Committee on World Food Security

High Level Panel of Experts on Food Security and Nutrition

Report on Price Volatility

A zero draft consultation paper

11 May 2011

A draft report by the HLPE Project Team

Benoit Daviron (Team leader)
Niama Nango Dembele
Sophia Murphy
Shahidur Rashid

Under the Oversight of:
Sheryl Hendriks
Derek Byerlee
Alain de Janvry
Renato Maluf
Carlos Perez Del Castillo
(HLPE Steering Committee members)

Preface

In October 2010 the newly reformed Committee on World Food Security (CFS) requested its High Level Panel of Experts on Food Security and Nutrition (HLPE) to conduct a study on price volatility and to present the findings at its next session in October 2011.

The High Level Panel of Experts for Food Security and Nutrition (HLPE) was created in October 2009 as an essential element of the reform of CFS, and as the scientific and knowledge-based pillar of the Global Partnership for Agriculture, Food Security and Nutrition. The HLPE was launched in July 2010 with the appointment of its Steering Committee. The HLPE seeks to improve the robustness of the policy making by providing independent advice to assist the CFS in reaching political consensus, and in turn, take political decisions based on comprehensive assessments.

Following the 36th meeting of the CFS, the HLPE was entrusted with the mandate to undertake studies and present policy recommendations on issues related to world food security. This includes a study on price volatility that covers *"all of its causes and consequences, including market distorting practices and links to financial markets, and appropriate and coherent policies, actions, tools and institutions to manage the risks linked to excessive price volatility in agriculture. This should include prevention and mitigation for vulnerable producers, and consumers, particularly the poor, women and children, that are appropriate to different levels (local, national, regional and international) and are based on a review of existing studies. The study should consider how vulnerable nations and populations can ensure access to food when volatility causes market disruptions"*.

Following the procedures of the HLPE, a Project Team was appointed to conduct the study and prepare a paper putting forward the results of the analysis and recommendations on key policy instruments to reduce the frequency and magnitude of price shocks, manage risk, strengthen coping strategies and improve resilience at all levels (household, national, regional and international), with a special and deliberate focus on options for developing countries with special attention on policies with positive impacts on household food security. The policy recommendations are intended to provide a range of responsive instruments and processes that respond to changing contexts and situations (for example new shocks, unexpected events etc.) requiring a balance of risk management vs. risk response options to ensure resilience. The Project Team was asked to give consideration to:

- Developing economy perspectives
- Climate adaption and mitigation measures
- Provide incentives for farmers to keep producing vs. short-term cheap food for consumers
- Comprehensive and holistic solutions
- Conflict and instability
- Pro-poor growth focus
- Nutrition-sensitivities and the
- Impact of various recommendations on vulnerable groups, including women and children.

This consultative document presents the draft findings and recommendations of the Project Team, drawing on a vast body of international literature, personal experience and the input received from an earlier digital public consultation on this topic. This document is not a final document but a zero draft submitted to electronic public expert consultation, prior the finalization of the paper by the HLPE. The final report is to be approved by the Steering Committee of the HLPE in July 2011, and will be submitted to the CFS in preparation of discussions at its 37th sitting (17-22 October 2011).

The on-line consultation will seek to review the recommendations of the paper and assist in refining, strengthening and sharpening the recommendations to ensure that they provide clear guidance for global, regional and national decision makers having to deal with price volatility.

Yours sincerely,

On behalf of the Steering Committee of the HLPE, Prof. Sheryl Hendriks, in charge of the coordination of the HLPE Steering Committee's oversight for this study.

Contents

Preface ii

INTRODUCTION 6

I. Recent price volatility in international food markets: three interpretations 3

A. Excessive food price volatility 5

1. Food demand 7

2. Food supply variability 11

3. Trade policies 12

4. Speculation on future markets 15

B. CYCLICAL FOOD CRISES 18

1. Looking for world agricultural cycles 20

2. The decline of agricultural investment 25

3. The decline of public spending on agriculture 26

4. The decline of public support more broadly 29

C. EMERGING SCARCITIES 32

1. When the green revolution met its limits 33

2. An unlimited demand for agricultural product 37

II. Price transmission and its consequences for food security 41

A. The transmission of international price volatility to domestic markets varies across developing country domestic markets 41

B. But price volatility that results from domestic sources is also, a permanent problem in many poor countries 45

C. Consequences of price volatility on food security 50

III. Policy options to address price volatility 52

A. International options 52

1. Slowing down speculation 52

2. Restoring confidence in the international trading system 54

3. Building stocks at the world and regional level 61

4. Investing in an agro-ecological agriculture 65
5. Curbing the growth of developed countries food demand 66
IV. National options 68
1. Assessment of national response to the 2007-2008 price spike 68
2. National policy options to manage volatility 73
3. Accounting for country specificities in managing food price volatility 78
References: 85

INTRODUCTION

Since 2006, international food prices have twice risen sharply. The first rise was broken by the world financial crisis. The second one is still going on. The present report aims to (i) analyze the causes of this renewed international food price volatility and the consequences for poor countries concerning the behavior of their domestic prices and food security of vulnerable populations, and (ii) propose key policy recommendations at the international and national level.

The first part of the report deals with the causes of the recent international food price rises. It proposes three different interpretations of the phenomena. The first interpretation defines food price rises as a problem of "agricultural price volatility" (suggesting implicitly that high prices will not last) and as a quasi-natural and permanent problem of agricultural markets. The second interpretation points to the existence of periodic international food crises (1950's, 1970's, now) and says they can be explained by the cyclical nature of investment in agriculture. The third interpretation sees current price increases as an early signal of coming and lasting scarcities on agricultural markets.

The report does not choose between these three interpretations. Instead, it emphasizes their complementarity. For example, the need for significant public investment in agriculture, that is the main learning of the second interpretation (cyclical crisis), will clearly be conceived differently if the third interpretation (coming scarcities) is taken into account.

The second part of the report shows first that international food price rises have been unevenly transmitted to domestic prices in developing countries. In most countries transmission was delayed but the increase in domestic food prices persisted. In many poor countries, particularly in Africa, this volatility imported from the international markets came on top of chronic domestic volatility in local foods prices. The second part of the report gives also some information on the consequences of price volatility (imported and domestic) on the food security of vulnerable populations. An assessment of these consequences proved to be a difficult task as very few studies provide relevant information.

The third part of the report presents key policy recommendations to address price volatility and its consequences for food security. At the international level, it discusses six objectives:

- Regulating speculation
- Restoring confidence in international trade
- Building stocks at the world and regional level
- Investing in agro-ecological agriculture
- Curbing food demand in developed countries

These six objectives raise two fundamental issues. The first is the place given to trade in food security strategies. For almost three decades, participation in trade has been advocated as the best way to manage food security. Numerous efforts have been made to create rules and institutions that establish fair competition on international agricultural markets. "Market access" was presented as purely a problem for exporting countries. The recent food price rises, their causes and consequences, have demonstrated that "market access" can also be a problem for importing countries. Rapidly increasing prices on futures markets, export bans and competing demand from energy-hungry car drivers have raised significant doubt that international trade can guarantee food security. The increasingly discussed failure of the Doha Round reinforces that doubt.

