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HEDGING CEREAL IMPORT PRICE RISKS AND INSTITUTIONS TO ASSURE IMPORT SUPPLIES

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Abstract

The recent world food price spike raised to the fore the issues of how countries can manage their basic staple food imports in times of crises. There are many risks to food imports, ranging from price risks to risks of non-performance and hence threats to domestic food supplies. The paper first provides a review of the risks and food import access problems faced by various low and middle-income net food staple importing countries and reviews pertinent policies to deal with them. A short review of some institutional issues in food importing is given to introduce more detailed discussion of food import risk management. Subsequently empirical simulations are done to show how food import price risk can be hedged with futures and options based on data of the past 25 years for several countries. Then a proposal for a food import financing facility designed to alleviate the financing constraint of many is presented. Finally institutional mechanisms that could assure availability of staple food import quantities to food importing countries, in the form of clearing houses, are discussed.

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1. INTRODUCTION

The sudden and unpredictable increases in many internationally traded food commodity prices in late 2007 and early 2008 caught all market participants, as well as governments by surprise and led to many short term policy reactions that may have exacerbated the negative impacts of the price rises. On the basis that such interventions were in many cases deemed inappropriate, many governments, think tanks, and individual analysts have called for improved international mechanisms to prevent and/or manage sudden food price rises. Similar calls for improved disciplines of markets were made during almost all previous market price bursts, but were largely abandoned after the spikes passed, largely because they were deemed difficult to implement. However, the fact that the recent downturn in prices coincided with a global financial crisis, which in itself has contributed to increasing levels of poverty and food insecurity, appears to have galvanized attention on the issues facing global agricultural markets. The purpose of this paper is to discuss issues relevant to managing food staple import risks, and to assess possible new international institutional mechanisms designed to instill more confidence, predictability and assurance in global markets of basic food commodities, with the ultimate purpose to render less likely future food price spikes.

The financial crisis that started to unravel in 2008 coincided with sharp commodity price declines, and food commodities followed this general trend. The price volatility has therefore been considerable. For instance, in February 2008, international wheat, maize and rice price indices stood higher than the same prices in November 2007, only three months earlier, by 48.8, 28.3, and 23.5 percent respectively. In November 2008, the same indices stood at -31.9, -3.2, and 52.3 percent higher respectively, compared to November 2007. In other words within one year these food commodity prices had increased very sharply and subsequently declined (except rice) equally sharply. Clearly such volatility in world prices creates much uncertainly for all market participants, and makes both short and longer term planning very difficult. Analyses of food commodity market volatility indicate that, albeit not unusual from a historical perspective, this volatility is likely to continue and possibly increase in the future due to new factors, external to the food economy (Sarris, 2009a, 2009b). Food market instability can also lead to various undesirable short and long term impacts, especially for vulnerable households, as several studies have documented (e.g. Ivanic and Martin, 2008, and several other studies in the same special issue of the journal Agricultural Economics).

Staple food commodity price volatility, and in particular sudden and unpredictable price spikes, creates considerable food security concerns, especially among those, individuals or countries, who are staple food dependent and net buyers. These concerns range from possible inability to afford increased costs of basic food consumption requirements, to concerns about adequate supplies, irrespective of price. Such concerns can lead to reactions that may worsen subsequent instability. For instance excessive concerns about adequate supplies of staple food in exporting countries' domestic markets may induce concerned governments to take measures to curtail or ban exports, thus inducing further shortages in world markets and higher international prices. The latter in turn may induce permanent shifts in production and/or consumption of the staple in net importing countries, with the result that subsequent global supplies may increase and import demands may decline permanently altering the fundamentals of a market.

The recent food market spike occurred in the midst of another important longer term development. Over the last two decades there has been the shift of developing countries from

the position of net agricultural exporters - up to the early 1990's - to that of net agricultural importers (Bruinsma, 2003). Projections to 2030 indicate a deepening of this trend (ibid.), which is due to the projected decline in the exports of traditional agricultural products, such as tropical beverages and bananas, combined with a projected large and growing deficit of basic foods, such as cereals, meat, dairy products, and oil crops. According to the latest FAO figures (FAO, 2009a) in 2008/9 global imports of all cereals were 280.2 million tonnes, 215.2 million tonnes of which were imports of developing countries. Within developing countries, those classified as Least Developed Countries (LDCs) have witnessed a fast worsening of their agricultural trade balance in the last fifteen years. Since 1990, the food import bills of LDCs have not only increased in size, but also in importance, as they constituted more than 50 percent of the total merchandise exports in all years. In contrast, the food import bills of other developing countries (ODCs) have been stable or declined as shares of their merchandise exports (FAO 2004).

This trend has been particularly pronounced for Africa. Table 1 indicates that during the period 1970-2004, the share of agricultural imports in total imports of goods and services has declined, but the share of imports in total merchandise imports has increased, with the exception of North Africa. More significantly, the share of agricultural imports in total exports of goods and services, an index that can indicate the ability of the country to finance food imports, while declining from 1970 to 1980 and 1990, has increased considerably from 1990 to 2002-04. This suggests that agricultural (mostly food) imports have necessitated a growing share of the export revenues of African countries.

Among Asian developing countries, by contrast, over the same time period the share of agricultural imports in total imports of goods and services has declined from 33.0 to 7.8 percent, and the share of total food imports in total exports of goods and services has declined from 15.5 to 7.1 percent. Hence Asian developing countries' food imports have not increased beyond their capacity to import them. In Latin America and the Caribbean (LAC) agricultural imports are on average less than 20 percent of total merchandise imports. The above suggests that the issue of growing food imports with inability to pay is mostly an African LDC country problem.

The medium term food outlook, based on projections of net imports of the FAO COSIMO model that pertain to developing countries and LDCs, indicate that based on current estimates, developing countries will increase their net food imports by 2016 in all products except vegetable oils. Similarly LDCs are projected to become an increasing food deficit region in all products and increasingly so. Clearly this suggests that as LDCs become more dependent on international markets, they will become more exposed to international market instability.

The conclusion of this descriptive exposition is that many developing countries and especially LDC countries in Africa, have become more food import dependent, without becoming more productive in their own agricultural food producing sectors, or without expanding other export sectors to be able to counteract that import dependency. This implies that they may have become more exposed to international market instability and hence more vulnerable.

Turning to analysis of food import bills a study by Gürkan, et.al. (2003) has indicated that between the mid-1980s and 1990s, the LDCs were under economic stress due to the need to import the food they required to maintain national food security. The food they imported reached, on average, about 12 percent of their apparent consumption by the end of the millennium. While this is not necessarily a negative outcome, as it maybe due to domestic

production restructuring following comparative advantages, the study showed that throughout that period, the growth in these countries' commercial food import bills consistently outstripped the growth of their GDP, as well as total merchandise exports. The study also revealed that LDCs faced large and unanticipated price 'spikes' that exacerbated their already precarious food security situation. Indeed, it was discovered that variations in import unit costs of many important food commodities contributed to around two-thirds of the variation in their commercial food import bills. Coupled with substantial declines in food aid flows over the same period, these developments have brought about a significant increase in the vulnerability of the LDCs.

A more recent analysis by Ng and Aksoy (2008) supports the above observations. It reveals that of 184 countries analysed with data for 2004/5, 123 were net food importers, of which 20 were developed countries, 62 middle income countries and 41 low income countries. From 2000 to 2004/5 more low income countries have become net food importers. They revealed that the 20 middle income oil exporting countries are the largest food importers, and that their net food imports have increased significantly. This is the group that is most concerned about reliability of supplies rather than cost of imports. They also revealed that several small island states (which are generally middle income countries) and low income countries (LICs mostly in Africa) are most vulnerable to food price spikes. Analysis of recent data indicates that among the non-grain exporting oil exporters the average share of cereal imports to total domestic supply is 56 percent. Among Small Island Developing States (SIDS) the same average is 68 percent.

In light of the above developments, it seems that the problem of managing the risks of food imports has increased in importance, and is already a major issue for several LDCs and low income food deficit countries (LIFDCs)[2]. The major problem of LIFDCs is not only price or quantity variations *per se*, but rather major unforeseen and undesirable departures from expectations, that can come about because of unanticipated food import needs due to unforeseen adverse domestic production developments, as well as adverse price moves. In other words, unpredictability is the major issue. This is also the gist of the argument of Dehn (2000), who argued that the negative impacts on growth of commodity dependent economies come from unanticipated or unpredictable shocks, rather than from ex-post commodity instability per se.

Apart from the problem of unpredictability of food import bills for LIFDCs, another problem that surfaced during the recent food price spike was the one of reliability of import supplies. Several net food importing developing countries (NFIDCs) that could afford the cost of higher food import bills, such as some of the middle income oil exporting countries and small island states mentioned above, faced problems of not only unreliable import supplies but also the likelihood of unavailability of sufficient food import quantities to cover their domestic food consumption needs. This raises a different problem for these countries, namely the one of assurance of import supplies. Several of these countries, e.g. those surrounding the Arab Peninsula and the Persian Gulf, have unfavourable domestic production conditions and rely

[2] LIFDCs are a FAO classification. The latest list of May 2009 includes 77 countries. The list of LDCs is one used by the United Nations (UN) and as of May 2009 includes 50 countries. All but 4 LDCs are also included in the LIFDC list. The list of NFIDCs is a World Trade Organization (WTO) group, which as of May 2009 includes all 50 LDCs and another 25 higher income developing countries, for a total of 75 countries. Of the 25 extra countries in this list only 8 are in the FAO list of LIFDCs, the others being higher income countries. The Low Income Countries (LICs) is a World Bank classification of 53 countries that overlaps significantly with the UN list of LDCs

on imports for a substantial share of their domestic consumption. Unavailability of supplies creates large food security concerns for these countries.

The issue of food import risk for LIFDCs has been discussed extensively for some time, especially after the commodity crisis of the early 1970s Several proposals for international food insurance schemes were put forward in that period (for an early review see Konandreas, et. al, 1978). The issue of financing of food imports by LIFDCs featured prominently in the discussions leading to the World Trade Organization (WTO) Uruguay Round Agreement on Agriculture (URAA), and gave rise to the "*Decision on measures concerning the possible negative effects of the reform programme on least-developed and net food-importing developing countries"***,** also known as the "Marrakesh Decision" (article 16.1 of the URAA). In the Marrakesh Decision, Ministers recognized "that as a result of the Uruguay Round certain developing countries may experience short-term difficulties in financing normal levels of commercial imports and that these countries may be eligible to draw on the resources of international financial institutions under existing facilities, or such facilities as may be established, in the context of adjustment programs, in order to address such financing difficulties."

The rest of the paper proceeds as follows. In the next section we provide a review of the risks and food import access problems faced by various countries including LIFDCs and NFIDCs, and issues pertinent to policies to deal with them. Subsequently we present a short review some institutional issues in food importing. In the fourth and fifth sections we show how food import price risk can be hedged with futures and options and provide empirical evidence based on data of the past 25 years for several countries. In the sixth section we discuss a Food Import Financing Facility designed to alleviate the trade finance constraint that seems to affect LIFDCs. In the seventh section we discuss an international institutional mechanism, in the form of a globalized clearing house, to assure availability of food import quantities by food importing countries. The final section concludes.

2. RISKS FACED BY FOOD IMPORTERS AND POLICIES TO DEAL WITH THEM

Policies for the effective management of price booms differ depending on whether the shock affecting the country is transitory or permanent. Factors to consider are the following: (i) Does the price shock have its origins in factors external to the country, such as world markets, or in domestic production supply imbalances in the markets concerned? (ii) How transitory are the factors that have led to the price shock? (iii) What is the level of uncertainty concerning the factors that may influence the future course of prices? The answers to these questions are not easy, and there may be legitimate differences of opinion among analysts concerning such assessments.

The second issue concerns the possible impacts of the price shock on the country's economy and its citizens. The impact of increasing prices on the wider economy is determined by a number of structural characteristics. Typically, low income food importing countries that are dependent on foreign aid and are characterized by high levels of foreign debt are the most vulnerable to positive food price shocks. Food price increases will directly affect consumption, increasing the incidence of poverty, as well as government expenditure and borrowing, thus worsening debt sustainability. The deterioration of the terms of trade may result in destabilizing the economy and hinder economic growth. In the long run, given that

countries implement appropriate policies to stimulate agricultural production, supply response to high prices may partly offset this negative impact.

The potential adverse effects of high commodity prices are not restricted to low income food importing countries. Economic insight suggests that exporting countries may experience long run negative consequences at the macroeconomic level. For these countries, the most frequently cited negative consequence is that of exchange rate appreciation causing a contraction in the non-commodity sector of a commodity exporting economy. Unless the institutional environment in a country assists investment opportunities, high prices may have no permanent impact on the sector.

