

# Price Volatility in Food and Agricultural Markets: Policy Responses

Policy Report including contributions by

FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank,  
the WTO, IFPRI and the UN HLTF

2 June 2011



The World Bank Group



UN-HLTF on  
Global Food Security



G20 leaders at their summit meeting in November 2010 requested FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank and the WTO (to) work with key stakeholders to develop options for G20 consideration on how to better mitigate and manage the risks associated with the price volatility of food and other agriculture commodities, without distorting market behaviour, ultimately to protect the

The preparation of this report, coordinated by the FAO and the OECD, has been undertaken in a truly collaborative manner by FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTf. We, the international organisations, are honoured to provide you with this joint report and look forward to continuing collaboration within the G20 framework to further elaborate and, as appropriate, implement the recommendations of the international organisations that it contains.

2 June 2011



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## 1. Introduction

### 1.1 Scope

1. Under the Food Security pillar of the Seoul Multi-year Action Plan on Development, the G20 stakeholders to develop options for G20 consideration on how to better mitigate and manage the risks associated with the price volatility of food and other agriculture commodities, without distorting market

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2. The approach taken in this report reflects the view of the collaborating international organisations that price volatility and its effects on food security is a complex issue with many dimensions, agricultural and non-agricultural, short and long-term, with highly differentiated impacts on consumers and producers in developed and developing countries. The report begins with a discussion of volatility and of the ways in which volatility affects countries, businesses, consumers and farmers. Lessons learned from recent experiences are briefly reviewed as well as the factors determining likely levels of volatility in future. This report offers suggestions for a systematic and internationally coordinated response building on the lessons learned as a result of the 2007-2008 crisis.

3. It is important to distinguish between policy options designed to prevent or reduce price volatility and those designed to mitigate its consequences. Both types of intervention are explored in detail. Scope is identified for actions at individual, national, regional and international level. Some would help to avert a threat, others are in the nature of contingency plans to improve readiness, while still others address long-term issues of resilience. Finally, the report explores mechanisms of international and to monitor progress.<sup>1</sup>

### 1.2 What is volatility?

4. In a purely descriptive sense volatility refers to variations in economic variables over time, (more technical definitions of volatility and related terms are put forward in Annex A) Here we are explicitly concerned with variations in agricultural prices over time. Not all price variations are problematic, such as when prices move along a smooth and well-established trend reflecting market fundamentals or when they exhibit a typical and well known seasonal pattern. But variations in prices become problematic when they are large and cannot be anticipated and, as a result, create a level of uncertainty which increases risks for producers, traders, consumers and governments and may lead to sub-optimal decisions. Variations in prices that do not reflect market fundamentals are also problematic as they can lead to incorrect decisions. These implications of volatility will be explored in detail in Chapter 2.

5. Behind concerns about volatility lie concerns about price levels and behind both, lie concerns about food security. While producers benefit (or at least those who are net producers and whose asset base and knowledge enable them to respond effectively), consumers, especially poor consumers, are severely adversely affected by high prices<sup>2</sup>. Food accounts for a very high share of the total budget of the poorest households. And because poor households often consume foods that are less processed the effect of rises in commodity prices is felt more strongly. These households find their nutrition status (especially of pregnant women, children and those affected by long-term diseases such as HIV), as well as their capacity to purchase education, health care, or other basic needs compromised, when food prices are high.

6. Producers are more concerned about low prices, which may threaten their living standards as well as their longer term viability when income is too low to provide for the farm family or for the

operational needs of the farm. Uncertainty may result in less than optimal production and investment decisions<sup>3</sup>. In developing countries, many households are both producers and purchasers of agricultural products. For this group the impacts of price volatility are complex, with net outcomes depending on a combination of many factors.<sup>4</sup>

7. No attempt is made here to define extreme or excessive price volatility. Suffice it to say that volatility becomes an issue for concern and for possible policy response when it induces risk averse behaviour that leads to inefficient investment decisions and when it creates problems that are beyond the capacity of producers, consumers or nations to cope. What constitutes excessive volatility depends very much on the situation of the individual or nation. Poor consumers in less developed countries without access to adequate social support are most immediately affected by price surges. Small resource limited farmers face particularly severe problems when prices fall. The episode of volatility that occurred during the 2007-2008 period, resulted in poor, vulnerable consumers and producers and poorer developing countries dependent on food imports experiencing severe economic, social and political stress because of high prices and fears of scarcity. Lessons learned concerning appropriate national and international response are instructive as we enter 2011 with many commodity prices again increasing sharply.

**1.3 Trends in volatility**

8. When looked at in the long term there is little or no evidence that volatility in international agricultural commodity prices, as measured using standard statistical measures is increasing and this finding applies to both nominal and real prices<sup>5</sup>. Volatility has, however, been higher during the decade since 2000 than during the previous two decades and this is also the case of wheat and rice prices in the most recent years (2006-2010) compared to the nineteen seventies.<sup>6</sup> Another conclusion that emerges from the study of long term trends in volatility is that periods of high and volatile prices are often followed by long periods of relatively low and stable prices. Finally, it is well established that agricultural markets are intrinsically subject to greater price variation than other markets, for reasons that are outlined in the introduction to Chapter 2.

9. International commodity prices since 1970 are presented in Figure 1 and commodity price movements during the past decade as shown in Figure 2.

