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Alternative mechanisms to reduce food price volatility and price spikes

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1 Background

1.1 2007–08 food price crisis

The 2007–08 food price crisis caused hardship on a number of fronts in countries throughout the world. The steep rise in food prices led to economic difficulties for the poor and generated social and political turmoil in many countries. Haiti, Egypt, Bangladesh, Côte D'Ivoire, Uzbekistan, Yemen and Indonesia are among the 33 countries that saw violent food riots, demonstrations or social unrest as a result of rising food prices. In addition to the economic, social and political impacts, the crisis may also lead to long-term, irreversible nutritional damage, especially among children. For example, across several Latin American countries, simulations have shown important reductions in calorie intakes at both the national level and within vulnerable households with children of 0–2 years of age. In all countries, poorer households that were already consuming at levels below the calorie adequacy threshold showed greater reductions in calorie intakes (Robles and Torero 2010). These long-term health effects are especially detrimental to already vulnerable populations and their cost should be taken into account as solutions to these price spikes are examined.

As long-term solutions to the food price crisis are sought, it is important to understand the root causes of the problem. The crisis was triggered by a complex set of long- and short-term factors, including policy failures and market overreactions. One important factor in the crisis could had been the entry of significant financial resources into futures markets, including food commodity markets, which could have contributed to a price spike during the first six months of 2008. It is important to note that still there is no common agreement among experts on this and there is significant discussion around the possibility that channelling financial resources through commodity futures markets may have triggered the food crisis and in particular the role of speculators in the crisis. Establishing theoretical and especially empirical linkages between future prices and spot prices is not easy, and testing causality is even more complex (for the theory on the topic see Sanders and Irwin 2010).

On the one hand, and in favour of this argument, Robles et al. (2009) and Robles and Cooke (2009) used monthly Chicago Board of Trade (CBOT) data to test whether lagged proxies for speculative activity in the CBOT (e.g. various ratios of non-commercial activities relative to total activities) predict changes in spot prices. They conducted 23 tests based on four commodities and six proxies for speculative activity, and found evidence of Granger causality in 6 of the 23 tests. In a similar line, Gilbert (2010) also tested the impacts of futures market activity on spot prices, although he used different dependent and independent variables, and found that futures positions have a large effect on food prices. On the other hand, and against

the speculation argument, authors such as Wright (2009) disregard the evidence presented by the previous authors questioning the use of Granger causality tests[1] and the fact that trading volume and short speculation have generally not been viewed as problematic. Unfortunately, Wright (2009) does not provide any reference to empirical work supporting this statement nor does he provides any theoretical foundation. In fact, the idea that speculation might come from either short or long positions in futures markets is implicitly present in the old working's speculative 'T' index (see Sanders et al. 2008, p. 10). Furthermore, Irwin et al. (2009a,b,c) argue that as we have not observed build-ups of grain inventories then the case for speculation as a driver for prices weakens. However, Krugman (2008) and Irwin (2008) should mention that what we should observe is an increase in inventories relative to a counterfactual level of inventories instead of past levels of inventories. This is a very important distinction and a basic point for those in the impact evaluation business. As we all know, more than one driver has played a role in the behaviour of grain prices in the period 2006–08, and these same drivers could have also played a role in explaining changes in inventory levels. Hence the right question to ask is whether stock levels were above the levels that would have taken place in the absence of speculation. In other words, request stock levels with and without speculation instead of stock levels before and after speculation. Abbott (2009) shows that, based on the correct counterfactual level, there seems to be a relative accumulation of inventories in corn in the USA. Clearly during 2007 and 2008 stock levels (actually the stocks-to-use ratio, which is the correct way to measure stocks) were to the right of a longer-run equilibrium relationship between prices and stock levels. Then, based on historic data for such high prices during 2007 and 2008, we should have observed lower stock levels than those actually observed.

In summary, and despite the significant recent literature on the potential causes behind the 2007–08 crisis, we do not yet have the definitive diagnosis that analyses all the potential causes in a quantitative basis. In this respect, Table 1 shows a more complete discussion of the different demand- and supply-side factors that contributed to the recent food price crisis. As a result, and given the lack of a clear causal diagnosis, it is even more difficult to analyse the potential policies that are necessary to avoid such a crisis in the near and long-term future. However, it is generally agreed that this episode, and also what has happened since October 2010, highlights the need for more research on the architecture of international financial and agricultural markets, so we can identify proper mechanisms for reducing extreme price volatility, especially given the extreme impacts they have on the livelihoods of the poor (Sommer and Gilbert 2006; Bakary 2008; Brahmbhatt and Christiaensen 2008; OECD 2008; UNCTAD 2008; von Braun 2008a,b,c; von Braun et al. 2008; World Agricultural Outlook Board 2008; Headey and Fan 2010; HM Government 2010).

[1] Wright argues that the Granger causality test is controversial, raising the well-known issue of whether Granger causality actually tests for causality or tests only for the forecast capacity of one variable on another. What he clearly misses is the fact that the authors argue 'Granger causality' and not causality. The fact that Granger causality tests might reflect forecast capacity of speculation variables on spot prices rather than true causality was explicitly discussed in Robles et al. (2009). Moreover, in Robles et al. (2009) the rolling regressions growth rates of prices are modelled as autoregressive process with mean reversion to a long-run growth rate, hence deviations to this long-run growth rate have transitory effects on growth rates but permanent effects on price levels. Adding a lagged speculation and rejecting non-Granger causality has the following interpretation: the speculation proxy carries information relevant to explain the price growth rate in the future that is not reflected in the current growth rate of prices.

1.2 Food price instability

For several decades, the dominant approach for managing food price instability has been to stabilise income without affecting prices. The idea behind this approach is that prices guide behaviour, so any attempt to change prices damages this mechanism for resource allocation. At the same time, the 'natural' insurance that comes from the negative correlation between harvest size and price level stabilises producers' incomes. Thus, any effort to stabilise food prices reduces the correlation between prices and harvests and disrupts the existing natural equilibrium. Under this strategy, private insurance and hedging instruments, along with public instruments targeting vulnerable households, are used to manage risk and stabilise prices. However, in the changing global economy, prices do not always convey the appropriate information to the economic agents. Price stabilisation then becomes essential in order to eliminate the endogenous component of price instability without affecting the natural price instability component[2].