Similarly at the micro level, inhabitants of a country will be affected differently by high food prices. While generally urban households that are net staple food buyers will lose, as they have to pay more to keep adequate diets, many rural households, especially those that are substantial producers of staple foods will benefit. Households react differently to price booms depending on whether they are urban, or rural, as well as on their initial endowment and production structure, their consumption patterns, the constraints they face in terms of investment, and the policies that are in force. While poor urban households constitute the most vulnerable population group, poor households in the rural areas may also be negatively affected depending on how they adjust to increasing prices, in terms of changes in production, consumption and savings. On the one hand, if household consumption and activities are not conditioned by credit constraints, income windfalls can be invested, resulting in consumption and welfare increases in line with income from the investment. On the other hand, if the household faces credit and liquidity constraints, as most poor rural households in developing countries do, price boom windfalls can be consumed right away. Thus, price increases may benefit a number of net producing households, leave other households unaffected in the long run, or significantly worsen the welfare of some net consuming and inadequate food producing households. Moreover, price booms are often associated with increased price and general market volatility that may affect income and investment decisions. Finally, the extent of infrastructure development, the availability of credit markets and extension services and the policy environment are crucial factors in the management of price booms by households. For example, well functioning credit markets will allow producers to invest amounts higher than their household savings permit, whilst targeted extension services can assist households in making appropriate investment choices.

Any adopted policy measure should not try to protect or benefit one vulnerable group by damaging the benefits to another poor constituency. In this context, it is important to ascertain the extent to which price signals are transmitted to the domestic markets, the identification of vulnerable population groups that can be targeted for support, as well as the agricultural sector's ability to respond to increasing prices. The macroeconomic environment is also important in formulating policy options. Important indicators consist of the composition of the current account of the balance of payments, the terms of trade, the movements of exchange rates, the country's foreign borrowing requirements and the fundamental characteristics of the domestic labour market.

The third issue that is imperative before a country adopts specific policy measures is to ascertain and be clear about the objective of the policy. Too often policy measures are adopted with a very narrow objective, and may end up affecting negatively other areas of equally important domestic concern. Also if the objective is known and generally agreed upon, then any policy measure can be judged against others that may offer similar benefits,

but with smaller side effects or negative secondary consequences. Finally, is there are more than one policy objectives, it may well be that a combination of measures is necessary to simultaneously achieve all of them.

The reactions to the recent price boom, suggest that policy reactions to the food price surge have been prompt, with governments in many developing countries initiating a number of short-run measures, such as reductions in import tariffs and export restrictions, in order to harness the increase in food prices and to protect consumers and vulnerable population groups. Other countries have resorted to food inventory management in order to stabilize domestic prices. A range of interventions have also been implemented to mitigate the adverse impacts on vulnerable households, such as targeted subsidized food sales (Rapsomanikis, 2009).

Demeke, et. al. (2009) made a review of policies adopted in response to the recent food price spike and they indicate that the responses of developing countries to the food security crisis appear to have been in contrast to the policy orientation most of them had pursued over the last decades as a result of the implementation of the Washington consensus supported by the Bretton Woods Institutions. This period had been characterized by an increased reliance on the market – both domestic and international – on the ground that this reliance would increase efficiency of resources allocation, and by taking world prices as a reference for measuring economic efficiency. The availability of cheap food on the international market was one of the factors that contributed to reduced investment and support to agriculture by developing countries (and their development partners), which is generally put forward as one of the reasons for the recent crisis. This increased reliance on markets was also concomitant to a progressive withdrawal of the state from the food and agriculture sector, on the ground that the private sector was more efficient from an economic point of view.

The crisis has shown some drawbacks of this approach. Countries depending on the world market have seen their food import bills surge, while their purchasing capacity decreased, particularly in the case of those countries that also had to face higher energy import prices. This situation was further aggravated when some important export countries, under intense domestic political pressure, applied export taxes or bans in order to protect their consumers and isolate their prices from world prices.

As a result, several countries changed their approach through measures ranging from policies to isolate domestic prices from world prices; moving from food security based strategies to food self sufficiency based strategies; by trying to acquire land abroad for securing food and fodder procurement; by trying to engage in regional trade agreements or; by interfering with the private markets through price controls, anti-hoarding laws, government intervention in output and input markets, etc.

Before one discusses any mechanism to manage food import risks it is important to ascertain the types of risks that are relevant to food importers. Food imports take place under a variety of institutional arrangements in developing countries. A study by FAO (FAO, 2003) contains an extensive discussion of the current state of food import trade by developing countries. It notes that while in some LIFDCs state institutions still play a very important role in the exports and imports of some basic foods, food imports have been mostly privatised in recent years, although with some exceptions, and in some countries, state agencies operate alongside with private importers.

A public sector food importer, namely a manager of a food importing or a relevant food regulatory agency each year faces the problem of determining the requirements that the country will have to satisfy the various domestic policy objectives. Such objectives may include domestic price stability, satisfaction of minimum amount of supplies, demands to keep prices at high levels to satisfy farmers, or low to satisfy consumers and many others relevant to various aspects of domestic welfare. For instance if the government of the country needs to keep domestic consumer prices of a staple food commodity stable at some level p_c then an estimate of domestic requirements in a year t could be given by a simple formula such as

$$R_t = D(p_{ct}) - Q_t \qquad (1)$$

Where R denotes the yearly requirements, D(.) the total domestic demand of the commodity (which will, of course, depend on other variables than just price), and Q denotes the domestic production. Private stockholding behaviour would be part of the demand estimates in (1).

The problem of the manager of the food agency is four-fold. First there needs to be a good estimate of the requirements. This is not easy for several reasons. First estimates of domestic production are not always easy, and more so the earlier one needs to know them. While richer countries have developed over time sophisticated systems of production monitoring, this is not the case for developing countries, especially those that are large and obtain supplies from a large geographical area. Another problem in assessing requirements concerns the estimates of domestic demand, which are also subject to considerable uncertainties. These uncertainties involve the other variables that enter the demand of the staple, such as disposable incomes, the prices of substitute staples, the behaviour of private stocks, and many other variables. Clearly these errors are larger the longer in advance one tries to make an estimate of domestic requirements, and the less publicly available information exists about the variables that determine demand.

The second problem of the public sector food agency manager, once the domestic requirements have been estimated, is to decide how to fulfil them, namely through imports, or by reductions in publicly held stocks, if stock holding is part of the agency's activities. A related problem is the risk of non-fulfilment of the estimated requirements which may cost domestic social problems and food insecurity. The third problem of such an agent is how to minimize the overall cost of fulfilling these requirements, given uncertainties in international prices and international freight rates, and to manage the risks of unanticipated cost overruns. For instance, if the agency imports more than is needed, as estimated by ex-post assessment of the domestic market situation, then the excess imports will have to be stored or re-exported and these entail costs. Finally, but not least, and related to the overall cost of fulfilling the requirements, the agent must finance the transaction, either through own resources, or through a variety of financing mechanisms.

In many countries the State has withdrawn from domestic food markets, and it is private agents who make decisions on imports. The problem, however, of private agents, is not much different or easier than that of public agents. A private importer must assess with a significant time lag, the domestic production situation, as well as the potential demand just like a public agent, and must plan to order import supplies so as to make a profit by selling in the domestic market. Clearly the private importer faces risks similar to those of the public agent, as far as unpredictability of domestic production, international prices, and domestic demand are concerned, and in addition faces an added risk, namely that of unpredictable government

policies that may change the conditions faced when the product must be sold domestically. During the recent food price crisis, surveys by FAO documented the adoption of many short term policies in response to high global staple food prices, which must have created considerable added risks for private sector agents. Furthermore, the private agent maybe more credit and finance constrained than the public agent. In fact the study by FAO (2003) indicated that the most important problem of private traders in LIFDCs is the availability of import trade finance.

The outcome risks (welfare or financial losses for instance) faced by the various food import agents depend considerably on the extent to which their operations and actions depend on uncertain and unpredictable events. Apart from the domestic uncertainties, like production and demand unpredictability, the main external uncertainty facing food importers is international price variability and hence unpredictability. International prices for importable staple commodities are quite variable, as they respond to fast shifting global market fundamentals and information. In the context of the events of the last two years, it is interesting to examine the evolution of world market price volatility. Figure 1 plots the indices of annualized historic volatilities (estimated by normalized period to period changes of market prices) of nominal international prices of the basic food commodities (wheat, maize and rice) over the previous five decades. The figure also exhibits the nominal international prices on the basis of which the indices of volatility are determined. The reason for the juxtaposition of the two types of information is to examine visually the relationship between the level of commodity prices and the market volatility. It has been known for along time since Samuelson's classic article (Samuelson, 1957) that in periods of price spikes, overall supplies are tight, and market volatility should be higher, hence the expectation is that during periods of price spikes the index of market volatility should exhibit a rise as well.

A most notable characteristic of the plots in figure 1 is that historic volatility (as an index of market instability) of most food commodities, while quite variable, appears not to have grown secularly in the past five decades. However, this is not the case for rice. During the most recent boom of 2007-8, the volatilities of all three commodities appear to have increased markedly. These observations, while only visual, and need to be corroborated with appropriate econometric analysis, suggest that volatility tends indeed to increase during price spikes, just as theory predicts. This suggests that unpredictability increases during periods of prices spikes, and this makes problems of managing import risks more difficult. If the data is plotted in real terms the conclusions are the same, suggesting that volatility issues are little affected by whether one uses nominal or real prices.

The above discussion pertains to risks faced by food importers, whether public or private, in determining their appropriate trade strategies, whether these involve imports only or imports and stock management. However, once the level of imports needed is determined, there are two additional risks faced by import agents, apart from the price risk. The first is the financing risk, namely the possibility that import finance may not be obtainable from domestic of international sources. This is the risk identified as most crucial by the FAO (2003) study for agents in LIFDCs. The second risk is counterparty performance risk, namely the risk that a counterparty in an import purchase contact will default and fail to deliver. This latter risk is one that came to the fore during the recent price spike, and is can be due to both commercial and non-commercial factors. Commercial factors may include the inability for the supplier to secure the staple grain at the amount and prices contracted because of sudden adverse movements in prices. Non-commercial factors includes things such as export bans, natural

disasters or civil strife, in the sourcing country that may render it impossible to export an agreed upon amount of the staple.

There are four ways to manage the food import risks. The first involves **avoiding or reducing the risk** altogether. This can only be done if there is no need for imports. For a public agency this can be done only if a policy of food self sufficiency or near food self sufficiency for the relevant staple is pursued by the government, perhaps combined with a policy of domestic stock management to control domestic consumer prices. Lower import dependence leads to less vulnerability in terms of import price spikes, but a rearrangement of domestic production structure, which may not be efficient. Hence there exists a trade-off between avoiding the excessive reliance on variable and risky imports in order to assure more reliable staple food supplies, and avoiding skewing the domestic production pattern toward commodities which may not ensure adequate profitability to producers or comparative advantage to the country. For an early illustration of this idea applied to a developing food importing country (Egypt) country see Sarris (1985). For a private agent, avoiding import risk can be done if the agent decides not to import at all.

The second way to manage the food import risk is to attempt to **change the fundamentals of supply and demand**, by manipulating directly the markets that create those risks. For instance, if prices are unstable, then one way to deal with this problem is to try to stabilise prices. This attitude to dealing with risks was in fashion in earlier periods, when it was thought that direct commodity control was the proper way to deal with commodity market risk. Domestic control of agricultural markets was the dominant paradigm for a long time in many countries, and is still practised widely in several countries (including many developed ones). The experience of international commodity control was disappointing (Gilbert, 1996) and is justifiably not currently regarded as an option. Domestic price control of commodities through either trade policy or direct market intervention has also proven to be very expensive, either financially or from a growth perspective. The reason is that it invariably distorts long term market signals, and hence affects the allocation of resources, with likely adverse consequences for growth. It also turns out to be very costly as Deaton (1999) has very convincingly shown, and as developed country governments in the EU and the US have found out.

The third way to manage food import price risks is to **transfer some of the risk to a third party for a fee**. This is the standard approach to insurance, where a well defined event and related risk is identified first, and then insurance is purchased against the eventuality of the risk materializing. Insurance depends considerably on the ability to identify the risks to which the agent is exposed (which involves not only the specific events, but also the probability distribution of their occurrence) and which are important for the agent, and the availability of insurers who are willing to provide the insurance for a reasonable and affordable premium. Usually insurance can be provided for events for which a probability distribution can be ascertained, and is readily observable, and for risks that can be pooled across a wide range of insured agents. Insurance can be much more easily provided (privately or publicly) for risks that are idiosyncratic and hence can be pooled together by an insurer, such as individual health risks, than for events that are "covariate" namely affect a wide range of agents simultaneously. High global prices for instance create covariate risks, as they affect all food importers simultaneously. It is clear that food imports are affected by both idiosyncratic risks (namely those that are particular to a country at any one time, such as production shortfalls), as well as covariate, such as global price shocks that affect all importers simultaneously. Global covariate risks create systemic risk problems, and hence may need global solutions.

The fourth way to manage food import risks is to **do none of the above** and just cope with whatever the situation in every period maybe. In other words "bend with the wind". Such a strategy requires the ability to adjust one's situation to cope with the unexpected event. For instance, if an agent has enough financial resources, and high prices just involve higher cost of imports, then the agent may just pay the higher prices. If the agent faces unavailability of enough import supplies then this will imply reduced domestic consumption with whatever consequences this may have. Clearly this may not be an acceptable option in many country situations.

The major competition in managing food import risks is between approaches two and three above. For a long time governments considered that the best way to reduce commodity price instability was to intervene in the markets and try to stabilize them. Instability was considered a problem that had to be dealt with by eliminating it or reducing it. While some countries have been successful at doing this (the EU through the Common Agricultural Policy, many Asian countries through parastatals, etc.) many others, especially those in Africa, in the course of controlling markets, had rather adverse impact on market functioning. Recently there are many more risk management tool and institutions available, and this is the technological development that must be considered when discussing policy options.

