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

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 most vulnerable."

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.

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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 "request that FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank and the WTO 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 most vulnerable". This report has been prepared by FAO, IFAD, IMF, OECD, UNCTAD,WFP, the World Bank, the WTO, IFPRI and the UN HLTF.

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 2007-2008crisis.

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 cooperation to implement this report's recommendations and to monitor progress.[1]

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[2]. 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[3]. 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.[4]

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[5]. 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.[6] 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)

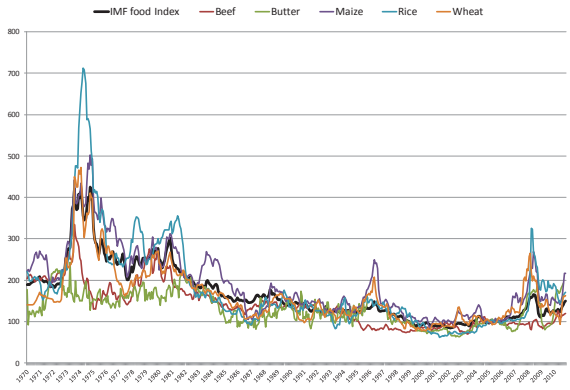
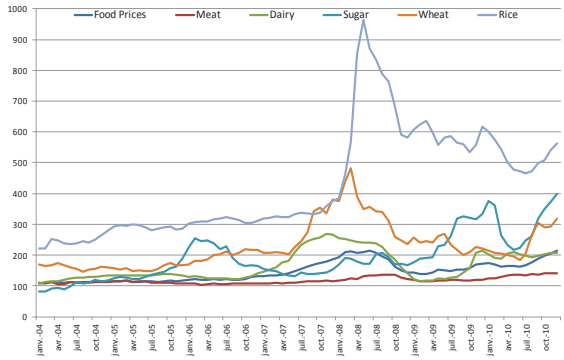


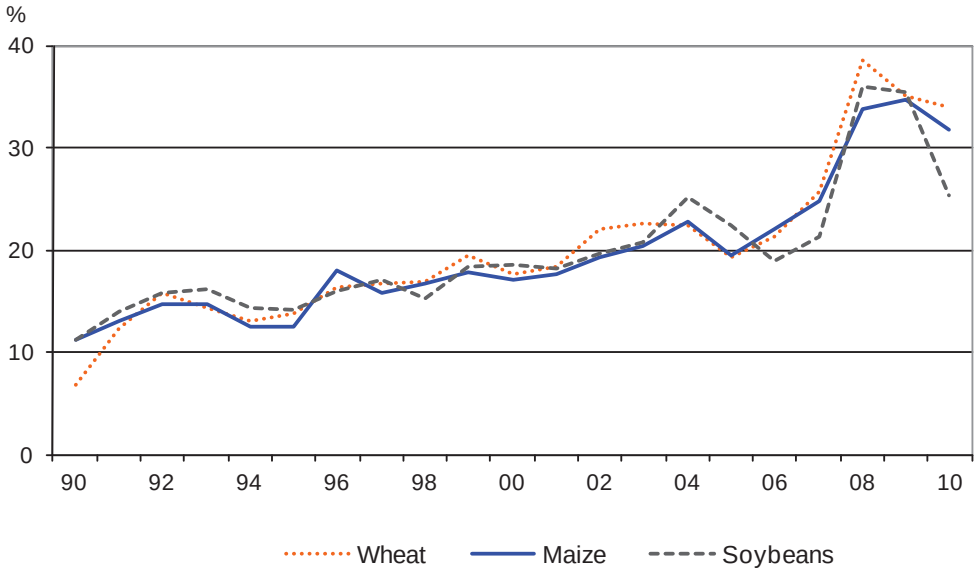
Figure 2. Monthly commodity price indices (2002-04=100)



10. Since 1990, as shown in Figure 3, the implied volatility for major crops has increased significantly.[7] 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.[8] 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 during 2010 and there have been sharp rises in some food prices. By early 2011, the FAO's food price 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.[9] 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 concerns about volatility is a concern about price levels, particularly the impact of high prices on the food security of the most vulnerable households and countries and of low prices on vulnerable producers.

16. Most agricultural commodity markets are characterized by a high degree of volatility. Three major market fundamentals explain why that is the case. First, agricultural output varies from period to period because of natural shocks such as weather and pests. Second, demand elasticities are relatively small with respect to price and supply elasticities are also low, at least in the short run. In order to get supply and demand back into balance after a supply shock, prices therefore have to vary rather strongly, especially if stocks are low. Third, because production takes considerable time in agriculture, supply cannot respond much to price changes in the short term, though it can do so much more once the production cycle is completed. The resulting lagged supply response to price changes can cause cyclical adjustments (such as the often referenced 'hog cycle') that add an extra degree of variability to the markets concerned. Business cycle fluctuations in demand for agricultural non-food commodities (such as cotton) from rapidly growing, industrializing economies may also be contributing to increased volatility.

17. As of Spring 2011, world price levels as reflected in various measures, including the FAO's world food price index, have once again reached the levels of 2007/08, giving rise to concerns that a repeat of the earlier crisis is underway. Several of the same factors known to have contributed to the 2007/08 crisis are also present – weather-related crop losses, export restrictions, high oil prices, and a depreciating US dollar, against a background of a continuing tight supply-demand balance. The debate on the impact of financial investment in commodity markets also continues. On the other hand, the 2010/11 situation differs from the earlier episode in some important respects. Firstly, the 2010 harvests in many food importing countries in Africa were above average or very good, so that prices in the region have been more stable. Stocks were higher at the outset which has also helped to mitigate the price rises. Finally, the price increases have been differently distributed among commodities. Meats, sugar and dairy

products are all affected, and these are commodities that are less important in the food bills of the most vulnerable. It should be noted also that while the index of prices for cereals has come close to its 2008 level on average, and prices of vegetable oils are also very high, contrary to the 2007/08 situation the price rises have not affected rice. As rice is the staple food of many millions of the world's most vulnerable consumers, this means that the incidence of current price increases is somewhat different. Nevertheless, there are serious risks to food security and the situation needs to be kept under close review by national governments, and by international organisations and non-governmental agencies. .

2.1 The determinants of future increases in food prices and of volatility

18. Growing population and income in emerging and developing countries will add significantly to the demand for food in the coming decades. By 2050 the world's population is expected to have reached about 9 billion people and the demand for food to have increased by between 70% and 100%. This alone is sufficient to exert pressure on commodity prices. According to the latest OECD/FAO medium term outlook projections, prices of crops and most livestock products will be higher in both real and nominal terms during the decade to 2019 than they were in the decade before the 2007/08 price spikes. If the rate of growth of agricultural production does not keep pace with demand, upward pressure on prices will result. A demand or supply shock in a situation where the supply-demand balance is already tight, can, for the reasons explained in the previous paragraph, result in increased volatility around the upward trend.

19. The demand for food and feed crops for the production of biofuels is another significant factor. During the 2007-2009 period biofuels accounted for a significant share of global use of several crops – 20% for sugar cane, 9% for vegetable oil and coarse grains and 4% for sugar beet. Projections encompass a broad range of possible effects but all suggest that biofuel production will exert considerable upward pressure on prices in the future. For example, according to one study international prices for wheat, coarse grains, oilseeds and vegetable oil could be increased by 8%, 13%, 7% and 35% respectively[10]. Moreover, as long as governments impose mandates (obligations to blend fixed proportions of biofuels with fossil fuels, or binding targets for shares of biofuels in energy use), biofuel production will aggravate the price inelasticity of demand that contributes to volatility in agricultural prices.

20. Agricultural commodity prices are becoming increasingly correlated with oil prices. Oil prices affect agricultural input prices directly and indirectly (through the price of fuel and fertiliser, for example). In addition, depending on the relative prices of agricultural crops and oil, biofuel production may become profitable (without government support) in some OECD countries. Financial investment in commodities may also have contributed to an increasing correlation between oil and non-oil commodity prices because of the significant share of such investment that tracks indexes containing a basket of different commodities. High and volatile oil prices (if that is what is expected) could therefore contribute to higher and more volatile agricultural prices, through higher input costs, higher demand for the commodities used in the production of biofuels (sugar, maize, vegetable oils), through competition for land with commodities that are not used directly for the production of fuel, and possibly through financial investment in commodity baskets.

21. Low stocks relative to use, and uncertainty about stock levels in some parts of the world contributed to the 2007/2008 price spike. Stocks can be drawn down in response to a supply or demand shock, but once they have been depleted, supply can no longer be increased until new production comes on board. Even expectations of depleted stocks may lead prices to rise sharply. The low stock levels observed in recent years have been attributed to the partial dismantling of price support and intervention purchase schemes in some OECD countries, as well as to correction of the quality of information on private and government held stocks in important producing and consuming countries. Stocks were rebuilt during 2009 and the first part of 2010 but currently stocks are again being depleted. If stock levels

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 2010. In 2008, an already tight market situation for wheat was aggravated by drought in Australia, which is an important supplier of wheat to world markets. Canada, another important supplier, also experienced weather related low yields for several crops. More recently, drought followed by fire in the Russian Federation, fears about the Australian and Argentinean crops, and several downward revisions of US crop forecasts in late 2010 and early 2011 have brought strong market reactions and soaring prices. It is not clear whether these weather-related events are transitory in nature, cyclical (*El Nino* and *La Nina*) or the harbingers of long term climate change. Experts concur broadly that climate change will, in the longer term, lead to worsening conditions in some arid and semi-arid regions where agricultural production is already difficult, while temperate regions in particular, but not exclusively, may benefit. It is also thought that climate change will lead to more frequent extreme events such as droughts, heat waves and floods. Clearly, climate change will provoke some adjustment of production patterns around the world, as well as increased risks of local or regional supply problems that could add to future volatility.

23. Stronger demand for food crops and animal products in conjunction with slow growth in agricultural productivity and low stocks results in upward pressure on prices. Recent years have also seen some shift in production patterns, particularly of food and feed grains, and world markets are more dependent on supplies from the Black Sea region and other, newer, agricultural production regions than in the past. Yields in these regions are less stable and supply more variable than in some other parts of the world where natural conditions are better and where application of the most up-to-date technologies and management practices have increased and stabilised yields. As the geographical distribution of production changes, supply may therefore become more variable, in turn leading to increased price volatility.

24. The same underlying factors that are leading to increased demand for food – growth in population, affluence leading to increased demand for animal protein, urbanisation, and biofuels – are also increasing pressure on finite resources such as land and water. While such resource constraints are, thus far, more local than global in nature, growing concern is evident and the associated uncertainty may imply upward pressure on prices and continuing or increased volatility.

25. During the 2007-2008 period, some policy measures put in place by a number of governments contributed directly and indirectly to the crisis (export restrictions, hoarding), increasing the amplitude of price movements and in some cases provoking price increases that were otherwise inexplicable in terms of the market fundamentals. Inappropriate policy responses also contributed to volatility and could continue to do so unless the international community is able to take steps to avoid such actions. Additionally, private and public actors responding to the general nervousness of the markets, or for speculative reasons, engaged in hoarding or precipitated purchases in an already tense market situation. How to avoid repetition of these types of damaging private and public reactions is addressed later in this report.

26. Trade in many agricultural commodities is denominated in USD. A depreciating USD, as occurred in the years before and up to the peak of the price rises, causes dollar denominated international commodity prices to rise, although not to the full extent of the depreciation. The opposite occurs when the dollar appreciates as was the case from mid-2008 onwards. These currency movements added to the amplitude of the price changes observed. (They also help to explain why demand remained strong in countries where the currency was appreciating against the dollar and why falling prices were not fully felt in the same countries once the dollar began to appreciate again.) Exchange rate volatility *per se* is

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 reducing or smoothing price fluctuations – indeed, this is one of the primary functions of commodity futures markets. This topic will be taken up in more detail in Chapter 3.

28. This catalogue of factors points to a likelihood of higher real prices and a risk of increased volatility in future years. While it is not possible to forecast future prices or future returns, there may be ways in which the international community could be alerted to a risk that a period of excessive volatility is in the offing.[11] Various tools and mechanisms that could assist in this respect are described in later sections.

29. There are also a number of factors that could act to mitigate increased price pressure and increased volatility. Most important will be the supply response? Analysts have consistently underestimated the capacity of producers to respond to positive market signals, as well as the potential for higher yields and increased acreage. Successful conclusion to the WTO Doha Development Agenda negotiations would be an important step, along with complementary policies that improve supply capacity and ensure the benefits of open and competitive markets are widely spread. Deeper integration of global and regional markets, better defined safeguard mechanisms and improvements in the competitive environment will bring increased trade volume and more suppliers and buyers to markets that are currently very shallow. Local or regional supply shocks could more easily be absorbed leading to lower volatility on domestic and international markets and food could more easily flow from surplus areas to rapidly urbanising food-importing areas

30. The extent of potential future increases in prices and volatility cannot be estimated accurately, but the risks are sufficiently large to warrant serious reflection about what can be done to mitigate it – when the nature of the underlying causes makes mitigation possible – and to manage the consequences, when, as is inevitable, episodes of high volatility occur. The remainder of this report takes up this crucial topic.

2.2 Why does agricultural price volatility matter?

31. At the macro level it is useful to distinguish between long and short run effects of commodity price volatility and between importing and exporting countries. The assumption is that countries likely to be most concerned by macro-economic impacts of agricultural price volatility are developing or emerging economies that are dependent on agricultural commodities for a large share of their export revenues, or whose food imports are significant in balance of payment or government finance terms. For exporting countries heavily dependent on agricultural commodities, exceptionally low prices will have immediate balance of payments impacts, but beyond that, uncertainty may curtail investment and affect capacity utilization and there is some evidence of long-lasting significant negative effects on growth. Importing countries faced with exceptionally high prices may also experience deterioration in the balance of payments and deterioration in their public finances. Food price increases can have major repercussions on the whole economy. For low-income food-importing countries, high food prices can result in inflation

and high import bills which in turn worsen the current account balance. As countries have to export more to pay for imports, such deficits may result in the depreciation of the exchange rate. Fiscal measures, such as cuts in import tariffs and in taxes on food, subsidization of food consumption, and increased demands on risk management instruments entail increased budgetary costs that will have to be met by increased government borrowing and budgetary discipline.

32. Looked at from the demand side, significantly higher food prices are disastrous for the poor especially in developing countries where up to three-quarters of their total income may be spent on basic foodstuffs. Immediate impacts are obvious, but there are also longer term costs imposed on the poorest and most vulnerable as spending is switched to less nutritious foods and away from other basic needs such as education or health. Typically the effects are felt more strongly by women and children. Particularly severe are the effects on children – stunting and cognitive loss often occurring as a result of inadequate nourishment during the first 1 000 days after conception. The consequences are tragic for individuals and for future prosperity in the countries where they live. This is not only an issue of concern for the affected countries but also for humanitarian agencies and the international community.

33. Food price inflation can also be a serious issue in middle income countries, where many consumers expend as much as half of their budget on basic foods. Even in the developed countries significantly higher food prices can create hardship for the least well-off, who tend also to devote a larger share of household spending to food. Nevertheless, consumers in developed countries face wider choices in terms of their ability to adjust spending on different types of foods and most developed countries have safety net mechanisms that are well suited to delivering targeted assistance to the most affected.

34. Looked at from the supply side, high prices benefit net producers of these commodities and signal a need for increased production. Price increases affect mainly grains and oilseeds which is a high proportion of total costs in intensive production systems. Profitability of livestock enterprises will be affected especially if these costs cannot be fully passed on to consumers. Volatile feed prices are also problematical for livestock producers; such uncertainty is detrimental to investment and production decisions, particularly where the physical production cycle is long.

35. Low or volatile prices pose significant problems for farmers and other agents in food chains who risk losing their productive investments if price falls occur while they are locked into strategies dependent on higher price levels to be viable. Farmers who have already planted their crop are the classic example. Poor smallholders who do not have access to credit may have difficulty financing the crucial inputs needed to plant again and stay in business. This kind of problem may be particularly severe for the female smallholders who are in the majority in many countries. Many farmers in developing (and even some in more advanced) economies may not be operating on a sufficiently large scale to be able to carry over income from one season to another. Thus, both the welfare of the family and the viability of the farm may be threatened by excessive volatility. Uncertainty may also result in sub-optimal investment decisions in the longer term.