1.3 Price volatility and lack of buffer stocks

Although the difference between too little and adequate grain stocks is relatively small, a lack of sufficient stocks can lead to large price increases and a breakdown of functioning markets. Both 1973 and 2007 showed global grain stocks hitting record lows, prompting global food crises. The difference in global end-of-year stocks in 2004–05 and 2007–08 was only about 60 million tonnes, or 2.7% of global production, but with prices rising sharply in 2007–08 this difference in grain stocks, combined with the price increases, was enough to cause serious problems in the market and especially in the more concentrated commodities, as the case of rice (Timmer 2009).

In the short term, both supply and demand for grain are very inelastic. In addition, droughts, floods or any other severe weather shocks can have a significant impact on supply because grain production is so sensitive to weather. Together with the inelasticity of demand, any supply shocks can lead to price spikes and hoarding by farmers in order to take advantage of higher prices in the future. At a regional level, on the other hand, grain production is less affected by weather, and shortages in production in certain areas can be compensated for by higher production in other areas. As a result, international trade can reduce the need for large national-level grain reserves. However, because so many countries had reduced their public grain reserves by 2007, when prices began to rise, many governments had no mechanism for stabilising their grain markets. A few countries did have sufficient reserves but did not want to sacrifice their reserves to stabilise the global market. Governments in a few exporting countries further worsened the situation by temporarily establishing export barriers and reducing import barriers – by adding upwards pressure on commodity markets, global market stability was sacrificed in order to stabilise domestic prices.

[2] For more information, see Galtier (2009).

1.4 Financial crises

In addition to the effects of the price increases, the financial crisis also served to further restrict trade flows and exacerbate the problems cause by decreased stocks and price volatility. Owing to a variety of factors, including decreased investment, decreased consumer incomes and increased household savings rates, the demand for capital goods was reduced, and thus affecting the trade of such goods[3]. In addition, as a result of the credit crunch, short-term credit devoted to trade activities (trade finance) has been contracted, raising directly the cost of trade. With this contraction in the lower part of the balance of payments, the capacity of several developing countries to finance their imports has also been severely affected. The decreased activity in developed countries has led to a fall in remittances and foreign direct investment flows, further limiting the payment capacity of several countries[4]. In order to adjust, most developing countries have devalued their currency at the cost of losing real income valued at world prices, leading to decreased demand. Finally, although the protectionist pressures have been largely controlled, trade policies have also been impacted by the financial crisis[5]. The protectionist effect of certain tariffs increases automatically as prices fall. Owing to the collapse in demand, there has been a sharp decrease in merchandise prices since the beginning of the crisis; with a fixed tariff, the percentage of the price represented by the tariff increases when the price falls.

Table 1: Explanations for rise in agricultural commodity prices

Factors	Mechanism	Effects
Demand-side factors		
Income growth, population growth and urbanisation	Cereal demand has been growing at 2–3% per year, thanks to rising incomes in China, India and, more recently, sub-Saharan Africa. Meanwhile, yield growth in these cereals has declined from 3% in the 1970s to 1–2% in the 1990s	This resulted in a significant reduction of cereal reserves to less than 400 million tonnes in 2007 from 700 million tonnes in 2000
Ethanol/Bio-fuels	With oil prices at an all-time high of more than US$120 a barrel in May 2008 and with the USA and the EU subsidising agriculture-based energy, farmers have shifted their cultivation towards crops for biofuels	Impacts vary from Lipsky (2008) estimating that the increased demand for bio-fuels accounted for 70% of the increase in maize prices and 40% of the increase in soybean prices to Rosegrant et al. (2008) estimates of long-term impact on weighted cereal prices of the acceleration in bio-fuel production from 2000 to 2007 to be 30% in real terms
Supply-side factors		
Increased oil/fertilizer prices	Oil prices increased significantly	Affected directly transportation costs and indirectly price of fertilisers (see IMF Fiscal Affairs, 2008)
Low R&D	The neglect of agriculture in public	As a result, agriculture productivity growth has

[3] Average projected GDP growth in developing countries is a quarter of what was expected during the first half of 2008; average growth in Eastern Europe, Central Asia, and Latin America and the Caribbean is projected to be negative (IMF, World Economic Outlook). According to the International Labor Organization (ILO) projections (2009), an additional 30 million people worldwide will be unemployed in 2009, an estimated 22 million of whom live in developing countries. The reduction in the incomes of final consumers, fuelled by decreasing profits for firms and increased unemployment, further reduced demand for all consumption goods and services, including imports. As the household savings rate increases, the share of income that households devote to consumption also decreases.

[4] The World Bank estimates a 7.3% fall in remittances in-flows to developing countries in 2009 (World Bank, 2009), while UNCTAD projects a 40% fall in global FDI flows for 2009 (UNCTAD 2009).

[5] See Bouet and Laborde (2009) for further discussion.

investments in agriculture	investment, research and service policies during the past decade has undermined its key role for economic growth	declined and is too low
Droughts/Climate change	Occurring in large grain-producing nations, droughts and climate change have lowered worldwide production	More volatile weather patterns related to climate change increased
Other fundamental factors		
Dollar devaluation	The indicator prices of most commodities are quoted in US dollars, and the dollar went through a substantial depreciation	Even though, when adjusted for inflation and the dollar's decline (by reporting in euros, for example), food price increases were smaller but still dramatic
Large excess of liquidity in G7 countries	Large excess liquidity in several non-G7 countries, nourished by the low interest rates set by G7 central banks	Commodity prices are the result of portfolio shifts against liquid assets by sovereign investors, sovereign wealth funds, partly triggered by lax monetary policy, especially in the USA (for details, see Calvo 2008 and Rojas-Suarez 2008).
Second-round effects		
Protectionist measures	Ad hoc trade policy interventions, such as export bans, high export tariffs or high import subsidies were partly triggered by the price crisis and exacerbated the crisis symptoms. As of April 2008, 15 countries including major producers imposed export restrictions on agricultural commodities, thereby narrowing the global market	Policy responses such as export bans or high export tariffs may reduce risks of food shortages in the short term for the respective country, but they are likely to backfire by making the international market smaller and more volatile. IFPRI simulations with the MIRAGE global trade model had shown that these trade restrictions can explain as much as 30% of the increase in prices in the first six months of 2008
Speculation	The flow of speculative capital from financial investors into agricultural commodity markets was significant. From May 2007 to May 2008, the volume of globally traded grain futures and options increased substantially	There is still not agreement on this and there are basically two groups: (a) Robles et al. (2009) and Robles and Cooke (2009) implemented Granger causal test to identify to what extent indicators for speculative activity can help forecast spot price movements using CBOT monthly and weekly data. They show some evidence that speculative activity partly explains the price spike since January 2008. There are other authors. Similarly, Gilbert (2010) shows some evidence of speculation; (b) Wright (2009) and Irwin et al. (2009 a,b,c) opposed this argument