The above discussion assumed that there are no external insurance systems or safety nets or risk diversification instruments available to the entities (individuals of countries) that are exposed to commodity risks. This, however, is not the case for entities in developed countries. Farmers and agricultural product consumers (such as all agents in the marketing chain) in developed countries have a variety of market based instruments with the help of which they can manage the risks they face. For instance elevators that buy grains from farmers in the USA hedge their purchases from farmers in the futures or options markets. Similarly international buyers of coffee and cocoa manage their exposure to commodity risks in the international future and option markets. Producers and consumers in these countries have developed sophisticated market based risk management strategies to deal with commodity risks, and the development of a variety of financial instruments in the last two decades (futures, options, swaps, etc.) has enlarged the possibilities for risk management by these agents. The consequence is that producers and consumers of commodities in developed countries can trade for a price the risks they face in organised markets as well as in less organised over the counter (OTC) markets (for a review of such risk management possibilities and practices see Harwood et. al. 1999, Sarris, 1997, and Varangis, et. al, 2002).

While the modern markets for risk management instruments are open to all, entities within developing countries have not been very active in using them. The reasons involve a variety of institutional imperfections and financial constraints (for a review see Debatisse et. al. 1993). This implies that aid in the form of additional national or domestic targeted safety nets is likely to be not only useful, but also conducive to growth and poverty alleviation. This is the main justification for provision of safety nets at the micro or macro level.

Compensatory financing, such as what has been provided through STABEX, and what is now provided by the Cotonou agreement, and the IMF's CCFF, have been the main macro instruments to deal with export earnings vulnerability of developing countries. While the underlying theoretical and empirical rationale for these instruments is solid, their implementation is likely to lead to results opposite to what is desirable. The reason is what is known in the insurance literature as moral hazard. This refers to behaviour, which is altered

by the provision of the insurance, so as to make the recipient party adopt more risky strategies, and hence be more vulnerable. A good example is the changed structure of European and US farm producers because of the provision of extensive safety nets in the form of various price supports. The consequence of these programs, apart from the expanded production, has been both increases in the size of many farmers, but also considerable specialisation, something that has made them very vulnerable to downward price fluctuations, and has increased their opposition to reducing the level of the various developed country agricultural safety nets.

The same idea applied to compensatory financing implies that governments of countries recipient of compensatory finance might not make efforts at reducing the exposure to export earnings and import expenditure uncertainty facing them. In fact, they may even adopt export concentration, rather than export diversification strategies, if they know that any export earnings shortfall will be compensated.

The point of this discussion is that the only risks that should be insured via either compensatory financing or any other domestic or national safety net mechanism, without leading to moral hazard problems, are the unanticipated ones. Predictable variations should be dealt with differently, for instance through ex-ante planning, and not ex-post. Compensating for predictable variations in incomes, encourages governments or producers to avoid the necessary ex-ante adjustments.

That unpredictability rather than instability is the main problem in agricultural production, is one of the oldest, but apparently forgotten or not appreciated, issues in agricultural economics. In fact one of the earliest classic works in agricultural economics considered exactly the issue of agricultural price unpredictability and the benefits of establishing forward prices for producers (D.G. Johnson, 1947). By establishing forward prices for agricultural producers, one basically eliminates one of the most troublesome and potentially damaging sources of income unpredictability, and makes producers able to plan better their activities.

Establishing predictability in agriculture has been one of the earliest institutional developments of the modern era in developed countries. In fact the modern US agricultural marketing system realised very early the benefits of a market based system of forward prices, and through the simple system of warehouse receipts, emerged one of the most sophisticated and useful marketing institutions in modern agriculture, namely the institution of futures markets. It is not perhaps coincidental that futures markets developed independently in several countries and long time ago. In more recent years, the development and globalisation of financial markets has led to the proliferation of many other risk management commodity related instruments, notably options, and weather related insurance contracts. While in some developed countries the marketing system response to unpredictability has been the establishment of sophisticated forward markets, in most other countries, both developed and developing, the response of producers, and through their pressure of governments, has been the institution of fixed or minimum price marketing arrangements.

In principle such minimum fixed price schemes, can be viable, and logically justified, if there is a good mechanism of predicting future prices. The major problem, however, of most such schemes is not that they are in principle wrong, but that they have most often been transformed to price support or taxation instruments that have veered off their purpose of providing forward signals and minimum prices based on proper predictions. Examples abound in both the developed countries, (for instance the consequences of the expensive and

inefficient EU based agricultural price supports are well documented), as well as developing ones (for instance the large implicit taxation involved in much of African export agriculture). The consequence for developing countries is that now, under pressure from donors, the older and inefficient marketing systems that provided some price predictability have been abolished, without any new system in their place.

It, therefore, appears that the major issue in post adjustment agriculture in most developing countries is how to establish some forward pricing or insurance system for agricultural producers and governments without distorting the markets. Once such forward mechanisms can be established then one can talk about systems of insurance or systems of compensation.

Concerning prices, the major issue, of course, in establishing predictability, is to have some mechanism of assessing future prices. There are basically two such ways. The first is based on market evaluations of the future, and as such it is institutionalised in the organised futures markets that exist for many commodities. The second is based on some kind of technical evaluation of prices, for instance based on a mechanical formula using moving averages of past realisations. Price forecasting is a very uncertain endeavour, however, and the relevant issues are beyond the scope of this paper.

In the sequel the perspective taken is that of an agent, public or private, who has an estimate of requirements of the staple product for his/her commercial or other needs, whatever those maybe, namely for profit or for food security purposes. Furthermore, it will be assumed that the agent has made a decision of the mix of imports and stock adjustment that will be utilized to satisfy these requirements. This decision, it must be underlined, is a highly nontrivial one for a public agent, and may involve considerable analytical sophistication. Examples of the very few available relevant empirical applications are Sarris (1992) for Ghana, Pinckney (1989) for Bangladesh, and Berlagge (1972) for Pakistan.

3. SOME INSTITUTIONAL ISSUES OF IMPORTING STAPLE FOODS AND RISKS INVOLVED

International staple food trade, even though if involves relatively low or no levels of transformation of the raw material, is a complicated business. The stages involved start with the collection of the staple from producers, warehousing and transporting to port, sea transport, port unloading and warehousing at destination, transporting and/or processing in the destination country, warehousing there, and finally selling to the final buyer. The full cycle takes normally 3-6 months, and many times longer, hence it involves considerable risks over the period from which the two parties to a transaction (seller and buyer) enter into some kind of contractual agreement for a transaction and the final settlement of goods delivery and payment.

For an importer (public or private) who estimates that he will need to have a specific quantity of imports available at a given future time t, (for ease of exposition t is measured in months), and given that the time lag between contracting a transaction and delivery is some months, the process starts several months ahead, with a decision to contract for local delivery some months k in the future. A first decision that must be made by the importer is the number of months k ahead of the actual delivery of the anticipated needs at t. In most countries international grain importing is done through the use of spot tenders for a set of specified contract requirements (quantity, quality, etc.). These involve a short period (1-2 weeks) before

the tender's closing date, and this is done so as to minimize the risk of the counterparty to the transaction to renege on an agreed contract awarded.

For an importer who has decided on a given level of imports, there are three major risks. The first is the risk of unanticipated movements in prices. The second is the counterparty risk of non-delivery of the agreed supplies. A major factor in contract defaults is adverse price movements that have not been hedged adequately by supplier, so price risk is a major factor in counterparty delivery risk. The third is the risk of adverse financial developments that are not adequately foreseen, such as credit related constraints or sudden changes in the country's or the financing bank's conditions.

The advantage of the spot tender is that the risk of anything going wrong, whether it is price change or any other event that may impinge on the contract, is small, given the short amount of time between the award of the tender and actual delivery. However, in periods of market upheaval as in the last two years, the risk of counterparty default increases considerably for spot tenders. This is because any trader who wins the tender, unless already assured of supplies, either through own supplies already in warehouse or through already committed purchases, may choose to renege on a contract, in the face of adverse price movements, if he has not covered adequately the price risk of the transaction. An alternative is to plan several months k in advance, with a forward contract. While such a contract will diminish the counterpart risk of not finding enough supplies, it will increase the price risk, which if not covered adequately, may be detrimental to the importer. Another alternative to a spot or forward contract is a longer term contract for regular deliveries. Such a contract allows considerable room for forward planning on both the importer and the supplier, sides but it can only be done when there is a clear knowledge of regular and recurrent needs for a particular product.

Another way for the importer to lessen the counterparty risk is to arrange for a third party to take part of the risk. This can usually be a bank which could provide an Over the Counter (OTC) delivery contract. While banks are not usually physical traders, they maybe able to ensure better the performance of such contracts by contracting with suppliers in exporting countries and basically lessening the risks to the buyer.

The financing of imports and managing the risk of the financing provided is a very complicated business and involves a variety of agents. An excellent discussion of the various institutional arrangements can be found in FAO (2003). One may start by reviewing the principal payment methods for international trade, which range from open account-clean draft payment terms, namely payment upon shipment or arrival, to a variety of deferred payment terms, such as open account-extended payment, consignment, irrevocable letter of credit, cash in advance, and many others. All of these payment terms involve a variety of financing arrangements, such as seller's credit (deferred payment from buyer) which give rise to trade bills and traders' acceptances, issuance of letters of credit by local importer country banks, bank loans to importers, and others. Depending on the terms of financing, the cost and risks of these financing arrangements differ.

The major conclusion of the survey on financing of food imports done by FAO (2003) was that the major problem for developing country food imports is the existence of significant financial constraints in developing countries that may prevent the local agents, public or private to import the full amounts that they deem appropriate for their operations.

4. HEDGING FOOD IMPORT PRICE RISK WITH FUTURES AND OPTIONS[3]

The problem that will be dealt with in this section is whether the use of organized futures and options markets can reduce the unpredictability of the food import bill, and at what cost. Consider an agent who needs to plan imports of some basic food into a NFIDC or LIFDC. The present analysis focuses on wheat, which is one of the most widely traded cereals, characterised by well established cash, futures and options markets, and is imported by many NFIDCs. Most countries in this group do in fact import more than just wheat: maize, rice, other cereals, as well as other staples are also common import items.

The problem posed is the following. In the course of a year, the agent will need to import certain amounts of wheat for delivery to the country's border in a given month. It shall be assumed that the agent knows the amounts to be imported in every month several months ahead. While this assumption may not be perfectly valid as, despite the overall advance production information, monthly requirements may not be exactly known many months in advance, the results stay valid under the objective analysed.

In order to expose simply the theory behind the hedging rules, assume initially that the agent knows that at time 1, which is some months ahead of the present time, that he will need to import m_1 units of the basic cereal (wheat or maize). The price he will pay when ordering the above amount will be denoted as p_1. Define the following variables: f_0 is the futures price of the commodity observed in a relevant organized commodity market at the current period (which is denoted by a subscript 0) for the futures contract expiring at the, or nearest after, the period 1, at which the actual order for imports will be placed. Define by f_1 the price of the same futures contract at time 1. Denote by x the amount of futures contracts (in units of the quantity of the product) purchased at the current period, and by z, the amount of call options contracts purchased also at the current period. The call option contract is written on the same futures contract expiring at or soonest after period 1, and stipulates that if the futures price f_1 at time 1 is above a strike price s, determined at the time of the purchase of the option, then the owner of the call option can "exercise" the option and receive the difference $f_1 - s$ between the futures price at period 1 and the strike price s. The price of the option in the current period is denoted by r_0, whereas the profit from the option in period 1 is denoted by π_1. This profit will be equal to $f_1 - s$ if the option is exercised, and zero otherwise. The profit of the option can be written succinctly as $\pi_1 = (f_1 - s)l$, where l=1 if $f_1 \geq s$ and l=0 if $f_1 < s$.

Given the above definitions, the foreign exchange cost to the agent can be written as follows.

$$M = p_1 m_1 - (f_1 - f_0)x - (\pi_1 - r_0)z \qquad (2)$$

It shall be postulated that the agent wishes to minimize the conditional variance of (2), conditioned on information available at the time the agent makes the hedge. This is the objective utilized in several previous analyses of hedging rules, such as Lapan, et. al. (1991), and Sakong et. al. (1993), and can also be derived from more general welfare objectives. This objective also turns out to be relevant even if the agent wishes to minimize only the variance of the positive deviations from the unanticipated import cost (see Sarris, et. al. 2009). In any case this objective is not meant to capture the full range of domestic food security objectives in any given country, but only the narrower objective of reducing unpredictability of imports.

[3] The analysis and results in this section are exposed more fully in the paper of Sarris, Conforti and Prakash (2009).

The solution to the above problem is found under some assumptions about the relationship between the cash and the futures price. Following Benninga et. al. (1984), the cash price is written as a linear function of the near futures price.

$$p_1 = \alpha + \beta f_1 + \theta_1 \qquad (3)$$

where θ_1 (the basis risk at time 1) is independently distributed from f_1 and has zero mean.

It is also assumed that the current (namely at time 0) futures price is unbiased, namely that the currently observed futures price f_0 is the (conditional) expected value of f_1 , and that the options are fairly priced in the sense that the current option price r_0 is the expected value of π_1.

Given the above assumptions, the minimization of the conditional variance implies that the optimal solution is $x = \beta m_1$ and z=0. In other words the result is that the optimal futures hedge ratio is equal to β, namely the correlation coefficient between the futures and the cash price. This is a well known result in the futures hedging literature (Benninga et. al. 1984; Rolfo, 1980).