2.3. Lessons learned from recent experiences

36. It is beyond the scope of this paper to undertake an exhaustive account of the ways in which national governments and international institutions responded to the price volatility during 2007-2008. It is generally agreed, however, that policy responses were mainly ad hoc in nature, that some decisions were taken hastily, and that measures were somewhat inconsistent and largely uncoordinated at international level. The speed and strength of the price rises also took the international agencies by surprise and, they too, had to resort to *ad hoc* measures. Developed countries relied mainly on already existing safety net mechanisms while developing countries took new measures or adjusted the parameters of existing instruments.

37. Of 81 developing countries surveyed by the FAO, 43 reduced import taxes and 25 either banned exports or increased taxes on them.[12] 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 basic foodstuffs for their populations, believing that high prices would persist and that scarcity was imminent, notwithstanding the fact that they did not have any immediate or short term need to do so.

38. The extremely rapid run-up in food prices eroded the capacity of the national and international relief organisations to purchase food in the most hard hit countries and regions. With prices doubling or tripling within a few months, their purchasing power was dramatically reduced. While response to appeals made, for example, by the World Food Programme were both rapid and generous, crucial weeks and months were lost as international organisations and humanitarian NGOs scrambled to raise funds or divert monies from other uses to address the crisis. This situation revealed deficiencies in international readiness to deal with such a widespread problem.

39. The events of 2007-2008 also revealed serious deficiencies in the quality of the information base, and in particular concerning short-term forecasts and the level of stocks. More timely, complete and accurate information and improved capacity to identify and analyse early warning signs might have calmed the markets, re-assured populations and resulted in better readiness.

40. The different measures taken by individual governments in response to the crisis had different degrees of effectiveness.[13] The scale of the price increases was such that for many countries reducing import tariffs had a relatively modest impact because the initial tariffs were low or the scale of the price increases was so large. In any event, this instrument was quickly exhausted as tariffs were reduced to zero. Some of these countries suffered steep falls in tariff revenues and deterioration in their fiscal situation. Export taxes and restrictions differed between countries in their effectiveness in keeping domestic prices lower and in some cases had only a relatively minor effect. Export restrictions by major food exporters had strong destabilising effects on international markets. As more countries followed the first movers, volatility was exacerbated and the upward price movement was amplified. Export restrictions proved extremely damaging to third countries, especially the poorest import dependent countries, and to the efforts of humanitarian organisations to procure supplies, despite various ad hoc exemptions and exceptions which were put in place in order to mitigate the worst of these "beggar thy neighbour" effects.

41. Targeted assistance to those most in need, either using cash transfers or direct food assistance, may be the most effective and equitable way of reaching those affected by a food price crisis and several countries have successfully used this kind of instrument. However, many countries did not have the administrative frameworks in place to be able to implement safety-net measures at short notice. Neither did they have the fiscal capacity. They therefore made blanket market and trade interventions that sometimes proved ineffective or costly or both. Such measures, when they delivered some relief did so irrespective of need. This revealed the importance of contingency planning to better equip countries to be able to deliver targeted assistance where it is most needed.

42. Estimated numbers of hungry people in the world rose from 820 million in 2007 to more than a billion in 2009, proof that neither national nor international responses were able to fully cope with the scale of the problem. Deficiencies in information, communication, and in readiness contributed, as did uncoordinated measures that may have actually aggravated the problem for people and countries less well able to cope. The numbers of hungry people have since dropped to about 900 million. These events have drawn increased attention to the fact that a significant proportion of humanity (about 16%) remains

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 for the most vulnerable and food insecure, respectively. A key element in any long term solution is investment in increasing the productivity and resilience of developing country agriculture. This can contribute to improving food security in two ways. It can reduce food price volatility, for example through increased productivity and improved technical management of production and of risk, and it can help farmers and households to cope better with the effects of volatility, once it occurs. The set of recommendations put forward here, if implemented, would probably constitute the single most important contribution to an enduring solution to global food insecurity. While the benefits would accrue in the longer term, actions are needed immediately.

44. Agriculture is a source of livelihood for about 86% of rural people – 1.3 billion smallholders and landless workers – it provides "farm-financed social welfare" when there are urban shocks, and a foundation for viable rural communities.[14] Long run projections are fraught with difficulty and estimates can vary widely. According to FAO, the rate of growth in agricultural production is expected to fall to 1.5% between now and 2030 and further to 0.9% between 2030 and 2050, as compared with 2.3% per year since 1961. Population estimates suggest that by 2050 the planet will be home to 9.1 billion persons, up from the current population of 6.8 billion. This represents a 34% increase over the next 41 years.[15] These particular estimates suggest that in the future, with the supply of food not growing at the same pace with demand, upward pressure on prices could be a principal attribute of world food markets. In addition to high price levels, shocks, due to climatic or other reasons, can create wide price movements, as the food market may lack the capacity to absorb them. This adds to vulnerability and underlines the importance for supply to keep up with growing demand.

45. Investing in agricultural productivity growth and resiliency in low income countries is paramount to addressing local food price volatility. FAO estimates indicate that agricultural production would need to grow globally by 70% over the same period, and more specifically by almost 100% in developing countries, to feed the growing population. In the medium and longer term only investment in developing countries' agricultural sectors will result in sustainable increases in productivity, healthy markets, increased resilience to international price spikes and improved food security. Investments in infrastructure, extension services, education, as well as in research and development, can increase food supply in developing countries and improve the functioning of local agricultural markets, resulting in less volatile prices. In this way, markets can work for the poor people who bear the burden of food price volatility.

46. Waste, due to post harvest losses, inadequate storage and infrastructure as well as under-developed markets in general are a huge issue in agriculture in developing countries, amounting to a significant proportion of production. The investments proposed here would contribute to reducing or even eliminating avoidable waste of this type and in so doing would provide a significant boost in the quantity of food actually reaching consumers. The increase in production needed to meet the anticipated future demand would therefore be less than what is currently estimated. Similar efforts to avoid waste – which in the developed countries occurs mainly at retail level and in homes and restaurants – would also have large beneficial effects. This aspect is discussed in section 4.5.

47. The investments required in developing countries to support this expansion in agricultural output amount to an average annual net investment of USD 83 billion (in 2009 USD).[16] This total

includes investment needs in primary agriculture and necessary downstream services such as storage and processing facilities, but does not include public goods like roads, large scale irrigation projects, electrification and others that are also needed.

48. Most of the investment, both in primary agriculture and downstream sectors, will have to come from private sources, primarily farmers themselves purchasing implements and machinery, improving soil fertility, etc. For a better functioning agricultural system and improved food security, three kinds of public investments are also needed.

- Direct investment in agricultural research and development particularly on practices that enhance the resilience of small-scale agriculture towards climate change and resource scarcity.
- Investment in sectors strongly linked to agricultural productivity growth and to strengthening the integration of smallholders into markets, such as agricultural institutions, extension services, roads, ports, power, storage and irrigation systems.
- Non-agricultural investment to enhance the rural institutional environment and bring about positive impacts on human wellbeing, like investment in education, particularly of women, sanitation and clean water supply, and health care.

49. Farmers and prospective farmers will invest in agriculture only if their investments are profitable. Many types of public goods, such as the above mentioned, that make private investments financially viable can only be provided by the governments. Private sector investment also needs to be encouraged at all stages in the value chain – upstream of the farm, in seed and fertilizer production and distribution, and downstream in processing, marketing and distribution. Underlying competition problems that have led to the development of cartels or of monopsonistic/monopolistic market structure should also be tackled.

50. However, the capacity of the poorer developing countries to fill the investment gap is limited. The share of public spending on agriculture has fallen to an average of around 7% in developing countries, even less in Africa, and the share of official development assistance going to agriculture has fallen to as little as 3.8%. Commercial bank lending to agriculture in developing countries is also small – less than 10% in sub-Saharan Africa. Private investment funds targeting African agriculture are an interesting recent development but current investments are still small.[17]

51. Investments in agricultural research and development have been shown to have very high rates of return and have an important role to play in fighting hunger and poverty. Bridging the gap between research and development in the main cereals and staples that are most important for small farmers in regions with high prevalence of hunger is an important challenge.

52. The agricultural sector is very green-house-gas (GHG) intensive: it accounts for about 13%-33% of global GHG-emissions, but only for about 4% of global output. Agriculture will therefore be called upon to contribute significantly to mitigation. At the same time, agriculture will be affected in ways that are not fully understood or fully predictable, but there is little doubt that some regions, principally arid and semi-arid zones, will come under increasing pressure. Climate change will lead to more frequent extreme events such as droughts, heat waves and floods. These incidents will affect not just production and the volatility of production, they may also create new difficulties related to water quality, storage and related food safety issues. Complex demands for mitigation and adaption will therefore be made on the sector during a period when significantly increased production is needed in response to projected needs. In-depth research on the link between climate change and agricultural production will be needed and would best be undertaken in coordination with the IPCC, while building agricultural resilience through increased funding for climate change adaptation measures in developing countries will be extremely important for example, under the newly created Green Climate Fund.[18] [19]

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.[20]

54. At present, much public research is carried out by the International Research Centres of the Consultative Group on International Agricultural Research (CGIAR). There is general recognition of the utility and benefits provided by this system of international research bodies and affiliated organizations which have enormously contributed to the global pool of available agricultural technology and knowledge. A new CGIAR Multi-Donor Trust Fund is established to harmonize donor investments in key global challenges on agriculture and is being hosted and managed by the World Bank. New results-oriented research programs focus on climate change mitigation and adaptation policies and technologies and include a broad group of partners. There is a need to increase and sustain the financing of such bodies in order that they may continue to invest today in the techniques and innovations that will be needed to deal with the food security and climate challenges that have been defined elsewhere in this report.

55. Increasing public investment in transport and productive infrastructure, as well as in human capital, is central in stimulating productivity and reducing post-harvest wastage. Improving infrastructure, in particular rural roads and market facilities such as warehouses, storage facilities and market-information systems are important in reducing transport costs and integrating smallholders to markets. Investing in, and improving irrigation facilities, and market institutions and mechanisms will result in increased quantities of food produced, better quality and more stable prices.[21] Improving extension, education and health, targeting small producers but also other value chain actors, are key elements of a sound policy approach to increase productivity and enhance food security and the well-being of farmers. Annex B to this report contains a more complete treatment of the role of smallholders, describing their role in production and consumption, how they are impacted by volatility and further developing some of the policy recommendations made here to apply more specifically to small scale agriculture.

56. All these responses to increase the resilience of agriculture and stabilize prices require public interventions. Government expenditure on agriculture can have a significant positive impact on productivity. Foreign direct investment also has a positive impact on productivity growth, but only if carried out responsibly in combination with efficient bureaucracy, a lack of corruption, and democratic political structures.[22] [23]

57. More and better support for public investment in agriculture public goods will allow private sector actors, including smallholders and small-scale market agents, to respond more profitably to rising prices, both increasing local food supply and boosting the incomes of the poor.

58. Priority interventions include support for generation, adaptation, and adoption of improved technology; improved agricultural water management, tenure security and land markets; and strengthening agricultural innovation systems. Not only must there be far more investment in public goods in these areas to facilitate smallholder and other private sector supply response, but investment must be better.

59. The Global Agriculture and Food Security Program (GAFSP), launched in April 2010, provides an important avenue for public investment. The GAFSP has pledged USD 925 million from a number of donors. To date, investment programmes are assisted by the World Bank, the African Development Bank, the Inter-American Development Bank, the International Fund for Agricultural Development

(IFAD) and FAO. However, there are unfunded country proposals to GAFSP, amounting to approximately USD 800 million.

Recommendation 1

G20 governments commit to take comprehensive action to strengthen the longer term productivity, sustainability and resilience of the food and agriculture system world-wide, encompassing several elements.

- Improve food and agriculture innovation systems, encompassing public and private investments in scientific research and development, technology transfer, and education, training and advisory services and ensure that successful practices are scaled up.
- Strengthen the CGIAR system to support technological innovation and global dissemination of technology, in particular to improve productivity performance in less developed countries taking into account the needs of smallholder and especially women farmers.
- Support the development of technologies and provide the appropriate incentives to address challenges specific to climate change and sustainable resource use (land and water).
- Increase public (ODA and national governments) investment in developing country agriculture, and in activities strongly linked to agricultural productivity growth, such as agricultural institutions, extension services, roads, ports, power, storage, irrigation systems and information and communication technology, where appropriate. link public investment to the provision of sustainable public-private-civil society partnerships.
- Support comprehensive national food security strategies that are country-owned and led, evidence-based and inclusive of civil society and farmer organizations. In this respect, follow up on previous G 20 commitments, such as the Pittsburgh summit commitment, to fund the Global Agriculture and Food Security Program.
- Provide the enabling environment for farmers and other private sector actors to scale up investments, above and beyond ODA and national government spending, to achieve the increased productivity and enhanced resilience on which long term food security will depend. To elicit the needed level of private sector investment, less developed countries in particular will need to support introduction of effective governance systems and institutions, stable macroeconomic conditions, sound structural policies, human capital development and public services.

Annex C to this report contains selected project descriptions furnished by the international organisations, to illustrate the kinds of practical, action-oriented initiatives that are needed in order to implement the recommendations made here.

4. Policy options to reduce price volatility

60. There are many factors that contribute to high and volatile agricultural prices, making necessary a combination of policy responses. In order to meet their objectives, policies need to be legitimate and broadly owned by relevant stakeholders, particularly those policies that aim to restore trust in markets and avoid panic-driven behaviour. The goal of the policies recommended is not to eliminate agricultural price volatility, but rather to reduce uncertainty, and perhaps also the amplitude of variations by smoothing out the extremes. Most importantly, price volatility should reflect market fundamentals as accurately as possible and not convey incorrect signals as a result of missing or wrong information, speculation, panic or other disruptive factors.

4.1 Market information, transparency and policy response

61. A lack of reliable and up-to-date information on crop supply, demand, stocks and export availability contributed to recent price volatility.[24] Information on the current situation and outlook for global agriculture shapes expectations about future prices and allows markets to function more efficiently. Lack of accurate information on market fundamentals may reduce efficiency and accentuate price movements.[25] At a regional level (mainly in Africa, but also in Haiti, Afghanistan and some Central American countries), a few successful efforts, such as the Famine Early Warning System Network, have

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 systematic monitoring of the state of crops, and to develop mechanisms for improved short-run production forecasts, able to translate crop growth, meteorological and remote sensing data into yield and production expectations. Greater use could be made of satellite data and geo-information systems and, in this context, international co-ordination and exchange of technologies and information could be enhanced.

63. Information on stocks is an essential component of a global food market information system, yet reliable data on stocks of grains and oilseeds are often not collected or, if collected are not reported publicly. The reasons for poor stock data are multiple: some countries no longer hold public stocks because the policy measures that created them have been removed or reformed; stocks can be very dispersed among farmers, traders and other actors and difficult to track; and some information on stocks is commercially sensitive. Generally, international agencies estimate net changes in stocks as a residual on the basis of data on production, consumption and trade. As a result it is not possible to have complete confidence in world food stock estimates. International cooperation could redress this situation and ensure that reliable information on global stocks becomes widely available. This would in turn better inform market participants and help avoid mis-informed panic-induced price surges. A first step could be an audit and assessment of available information, identifying gaps and proposing ways in which they could be filled.

64. Monitoring food prices, both on cash and futures markets, is essential in a food market monitoring system. In a similar manner, assessing changes in oil prices and analysing their impact on food markets is important.[26] Better information about domestic price movements is necessary to better understand how international price changes affect domestic markets in developing countries. Such information is important for early warning systems, such as the FAO Global Information Early Warning System and for Vulnerability Analysis and Mapping of WFP.[27] It is also crucial for policy making and designing effective risk management instruments for developing countries.

65. For developing countries, enhanced market information and early warning systems would enable both governments and the private sector to plan ahead. Governments would be able to more accurately assess needs, make budgetary provision for producer and consumer safety nets and better position emergency food security reserves. Better market information and analysis could reduce uncertainties and assist producers, traders and consumers to make better decisions.

66. Over the last decade a great deal of baseline information on food security vulnerability has been developed. WFP support of national Food Security Monitoring Systems already provides a monitoring and decision support tool to help governments manage and respond to risk related to price, weather or other hazards. The reliability and timeliness of such early warning systems needs to be improved, and capacity to develop and utilise them could be strengthened at both the national and regional level. The focus should be on countries that are particularly vulnerable to price shocks and food emergencies.

