policy makers, they are expected to indicate the general direction and relative significance of market and policy effects. Indeed, despite their fundamental differences in approaches and scenario design, the various models that have been used to assess the impacts of rice market liberalization show widespread congruency in the predicted direction of price and trade impacts following reform, with reference prices and rice trade both set to increase.

Scenarios involving full reform tend to show the largest impacts. In terms of the impacts of distortions in the international rice market, although a few CGE models identified domestic support as being the most critical, in general both CGE and PE models identify trade barriers as being the major source of market distortion. This is of great relevance to the current negotiations, given the different emphases that countries place on the two sets of policies. For instance, the United States provides large domestic support to rice producers under the green, blue and amber boxes, while maintaining relatively low tariff protection. This is in contrast to Japan, which relies mostly on border measures to insulate its rice market, while limiting government market interventions. However, it is difficult to assess the relative weight of policies and the complex nature of government intervention, especially as models generally fail to take fully into consideration the special features of the rice market and of rice policies, in particular, state trading enterprises, trade preferences or special safeguard mechanisms. To ensure that models produce meaningful results, these features must be somehow conceptualized into modelling frameworks.

Price effects in CGE models for paddy rice appear positive and large, with little impact on milled price. This finding cannot be compared with PE models, since the latter typically treat rice as a homogenous product or distinguish the rice market according to rice varieties. In general, the scale of change varies substantially, depending largely on the nature and magnitude of the initial policy distortions. However, the specification of the rice commodity by CGE models using the GTAP database into paddy and processed rice is of little relevance to the current structure of rice trade, which is mainly conducted in the form of husked and milled rice.

Thus, perhaps the most important challenge in quantitative modelling of the global rice economy is the need to capture the heterogeneity of the commodity in this sector. Models such as RICEFLOW and AGRM of FAPRI that distinguish between rice varieties better represent international rice trade. Analyses using these models reveal that liberalization would entail much sharper price increases for medium grain than for long grain rice. The medium grain price increases would benefit a limited number of countries in the temperate or sub-tropical climatic zones that can respond to the new market opportunities by expanding production and exports. Major gains would also accrue to medium grain rice consumers in the liberalizing countries who, in spite of the world price increase, would face lower prices domestically. The model results show much weaker price impacts from liberalization for long grain rice, because of the potential for wider supply responses among Indica rice producing countries and the lower degree of policy distortions prevailing in the long grain market. However, the differentiated price impacts largely reflect the assumption that global supply responsiveness is small for medium grain varieties, with only temperate zones able to expand production. This assumption may become less sustainable in the longer run, as medium grain rice varieties are being adapted to tropical climatic conditions. Indeed, these technical innovations may suggest that, over a long time horizon, price impacts across the two rice markets might be of a similar scale and generally smaller than predicted, therefore giving rise to weaker price effects stemming from liberalization. On the other hand, the welfare implications for individual countries of higher prices in a liberalized market environment will mainly depend on their net-trading position as, in normal conditions, net importing countries would be expected to lose out from rising international prices, especially if their base level of border protection was already relatively low, as is the case for many sub-Saharan African countries.

The above discussion brings forth several issues for consideration by policy makers. In particular, questions may be raised regarding the emphasis and extent to which developing countries should aim at dismantling policies that are often designed to improve food security or to protect the livelihoods of the rural poor from external shocks. The July 2004 WTO Framework

Agreement recognises the legitimacy of governments pursuing such objectives by allowing them to designate selected products as special (in the case of developing countries) or sensitive (both developing and developed countries) products, which will be subject to differential treatment. Rice would seem to qualify for such designations based mainly on food security, rural development and environment protection criteria. These particular concerns are also of relevance to the negotiations on state trading agencies, which continue to exert considerable power on the rice market of many developing countries, with the objectives of ensuring domestic price stability and of guaranteeing minimum food supplies at the national and household levels. In this regard, the WTO Framework calls for special consideration to be given to maintain the monopoly status of state trading enterprises in developing countries. Against this backdrop, the possibility of a far-reaching liberalization of the rice international market appears rather distant.