One could hypothesize, even in the case in point in which import quantities are known *ex-ante*, that the importer only has call options available as a hedging instrument, instead of futures, and explore the optimal hedging rule for this case. It can then be easily derived from the above equations, that in such a case the optimal hedge ratio with call options only is also equal to β, irrespective of the strike price.

All the above discussion pertains to the problem of hedging future import requirements. However, another possibility for the importer, is to buy at time t, namely k months ahead of the actual needs, and store the commodity, until time $t+k$. An agent following such a strategy would need to decide whether to store the physical commodity in the country of destination or in the country of origin. Either way, she/he will need to pay storage cost, and deal with the price uncertainty at the time of the sale. Futures prices reflect the market determined cost of storage of a commodity between the time the futures is bought and the later physical transaction time (times t and $t+k$ in our discussion), albeit this cost can be negative because of backwardation. Hence buying futures can be considered as an alternative to storing, albeit the market determined cost of storage in the Chicago market, may have little to do with the cost of storage (and any implicit backwardation) in the local market. If the agent is well aware of the domestic storage situation, and thinks that the domestic price of storage (including any convenience yield) is lower than the market price of storage as determined in the hedging market (in this case Chicago), then it may indeed be appropriate for her/him to order the commodity now at time t, and then store it in the country of destination and sell it later. However, this is something about which we do not have any information, and do not pursue further here.

Turning to empirical implementation the situation simulated is one where monthly wheat imports can be hedged with futures and options in the Chicago market. Analysis of wheat import data by source for most countries reveals that the bulk of wheat imports is obtained from three sources, namely the US, Australia, and Argentina. Time series analysis of the monthly export unit values of Australia and Argentina as well as that of the monthly US Gulf price for hard winter ordinary no 2 wheat, indicate that they are highly correlated. Hence the US Gulf price is considered as an indicative price for all wheat imports. The next issue concerns the relationship between the Gulf prices and CBOT prices, as it is this that will dictate the hedge ratio, as well as the form of the function for price expectations. Time series

analysis indicated that these prices are cointegrated, and that adjustment to short term shocks is quite fast. Hence the parameters obtained in the relevant time series estimations are used to specify the parameters of equation (3)[4].
Consider the problem of hedging the price risk for an amount of wheat equal to the hedge ratio times the known amount that will be imported some months ahead.

Futures and options daily data were obtained from the Chicago Board of Trade (CBOT) from 1985 to 2008, hence they include the high price episode of the last two years. It is assumed that all import transactions are done at Gulf prices. The simulations involve buying futures or call options k months in advance of the actual order, and selling them when the actual physical transaction for wheat imports is concluded.

The actions of the agent will aim at insuring the price risk of the physical purchases. It will be assumed that the cash orders for wheat imported in a given month are placed one month in advance. This appears reasonable in light of the norms of the trade, and implies that the prices, at which wheat imports will be valued and eventually paid, are prices of one month ahead of the actual physical arrivals at the border.

In order to implement the simulations, the agent must decide on the parameters of the rules to follow, namely: the day of the year and month at which the contract (futures or option) is bought; what contract to buy (namely for which month to buy a futures or option contract); how much quantity to buy of the contract, and; for options, the decision must be made at what strike price to buy a call option.

The following rules (strategies) are simulated

Rule 1. Hedging only with futures contracts

Under this set of rules, which are similar to those simulated by Faruqee et al (1997), it is assumed that the agent buys futures *k* months in advance of the date when he/she needs to contract the actual delivery. The contract date is assumed to be one month before the needed monthly physical delivery of import, as per the seasonal import needs, which, as indicated above, is assumed to be known. The futures contract at which the futures transaction will be made will be the closest available after the date in which the purchase is needed. For the simulations reported below, it has been assumed that the day when the transaction is made is the day closest to the middle of the month.

Concerning costs, it is first assumed that the cost of buying or selling futures is US$0.15 per tonne, just as in Faruqee et. al. (1997). In addition it is assumed that each futures transaction requires the deposit of a 5 percent margin. There is an interest cost on this margin valued at the US monthly short term interest rate. This cost is calculated over the period of the hedge.

Rule 2. Hedging with options

All the conditions stated above for futures, concerning the dates at which the contracts are bought and the dates of expiration, also hold for the simulations with call options. The only difference is that in this case the strike price also has to be determined. The rule here is that

[4] It turns out that the hedge ratio β is very close to 1 (0.998) and the constant is quite small.

the strike price is parameterized as $(1+\alpha)\ p^{f}_{t,t+k}$ where $p^{f}_{t,t+k}$ denotes the futures price observed in month t for the contract expiring at or in the nearest month after the period $t+k$, when the actual transaction will be made. The parameter α is the proportion above this future price for which insurance is sought. Hence if α =0.1, the (out of the money) call option bought implies that if the future price observed at the time of ordering the grain import, is above the strike price - which as per the option specification is 1.1 times the current future price - then the difference between the actual higher futures market price and this strike price will be paid to the buyer of the option, namely the agent. Based on industry information, a transactions cost for buying the call option equal to 4.5 percent of the option price is assumed.

It is assumed that the objective of the hedging exercise is to reduce the conditional variance of the import bills. Given this assumption, an ex-post measure of success of the hedging strategy, as per the theory exposed earlier, is the variance of the unpredictable changes in the values of imports with and without hedging. These changes can be expressed for a period t+k as follows

$$M_{t+k} - E(M_{t+k,t}) = \{p_{t+k} - E(p_{t+k,t})\}m_{t+k} \qquad (4)$$

One can then compute the variance (or standard deviation) of the changes in (4) over a given historical period. Note that implicit in (4) is the assumption, already discussed earlier, that the expected and actual imports at time $t+k$ are the same.

When the same imports are hedged with futures, the unpredictable change in the import cost is equal to:

$$\{[p_{t+k} - E(p_{t+k,t})] - \beta(f_{t+k} - f_t - \tau_f f_t - m\arg c)\}m_{t+k} \qquad (5)$$

where τ_f denotes the unit transactions cost of buying a futures contract and margc is the interest cost of the margin.

Finally, when the same imports are hedged only with call options, the unpredictable change in the import cost is equal to:

$$\{[p_{t+k} - E(p_{t+k,t})] - \beta(\pi_{t+k} - r_t - \tau_o r_t)\}m_{t+k} \qquad (6)$$

where π is the actual realized profit on the option contract (namely equal to $f_{t+k} - k$, if this quantity is positive at time $t+k$, and zero otherwise) τ_o denotes the unit transactions cost of buying a call option contract.

As per assumption (3) and the empirical estimates of (3) the conditional expectation at time t of the cash price at time $t+k$ is a linear function of the conditional expectation of the nearest futures price at time $t+k$. Under the assumption that future markets are unbiased, this latter expectation is equal to the price of the futures contract that expires at or near time $t+k$, observed at time t. Hence the following expression is used for estimating the conditional expectation in equations (4)-(6)

$$E(p_{t+k,k}) = \alpha + \beta f_t^{t+k} \qquad (7)$$

where f_t^{t+k} is the price at time t of the futures contract expiring at or nearest after period $t+k$, and α, β are parameters to be estimated empirically (see next section).

The simulation exercise compares the normalized standard deviations of the expressions in (4)-(6). The normalization is obtained by dividing the standard deviation of the differences in expressions in (4)-(6) by the average unhedged import bill over the whole period of the simulation (namely the average of the magnitudes $p_t m_t$). This normalization term is the same in the case of unhedged and hedged imports, so that whatever differences are estimated in the variability measures of the above expressions are due to the application of the futures and options hedges and not the denominator. It should be underlined that the average monthly import values are approximate and indicative wheat import bills, built up on the assumption, discussed above, that the price paid by an importing country when importing from the US or any of the other main exporters is the Gulf price.

5. EMPIRICAL SIMULATION RESULTS OF HEDGING WHEAT IMPORTS WITH FUTURES AND OPTIONS

Table 2 presents the average unanticipated changes in the cash and future prices over the periods 1985-7 to 2005-12 the recent upheaval 2006-1 to 2008-12 and for the two periods combined, and standard deviation of prediction errors.

Several observations are in order. First the ability of a simple linear formula like (7) to predict the subsequent actual cash price is quite good on average in "normal" periods, even some months in advance. Notice that the average percent forecast errors during the period 1985 to 2005 for all values of were smaller than 1.2 percent. During the period of high prices, namely the period 2006-8, the ability of a simple formula like (7) to predict the eventual cash price of wheat deteriorated only slightly for k=2 and k=4, but more so for k=6. This performance is mirrored in the ability of the futures price for forecast the subsequent futures price. The forecast statistics for average unpredictability of the futures prices are quire similar to those of the cash market statistics.

Turning to the variability of ex-ante predictions, the last two sets of rows in table 2 exhibit the standard deviation of the percent forecast errors of the expected cash and the futures prices. It can be seen that these are considerable and increase with the length of time before the actual purchase, as would be expected. For instance for k=2, namely for two months advance, the average percent standard deviation for the cash and futures price of wheat over the period 1985-2005 is around 8 percent. As the 95 percent confidence interval for predictions under normality is about two standard deviations, these numbers imply that even within 2 months before actual ordering, the price uncertainty is in the vicinity of 16 percent of the currently observed cash price. This is considerable and basically indicates the variability and unpredictability in these markets, even for short planning periods. For k=4 the same standard deviations increase to 10-11 percent. For k=6 the numbers jump to about 13 percent. Notice, however, that during the food price increase period of 2006-8, the unpredictability increased considerably, with the standard deviations of the prediction errors in both cash and futures markets increasing by 100 percent or more in some cases from the averages of the more normal twenty year period of 1985-2005

Turning to the unpredictability of the import bills, out of the LIFDCs group, eleven countries were selected that have been wheat importers over the past 25 years, based on availability of

monthly import data. The sample of importers accounted for 58 percent of total LIFDCs wheat imports in the period 1980-2008, and for 23 percent of world imports of this product.

Table 3 indicates the unanticipated normalized standard deviations of monthly wheat import bill changes (based on (4)) with and without hedging with futures. Table 4 repeats the exercise when hedging is done only with at the money options. The results cover as in the previous tables two periods, namely the period 1985-7 to 2005-12, namely before the grains price spike, the spike period 2006-1 to 2008-12, and the two periods combined.

The results in table 3 indicate that for all the countries analyzed there seems to be substantial reductions in import bill unpredictability for all periods and for all values of k, when imports are hedged with futures. The only exception seems to be India for which the unpredictability with futures and for k=4 seems to have slightly increased. This seems an oddity and is not due to the behaviour of the cash or futures prices, as these affect all countries in the same fashion. The phenomenon maybe due to the particular pattern of imports of India during the crisis period. In fact wheat imports of India during the last year of the crisis period, namely 2008, declined to about 10 percent of the average wheat imports of the previous two years. Furthermore, India seems to have exhibited in the past a marked seasonal pattern of wheat imports, with low imports early in the calendar year, peaking in the middle of the year, and then declining during the rest of the year. It maybe that the combination of the particular price pattern of wheat during the crisis, in combination with the particular import pattern of India during the crisis generates this result.

The reductions in unpredictability of import bills seem to be larger during the crisis period of 2006-8 compared to the earlier period for all countries and values of k, with the notable exceptions of China and India.

Table 4 indicates that if hedging was done with options only, the unpredictability of wheat import bills would have also decreased considerably for all countries and periods, again with the only exception being India for the crisis period and for k=4. The percent reductions in unpredictability are smaller with options (as expected from theory) in all cases. The reductions seem to be larger for the crisis period for all countries except China and India.

The simulated reductions in unpredictability are quite substantial. An important result is that reductions in unpredictability were quite significant during the recent crisis period and larger than in normal times. This suggests that during price spike periods, considerable advantage in import bill management can be obtained by the use of organized futures and options markets.

As organized futures and options markets in the CBOT, seem to be quite efficient, no agent can be expected to make profits in the long run from applying hedging rules of the types simulated here. Hence the motivating force for hedging can be predictability and improved planning, and not profitability, which would rather be the motivation of private speculators, but not of financial or import planners.

6. A PROPOSAL TO CREATE A DEDICATED FOOD IMPORT FINANCING FACILITY[5]

As identified in previous studies by FAO (2003), a major problem facing LDCs and NFIDCs is financing for both private and parastatal entities of food imports, especially during periods of excess commercial imports. The financing constraint arises from the imposition, by both international private financial institutions and domestic banks that finance international food trade transactions, of credit (or exposure) limits for specific countries or clients within countries. These limits can easily be reached during periods of needs for excess imports, thus constraining the capacity to procure finance for food imports and as a result, food import capacity. It is this constraint that the facility proposed here is designed to overcome.

The purpose of the food import financing facility (FIFF) is to provide financing to importing agents/traders of LDCs and NFIDCs to meet the cost of **excess food import bills**. **The FIFF will not replace existing financing means and structures; rather it is meant to complement established financing sources of food imports when needed.** This will help "to maintain usual levels of quantities of imports in the face of price shocks, or to make it possible to import necessary extra quantities in excess of usual commercial import requirements", as anticipated under the Marrakesh Decision. The financing will be provided to food importing agents. It will follow the already established financing systems through central and commercial banks, which usually finance commercial food imports using such instruments as letters of credit (LCs). The financing provided through the FIFF will not only increase the financing capacity of local banks, but will also induce the exporters' banks to accept the LCs of importing countries in hard currency amounts larger than their credit ceilings for these countries.