1.5 Climate change

With the financial crisis fuelling the economic, social, political and global health problems associated with already volatile food prices, a third factor must also be taken into account. The more variable temperatures, changes in precipitation patterns and increased occurrences of extreme weather events, such as droughts and floods, that accompany climate change will increasingly affect the global food supply. As a result, the global community will have to deal with the issues prompted by the food price and financial crises of recent years more and more as prices are increasingly affected by both supply and demand issues around the world. What is evident from these crises is that governments will find it difficult to deal with these issues at a national level.

In summary, if there is something we can have confidence in, it is that agricultural commodity prices will be very volatile in the coming years; therefore, a careful analysis of different policies that could be implemented to reduce or diminish the effects of increasing price volatility, and especially to reduce the probability of significant price spikes, is necessary. The price spike episode of early 2008 clearly highlights the need to modify the institutional architecture of international financial and agricultural markets to address their effects on the livelihoods of the poor.

2 Review of policies proposed/implemented to reduce price volatility in the past

Physical reserves have been used at national, regional and international levels at different times throughout history to control price spikes and reduce price variability. For decades, large countries such as China and India have kept a significant level of physical reserves because of their size and the effects that their entry into world markets during harvest shortfalls would have on prices. The USA operated a farmer-owned reserve for several decades, which gave farmers loans and money towards storage costs in exchange for following requirements for when this stored grain could be sold. The farm bill passed in 1996; however, it virtually eliminated physical grain reserves.

Many African countries, including Burkina Faso, Mali, Mozambique, Niger, Ethiopia and Tanzania, established nationally based food security reserve stocks between 1975 and 1980. This was during a time of heavily managed agriculture and, because global grain prices were extremely high, many of these governments did not trust world markets to be secure sources of grains during an emergency. However, it proved to be quite difficult to accurately estimate how much grain was actually needed in these reserves. There was a tendency to overestimate the amount of grain needed in an emergency. Quantities were based on estimates of what people eat normally when, in fact, people facing hunger eat less and often switch to cheaper foods, which then make up some of the shortfall. There were a number of other difficulties, including use of the reserves in normal market operations by the parastatals, insufficient resources to replenish reserves, and the unwillingness of donors to support these activities, which eventually led to the disappearance of these food security reserve stocks in most countries. Interest in the establishment of strategic grain reserves was revived following the liberalisation of the cereals markets during the structural adjustment of the 1990s. Governments attempted to insure against the failure of the private sector during this period, but many of the experiences in managing these reserves were similar to previous attempts at grain reserves. Mismanagement, corruption, damaged donor relations and erroneous estimates of consumption and production plagued governments as they tried to manage these reserves.

Interest in regional reserves also increased after the last food price spike in 1973–74. The Food and Agriculture Organization (FAO) (1980) noted the establishment of the Association of Southeast Asian Nations (ASEAN)'s Food Security Reserve (which was never operational) and also a proposal by CILSS (Inter-State Committee on Drought in the Sahel) to establish a regional reserve in the Sahel. FAO provided technical assistance to support these initiatives. The idea of creating a regional food reserve for Mediterranean countries was also put forward, but it was not until the recent food crises that the ASEAN initiative was reactivated. To ensure food security in the region, ASEAN has established various cooperation programmes, one of which is the East Asia Emergency Rice Reserve (EAERR). EAERR is a regional cooperation programme among the ten ASEAN member states, China, Japan and the Republic of Korea. Specifically, it is an initiative of the ASEAN Ministers on Agriculture and Forestry and the Ministers of Agriculture of the People's Republic of China, Japan and the Republic of Korea (AMAF Plus Three) to provide food

assistance, strengthen food security in emergencies caused by disasters and alleviate poverty. The EAERR is therefore a mutual assistance system to share rice stocks among the 13 countries. It also aims to contribute to price stability of rice in the region. The EAERR plans to develop a proposal to upgrade the pilot project to become a full-fledged scheme among the ASEAN Plus Three countries. A draft ASEAN Plus Three Agreement on Emergency Rice Reserve for this purpose is in the process of being developed. However, the realisation of a permanent scheme is subject to internal consultation, further assessment and evaluation of the outcomes of the pilot project. For a mechanism like the EAERR to work, political support from the ASEAN Plus Three countries is necessary. The EAERR pilot project is closely related to the ASEAN Food Security Information System (AFSIS) Project and the work of the ASEAN Food Security Reserve Board (AFSRB)[6] in establishing food security in the region.

International commodity agreements (ICAs) were established to stabilise individual commodity prices at the global level after the Second World War. However, most of these agreements collapsed and by the early 1960s only the agreements for wheat, sugar, coffee, tin and olive oil remained. Although opinions differ on the details of why these agreements were unsuccessful, few ICAs played any role in stabilising prices. The ICA on rubber actually had procedures to deal with increases and decreases in its price bands, but because it followed market prices for the most part it was only able to smooth rather than stabilise prices. The cocoa and sugar agreements were simply too weak to accomplish their objectives while the tin agreement was trying to hold prices too high without necessary financial backing. Coffee is argued to have been the most successful in raising and stabilising prices, before it lost consumer support and collapsed. Although some of the bodies that govern the ICAs still exist[7], these days they mostly assist their respective industries by publishing relevant statistics and studies rather than stabilising prices.

Price stability and a stable supply of wheat were maintained during the early years of the International Grains Council (previously the International Wheat Council). However, this is most likely due to the relative stability of supply and demand during this time, and the agreements broke down during the 1973–74 food crisis. Prompted by the price shock, international interest in grain reserves was again generated and the United Nations Conference on Trade and Development (UNCTAD) organised discussions on the possibility of establishing international grain reserves (Wright and Bobenrieth 2009). The idea was to hold stocks nationally while managing them internationally, but issues of trigger price levels, stock levels and contributions, and special provisions for developing countries led to failed talks and the proposed international grain reserve was not established.