ANNEX: Rice policies in the major rice producing/trading countries (Last updated May 2005)

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
Argentina	Net exporter WTO member	Support to producers is largely limited to research programmes.	Rice imports are subject to an ad valorem tariff of 10-12 percent, 0 percent if rice is sourced from Mercosur countries A 10 percent tax is levied on rice exports.
Australia	Net exporter WTO member	Rationed irrigation water. The Rice Marketing Board for the State of New South Wales holds a selling monopoly on the domestic (and export) market, giving rise to a double pricing system. The monopoly status of the Board over rice domestic marketing and trade has been extended till January 2009.	Rice imports are free of duty Rice exports are under a single-desk monopoly by the Rice Marketing Board for the State of New South Wales (RMB). Sun Rice, formerly the "Rice Growers" Co-operative Limited" has been designated to act as the Board agent to conduct local purchases and exports. In 2004, the export monopoly status was extended till January 2009.
Bangladesh	Net importer WTO member	Government funds major investments in irrigation and gives subsidies on improved varieties seeds and credit. The Government announces minimum producer prices, but has no legal obligation to intervene to sustain those levels The Government influences domestic rice prices by choosing to buy on the domestic or import markets the rice it needs for the public distribution programme. Food distribution programmes limited to the most vulnerable groups. Operated jointly by Government and WFP.	Rice imports are charged an ad valorem tariff of 7 percent, supplemented by a value-added tax of 15 percent (on duty paid value); a 3 percent advance Income tax and a 4 percent Infrastructure Redevelopment Surcharge. The levels of these taxes are often modified to stabilize domestic prices.
Brazil	Net importer WTO member	Rice producers benefit from minimum producer prices, differentiated by region and type, and subsidized credits. Preferential loans are also granted for investment in storage. Through the programme "Fome Zero" (Zero Hunger), CONAB buys, stores, and redistributes rice to poor households.	Rice imports from Mercosur member countries are duty free. Rice from non-members are applied an ad valorem tariff of 10 to 18 percent, supplemented by an import declaration fee, port fees, a Merchandise Circulation Tax (ICMS) and an Industrialized Product Tax (IPI).

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
China, mainland	Net exporter WTO member	Producer subsidies on irrigation and improved seeds. Rice is subject to minimum "Protective" prices set at 1 400 Yuan (US$169) and at 1 500 Yuan (US$181) per tonne for early Indica and Japonica paddy rice respectively. Special rice/grain provinces have been designated to receive large input and credit subsidies. Since 2004, grain producers have also benefited from direct income payments.	International trade in rice (and other cereals) remains largely under government control. The State Planning and Development Commission in consultation with the State Council decides on the volume of exports, which are then administered by the Ministry of Foreign Trade and Economic Co-operation (MOTE) and carried through by state trading enterprises, in particular the China National Cereals, Oils and Foodstuffs Import and Export Corporation (COFCO). Private licensed traders are allowed to import rice and are eligible to half of the preferential tariff quota of 5.3 million tonnes, subject to a 1 percent in-quota tariff. The other 50 percent of the quota is reserved to the state trading enterprises. Out-of-quota imports are levied a tariff of 65 percent. Rice imports are subject to the Special Safeguard Provision. Rice exports remain under a state monopoly.
Colombia	Net importer WTO member	Rice is subject to a crop absorption mechanism constraining importers to buy rice locally at a minimum price in order to obtain import licenses. Since end 2003, the system has been replaced with a preferential quota system, with the licenses auctioned based on commitments to purchase rice locally. Subsidies on storage are granted to millers to keep rice from the market after harvest, so as to reduce seasonal price fluctuations.	Rice imports are applied an ad valorem tariff of 80 percent. They are subject to prior authorization, unless originating from Andean Pact countries. Imports from the latter are subject to a quota of 150 000 tonnes (in paddy terms). A tariff rate quota of 180 000 tonnes (paddy equivalent) is also available for imports originating from non- Andean member countries. Out-of-quota imports are subject to a variable duty determined through the Andean Price Band Mechanism. Rice imports are subject to the Special Safeguard Provision. No restriction on rice exports. Export subsidies no longer available.
Côte d'Ivoire	Net importer WTO member	Little direct support from the Government except through structural support to develop low lands for rice production and to promote Nerica rice cultivation.	Ad valorem duty varying from 5 to 10 percent
Egypt	Net exporter WTO member	Rice cultivation is officially restricted to maximum 504 000 hectares and is subject to water rationing. The Government has given strong support to disseminate short-season growing varieties. The Government influences domestic prices through the granting of subsidized credits to state-owned mills for public paddy purchases.	Rice imports are charged an ad valorem duty of 2 percent. Exports are largely liberalized. Occasionally, subsidies on transportation have been granted to exporters