The FIFF is envisioned not to actively provide finance to a given country's agents continuously, but only if specific conditions arise. Such **trigger conditions** involve predicted food import financing needs in excess of some margin above trend levels of food import bills. The predictions will be based on the *price* and *volume* components of imports, whereby prices are world market prices for key food commodities imported by LDCs and NFDICs. The volume component involves indicators relating to reductions in domestic production due to a variety or objectively determined indicators (primarily weather), or reductions in food aid which may force the country to import more at commercial terms. A key decision in the set up of the facility is whether only external (mainly price) shocks are to be financed, or also some types of internal shocks (e.g. those due to natural disasters or adverse weather). The FIFF outlined below can function under either or both of these conditions.

Based on appropriate trigger conditions (to be elaborated below) and appropriate amounts (specific to each country), the FIFF will make available financial resources to the concerned banks (of the importing or exporting country), in the form of guarantees and not actual funds, albeit the latter could also be envisioned. The banks in turn will make the excess finance available to domestic food exporting or importing agents, over and above their normal financing needs or ceilings. A key aspect of the FIFF is that it will not finance the whole food import bill of a country, but only the excess part (to be discussed below). In this way "co-responsibility" will be established, only real and likely unforeseen needs will be financed, and the cost of excess financing will be kept at a low level.

[5] The discussion in this section draws partly on an earlier unpublished paper by FAO and UNCTAD (2005)

The basic feature of the proposed FIFF is to provide the required finance at a very short notice, and exactly when needed, once the rules of operation are agreed upon in advance. Thus, the delays common to past ex-post insurance or compensation schemes that rely on ex-post evaluation of "damages" can be avoided. The proposed FIFF will operate in real time.

The FIFF could function in different ways. The most efficient way for the FIFF to operate is like a **"guarantee" fund**, which will enable commercial banks to extend new credit lines to food importers when required. Alternatively, the FIFF can act as a financing intermediary, borrowing in the international bank and capital markets for on-lending to food importers. In both cases, its financial strength would be based on guarantees provided to the FIFF by a number of countries or international financial institutions. The fund will charge a small premium to cover its operational and risk costs, and will also hedge its loans in the organized and over the counter (OTC) derivatives markets so as to minimize the risk of losses. The main advantage of the FIFF lies in its minimal costs. Through risk pooling for a large number of countries and food products, and owing to its risk management activities, the operational costs and the amount of the revolving fund needed for the FIFF will be relatively small. Some estimates of the size of the fund needed, in terms of the average yearly financing needs, are elaborated in an appendix to this paper.

The **basic structure** of the facility would consist of the following:

1) A core team of experts (seconded from various international institutions, or employed directly) will be dedicated to the FIFF and assume the task of estimating food import trends and current requirements, as well as determining the trigger conditions and the amounts of excess food import financing limits for each affected country.
2) The FIFF will benefit from guarantees by a number of countries, which will allow it to borrow for long term in international markets to make up its operating fund, or to provide loan guarantees to commercial banks.
3) When specific trigger conditions arise, the FIFF will interpose between importers and sellers (without interfering in normal commercial relationships). Through its actions, it will make available financing to banks financing food exports, or the central and/or commercial banks of importing countries, (according to pre-set procedures and criteria), who will then make additional loans available to exporters or domestic importers. These loans will be reimbursed to the FIFF within six months (or a longer period agreed upon) by the relevant banks.

The real functioning of the facility will be more complex, since it has to reduce FIFF costs, as well as the financing risks and the necessary interest rate charges. However, these are implementation details that will be worked out once the principles are agreed upon.

Trigger conditions involve the prediction of food import bills that are above a certain agreed margin over trend food import bills. The predicted food import bills will include as mentioned earlier *price* and *volume* components. Prices are world market prices (in agreed visible commercial international markets with appropriate volume to be considered representative of world market conditions) for key food commodities imported by LDCs and NFDICs. Predicted prices consist of futures prices (when these exist) or forecasted prices (with models developed and maintained by the FIFF, and agreed upon by the FIFF membership). As it is impossible to specify whether world price increases, especially over a short period, are due to trade related factors or other economic or natural factors, and since there is a need to be objective, no attempt will be made to specify the types of underlying causes of price shocks

that will trigger FIFF financing, or make FIFF financing conditional on any of these price augmenting factors.

Import volume indicators can relate to one or more of the following: Reductions in food aid which may force the country to import more at commercial terms; Reductions in access to food on various preferential terms; Reductions in domestic production, due to variety of unforeseen, mainly natural causes and which cannot be compensated by food aid.

The triggers will involve predicted food import bill requirements in excess (by given margins) of trends that are assessed on the basis of past volumes, and agreed methods. The import bill predictions cannot be fully comprehensive, as, of necessity, they can include only the major food imports for which there are reliable international price indices.

The facility will make **financing** at normal commercial terms. The basic tenor could be six months (more than enough to export and sell the food imported under the facility onwards to the public), and interest rates will not be less than those paid by central or commercial banks in each borrowing country for international borrowing under normal conditions. This has two important implications: interest rates will differ from country to country; the facility will have a built-in capacity to resist unnecessary disbursement, as credit terms will only be attractive in times of crisis when borrowers are unable to find "normal" credit conditions. Interest rate subsidies or a longer repayment period are inefficient, and are thus not envisioned. It should be kept in mind that the purpose of the FIFF is not to subsidize excess food imports, but to enable the realization of additional food imports needed by the country, something that may require finance beyond the various credit ceilings available by international private financial institutions for LDC and NFIDC banks and clients.

The FIFF is designed to alleviate international credit constraints for food imports. The constraints involve country specific credit ceilings by commercial banks in developed and other countries, involving loans to a given country for any purpose. There are various ways for the FIFF to overcome this constraint. One would be for the FIFF to refinance credit lines provided by these commercial banks[6]. Another mechanism is to involve the FIFF in ex-ante tripartite agreements between perhaps an international financial institution representing both donors and recipient countries, the FIFF, and the relevant commercial banks, who would agree to increase their country exposure in the "trigger cases" specified by the FIFF and for amounts also specified by the FIFF. In this way FIFF could serve as a guarantor or reinsurer of "excess financing exposure". These agreements will have to be ex-ante, so that when the time comes for the extension of credit above any given credit limits, commercial banks can immediately obtain the FIFF guarantee. The FIFF could hedge both foreign exchange risk, as well as the sovereign risk through existing and emerging commercial markets for such risk (there are such instruments currently been traded and many regional multilateral banks are interested in developing them further).

The principal **risk** for the FIFF is that it will not be reimbursed by its borrowers. This risk will be managed actively. As the facility would not set out to disturb the normal functioning of international food trade, there is a "non-zero" risk that the local or central banks cannot be reimbursed by their local food importing clients. This would primarily be the concern of the domestic and central banks of each country, and not the FIFF. Nevertheless, lack of

[6] This is a mechanism used for example in the USA to enable domestic banks to provide more rural loans and mortgage loans to smaller clients, with public institutions such as FannieMae providing a refinancing facility to these banks.

reimbursement by the ultimate beneficiaries of the finance may lead commercial banks to default on their obligations (or delay repayment) to the FIFF.

The facility will follow the normal patterns of food trade. In most LDCs and NFDICs, food imports are in private hands, and many of the ultimate beneficiaries of the financing will be small private companies. Perfect control of risks will be impossible, but there are several ways to reduce risks, including counter guarantees from local banks, and the use of collateral management companies to keep physical control over the foodstuffs until they are sold onwards by the importer. As mentioned above the risk management activities of the FIFF will be instrumental to minimize losses. The cost of these risk management activities of the FIFF can be built into the interest rate differentials between the sources of FIFF funds, and its loans.
The FIFF would benefit from guarantees from a number of countries. Ideally, this would include a number of OECD countries, which would enable the FIFF to borrow at AAA terms. But any group of countries could provide guarantees; the risk rating of the FIFF is then likely to be that of the best-rated among these countries or possibly a bit better than this.

As noted before, there are different ways, of varying financial complexity, for the FIFF to ensure that food importers obtain extra finance when conditions require it. In one model, on the back of its guarantees from member countries, the FIFF can borrow easily from the international bank and capital markets. Two types of borrowing activities can then be envisioned. The first, to be conducted at the start of the FIFF, will involve borrowing long-term to set up a small revolving fund that will provide the initial capital of FIFF. In addition to this revolving fund, the FIFF may need additional funds in a given "bad" year. In such a year, the FIFF would borrow additional funds from international capital markets under the guarantees of the contributing countries. If the proper mechanisms have been set up beforehand, the delay between trigger conditions being breached, and money being available to extend finance to central or commercial banks could be less than two weeks. This will ensure that normal commercial imports of foodstuffs can continue uninterrupted even in times of large external shocks.

Assuming that the FIFF's operational costs are covered by WTO member contributions[7], there will be a fairly large gap between the financing costs that the FIFF faces, and the normal credit terms that food importers or their banks in LDCs and NFDICs are used to. The FIFF should be able to borrow at investment grade rates, and on lend at rates a few percent above this. The difference can be used for a number of purposes, such as: buying sovereign risk insurance and currency convertibility insurance to insure against default risk; buy "call options", much as discussed in the previous section; build a lower-cost tranche (or a tranche with stronger protection against the risk of world market price spikes), allowing countries with well-targeted food distribution programmes to continue providing food at reasonable terms to certain groups. In the latter two cases, these add-ons have their own large benefits (in particular compared to many of the non-market based alternatives), and donor agencies may wish to make extra grant funds available for such purposes. LDCs and NFDICs may also wish to take out "insurance" against the risk of world market price increases at their own cost, and the FIFF could advise such governments on this, given its own expertise and involvement in such risk management operations.

[7] Alternatively, if the guarantees that it receives are good enough, the FIFF could be allowed to become self-financing in a manner similar to the World Bank, that is to say, it would be able to borrow cheaply against the guarantees even when LDCs and NFDICs do not require the support, and place the funds in higher-earning assets.

Operational costs of the FIFF will be low. The FIFF will have two core functions, and one secondary function. The first core function is to gather and analyze data on food prices, food quantities, needs, and food aid flows, in order to assess the triggers for the extension of additional credit, as well as the amounts of additional financing needed, building on work and technical capacity done in existing organizations (FAO, WFP, IFPRI, World Bank, etc), and hence would require minimum resources in terms of full time technical staff members.

The second core function is to ensure food trade finance when trigger conditions are reached for one or more countries. This requires some financial management expertise. If it is deemed that this is beyond the capacity of the FIFF, then this could be outsourced to one or more international banks or insurance companies, which would act as an agent for the FIFF and be paid on a real cost basis.

Financing needs of the FIFF. To put some numbers behind the concept, appendix A makes some calculations of the yearly average financing needs of a FIFF of the type proposed here, as well as calculations of the maximum financing needed in an exceptional year. The computations suggest that average yearly FIFF guarantee financing for LDCs would be in the vicinity of US$200-430 million, while the financing needs in an exceptional year may reach as much as US$2,400 million. To put these figures in perspective the average yearly LDC commercial food import bill for all foods between 2000 and 2007 was US$10.7 billion. Hence the FIFF average annual financing needs would constitute about 2-4 percent of yearly LDC combined commercial food imports. In a year of exceptional needs, the value of FIFF guarantee financing needed could rise to as much as 23 percent of the total LDC food import bill. If all LIFDCs were to be covered by the FIFF, then the guarantee financing needed would be in the range of US$960-1937 million, and this constitutes around 1.8-3.7 percent of the average LIFDC food import bill for the period 2000-2007. In an exceptional year the maximum financing needed could rise to as much as US$10 billion, which would be about 19 percent of the total LIFDC average food import bill of the same period.

7. AN INTERNATIONAL GRAIN CLEARING ARRANGEMENT TO ASSURE FOOD IMPORT SUPPLIES

The above discussion and analysis pertains to managing the unpredictability of prices and the attendant risks, and alleviating the financing constraints faced by staple food importers. This, however, does not deal with the problem of counterparty performance risk, namely the risk of reneging on a delivery contract, faced by many food importers. In other words, the problem in this case is not so much unpredictability of food import costs, or high food import prices, or financing, but rather assurance that supplies will be delivered. This does not only pertain to short term contracts but also longer term contracts. As mentioned earlier, the basic reason for non-performance of international staple food import contracts is adverse price movements or adverse financial events that prevent a food exporter or trader to fulfil an import contract.

The basic risk of a defaulter on a delivery contract is one of damage to a trader's reputation and missing on future contracts. This risk, however, must be counterbalanced against the risk of very adverse financial outcomes for the trader, including possible bankruptcy if a contract that has not been hedged or planned appropriately, is executed. Clearly this is not an easy decision of a trader, and probably depends on factors such as the magnitude of the market under threat to future contracts, the size of the trader, the industrial structure of the trade and the number of alternative sources for the same type of contract, the financial situation of the

trader, the size and possible damage to the trader's reputation, etc. One, thing, however, that seems to imply a higher risk in international trade deals compared to domestic ones, is the fact that there seems to be no contract enforcement mechanism in international staple food grain transactions.