67. The experience of the 2007-08 food price crisis and the current excess price volatility in many international food markets have exposed weaknesses in relation not only to the provision of market information at the global level but also to the coordination of policy responses to food price volatility. There is need to ensure better preparedness and more rapid and consistent policy responses in times of

crisis. Building on and complementing existing systems, improvements in global market information and policy guidance could be achieved through a collaborative food information and policy initiative, the Agricultural Market Information System (AMIS). Such initiative would improve data reliability, timeliness and frequency, as well as enhance policy coordination in times of crisis.

68. AMIS could be built on the model of JODI (the Joint Oil Data Initiative), launched in 2000 to improve information about oil markets. However, it would have the additional function of issuing global food price surge alerts and promoting policy coherence. AMIS would involve the major food producing, exporting and importing countries. It would also involve a joint *Secretariat* comprising of international organizations with capacity to collect, analyse and disseminate information on a regular basis regarding the food situation and outlook, as well as food policies.

69. The structure of AMIS would include two groups to effectively perform two important functions: a *Global Food Market Information Group* would be responsible for food market information collection and analysis, while the promotion of international policy coordination would be the objective of a *Rapid Response Forum.*

70. Increased and regular exchange of information and collaboration between market experts from participating countries and organizations in the *AMIS Global Food Market Information Group* could result in more complete and reliable data on consumption, production, trade and stocks, increasing market transparency and curbing food price volatility that is not based on underlying market conditions.

71. Through the comprehensive coverage of global major food markets and the close monitoring of prices in combination with food security assessments across vulnerable countries *AMIS* will also provide a mechanism for global early warning. This will increase the scope for more "automated systems" of evaluating food security implications of changing market situations whereby an indicator of different degrees of severity can be calculated routinely and where appropriate trigger an alert.

72. The *AMIS Rapid Response Forum* would provide policy advice and promote policy coordination when the market situation and outlook indicates a high food security risk. Through the participation of policy experts from the major producing and importing countries *AMIS Rapid Policy Response Forum* will be able to mobilise political support to achieve agreement on appropriate policy response and actions in times of crisis.

73. The Rapid Response Forum will meet in response to a food crisis alert. Its actions would be as follows:

- receive and assess information and analyses from the AMIS Secretariat on the current global market situation and outlook and issue regular statements on the ensuing implications for food security; receive information and assessments for particularly vulnerable countries.
- provide appropriate policy guidance and promote policy coordination when the market situation and outlook indicates a high food security risk. Such guidance will encourage the implementation of efficient and effective policies, the avoidance of potentially damaging policy choices, and will ensure that humanitarian responses are rapid and appropriate.
- work closely with the Committee on World Food Security (CFS) to promote greater policy convergence and strengthen policy linkages at global level.

Recommendation 2

Building upon existing mechanisms, establish an Agricultural Market Information System encompassing four elements.

- G20 governments commit to instruct statistical or other relevant agencies to provide timely and accurate data on food production, consumption, and stocks. Where the mechanisms and institutions are not in place nationally to do so, G20 governments should undertake to create them.
- International Organizations, with broad involvement of countries (G20 and other relevant players) commit to undertake monitoring, reporting and analysing of current conditions and policy developments in major markets as well as to enhance global food security by encouraging information sharing, improving data reliability and increasing transparency, and introducing a global early warning system.
- G-20 governments support the establishment of a Rapid Response Forum, with broad involvement of countries (G20 and other relevant players) building on the proposed Agricultural Markets Information System to promote policy coherence and coordination in times of crisis.
- International Organizations support the improvement of national or regional systems to monitor stocks, production, forecasts (with improved modelling and weather forecasting), food and nutrition security and vulnerability, in order to enhance Early Warning Systems in vulnerable developing countries and regions.

Concrete proposals on the implementation of this Agricultural Market Information System are detailed in a comprehensive scoping proposal made available as a separate document.

4.2 International food stocks

74. Buffer stocks attempt to influence prices rather than to provide emergency relief in a crisis. At the international level buffer stocks have been an important characteristic of commodity markets in the past. However, the various international commodity agreements which provided for stockholding or supply controls to stabilise prices have either collapsed or been replaced by agreements whose main role is market information provision.

75. Historically, international buffer stock mechanisms are widely judged to have had limited success in reducing the volatility of prices. They have been more effective in moderating downward price movements than price surges. In the case of a price surge, a buffer stock agency can only release in the market what it has previously bought, and once its stock is exhausted there are no further means to curb price increases.[28]

76. Attempting to stabilise prices using buffer stocks is potentially very costly. Stabilising world prices around a level either lower or higher than that determined by market fundamentals requires significant resources. Attempts to defend a price ceiling and reduce the average world level of food prices over time can lead to substantial costs. Buffer stocks set to defend against price spikes are also vulnerable to speculative attacks. If speculators perceive that the stocks held by the stabilization agency are insufficient to maintain the target lower price level, they will compete to buy the entirety of the stock in order to take advantage of likely profits.[29]

4.3 Futures markets

77. Futures markets perform several functions: they provide the instruments to transfer price risk, they facilitate price discovery and arguably, increasingly in recent years they are offering commodities as an asset class for financial investors, such as fund and money managers who had not previously been present in these markets.

78. Commercial participants utilize futures contracts to “hedge”, or insure their crops or inventories against the risk of fluctuating prices. For example, processors of agricultural commodities, who need to obtain inventories, buy futures contracts to guard against future price rises. If the price rises, they use the

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 risk of future price fluctuations to gain a risk premium. They are "non-commercial" participants as they have no involvement in the physical commodity trade in contrast to "commercial" participants, such as farmers, traders and processors.[30]

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. [31] 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 prices fall, independently of any changes in market fundamentals.[32]

83. The debate on whether speculation stabilizes or destabilizes prices resumes with renewed interest and urgency during high price episodes. Some analysts purport that the influx of financial investors in commodity futures markets has scant impact on market prices.[33] Other analysts stress that the large amount of money invested in commodity futures by financial investors has amplified price movements to an extent which cannot be explained by market fundamentals.[34] More research is needed to clarify these questions and in so doing to assist regulators in their reflections about whether regulatory responses are needed and the nature and scale of those responses.[35]

84. Despite these differences, there is widespread agreement that for agricultural commodity derivatives markets to function well, and as intended in terms of hedging and price discovery, appropriate regulation needs to be in place across all relevant futures exchanges and markets. In particular, there is need for greater transparency about transactions across futures markets and especially across over-the-counter (OTC) markets, where transactions take place off the regulated commodity exchanges. Comprehensive trading data need to be reported to enable regulators and participants to monitor information about the frequency and the volume of transactions to understand what is driving commodity prices.[36] Such data exist for some commodity exchanges (though perhaps in an aggregate form which makes the identification of various participants difficult), but are currently unavailable for off-exchange trading.

85. The specific nature of the regulatory framework for futures exchanges and OTC markets, whether for agriculture or other commodities, is an issue best addressed by financial market regulators. And indeed significant regulatory changes have already been decided or are under consideration in several important jurisdictions. In the United States, the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) has mandated a tightening of financial market regulation to improve transparency

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.[37] 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.[38]

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:[39]

- 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.[40]
- Ensuring that changes in regulation are adopted across commodity exchanges and across countries in order to avoid the migration of participants and regulatory arbitrage.[41]

88. Beyond regulatory concerns, new futures instruments for mitigating commodity price risk exposure might be explored. For example, a global wheat contract that would specify export delivery points in the major producing regions has been proposed.[42] The potential advantages of a global futures contract with compulsory delivery include: identifying "cheapest to deliver" sources by designating delivery points all over the world; acting as a global signalling system of both price and regional supply availabilities; and attracting well-informed commercial entities while deterring non-commercial entities from investing on such contracts. The development of such new instruments lies with the futures exchanges and the market participants.

Recommendation 3

- G20 governments recognize the need to improve information and transparency in futures and over-the-counter markets and encourage appropriate rules to enhance their economic functions paying attention to the need for harmonization across exchanges in order to avoid regulatory arbitrage.
- Proposed changes should be considered in light of the on-going review of regulatory oversight of all financial markets and not solely agricultural commodity markets, in particular by G20 Finance Ministers and Central Bank Governors.
- The G20 supports the efforts made by the United States, the European Commission and others in addressing transparency and efficiency issues in futures markets.

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.[43] Trade is an excellent buffer for localised fluctuations originating in the domestic market. Though stockholding is a necessary component of a well functioning market, in particular to smooth out seasonal fluctuations and time lags in trade, year-to-year variations in domestic production can be more effectively and much less expensively buffered by adjustments in the quantities imported or exported.[44] To the extent that shocks tend to be specific to individual regions of the globe, and to partly cancel out on a worldwide level, world output of a given agricultural product is far less variable than output in individual countries. International trade is therefore a potentially powerful engine to even out supply fluctuations across the globe, and as a result to reduce market volatility. To fulfil this beneficial pooling function to the maximum degree, trade has to be able to flow between nations and the tendency which has emerged, in recent crises, for countries to try to insulate themselves from international markets needs to be reversed.

90. More generally and in the longer term context, trade is an essential component of any food security strategy. There is significant potential for increased production in many parts of the world, but not all countries everywhere can or should aspire to supplying all their own needs. Doing so is excessively costly, and will reduce choice and quality, without providing the reliability needed to achieve food security. Moreover, the impact that climate change will have on food production is uncertain, but many experts concur that it will lead to a worsening of conditions for agricultural production in some countries or regions already facing difficult climatic and natural conditions. Experts also agree that there will be an increase in the incidence of extreme events such as drought, heat-waves, and floods. A combination of better functioning and deeper markets for agricultural commodities and improved supply capacity and resilience will allow countries in the most vulnerable zones to overcome these problems.

91. Trade policy restrictions are not the only impediment to the free flow of goods and services. Market and transportation infrastructure, the capacity to meet sanitary and phyto-sanitary requirements and many other factors will determine a country's capacity to export. Initiatives such as the Aid-for Trade programme being implemented by the WTO and the OECD are contributing to overcoming some of these domestic barriers to trade. A stepping up of this effort could bring significant benefits to developing countries with export potential in agriculture.

92. Policies that distort production and trade in agricultural commodities potentially impede the achievement of long run food security, by stimulating or conserving production in areas where it would not otherwise occur and by distorting, obscuring or impeding the transmission of price signals to competitive producers elsewhere. The efficient functioning of food supply chains domestically and internationally also requires attention to be paid to competition policy issues upstream and downstream of the farm sector, as a necessary complement to agricultural and trade policy reforms.

93. Despite on-going reforms there are still significant barriers to trade in agricultural commodities among developing countries and between developing and OECD countries. They contribute to the "thinness" of international markets that has been blamed for some of the volatility experienced in recent years. Average tariffs on agricultural and food are high for middle income and high income countries, 25% and 22% respectively.[45] Protectionism on agricultural products is not only higher than on non agricultural products (by a factor of four), it is also much more volatile.[46] Agricultural trade policies are designed to insulate domestic prices from world markets and lead to pro-cyclic effects: protection decreases when prices are high, increasing demand on world markets, and increases when world prices are low – effectively operating as a variable levy. Therefore, large country trade policies increase world price volatility and create negative externalities for smaller countries.[47] A conclusion of the Doha Round will reduce the scope to implement destabilizing policies on world markets by reducing the bound level of tariffs and subsidies.

94. OECD monitors support and protection of agriculture in its own member countries and in some emerging countries that are major players in global food production and consumption. While trends in the indicators measuring support and protection all point towards a continuing reduction in the levels and the intensity of distorting interventions, much still needs to be done. Latest data for the OECD countries indicate that government support still accounts for 22% of the total receipts of agricultural producers and that more than half of that support is delivered in ways that are highly distorting of trade and competition[48].

Clarifying and strengthening provisions concerning export restrictions

95. Under WTO disciplines, quantitative restrictions are generally prohibited by Article XI of GATT 1994 Agreement but an exception allows governments to prohibit or restrict exports on the condition that these measures are "[...] temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party."

96. Export prohibitions or restrictions relating to foodstuffs must also conform with the provisions of the Agreement on Agriculture, that requires WTO Members to give due consideration to the effects of such prohibition or restriction on importing Members' food security, give notice in writing, as far in advance as practicable, and consult, upon request, with other WTO Members. These provisions do not apply to a developing country Member, unless the measure is taken by a developing country Member which is a net-food exporter of the specific foodstuff concerned.

97. These disciplines are considered to have been insufficient and weak during the 2007-2009 period, when export restrictions exacerbated or even, according to most experts, caused severe disruption and a collapse in confidence on international markets. Export restrictions have also contributed to the price increases and general market nervousness currently being experienced.[49] It has been estimated that if countries are free to implement export taxes a 10 percentage point increase in world prices can be amplified to between 20 and 50 percentage points. In addition, the risk of export restrictions, and the asymmetry between international disciplines (e.g. in WTO agreements) on export restrictions (unbound) and import restrictions (bound) is a severe barrier to increasing trust in international markets. To be sure that international trade is a reliable source of food supply net food importers should benefit from much stronger guarantees from their trading partners. A "first best option" would be to a ban on export restrictions. Countries would address domestic food security issues with direct and targeted support. However, it is most unlikely that a ban on export restrictions would be agreed and, even if agreed, that it would be enforced during a food crisis. On the other hand, reinforced rules, in particular in terms of transparency, are both possible and useful.

98. As agricultural markets become more open, alternative measures addressing market imperfections, many of which are policy driven, are needed. This would ensure that the *potential* new opportunities created can *actually* be exploited by competitive suppliers. In the case of less developed countries in particular, investments in improving supply capacity, including Aid for Trade will be important.

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:

- develop an operational definition of a critical food shortage situation that might justify consideration of an export restricting measure. An export ban would be defined as a time-limited measure of last resort, allowed only when other measures, including triggering domestic safety net measures for the poorest, have been exhausted, and taking into account, in particular, the food security needs of least developed countries and net food importing developing countries.
- widen, strengthen and enforce consultation and notification processes currently in place at the WTO. The intention to impose an export restriction would have to be notified in advance of the action being applied and a "fast track" consultation process could be put in place to discuss whether the measure can be avoided and how. Consultation should be on-going and regular with a view to ensuring that the measure, once in place, is removed at the earliest possible moment.

99. With respect to export restrictions nations have agreed to commit to make humanitarian exemptions, first, at the G8 Summit in L'Aquila in July 2009, and then at the World Summit on Food Security in Rome in November 2009, where all FAO member states agreed to "remove food export restrictions or extraordinary taxes for food purchased for non-commercial humanitarian purposes, and to consult and notify in advance before imposing any such new restrictions". If honoured these commitments would allow food to be shipped rapidly to where it is needed in an emergency.

100. Some nations that imposed export restrictions during 2008 and 2010 made exemptions for purchases of humanitarian food, including those by the WFP. However, others have not made such exemptions, forcing in-country and international humanitarian agencies to purchase food from more distant sources. And most exemptions, if made, are on a case-by-case basis after concern has been raised and the exemption requested. Valuable emergency response time and resources are lost, as procurement teams have to spend time negotiating, or find alternative suppliers from other regions.

Recommendation 5

- G20 governments strengthen the commitments made at the L'Aquila and Rome Summits, calling on all nations to allow purchases of humanitarian food, especially by WFP, to be exempted from food export restrictions and/or extraordinary taxes, so that humanitarian food can be purchased, exported and/or transited regardless of any prohibitions, restrictions or extraordinary taxes imposed; and resolve to bring this commitment and call to the UN General Assembly and to the WTO.

Reducing policy conflicts between food and fuel

101. Between 2000 and 2009, global output of bio-ethanol quadrupled and production of biodiesel increased tenfold; in OECD countries at least this has been largely driven by government support policies.[50] Moreover, trade restrictions by favouring domestic sources of raw material for biofuels do not maximise expected environmental benefits. Biofuels overall now account for a significant part of global use of a number of crops. On average, in the 2007-09 period that share was 20% in the case of sugar

cane, 9% for both oilseeds and coarse grains (although biofuel production from these crops generates by-products that are used as animal feed), and 4% for sugar beet.[51] With such weights of biofuels in the supply-demand balance for the products concerned, it is not surprising that world market prices of these products (and their substitutes) are substantially higher than they would be if no biofuels were produced. Biofuels also influence products that do not play much of a role as feedstocks, for example wheat, because of the close relations between crops on both the demand side (because of substitutability in consumption) and the supply side (due to competition for land and other inputs).