The second issue is the medium and long-term future of the supply demand relationship on food markets. Because of the role played by biofuels, the recent food price rises are easily connected to the uncertain future of fossil fuels and more generally to the depletion of natural resources. It is worth remembering Martin Wolf's statement made at the height of the 2007/08 price spike "… the biggest point about debates on climate change and energy supply is that they bring back the questions of limits. This is why climate change and energy security are such geopolitical significant issues. For if there are limits to emissions, there may also be limits to growth. But if there are indeed limits to growth the political underpinnings of our world fall apart. Intense distributional conflict must then re-emerge – indeed, they are already emerging – within and among countries" (Wolf 2007 quoted by Evans 2010). From this point of view, curbing food demand in developed countries is certainly a major issue for long-term world food security.

The report then turns to national level policy recommendations. After assessing possible policies, the report first presents a menu of available instruments for dealing with price volatility. Then it insists on the necessity of taking into account each country's specificity and to elaborate, on the model of Poverty Reduction Strategy Papers (PRSPs), a national strategy that integrates price volatility as a component.

I. Recent price volatility in international food markets: three interpretations

Since 2006, international food prices have twice risen sharply (the second rise is still in motion), a situation not seen on international food markets for over twenty years. Table 1 summarizes these price increases, which ranged from 37.5 per cent (for sugar) to 224 per cent (for rice) between January 2007 and June 2008. Wheat rose 118 per cent between January 2007 and March 2008 and maize rose 77 per cent between January 2007 and June 2008 (Global Food Markets Group, p 24, 2009). Then prices started to fall at the end of 2008 (see figure 1). Indeed, after the steep increase, the prices for rice and wheat dropped by 55 per cent in the 2nd half of 2008 while maize dropped by 64 per cent for the same period (Blein and Longo 2009).

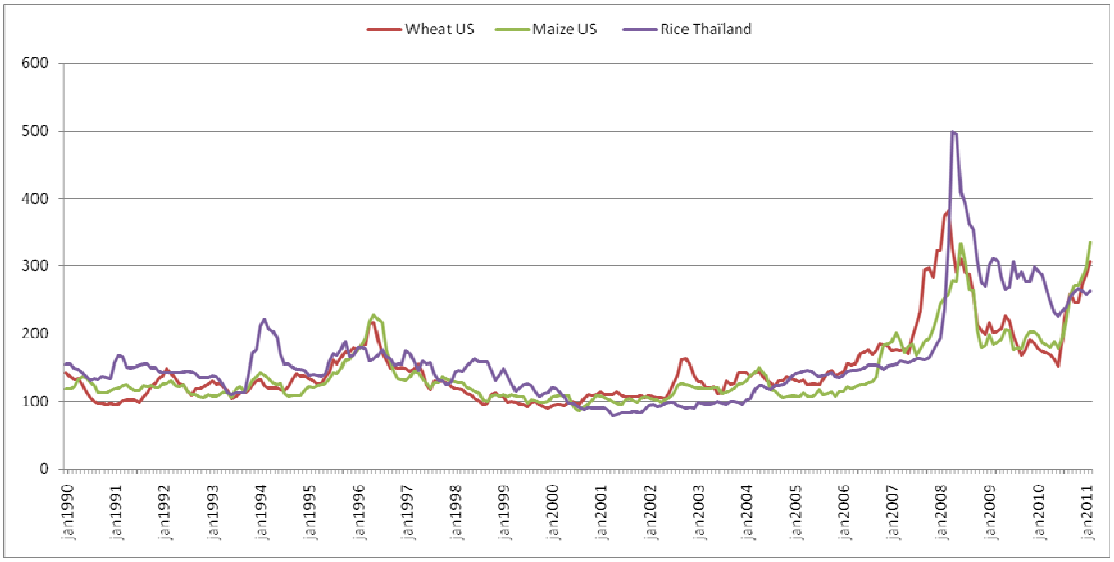
Table 1: Food price indexes (2000=100)

	1990-2006 Average	**2008 Highest monthly value**	**2009 Annual Average**	**2010 Annual Average**	**2011 January – March average**
Food	124	292 (June)	205	224	284
Cereals					
- **Rice**	126	340 (April)	214	215	289
- **Wheat**	129	448 (April)	274	241	229
- **Corn**	130	305 (June)	196	196	281
	122	324 (June)	187	209	319
Fats and oils					
	127	341 (June)	216	244	321
Sugar					
	120	165 (Feb.)	222	260	348

Source: World Bank (2011)

Figure 1 : Free market commodity price indices, monthly, 1990 January – 2011 February

Measure – Price indices 2000=100



Source : **UNCTAD**

International food prices then started to rise sharply again in the second half of 2010, and the price index of food surpassed the peak levels of 2007-08 (Ortiz, Chai et al. 2011). The Food and Agricultural Organization's (FAO) food price index increased by over 30 per cent between June and December 2010, while the price index for cereals jumped by 57 per cent during the same period (Ibid).

The numbers show how volatile prices continue to be. Analysis of cereal price movements in international markets between January 2006 and December 2011 also shows that prices have increased more than they have fallen, implying a general increase in average price levels. Food prices have not returned to their pre-2007/08 levels. Instead, prices are now fluctuating around a level twice as high as the average level in the period 1990-2006.

These rises have generated a vast quantity of analysis and debate that seeks to characterize and solve the "problem of food price volatility". The following discussion presents a summary of some of this analysis and debate. To understand the differing perspectives on the topic, it is helpful to distinguish three different but complementary interpretations of recent food price volatility in international markets.

1. The first interpretation – dominant in the discourse on the topic – defines food

price rises as a problem of “agricultural price volatility”, suggesting implicitly that high prices will not last (i.e. in colloquial terms: the cure for high prices is high prices). Price volatility is conceived as a natural and permanent problem of agricultural markets, related to, for example, low elasticity of demand and climate shocks affecting supply. In addition to the inherent “normal” level of volatility in agricultural markets, there is “excess” volatility, such as has characterized much of the period since 2007;

2. The second interpretation points to the existence of periodic international food crises (1950s, 1970s, now) and says these can be explained by the cyclical nature of investments in agriculture, particularly the rise and fall of public investment;

3. The third interpretation sees in the current price increases the early signal of coming and lasting scarcities on agricultural markets. The volatility is linked to the lack of equilibrium in supply and demand as a new context emerges. The interpretation emphasizes the increasing pressures placed on natural resources, whether directly linked to agricultural production (water, soil, biodiversity) or indirectly linked (oil, climate change). The argument suggests new sources of demand - possibly coupled with diminishing productivity growth in agriculture - have combined to bring supply and demand too close together for stable prices to be a likely outcome.

Each of these three characterizations of price volatility is related to different temporal horizons: short-, medium -and long-term. Each also highlights different problems of economic efficiency and equity at the international level. The rest of the discussion in this part of the report focuses on international food markets and elaborates on each of these interpretations.