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
European Union	Net importer WTO member	Rice farmers are eligible to receive direct payments on a maximum paddy production volume of 2.4 million tonnes (close to 90 percent of production), of €177 (US$216) per tonne, of which €102 (US$124) in the form of a "single farm payment" and €75 (US$91) as a "crop-specific aid", both based on historical (2000-2002) production rights. The single farm payment is linked to the respect of the environment, animal welfare and quality standards under the principle of "cross-compliance". The paddy intervention prices is set at €150 (US$183) per tonne. Government procurement purchases are subject to a ceiling of 75 000 tonnes per season.	Since 1 September 2004, a new rice import regime has replaced the variable duty system[1] with "fixed duties", on a provisional basis.[2] As a result, a €65 per tonne duty will be applicable on husked rice and €175 per tonne on milled rice imports, much lower than the previous WTO bound tariffs of €264 per tonne and €416 per tonne, respectively. As of March 2005, the EU agreed to make <u>husked</u> rice imports subject to a "variable" a tariff of 65.0 percent, 42.5 percent or 30.0 percent per tonne, depending on the level of actual imports compared with a reference import level. Rice imports are subject to the Special Safeguard Provision. The EU grants preferential access to India and Pakistan, Egypt and ACP countries. It has committed to grant unlimited and free-of-duty access to rice from 49 least developed countries as of 2009. Under the URAA, the EU has retained the right to use export subsidies on 133 400 tonnes (milled equivalent), with a maximum budgetary outlay of €36.8 million per marketing year.
Guyana	Net exporter WTO member	Programmes are in place to enhance efficiency in production. At the same time, the government is promoting a diversification of rice cultivation into alternative products, as the value of its preferential access to the EU is being eroded following the reform of the EU rice policy regime.	The country exports 70 percent of production, especially to other Caricom countries and to the EU. Guyana (and Suriname) has preferential access to the EU under an ACP quota of 125 000 tonne quota for husked rice and a 20 000 tonnes quota for broken rice. ACP countries only face duties equivalent to 35 percent of the standard EU MFN duty, minus €4.35 per tonne for husked rice or minus €3.62 per tonne from broken rice. The latest rice reform in the EU is threatening the value of such preferences, because it entails a strong reduction in import tariffs to competing suppliers and in EU internal prices.

[1] The variable duty system has been linked since 1995/96 to the intervention prices through the "Margin of Preference import duty calculation" system: under the US/EU Blair House Accord embodied in the WTO agreement, the duty-paid import price could not exceed the effective EU intervention price by more than 80 percent for husked Indica rice; by more than 88 percent for husked Japonica; by more than 163 percent for milled Indica rice and by more than 167 percent for milled Japonica.

[2] Pending an agreement with its traditional rice supplying countries. The date limit for revision is 30 June 2005.