Contracts in organized commodity exchanges are enforced because there is a clearing house which is responsible for making sure that all transactions are executed. Similarly contracts within one national legal jurisdiction can be enforced or enforceable as there is a legal system to ensure contract enforcement, albeit a court based legal enforcement system is quite slow. Most international contracts are very similar to Over the Counter (OTC) contracts in the sense that is it only the financial and reputation status of the two parties that instils confidence in contract enforcement. There is no mechanism for international contract enforcement, and whatever juridical procedures exist are slow, uncertain, and costly, and cannot deal with the immediate risk of contract cancellation.

The basic missing institution is an international clearing house type of arrangement similar to the clearing houses that are integral parts of the organized commodity exchanges, which ensure that all contracts are executed. The key question is whether an international clearing type of mechanism can be envisioned to ensure the performance of staple food type of import contracts. In the sequel, we examine the components of what may be termed an **International Grain Clearing Arrangement (IGCA).** The objective of an IGCA would be to guarantee or insure performance of grain import trade contracts (short, medium and long term) between countries or private entities.

A major function of a commodity exchange clearing house, apart from the settlement of the financial contracts, which amount to the bulk of settlements, is to ensure that physical delivery can take place, if needed. This is for instance one of the functions of the Chicago Mercantile Exchange (formerly the Chicago Board of Trade), and to ensure this a variety of rules and regulations with respect to delivery obligations are adopted by the exchange and the clearing house. In most organized exchanges physical delivery is a very small portion of all transactions, but if a trader insists on delivery then this must be arranged by the exchange. Many exchanges have arrangements with warehouses so that physical deliveries can be made against a futures contract, and there are severe penalties for anyone with an open contract who either does not fulfill the financial terms or does not deliver a physical commodity on it. It is these properties that would need to be emulated by an envisioned IGCA, in order to it to be viable as a guarantee institution in international staple food transactions.

Probably the best way to implement something on an international scale resembling the functions of the clearing houses of existing organized exchanges would be to **link existing or envisioned commodity exchanges**, with their respective clearing houses. In other words, it maybe appropriate to think of how parts of contracts bought on one exchange could be guaranteed not only by the clearing house of the exchange in question but by clearing houses of other linked exchanges. Consider, for instance a the situation of an importer, who is contemplating of purchasing at a later point of time, some months from now, a given amount of wheat or maize or another staple for which there are organized exchanges. The subsequent purchase will be done with an open tender for delivery to the location and at the time the importer desires. If the importer follows the hedging methods outlined and simulated in section 4 above then he/she may opt to buy a futures contract or a call option in the Chicago wheat futures or options market some months in advance of the actual tender, or the same in some other related commodity market. When the time for ordering arrives, and in case the

importer cannot find anyone to respond to his tender at the time of order, the futures contract could be held to maturity and the importer could request delivery of physical grain. If he holds a call option, then he could exercise the option and buy the underlying futures contract at the strike price and then hold on to the futures contract until delivery.

The problem is that delivery at a recognized warehouse, e.g. near Chicago where the CBOT delivery locations are, may not be what the importer wants, and may need to incur considerable cost to transport those amounts to his desired import location. Hence what would be desirable is to have the possibility of taking delivery of the same amount of grain but at a location much closer to his desired destination. One way to do this would be to establish links between various commodity exchanges around the world, so that on the one hand the price difference between grain stocks in different locations would be equal to the relevant cost of transport and other transactions charges.

The IGCA could be then be envisioned as a branch of the linked commodity exchanges which would in essence consist of some parts of the underlying clearing houses of the exchanges. The IGCA would try to guarantee that physical supplies around the world at various exchanges are available to execute the international contracts in its member exchanges. This could be done, for instance, if part of the financial reserves of the clearing houses that are members of the IGCA could be transformed into a physical reserve, via for instance holding warehouse receipts in various reliable locations around the world. The advantage of transforming part of the financial reserves into physical reserves would be two fold. First, the value of the underlying reserves would fluctuate with the price of the underlying commodity. This is like marking the underlying assets to market. This would obviate the need by contracting parties to post additional margins in case the price of the commodity increases suddenly. Second, and this is perhaps a major positive aspect, if some of the financial reserves of the IGCA were to be transformed into warehouse receipts, the physical execution of the underlying contracts, and not only their financial settlement, could be guaranteed. The commitments in futures or warehouse receipts of the IGCA could be liquidated once the actual deliveries on the relevant contract were executed. The liquidation of the physical positions or futures holdings of the IGCA would provide the funds to return to the contracting parties their posted insurance margins. In fact, since the liquidation of the IGCA margins would result in a variable amount as prices fluctuate on the underlying warehouse receipts or futures contracts, the restitution to the contracting parties of their initial margins would be variable and close to a fixed share (minus some transactions cost) of the underlying transaction value. Hence the true cost to the two parties to an international contract would be the interest foregone or paid for the posted good faith margin. Given all the other transactions costs in an international staple food import contract this may not be too high.

The IGCA would guarantee the execution of contracts by pooling the resources of several exchange related clearing houses. This would ensure that there would be liquidity in terms of physical reserves to honor individual contracts in case of non-performance by a participant. In fact, the major underlying benefit of the IGCA would be that by investing a small part of its reserves into physical warehouse receipts or deliverable futures contracts, it would create a global physical commodity reserve stock that could be utilized to execute international staple food contracts in case of non-performance of the exporting party to a transaction. The major difference, however, of such a stock and stocks envisioned in previous discussions on global price stabilization would be that this reserve stock would be used only to make the market work, namely ensure physical delivery and not to change the fundamentals of the market, as most of the other stock holding ideas envision. In the words, the stocks held in the form of

warehouse receipts or other physically executable contracts, would perform the function normally done by so-called pipeline stocks, which are held by various market participants to ensure that there is uninterrupted performance of the normal market functions of the agent. Their function would not be to stabilize or speculate, but simply to ensure liquidity in the market, much as the financial reserves of the commodity clearing houses ensure liquidity to execute all underlying financial contracts. The necessity for an international arrangement to have such stocks is that there is no such physical liquidity mechanism internationally. In other words one of the main functions of the IGCA would be to ensure global physical grain liquidity. The IGCA could spread the risk of non-performance or country problems by holding its commodity reserves in several geographic locations, as well as several organized exchanges.

A major risk of such a IGCA would be that a sovereign country in whose territory, the warehouses of the underlying stocks in which the IGCA has invested are physically located, could impose export restrictions or bans that may make the physical release of stocks impossible. Here, however, is where appropriate export related disciplines could be formulated in the context of the World Trade Organization (WTO), or another regional arrangement, to prevent exactly this type of phenomenon. Rules could be formulated. For instance such rules could guarantee that export prohibitions of staple food products cannot apply to the holdings of the IGCA. If sovereign governments are members or parties of the IGCA, then they could ensure that such rules are part of any WTO agreement. Also if major IFIs, such as the World Bank, the IMF, and other IFIs are financiers of such a IGCA, then the type of sovereign type of default could be guaranteed by these IFIs, perhaps in the same manner they provide sovereign guarantees and insurance for other investment projects. In other words, default on any of the contracts insured with the IGCA would entail default with the IFIs behind it, and this may make it harder to default. On the downside, the relevant IFIs may be required to devote part of their sovereign guarantee capacity to this.

Another major risk of the IGCA maybe the possibility of default by a party. This does not have to be only be a supplier (in case for instance of increased prices), but could also be the buyer (in case of suddenly decreased prices), who may not be interested in a contract at some prices that may now be considered too high. In such a case the seller would be losing a portion of the value of the contract due to the decrease in price. Given that the IGCA would be an extended arrangement among viable commodity clearing houses, it could compensate the seller by the difference in the original and current value of the contract insured through the relevant exchange or clearing house.

An essential element then of the proposed IGCA is the internationalization and linkage of commodity exchanges. This implies that the additional performance guarantees that are envisioned here can be obtained if two conditions exist. First appropriate exchanges must exist in different geographic locations around the world. Such locations should most likely be near the major production areas for the commodity in question. Second most importers of the food commodity would hedge their subsequent purchases in such exchanges. This can become part of most food importers trading practices, and it probably is already a practice by many importers. The existence of more exchanges would probably reduce the basis risks and hence make trade more efficient.

To obtain an idea of the possible size of an IGCA, recall that in 2008/9 global cereal trade amounted to 266 million metric tonnes. The cereal imports of the most cereal import dependent economies, namely the major oil exporters and the SIDs amounted to about

50 million tonnes of this total. The LDCs accounted for another 20 million tonnes. We could assume that these are approximate figures of the amounts that maybe needed to be assured in the fashion mentioned above. However, the total of 70 million tonnes may be too much as an estimate of the potential volume of hedgeable commodities in organized exchanges that are members of an IGCA. Suppose then for the sake of the argument that half of this amount is hedged. Assume that each party to the import transaction posts a 5 percent margin with the relevant exchange. This implies that 10 percent of the 35 million tonnes, or 3.5 million tonnes of cereal equivalent would be an amount of reserves, in financial or physical form that the IGCA through its member exchanges maybe called to manage within a year. Clearly this figure would not be the amount held at any one point in time, and in fact the actual amount to manage would be a fraction of this, perhaps 20-30 percent at any one time. This implies that the actual reserve of the IGCA at anyone time may not be more than 1 million tons grain equivalent. This, however, is quite substantial compared to anyone transaction that is likely to be executed within a year, and hence the liquidity of the IGCA maybe adequate to cover any potential physical reneging of contracts. At an average price of US$200 per tonne for cereals, the amount of money managed would not be larger than US$200 million, which is a not a very large number, compared to the total value of grain trade. In fact the assets of the CME group that manages the CBOT and its clearing house are much larger than such an amount. The total average safeguard package of the CME group that guarantees performance against a default is around US$7 billion.

8. SUMMARY AND CONCLUSIONS

The paper has presented various dimensions of the problem of staple food import management, and has discussed three specific ways to manage food imports. The first way involves using futures and options to manage food import price risks. The empirical analysis showed that futures prices are good predictors of subsequent global spot prices, and for these reasons they provide a good hedging medium. Hedging with futures and options seems quite viable, and in fact considerable unpredictability reduction can be obtained by using either futures or options. The scope for the reduction in unpredictability is larger when hedges are made with futures compared to hedging with options only.

A number of *caveats* are in order when considering the results of the hedging simulations. Firstly, given the importance of the countries involved in global wheat imports, one may question whether their involvement in the CBOT may influence the price determination process in the exchange. Secondly, as mentioned, the simulations are based on a comparison with purely commercial transactions in the spot market, whereas it is known that for many of the selected countries, concessional transactions are a considerable share of cereal imports. Thirdly, it maybe that a dynamic hedging strategy along with the seasonal import pattern, and possibilities for substitution among food products, may make a difference to outcomes.

The second part of the paper discussed the idea of a Food Import Financing Facility (FIFF) to alleviate the trade financing constraint facing many low income food deficit countries. The idea proposed is based on a system of financial guarantees for financial institutions which could use these to increase their exposure limits to developing food importing countries, especially in times of elevated food import needs. It was seen that the amounts involved are not excessive given the current financing requirements for LIFDC food imports.

The third part of the paper discussed the idea of an International Grain Clearing Arrangement (IGCA), starting from the observation that the major missing institution in international grain

trade was an international contract enforcement institution. It was suggested that such an institution could function as a link between the clearing houses of existing or prospective commodity exchanges. Several aspects of such an institution were discussed, including the possible ownership of it, the risks of defaults, the link with physical reserves, etc. It was estimated with very rough calculations that such a new institution would not weight heavily on the market and hence would not influence the fundamentals of supply and demand in global import trade. It would just facilitate trade and hence basically make sure that there is enough physical grain "liquidity" to execute normal commercial contracts. Needless to say that the idea is at early stages and considerable more analysis and institutional design is needed before it can take be considered for implementation.

It must be emphasized that all mechanisms to manage food imports discussed in this paper aim at managing food import risks without distorting the physical markets. As the idea of market management in any form creates all sorts of problems and entails many political and managerial difficulties, it is these perhaps such properties of market non-distortion that should be considered as the major attributes of any mechanism or institution to better manage food import risks.