A. Excessive food price volatility

Price volatility can be difficult to define and still harder to measure. Broadly, price volatility is the movement of a price up or down over a given time period. That movement can be close to zero (low volatility) or some degree of magnitude larger (tending to high volatility). The period matters: volatility is measured over a short time period. For economists, price variations are an essential component of the normal functioning of markets. Prakash (2011:3) reminds us of a very basic statement of economics: “The essence of the price system is that

when a commodity becomes scarce its price rises, thus inducing a fall in consumption and signaling more investment in the production of that commodity". Some degree of volatility is essential to functioning markets.

Most literature distinguishes between normal and extreme volatility, which might also be characterized as good and bad volatility. Finding agreement on the distinction, however, is not so easy. There is no simple measure that applies to all situations. Prashak (2011) suggests the following: "However, the efficiency of the price system begins to break down when price movements become increasingly uncertain and precipitous, and ultimately reaches the point of redundancy when prices undergo "extreme volatility" - or "crisis" - to use popular terminology." He adds, "Attempting to quantify the exact magnitude of a shock that could propagate crisis is problematic and is subject to a degree of arbitrariness. Such an exercise must take vulnerability into account (…). Consequently, a better approach to characterize extreme volatility and crisis refers to the shock's likelihood to overwhelm a country's ability to dampen the shock or to mitigate its impact. "Ability" here is related to a country's degree of vulnerability." The definition of extreme volatility in relation to vulnerability means that there is no a universal criterion or threshold to identify it.

Beside its impact on individuals and countries, the assessment of whether price volatility is normal measures the relation between price variations and the so-called "market fundamentals". "Excess volatility" is sometimes used to qualify a price variation that cannot readily be explained by a change in supply or demand. This inherent vagueness opens assessments of volatility to unending controversy, as illustrated by the ongoing debate on the role of speculation in price formation and whether it has led to excessive volatility or not. It is not easy to establish a baseline from which to measure normal and excessive.

In a more pragmatic approach, several authors have used a variety of methods to assess if food prices are becoming more volatile over time or not (Calvo 2008; Gilbert and Morgan 2010; Huchet-Bourdon 2010; Abbott 2011). They almost unanimously conclude that there is no tendency towards increased price volatility over the past fifty years (1960 – now). However, they also notice that volatility in international agricultural commodity markets is currently higher than it was in the 1990s and 2000s but not higher than it was in the 1970s.

Volatility nonetheless occurs for many reasons. It it is important for policy-makers to

understand what is driving excessive volatility today and what can be done to curb/manage it. Numerous causes are discussed in literature to explain food price volatility, and its recent increase. The following section summarizes this analysis under four headings: food demand, agricultural supply, trade policies, and speculation.

1. Food demand

The characteristics of food demand are not exactly a cause of price volatility but they do make volatile prices more prevalent. Three characteristics will be discussed here: food price inelasticity, demand shocks and substitutability between commodities.

a) Food price inelasticity: a very uneven distribution at the world level

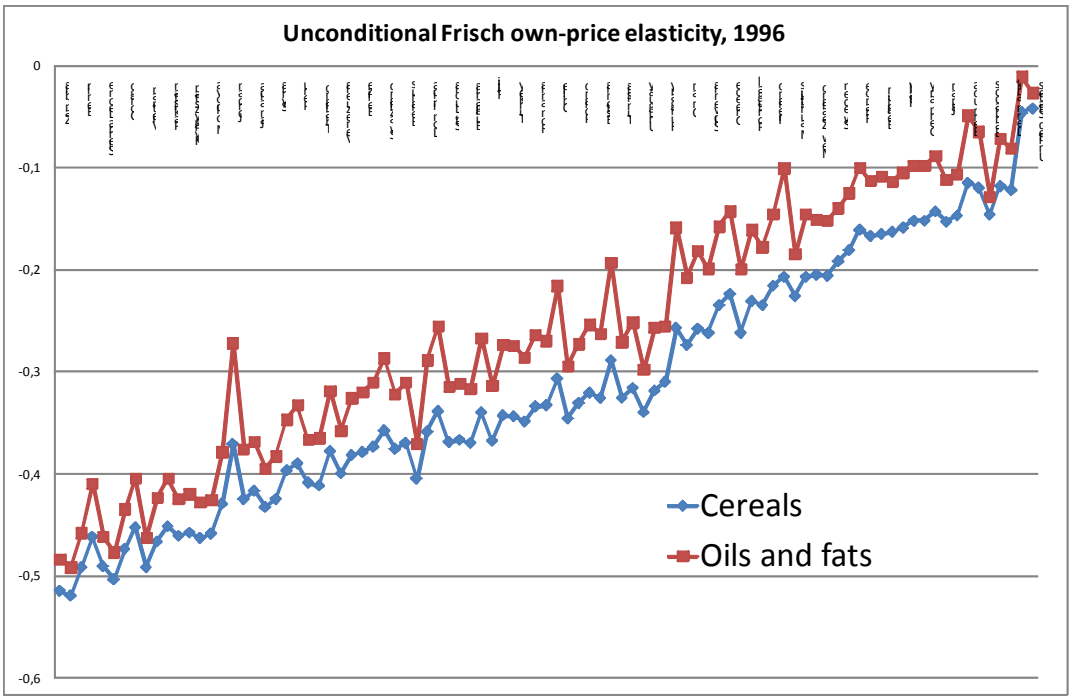
Almost every analysis of food price volatility starts with the reminder that food consumption is price inelastic, i.e. that people have to eat no matter how high prices may go. This means important price variations are necessary to adjust demand to any excess or deficit in supply. This much is well known. What is less discussed is the uneven distribution of food price elasticity at the world level. Everyone has to eat, but not everyone has the same capacity to pay more when prices rise.

Consumers with very different levels of income, and buying very different products, are indirectly competing on international food markets. For the rich consumers of OECD countries, agricultural prices represent a small share of the overall value of the highly processed foods they eat and food expenditures are just a small part of their total budget. This makes richer consumers relatively indifferent to even quite large fluctuations in the price of raw commodities. They are relatively more price inelastic, in economic terms, than poor consumers living in a Least Developed Countries (LDC), who mostly buy unprocessed commodities. This means that agricultural commodity prices represent a large proportion of the final price they pay for food items and that food expenditures are a large part of their household expenditures. In 1996, the budget share of food expenditures reached 73 per cent in Tanzania against 10 per cent in the USA (Seale, Regmi et al. 2003).

This makes poorer countries much more responsive to changes in food prices than wealthier ones (Regmi, Deepak et al. 2001). The figure 2 presents price elasticity for cereals and vegetable oils calculated for 114 countries ranked in relation to their 1996 per capita GDP. It clearly shows the inverse relation existing at the world level between income and food price

elasticity. For the poorest countries, price elasticity for cereals and oil/fat demand is equal to -0.5. For the richest, it is almost zero. When prices rise, populations in poor countries eat less food.