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
India	Net exporter WTO member	Outlays from the Government to finance input subsidies, especially fertilizers, energy and irrigation are particularly large. Minimum producer prices are announced before harvest. The Food Corporation of India has pledged to procure unlimited amounts at the minimum price level. The FCI every year announces two retail prices on rice sold through the FCI system for above-poverty line and below-poverty line consumers. Sales at below-poverty line prices are rationed.	Rice imports are applied an ad valorem tariff of 70-80 percent. Although rice is not eligible to export subsidies under WTO, subsidized sales for export have been made by the Food Corporation of India from 2001 to 2003. The Government sustains the subsidies were legitimate because they covered storage and transportation costs. Exports of Basmati rice enjoy duty-free access to the EU.
Indonesia	Net importer WTO member	The government is reclaiming land for rice cultivation in Sumatra and Kalimantan. The government grants subsidies on fertilizers and hybrid rice varieties seeds. Rice is subject to minimum producer prices. However, BULOG, the state-own marketing enterprise, only purchases rice for its distribution system and for the constitution of rice reserves. About 2 million tonnes of rice are distributed at subsidized prices by BULOG to vulnerable population groups under the *Raskin* or "rice-for-the-poor" programme.	Based on its WTO commitments, the country has opened a 70 000 tonnes tariff rate quota subject to a 90 percent tariff. Actual imports in normal years far exceed the TRQ. Both private traders and BULOG, the state-own marketing enterprise, are eligible to import rice, subject to the payment of a specific tariff of Rupiah 430 per kg (US$38 per tonne). Since January 2004, rice imports have been banned. Imports are often made under government-to-government deals.
Iran, Islamic Rep.	Net importer Non-WTO member	Minimum producer prices are set at very high levels. The Government promotes high- yielding rice varieties.	Since 2004, the private sector has been authorized to import rice, subject to a 100 percent ad valorem duty and a discretionary tariff of Rial 1 500 per kg (US$190 per tonne).
Japan	Net importer WTO member	Japan launched the Rice Policy Reform Law in April 2004, for implementation over a 6 year period, which will abolish the Production Adjustment Promotion Programme (PAPP) by 2010. Currently, about 1 million hectares of rice land are being diverted under that programme, which makes rice producers eligible to direct payments varying depending on the alternative to rice chosen by the producer. Participation in the PAPP makes producers eligible to price deficiency payments under the Rice Farming Income Stabilization programme, to cover up to 80 percent of the difference between a 7-year moving average standard price and the current market price. The government has begun to modify PAPP in 2004 by setting rice production targets, rather than rice area targets, at the prefecture level.	Japan renounced in 1998 to the WTO Special Treatment provision and opted to "tariffy" rice. The tariff was bound at 341 yen /kg (US$3 100/tonne) on over-quota imports. The tariff quota remained at 770 000 tonnes (husked equivalent), with the in-quota tariffs set at zero. The government has the exclusive right to import rice under the quota. Over 80 percent of the quota is filled by the Food Agency directly under the "Ordinary Market Access", and the rest allocated through auctions to private traders under the "Simultaneous-Buy-Sell" (SBS) system, subject to the payment of a mark-up to the Food Agency that cannot exceed 292 yen/kg. Japan has made an intensive use of the WTO safeguards on rice. In 2002/03, Japan notified to WTO a level of rice food aid of 177 000 tonnes.