**Figure 1. Agricultural commodity prices in real terms (2005=100)**

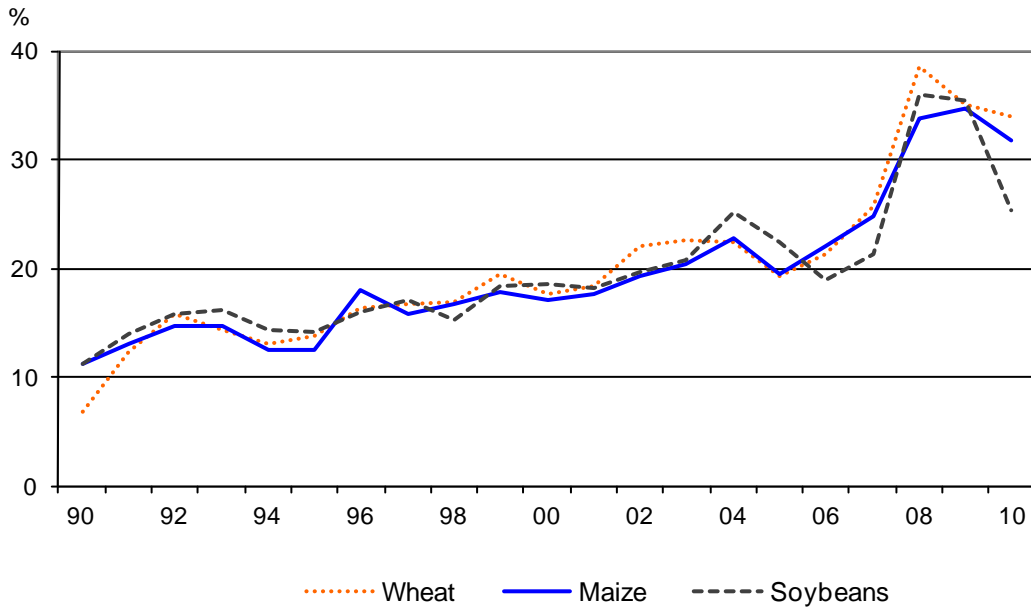
**Figure 2. Monthly commodity price indices (2002-04=100)**



10. Since 1990, as shown in Figure 3, the implied volatility for major crops has increased significantly.<sup>7</sup> Implied volatility reflects the expectations of market participants on how volatile prices will be and is measured as a percentage of the deviation in the futures price (six months ahead) from underlying expected value (for a more detailed explanation of implied volatility see Annex A). Broadly

speaking, increases in implied volatility reflect how market conditions and unpredictable events translate to higher uncertainty ahead for traders and other market participants.

**Figure 3. Implied volatilities (annual)  
1990-2010\***



\* FAO (2010), *Food Outlook*, November. See also Annex A for an explanation of implied volatility and a description of the assumptions that underpin the measure.

11. Irrespective of any conclusion that might be drawn concerning the long term trends, there is no doubt that the period since 2006 has been one of extraordinary volatility. Prices rose sharply in 2006 and 2007, peaking in the second half of 2007 for some products and in the first half of 2008 for others. For some products the run-up between the average of 2005 and the peak was several hundred percent. On the rice market the price explosion was particularly pronounced. The price rises caused grave hardship among the poor and were a major factor in the increase in the number of hungry people to more than one billion.<sup>8</sup> Prices then fell sharply in the second half of 2008, although in virtually all cases they remained at or above the levels in the period just before the run-up of prices began. Market tensions emerged again

index was again at the level reached at the peak of the crisis in 2008 and fears emerged that a repeat of the 2008 crisis was underway.

#### 1.4 Volatility in global versus national markets

12. The trends and fluctuations described in the previous paragraphs relate to international prices. Domestic price movements can be different. The extent to which global prices are transmitted to domestic markets depends on how strongly integrated the latter are with the former. Measures such as import duties, export taxes, non-tariff barriers or domestic policies such as price support all influence the extent to which price changes in domestic markets mirror those on international markets. Market structure is also important. In monopsonistic markets, whether private or state controlled, higher international prices may not always result in better prices for producers. Countries that insulate their own markets export instability onto international markets, especially if they are major players in terms of consumption or production. The degree of processing of final consumption goods also affects price transmission. Lack of domestic infrastructure and generally undeveloped or inefficient market structures can also significantly obstruct price transmission due to high transport and transactions costs.



13. Developing country markets often lack the capacity to absorb domestic shocks, and can be subject to high domestic price volatility even during periods of calm international markets. Attention also needs to be paid to volatility at local and national levels, and to its consequences for poor rural people including small farmers. The causes may relate to climate shocks, pests or other natural calamities, exacerbated by the fact that farmers may have poor access to technologies and generally poor management of soil and water. Poor infrastructure, high transport costs, absence of credit or insurance markets and various policy and governance failures may compound the initial difficulty. A relatively minor climatic incident in these conditions can become a serious food crisis at local or regional level. Again those most affected will be poor consumers and rural dwellers, mainly smallholders in less developed countries or regions, heavily dependent on their own production.

14. During the 2007-2009 price spike and subsequent decline, there were quite significant differences among regions and products in the speed and degree to which world price movements were felt in regional or local markets. Many factors explain these differences including policy responses, exchange rate movements, competition policy, market structure and degree of market openness.<sup>9</sup> These differences are important because they suggest that both price levels and degrees of volatility may differ significantly from place to place at any given time and, therefore, that the level of hardship and disruption being experienced may also differ. The international community needs timely and differentiated information about the situation in different places in order to respond appropriately.

## **2. Price volatility in food and agriculture, potential developments and impacts**

15. Are recent events random – resulting from an unusual coincidence of different factors – or are there reasons to believe that the world is entering into a period of recurrent episodes of extreme price volatility? It is not possible to have a view on the appropriate policy responses to volatility without first exploring this question in some detail. In this context too, it is worth recalling that behind the expressed



remain low in major markets, and projections based on existing knowledge of market conditions and policy settings suggest that they may, the risk of volatility in prices will remain high.