[6] The AFSRB is an ASEAN mechanism for sharing of rice stocks in times of shortage, particularly through the trigger of a collective operation of the committed ASEAN Emergency Rice Reserve (AERR). Currently, the total quantity of the AERR is 87,000 metric tonnes for emergency purposes.

[7] Coffee (ICO); cocoa (ICCO); Cereals, oilseeds (IGC); sugar (ISO); jute (IJSG); rubber (IRSG); bamboo, rattan (INBAR); tropical timber (ITTO); cotton (ICAC); olives, olive oil (IOOC).

3 Review of policies proposed as a result of current price strike

Following the food price crisis of 2007–08 and the recent events after October 2010, there have been numerous proposals put forward to prevent such events occurring again. The proposed plans address a range of ideas for improvement, including physical reserves at different levels, virtual reserves, improvements in information and coordination, trade facilitation and others. In terms of storage, emergency reserves for food aid, internationally coordinated public grain reserves, and national and regional stocks have been proposed. More than ten proposals were put forward to prevent price spikes and price volatility in the future. These proposals can be grouped as follows: (i) information and research, (ii) trade facilitation, (iii) reserves and stocks, (iv) financial instruments and (v) regulatory proposals.

3.1 Information and research

There are two key proposals to improve information and coordination to increase market confidence and relieve temporary disruptions in supply. First is the proposal of Wright (2008, 2009) and Evans (2009) on an international food agency (IFA), and second is the proposal by Martins-Filho et al. (2010) on an early warning mechanism (EWM) to identify price abnormalities.

Wright (2009) argues that confidence in markets could be increased were there more and better information on stocks. Similarly, Evans (2009) and Wright (2008) propose the creation of an IFA, modelled after the International Energy Agency (IEA)[8], which would report on stock levels and develop protocols for international collaboration to improve the global response to shortages and help prevent the onset of market panic. Two potential criticisms are central to this proposal. First, many international agencies are not optimistic that better information on existing stocks and their evolution over time can be generated without considerable effort, international coordination and costs. This is even more relevant given the current lack of appropriate information on public holding of stocks by key producer countries as China and India, but also because there are so many stockholders, many of which are held by private enterprises and therefore are considered commercial secrets. The lack of appropriate information and knowledge of who holds what stocks at a precise time will immediately put in question trying to develop the IFA proposed by Evans (2009). Second, it is not clear how protocols for emergency response could be agreed with such level of asymmetry of information and even more which mechanisms will be used to identify which are the critical levels of stocks under which the IFA should call for international collaboration to respond to shortages. Resolving both of these problems could be extremely costly, although just the availability of information on physical stocks at the global level could help to reduce price volatility.

[8] The IEA was established in 1974 in the wake of that commodities spike. It reports on public and private petroleum stocks in OECD member states, and has developed protocols for international collaboration in assuring supplies reach a member country should there be a disruption to their import market (Wiggins and Keats 2009 a,b).

Martins-Filho et al. (2010)[9] propose a model to estimate conditional quantiles for log returns of future prices (contracts expiring between one and three months) of hard wheat, soft wheat, corn and soybeans. This fully non-parametric model forecasts in advance the cases in which the value of the realised returns (log returns of future prices contracts expiring between one and three months) are higher than the forecast 95% conditional quantile for the log return on the following day based on a model that includes daily returns since 2001. When this event happens it means that the realise return is an abnormality and we expect it to fall under the 95th percentile return in the following day. This additional information to the market by itself could help to reduce potential asymmetry of information among buyers and sellers helping to reduce extreme price volatility. One main caveat of the model is that currently it is operating only for commodities traded in the futures market, but the framework can also be extended to spot markets if better price information existed.

3.2 Trade facilitation

Other proposals aim to facilitate trade in order to reduce risks in grain trading when supplies are low and avoid disruptions in grain market. Sarris (2009) proposes a type of food import financing facility (FIFF) that would alleviate financing constraints as well as an International Grain Clearinghouse Arrangement (IGCA) to ensure the availability of staple food imports. This international clearing house would reduce risks that exporters renege on contracts when supplies are tight by guaranteeing contracts for grain deliveries. Finally, Wright (2009) and Lin (2008) take a different approach to trade facilitation (TF) with plans to prevent export bans in order to avoid any disruption of supplies.

The FIFF was initially proposed to the IMF in early 1980 by the World Food Council and the FAO and was implemented in May 1981, although as mentioned it raised several questions about its possible effect on world grain prices. The facility could create a significant increase in demand by developing countries for grain in some years of tight supply and thus could put strong pressure on prices to rise. Moreover, despite its existence, this facility has not been used in the last ten years, not even during the 2007–08 crisis. According to Shaw (2007), 'terms for accessing the facility were set too high to make it attractive or acceptable'. Where countries have existing balance of payment weaknesses, they cannot access the CFF without a parallel fund-supported adjustment programme. If this facility is to be used more as a humanitarian instrument as a result of the price crises, it clearly seems more targeted to emergency situations and not directly linked to the reduction of price volatility. In addition, it is susceptible of significant governance problems and costs, and it will be required to develop an independent FIFF without IMF-attached conditionalities (for further details see Huddleston et al. 1984; Valdés 1981; Adams 1983).

On the other hand, the IGCA proposal, as mentioned by Wiggins and Keats (2009 a,b), looks somewhat similar to the International Commodity Clearing House (ICCH) proposed in 1949. Wiggins and Keats point out that at that time the world food situation was characterised by commodity surpluses in areas with strong currencies

[9] For further details see http://www.foodsecurityportal.org/sites/default/files/Martins-FilhoToreroYao2010.pdf

(particularly the US dollar), while countries with weaker currencies and insufficient supplies could not afford imports. This led to the ICCH proposal: a public corporation, to be housed in the FAO, with a budget of US$5 billion. The initial proposal covered half a dozen main functions, which even included coordination and negotiation of bilateral and multilateral trade agreements, but given its complexity and the requirement need to transfer power to multilateral organisations it was rejected by FAO member nations.