102. At the international level, crop prices are increasingly related to oil prices in a discrete manner determined by the level of biofuel production costs. Increases in the price of oil enhance ethanol's competitiveness relative to petrol and strengthen its demand. Since both energy and food/feed utilise the same input, for example grain or sugarcane, increases in the production of ethanol reduce the supply of food and result in increases in its price. This relationship between the prices of oil, biofuels and crops arises due to the fact that, in the short run, the supply of crops cannot be expanded to meet the demand by both food and energy consumers.

103. If oil prices are high and a crop's value in the energy market exceeds that in the food market, crops will be diverted to the production of biofuels which will increase the price of food (up to the limit determined by the capacity of conventional cars to use biofuels - in the absence of flexfuel cars and a suitable distribution network). Changes in the price of oil can be abrupt and may cause increased food price volatility. Support to the biofuel industry also plays a role. Subsidies to first-generation biofuel production lower biofuel production costs and, therefore, increase the dependence of crop prices on the price of oil. Such policies warrant reconsideration.[52] [53]

Recommendation 6

G20 governments remove provisions of current national policies that subsidize (or mandate) biofuels production or consumption. At the same time, governments should:

- Open international markets so that renewable fuels and feed stocks can be produced where it is economically, environmentally and socially feasible to do so, and traded more freely.
- Accelerate scientific research on alternative paths to reduced carbon emissions and to improved sustainability and energy security.
- Encourage more efficient energy use, including in agriculture itself, without drawing on finite resources, including those needed for food production.

Failing a removal of support, G20 governments should develop contingency plans to adjust (at least temporarily) policies that stimulate biofuel production or consumption (in particular mandatory obligations) when global markets are under pressure and food supplies are endangered.

Some ideas for how this could be done are explored in Annex D.

4.5 Dealing with waste

104. Waste has been identified as an important issue which affects the underlying supply-demand balance for food.

- In developing countries, post-harvest and post production losses due to inadequate infrastructure, poor storage facilities, inadequate technical capacity and under-developed markets are the main causes of waste.

- In OECD countries and increasingly in emerging economies waste occurs in the distribution system, in the restaurant sector and at home,[54]including parts of food products which are not economical to use; food that does not meet cosmetic standards, plate waste; food that is discarded because it spoiled, and inefficient use of food , contributing to obesity.

105. Most losses are avoidable to some degree and some types of waste could be almost entirely eliminated. Reducing waste could be an important part of a strategy to improve food security while reducing environmental and resource pressures. If food waste can be reduced, the increase in production estimated to be needed to meet the increase in demand over the next 40 years would be smaller. Reducing waste would also help to reduce the pressure on land, water stress, soil degradation, and greenhouse gas emissions.[55] In developing countries, the measures proposed in Chapter 3 to improve the overall resilience and productivity of agriculture should address much of the problem of waste from post-harvest losses. In developed countries, possible avenues for policy action could include engaging with the private sector, to increase awareness and develop voluntary agreements, reviewing regulations that may inadvertently generate avoidable waste, supporting research to improve storage, prolong shelf life and better detect deterioration, implementing public education campaigns, and investment in better assessment and monitoring.

5. Policy options to deal with the consequences of price volatility, particularly for the most vulnerable

5.1. Coping with volatility in the short run: buffer stocks, emergency food reserves, international and national safety nets

National buffer stocks

106. Buffer stocks are an important policy instrument in a number of emerging economies and developing countries, though they have been virtually abandoned in developed countries. Some rice producing Asian countries rely on a combination of rice reserves, import or export monopolies, and domestic procurement to stabilise prices within a pre-determined band. These measures aim to stabilise domestic rice prices and, in some cases, have stimulated agricultural growth. In Africa, the experience with maize buffer stocks is mixed.

107. The operational costs of buffer stocks are significant. Appropriate storage infrastructure is extremely costly to acquire, and buying the food stock and holding it is also very expensive. Domestic procurement, food releases from buffer stocks and trade programmes require continuing budgetary allocations to cover any operational losses occurring in domestic and international trading. Losses incurred on behalf of policy-dictated objectives for price stabilization may be viewed as direct subsidies. Although expenditures associated with the acquisition and holding of stocks for food security purposes can qualify under the WTO Green Box,[56] from a WTO point of view, such price stabilisation mechanisms could also be considered as trade distorting support. In times of price increases, such costs can escalate to significant levels, rendering buffer stocks ineffective in containing price surges.

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.[57] 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 as reserves have to be rotated in order to avoid deterioration in quality. This practice often affects the market price, sending the wrong signals to producers and consumers.

109. As attempts to stabilize food prices have proved either costly or ineffective, market based initiatives may be superior in countering food price volatility and enhancing food security in developing countries. Private storage, such as village granaries, can help communities to better match local supply and demand. Private sector storage investments in developing countries, either on-farm, in villages or regionally, are constrained by poor policies and a poor enabling environment generally. At the farm level, capital costs of new storage and storage technology are prohibitively high. At the village level, there are clear advantages to collaboration in storage in order to aggregate sufficient amounts of produce to attract traders as well as to share storage and transport costs. [58] [59]

110. Policies that would facilitate access to credit for storage improvements by farmers, cooperatives and private traders should be considered. Producer organizations are critical to food storage development. There is also need for training to build specialized storage management skills both for farmers' association and cooperatives as well as for the private sector.

Emergency food reserves

111. Relatively smaller food security emergency reserves can be used effectively and at lower cost to assist the most vulnerable. Unlike buffer stocks that attempt to offset price movements and which act as universal subsidies benefiting both poor and non-poor consumers, emergency food reserves can make food available to vulnerable population groups in times of crisis. In addition, emergency reserves of relatively small quantities of staple foods will not disrupt normal private sector market development which is needed for long term food security.

112. Governments in vulnerable countries should integrate such emergency food reserves in their national food security strategies. The effectiveness of such reserves could be improved if national emergency food reserve agencies operated independent of political process,[60] with well-defined, clear and transparent triggering mechanisms supported by effective early warning systems.[61] Emergency reserves should be integrated with social and food security safety nets and other food assistance programmes, to increase their effectiveness in benefiting the vulnerable. Finally, emergency reserves ought to be adequately resourced and financed, whether by governments, the international donor community, or both. For food emergencies, contingent financing plans are important and governments should be prepared to allocate budget when there is need.

113. Some developing countries may not have the capacity to operate national emergency reserves and small, strategic food reserve systems at regional level could fill the gap. In regions, where food crises are likely to recur and transport infrastructure is weak, such emergency reserves could help to provide food to the hungry fast. A regional system could also provide the foundation for an eventual transition to national ownership and control. WFP is developing a proposal for a cost-effective system of small, strategically positioned emergency food reserves for vulnerable nations and regions.

114. Global food security can also significantly benefit from adequate emergency provision of food and resources from the international community to meet future needs:

- Improving humanitarian access to existing national stocks will help meet immediate food assistance needs.

- Providing sustained support for WFP's use of forward purchase contracts and risk management 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.[62]

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-effective system of small, strategically positioned emergency food reserves by the end of 2011.
- A code of conduct be developed by International Organizations to ensure the free flow of humanitarian food supplies, to enhance responsibility and transparency, strengthen the global food security architecture and avoid negative effects on the market.
- G20 governments put in place sustained support for the efforts of humanitarian agencies to assist countries facing crises by ensuring that they have predictable and reliable access to the financing needed, (for example for advance purchasing facilities).

Annex E presents proposals for strengthening the forward positioning of humanitarian food assistance and for an emergency food reserves system, detailing its operations, financing and governance.

Annex F provides suggestions as to how the proposed code of conduct would operate.

5.2 Coping with volatility in the short run: international and national safety nets

International safety nets

116. In times of crisis, contingent and compensatory financing facilities are important mechanisms assisting countries to avoid major fiscal deficits, and lower the cost of imported food, while maintaining key social assistance programmes.

117. The World Bank is currently helping countries deal with the food crisis through instruments to help manage short-term impacts, including grant funding for rapid response in the poorest and most vulnerable countries and expedited use of International Development Assistance (IDA) and International Bank for Reconstruction and Development (IBRD) funds under programs such as the Global Food Crisis Response Program (GFRP), as well as increased Regular IDA and IBRD lending, policy advice and technical assistance.

118. Starting at the height of the 2008 food price spike, the GFRP provided rapid assistance to the most vulnerable countries, with more than half of support going to Sub-Saharan Africa and around a third to countries in Asia where the numbers of poor are concentrated. Assistance has focused on fiscal support, safety nets for the most vulnerable, and agriculture supply response, including stimulating short-term food production. For more vulnerable countries, budget support under the GFRP provided fiscal space to allow reductions in import tariffs or suspension of custom duties or taxes on food, to mitigate the impact of higher prices. To date, the GFRP has allocated USD 1.5 billion to 44 countries, benefiting nearly 40 million people. It is presently authorized to expedite processing of up to USD 760 million of

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. IMF lending helped address low income countries' (LICs) balance of payments problems 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 revenue from other commodities, 25 LICs received assistance (USD 487 million for 16 LICs under shocks-related windows; and USD 761 million for nine LICs under other windows).

121. In 2009, the IMF overhauled its concessional lending for LICs to address more directly needs for short-term and emergency support, and more than doubled the resources available to LICs to up to USD 17 billion through 2014. Three facilities allow for significantly more financing and more concessional terms: the Rapid Credit Facility (RCF, best for rapid support, providing outright disbursement without program-based conditionality); the Standby Credit Facility (SCF, provides support for short-term financing and adjustment needs caused by policy slippages or shocks, and can be used on a precautionary basis) and the Extended Credit Facility (ECF, assistance for underlying imbalances expected to be resolved over the medium term; existing ECF arrangements can also be topped up to provide rapid support for food and fuel price shocks). LICs also receive exceptional forgiveness through end-2011 on all interest payments due to the IMF under its concessional lending instruments.

122. The IMF is also exploring the scope for creating ex ante financing instruments for LICs with a track record of sound policy frameworks to provide lower cost alternatives to insure against food price risks and reduce incentives to take disruptive, second-best policy measures in crises. Budget constraints present significant difficulties for low-income countries that do not have the ability to cope with counter-cyclical expenditures. International support will continue to be important in enabling them to meet the increased demands on their budgets during food price surges. Additionally, under the 1999 Food Aid Convention there is a commitment to provide assistance to meet the annual food needs of approximately 23 million people. The Convention has been signed by just under half of the G20 members (Argentina, Australia, Canada, France, Germany, Italy, Japan, the United Kingdom and the United States).

National consumer and producer safety nets

123. Food price surges, as well as increased prices of inputs such as fertilizers, reduce the incomes of poor and vulnerable households, and put stress on family budgets. Households undertake distress sales of assets, take children out of school or jeopardize their nutritional status with consequences that last long after the price surge recedes. Such temporary and long-lasting impacts provide both a humanitarian and economic rationale for interventions that mitigate the impact of the shock, maintaining the purchasing power of vulnerable consumers and the profitability of smallholders through safety nets.

124. For poor consumers, scaling-up existing safety nets is a viable option in countries where these are already in place. This is achieved by adding new beneficiaries and/or by increasing transfers made to beneficiaries. Where countries have conditional cash transfer programs in place, linking these higher transfers to certain conditions, for example, supporting pregnant and lactating women and children under two years of age, provides a mechanism for both mitigating the short term impact of the shock while simultaneously reducing long term adverse consequences. However, many poor and vulnerable nations and populations have no safety net systems in place and therefore need international assistance. Targeted food safety nets such as child nutrition schemes, job and asset creation and school feeding programs help vulnerable people to cope with price volatility or other shocks and can be scaled up relatively easily in a crisis.[63]

125. In the absence of expanded access to social safety nets, it is inevitable that there will be a rise in the numbers at risk of under-nutrition, reduced educational achievement, lost productivity, and increased morbidity and mortality. The nutritional dimensions of all safety nets need particular attention to reduce the adverse impact of price volatility on both societal resilience and prospects for economic growth. The framework for Scaling-Up Nutrition (SUN), released during 2010, is now being pursued by an increasing number of poorer nations and a broad movement of civil society organizations, businesses, scientific groups and development partners. Implementation of the Framework helps to mitigate the negative nutritional impact of high food prices and food price volatility. It embraces both "*nutrition–specific interventions"* (including vitamin and mineral supplements for pregnant women or young children, breast-feeding promotion, nutrient-dense foods for young children, fortification of staple foods and nutrition education) and "*nutrition-sensitive programmes"* in a range of sectors, including agriculture, health, social protection and poverty reduction, employment, education and emergency relief. If programmes are not sensitive to nutritional realities they may well have no impact in improving nutrition and socio-economic wellbeing[64]. The interagency REACH partnership is helping nations take forward this nutrition agenda at the country level.

126. A critical issue in the context of price surges is whether assistance designed to maintain food and nutritional security should be provided in the form of cash, food vouchers or food. Each has advantages and drawbacks. Where markets are well functioning, cash may be a more cost effective means of providing assistance. However, cash transfers leave the poor exposed to price risks. When food markets function poorly, or where prices are increasing rapidly, food transfers may be a more effective means of mitigating the effect of price surges. [65]

127. Budget requirements present significant difficulties – especially for low income developing countries which do not have the ability to accommodate counter-cyclical expenditures in times of crisis. Foreign support such as that provided under the international safety nets described above, will have to be mobilized to enable these countries to meet the increased demand on their budgets, at a time when such budgetary outlays can have major repercussions on their economy. There is also need to design safety net mechanisms *ex ante*, even if funds are not sufficient to implement them at first. Having pre-identified the vulnerable, the safety net can be activated with funds from the international community.

128. When prices surge, although many producers benefit, producer safety nets may became relevant for some farmers if there is a also a significant and rapid increase in the international price of fertilizers or other inputs. A significant reduction in the use of fertilizers can have negative longer term effects on the livelihood of smallholders. Targeted input support enhances the ability of smallholders to respond to the increase in food prices and contributes towards household and national food security. However, targeted input subsidies involve high costs, while the management of such programs is difficult, especially during periods characterized by volatile food and input prices. In some settings they may lead to, or exacerbate, environmental damage. Political pressures for expansion of producer safety nets may lead to an unsustainable fiscal burden that may hinder, rather than promote long-run growth. Therefore, it is important that such programmes are temporary, only target farmers that either have no means to finance input purchases or have no access to credit and stay in place for a limited period only. In the longer term, attention to market structure issues and competition policy could be a more effective means of improving producer access to competitively priced inputs.

Recommendation 8

- G-20 governments support continued provision of efficient, well functioning international mechanisms to assist low income developing countries during food price crises including provision of adequate contingent financing from the international financial institutions.
- G-20 governments support the development of appropriate, targeted and cost effective national safety nets that can be stepped up when needed, ensuring that they are adequately resourced, contribute to the improvement of nutrition, and link, when appropriate, to the proposed regional emergency food reserves and distribution systems.

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.[66]

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, financial and insurance markets do not exist, or are under-developed. The vulnerable population is made up mainly of geographically dispersed, asset poor, smallholders with limited access to knowledge and markets. This leads to high operational costs for risk management programs. Women smallholders typically fare worst, as their access to assets, finance, extension or other risk management or coping instruments is even more limited than for other smallholders.

134. Considerable effort and research is being invested in developing innovations such as weather index-based crop insurance, which seeks to address the challenges of insuring smallholders. The underlying concept is that farmers are paid whenever rainfall or temperature is so high or so low that it is likely to cause a significant fall in crop yields, or whenever droughts, frost, or precipitation cross specific thresholds. The measurement of these events is undertaken by weather stations or even satellite technology. The advantage of this approach is that insurers do not need to make field level assessments and therefore administration costs, and thereby insurance premiums, are reduced.

135. However, weather-index insurance requires a number of conditions to be in place. Primarily, the risks being insured should be insurable. The index chosen must be strongly correlated to local yields and there must be a network of local weather stations and/or available remote sensing options. Other conditions have to do with overcoming information problems and cash constraints. Farmers should have

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.[67] 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. Market-based protection of a country against the impact of severe weather shocks, such as droughts can also be achieved through the use of weather-index insurance. Similarly to the producer level instrument, an index links rainfall and crop production, so that changes in weather will reflect the likely loss in production. Using such an instrument, if production is negatively impacted by a specified weather parameter, then the country will receive a payout. The payout can be used either to finance food imports or social safety net programmes to ensure food security in the affected area. Weather-index insurance was first used in Malawi in 2008 and is still in operation.