22. Climatic factors have indisputably contributed to the price rises in 2007/2008 and again in

beyond the scope of this report but if the future is marked by increased exchange rate volatility this will also have repercussions for the volatility of international prices of commodities.

27. There is no doubt that investment in financial derivatives markets for agricultural commodities increased strongly in the mid-2000s, but there is disagreement about the role of financial speculation as a driver of agricultural commodity price increases and volatility. While analysts argue about whether financial speculation has been a major factor, most agree that increased participation by non-commercial actors such as index funds, swap dealers and money managers in financial markets probably acted to amplify short term price swings and could have contributed to the formation of price bubbles in some situations. Against this background the extent to which financial speculation might be a determinant of agricultural price volatility in the future is also subject to disagreement. It is clear however that well functioning derivatives markets for agricultural commodities, could play a significant role in the future.

## PRICE VOLATILITY IN FOOD AND AGRICULTURA

37. Of 81 developing countries surveyed by the FAO, 43 reduced import taxes and 25 either banned exports or increased taxes on them.<sup>12</sup> A large number of developing countries implemented measures to provide relief or partial relief from high prices to consumers – 45 in all. Measures consisted of cash transfers, direct food assistance or increases in disposable income (by reducing taxes or other charges), or some combination of these measures. A significant number of countries also granted support to producers in order to offset rapidly rising input costs, as prices for fertilizer also surged as did feed costs for livestock producers. Several countries went to the international markets to procure supplies of

chronically under-nourished, even during periods of relatively normal prices and low volatility. The overarching goal of actions with respect to food price volatility should be to ensure that the most vulnerable people have access to sufficient, nutritious food. All policy interventions should have as their ultimate aim, the elimination of all food insecurity, whatever its cause.

### **3. Measures to increase productivity, sustainability and resilience of agriculture**

43. Sections 4 and 5 of this report address policy solutions that aim to reduce price volatility and to deal with its consequences, particularly                      solut





53. Agricultural research is increasingly being delivered by the private sector with technologies being developed for larger, commercial farming operations. The adoption of such technologies requires increased management skills and effective learning, so that small farms too can have access to innovative inputs. There is need to improve agricultural technologies specific for, and well targeted to small-scale agriculture and for appropriate production policies and practices aimed at increasing smallholder productivity in a sustainable manner.<sup>20</sup>



increased the availability of information to governments and market participants. Better information and analysis of global and local markets and improved transparency could reduce the incidence and magnitude of panic-driven price surges.

62. Recent events have revealed weaknesses in the capacity of nations and international organizations to produce consistent, accurate and timely agricultural market data and analysis, especially in response to weather shocks. Action is needed to increase capacity to undertake more frequent and





increased value of the futures contract to offset the higher cost of the physical quantities they need to purchase.

79. Speculators also trade in the futures markets; they buy and sell futures contracts and take on the

farmers, traders and processors.<sup>30</sup>

80. Since the beginning of the last decade, commodity derivative markets, including those for agricultural commodities, have experienced significant inflows of funds from non-traditional investors, such as commodity index funds, swap dealers and money managers. These financial investors hold large futures positions including in basic food commodities such as wheat, maize and soybeans as well as in cocoa, coffee and sugar.

81. Another essential function of futures markets is to facilitate price discovery. Price discovery is the continuous process by which futures prices are reassessed by buyers and sellers as new information becomes available. Market participants continuously update their expectations as both public and private information become available. They adjust their market behaviour and through their transactions, information is incorporated into the price.

82. Speculators are necessary for the performance of both these functions. They buy and sell futures contracts and take on the risk of price fluctuations to earn a profit on price movements. By doing so, they provide the market liquidity which enables commercial hedgers to find counterparties in a relatively costless manner. Too little non-commercial participation results in low liquidity and potentially in large seasonal price swings.<sup>31</sup> Too much non-commercial participation can cause frequent and erratic price changes. This is the case when speculators assume that past developments carry information on future price movements, giving rise to trend chasing. This will result in buying after prices rise and selling after p

and reduce systemic default risk in the over-the-counter (OTC) derivatives trade. In the European Union, with the same objectives, the Commission has adopted a proposal for regulation of OTC derivatives trading and is currently reviewing several key directives that regulate financial markets including the Market Abuse Directive and the Markets in Financial Instruments Directive.

86. In addition to the long-established markets in the United States and Europe, agricultural commodity futures exchanges also exist in some emerging-market members of the G20, including Brazil, China, India and South Africa.<sup>37</sup> Price developments in most of the contracts traded on these exchanges closely follow the developed-country exchanges where price discovery provides global benchmarks. Trading on local platforms allows exchange-rate risk to be avoided and reduces basis risk stemming from a variety of factors: climatic conditions and different seasonal timings (South Africa), restrictions on international and domestic trade (China), differences in quality specifications and difficulty in delivering to overseas markets (Brazil). Some exchanges, e.g. in India, offer exchange trading for commodities (e.g. cardamom and mentha oil) for which contracts exist nowhere else. All of these futures exchanges are established venues for price-risk management through futures contracts on internationally traded commodities and they have a highly although not necessarily heavily regulated environment.<sup>38</sup>

87. More generally, debate is on-going at national and international level about the possible merits of the following actions in terms of transparency and improved market functioning:<sup>39</sup>

Establish a trade depository to register OTC contracts, in line with earlier decisions in the G20 Summit in 2009 in Pittsburgh.

Use of speculative position limits on commodity futures contracts to ensure control of undue market influence.