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
Korea. Rep.	Net importer WTO member	The Government is promoting a consolidation of the rice sector and is funding specialized farms to foster a consolidation of land holdings and promote efficiency gains. Since 2003, rice farmers have been encouraged to leave their rice land idle under a land diversion programme. Under the Scheme, eligible farmers receive a <u>Direct Payment For Adjustment of Rice Production</u> for three years, at an annual rate of Won 3 million (US$3000) per hectare. In March 2005, the government eliminated the government purchasing programme, replacing it with a <u>Public Storage System for Emergency,</u> as a means to stabilize producer prices at harvest time. In addition the Government introduced <u>fixed direct payments</u> at a rate of Won 600 000 (US$600) per hectare and, when prices fall below a target level, <u>variable direct payments</u> to compensate for 85 percent of the difference, minus the transfers made as fixed income compensation payments. For 2005-2007, the target price has been set at Won 2 126 per kg (US$2 000 per tonne), on a milled rice basis.	Under the WTO, the country deferred tariffication on rice and opened a Minimum Market Access (MMA) quota reaching 205,228 tonnes in 2004, with an in-quota tariff of 5 percent. The government is the sole importer under the quota. The imported rice was not retailed but used, instead, for feed or further processing In April 2005, the country was allowed to postpone the tariffication until 2014, conditional on an increase of the MMA to 7.96 percent of base year consumption, or 408 700 tons by 2014. The MMA will be composed of a fixed portion equal to an overall 205 228 tonnes, which will be allocated as country specific quotas to the United States (50 076 tonnes), China (116 159 tonnes), Thailand (29 963 tonnes) and Australia (9030 tonnes); and a second portion, which will be expanded from 20 347 tonnes in 2005 to 203 228 tonnes by 2014, which will be assigned through public tenders. The Government also committed to let 10 percent of the imported rice reach consumers as of 2005 and to increase the share to 30 percent by 2010.
Malaysia	Net importer WTO member	The Government tries to improve the efficiency of the domestic sector by phasing out unproductive paddy areas and by designating eight special zones, or "granaries" in Peninsular Malaysia. The country is also reclaiming new land for paddy cultivation in East Malaysia for large-scale commercial paddy production by the private sector. Traditional paddy producers have benefited from high fertilizer subsidies and minimum producer prices, but these have remained unchanged since 1998.	The country formally applies a 40 percent tariff, but rice imports are under the monopoly of BERNAS, a former state trading enterprise now privatized, which has kept its original mandate to secure adequate grain supplies while protecting domestic producers
Myanmar	Net exporter Non-WTO member	Rice production is being promoted through the reclamation of new lands, multiple cropping, and the provision of irrigation infrastructure. Paddy producers are subject to compulsory quota deliveries to the Myanmar Agriculture Produce Trading (MAPT) at government set prices. No direct sales can be made by producers to private traders.	In April 2003, the government rice export monopoly was abolished. Private sector exports were allowed subject to prior approval and to minimum export prices. In January 2004, a temporary six months ban on rice export was imposed. Since 2005, private entrepreneurs growing rice have been allowed to export their own rice.

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
Nigeria	Net importer WTO member	Input subsidies are granted, particularly on fertilizers, machinery, credit, and extension. The Government promotes Nerica rice varieties. In 2002, the "President's Rice Initiative" was launched with the objective to render the country rice self-sufficient by 2006.	Rice imports are charged a 75-100 percent tariff, subject to a minimum price of US$230 or US$205 per tonne if rice comes from Thailand or India respectively. In addition, 10 percent special rice development duty is applied.
Pakistan	Net exporter WTO member	Support to rice producers largely limited to technical assistance for breeding and transfer of technologies, especially to disseminate certified seeds. Fertilizers are exempted from taxes. The Government ceased to administer support prices for paddy in 2003 but continued to announce them for indicative purposes. In 2004, they were redefined as "rescue prices", to be implemented by the Pakistan Agricultural Storage and Supplies Corporation (PASSCO).	The government plays an active role in promoting rice sales abroad on behalf of the private sector, while also providing some freight subsidies.
Philippines	Net importer WTO member	Much of the strategy to raise production lies on an extensive use of hybrid rice varieties. A 50 percent subsidy on certified seeds and fertilizers was granted for that purpose in 2003, with the scheme covering 540 000 hectares of irrigated land, or 13 percent of rice cultivation. Government procures paddy at minimum support prices.	Under the WTO special treatment provision, Philippines deferred tariffication on rice and opened a minimum access quota, which reached 240 000 tonnes by 2004, subject to a 50 percent tariff. Only farmer organizations can import under the quota, while the bulk of the country's rice imports is carried through by the state trading firm, the National Food Agency (NFA). The country is now in the process of negotiating an extension to the waiver on tariffication with WTO partners.
Thailand	Net exporter WTO member	The Government is funding in co-operation with the private sector large investments in marketing infrastructure. Programmes to enhance efficiency have been launched, with the ultimate goal of raising farmers' incomes. The programme rests on the distribution of high quality seeds and improved use of pesticides but also envisages a zoning of the rice lands, to avoid the mixing of varieties, and an extensive development project for fragrant rice in the North-East. In recent years, the government has actively sustained producer prices through a mortgage scheme and large intervention purchases, guaranteeing a relatively high minimum price to producers.	Rice imports are subject to the Special Safeguard Provisions. The country has committed to open a preferential access quota of some 250,000 tonnes, but being a low cost, efficient producer, it has hardly needed to import any rice. Thailand carries out export promotion activities through the Department of Foreign Affairs and the Department of Export Promotion. The Government also engage in direct sales, under government-to-government deals.
United States	Net exporter WTO member	Under the 2002 Farm Bill, producers are eligible to direct income support payments, or <u>direct payment (DP),</u> which is paid on 85 percent of an historically established payment area base and yield, at a rate of US$235/cwt	Rice imports are charged a specific tariff of US$14 per tonne for milled rice (11.2 percent *ad valorem* if parboiled), US$21 per tonne for husked (brown) rice (US$8.30 per tonne for basmati husked) and US$18 per tonne for paddy rice.