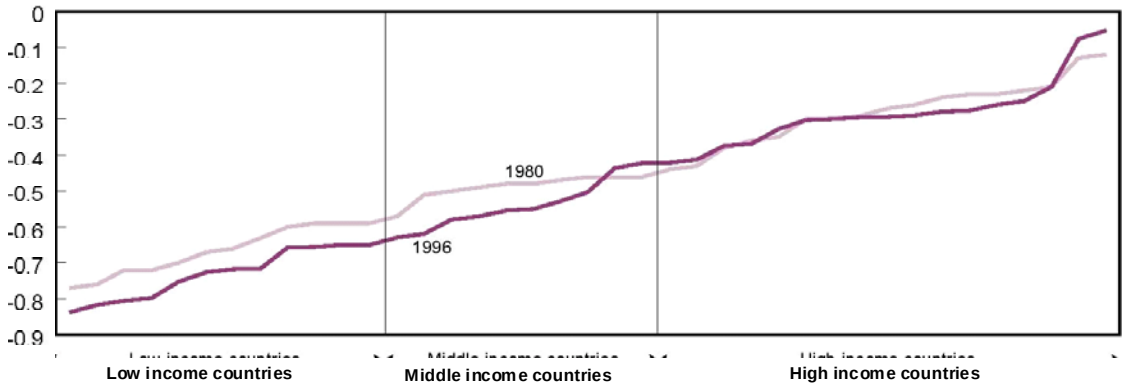
Figure 2 : Price elasticity distribution at the world level



Source : Regmi, Deepak et al. 2001

Moreover, the difference between food price elasticity in the poorest and richest countries seems to be increasing over time (see figure 3 from Regmi, Deepak et al. 2001): the slope of the curve increases between 1980 and 1996. Price elasticity is becoming higher for the poor countries and smaller for the rich.

Figure 3: Food price elasticity distribution at the world level, 1980-1996



Source : Regmi, Deepak et al. 2001

This inverse relation between income and food price elasticity means that, because incomes are growing in most of the world, world food demand is becoming less and less price elastic. In turn, supply variations provoke higher levels of price volatility because demand does not lessen even as supply dwindles. Moreover, the inverse relation, existing at global level, between income and food price elasticity implies that, in a situation of an open market, the poorest countries absorb a larger proportion of the quantitative adjustment necessary to balance the market.

Obviously, one of the questions raised by this observation is what impact biofuel consumption is having on food price elasticity in the United States and Europe. There does not appear to be any study investigating this question. Some observers suggest that biofuel production could be used to increase food price elasticity. However, in the existing situation (public support, mandatory use and absence of mechanisms to limit supplies), it is more than probable that the increase of biofuel production is instead reducing the already low level of food price elasticity of rich countries.

b) Demand shock: the biofuel boom

Food demand is supposed to change only in relation to population and income and is said to be relatively immune to the influence of fads. This is why food demand shocks are very rare. Only technological innovation and government intervention can generate such shocks. This is exactly the case with biofuels. The production of biofuels has exploded in both the United States and Europe since 2004 (table 2); generating a major shock on demand in cereal and

vegetable oils markets.

Table 2: Biofuel production (millions of liters)

	1995-1997	2000-2002	2007-2009
USA			
Ethanol	4542	7167	34887
Biodiesel	0	29	2318
EU			
Ethanol	102	1034	4889
Biodiesel	450	978	8041
Brazil			
Ethanol	14177	11490	25308
Biodiesel	0	0	957

Source**:** OECD Aglink database

Starting from close to zero in 2004, the biofuel industry today uses about one quarter of US corn production and half the EU's production of vegetable oils (See table 3). After some initial debate, hardly anybody today contests the fact that biofuel production has been a major factor in the recent food price increases (FAO 2008; Mitchell 2008; OECD 2008).

Table N°3: Share of agricultural output

	2007
Maize, US	
Share of US output	23.2 %
Share of world ouput	8.4 %
Vegetable oil, EU	
Share of EU ouput	47.2 %
Share of World Output	8.7 %

Source: Steenblick 2010

c) Commodity substitutability: the new energy/food linkage

Shocks that occur on one specific agricultural commodity market are transmitted to other agricultural commodity markets by the substitution between products made by consumers and processors. Substitutability creates strong connections and synchronicities between

commodity prices. Substitutability between agricultural commodities has always existed. It has been reinforced in the last fifty years by the development of the animal feed industry, which is well known for its ability to efficiently and quickly substitute grains and oilseeds.

Today, with the boom of the biofuel industry, oil (petroleum), too, has become substitutable by agricultural products. Historically, energy prices affected food prices through the cost of agricultural inputs: gasoline, fertilizers, and pesticides. Currently, the price of food is also affected by the increasing use of agricultural commodities for the production of biofuels.

Based on Tyner's (2007) analysis, FAO shows that with an oil price of 100 dollars per barrel, U.S. ethanol processors can afford to pay up to US$162 per metric ton of maize for biofuels production and, with subsidies, up to $220 (FAO 2008). FAO shows also that with an oil price of $120 per barrel (the price reached in April 2011) and with the existing subsidies, and ethanol production would still be profitable with a maximum maize prices of $270. When oil prices exceed a certain level ($50 according to World Bank 2009, $75 according to Hertel and Beckman 2010), the price of maize becomes closely correlated to the price of oil, where a 1 per cent increase in oil price can result in a more or less 0.9 per cent increase in the price of maize (World Bank 2009:73, see also Tyner 2010). According to the FAO, the same kind of correlation is apparent for three other biofuel feedstocks: rapeseed, soybean and palm oil (FAO 2008: 40).

2. Food supply variability

Confronted with an inelastic demand, food supply variability is classically considered the major cause of price volatility. Two visions can be distinguished here (Gouel 2010):

- For the large majority of authors, agricultural supply variability is explained by climatic events (drought, flood, early frost, etc…). Could the current price increases be the result of more frequent climatic accidents? The specialists claim that the increased frequency of extreme weather events will be one manifestations of climate change(Easterling, Aggarwal et al. 2007), but the data needed to prove this claim are still lacking. The International Disaster Database (http://www.emdat.be/) provides some information that indicates an increasing number of floods and extreme temperatures but there is no clear link between this fact and the increase in agricultural supply variability. Nonetheless, some analysts claim the link exists (see for example

that McCreary (2011) suggests that the severe drought in Australia and Western Canada are already illustrations of such a shift).

- For some authors, supply variability, and then price volatility are endogenous, i.e. resulting from the behavior of market participants. In this argument, assumes producers have naïve expectations and base their production decisions on actual price and reduce heir production when price are low so that the next period will see the opposite situation of high prices and vice versa (Prakash 2011: 29; Mitra and Boussard 2008). Market liberalization creates a new context that could explain the existence of such phenomena (known by economists as the cobweb phenomena) at the world level. Even if some empirical evidence shows the existence of medium cycles for livestock and perennial crops, it is still very limited and no similar evidence has been found for grain or oilseeds markets.

Farmers' behavior is perhaps more complicated than the cobweb model suggests, at least in the context of OECD-style supports and interventions. In the U.S., although the number of planted acres in grain fell in the late 1990s with changes to price supports and low prices in both domestic and international markets, actual production increased. It appears that farmers expand acres when prices are high but they do not necessarily reduce production when prices fall, at least in the short to medium-term (Ray, 2000 http://www.agpolicy.org/weekcol/011.html). This effect does not change the investment decisions of non-farmers in the food system (research and development in the public sector and/or by private companies), where low prices would be expected to reduce interest. Certainly, public investment in agricultural research and development has fallen. It is noteworthy that commercial investment in biotechnology, which has been very significant, has focused on technologies to make plants more tolerant of various inputs, such as herbicides, and not on ways to increase yields.