Use of maximum limits to daily price changes to reduce volatility.

Use of limits on inventories held in delivery warehouses by non-commercial entities to limit market manipulation possibilities.

Introduction of provisions for high volume and frequency trading into the regulatory regime.<sup>40</sup>

Ensuring that changes in regulation are adopted across commodity exchanges and across countries in order to avoid the migration of participants and regulatory arbitrage.<sup>41</sup>

88.

**4.4**      *Domestic and trade policies*

*Reducing import barriers, trade distorting domestic support, and all forms of export subsidies*

89.      Price volatility may originate from either domestic or international markets.<sup>43</sup> Trade is an





#### **Recommendation 4**

G20 governments demonstrate leadership in on-going WTO DDA negotiations, moving immediately to strengthen international disciplines on all forms of import and export restrictions, as well as domestic support schemes, that distort production incentives, discourage supply in response to market demand, and constrain international trade of food and agriculture products. Specifically,

substantially improve market access, while maintaining appropriate safeguards for developing countries, especially the most vulnerable ones;

substantially reduce trade distorting domestic support, especially by developed countries; and,

eliminate export subsidies.

Taking existing WTO rules into account and the state of play in the DDA negotiations G20 governments should:



4.5

108. Poor management makes buffer stocks ineffective. There is repeated evidence that releases are made too late to influence food prices or to safeguard food security.<sup>57</sup> Abrupt and unpredictable changes in buffer stock operations raise market risk significantly and discourage private investment. Often poor storing practices lead to large and costly physical stock losses. Holding food in reserve can also have a negative impact on the market

instruments would allow the agency to maximize efficiency and effectiveness and ensure a secure and predictable pipeline. Since 2008, the World Food Programme (WFP) has used Forward Purchasing to achieve more rapid and cost-effective food delivery to beneficiaries across countries in various regions.<sup>62</sup>

115. The above proposals, can be part of a framework of principles which could set out how already established and well-functioning national stocks and regional emergency food reserves can operate more effectively together in order to mitigate the negative effects of food price surges in the future without distorting market behaviour.

#### **Recommendation 7**

Recognizing the primary responsibility of countries themselves, G20 governments provide support where there is need to increase capacity to implement food emergency reserve systems

G20 governments support the World Food Programme in the development of a cost-

existing IBRD and IDA funds through the end of 2011, with the possibility that this is extended through 2012.

119. Rapid implementation of GFRP programs benefited from partnerships with civil society organizations in 16 countries, and UN agencies such as the WFP, UNICEF and FAO in eight countries. The GFRP was augmented by trust funds under the Rapid Social Response program and the Japan Social Development Fund Emergency Window.

120. arising from the surging food prices in the food crisis of 2008. While the overall incidence of problems was limited, partly because many LICs benefitted from increased export rev

125. In the absence of expanded access to social safety nets, it is inevitable that there will be a rise in



### 5.3 *Coping with volatility in the long run: market-based mechanisms to protect producers against price and other risks and to stabilize food import bills*

#### *Risk management for vulnerable producers*

129. The nature of the risks facing farmers varies from one country to another. The capacity farmers have to deal with such risks also varies across different farmer categories. In developed countries, large-scale, commercially orientated and well equipped farmers are more able to manage price and weather-related risks through market-based instruments. Smaller farmers may lack access to the knowledge, assets, technologies, market instruments and governance structures to adequately manage their risks. In developing countries, smallholders with little capital, and limited access to markets, often have no possibility to protect themselves against a variety of risks which characterise less developed agricultural sectors.

130. For farmers who have access to market-based insurance tools, normal variations in production and prices do not require any policy response and should be directly managed by them, as part of normal business strategy. Infrequent catastrophic events are, by definition, beyond the capacity of farmers or markets and therefore require government involvement. In between the normal and the catastrophic risks is an intermediate risk level that can be handled through market tools, such as insurance and futures markets or through cooperative/mutual arrangements among farmers themselves.<sup>66</sup>

131. Farmers face both production and price risks. Adverse weather, pests and diseases, as well as volatile prices (negatively affect farm income) and result in farmers making sub-optimal choices on what and how much to produce. Many actions, such as the introduction of disease resistant varieties, irrigation and drainage systems can reduce the risk to which farmers are exposed, especially in developing countries. Market-based insurance mechanisms also provide a way to transfer risk and assist farmers in making production decisions.

132. Insuring against frequent weather shocks such as partial drought, either in developed or developing countries presents significant difficulties. The fact that adverse weather conditions affect a great number of farmers in the same location makes insurance very expensive and often commercially unviable. However, for less frequent and more catastrophic events, insurance tools may succeed in assisting farmers.

133. In developing and emerging economies, risk management faces numerous challenges. Often,

a clear understanding of how weather index insurance works and should be able to pay for it. In the medium and long term, these conditions can be put in place with appropriate government intervention.

136. Protection against price risks for producers faces similar problems. In addition to poor access to markets and knowledge, farmers produce small quantities to make participation in futures markets worthwhile. Even if aggregated across farmers, production is subject to problems of standardisation and quality. Moreover, few developing countries have commodity exchanges where farmers and other market participants can hedge against price fluctuations. In addition, as domestic prices are often not strongly related to world market prices, due to high transfer costs, producers cannot utilise existing international commodities exchanges. If such risk management instruments are to scale up, governments and donors will need to intervene more actively to provide an enabling environment and facilitate the development of markets. However, although such instruments have strong potential, additional innovations are required.<sup>67</sup> In general, it has proved extremely difficult to target smallholders directly in a cost-effective manner for use of financial risk management tools.