140. For price risks, the principal instruments that could be used to manage the price volatility of food import bills are futures and options contracts (financial instruments) or over the-counter (OTC) contracts (physical instrument). The main difference between them is that financial instruments can provide a country with a cash payout to enable them to offset higher food prices for physical imports, whereas physical instruments seek to manage price and supply risk and provide for the physical import of the food. Both types of instruments are offered by financial institutions and traders. While an in-depth discussion of the advantages and disadvantages of different instruments cannot be covered here, a brief description and explanation is provided in Annex G.

141. By buying futures contracts, a government which wishes to protect itself against a possible grains price surge "locks" in a price agreed at the time the contract was concluded. With futures contracts

the country will obtain greater certainty over the price, but not flexibility. Should the market price move lower, against a government that has bought futures contracts, the government will be responsible for paying, to the market counterparty, the difference in price movements. In practice, this means that futures may not be a useful instrument for governments since there is an unpredictable and potentially large liability associated with taking a futures position each time the government hedges. In poor countries this can create considerable political difficulty, in addition to the financial loss. Additionally, due to the fact that futures contracts are not sold at a price including delivery to the importing country, there is a risk that the price which was locked in will not completely manage the cost of the delivered food. Known as basis risk, this is a major challenge to the use of exchange-based financial products to manage the risk of food price increases at a sovereign level.

142. Call option contracts "lock" in a maximum price, but with no obligation to buy at that price if market conditions are favourable for the government (i.e. if prices have moved lower).. The country will still be able to benefit from lower prices after the agreement, as they do not have to purchase at the agreed price. This approach provides certainty about a maximum price and flexibility.

143. The major advantage to the hedging government is that the maximum cost of food imports is known more or less accurately at the time the hedge is initiated. As call options have the effect of putting an approximate 'ceiling' price on food to be purchased, they are particularly attractive if the intention is to protect food importing countries against a price surge. However, they come at a cost and governments have to pay fixed premiums for the option to purchase food whatever the prevailing market price. Call options can be settled either financially or physically. One potential disadvantage with physical call options is that the transactions are not executed through a commodities exchange which oversees performance and manages counter party risk. In this case, counter party risk can be reduced through the use of performance guarantees, intermediated payment tools or re-insurance by an international bank

144. Significant investment is needed to overcome the lack of technical expertise on the use of these instruments in developing countries. Experience has shown that engaging developing and emerging countries on risk management takes a sustained effort to build capacity to the point where decision-makers are comfortable with the use of risk management tools. Globally there is a need to learn lessons from countries such as Mexico that have become sophisticated in developing a framework for analyzing risks and taking innovative steps to manage those risks.

145. Equally, many governments are not focused on *ex ante* management of food price shocks. Although they are aware of the country's vulnerability, the exposure to food price risk and its fiscal implications are not properly assessed. There is, additionally, a need for contingent financing in order to finance such instruments and food imports. Governments have to be ready to allocate a part of their budget to pay the premiums for such products, or to import food directly in times of need.

146. Nevertheless budget constraints present significant difficulties for low-income countries that do not have the ability to cope with counter-cyclical expenditures. International support will be needed to enable them to meet the increased demands on their budgets. Under the 1999 Food Aid Convention signed by nine of the G20 countries (Argentina, Australia, Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) there is a commitment to provide assistance to meet the annual food needs of approximately 23 million people.

147. It is important to recognize that there is no single risk management tool that will meet the diverse needs of countries exposed to price volatility, particularly given the complexity of local market and policy environments. Solutions need to be highly customized, drawing on a mix of different tools and responses. A successful approach to strengthening risk management frameworks in low income countries will need to build on existing capacities, create platforms which allow private sector market participants to be part of the solution, and find ways to overcome the major constraints to greater use of

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 through the IFC's proposed Global Agricultural Price Risk Management Facility.

- 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, catastrophe bonds, and contingent lines of credit) to provide immediate liquidity in response to a disaster.

- Modernization of meteorological services to help countries improve early warning systems, disaster risk assessment and financing, and develop climate change adaptation strategies.

Recommendation 9

- G-20 governments support the scale up of efforts to provide vulnerable households (including producers), communities and governments with effective, market-based risk management options.
- G-20 governments support the scale up of a broader set of fiscal risk management services which include facilitation of commodity hedging, advisory services to strengthen in-country financial risk management capacity, disaster risk financing, and modernization of meteorological services.

6. Improving international policy coordination in relation to food price volatility: market information and policy responses

149. The experience of the 2007-08 food price crisis and the current excess price volatility in many international food markets have exposed a number of weaknesses in relation to the provision of market information at the global level and the coordination of policy responses to food price volatility. This report contains a number of proposals and recommendations that address the most severe and most pressing of those deficiencies.

150. Mindful of the need to avoid proliferation of new mechanisms, in all cases the proposals made build on existing institutions, organisations and expertise. The main innovations involve increasing the regularity, speed and where appropriate, the visibility of information and advice, improved coordination and information sharing, and ensuring that existing networks are fully joined up. Provision is made for countries to engage in discussion of appropriate policy responses with a view to increasing transparency and avoiding hasty or inconsistent actions that could have damaging consequences.

151. The main pillar of the proposal coordination structure involves the Agricultural Market Information System (AMIS) composed of a Secretariat, a Global Food Market Information Group and a Rapid Response Forum. The details of this proposal are described in section 4.1 and a detailed scoping note is provided in a separate document.

152. An important role is also envisaged for the Committee on World Food Security which would also receive information from AMIS. The two institutions would work closely together to promote greater policy convergence and strengthen policy linkages at the global level. The establishment of strong links between CFS, AMIS and the participating International Organizations will combine political will with strong technical expertise and would greatly facilitate the intensified discussion and enhanced policy coordination needed among countries and among those international agencies with responsibility for different response mechanisms.

153. The CFS would, in keeping with its existing role, membership and expertise, undertake the broad task of monitoring the implementation of the full range of recommendations and actions taken by countries and international organisations.

Recommendation 10

The G-20 should support the proposals made throughout this report to strengthen policy coordination in relation to food price volatility, building on and strengthening existing institutions and networks, improving coordination and timeliness in order to improve readiness, and promoting policy coherence and coordination in times of crisis. The international organisations that have prepared this report are asked to continue collaboration with the G20 to further elaborate the recommendations and, as appropriate, to implement them. The CFS should be charged with the broad task of monitoring the implementation of the recommendations of this report.

Endnotes

1. The evidence base for the analysis and recommendations put forward in this report is extensive. Endnotes throughout the text will draw the reader's attention to the main sources. In addition, when the

2. Wodon, Q., C. Tsimpo, P. Backiny-Yetna, G. Joseph, F. Adoho and H. Coulombe (2008), "Potential impact of higher food prices on poverty," *Policy Research Working Paper* No. 4745, Washington, DC, World Bank.

3. Higher price volatility, however, may also result in higher expected losses for farmers..Using a simple model for producer's profit maximization with price uncertainty, Martins-Filho, C. and M. Torero (2010) show that the expected loss in profits for a producer is monotonically increasing in the observed volatility in prices.

4. Rapsomanikis, G. (2009) *Policies for the effective management of food price swings*, FAO Commodity and Trade Policy Technical Paper No. 12.

5. *OECD-FAO Agricultural Outlook 2010-2019* (including special Chapter 2 on price transmission and volatility on agricultural markets).

6. Huchet-Bourdon, M. (2011), "Developments in commodity price volatility," forthcoming *OECD Food Agriculture and Fisheries Working Paper.*

7. Prakash, A. (2011), "Why Volatility Matters," in Prakash. A. (ed) *Safeguarding Food Security in Volatile Markets*, FAO.

8. FAO, (2009) The State of Food Insecurity in the World, Rome, October, 2009

9. For further details refer to Robles, M. and M. Torero (2009), "Understanding the Impact of High Food Prices in Latin America," in *Economía*, 10(2):117-164, and Nick Minot (2010), *Transmission of World Food Price Changes to Markets in sub-Saharan Africa*, IFPRI Discussion Paper 1059

10. OECD (2008), *Biofuel Support Policies – An Economic Assessment*, OECD, Paris. See also Al Riffai, Dimaranan and Laborde (2011) :" European Union and United States Biofuel Mandates Impacts on World Markets" and Laborde (2011) "Assessing the Land Use Changes Consequences of European Biofuel policies and uncertainties".

11. Martins-Filho, Torero and Yao (2010), Estimation of quantiles based on non linear models of commodity price dynamics and extreme value theory", IFPRI, mimeo (*http://www.foodsecurityportal.org/policy-analysis-tools/wheat-prices-and-returns)*. This model estimates conditional quantiles (95% quantile) for log returns of future prices of different agricultural commodities. The realized return in a particular day can then be compared to forecasted 95% conditional quantile to detect price abnormalities in specific commodities on the agricultural markets.

12. Demeke, M., G. Pangrazio and M. Maetz (2009), *Country Responses to the Food Security Crisis: Nature and Preliminary Implications of the Policies Pursue,*. FAO Initiative on Soaring Food Prices.

13. Jones, D. and A. Kwiecinski (2010), Policy response in emerging economies to International Agricultural Commodity Price Surges, *OECD Food Agriculture and Fisheries Working Paper* No 34.

14. World Bank (2008). *World Development Report*, Washington D.C.

15. FAO (2009). *Investment. High level Expert Forum on How to Feed the World*, 12-13 October 2009, Rome.

16. Schimdthumber, J., J. Bruinsma and G. Boedeker (2009). C*apital Requirements for Agriculture in Developing Countries*, paper presented at the FAO meeting on "How to Feed the World in 2050, 22-24 June 2009, Rome.

17. FAO (2009). *Investment. High level Expert Forum on How to Feed the World*, 12-13 October 2009, Rome.

18. "Agriculture at the Crossroads: *Guaranteeing* Food Security in a Changing Global Climate", *UNCTAD Policy Brief No. 18*, December 2010).

19. Hoffmann U (2011), *Assuring Food Security in Developing Countries under the Challenges of Climate Change: Key Trade and Development Issues of a Fundamental Transformation of Agriculture*, UNCTAD Discussion Paper No. 201, Geneva.

20. IFAD (2010), *Rural Poverty Report 2011: New realities, new challenges, new opportunities for tomorrow's generation*, Rome.

21. IFAD (2009), *IFAD's response to climate change through support to adaptation and related actions*. Comprehensive Report.

22. Cramon Taubadel, S., G. Anriquez, H. deHaen and O. Nivyevskiy (2009). *Investment In Developing Countries' Food and Agriculture: Assessing Agricultural Capital Stocks and their Impact on Productivity*, paper presented at the FAO meeting on How to Feed the World in 2050, 22-24 June 2009, Rome.

23. OECD Draft Policy framework for *Investment in Agriculture: Reaping the Benefits of Investment in Africa's Agriculture Through an Integrated Policy Framework* (Joint NEPAD/OECD/SWAC effort) DAF/INV/AGC(2010)7.

24. FAO (2010). *Final Report of the Extraordinary Joint Intersessional Meeting of The Intergovernmental Group (IGG) On Grains and the Intergovernmental Group on Rice*, 24 September 2010.

25. Prakash, A. and M. Stigler (2011) "The Economics of Information and Behaviour in Explaining Excess Volatility," in A. Prakash (ed.), *Safeguarding Food Security in Volatile Markets*, FAO, Rome.

26. Market Indicator section in *FAO Food Outlook*.

27. FAO-GIEWS available at *www.fao.org/giews/pricetool*.

28. Gilbert, C. (2011) An Assessment of International Commodity Agreements for Commodity Price Stabilization. A. Prakash (Ed.), Safeguarding Food Security in Volatile Markets, Rome, FAO.

29. Wright, B. and A. Prakash (2011). "The Fallacy of Price Interventions: A Note on Price Floor and Bands and Managed Tariffs," in A. Prakash (Ed.), *Safeguarding Food Security in Volatile Markets*, Rome, FAO.

30. In reality, the distinction between the different types of participants is blurred as the same market actors may be active as both commercial and non-commercial market participants.

31. Gilbert, C.L. (2008), *How to understand high food prices*, paper presented at FAO Experts' Meeting on Policies for the Effective Management of Sustained Food Price Increases, Trade and Markets Division, Rome, 10–11 July 2008.

32. UNCTAD (2009). *The Financialization of Commodity Markets*. Trade and Development Report 2009 United Nations: New York and Geneva

33. Sanders, D.R. and S. Irwin (2010). "A Speculative Bubble in Commodity Futures Prices? Cross Sectional Evidence," *Agricultural Economics*, Vol. 41, pp. 25-32.

34. Gilbert, C. (2010), *Commodity Speculation and Commodity Investment*, FAO Commodity Market Review 2009-2010.

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*

Gilbert, C. (2010), "How to understand high food prices", *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 Markets", *The World Bank. Policy Research Working Paper 5028*, August.

Irwin, S.H., D.R. Sanders, and R.P. Merrin (2009a), "Devil or Angel? The role of speculation in the recent commodity price boom (and bust)", *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*.

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

36. Berg, A. (2011), "The Rise of Commodity Speculation: From Villainous to Venerable" in A. Prakash (Ed.) *Ibid*.

37. Part of this paragraph draws on UNCTAD (2009), Development Impacts of Commodity Exchanges in Emerging Markets. Report of the UNCTAD Study Group on Emerging Commodity Exchanges. Document UNCTAD/DITC/COM/2008/9. United Nations: Geneva and New York.

38 Nevertheless, a sentiment that excess speculation or market manipulation might have caused sharp price increases in critical commodities triggered government enquiries in South Africa in 2001–2003 and India in 2007. Following an investigation, the government of South Africa took no action. By contrast, the government of India suspended trading in a number of commodities prior to a report by an expert committee. This report found that futures trading was associated with higher price volatility only for those commodities whose contracts face small market size and scarce deliverable supplies, which implies shortcomings in contract design rather than in the functioning of the exchange. For a discussion of the Indian case, see, T. Lingareddy (2008), "Expert Committee on Commodity Futures: Agreements and Disagreements", *Economic and Political Weekly*, 43(34): 35–42.

39. UNCTAD (2009). *The Financialization of Commodity Markets*, Trade and Development Report 2009, United Nations: New York and Geneva. Berg, A. (2011), "The Rise of Commodity Speculation: From Villainous to Venerable," in A. Prakash (Ed.), *Ibid*.

40. Bart Chilton, CFTC Commissioner, "Rein in the Cyber-Cowboys," *Financial Times*, 6 September 2010

41. Hernandez, Ibarra and Trupkin (2011), "How far do shocks move across borders? Examining volatility transmission in major agricultural futures markets," *IFPRI Working Paper*.

42. Berg, A. (2011), "A Global Wheat Contract. Towards a New Food Security Instrument," in A. Prakash (Ed.), *Ibid*.

43. See endnote 5.

44. OECD, *Stabilisation Policies in Developing Countries After the 2007-08 Food Crisis*. Document TAD/CA/APM/WP(2010)44, OECD internal document.

45. Boumellassa, H., D. Laborde and C. Mitaritonna, *A picture of tariff protection across the World in 2004 MAcMap-HS6, Version 2* 2009, IFPRI Discussion Paper 903. Washington, D.C. International Food Policy Research Institute (IFPRI)

46. Bouët, A. and D. Laborde, *The potential cost of a failed Doha round*, IFPRI Discussion Paper 886. Washington, D.C. International Food Policy Research Institute (IFPRI) and *Assessing the potential cost of a failed Doha Round",* World Trade Review, Cambridge University Press, vol. 9(02), pages 319-351.

47. "Large country" is used here to mean a country that is significant enough in trade terms to affect prices, and the corollary for small countries.

48. OECD 2010, *Agricultural Policies in OECD Countries: At a Glance*, OECD, Paris.

49. Bouet, A. and D. Laborde (2010) *Economics of export taxation in a context of food crisis*, IFPRI Discussion Paper 994 and "The Economics of Export Taxes in the Context of Food Security in OECD, *The Economic Impact of Export Restrictions on Raw Materials*, OECD Publishing.

50. See endnote 8.

51. OECD/FAO (2010), Agricultural Outlook 2010-2019, OECD, Paris.

52. Balcombe, K. and G. Rapsomanikis (2008). "Bayesian estimation and selection of nonlinear error correction models: the case of sugar-ethanol-oil nexus in Brazil" *American Journal of Agricultural Economics*, 90(3): 658–668.