Major rice players	Trade status 2000-2003	Domestic Policies	Trade Policies
		(US$51.81/tonne). This payment is not conditional on any level of production and is considered to fall in the Green Box. Producers benefit from <u>direct price support</u> under the loan deficiency payment, which provides a price floor, (loan rate) at US$6.50 per cwt (US$143.3/tonne). When the loan rate exceeds the announced world market price, producers can opt for a marketing loan deficiency payment (LDP) based on the difference between the two on all their actual production level. From a WTO perspective, the LDP payments fall within the amber box. A third policy instrument has been introduced in the form of <u>counter-cyclical payment (CCP)</u>. The CCP is paid on the difference between the target paddy price of US$10.50/cwt (US$231.5/tonne) and the larger of either the estimated market price or the sum of the loan rate plus the DP. The maximum amount that the CCP can be is US$1.65/cwt (US$36.38/tonne). Although the United States originally notified both the DP and CCP as decoupled, green box measures, the WTO has ruled, in the case of cotton, that the CCP falls within the amber box.	Rice imports are subject to the Special Safeguard Provision. The United States is allowed to subsidize 38 544 tonnes of rice exports, with an expenditure ceiling of US$2.4 million. However, no subsidized rice exports have been notified since 1996 to WTO. The country assists exporters through a credit guaranteed programme. In addition, it shipped rice in the form of food aid, under the PL-480 program, Food for Education and Food for Progress programmes.
Uruguay	Net exporter WTO member	No specific support is granted to the rice sector, which only benefits from the provision of general services such as research, extension, and pest and disease control. In 2003, a Rice Support and Financing Fund was established to support development rice activities and to help financially indebted producers. The Fund is financed by the Sector itself, through the payment of a 5 percent export tax.	Imports subject to the Common External Tariff of Mercosur, now at 20 percent The country exports 90 percent of its production, principally to Brazil, where it has free of duty access under Mercosur. All rice exports are subject to a 5 percent export tax, which is used to finance the Rice Support and Financing Fund.
Viet Nam	Net exporter Non-WTO member	Viet Nam pursues an intensification policy in rice, aimed at raising yields and quality. At the same time, it is fostering a diversification of marginal lands out of rice. Producers have been encouraged to establish direct links with processors and exporters, under delivery contracts at pre-determined prices.	Although Viet Nam removed quantitative restrictions on rice exports in 2001, in 2004, rice exporting companies were required to pre- register export contracts. The bulk of the country's exports are carried through by the State trading Northern Food Corporation and Southern Food Corporation Inc. (Vinafood I and Vinafood II).

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