137. Warehouse receipts systems can enable producers, farmer organizations or traders to access secure and reliable storage, and can provide them with documentary title to their produce, which can be used to obtain finance. This avoids being forced to sell immediately after harvest and potentially results in smoothing seasonal price variations. This cooperative system can also help to reduce storage losses, and promote efficient private trade. This may contribute to reducing volatility, while assisting smallholders to better manage risks and participate in markets.

#### *Risk management for governments*

138. Governments face the same risks as farmers. Food production and price shocks can negatively affect the balance of payments, foreign currency reserves and worsen the ability to implement social safety programmes. For countries that are either food import dependent or need to import if domestic production suffers a shock, addressing price risk becomes acutely important. Market-based mechanisms, such as the use of weather derivatives or hedging instruments to manage production and price risks, may provide an alternative option to international policy solutions such as compensatory financing facilities. However, given the technical nature of such market-based approaches to managing food price volatility, there is a need to establish and train institutions at the national level.

139.

the country will obtain greater certainty over the price, but not flexibility. Should the market price move

risk management tools: weak legal /regulatory frameworks, poor credit standing, and a lack of knowledge, understanding, and confidence about how to use these tools.

148. A menu of approaches which can be used to strengthen country-based risk management frameworks includes:

Facilitation of commodity hedging by providing assistance to help governments and private sector entities structure and execute physical hedging transactions; intermediation of financial commodity hedges by multilateral development banks and international financial institutions; and risk-sharing the underlying credit exposure in order to expand the reach of these tools, as is planned

Advisory services to help governments evaluate exposure to and find ways to manage a wide set of fiscal risks and contingent liabilities associated with exogenous shocks such as commodity price shocks (food, fertilizer, and energy), but also natural disasters and climate change.

Disaster risk financing solutions, based on the use of parametric and other triggers (for example weather derivatives, cat

151.

*Endnotes*

1. The evidence base for the analysis and recommendations put forward in this report is extensive.

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35. On the one hand and in favour of this argument:

Robles, M., M. Torero, and J. von Braun (2009), *When Speculation Matters Issue Brief 57*, Washington, DC: International Food Policy Research Institute, [www.ifpri.org/pubs/ib/ib57.asp](http://www.ifpri.org/pubs/ib/ib57.asp)

*Journal of Agricultural Economics*, Vol. 61, preliminary online version.

Robles, M. and B. Cooke (2009), Recent food prices movements: A time series analysis, *Discussion Paper 942*, Washington, D.C., International Food Policy Research Institute.

Tang K. and W. Xiong (2010), *Index investment and financialization of commodities*. Princeton University. Working Paper 16385, National Bureau of Economic Research. Cambridge (Mass). September.

On the other hand and against this argument:

Wright, B. (2009), International Grain Reserves and Other Instruments to Address Volatility in Grain *The World Bank. Policy Research Working Paper 5028*, August.

rec *Journal of Agricultural and Applied Economics*, Vol.41: 393  
402.

Irwin, S.H., P. Garcia, D.L. Good, and E.L. Kunda (2009b), *Poor Convergence Performance of CBOT Corn, Soybean and Wheat Futures Contracts: Causes and Solutions*, Marketing and Outlook Research Report 2009-02, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, March.

Irwin, S., D. Good, P. Garcia, and E. Kunda (2009c), *Comments on Permanent Senate Subcommittee on Investigations Report 'Excessive Speculation in the Wheat Market'*, Department of Agricultural and Consumer Economics, University of Illinois. July 2009. Available under *Miscellaneous Publications* at [www.farmdoc.uiuc.edu/irwin/research.html](http://www.farmdoc.uiuc.edu/irwin/research.html).

Abbott, P.C. (2009), Development Dimensions of High Food Prices *OECD Food, Agriculture and Fisheries Working Paper N°18*, OECD, Paris.

36.



PRICE VOLATILITY IN FOOD AND AGRICULTURA

59. Shepherd A. (2009), *Promoting Sustainable Grain Storage Improvements in Africa*, FAO Agricultural Management, Marketing and Finance Working Document 27.
60. Managing food price risks and instability in a  
*Food Policy*, 31:275-287.
61. International Fund for Agricultural Development and World Food Programme (2010), *Potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods*, by P. Hazell, J. Anderson, N. Balzer, A. Hastrup Clemmensen, U. Hess and F. Rispoli. Rome
62. WFP (2010), *Review of the Working Capital Financing Facility*, World Food Programme, Rome.
63. Grosh, M., C. del Ninno, E. Tesliuk and A. Ouerghi (2008), *For protection and promotion: The design and implementation of effective safety nets*, World Bank.
64. The overall strategy for responding to both the immediate and longer term dimensions of food insecurity, including an analysis of critical unresolved issues, is spelt out in the Updated Comprehensive Framework for Action presented by the High Level Task Force on Food Security (2010) - which is made up of most of the organizations involved in the preparation of this report.
- 65.
66. OECD (2009), *Managing risk in agriculture. A holistic approach*, Paris, OECD.
67. Results from a small scale pilot