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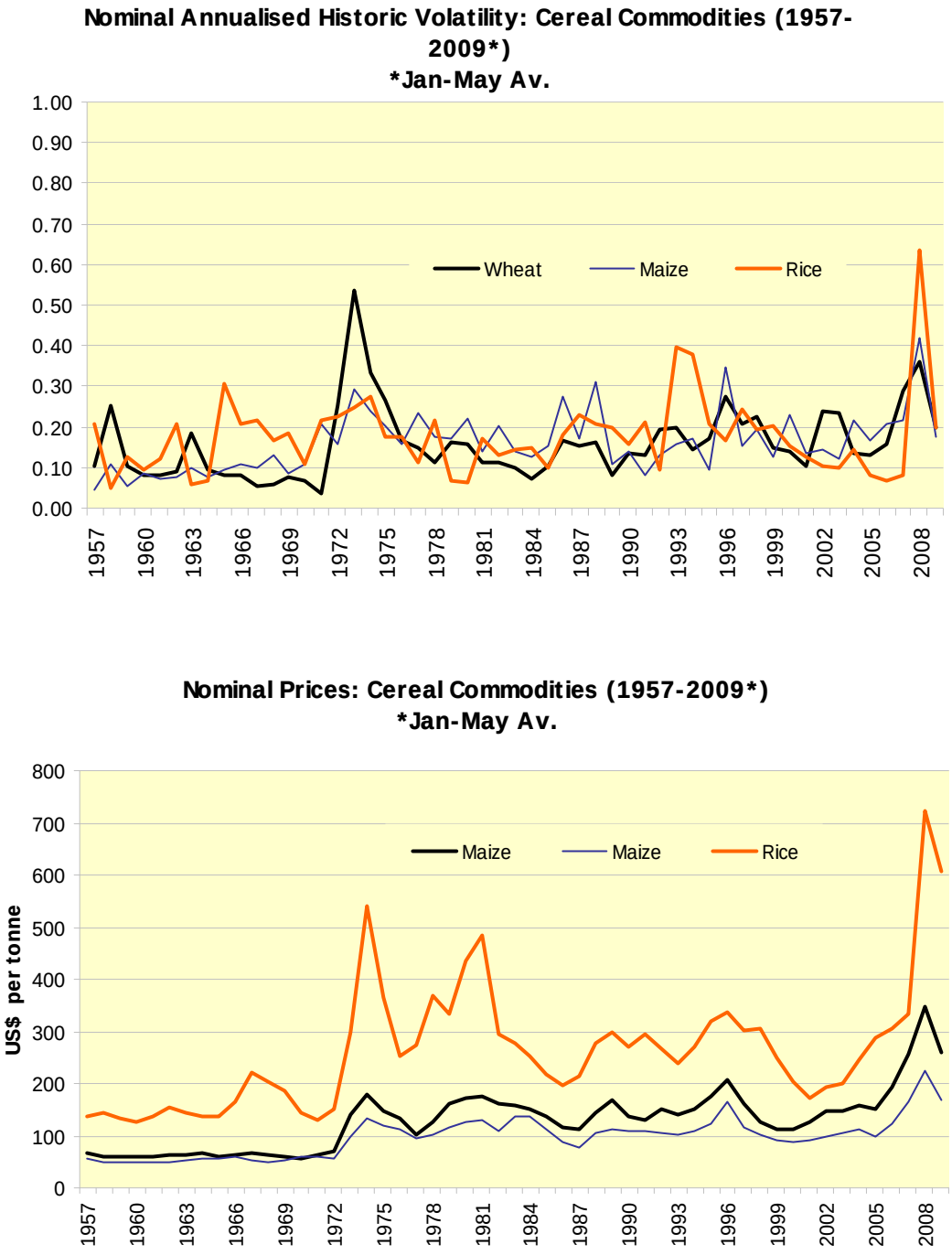
Figure 1. Historic volatility and nominal international prices for the major cereal commodities 1957-2009



Source: FAO Trade and Markets Division

Table 1. Developments in African agricultural import dependence 1970-2004

Share of agricultural imports in total imports of goods and services				
	1969-71	1979-81	1989-91	2002-04
North Africa	20.4	4.8	3.5	3.4
Sub-Saharan Africa: LDC	38.4	22.2	19.6	15.1
Sub-Saharan Africa: Other	33.5	20.9	21.4	15.9
Africa	33.3	18.5	17.3	13.2
Share of agricultural imports in total merchandise imports				
	1969-71	1979-81	1989-91	2002-04
North Africa	23.9	24.2	23.0	17.5
Sub-Saharan Africa: LDC	21.5	22.2	25.9	27.3
Sub-Saharan Africa: Other	17.4	14.8	14.2	18.1
Africa	20.6	20.3	22.4	23.7
Share of food imports in total exports of goods and services				
	1969-71	1979-81	1989-91	2002-04
North Africa	14.4	18.3	13.2	9.9
Sub-Saharan Africa: LDC	37.6	28.2	30.2	34.9
Sub-Saharan Africa: Other	14.1	8.7	6.8	11.1
Africa	24.1	18.8	17.9	20.9

Source: Author's calculations from FAO data

Table 2. Average unanticipated prediction errors of cash and futures prices, coefficients of variation of cash and futures prices, and standard deviations of percentage prediction errors of cash and futures prices for wheat on CBOT over 1985-2008

		1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12
Average Gulf price (USD/ton)		143.3	257.6	157.6
$(P_t - E_{t-k}(P_t))/ P_t$ (percent)	k=2	-1.1	1.5	-0.7
	k=4	-1.2	1.6	-0.9
	k=6	-1.0	4.2	-0.3
$(F_t - F_{t-k,t})/ P_t$ (percent)	k=2	-0.3	0.9	-0.2
	k=4	-1.3	1.0	-1.0
	k=6	-1.9	3.5	-1.2
CV of Gulf price (percent)		18.9	30.3	33.7
CV of CBOT near futures price		17.1	32.2	31.8
Stdev of $(P_t - E_{t-k}(P_t)/ P_t)$ (percent)	k=2	8.3	16.1	9.6
	k=4	10.9	22.6	13.0
	k=6	13.3	26.0	15.6
Stdev $[F_t - (F_{t-k,t})/ P_t]$ (percent)	k=2	8.0	16.2	9.4
	k=4	10.4	22.6	12.6
	k=6	12.9	25.6	15.2

Source: Sarris, Conforti and Prakash, 2009

Table 3. Unanticipated normalized standard deviations of monthly wheat import bill changes with and without hedging with futures and at the money options

	Unanticipated normalized standard deviation of monthly import bill changes without hedging			Unanticipated normalized standard deviation of monthly import bill changes, when hedged with futures only			Percent difference from unhedged		
	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12
	k=2			k=2			k=2		
Bangladesh	10.0	21.1	16.4	6.0	5.9	6.2	-40.5	-72.1	-61.8
China	11.1	20.3	11.9	5.2	11.2	5.5	-53.3	-44.9	-53.3
Egypt	9.4	21.5	15.5	5.3	6.0	5.8	-43.1	-72.0	-62.6
India	24.3	27.7	41.3	14.0	25.7	35.4	-42.3	-7.2	-14.4
Indonesia	10.9	18.7	17.0	6.8	6.8	7.1	-37.8	-63.8	-58.5
Mozambique	9.4	15.0	14.9	6.9	7.9	8.4	-26.1	-47.2	-43.4
Nicaragua	13.8	23.6	18.8	7.0	8.1	7.7	-49.2	-65.6	-58.9
Pakistan	14.9	48.2	30.6	5.9	4.8	5.8	-60.1	-90.0	-81.2
Philippines	10.0	18.4	14.7	6.1	6.6	6.6	-39.2	-64.0	-55.1
Sudan	10.3	19.1	16.0	6.8	6.7	7.2	-34.5	-64.8	-54.9
Tanzania	11.8	26.8	33.8	9.4	6.9	10.3	-19.9	-74.3	-69.6
	k=4			k=4			k=4		
Bangladesh	14.4	30.3	23.5	5.9	5.9	6.2	-58.7	-80.6	-73.4
China	16.0	27.0	17.1	5.2	11.2	5.5	-67.5	-58.5	-67.5
Egypt	12.3	23.1	17.8	5.3	6.0	5.8	-56.6	-73.9	-67.4
India	30.8	25.1	40.4	14.0	25.7	35.4	-54.4	2.4	-12.3
Indonesia	14.1	21.9	20.7	6.0	6.8	7.1	-57.3	-69.0	-65.9
Mozambique	12.6	22.2	21.5	6.9	7.9	8.4	-44.9	-64.3	-60.7
Nicaragua	21.5	32.8	27.4	7.0	8.1	7.7	-67.3	-75.3	-71.8
Pakistan	20.9	52.7	35.0	5.9	4.8	5.8	-71.7	-90.9	-83.6
Philippines	12.8	23.6	19.0	6.1	6.6	6.6	-52.6	-71.9	-65.2
Sudan	12.8	18.8	17.4	6.8	6.7	7.2	-46.9	-64.2	-58.5
Tanzania	14.3	24.8	31.8	9.4	6.9	10.3	-34.0	-72.3	-67.6
	k=6			k=6			k=6		
Bangladesh	17.0	40.9	30.9	5.9	5.9	6.2	-65.1	-85.6	-79.8
China	19.7	35.1	21.0	5.2	11.2	5.6	-73.5	-68.0	-73.5
Egypt	14.6	27.6	21.7	5.3	6.0	5.8	-63.4	-78.2	-73.2
India	34.6	33.6	51.7	14.0	25.7	35.4	-59.4	-23.5	-31.4
Indonesia	15.8	26.3	25.0	6.0	6.8	7.1	-62.0	-74.3	-71.7
Mozambique	14.3	24.2	24.3	6.9	7.9	8.4	-51.7	-67.3	-65.3
Nicaragua	24.4	55.0	40.1	7.0	8.1	7.7	-71.2	-85.3	-80.7
Pakistan	27.0	63.2	42.7	5.9	4.8	5.7	-78.1	-92.4	-86.6
Philippines	14.9	24.1	21.0	6.1	6.6	6.6	-59.5	-72.6	-68.5
Sudan	14.8	21.5	20.7	6.8	6.8	7.2	-54.1	-68.4	-65.0
Tanzania	17.5	30.0	38.8	9.4	6.9	10.3	-46.0	-77.0	-73.5

Source: Sarris, Conforti and Prakash, 2009

Table 4. Unanticipated normalized standard deviations of monthly wheat import bill changes with at the money options hedging only

	Unanticipated normalized standard deviation of monthly import bill changes without hedging			Unanticipated normalized standard deviation of monthly import bill changes, when hedged with at the money options only			Percent difference from unhedged		
	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12	1985-7 to 2005-12	2006-1 to 2008-12	1985-7 to 2008-12
	k=2			k=2			k=2		
Bangladesh	10.0	21.1	16.4	7.6	12.7	10.7	-24.5	-40.0	-34.5
China	11.1	20.3	11.9	6.9	13.5	7.4	-37.9	-33.5	-37.9
Egypt	9.4	21.5	15.5	6.4	13.1	10.0	-31.6	-39.3	-35.9
India	24.3	27.7	41.3	20.7	25.5	37.4	-14.9	-7.8	-9.3
Indonesia	10.9	18.7	17.0	7.7	11.6	11.2	-29.3	-37.9	-34.5
Mozambique	9.4	15.0	14.9	8.1	8.1	10.5	-13.3	-45.9	-29.6
Nicaragua	13.8	23.6	18.8	9.5	9.1	9.8	-31.6	-61.3	-47.8
Pakistan	14.9	48.2	30.6	9.0	29.9	19.4	-39.6	-38.0	-36.6
Philippines	10.0	18.4	14.7	7.6	11.6	10.1	-23.2	-36.8	-31.3
Sudan	10.3	19.1	16.0	8.1	12.1	11.0	-21.6	-36.9	-31.4
Tanzania	11.8	26.8	33.8	11.6	17.0	22.7	-2.1	-36.7	-32.9
	k=4			k=4			k=4		
Bangladesh	14.4	30.3	23.5	10.3	15.1	13.4	-28.1	-50.1	-43.1
China	16.0	27.0	17.1	9.1	16.1	9.7	-43.3	-40.2	-43.2
Egypt	12.3	23.1	17.8	8.3	10.9	9.8	-32.2	-52.7	-45.0
India	30.8	25.1	40.4	29.2	26.1	39.6	-5.1	3.9	-2.0
Indonesia	14.1	21.9	20.7	9.7	10.7	11.4	-30.8	-51.3	-45.1
Mozambique	12.6	22.2	21.5	10.4	11.2	12.3	-17.5	-49.4	-42.6
Nicaragua	21.5	32.8	27.4	15.4	10.8	14.5	-28.7	-67.0	-47.3
Pakistan	20.9	52.7	35.0	14.5	30.2	21.7	-30.6	-42.7	-38.1
Philippines	12.8	23.6	19.0	9.1	11.7	10.9	-28.7	-50.4	-42.8
Sudan	12.8	18.8	17.4	9.7	9.1	10.2	-23.6	-51.7	-41.4
Tanzania	14.3	24.8	31.8	12.8	14.8	20.3	-10.4	-40.6	-36.3
	k=6			k=6			k=6		
Bangladesh	17.0	40.9	30.9	12.4	21.1	17.6	-27.5	-48.3	-43.0
China	19.7	35.1	21.0	10.8	21.9	11.5	-45.2	-37.6	-45.0
Egypt	14.6	27.6	21.7	10.0	12.7	11.6	-31.9	-54.0	-46.6
India	34.6	33.6	51.7	29.3	28.2	42.4	-15.2	-16.1	-18.0
Indonesia	15.8	26.3	25.0	10.5	12.3	12.8	-33.2	-53.1	-48.7
Mozambique	14.3	24.2	24.3	11.4	12.1	13.4	-20.5	-49.8	-44.7
Nicaragua	24.4	55.0	40.1	18.6	26.7	22.9	-24.0	-51.6	-42.8
Pakistan	27.0	63.2	42.7	19.8	36.5	27.2	-26.7	-42.2	-36.3
Philippines	14.9	24.1	21.0	10.5	11.4	11.5	-29.9	-52.9	-45.1
Sudan	14.8	21.5	20.7	11.0	8.7	10.9	-25.6	-59.2	-47.3
Tanzania	17.5	30.0	38.8	16.1	16.2	22.5	-7.7	-46.0	-42.0

Source: Sarris, Conforti and Prakash, 2009

APPENDIX A. ESTIMATES OF THE FINANCING NEEDS OF THE FIFF.