In the current version the IGCA proposal, as explained by Wiggins and Keats (2009 a,b), would guarantee grain trade contracts (between countries or private entities) in the medium and long term. It would be housed in an existing institution such as an international bank or multilateral financial institution, and would function as a holding body for a 'good faith margin' contributed by the buyer and the seller in any particular contract. These amounts, posted as margins, could be borrowed from international banks or other multilateral financial institutions. To guarantee availability of physical supplies, the IGCA would invest its financial reserves in physical stocks of grain in locations of excess supply, or in the form of futures contracts in organised commodity exchanges. Any commitments in futures taken out as insurance on a particular contract could be liquidated upon execution (physical delivery between buyers and sellers) of said contract.

As in the initial proposal, and in addition to the governance issues, the key questions are: how large would these margins have to be, and who will invest in them? Will it require international support, and if so how will this be coordinated, especially under times of global tight supply? In addition, it has two more key problems: first, the need to have a global storage mechanism in place and its necessary international governance and, second, it does not specify any triggering mechanism that will make it effective, i.e. when the grain guarantee will be executed.

Finally, in the case of Wright (2009) and Lin's (2008) proposal, the most difficult part would clearly be getting countries to commit to this and then adhering to it during a food crisis. When faced with a choice between breaking international agreements regarding exports or protecting their citizens and ensuring national food security, however, it is difficult to believe that export bans will not occur in the future regardless of any action taken to prevent them. Moreover, and as shown by Martin and Anderson (2010) and Bouet and Laborde (2009), if export taxes are raised in a large agricultural-based economy this will raise world prices (through a reduction in world supply), which will not be good for small net food importing countries. Reduction of import duties has exactly the same effect: an increase in world prices through an expansion of demand on world markets. Furthermore, when augmentation of export taxes is added in large food-exporting countries and import duties are reduced in large food-importing countries, real effects will occur for small food-importing countries, so the solution is not only facilitation of trade but also the effects that different trade policies could have and the governance required to be able to avoid large countries to implement policies with the objective of constant food domestic prices. The costs of a lack of cooperation in and regulation of (binding process) such policies in a time of crisis is an extremely complex issue, and it is not clear if WTO dispute resolution mechanisms could be used and be effective.

3.3 Reserves and stocks

There have been several proposals on physical reserves: (i) emergency reserves (ERs) by von Braun and Torero (2008); (ii) international coordinated grain reserves (ICGRs) by Linn (2008) Bon Braun, Lin, Torero (2009)and for rice by Timmer (2009); (iii) regional reserves (RRs) by regional associations of governments; and (iv) country-level reserves (CRs) by multilateral institutions such as the World Bank.

The ERs is a modest emergency reserve of around 300,000–500,000 metric tonnes of basic grains – about 5% of the current food aid flows of 6.7 million wheat-equivalent metric tonnes – would be supplied by the main grain-producing countries and funded by a group of countries participating in the scheme. These countries would include the Group of Eight Plus Five (G8+5) countries (Canada, France, Germany, Italy, Japan, Russia, the UK, the USA, Brazil, China, India, Mexico and South Africa) and perhaps others. This decentralised reserve would be located at strategic points near or in major developing country regions, using existing national storage facilities. The reserve, to be used exclusively for emergency response and humanitarian assistance, should be managed by the World Food Programme (WFP). The WFP would have access to the grain at pre-crisis market prices to reduce the need for short-term ad hoc fundraising. To cover the cost of restoring the reserve to its initial level (i.e. the difference between the post- and pre-crisis price multiplied by the quantity of reserves used by WFP), an emergency fund should be created and its level maintained by the participating countries. The fund should be accompanied by a financing facility that the WFP could draw upon as needed to cope with potential increased transport costs, as experienced in the 2008 crisis. This arrangement could also be defined under a newly designed Food Aid Convention, and it is clearly for humanitarian purposes rather than to reduce excessive price volatility.

On the other hand, the other three mechanisms had been proposed as ways through which excessive price volatility can be reduced. Clearly, some combination of reserves will probably be necessary, but in the case of country-level reserves they should be thought of as a strategic reserve and not as a food stock held by marketing board/parastatals. Enforcing a floor price and ceiling price by marketing boards or parastatals has always involved holding physical stocks of grain, and there is significant evidence of how much they will distort markets (Rashid and Saloman 2010). Strategic grain reserves are different from such stocks. In fact, the strategic reserve was introduced in many countries because marketing boards failed to address shocks, such as the prolonged droughts in the countries of the Sahel region, but they cannot be thought of as mechanisms to reduce international price volatility. Moreover, three key challenges arise with maintaining these types of strategic reserves that will need to be addressed: the determination of optimum stock levels, the level of costs and losses associated with these reserves, and the uncertainties that strategic reserves can bring out in the market place. Not only is the process of determining optimum stock levels politically loaded, but reserves are also highly dependent on transparent and accountable governance. In addition, predicting supply, demand and potential market shortfalls can be extremely difficult. In terms of costs, physical reserves cost money and must be rotated regularly, for example in African countries, as analysed by Rashid and Saloman (2010), the costs of holding a

metric tonne of food varied from US$20 to US$46 in these countries. The countries that need reserves most are generally those least able to afford the costs and oversight necessary for maintaining them. The private sector is better financed, better informed and politically more powerful, which puts it in a much better position to compete than most of the governments that would be managing these reserves. Finally, the uncertainties that strategic reserves can introduce into the marketplace can be problematic. They distort markets, and any mismanagement and corruption associated with these reserves may actually exacerbate hunger rather than resolve food security issues.

With respect to the global coordination of reserves and regional reserves, in addition to high costs of storage (both opportunity and effective costs when referring to creating a new physical reserve), and the fact that its creation will put more pressure over prices given we are currently facing moments of tight supply, there are several additional concerns that need to be taken into account. First, and similar to the security provisions of the IEA, the key challenge is to develop a governance structure for such a commitment between the member countries sponsoring the global coordinated reserves that will be honoured when markets are under stress. Second, the global or regional reserves will clearly require trigger mechanisms to make decision of release stocks to calm markets in times of stress. Such a mechanism is a necessary condition for this to operate as a tool to reduce extreme price volatility. In addition, the transparency of such a mechanism will be of key importance. The model proposed by Martins-Filho, Torero and Yao (2010) could be a possible alternative. Finally, a physical reserve, regional or global, will not resolve the problem of interlinkages within the financial, energy and food commodity market; this is a key problem that could be extremely relevant if excessive speculation is a cause behind the extreme price spikes.