## Annex A.

### Definition of volatility and related terms

1. **Return:** Let  $P_t$  be the price of an agricultural commodity in time period  $t$  ( $t$  can represent days, months, etc.) The return in time period  $t$  is defined as  $R_t = R_t = (P_t - P_{t-1})/P_{t-1}$
2. **Volatility:** od  $t$ . If there is  
 positive or negative) and we speak of large returns or large volatility. Hence, extreme values for returns reflect extreme price variation (volatility) and vice versa. Clearly, if there is no price variation over time (volatility)  $P_t = 0$  and  $R_t = 0$ . Note, that a period of sustained price increases (or decreases) may be characterized by low or high volatility.
3. **Large return:** A large observed return is defined to be a return that exceeds a certain pre-established threshold. This threshold is normally taken to be a high order (95 or 99%) quantile,<sup>1</sup> i.e. a value of return that is exceeded with low probability (5% or 1%).
4. **A time period of extreme volatility:** A period of time characterized by extreme price variation (volatility) is a period of time in which we observe a large number of large daily returns.
5. **Implied volatility:** Implied volatility price of a commodity is likely to move in the future. It is called "implied" because, by dealing with future events, it cannot be observed and can only be inferred from the prices of derivative options gives the bearer the right to sell a commodity (put option) or buy a commodity (call option) at a specified price for a specified future delivery date. Options are just like any other financial instrument, such as futures contracts, and are priced based on market estimates of future prices, as well as on the uncertainty surrounding these estimates. They are subject to the law of supply and demand. Hence, any excess or deficit of demand would suggest that traders have different expectations of the future price of the underlying higher the underlying uncertainty and hence the implied volatility of the commodity. Does implied volatility matter? Prices that are observed today for commodities traded in the major global exchanges are influenced by the sentiment captured by implied volatility. When these markets are efficient, they convey all known information, future and present, pertinent to the market and the commodity. Hence, implied volatility as a metric is an important instrument used in the price discovery process and as a barometer for where markets might be headed.
6. The concept of implied volatility is based on the Black-Scholes option pricing formula. Given the exercise price, current price, risk free rate and maturity of an option, there is some value for volatility that makes the price determined by the Black Scholes formula equal to the current price. This is called implied volatility and is what is reported on Figure 3. It should be noted that the Black-Scholes formula rests on the assumption that logarithmic transformations of the returns are normally distributed and that their volatility is constant. These are quite strong assumptions

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1.









## Annex C.

### **Increasing the productivity, sustainability and resilience of agriculture in developing and emerging economies**

1. This annex aims to provide some concrete examples of initiatives that need to be taken by national governments, international organisations, development and humanitarian organisations, the private sector and public-civil society where possible, to bring about the needed transformation and invigoration of the agricultural



***National country owned and led, inclusive, food security strategies***

4. This is the essential next level. The quality of national food security strategies and the capacity to implement them is critical to the development effectiveness of the resources invested in delivering them. Governments, civil society, the private sector and donor partners are all stakeholders in national development processes. Through existing country-level co-ordination mechanisms, adequate donor capacity should be committed to support, and engage in, national policy and programming processes, in order to promote the development of inclusive, evidence-based policy and development processes that result in the delivery of effective and equitable public investments and regulation. Besides directly engaging in such processes, donors can also play important roles in supporting the capacity of civil society and farmers organizations to contribute to them.

***Promoting the needed investment***

5. Productive infrastructure, such as soil and water conservation and expansion and improvement of irrigation systems, is crucial in improving performance of the agricultural sector. Improved performance at farm level will not lead to improved food security and improved farm livelihoods unless other components in the value-chain are also developing apace, such as infrastructure supporting agricultural upstream and downstream activities, including transport, storage, processing and marketing facilities for agricultural products.

6. From the public sector, what is needed is, on the one hand, enabling policies and institutions in a variety of domains -





### *Maize*

- Climate change and environmental problems impose the need to develop new maize varieties, which should be resistant to drought, heat, water-logging and sub-optimal soil nitrogen. Location-specific varieties can solve different problems. The development of new varieties should be further boosted by the creation of public goods, through the dissemination of genomics, bioinformatics and phenotyping.
- Use spatial information on soil quality, availability of inputs, and weather information to construct an accurate map of detailed local potentials and challenges for maize.
- This information can be used to better advise National Agricultural Research and Extension Services.
- Create platforms to disseminate this information through Information and Communication Technologies (mobile phones, web-based platforms)
- Reduce losses in post-harvest through better management through development of new cost-effective technologies to reduce losses.

For further details see:

[docs.google.com/a/cgexchange.org/viewer?a=v&pid=sites&srcid=Y2d4Y2hhbmdlLm9yZ3xjb25zb3J0aXVtfGd](https://docs.google.com/a/cgexchange.org/viewer?a=v&pid=sites&srcid=Y2d4Y2hhbmdlLm9yZ3xjb25zb3J0aXVtfGd)

***Roots, tubers, and bananas (RTBS)***

Development of new varieties of RTBs:

-

*Education, extension and advisory systems*

19. Increasing productivity and resilience under more difficult environmental conditions is a knowledge-intensive proposition. It requires strengthening the human capabilities of those involved in agriculture, not only as producers but also as managers of natural resources. Priority areas where improved investments and policies are needed are agricultural education and advisory systems. These are not entirely separate areas of intervention. To the contrary, there is a need to develop supportive policy environments that can mobilise resources and co-operation among stakeholders with diverse interests so as to strengthen capability development through both education and advisory systems. Such stakeholders







absorb biofuels which places a limit on the amount of biofuel that can be taken up by the transport sector at any given time.

11. Some major biofuels producers have built flexibility provisions into their legislative or regulatory frameworks. In the United States, the 2007 Energy Act allows the Administrator of the Environmental Protection Agency to waive or reduce the mandate if there is sufficient reason to do so and that has been done systematically for cellulosic ethanol, for the simple reason that production is not large enough to fulfil the mandate. State governments and other affected parties can petition EPA to waive the mandate if it is shown to cause injury and EPA must make a decision in consultation with USDA. In theory this provides a degree of flexibility but in practice is difficult to make operational. In Brazil, biofuels policies incorporate a significant degree of flexibility although, at current prices, mandates are not binding, and production and consumption decisions are determined by relative prices. Flexibility in Brazil is enabled by the adoption of flexible technologies. On the production side many mills can modify the share of sugar-cane used for ethanol or for sugar production, and on the consumption side fuel flex cars mean that consumption depends on the relative level of oil and sugar cane and is not bound by the technical capacity of Brazilian cars to use the different fuels.