53. Schmidhuber, J. (2006) Impact of an increased biomass use on agricultural markets, prices and food security: A longer-term perspective. Paper presented to the International symposium of Notre Europe, Paris, 27-29 November, 2006.

54. Post-harvest and post-production losses that are due to inadequate infrastructure, technical capacity or markets are a more common source of waste in developing countries and will be mentioned in Chapter 5 in the context of measures to increase productivity, sustainability and resilience in agriculture.

55. This section draws on an internal OECD note "Waste management in the Food Chain: Scoping Paper (TAD/CA/APM/WP(2011)7) and on the UK's Government Office for Science Foresight Project on Global Food and Farming Futures; Synthesis Report C7:Reducing Waste.

56 Timmer P. (2010) "Management of rice reserve stocks in Asia: Analytical issues and country experience", *FAO Commodity Market Review* 2009-2010.

Balisacan, A., M. Sombilla and R. Dikitanan (2010), "Rice crisis in the Philip-pines: Why did it occur and what are its policy implications?" in D. Dawe (ed.) *The Rice Crisis: Markets, Policies and Food Security*, London: FAO and Earthscan.

Rashid, S. and S. Lemma (2010) *Strategic Grain Reserves in Ethiopia: Institutional Design and Operational Performance, forthcoming* IFPRI discussion paper.

57. Wright, B. (2009), "International grain reserves and other instruments to address volatility in grain markets," *World Bank Policy Research Working Paper* 5028.

58. IFAD (2009) Country Programme Evaluation, Federal Democratic Republic of Ethiopia, May. IFAD (2008) *Empowering Farmers in Tanzania through Warehouse Receipts System*.

59. Shepherd A. (2009), *Promoting Sustainable Grain Storage Improvements in Africa*, FAO Agricultural Management, Marketing and Finance Working Document 27.

60. Byerlee, D., T.S. Jayne, and R.J. Myers (2006), "Managing food price risks and instability in a liberalizing market environment: Overview and policy options," in *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. WFP (2008) "Vouchers and Cash Transfers as Food Assistance Instruments: Opportunities and Challenges" Rome.

66. OECD (2009), *Managing risk in agriculture. A holistic approach*, Paris, OECD.

67. Hill and Robles (2010) "Flexible insurance for heterogeneous farmers –Results from a small scale pilot in Ethiopia," IFPRI Discussion Paper.

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:** Volatility is a measure of price variation from period t − 1 to time period t. If there is a large price variation from period t − 1 to t then Rt is large (without regard to whether it 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) $P_t - P_{t-1} = 0$ 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,[1] 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 represents the market's expectation of how much the 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 contracts such as "options." An "option" 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 commodity. The more divergent are traders' expectations about future prices, the 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

1. For estimation of higher order quantile refer to: Martins-Filho, C., M. Torero and F. Yao (2010), *Estimation of quantiles based on nonlinear models of commodity price dynamics and extreme value theory*, IFPRI, mimeo, *http://www.foodsecurityportal.org/policy-analysis-tools/wheat-prices-and-returns.*

Annex B.

Food price volatility and food security – the role of smallholders in developing countries

1. Over one and half billion people in the world belong to households that farm on holdings sized 2 hectares or less. Many others practice family farming on holdings sized up to 5 or 10 ha. Smallholder agriculture –including farming but also livestock production, artisanal fishing, and forestry – is the basis for the livelihoods of most rural households living in extreme poverty in the developing world. Poor rural households are in turn two-thirds of the global population living below USD 1.25 a day per capita. Smallholder agriculture however, provides up to 80 percent of food consumed in some developing regions – notably Asia and Sub-Saharan Africa. It is thus a key sector for food security for multiple reasons: as a source of income for vast numbers of poor people, and as the main source of food in the developing world. It is also a sector that can play a major role in mitigating food price volatility and its impact in developing countries, both in the short and in the longer term.

2. In many developing countries, smallholders commonly face price fluctuations. These can be partly seasonal and relatively predictable. They mostly result from the fact that most poor farmers have to sell their produce right after harvest, fetching lower prices, and then buy food during lean periods, contributing to driving prices up. This common pattern is associated with lack of adequate technologies and facilities for post-harvest handling, storage, and processing, which would enable agricultural producers to hold on to their produce longer, and also to improve its market value. It is also associated with lack of adequate financial services that can reduce pressure to sell produce as soon as it is available, even though this means fetching low prices. Despite their predictability, seasonal fluctuations can be an important factor of poverty and food insecurity for smallholders.

3. Besides seasonal fluctuations, weather unpredictability and shocks can affect local smallholder supply and result in more volatile prices. Weak market information systems and poor market integration often result in smallholders making incorrect decisions on what and how much to produce, which contributes to inter-annual volatility. High transportation and transaction costs due to poor rural infrastructure, combined with weak market information flows, amplify the effects of local supply shocks on prices, as products do not smoothly flow from surplus to shock-affected areas. Unpredictable policy decisions affecting prices can also be major factors of volatility. Finally, price volatility in international markets can be transmitted to smallholders in various ways. Volatile oil prices can have major impacts on their production and marketing costs. If imported commodities are part of the food basket of smallholder households, or when their price influences commodities in this basket through substitution effects, international price volatility can also affect them as consumers.

4. Unlike better off producers, or those operating in markets where agricultural value chains operate effectively, smallholders in developing countries are not always able to benefit from higher prices. On the one hand, most of them are net food buyers. On the other, they lack assets, technologies, services, risk management tools, information, and infrastructure to respond effectively to higher prices and increase production. This also makes them ill-equipped to deal with price uncertainties and with the volatility of input prices, both of which can lead them to reduce investment as well as household expenditures. Price shocks however do not only contribute towards smallholders' vulnerability to poverty

and food insecurity. They also hinder the development of the sector. Smallholders seek to minimize their exposure to price shocks through a variety of risk management strategies, including crop and income diversification, and they attempt to develop self-insurance by smoothing consumption. Diversification can however inhibit efficiency gains from specialization in production, hindering smallholders' market integration and, more broadly, the development of the sector. Moreover, price risks discourage the adoption of technologies necessary for production efficiency, as producers may decide to apply less productive technologies in exchange for greater stability.

5. All recommendations put forth in the report also have relevance for smallholders in developing countries. The AMIS initiative (section 4.1) can support better capacity to collect and analyze agricultural market data in developing countries and better informed policymaking at the national and regional levels, with positive impact on smallholders. Smallholders are part of the private sector whose production trends and stocks need to be increasingly factored into data collection and analysis, hence it is important to gradually develop mechanisms that will make it possible to better involve them – through their organizations – in the process.

6. Better functioning of futures markets can have indirect impact on smallholders by mitigating international price volatility. In some countries, farmers are able to use derivatives as hedging tools, but in most cases this is beyond the reach of smallholders due to costs, poor access to information, the nature and quality of crops produced by smallholders, and other. How to make access to well-functioning futures markets a risk-management option for more smallholders in the future, particularly for organizations and groups of producers, is a challenge that requires research and innovation.

7. Progress on DDA negotiations and reduction of trade distorting domestic support is of major relevance for smallholders in many countries. Smallholder producers often face unfair competition on domestic markets from artificially low-priced imports, or artificially high costs in accessing international markets, due to trade distorting policies in their own countries or elsewhere. Progress on this recommendation is critical to enable smallholders to play a greater role in supplying growing urban markets in their countries, as well as in regional and international markets. This can contribute not only to greater food security (in terms of both availability and access to food), but also to deepening agricultural markets, thus reducing the incidence of volatility.

8. Improving biofuel policies also has important implications for smallholders. Of particular relevance is that renewable fuels and feedstocks should be produced where it is socially, as well as environmentally and economically feasible to do so. Smallholders can benefit from biofuel production as a source of income and a source of energy at the farm and community levels. However, investments in biofuel production have in some cases taken place in ways that have undermined the natural resource entitlements and livelihoods of smallholders – including those whose livelihoods depend on common property resources, thus contributing to food insecurity and vulnerability.

9. Food emergency reserve systems also have implications for smallholders as food producers and as a large part of the food insecure. Leveraging and targeting local purchases of food by multilateral agencies towards smallholders, including women, can provide a way of integrating smallholders into markets and enabling them to become more productive and to better contribute to local food market supply. The Purchase for Progress programme of WFP and partners is an example of such an initiative, which helps strengthen smallholders' access to markets and financial services, improve productivity, and reduce some of the risks that smallholders face.

10. Finally, the recommendation with the broadest and most direct relevance to smallholders concerns strengthening the productivity, sustainability and resilience of food and agriculture systems. In particular:

- Improving agricultural innovation systems, building capabilities, and scaling up successes are priorities for strengthening the capacity of smallholders to produce more efficiently. Smallholders need to be at the centre of innovation systems and help shape the R&D agenda so that crops and livestock products that matter to them as producers and consumers receive adequate attention. They also need to be at the centre of education and skills development around sustainable agricultural intensification, given that a capacity to respond to volatile environmental conditions requires strong innovation and management skills at the farm level. Women farmers, who are about half of smallholder farmers in the world, also need to feature much more prominently in these systems than they have so far.

- The CGIAR system has had a key role to play in the development of R&D and technology products conducive to a more productive, sustainable, and resilient small-scale agriculture. This system should continue to directly promote research on challenges of relevance to smallholders, while also promoting complementarities among R&D efforts among a range of public and private actors. More broadly, public investment in agricultural R&D is a crucial complement to private investments to support smallholder agriculture to better withstand price volatility and to help mitigate it.

- Poverty and lack of adequate technologies and knowledge can lead to unsustainable practices by smallholders, which impoverish the natural resource base and, in the longer term, contribute to volatile supply. The same factors undermine the ability of smallholders to withstand the effects of climate change. Smallholders critically need support to develop and invest in technologies and practices that are more sustainable and resilient. Experience shows that these can often build on local practices and knowledge, complemented by mainstream science and technology, based on productive partnerships among smallholders, researchers, and other actors. They also need appropriate incentives to adopt sustainable and resilient practices. Conversely, in many cases supply-boosting initiatives in response to price hikes encourage misuse of scarce resources and of energy intensive inputs.

- Involvement in the planning of national food security and development strategies is essential for smallholders to contribute to mitigating price volatility and to reach food security. It is in the context of these strategies that their role in ensuring food security and in contributing to broader development and growth can be identified, their potential and constraints articulated, and a coherent set of initiatives to unlock this potential developed. Experience shows that, in the absence of strong and representative participation of smallholders in national food security and development plans, the identification of this potential and of the needed measures is unlikely to take place. In this context, the role of producers' organizations can be particularly important to voice the concerns and interests of smallholders, to enhance their negotiating power with other stakeholders, and to allow them to influence relevant policymaking processes. There are, moreover, a variety of mechanisms through which smallholder producers can contribute to public debate on the design and implementation of relevant policies, including multi-stakeholder platforms and consultative forums.

- Smallholders are by far the main investors in agriculture in developing countries. To increase and stabilize supply and thus mitigate price volatility in developing countries, it is essential to provide enabling conditions for them – alongside other private investors – to invest more and at reduced risk and costs. Priority areas of institutional and policy development in this regard include: a) overall improved governance of rural areas; b) improved infrastructure and services, particularly for transportation, storage and processing, as well as investments designed for greater resilience to changing environmental circumstances, including irrigation facilities; c) support to pro-smallholder innovations in financial markets, particularly as concerns risk management, as innovative products (e.g. index insurance) often require public-private

partnerships, or public investments in the development of data gathering and analytic capacity; d) an enabling legislative and policy environment for small producers' organizations, which can greatly mitigate the risks faced by individual producers, and help thicken markets and thus reduce volatility. In recent years, a variety of institutional and organizational arrangements have emerged to address smallholders' constraints and enable them to better withstand price volatility. Producers' organizations in particular can provide an array of services, from enhancing access to markets, information, financial services, and technologies, to facilitating participation in policy making. In order to scale up successful approaches, relevant stakeholders need to come together with clear roles and responsibilities to define an enabling environment for producers' organizations to develop effectively and in an inclusive manner.

11. Undertaking the needed investments and policies will assist smallholders not only to reduce their own vulnerability to price volatility but also to contribute to the development of the agricultural sector and of the overall economy in their countries. In the longer term, development is typically accompanied by structural changes in the economy and a decline in rural populations, together with decreases in the share of agricultural output in total gross domestic product (GDP). It is also associated with a broad positive relationship between average farm size and GDP per capita, as more smallholders exit agriculture to seek employment in the non-farm sectors. During this process, farms become progressively more commercialized. Nevertheless, this path is not uniform across countries. Different agricultural systems are better suited to different environmental and demographic circumstances. Moreover, technological advances as well as a range of policies can contribute to shaping the process, leading to different possible outcomes. Also crucial is the extent to which non-farm employment opportunities – as well as employment opportunities in larger, commercially-oriented agricultural production systems – can be created to keep up with demographic growth in rural areas, and with exit from smallholder agriculture. At present and in the near future, in many food insecure countries (notably in sub-Saharan Africa) non-farm and urban sectors do not offer sufficient livelihood opportunities for a booming (urban and rural) population. As a result, exit from agriculture risks being associated with taking up precarious livelihoods in urban areas, and growing numbers of urban populations highly vulnerable to price shocks. Boosting smallholder agriculture, its market orientation, and its resilience – as well as its ability to drive growth in other sectors and to complement other forms of agricultural production - are thus priority areas in many countries in the next several years, particularly in an environment of greater price volatility.

12. In conclusion, there are multiple paths to commercialization, and agricultural development can be driven by either smallholders or larger farmers. Yet, in many developing countries, agriculture is dominated by small-scale farms and productivity is static. Without having the appropriate policy measures in place, the rapid evolution of food market systems and the related demands for greater volumes, quality and consistency can marginalize smallholders from the development process. Specific policies and strategies that integrate smallholders into markets, while supporting the creation of rural off-farm employment opportunities, are essential to an inclusive development process, no less than to mitigate food price volatility and its impact on a large section of the vulnerable global population.

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-private partnerships, with the full involvement of farmers' organizations and civil society where possible, to bring about the needed transformation and invigoration of the agricultural and rural sectors in developing and emerging countries. The examples are chosen to illustrate the different dimensions of the problem to which responses are needed and to give more concrete expression to the recommendations. Some approaches are innovative and have not been tried before. Others already have a proven track record and are strong candidates for scaling up and for application in different and wider geographical settings.

2. Specific examples relate both to the enabling environment and improvements in market functioning to attract private and public sector investment, and to specific initiatives to accelerate research and development and adaptation to climate change, enhance education and extension services and increase productivity and resilience. These priorities require domestic budgetary expenditures or support from foreign governmental and non-governmental sources. They also require private investment and public-private partnerships. The first set of initiatives relates primarily to institutional and governance mechanisms, to market development and the linking of the different actors in the chain, and to infrastructure development. The second relates to more explicitly sectoral efforts addressing specifics of food production, research and development, extension and education services, efficient use of inputs, risk management, adaptation to and mitigation of climate change.

The enabling environment

Comprehensive national development strategies

3. Efforts to enhance the livelihood of rural and farming households and to eliminate food insecurity and under-nourishment have to be part of, and consistent with, overall national development strategies that address deficiencies in the overall enabling environment. Without improvements in the enabling environment, a sectoral strategy cannot be fully effective and private investment will not be forthcoming. Efforts to develop agriculture need to be part of a coherent policy framework, consistent with efforts to develop other sectors and supported by macro-economic and financial policies that are conducive to investment and trade. Also important are issues of governance and the need for well functioning institutions within which markets and enterprises can develop and flourish. Infrastructure is also a key component. But, agriculture specific infrastructure investments cannot operate in a void. Investment in health and education in rural areas is a prerequisite for the success of sectoral initiatives to improve productivity and management on farms.

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 - from R&D to trade and markets, from natural resource governance to collective action by agricultural producers. Also needed is investment in relevant public goods as a complement to, and a catalyst of, private investment in agriculture.