3. Trade policies

a) Regular price stabilization policies

Domestic price stabilization policies always include measures that aim to isolate domestic markets from international price fluctuations. In so doing, they reduce the number of

consumers and producers participating in the quantitative adjustment between supply and demand, which in turn imposes a bigger adjustment for the rest of the world, and therefore, a bigger international price variation. The larger the world market, the smaller the price variations is supposed to be necessary to balance supply and demand. One of the objectives of liberalization policies and the WTO trade negotiations was precisely to build one unified world market that was big enough "to absorb", with limited price variations, any localized supply or demand shock.

However, very significant income disparities between countries, and among different populations within countries imply very unequal adjustments between those who spend half or more or their income on agricultural commodities and those who spend less than 10 percent of their income on food, of which an even smaller share is spent on raw commodities.

Classically, most international agricultural markets are characterized by thinness, i.e. a market where only a small part of the world production or consumption is exchanged. Because of this thinness, any abrupt increase in export supply or import demand in one country is supposed to be able to provoke an important price fluctuation. According to Anderson (Anderson 2009: 5)., "instability of international food prices in the early 1980s was three times greater than it would have been under free trade in those products. This suggests that the relatively high volatility in international food market is caused by the thinness of that market, which in turn is due to the use of variable trade policy instruments to insulate domestic food markets from fluctuation abroad."

In practice, the ratio "world export":"world consumption" is not a good indicator to evaluate the degree of market integration. The international wheat market illustrates the weakness of this indicator. For the last 30 years, roughly 20 per cent of world wheat production has been exported, with a slight downward trend in the last 15 years. However, in many countries, including the members states of the EU and FSU for example, current domestic prices are more connected to international prices than they were twenty years ago. Less wheat is exported, but domestic prices in many countries are much closer to international market prices than before.

In fact, it is quite difficult to get a clear idea of the degree of market integration at the world level. What we know that today the situation is very uneven. Some countries have connected

their domestic prices to international prices (e.g. the EU), while others such as India and China, have kept stabilization policies that, for rice or wheat, isolate domestic prices from international price fluctuations (OECD 2009; Yang, Qiu et al. 2008). Other countries have linked their prices, but have shown they will seek to isolate their markets if international prices become too volatile.

Thus, it is not relevant to explain the current price volatility by referring to the regular trade policies associated with domestic price stabilization. World food markets are certainly more integrated than they were twenty years ago. They are also certainly more integrated than they were in the sixties when food prices were spectacularly stable.

b) Trade shocks

Many authors point to abrupt changes in trade policy as one major explanation for the 2007/2008 price spikes. Export restrictions and import surges are invoked to explain rice price behavior during this period in particular. Several authors (Slayton 2009; Dawe and Slayton 2010; Headey 2011) have proposed very detailed accounts of the sequence of export restrictions (bans) implemented by exporting countries (India, Vietnam, Thailand) and the panic buying it generated on the international market.

In the same way, Yang, Qiu et al. 2008 describe the different measures adopted by the Chinese government to limit the transmission of the 2007/08 price rise to the domestic markets: release of governmental reserves, elimination of any subsidy for corn export, implementation of a new export levy then a grain export ban.

An FAO internet site gives an account of the policy measures taken in 2007 and 2008 by governments to reduce the impact of soaring prices (http://www.fao.org/giews/english/policy/index.asp) (see also Demeke, Pangrazio et al. 2009). According to this survey, which examined policy responses in 81 developing countries, 25 countries imposed export taxes or restrictions. More recently, the 2010 wheat price rise was in part caused by an export ban imposed by the Russian government after the severe drought and raging fires in Russia that summer.

This behavior is an example of poorly coordinated *ad hoc* responses to changes in either

world or domestic markets that exacerbate the price shock effects on international markets. The policy choices taken by exporters such as Russia and Argentina and India sent a strong signal to importing countries that the international market was still primarily a residual market, in which domestic interests remained paramount. Meanwhile, the temptation for importing countries to drop their import tariffs during the price rise proved counter-productive; tending to increase demand on the available supply, sending prices still higher.

4. Speculation on future markets

The role of speculation in the recent food price rises is fiercely disputed. The debate started with the 2007/08 price spike and is on-going. The synchronicity of price movements suggests that, beyond the specific fundamental situation of each commodity, some common factors are at work. Speculation could be one of them.

Speculation is an intrinsic part of how futures market work. Its role is contested, but many economists defend speculation as indispensable for the good functioning of futures markets. Speculators assume the price risk that markets operators (traders, manufacturers) do not want to carry. Speculators provide a market for hedgers. Hedgers need risk insurance – farmers want to lock into prices in case prices are low at harvest time; processors want to lock into prices in case prices rise. Because speculators buy when the price is low and sell when the price is high, they even out price extremes.

Yet if unregulated, speculators can also do significant harm to the market. In the, wake of the stock market crash and the depression in the 1930s, the U.S. government established regulations and oversight mechanisms to limit the negative effects of unchecked speculation. Any actor in the commodity market that was not buying or selling physical stocks was limited in how much they could invest—no actor was allowed to hold contracts worth more than 11 million bushels of grain (De La Torre Ugarte and Murphy 2008). These regulations were rolled back over the 1990s. In 2000, the U.S. Congress passed the Commodity Futures Modernization Act, weakening the rules on position limits and creating the possibility for speculation on unregulated so-called shadow markets (Frenk 2011). By 2008, the two largest index funds held a combined position in grains of 1.5 billion bushels, while the total long position of all index funds was over 2.2 billion bushels (de la Torre & Murphy, 2008).

The volume of activity on future markets leads many commentators to believe that increased speculation is an important, if not the leading, cause of increasing volatility of food prices. Th phenomenon is describe the as the "financialization" of the commodity markets (Domanski and Heath 2007) , or, as UNCTAD described it, the "growing presence of financial investors in future commodity exchanges" (UNCTAD 2009: 53).

Numerous authors (Ghosh 2010; de Schutter 2010) point to the passage of the Commodity Futures Modernization Act as the origin of a new financial product: the commodity index. A commodity index fund is composed of a number of different commodities. These indexes are sold by banks, which in turn hedge their exposure through commodities futures contracts on commodity exchanges. Compared to other financial products, commodity indexes have several advantages that make them very attractive to investors: returns are negatively correlated with returns on equities and bonds that makes the commodity index a useful counter against inflation and changes in the exchange rate of the dollar. Index funds treat agricultural commodities like any other asset, bought and sold in search of profit. Estimates suggest the money invested in commodity index funds increased fivefold from $46 billion in 2005 to $250 billion in March 2008 (WDM, 2010).