12. Available options to introduce flexibility into existing biofuel subsidies, tax expenditures and mandates are second-best solutions and in practice present very real design, operational and political economy problems. Additional research would be needed into the design of an operational and efficient mechanism and its possible effects. Removing provisions that artificially stimulate demand and supply for biofuels is the best way to avoid policy driven fuel – food/feed conflicts. A viable package of alternatives to current policies could include: open markets in renewable fuels, feed stocks, and food-feed commodities, so that production of biofuels and food-feed could occur where it is most economically, socially and environmentally sustainable to do so; increased scientific research on second generation feed stocks and other alternative paths to reduce carbon emissions and to contribute to both energy and food security globally; and, encourage more efficient energy use, including in agriculture itself, without drawing on finite resources, including those needed for food production

## **Annex E.**

### **Emergency humanitarian food reserves to support safety nets in poor countries**

1. In March 2011, the G20 Development Working Group and G20 Agriculture Deputies asked international organisations to study whether a cost-consistent with World Trade Organisation (WTO) rules, optimises existing instruments and enjoys strong national ownership and partnership could help poor countries ensure vulnerable people have rapid access to safe, nutritious food during food price and supply shocks.

2. In response to the G20 request, this Annex outlines two actions that could be taken immediately to develop a system of small, strategically positioned emergency humanitarian food reserves and to support the efforts of humanitarian agencies to assist countries facing crises.

#### **Ensuring rapid access to food for the most vulnerable**

3. The 2008 food price crisis triggered catastrophic food supply shortfalls for some nations and exposed three critical weaknesses in the global and national food security structures that require urgent attention:

The World Food Programme (WFP) did not have sufficient authorised risk management tools and support to protect its supply chain against price and supply shocks, including the ability to forward purchase and pre-position food for its operations,

Poor food deficit countries with little resilience to external shocks were at times unable to secure sufficient food to respond rapidly to the humanitarian needs of their most vulnerable population groups, including through national safety net programmes, and

Some nations were unable to purchase food on external markets. Risk premiums alone may have raised the cost landlocked African countries paid for food relative to their coastal neighbours by as much as 33.5 percent.

4. As discussed in Section 2 of this report, continued high and volatile cereal prices, falling stocks and export bans are once again driving rising hunger and malnutrition and challenging the capacity of nations and humanitarian agencies to quickly access a sufficient supply of food for vulnerable populations.

5. Conflicts and increasing weather-related shocks often exacerbate challenges associated with high and volatile prices – escalating food import needs and creating dangerous gaps in commodity pipelines that can threaten national and regional stability and undermine trust in market mediated food security.

6. Enabling nations to purchase sufficient food for their commercial needs on external markets is beyond the scope of this Annex. However, two separate but complementary actions that could be taken immediately to help poor food deficit countries secure sufficient food to respond to the humanitarian

needs of their most vulnerable population groups and to strengthen the ability of WFP to pre-position food for its operations are:

establishment of storage capacity along major humanitarian corridors as a means of strengthening its supply chain against price and supply shocks, and

Developing for consideration before the end of 2011 a pilot programme for a regional emergency humanitarian food reserve system that could help poor nations ensure predictable access to food for the most vulnerable through safety net programmes. Following implementation of a successful pilot, development of a broader network of regional emergency humanitarian food reserves could be considered.

**Action 1: A proposal to strengthen forward positioning of humanitarian food assistance**

7. authority to pre-purchase and pre-position food for vulnerable populations. A \$60 million forward purchase facility was put in place to buy commodities and pay shipping costs prior to receipt of donor contributions.

8. WFP is now planning to increase the level of forward planning and purchasing in its supply chain, including forward positioning of food aid along humanitarian corridors, supported by a recent authorization from its Executive Board to increase the revolving financing facility to \$150 million. Forward purchasing and positioning food will enable WFP to increase the effectiveness of its humanitarian response programmes while reducing the impact of food price volatility on its operations.

9. While WFP already has the necessary authorization to put these measures in place, further support from the G-20 would be critical to provide sustained levels of predictable and flexible funding, as well as scaling up storage capacity at strategic locations along humanitarian corridors.

**Action 2: A proposal for a pre-positioning for predictable access and resilience system**

10. During food crises caused by high and volatile prices or other shocks, a system of small

13. Unlike large-scale buffer stocks that attempt to offset price movements and act as universal subsidies, a PREPARE system would operate on a cost recovery basis according to market principles and sound business management practices. It would not fill commercial gaps or release stocks for the purpose of altering market prices.

14. To limit costs and to test an approach that can best deliver sustained value, a PREPARE system could be piloted with a limited group of countries in a particular region. If requested and supported by the G20, and based on further guidance, a written project plan for a pilot programme for a specific group

## PRICE VOLATILITY IN FOOD AND AGRICULTURA

23. In the case of both physical and virtual stocks, a PREPARE system would seek to maximize efficiency by offering a limited range of longer shelf life staple cereal commodities and perhaps also specialised nutritional products determined by local consumption patterns and nutritional needs.