3.4 Financial instruments

The establishment of virtual reserves is another plan that has been proposed by von Braun and Torero (2008, 2009 a,b) in order to prevent extreme price volatility from driving up futures market prices and thus spot market prices. The concept of virtual reserves is a safeguard mechanism to manage risk through the implementation of a virtual reserve backed up by a financial fund to calm markets under extreme price volatility. The concept had been widely used by central banks mostly for inflation targeting and dirty flotation of exchange rate.

The virtual reserves concept has inherited a global market analysis unit (GMAU), which will have two functions. First, and perhaps most important, it will be an early warning mechanism based on a model (see Martins-Filho, Torero and Yao (2010) for details on the model) that will forecast changes in returns for key staple commodities in the futures market and specify when a price abnormality occurs or when a price spike appears imminent. When this event happens it means that the realise return is an abnormality and it is expected to fall under the 95th percentile return in the following day or, on the contrary, if it remains over the 95th percentile it could imply the formation of a price spike. This announcement will be an alert to the market that there is higher likelihood of an intervention in the futures market, which will immediately increase the discount rate of potential short-term investors. Second, if,

despite the alert, there is evidence of an emerging price spike, the GMAU will alert that changes in returns are significantly above their normal levels based on market fundamentals. Finally, an autonomous technical committee will then decide whether to enter the futures market. This intervention would consist of executing a number of progressive short sales (that is, selling a firm promise – a futures contract – to deliver the commodity at a later date at the specified price) over a specific time period in futures markets at a variety of market prices in different futures months until futures prices and spot prices decline to levels within the estimated price bands. The GMAU would recommend the price or series of prices to be offered in the short sales.

This increase in the supply of short sales will reduce spot prices and should help to significantly reduce extreme price volatility by reducing the probability of the occurrence of abnormal returns. In other words, the intervention will create a backwardation in the market (the situation in which, and the amount by which, the price of a commodity for future delivery is *lower* than the spot price or a far-month future delivery price is *lower* than a nearby month future delivery price). Reducing these abnormal returns will minimise the potential second-round effects (as export bans, export restrictions or reduction of import tariffs) of this intervention given that spot prices will return to being consistent with fundamentals, and therefore the lower spot prices should not result in the accelerated use of available supplies. All futures contracts are ultimately settled either through liquidation by offsetting purchases or sales (the vast majority of agricultural futures contracts are settled this way) or through delivery of the actual physical commodity. In this respect, the virtual fund will only stand for delivery if there is a need to realise the futures sales, in which case the fund will be used to obtain the necessary grain supply to comply with futures contract delivery requirements and calm the markets. Usually, this action would not be necessary and the whole operation would remain virtual. Questions will remain about the price, the amount of short sales and the duration of the intervention in the futures markets, and answering them will require political consultation and continuous market monitoring and research.

The innovative concept behind the virtual reserve is the early warning alert that it gives to markets and regulators. Its presence alone is likely to divert short-term financial investors from entering this market and the probability of a real intervention is minimal. Nonetheless, the committee must be ready to trade grain when necessary and to assume the costs if in the future it must buy back contracts at a higher price than when sold. In that sense, a clear financial commitment is needed to give the correct signal to the market. The size of the initial commitment is still being studied. A comprehensive cost–benefit assessment of the system must go beyond agricultural markets to include food security and poverty considerations.

The key advantages of the VR with respect to a physical reserve concept are: (i) it is just a signalling mechanism; (ii) it does not put more stress on the commodity market; (iii) it does not incur in the significant storage and opportunity cost of a physical reserve; (iv) it resolves the problem of the inter-linkage between the financial and the commodity market; and (v) given that it is a signal, its effect over markets should be minimal.

On the other hand, there have been some critics to the VR concept. First, they have argued whether rising futures prices actually lead to increased spot market prices, but several studies suggest that changes in the futures prices of certain commodities generally lead to changes in spot prices[10]. In addition, the recent analysis of Hernandez and Torero (2010) complements these earlier studies by examining causal relations in the current decade with a much more developed futures commodity market. Their analysis used both linear and non-parametric Granger causality tests and identified a causal link in all cases. Results indicate that spot prices are generally discovered in futures markets. In particular, they found that changes in futures prices in the markets analysed led changes in spot prices more often than the reverse. Thus, from a policy perspective, these findings support the viability of implementing a global virtual reserve to address price abnormalities in grain prices through signals in the futures market and, if necessary, market assessment in the exchange of futures.

Second, Wright argued how difficult it will be for whoever is responsible to be certain that markets are out of equilibrium and that proposed interventions will not do more harm than good under any given circumstances (Wright 2009). In this sense, the model already developed by Martins-Filho, Torero and Yao (2010) has made significant progress towards the capacity to predict price abnormalities as previously explained. Third, there has also been a significant concern regarding the size of the necessary financial funds to assure the success of the signal by the VR. In that respect, the VR call for a coordinated commitment by the group of participating countries. Each country commits to supplying funds, if needed, for intervention in grain markets; this does not imply an effective expenditure. Therefore, the resources needed are promissory and not actual budget expenditures. Determining the size of this fund will require further analysis as commodity futures markets allow for high levels of leverage. This commitment cannot be compared with budget allocated for R&D. First of all, it is not expenditure but a commitment and, second of all, the size of this commitment should be significant enough to have a strong signal in the market. It is noteworthy that similar activities have been implemented in central banks such as the dirty flotation of the dollar where the central bank backs up with its reserves the limits of appreciation or depreciation of the currency within a certain range. Finally, there is also a question of the governance behind the VR mechanism. Clearly, agreement on the arrangements for the VR will not be easy and may require a high-level United Nations task force to analyse the way forward. Yet similar institutional arrangements have been made in the past; examples are the International Fund for Agricultural Development (IFAD), the Food Aid Convention (FAC), the IMF Cereal Import Facility and the IEA. IFAD, for example, was established as an international financial institution in 1977 as a major outcome of the 1974 World Food Conference in response to the food crisis of the early 1970s. The FAC, first signed in 1967 and renewed five times, is the only treaty under which signatories have a legal obligation to provide international development assistance.