A United Nations Conference on Trade and Development (UNCTAD) analysis in 2009 concluded: "part of the commodity price boom between 2002 and mid-2008, as well as the subsequent decline in commodity prices, were due to the financialization of commodity markets. Taken together, these findings support the view that financial investors have accelerated and amplified price movements driven by fundamental supply and demand factors, at least in some periods of time" (UNCTAD 2009).

Others authors argue speculation has no or minimal effect on prices. Sanders, Irwin et al. (Sanders, Irwin et al. 2008) conducted a very detailed analysis of the data published by the Commodity Futures Trading Commission (CFRC) in its three reports: Commitment of Traders, Commodity Index Trader and Banker Participation in Futures Markets. They confirm the dramatic increase in open interest in many futures that started in late 2004 and continued into 2008. They also show the very strong increase in index funds' share of total open interest from early 2005 to mid-2006—before the food price crisis peaked
. "For most markets, the index funds' per cent of open interest peaked in 2006 and has since stabilized, even through absolute position size continues to grow" (17). While the amount of

speculative money has grown, the index funds' share of the total has stabilized.

, Sanders, Irwin et al (2008), are not able to identify any historically high level of speculative activity using an index classically used to evaluate the adequacy of speculation in agricultural future market (the Working's T index). According their analysis, "the much publicized increase in long-only speculative positions is largely accompanied by a comparable increase in short hedging" (Sanders, Irwin et al, 2008, 14).

The authors list three additional reasons to be skeptical about the role of speculation:

- The highest concentration of long-only speculative activity occurred in livestock markets rather than grain and oilseed markets - livestock markets did not experience a price boom in 2007-2008
- Very high prices were recorded for commodities without futures markets and in agricultural futures market that are not included in the most famous commodity index (e.g. rice, milk)
- The period of most rapid growth of index fund activity occurred in 2004-2005, before the price boom.

Gilbert (2010) attempted to quantify the extent to which high commodity futures prices from 2006-2008 resulted from bubble behavior. He used an innovative econometric procedure developed by Phillips, Wu and Yu (2009) to study seven markets: oil, three non-ferrous metals (aluminum, copper and nickel) and three agricultural commodities (wheat, maize and soybeans). He found strong evidence of a speculative bubble in the copper market, a problematic result for oil and nickel and some evidence for soybeans. He did not find evidence of a bubble in the aluminum, maize and wheat markets. Moreover, Gilbert (2010) estimated a very limited impact of index-based investment on grain prices and concludes, "According to this estimate, it would be incorrect to argue that high oil, metals, and grains prices were driven by index-based investment but index investors do appear to have amplified fundamentally-driven price movements" (Gilbert 2010: 28).

More recently, when prices again started to climb in the middle of 2010, the FAO Committee on Commodity Problems concluded that "unexpected crop failure" and "speculative behaviour" rather than "global market fundamentals" were to blame (FAO, 2010). The

Committee pointed to five areas of concern:

a) The lack of reliable and up-to-date information on crop supply and demand and export availability.

b) Insufficient market transparency at all levels including in relation to futures markets

c) Growing linkage with outside markets, in particular the impact of "financialization" on futures markets

d) Unexpected changes triggered by national food security situations

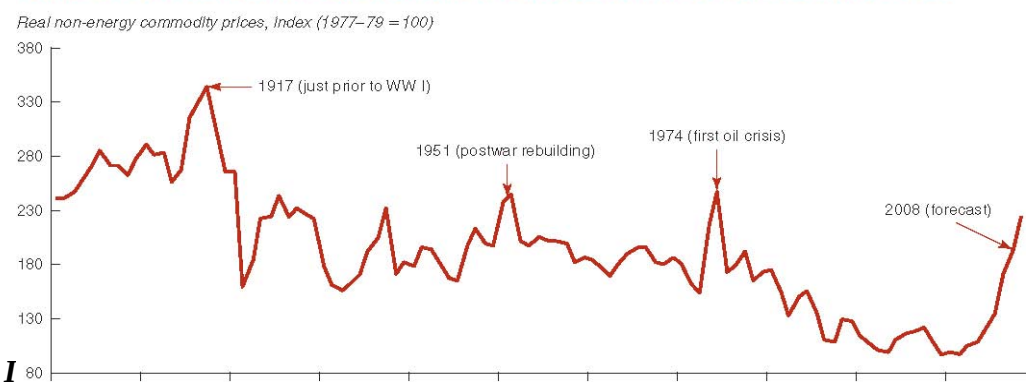
e) Panic buying and hoarding

It seems a series of factors: the deregulation of markets; the breakdown of the regulatory walls that once separated banks from insurance firms; the mobility of capital in the global economy; the volume of trading that is now typical; and, the enlarged mix of interests among those trading contracts, have at a minimum complicated the role played by commodity speculators. The situation invites further investigation as historic assumptions about how commodity markets work are tested in new circumstances.

B. CYCLICAL FOOD CRISES

The idea that food crises are a periodic occurrence can be found in many analytical papers (Gardner 1979; Timmer 2010; Headey and Fan 2010; Prakash 2011; Abbott, Hurt et al. 2008; World Bank 2009) and political declarations (for example "L'Aquila Declaration of the Leaders"). Timmer (2010) gives the following short and simple presentation of the idea: "World food crisis are relatively rare events, occurring roughly three times a century. But they also tend to be regular events, every three decades or so, suggesting there is an underlying cyclical cause" (Timmer 2010: 1). The World Bank , in its Global Economic Prospect 2009 (World Bank 2009), offered a century long presentation of these cycles, identifying four commodity booms since World War I: 1915-1917, 1950-57, 1973-74 and 2003-2008 (see figure 4 and table 4).

Figure 4: Four commodity booms since World War



I

Source: Grilli and Yang (1988) for 1900 to 1947; World Bank for 1948 to 2008.

Table 4: Principal characteristics of commodity booms

Common features	**1915–17**	**1950–57**	**1973–74**	**2003–08**
Rapid global real growth (average annual percent)	—	4.8	4.0	3.5
Major conflict and geopolitical Uncertainty	World War I	Korean War	Yom Kippur War, Vietnam War	Iraq conflict
Inflation	Widespread	Limited	Widespread	Limited second round effects
Period of significant infrastructure investment	World War I	Postwar rebuilding in Europe and Japan	Not a period of significant investment	Rapid buildup of infrastructure in China
Centered in which major commodity groups	Metals, agriculture	Metals, agriculture	Oil, agriculture	Oil, metals, agriculture
Initial rise observed in prices of	Metals, agriculture	Metals	Oil	Oil
Preceded by extended period of low prices or investment	No	World War II destroyed much capacity	Low prices and a supply shock	Extended period of low prices
Per cent increase in prices (previous trough to peak)	34	47	59	131
Years of rising prices prior to peak	4	3	2	5
Years of declining prices prior to trough	4	11	19	—