24. **Trigger criteria.** A PREPARE system would release food to participating eligible countries according to clear, transparent and pre-eligible country could drawdown a limited amount of commodities from the reserve if the following conditions are met:

At the global level, there is transparent and objective evidence of an external shock, such as a food price surge which is being transmitted to reGR.32-4(-)611.0u94 76ET6Tn9(s)-56(l)-5(n)1 76(sh)9(ock)

***Financing***

29. A PREPARE system would operate on a cost recovery basis, with appropriate burden sharing by all partners. Implementing the system beginning with a small pilot programme for a limited group of countries in one region would further reduce costs. The process of stock accumulation and disposal, as well as the financing and administration of the system, would be transparent.

30. Financing necessary to initially stock the reserve and to cover recurring management and capacity building expenses would come from donors and participating countries, including through the food reserves and/or safety nets are prioritised in those plans.

31. Initial costs associated with establishing the system would include expenses necessary to purchase and transport commodities to reserve sites. Limited investments in storage and other

*Governance and management*

35. A PREPARE system would operate under transparent and streamlined public governance structure with strong national and regional ownership and international oversight.

36. The system would be developed with input from the private sector and civil society in the participating eligible countries and regions concerned, including through existing structures. It would be governed jointly by participating eligible countries and an international organisation with existing regional economic communities. The international organisation initially would have legal custody of reserve stocks and would manage and provide oversight of the system, including:

Coordinating and facilitating the provision of capacity building assistance to participating eligible countries and regions for the operation of the system and for the development, deployment and management of safety net programmes,

Monitoring food releases through national safety nets or other assistance programmes,

Procuring food for the reserve according to food security targets,

Determining when trigger criteria have been met,

Notifying release prices and negotiating replenishment terms, and

Managing stock rotation.

Following a successful pilot period and through effective capacity building assistance, these functions could be transferred gradually to national and regional ownership and control. The international organisation, participating eligible countries and regional economic community concerned could develop a transition plan for this purpose.

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## Annex F.

### A code of conduct for responsible emergency food reserves management

1. Food emergency reserves are put in place in order to respond to food security problems, rather than to try to affect prices in the market. They are a policy instrument which can directly meet humanitarian goals and social policy objectives. The following set of principles and safeguards should govern the design, implementation and impact monitoring of emergency food reserves.
2. It is envisaged that the process of compiling a set of principles and good practices for responsible emergency food reserve management will involve a number of international organisations (FAO, IFAD, WFP, the World Bank), academics, governments and civil society. Collaboration and participation will be achieved by means of conferences and workshops.

#### **1. Emergency reserves should be well-linked to effective information and early warning systems**

Emergency food reserves operations should be based on sound market information and on effective early warning systems. The less reliable market information is, the greater the degree of uncertainty in assessing market developments. Early warning systems should identify the links between climate and price risks, food security, and livelihoods. They require medium term weather forecasting and enhanced capacity to translate this data into yield expectations in terms of reliability and timeliness. Better early warning would enable governments and international organisations to plan ahead, be pro-active and anticipate needs.

#### **2. The size of the reserve should be carefully determined**

The size of a food reserve can be determined on the basis of grains requirements of the vulnerable following the recognition of an emergency situation until additional supplies can become available. Governments should consider that food crises do not usually take place from one day to the next. For example, the implications of a drought are known well before harvest; therefore adjustments in the size of food reserves can take place through import programmes in accordance with the needs of the country. Reserves cannot be greater than a maximum size determined by the food requirements of the vulnerable. They cannot be smaller than a minimum level of food, set at one or two months requirements, and are to act as an insurance in emergencies.

#### **3. The reserve should be located strategically**

The question of storage location for food reserves is complex. There are advantages in having the reserve spread across several locations. However, fragmentation of the reserve increases monitoring costs. A reasonable approach could involve some storage in traditional deficit production areas adequate for the period when production may have been exhausted and transport infrastructure is inadequate, limited additional storage in good-quality stores in nearby small urban centres and larger stores in major urban centres.

**4. Food reserve agencies should be credible and operate with well defined rules**

## Annex G.

### Risk management activities and instruments

1. Risk management involves three main types of activities (and frequently involves a combination of them):

*Mitigation* avoidance of the activity involving risk or undertaking the risk related activity in a manner that reduces the level or potential impact of a realised risk (for example use of irrigation or drought resistant seeds in a drought prone area, use of pesticides, vaccinations and other actions).

*Transfer* transferring risk to a third party who will either indemnify you for loss if a given risk is realised (such as insurance) or who will pay you a given or calculated amount of money in a when specific situation (derivatives). The third party who assumes the risk will charge a fee for this service, commonly referred to as a premium.

*Coping* *ex ante* provision (normally financial) that enables the affected party to address the impact of a realised risk on an *ex post* basis (e.g. disaster risk financing, smoothing funds, germplasm banks, etc.). Coping is normally the residual activity in relation to a risk, once mitigation and transfer options have been already put into place.

2. The principal instruments that could be used to transfer price risk and protect against food price volatility and stabilise food import bills are as follows.

Type	Instrument	Advantage	Disadvantage
Financial	Futures	<ul style="list-style-type: none"> <li>- Gives direct exposure to moves in the financial market which should offset physical position.</li> </ul>	<ul style="list-style-type: none"> <li>- Basis risk where losses or gains in financial markets do not equate to those in the physical markets.</li> <li>- With high volatility, margin calls can become onerous</li> </ul>
		<ul style="list-style-type: none"> <li>- Only need to post a percentage of total value of food to be hedged</li> </ul>	

3. *Financial instruments* pose two major challenges for governments. Firstly, the degree to which the cha  
delivered to the buyer known as basis risk. Prices in futures markets change on a continual basis and reflect changes in perceived and future values of physical commodities for a number of specific months in a given year. While physical commodities generally adhere to these projected values (a phenomenon known as coner