[10] See Garbade and Silver (1983); Brorsen et al. (1984); Crain and Lee (1996).

3.5 Regulatory proposals

Since late 2005 a number of serious problems have plagued the futures and cash markets for grain (corn, soybeans and wheat). The most dominant problem is lack of price convergence between cash and futures prices. There seem to be several factors related to the uncoupling of cash and futures prices. The first concerns delivery certificates, which are issued by warehouses to those with a long position in the futures market until the contract expires. The problem in this case is that the longs are not using these certificates to take delivery but are holding them in part because of the value they retain. The second problem is that delivery is not occurring. Many market participants believe that the lack of load out is contributing to the lack of convergence in futures and cash prices. Because there is diminished demand for delivery, storage facilities have less space available. That condition raises a concern that storage rates should be reviewed to ensure that they are kept at the right level. An incorrect storage rate could contribute to the uncoupling of cash and futures prices. The fourth potential problem in the grain markets is the entry of large capital flows into the markets. Different types of funds (pension, index, etc.) that traditionally invest in the securities market have begun to trade in the commodity markets. The entry of this group and the amount of capital they are injecting into the market is controversial. Some market participants believe these long-only fund traders are in part responsible for the lack of price convergence in the grain market.

Researchers from government, academia, the futures and agricultural industries and private consulting firms have studied the poor market performance since late 2005 and have produced somewhat different findings concerning the price spike and the factors underlying the convergence problem in the corn, soybean and wheat futures markets. In summary, proposed solutions for the lack of price convergence include changing the storage facility fees; changing the futures contract to a cash settled contract; changing the design of the delivery instrument; compelling load out, i.e. compelling longs who stand for delivery; and reviewing trading patterns of fund traders to ascertain its effect on the market.

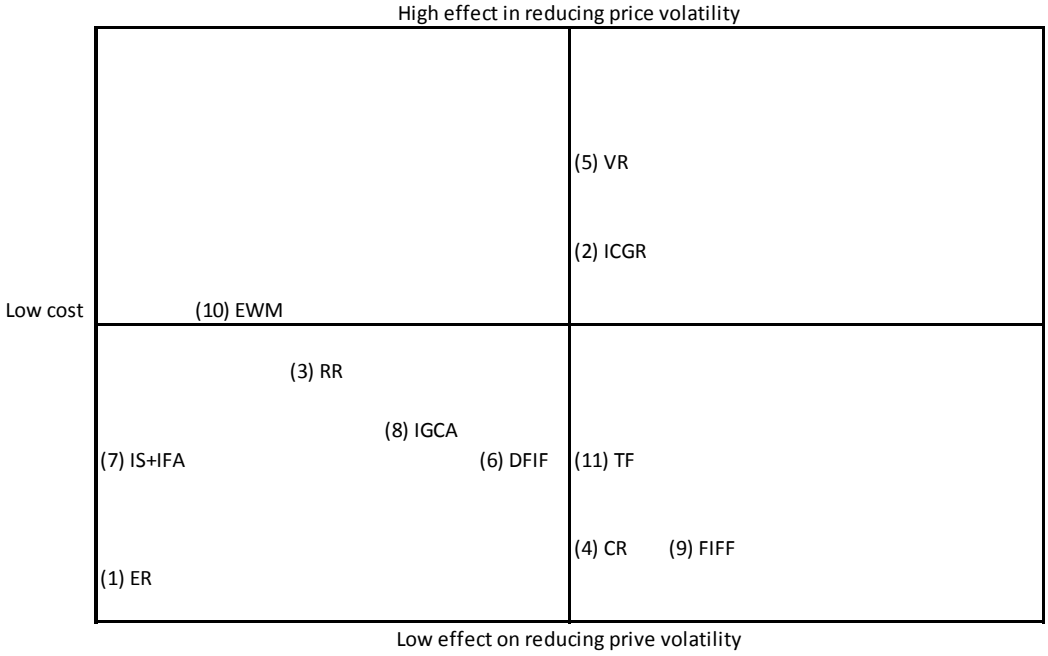
On the other hand, possible solutions that address potential existence of excessive speculation include imposing stricter speculative limits and larger margins; phasing out existing position limit waivers for index traders; imposing additional restrictions on index traders; investigating index trading in other agricultural markets; and strengthening data collection on index trading in non-agricultural markets.

To address concerns about the lack of price convergence both the Commodity Futures Trading Commission (CFTC) and other agencies in the US Government and the European Commission along with the futures industry have reviewed proposals and moved forward with seasonal storage rates, limits on the number of delivery certificates an entity can hold for non-commercial purposes, and an additional issue of the Commitment of Traders report to increase transparency. If the structural changes put in place do not significantly improve the price convergence between futures and cash prices then a cash-settled contract must be seriously considered. In any regard, the exchanges and regulators cannot continue to pursue solutions at a snail’s pace. These problems began in late 2005 and so far very few structural changes have occurred since.

Despite these regulatory measures seeming complementary to many of the proposals described above, one major problem behind any regulatory mechanism put in future exchanges is the level of linkages between the main future commodity markets. If what happens in one future exchange influences the others then regulation put in place in one will just transfer the problem to the other exchange, opening again the complexity of multi-country coordination as in the VR, or any global or regional reserve.

Finally, and as a way to summarise the analysis of all proposed alternatives, Figure 1 classifies the major proposed initiatives based on their cost (horizontal axis) and on their effectiveness in reducing price volatility (vertical axis). It is important to mention that only these two dimensions are used in this paper because the major objective of the paper is to identify the existing mechanism proposed and how effective they are in reducing price volatility. In that respect, some of these initiatives, such as the emergency food reserves (von Braun & Torero 2009 a,b) or the food import facility (Sarris 2009), had different objectives than reducing price volatility, and therefore they are ranked low in that dimension. This does not mean that they are not effective policies for their core objective. On the other hand, policies as the virtual reserves (von Braun and Torero 2009 a,b), the internationally coordinated grain reserves (Lin 2008), the regional reserves as the ASAEN or the International Grain Clearance Agreement (Sarris 2009), rank as more effective in reducing price volatility, although they vary significantly in the amount or resources needed for their implementation and in the amount of additional research that is required to be able to implement them properly.