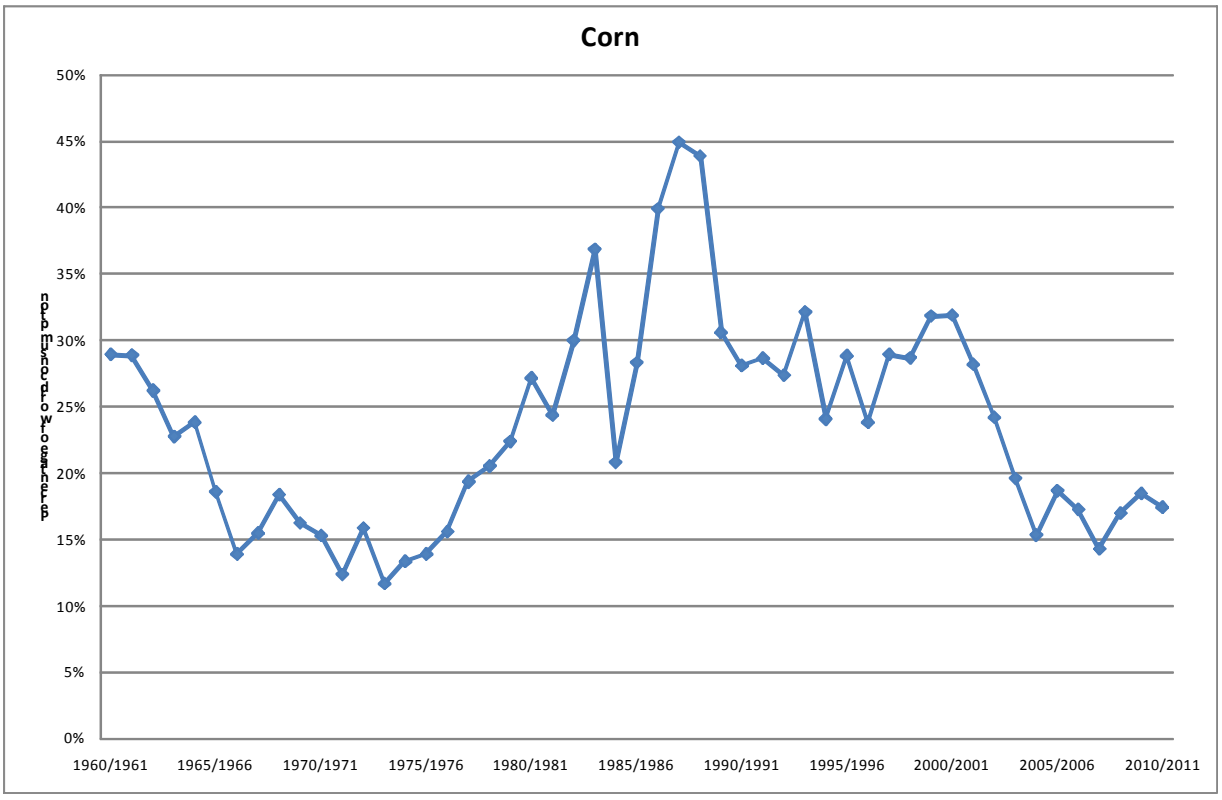
Source: World Bank 2009: 55

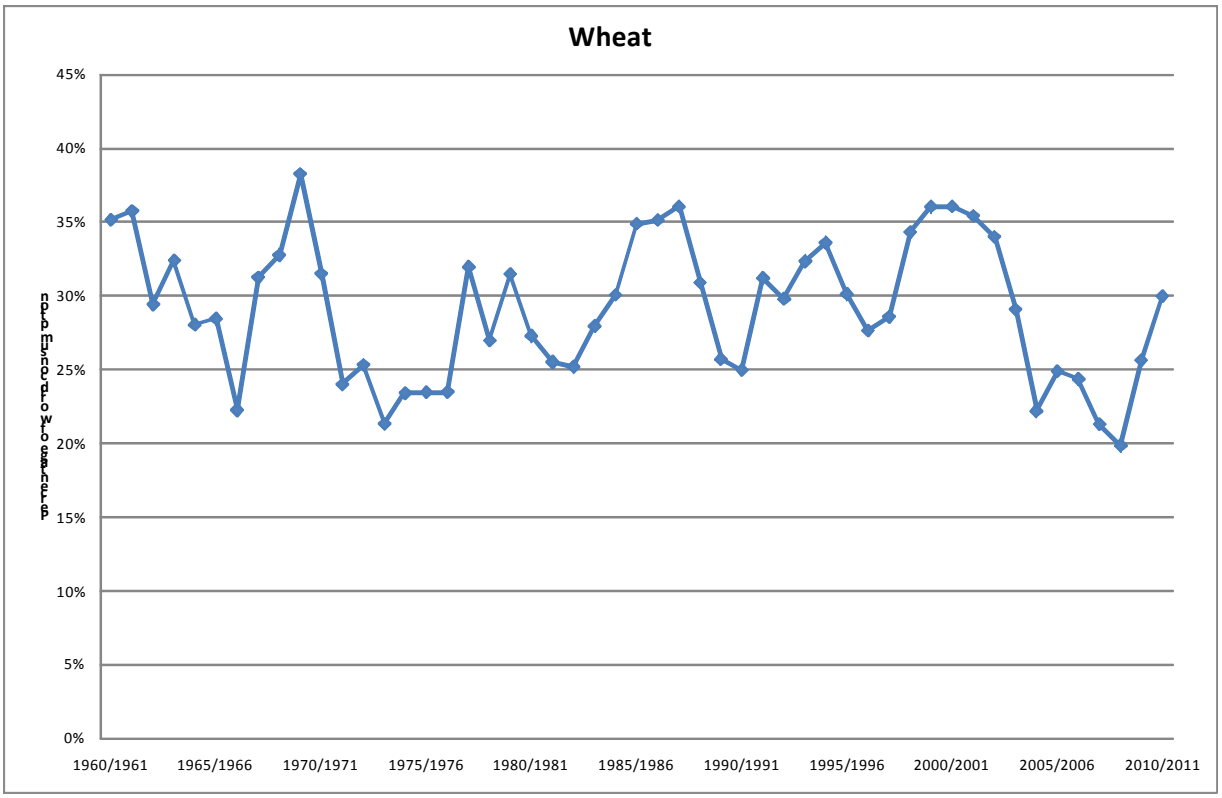
1. Looking for world agricultural cycles