Monitoring policies for agriculture and food security

7. A system of monitoring and evaluating the performance of policies for agriculture and food is a necessary component of any national food security strategy. Assistance may be needed for some developing countries to develop systems that monitor agricultural policies and assess performance relative to the food security objectives that they have set. This monitoring should include market incentives and disincentives being generated by policies (trade, market structures etc) as well as mapping expenditures for different purposes including those originating from aid against the stated objectives. One such effort is currently underway under the Gates Foundation funded MAFAP (Monitoring of African Food and Agriculture Policies) project being developed jointly by FAO and OECD. Similarly, several donors are engaged in strengthening the capacity of a range of national stakeholders to participate in monitoring and evaluation in ways that promote institutional learning as well as empowerment. There is room for continuing innovation in the development of appropriate methodologies in this regard, as well as for scaling up and institutionalizing others.

Supporting organisational development

8. Generally speaking, support to organization and collective action in agriculture requires simultaneous attention to: putting in place an enabling institutional and policy environment for organizations to form and operate; improving the capacity of organizations to represent their membership in an inclusive manner – including on a gender basis, strengthening downward accountability and avoiding donor-driven processes; and supporting the professionalization and market-related capabilities of relevant organizations.

Agriculture and food specific initiatives

Institutional development and improved market functioning

9. Agricultural and food markets have undergone profound transformations in virtually all developing and emerging countries, with increasing integration and complexity of value chains and higher entry and participation requirements particularly in urban and export markets. Farmers in developing countries, particularly small scale farmers, must therefore overcome considerable constraints to compete in modern markets. Sales through sophisticated channels, such as supermarkets and large traders, require greater managerial and logistics skills from farmers and an ability to provide continuity of supply and to meet demanding food safety and quality requirements, with the strong risk that if this cannot be done the market will be lost. Good market information, quantity, quality and food safety requirements and timing conditions are more accessible to larger farms.

10. Better information about the availability, location, and prices of products on farms and in markets, and about what product attributes are valued by the consumer could significantly enhance market functioning in developing countries and help smaller producers to become more integrated in markets. But information is subject to market failure, in that it is difficult to sell (the buyer does not know its value until after it is "purchased") and easy to reproduce (making it hard for the "producer" to recover costs).

11. **Market information systems** specifically designed for the conditions prevailing in developing countries have been successfully implemented in recent years and more such systems could be piloted and scaled up where appropriate. The pilot activity would have a direct effect on poverty where it is carried out because improved market information will reduce marketing margins, increase farmgate prices, and boost the incomes of rural households.

For further details see:
www.cgiarfund.org/cgiarfund/sites/cgiarfund.org/files/Documents/PDF/fc4_crp2_report.pdf

12. Activities which support participatory sectoral commodity value chain development processes in developing countries ensure that measures are inclusive of smallholder producers. Components of commodity strategy development include (i) the identification of mechanisms for improving provision of financial services and risk management opportunities for value chain actors, (ii) enhancing capacity in policy formulation supportive of smallholder integration, and (iii) professionalizing farmers' organizations to strengthen their skills in agribusiness management.

13. **Value chain development** typically requires identifying specific chains to support on the basis of the likely benefits in terms of productivity and marketable surplus increases, cash earning, diversification, and improved labour market conditions. It is important to pay attention to developing capacity in domestic markets, as often the costs of compliance with standards are high and specific investment and training are required.

14. **Aid for Trade** is another possible component. For an activity like WTO/OECD Aid for Trade (AfT) initiative to be effective, it is desirable to focus resources first on the most binding constraints on competitiveness. These differ for countries at different stages of development. There are many good examples of activities within this initiative that would benefit from increased AfT funding. An example of a success story is the Standards and Trade Development Facility (STDF) which resulted from a joint communiqué issued by the heads of the FAO, the OIE, the World Bank, WHO and the WTO, at the Doha Ministerial Conference in November 2001. The STDF has been mobilizing resources and assisting countries in building capacity in SPS-related areas. There is a large and continued demand for assistance in this area so vital for the food and agricultural trade of the developing countries.

Dealing with losses and waste

15. Value chain improvement is also critical to address the problem of waste within food systems. In poor developing countries most waste occurs on-farm and in transport and storage. Significant increases in food availability can be achieved by reducing these losses. The economic value of reduced wastage should provide both income benefits to producers and better prices for consumers. Support is needed to deepen food crop markets by addressing the range of infrastructure and competitiveness issues driving the high levels of waste. This includes in part improving production and farm management technologies. It also entails strengthening downstream links within value chains, through improved storage and processing infrastructure, better access to information about market requirements in terms of timing, quality and quantity, better coverage of energy supply systems – including through decentralized, off-grid approaches – and better transportation coverage. Successful projects reducing post-harvest losses through value chain development show that action is needed on all these complementary fronts in order for specific approaches to be effective. A good example of the need for complementary initiatives on these various fronts is that of local warehouse receipt systems and other similar mechanisms.

Research and innovation for improved productivity and adaptation to climate change

16. This is a key area for attention. Significant productivity, sustainability, and resilience quick wins are available through increasing the uptake of existing technologies for production and natural resource management. Many poorer small farmers in developing countries, particularly women farmers, do not use the higher yield technologies already available, either because they are not made available to them or because they are not well adapted to their needs. Investment in enhancing availability of affordable existing technologies, demonstrating the benefits to farmers from applying better methods and/or inputs, and strengthening their capacity to appropriately use such technologies are all essential to improve productivity as well as resilience.

17. New research is also needed to respond to the specific needs of developing countries and to the up-coming challenges of climate change, soil problems and water scarcity. A key component in improved productivity will be the development of new varieties of rice, maize, wheat and other crops, that are more resistant to drought, heat, pests and diseases, salinity and other soil problems and to enhance crop management to improve yields through improved cropping technologies – examples as follows.

Rice

- There is a need to improve the available global rice gene pool to boost the breeding of new varieties and to respond to climatic and environmental problems, Research and development can find new rice varieties that are resistant to: (1) drought, (2) diseases and insects, (3) salinity and other soil problems; (4) extremes of temperature and (5) floods.
- Yields can be improved and volatility can be reduced with improved rice cropping technologies such as alternate wetting and drying, site-specific nutrient management (SSNM), and practices of conservation agriculture which can be applied in diverse settings.
- The introduction of improved seeds and production techniques should be targeted towards areas where the potential for improved harvests would be the largest. To achieve this, (a) technology adoption analysis is needed, analyzing different local needs and barriers to technology adoption, (b) spatial analysis for effective targeting.

For further details see:
https://docs.google.com/a/cgxchange.org/viewer?a=v&pid=sites&srcid=Y2d4Y2hhbmdlLm9yZ3xjb25zb3J0aXVtfGd4OjZkYjRjOGM5NmMyODE1N2I

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/cgxchange.org/viewer?a=v&pid=sites&srcid=Y2d4Y2hhbmdlLm9yZ3xjb25zb3J0aXVtfGd4OjQ1YmViMTYyY2RjYzMyZA

Wheat

- Development of new varieties of wheat to improve resistance to diseases and insect pests, which include stem rust, yellow rust and wheat blast, and tolerance to heat and drought derived from climate change.
- Increased productivity that might lead to a "quantum leap." This can be achieved through improvements in four areas: (a) improved photosynthetic performance, (b) optimized grain yield with lodging resistance, (c) accumulation of yield potential traits, and (d) high-yield, cost-effective hybrids.

To promote the adoption of these new varieties, it is necessary to:

- Facilitate private-public participation in the seed industry to generate demand and supply coordination in this industry
- Strengthen regulatory policies in seed markets, including variety release, seed certification and phytosanitary measures.
- Enhance wheat Genebank holdings, which should be shared as a Global Public Good

Increase nutrient and water efficiency: Some potential innovations in this area are:

- Optimized nitrogen application in developing countries through sensor technology for nitrogen fertilizer dosing (NVDI).
- Improved weather forecasts, fertilizer response predictions and crop modelling should be combined to produce real-time decision guides that can be transmitted rapidly and efficiently by SMS to thousands of farmers.

For further details see: *www.cimmyt.org/en/component/docman/doc_download/503-wheat-global-alliance-for-improving-food-security-and-the-livelihoods-of-the-resource-poor-in-the-*

Roots, tubers, and bananas (RTBS)

Development of new varieties of RTBs:

- Stimulate the use and global exchange of RTB germplasm, facilitating access to genetic resources
- Development of heat and drought-resistant breeds, through genetic modification, mutation induction and / or molecular tools
- Development of pest and disease resistance, with herbicide-tolerance
- There is also a need to develop low-cost reliable kits for rapid and accurate detection of major pathogens in RTB fields. Such effort would avoid considerable losses in crops.

Livestock and fish

Controlling or Preventing Animal Diseases

- Vaccines and timely diagnostics for livestock and fish hatcheries can improve productivity by decreasing mortality and morbidity.

Breeding strategies

- New breeds of livestock have shown very positive results in terms of growth rate, milk production and disease resistance. Additional efforts are required in this area. New efforts should incorporate the needs / preferences of farmers and demand driven considerations.

Some of the mechanisms through which feed problems can be tackled are:

- Enhancement of feed varieties: Feed is also required as food for people. There is a need to develop improved and more efficient varieties.
- Development of new varieties that account for the specialized location-specific niches for forages
- Improve the use of available feeds on farms (optimization of diet components, introduction of feed conservation / processing technologies, enhancement of storage approaches, etc

For further details see: *mahider.ilri.org/bitstream/10568/3248/1/CRP_3-7_Proposal_March_Final.pdf*

Climate change mitigation

18. New and intensified research programmes are needed. In order to contribute to a slowing in climate change agriculture must reduce its own emissions. But agriculture, by converting CO2 to organic matter in the soil, can also improve its take up of emissions from other sectors. For example, AWD (alternate wetting and drying) practices in irrigated rice can reduce methane emissions dramatically and conserve water, while having virtually no effect on yields. Changes in timing of nitrogenous fertilizer application, use of slow release formulation and biological modification of plants can increase the efficiency of nitrogen use, reduce the amount converted to N2O and save farmers money. Conservation agriculture leaves plant material from the previous harvest on the field and minimizes ploughing so soil moisture is conserved and some of the organic material migrates into the soil. Increasing the intensity of feeding ruminants in Africa raises their productivity and reduces the amount of methane emitted per unit of output.

For further details, see *www.cgiar.org/corecollection/index.cfm?Page=search&CatalogID=5185* and the CCAFS website *www.ccafs.cgiar.org*)

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 include farmers' organizations, rural advisory services (public and private) and agricultural education systems – which in turn include both public and private actors.

20. Concerning agricultural education, there is need to strengthen curricula in educational institutions at all levels to support innovation and problem solving capabilities to address context-specific production, marketing, and natural resource management challenges. Peer-based learning approaches, such as Farmer Field Schools and other similar approaches, have also proved very effective to strengthen farmers' capabilities. Concerning advisory systems, initiatives that strengthen better linkages between private service providers, producers' organizations, and individual producers are increasingly emerging and require further support. The key to success is often a multi-stakeholder approach, in which the public sector provides incentives and an enabling environment for other actors, rather than acting as a direct service provider. At the global level, initiatives such as the recently established Global Forum for Rural Advisory Services can facilitate exchange of experiences in multi-stakeholder approaches and help develop the needed policy space for advisory services to evolve to confront emerging challenges.

For further details see:
www.cgiarfund.org/cgiarfund/sites/cgiarfund.org/files/Documents/PDF/fc4_crp2_report.pdf

Nutrition

21. The permanent solution to micronutrient malnutrition in developing countries is a diverse diet that includes pulses, fruits, vegetables, fish, and animal products. For the poor, this may take decades to realize. However, biofortification - breeding higher levels of micronutrients directly into key staple foods – is well advanced targeting the crops grown and consumed by the poor: rice, maize, wheat, pearl millet, cassava, sweet potato, beans. By providing some of the recommended daily allowance for micronutrients, biofortified crops can be effective in reducing malnutrition due to micronutrient deficiencies.

22. Biofortification has three key advantages

- By improving the nutritional content of the staple foods that poor people already eat, biofortification can be a sustainable method to deliver micronutrients to reduce malnutrition using familiar foods.
- Biofortification is an especially effective targeting mechanism to reduce malnutrition in rural areas, where they have limited access to supplements, commercially marketed fortified foods, or other urban-based interventions.

23. Unlike the recurring costs of traditional supplementation and food fortification programs, a one-time investment in a biofortified crop can generate new varieties for farmers to grow for years to come, in many different countries. It is this multiplier aspect of biofortification, across time and distance that makes it so cost-effective an investment. There will be some recurrent expenditures for monitoring and maintaining high-micronutrient traits in crops, but these costs will be relatively low. Because of its cost-effectiveness, the 2008 *Copenhagen Consensus* listed biofortification as one of its top five solutions to global challenges.

For further details see: *www.harvestplus.org/*

Annex D.

Introducing flexibility into policy driven demand for agricultural feed stocks for biofuel production

1. Government subsidies, tax expenditures and mandates - which are statutory obligations to use a specific quantity or share of biofuels – increase demand for some crops and contribute to higher world prices. In addition, mandate induced demand is completely inelastic with respect to price and adds to price volatility. Last, the speed with which mandates have been implemented during the last decade has coincided with and may have contributed to the depletion of inventories and has weakened the resilience of the markets to external shocks.

2. Removing the policies that create conflict between the use of crops for fuel relative to food and feed and which increase price volatility is the most efficient option[1]. This suggests that biofuel mandates should be removed, along with subsidies and trade barriers. Governments are reluctant to take these steps for various reasons. They may not want to forego the environmental or energy security benefits they believe the policies generate, or they may not want to see the substantial investment that has already taken place in biofuel production under-utilized. In this context, this Annex discusses possible alternative measures which could be implemented to alleviate pressure on food and agriculture markets.

3. First, trade restrictions on biofuels and their feedstocks should be eliminated to favour diversification of suppliers and limit the distortive effects of existing policies. Second, incentives should be given only to use of those feedstocks that are less correlated with food and feed markets, considering both direct effects and indirect effects through competition for inputs or factors of production such as land.. Finally, there is a need to introduce at least temporary flexibility into the operation of biofuel policies, and mandates in particular, in order to reduce their volatility exacerbating effects.

4. With respect to the flexibility issue, one option[2] would be for mandates to be made conditional on the value (or values) of an observable variable (or variables) and to be 'automatically' reduced or eliminated if the level of that variable exceeds a given threshold. The chosen variable could relate to prices or to the current or forecast short term level of inventories, or to other indicators that may emerge from the Agricultural Market Information System initiative (see section 4.1 of this report and the separate scoping paper). This would require much more reliable information than is currently available, both on prices and inventory levels, on the relationship between them and to a food crisis. Defining the rule for mandate modification would be a complex task. The design of the mechanism would need to include clear rules and procedures and be protected from political pressure which is likely to be intense in relation to any decisions relating to the mandates. The operational rules should also provide a needed degree of predictability for private agents allowing them to anticipate policy modifications and to avoid adding additional, unanticipated policy shocks in time of crisis.

1. OECD (2008), *Biofuel Support Policies – An Economic Assessment*, Paris.

2. See Laborde (2011), "Domestic Policies in a Globalized World: What You Do is What I Get. Consequences of biofuel mandates for global price stability." *www.foodsecurityportal.org/sites/default/files/A_brief_overview_of_Foodsecurity_and_Biofuels_1.pdf* for a discussion of these issues.

5. Conceptually, a variable mandate mechanism could be used to influence prices of the feedstock in question in either direction. In the specific context of this report, which addresses issues of price volatility and food security, the mechanism design would reflect the one and only purpose of the measure, that is, responding to a price spike that threatens food security. Flexible mandates are not proposed as a general price stabilisation measure in the context of farm policy.

6. In many countries, production and/or consumption of biofuels is subsidised in addition to being subject to mandate. Subsidies take various forms from investment grants, to soft loans, and tax concessions to producers and/or consumers. In the event that the mandates are not binding, governments might want to consider eliminating or reducing subsidies. Biofuel subsidies would then be conditioned on variables defining a food crisis, in the same way (and with the same inherent difficulty) as in the case of the mandate. This type of variable subsidy mechanism could only be developed with respect to measures that relate to current production and consumption such as excise tax reductions.

7. Eliminating or reducing the biofuel mandate could be very costly for biofuel producers and could lead to demands for compensation from governments. An alternative could be for governments to purchase call options on grain from biofuels producers, to be exercised when a food crisis occurs (again, according to pre-defined criteria, with the same complexity in designing the decision rule)[3]. Auctions could be used to set the option price; mandates would have to be suspended or relaxed in order for this alternative to work. Options contracts could also be used in situations where the mandates are no longer binding. Various combinations of contingent contracts could be used; substitution might be direct, or indirect via substitution of biofuels feedstock for grains fed to animals, and diversion of that grain to human consumption[4]. In practice none of these options would be easy to make operational as there is considerable risk of slippage by non-participating biofuel producers.