Figure 1: Proposals for reducing price volatility



Note: The vertical axis refers to the potential effect in reducing price volatility and the horizontal axis to the costs required for its implementation.

(1) ER = Emergency Reserve, Von Braun & Torero (2009 a,b), it requieres US$ 7.5Mpa but is to alleviate requirements of WFP during food scarcity and not to reduce price volatility

(2) ICGR= Internationally coordinated grain reserves, Linn (2008), it implies opportunity costs and coordination costs (approx US$ 1.05B pa) and it could have an impact in reducing volatility but high risks of coordination failure, requires capacity to predic price spikes, and not necessarily effective to tackle speculation in futures market. Timmer (2009) proposes a similar idea only for Rice given how concentrated this market is we expect it to have a higher effect in reducing volatility in this specific

(3) RR = Regional Reserves as the one of ASEAN, it implies opportunity costs and coordination costs, depending on the market share on the commodities of the countries involve it could have an impact in reducing volatility, but very high risks of coordination failure, and could distort market prices, patronage problems, and other principal agent problems.

(4) CR = Country level reserves, this could imply significant relative costs at the country level, significant distortions and little effect on volatility given low effect over international markets.

(5) VR= Virtual Reserves, Von Braun & Torero (2009), it requires US$ 12-20 B, risk of coordination failure, requires capacity to predic price spikes, could be effective in tackling speculation in futures market, requires certainty that markets are out of equilibrium to avoid distortion of interventions.

(6) **DFIF**=Diversion from industrial and animal feed uses, Wright 2009, it implies opportunity costs, coul+C16d distort market efficiency, and necessarily effective to tackle speculation in futures markets

(7) **IS+IFA**= Better information on Storage and International Food Agency (Wright 2009), very low cost not clear effectivenes in reducing price volatility

(8) **IG**CA= International Grain Clearance Arrangement, Sarris (2009). Not too costly, not clear how it will opperate, not clear size of margins, not clear if it will work when stocks are tight, and not necessarily effective to tackle speculation in futures markets

(9) **FIFF**= Food Import Financing Facility, Sarris (2009). Similar to IMF's food import facility, could be costly, possible moral hazard problems, and not effective to tackle speculation in futures markets.

(10) **EWM**=Early Warining mechanism

(11) **TF**= Trade Facilitation - Wright (2009) and Lin (2008)

4 Conclusion

The international food price crisis of 2007–08 led to economic difficulties for the poor, generated political turmoil in many countries and could have severe effects on confidence in global grain markets, thereby hampering the market's performance in responding to fundamental changes in supply, demand and costs of production. More importantly, they could result in unreasonable or unwanted price fluctuations that can harm the poor and result in long-term, irreversible nutritional damage, especially among children. This episode highlights the need to modify the architecture of international financial and agricultural markets in order to address the problem of price spikes.

Appropriate global institutional arrangements for preventing these market failures are missing. A global solution that prevents excessive price volatility in food markets may be costly, but given the losses created by food price crises like that in 2007–08, it will still have large positive net returns. It is clear that the incentives for speculation in food commodities, as one of the components behind the price volatility, could be reduced by (i) changing regulatory frameworks to limit the volume of speculation versus hedging, (ii) making delivery on contracts or portions of contracts compulsory, (iii) imposing capital deposit requirements when each futures transaction is made, or all three. These regulatory measures could be implemented case by case or as a platform through an international 'alliance of commodity exchanges'. Therefore, it is clear that (i) there is a need to undertake a policy debate about exchange regulation and the role of speculative traders and (ii) debate is very likely to include the issue of international harmonisation. There is also a clear need to improve the quality of information and of forecasting of price spikes for any of the potential policies to work properly.

Several of the proposals to reduce price volatility or the effects of the price crises will require significant and quick investments in further research on their implementation and potential risks and benefits. In addition, many of them target different objectives and therefore could substantially complement each other. For example, von Braun & Torero (2009) have proposed two global collective actions to meet these goals: (i) a small physical food reserve should be established to facilitate a smooth response to food emergencies and (ii) an innovative virtual reserve should be set up to help reduce the probability of significant market price spikes that could have severe effects on the poor. The first is not to target price volatility but just to reduce the risk of scarcity of commodities for the most vulnerable during similar crises.

The second proposal is not designed to stabilise prices in general, but to prevent damaging price spikes and the collapse of confidence in the international grain markets. It can also clearly complement Linn's (2008) proposal of an international coordinated regional reserve[11], and Wright's (2009) proposal for better information on storage and the development of an international food agency. Moreover, within the concept of virtual reserves, there is an institutional design that includes an intelligence unit that will not only improve information on storage but also enhance capacity to better monitor the probability distribution of price spikes. It is clear that the proposed actions will entail costs, but the modest costs of the required organisational elements must be balanced against the benefits of more effective international financial architecture. These benefits will include prevention of

[11] See von Braun, Linn and Torero (2009) for a joint proposal.

economic hardship and political instability, improved market efficiency and stronger incentives for long-term investment in agriculture.

All other proposals focus on different objectives and do not seem to have the potential to significantly reduce price volatility; nevertheless, they may have positive effects for other issues such as trade financing (Sarris 2009) or long-term effects of some of the variables behind the changes in supply and demand fundamentals (Wright 2009).

In the meantime, we observe a mixed set of policy actions being taken: many countries try to build up costly national reserves, others focus on increasing self-sufficiency, and still others engage in FDI to secure national food security through transnational land acquisition, rather than trade, because of lost confidence in trade owing to uncertainty around volatility. In addition, some are pressing for more regulation of exchanges, which would not avoid extreme price spikes and could even further distort markets. All of these policy actions threaten to move food agriculture further away from efficient market designs. A more promising step may be regional coordinated reserves as recently planned by ASEAN. However, a global problem needs global institutional responses.

One clear message from all these proposals is that a strong research-based 'intelligence unit' is needed to provide independent and trusted information to the decision-making body of a possible virtual reserve system (von Braun and Torero 2009 a,b), internationally coordinated regional reserves (Lin 2008), an international food agency (Wright 2009), an international grain clearance arrangement (Sarris 2009), a food import financing facility (Sarris 2009) or any of the physical reserves options. All of these alternatives will clearly benefit from this and at the same time it will allow a better evaluation of the costs and benefits of each.

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