The purpose of this technical appendix is to make some initial estimates of the average amount of financing needed yearly to operate the FIFF. Such estimates will provide donors with the information needed to consider the magnitude of the guarantees required to set up the FIFF revolving fund. The estimates provided here are, of necessity indicative, and need to be refined further, but they illustrate the magnitudes involved.

1. Methodology

The method utilized consists of two parts. First indicative food import bills are calculated and analyzed to see whether they are closely related with actual food import bills. Secondly two methods for computing food import bill trends are proposed and applied, in order to examine whether the calculations lead to similar magnitudes for FIFF needs. In the sequel these methods are outlined.

1.1 Calculation of indicative and trend food import bills.

For each of the 50 LDCs and the 77 LIFDCs consider the following basic 8 food groups: wheat, coarse grains, rice, dairy, meat, sugar, fruits and vegetables (including pulses), and oils. Let j denote the product index (j=1,..,8). For each group j annual import volumes (in mts) from 1961-2007 (or latest available) were compiled, and monthly series of international indicative absolute prices were also specified, as per FAO data. These prices were assumed to be the same for each country, as far as commercial imports are concerned. For groups of commodities such as fruits and vegetables, or meats, which include many commodities, the price of a representative product with a well observed international market was utilized as representative of the group. From the monthly prices annual averages were computed.
For each country i the following indicative food import bill (FIB) (not including amounts imported as food aid) was computed for each year t.

$$FIB_{it} = \sum_{j} p_{jt} M_{ijt} \qquad \text{(A1)}$$

where $M_{ij,t}$ denotes the volume of commercial imports of a given commodity or commodity group j in year t, and p_{jt} is the world indicative international price of commodity j in yeat t.

Clearly this indicative food import bill is not necessarily equal to the actual import bill recorded for each country, as there are differences due to the actual prices paid by each country (which may differ from international indicative prices because of transport costs, different countries of origin, etc.). However, such a simple computation as above is quite easy and straightforward to implement when one needs to make predictions of food import bills. Hence, an issue is whether such in indicative import bill is correlated with the actual ex-post import bills. Figure A1 exhibits graphs of actual (as obtained from FAOSTAT) versus indicative (as estimated from A1) food import bills for the LDCs and the LIFDCs (which includes almost all LDCs). It can be seen that the two lines in each figure move quite closely together, which suggests that the indicative food import bills are broadly representative of the actual observed ones.

1.2 Computation of trends in food import bills.

Trends in the indicative food import bills were computed by two methods.

Method 1. Compute moving averages directly on the indicative FIB_{it}, computed above, as follows

$$FIB_{it}^{Trend1} = \frac{1}{K}\sum_{k=1}^{K} FIB_{i,t-k} \tag{A2}$$

where K is an appropriate integer (in the empirical results a value of K equal to 3 is utilized, but values of 4 and 5 were also tried)

Method 2. Compute moving average trends on each of the variables in (A1) and then compute the resulting overall import bill trend.

$$p_{it}^{Trend} = \frac{1}{K}\sum_{k=1}^{K} p_{i,t-k} \tag{A3}$$

$$M_{it}^{Trend} = \frac{1}{K}\sum_{k=1}^{K} M_{i,t-k} \tag{A4}$$

$$FIB_{it}^{Trend2} = \sum_{j=1}^{8} p_{jt}^{trend} M_{ijt}^{trend} \tag{A5}$$

Clearly none of these crude methods are good estimates of the trend food import bills, and much better methods can be applied. However, the purpose of the empirical exercise here, is to estimate some ballpark figures for the financing needs of a FIFF, and for these purposes the above methods suffice.

1.3 Ex-post computation of above normal food import bills.

For each one of the two trends computed by the two methods above, derive the following sets of deviations from the indicative food import bill in (A1).

$$\Delta FIB_{it}^{1}(\alpha) = FIB_{it} - (1+\alpha)FIB_{it}^{trend1} \tag{A6}$$

$$\Delta FIB_{it}^{2}(\alpha) = FIB_{it} - (1+\alpha)FIB_{it}^{trend2} \tag{A7}$$

The parameter α denotes the proportion above the trend which will define an "excess food import bill", or differently an aggregate "import surge". A time series of above normal or excess food import bills (EFIB) that will be used for the analysis will be computed as follows (m=1,2 denotes the two methods for computing trends as indicated above):

$$EFIB_{it}^{m}(\alpha) = \begin{cases} \Delta FIB_{it}^{m}(\alpha) & if \quad \Delta FIB_{it}^{m}(\alpha) > 0 \\ 0 & otherwise \end{cases} \tag{A8}$$

The empirical analysis consists of first computing time series of the above EFIBs for both methods, and for various values of α for each country. The values of α simulate different potential trigger levels. For instance a value of α equal to 0.1 indicates that the FIFF is triggered when the predicted food import bill is more than 10% above the trend food import bill for the country.

Once the above time series for each country are computed, the following statistics of "aggregate excess deviations from trend food import bills" for all LDCs, and LIFDCs are computed.

$$EFIB_t^m(\alpha) = \sum_{i=1}^{n} EFIB_{it}^m(\alpha) \qquad \text{(A9)}$$

It is this latter time series that will form the basis for the empirical results.

1.4 Computation of potential "excess food import bills", and reliability of results.

The above computations indicate the positive variations above a trend of the realized food import bills. However, they certainly do not answer the question of how much additional commercial food imports would have taken place had the facility existed over the past 40 years. The reason for this is that the actual food imports of any given country take place in the presence of the financing constraints discussed in the main part of the report. Hence, it is impossible to know what amounts of imports would have taken place if the constraint did not exist.

A better methodology for estimating the requirements for FIFF financing, would be to have a method for predicting commercial food imports, preferably the one that will be applied by the FIFF should it be instituted, and then apply this method retroactively, namely ex-post for a long period, to the countries concerned, in order to estimate the predicted food import bills, in place of what was computed above as indicative food import bills. By estimating the difference between what is predicted on the basis of this methodology and the actual food import bills, one would have a good estimate of the amounts that would have been imported in the absence of constraints. This, however, need not be done at present, as in the absence of agreement on a FIFF, there is no need for such detailed methodology.

Given, however, that the realized commercial food imports are presumably a lower bound of the commercial food imports that would have taken place if the financing constraints did not exist, one may make a reasonable estimate of the excess amount of food imports that would have taken place without the financing constraint as follows. Assume that the hypothetical excess amount of food imports that would have taken place is proportional to what was calculated above as ex-post excess food import bills. In other words one may hypothesize that the food financing constraint would indeed be binding when there is a greater need for commercial food imports, and this greater need is evidenced in the periods when the actual food imports were above the trends, as indicated above. If one further hypothesizes that the actual amount of commercial imports that would have taken place if the financing constraint did not exist is proportional to the estimated deviations, then one can compute the amounts of excess financing needed. Of course, one can assume that the financing constraint would bind at different levels of what was defined above as constituting an excess, namely values of the parameter α.

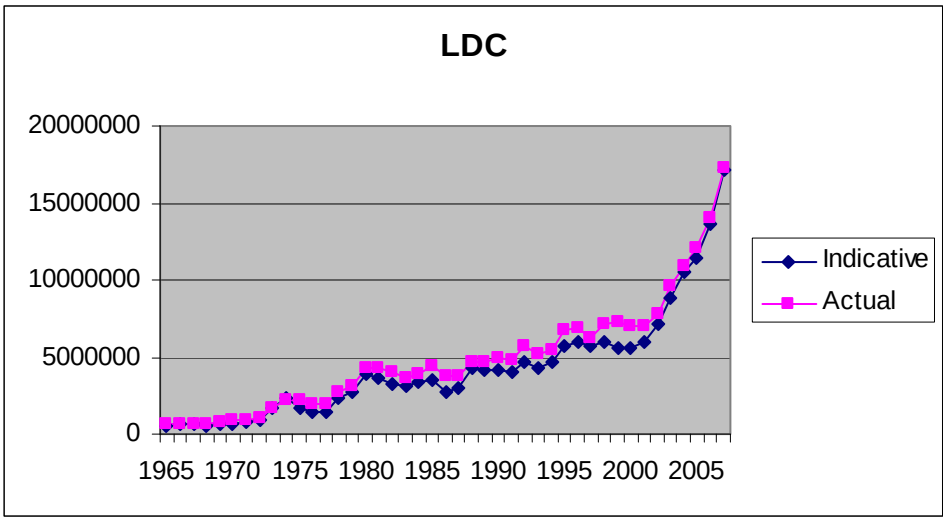
In the sequel this simple method is employed, under the assumption that the financing constraint would bind at different values of the parameter α, and that the excess food import bills that would have been realized had the constraint not existed, would amount to a fraction β of the EFIB computed in (A9). For the empirical illustrations a fraction $\beta=0.5$ is employed.

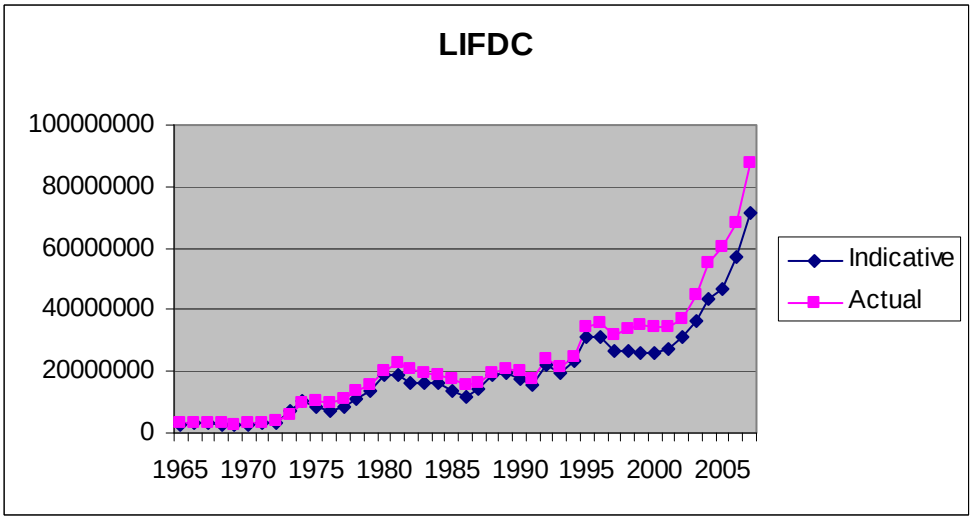
2. Empirical results

The method outlined above was applied, as indicated earlier to the 50 LDCs and the 77 LIFDCs for the period 1961-2007, which includes the "food crisis period of 1974-75 but only part of the recent food crisis period, as there is no data for food import bills for most countries for 2008. Table A2 indicates the actual values of the food import bills of these groups of countries for the period 2000-2007. It can be seen that for both LDCs and LIFDCs, the food import bills more than doubled in US$ terms during this period.

Tables A3 and A4 indicate the estimated amounts of "excess food import financing needs" that could be financed by the FIFF under the two different methods of computing the trends, as outlined above, and various values of the parameter α. The results indicate that the estimated values for FIFF required finance vary considerable both with the value of the parameter α. This may have to do with the fact that the food crisis of 1974-75 is quite close to the start of the simulation period, which is 1970. It is clear that as the value of the parameter α increases, the amount estimated declines. This is to be expected as a higher value of α, implies that it is a smaller amount of the estimated deviations that can be considered as excess food imports.

Figure A1. Actual versus computed indicative food import bills of LDCs and LIFDCs





Source: Author's calculations

Table A1. Actual total food import bills of LIFDCs and LDCs during 2000-2007 (in US$ million)

	LIFDC	LDC
2000	34294	6994
2001	34187	6970
2002	36702	7819
2003	44867	9664
2004	54940	10847
2005	60192	12076
2006	68228	14016
2007	87377	17268
Average	52599	10707

Source: FAOSTAT

Table A2. Estimates of the total excess food import financing needs during 1969-2007 of LDCs and LIFDCs under method 1 and for different values of the parameter α (all values in US$ million).

	LDC					
	$\alpha = 0.05$	$\alpha = 0.1$	$\alpha = 0.15$	$\alpha = 0.2$	$\alpha = 0.25$	$\alpha = 0.3$
MEAN	428	374	325	279	238	204
MIN	18	11	6	4	3	0
MAX	2,428	2,160	1,896	1,633	1,388	1,164
	LIFDC					
	$\alpha = 0.05$	$\alpha = 0.1$	$\alpha = 0.15$	$\alpha = 0.2$	$\alpha = 0.25$	$\alpha = 0.3$
MEAN	1,937	1,688	1,467	1,274	1,107	962
MIN	58	48	40	34	28	5
MAX	10,150	9,000	7,900	6,800	5,750	4,735

Source: Author's computations

Table A3. Estimates of the total excess food import financing needs during 1969-2007 of LDCs and LIFDCs under method 2 for different values of the parameter α (all values in US$ million).

	LDC					
	α = 0.05	α = 0.1	α = 0.15	α = 0.2	α = 0.25	α = 0.3
MEAN	431	377	327	282	242	207
MIN	19	14	9	5	3	0
MAX	2,444	2,176	1,913	1,651	1,406	1,177
	LIFDC					
	α = 0.05	α = 0.1	α = 0.15	α = 0.2	α = 0.25	α = 0.3
MEAN	1,951	1,703	1,479	1,288	1,120	974
MIN	58	48	40	34	28	10
MAX	10,200	9,050	7,950	6,900	5,850	4,816

Source: Author's computations