8. More research would be needed to define an appropriate mechanism. Political economy issues would need to be given careful attention. Even if, in principle, the option price (or other contingent terms) would be sufficient to compensate the industry for any losses incurred, in practice acceptance of a mechanism that could force some plants and workers to be idle for periods of time would be difficult to achieve. Governments, given the current tight fiscal policy context, might also have difficulty in gaining acceptance for a scheme that compensates a specific sector that has, in any event, been built thanks to public support.

9. From a global perspective, it is crucial to consider that any mechanism to modify the level of mandates (or subsidies) will require international policy coordination and harmonisation. In the absence of coordination if a large country decreases its mandate, it may simply encourage other countries to produce and/or consume biofuels. If an importing country maintains a high level of mandate, the overall effect will be entirely inefficient. The proposed forum to be built around the existing Committee on Global Food Security could be the best platform for the discussion and coordination among countries that would be needed to make flexibility in biofuel mandates or subsidies meaningful (see Chapter 6 of the main report).

10. The degree of flexibility possible in production and demand for biofuels is in any event technology dependent. On the supply side, flexible technological pathways allow the same feedstock to be processed for food or fuel in the same plant, depending on needs – Brazil does this successfully with sugarcane. On the demand side fully flexible cars that allow biofuels and fossil fuels to be mixed in almost any proportion enhance the feasibility of using mandates or other policy instruments flexibly, as and when appropriate. On the other hand, there is a technical limit to the capacity of conventional cars to

3. These suggestions are mainly drawn from Wright, B.D. *Addressing the Biofuels Problem: Food security Options for Agricultural Feedstocks*, paper presented to an IPC Conference, Sao Paulo, Brazil, 4 October 2010.

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 Sates, 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-effective regional "food emergency reserve" that is 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:

- Supporting the implementation of WFP's forward positioning network, including the 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. Following the 2008 food price crisis, WFP's Executive Board moved quickly to provide 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 regionally pre-positioned emergency humanitarian food reserves organised and operated with the active participation of the countries and regions concerned could help poor nations ensure rapid access to a minimum floor amount of safe, nutritious food for the most vulnerable through safety nets.

11. As explained further below, a Pre-Positioning for Predictable Access and Resilience (PREPARE) system could aggregate buying power and capitalise on economies of scale to procure food at market prices on global, regional and local markets – helping to address the food access challenges vulnerable countries can face during periods of high and volatile prices and other shocks. It could:

- Better enable participating countries to provide temporary support to the most vulnerable through national safety nets,
- Buy time between the emergence of supply gaps and acute hunger and malnutrition, and
- Build national and regional capacity to develop, deploy and manage safety net programmes.

12. By spreading risk across an entire region, the system could hold smaller stocks and rotate those stocks more efficiently. Food would not necessarily need to be stored in each participating country of a region, but could be located strategically based on logistical and cost considerations.

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 of countries and region could be developed. Such a plan would set out detailed recommendations for the operation, financing and management of a pilot system. Following preparation of a project plan, a high-level stakeholder workshop could be organised that would bring together senior officials from the countries and region concerned, international organisations and development banks to refine the plan and to discuss implementation and financing. A final plan could be delivered in October 2011 and initial actions necessary to implement the pilot could be launched as early as December 2011.

15. An in-depth review of the performance and cost-effectiveness of the system could be conducted at an appropriate point during the pilot to capture lessons learned and to assess the cost, feasibility and appropriateness of extending the system to other countries and regions.

Operation

16. A PREPARE system would optimise existing instruments and operate in a cost-effective and transparent manner according to pre-determined rules and objective, arms-length criteria. It would satisfy the criteria in Annex 2 to the WTO Agreement on Agriculture.

17. **Eligibility**. Eligibility would be limited to a defined group of vulnerable Low-Income Food Deficit Countries determined on the basis of specific and transparent criteria developed by independent third parties.[1] Eligible countries that choose to participate in the system would agree to undertake certain obligations, including:

- Releasing food through national safety net programmes that provide food to eligible vulnerable populations according to clearly-defined criteria related to nutritional objectives, where such programmes exist and have broad coverage, or
- Releasing food[2] to vulnerable populations (food such populations might not otherwise have had access to) through other targeted assistance programmes according to clearly-defined criteria related to nutritional objectives where safety nets are limited or do not exist, and
- Developing national safety net programmes in a specified period of time, with capacity building support provided by international organisations and/or through implementation of national food security investment plans.
- Food releases would be monitored by or occur under the supervision of WFP or another international organisation.

18.

1. One possible option would be to limit eligibility to Low-Income Food Deficit Countries (as determined by the UN Food and Agriculture Organisation (FAO)) that are Least-Developed Countries (as determined by the UN General Assembly) and members of a Regional Economic Community.

2. As explained at paragraph 26 below, a PREPARE system would either loan physical stocks to participating eligible countries against an obligation to replenish them with commodities of comparable type and quality within a specified period of time, or would sell food to participating eligible countries at the market-based cost of replenishment.

18. **Procurement**. To ensure predictable access to a sufficient supply of food at the lowest cost, a PREPARE system would employ a diverse range of tools to buy food commodities from unrelated parties through transparent, arms-length transactions at prevailing market prices. Such tools could include:

- Optimized spot purchasing that takes advantage of bulk purchases, relative commodity pricing, regional and international sourcing and seasonal price movements (i.e., post-harvest price lulls), and
- Virtual mechanisms for long-term price management. Such mechanisms might include:
  - Fixed price forward or average contracts with suppliers, including farmer cooperatives located in partner regions and Long Term Agreements,
  - Physical call options on commodities held by the private sector in partner regions, including warehouse receipt programmes, and
  - Drawdown rights on existing national reserves, where a national reserve may agree to make available for purchase (or loan) up to a certain volume of stock from particular locations.

The proposed Agricultural Market Information System (AMIS) would be crucial in providing information on global market prices to facilitate cost-effective purchasing.

19. Local and regional procurement, including to the extent possible from smallholder farmers, would be a critical aspect of the system's operations and may have a positive impact on local production capacity. To avoid distortions, local markets would be monitored closely through existing food security monitoring systems to understand trends in production and prices.

20. **Size and composition**. A PREPARE system would seek to optimize the use of physical and virtual stocks for maximum efficiency.[3] The system would hold a small amount of rapidly deployable physical stocks sufficient to cover up to a maximum of 30 days of projected needs for the most vulnerable. Additionally, up to 60 days of supply could be made available through virtual mechanisms.

21. The volume and accumulation of stocks will correspond to pre-determined targets related solely to food security. The actual physical stock level may require further adjustment based on closer examination of participating eligible countries and their specific challenges.

22. The size of the reserves could be determined by first estimating the needs of people likely to be vulnerable and require food through safety nets/targeted assistance programmes during food crises in each participating eligible country. This basis amount of food could then be reduced by taking into account the following factors:

- The amount of food likely to be made available by national reserves and international food aid sources; and
- The "risk pooling" effect across participating eligible countries in particular regions. Since it is unlikely that every participating eligible country across a given region would require food at the same time, the overall size of the system could be reduced accordingly.

3. For the purposes of this Annex, 'virtual stocks' are understood as commodity commitments not physically held by the PREPARE system, including financial contracts and instruments as well as drawdown commitments from government and other reserves.

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-determined access or "trigger" criteria. A participating 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 regional and national markets.[4]
- At the regional, national or local level, there is an existing or emerging food shortage indicated by national early warning mechanisms, the Global Information and Early Warning System (GIEWS) or the Famine Early Warning Systems (FEWS) Network, which can also help to prioritise needs.[5]
- The participating eligible country formally requests food from the system to meet the humanitarian needs of vulnerable populations, according to the eligibility criteria in paragraph 17.

A pilot programme project plan would make specific recommendations on appropriate triggers that meet these criteria and can enable participating eligible countries to access food in a timely manner for safety net programmes, based on a thorough review of a range of potential models.

25. **Release terms**. When the trigger criteria are met, a PREPARE system could release an amount of physical food sufficient to meet up to 30 days of projected needs for the most vulnerable to the participating country concerned for distribution through national safety net or other targeted assistance programmes. Food purchased or loaned through virtual mechanisms could be made available for an additional period (possibly up to 60 days).

26. To ensure a cost-efficient and sustainable operation, the system would either loan physical stocks to participating eligible countries against an obligation to replenish them with commodities of comparable type and quality within a specified time period, or would sell food to participating eligible countries at the market-based cost of replenishment.

27. **Stock rotation**. A PREPARE system would seek to hold as little physical stock as possible. It would employ an appropriate rotation strategy to manage stocks in the event there are extended periods when participating eligible countries do not require particular commodities from specific reserve sites.

28. To rotate stocks, the system primarily would rely on commodity exchanges with food assistance organizations, including UN agencies and NGOs. Such organizations could make withdrawals from the reserve upon confirmation of incoming supply.

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4. A model developed at IFPRI by Martins-Filho, Torero and Yao is a transparent and objective measure of extreme price volatility at the global level. This model forecasts changes in returns for key staple commodities in the futures market and specifies when a price abnormality occurs or when a price spike appears imminent. See Martins-Filho, C., Torero, M. and Yao, F. 2010, "Estimation of quantiles based on nonlinear models of commodity price dynamics and extreme value theory," IFPRI, mimeo (*www.foodsecurityportal.org/policy-analysis-tools/wheat-prices-and-returns*).

5. Other information systems, including the proposed Agricultural Market Information System (AMIS), could potentially also be drawn upon to support the assessment of needs.

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 World Bank's IDA programme and through support for national food security investment plans, where 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 infrastructure may also be required. Since the system will operate on a cost recovery basis, commodity costs would be neutral following initial stocking.

32. Recurring costs for the ongoing management and operation of the system would include storage, stock rotation, virtual stock commitments (e.g. physical call option premiums), and administration. Initial and recurring costs could be minimized in a number of ways, including by:

- Stocking the reserves through in-kind commodity donations,
- Maximizing the use of drawdown commitments on national reserves,
- Adjusting the release terms to offset ongoing running costs,
- Outsourcing storage arrangements to the private sector on a competitive basis, and
- Implementing a lean staffing and administration structure.

33. Development of a pilot programme project plan would include preparation of a thorough cost estimate based on the number and location of eligible countries participating, the appropriate mix of cereals for those countries, prevailing market prices, anticipated in-kind donations and other factors which cannot be known with certainty at this time. As an initial estimate, however, a regionally-based pilot programme that would require a physical stock of 150 000 metric tonnes of basic mixed cereals could have an initial stocking cost of USD 65-70 million and recurring management and operational costs (which include virtual stock commitments) of around USD 18-20 million per annum.[6]

34. The initial and recurring costs of a pilot programme would be carefully documented and reported. On the basis of that documentation, a detailed analysis of the cost-effectiveness of the programme could be conducted to inform a broader assessment of the cost, feasibility and appropriateness of extending a PREPARE system to other countries and regions.

6. Commodity costs as of March 2011 based on World Bank Global Economic Monitor (GEM) Commodities data. Ongoing operational costs include storage costs, rotation costs and administrative overhead, as well as costs associated with maintaining a limited amount of physical call options such as virtual stocks. It should be noted that the cost of virtual stocks can vary significantly depending on market conditions.

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.

37. If endorsed by the participating eligible countries and the regional economic community concerned, WFP would be the appropriate organisation to jointly govern, manage and provide oversight of the system in view of its long experience in supply chain management and history of advising governments on local, national and regional reserves. It may be possible to improve cost-effectiveness by outsourcing certain system operations to the private sector.

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

Food prices are highly politicized and food reserves' operations are not independent of the political process. This gives rise to credibility problems. Food reserve agencies should enjoy autonomy from the political process similar to that of a central bank. Ideally, a set of clearly defined and transparent rules based on early warning information, such as expected availability, or price triggers are necessary.

5. Food reserves should be linked with safety nets

Targeted food release increases the effectiveness of emergency reserves. Compared with cash transfers, in-kind food distribution through safety nets places a lower budgetary strain on government resources, as often foreign assistance is available in terms of food aid in kind. In the absence of well-established safety nets, subsidized grain can be released in areas with a very high proportion of poor. Safety nets can also facilitate the rotation of the reserves in times of calm markets, so that the quality of food will be preserved without distorting the market.

6. Emergency reserves should be established and replenished in a market-responsible way

Purchases from local markets and through import programmes should be carried out not only to guarantee the availability of food in the reserve, but also to ensure that private trade is not prevented from developing or harmed. Discrete and unexpected policy responses, increase uncertainty and weaken the incentive for the private sector to engage in trade, especially if the emergency food reserve is large. Sudden export bans, which facilitate domestic procurement by the reserve, may harm traditional trade partners. Purchases for humanitarian food aid should be exempt from export bans to allow rapid food provision where it is needed in times of crisis.

7. Emergency reserves should be linked and have counter-cyclical funding

Strong linkages between existing reserves, increasing collaboration and achieving pooling of resources will strengthen the regional food security architecture. Emergency food reserves ought to have a counter-cyclical budget so that operations can be scaled-up as need increases and scaled-down subsequently. Such budget requirements present significant difficulties – especially for many low income developing countries – as when food prices surge or the economy slows down decreases in government revenue and increases in social expenditures happen at the same time.

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	- Gives direct exposure to moves in the financial market which should offset physical position. - Only need to post a percentage of total value of food to be hedged	- Basis risk where losses or gains in financial markets do not equate to those in the physical markets. - With high volatility, margin calls can become onerous in terms of quantum and cash flow. - In fast moving markets it can become very difficult to liquidate a futures position. - Unless you take the physical at the terminal market, you still need to buy the physical.
	Options (calls and puts)	- Avoids direct exposure to the market (margin calls) and acts more like “insurance”, although still offers no actual indemnity. - The lesser the price protection sought, the cheaper the option.	- There is a fixed cost, which is the premium - In volatile markets, premiums are higher. - Basis risk is the same. - Ability to liquidate the realized future is still the same. - Physical contract still required.
Physical (OTC)	Forward contract	- Lock in a price and a volume for delivery at a time in the future.	- Counter party risk is not managed (unless mitigation tools such as collateral guarantees and/or intermediation are used). - If the market moves in buyer’s favour they will not be able to benefit from the price change.
	Physical options contracts	- Price and volume locked in plus no obligation to buy if the market subsequently moves in buyer’s favour.	- Counter party risk is not managed (unless mitigation tools such as collateral guarantees and/or intermediation are used). - There is a fixed cost, which is the premium. - In volatile markets, premiums are higher

3. *Financial instruments* pose two major challenges for governments. Firstly, the degree to which the change in the value of the futures market "mirrors" the change in the cost of the physical food item 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 convergence), the physical price on any given day may not strictly correlate.

4. In addition, between the prices quoted on an international exchange and delivery to a country, there are a number of expenses (e.g. transport, insurance, finance etc) which are also subject to variability and they are not covered by the futures contract. For many food commodities (largely due to their volume to value ratio), these other expenses can be a major share of the delivered cost of a product. It is therefore possible that a government's financial instrument would not cover all of their price exposure.

5. Secondly, for financial products, a buyer or seller must maintain what is known as a "margin" (basically a deposit of money) with the exchange for futures and pay a premium for options. The purpose of the margin is to ensure that a person who holds a future will pay to the exchange the difference in the purchase and subsequent daily value of the futures contract. This margin is established when a party buys a future and its amount is re-assessed on a daily basis. The importance of this is that, when prices are falling, a holder of a futures contract will be expected to deposit monies with the exchange. The value of these payments can run into USD millions and therefore a buyer must have either monies or credit available to meet these exchange requirements. Failure to make the margin payment can result in a forfeiture of the futures contract and penalties. For options contracts, the cost of premiums rise as market volatility rises and options close to current price levels become more expensive.

6. *Physical contracts* (either forward or option), are not executed through a commodities exchange which manages counter party risk through margin payments. However, through the use of intermediated payment tools, performance guarantees or underwriting by an international bank etc, it is possible to largely manage such counter party risk. Given that such contracts are concluded at a price that includes delivery to the purchasing country, issues of basis risk are also largely covered.