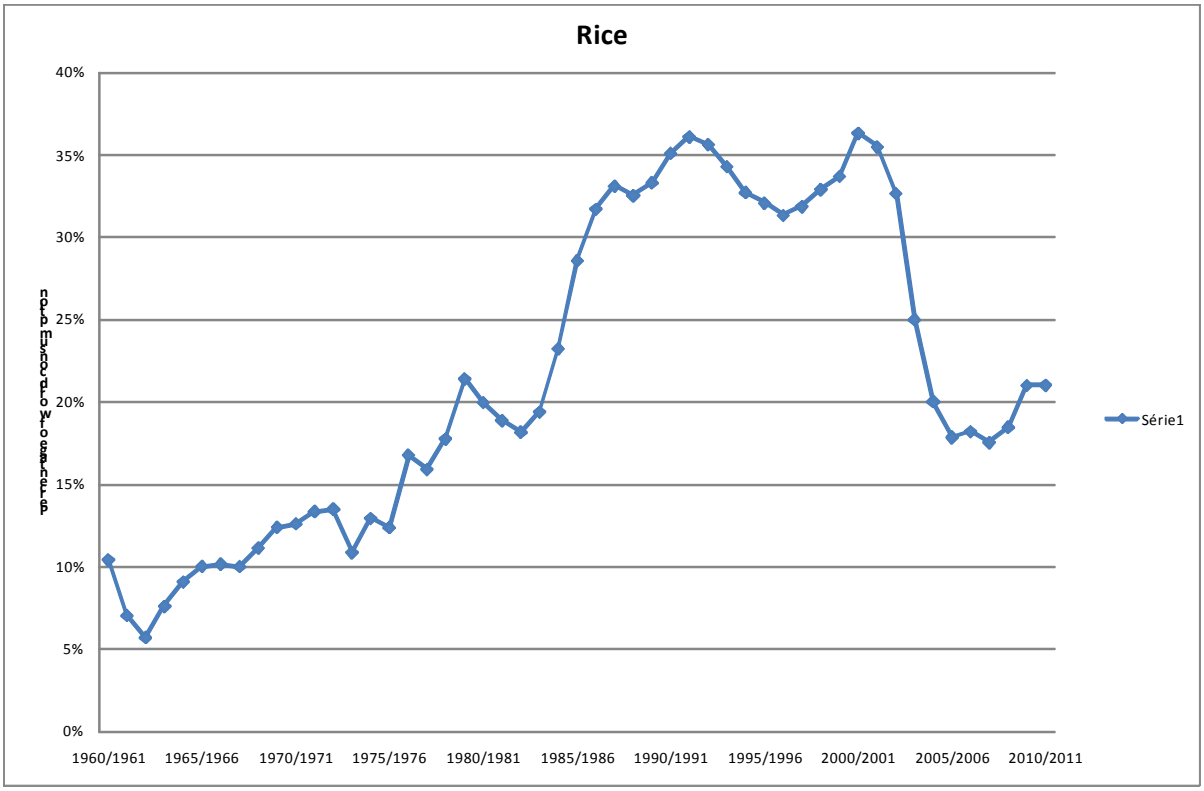
Limiting our analysis to agricultural commodities and to the post World War II period, successive food crises can be related to the evolution of world stocks. This relation on the grain markets has been recently discussed by Gilbert (2010). According to this author: "Low elasticities imply that small shocks to production can have a large price impact. However, the impact of shocks on commodity prices is moderated by stockholding. Low prices, caused either by positive supply shocks, negative demand shocks, or both of these, imply probable positive returns to stockholding. Consumption demand is therefore augmented by stock demand until point as the expected return from holding stocks is equal to rate of interest on comparably risky investments. The fall in prices is moderated to the extent that excess supply is absorbed in stocks. The same mechanism works for excess demand resulting from negative supply shocks or positive demand shocks. These result in destocking thereby augmenting supply. The catch is that destocking requires an inventory. Once stockout occurs, price is determined simply by equality of production and consumption demand. The non-negativity constraint on stocks implies that stockholding behavior will be more effective in moderating downward than upward price movements. This leads to the observation that commodity price cycles will typically exhibit long flat bottoms punctuated by occasional sharp peaks." (Gilbert 2010: 8).

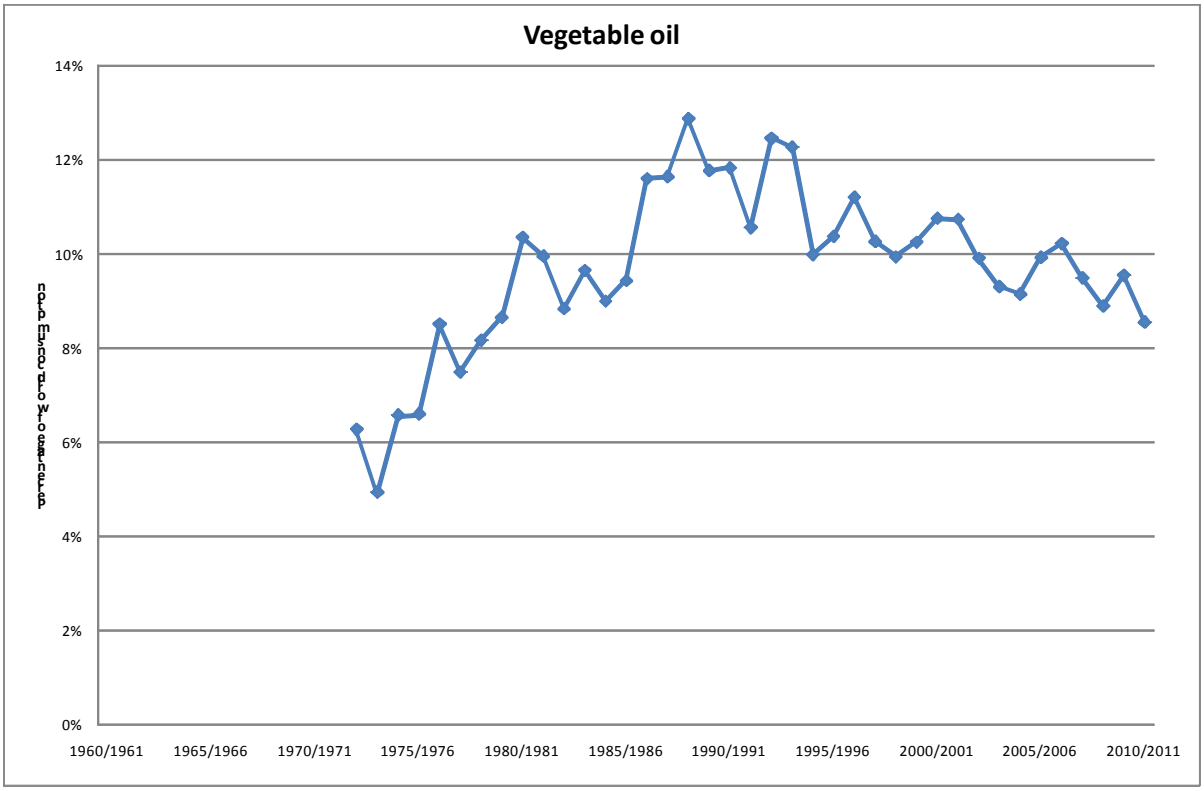
The easiest way to study the evolution of world stocks is to measure them as a percentage of world consumption (see figure 5). The cycle is the most visible for maize, with a clear stock decrease during the 1960s and a low point in early 1970s, followed by a rapid accumulation until the end of the 1980s and then, once again, a decrease until the mid-2000s. A similar evolution can be observed for the vegetable oils market since early the 1970s (we do not have data for the 1960s) where an increase in stock volumes was seen until the end of the 1990s when a slow, on-going decrease was seen. World stocks for rice also show rise-and-fall behavior, but over a longer period, stocks increasing continuously between early 1960s and the beginning of the 1990s and declining abruptly since 2000. World stocks for wheat do not show clear cyclical behavior.

Figure 5: World stocks in per cent of world consumption for corn, wheat, rice and vegetables oils, 1960-2010









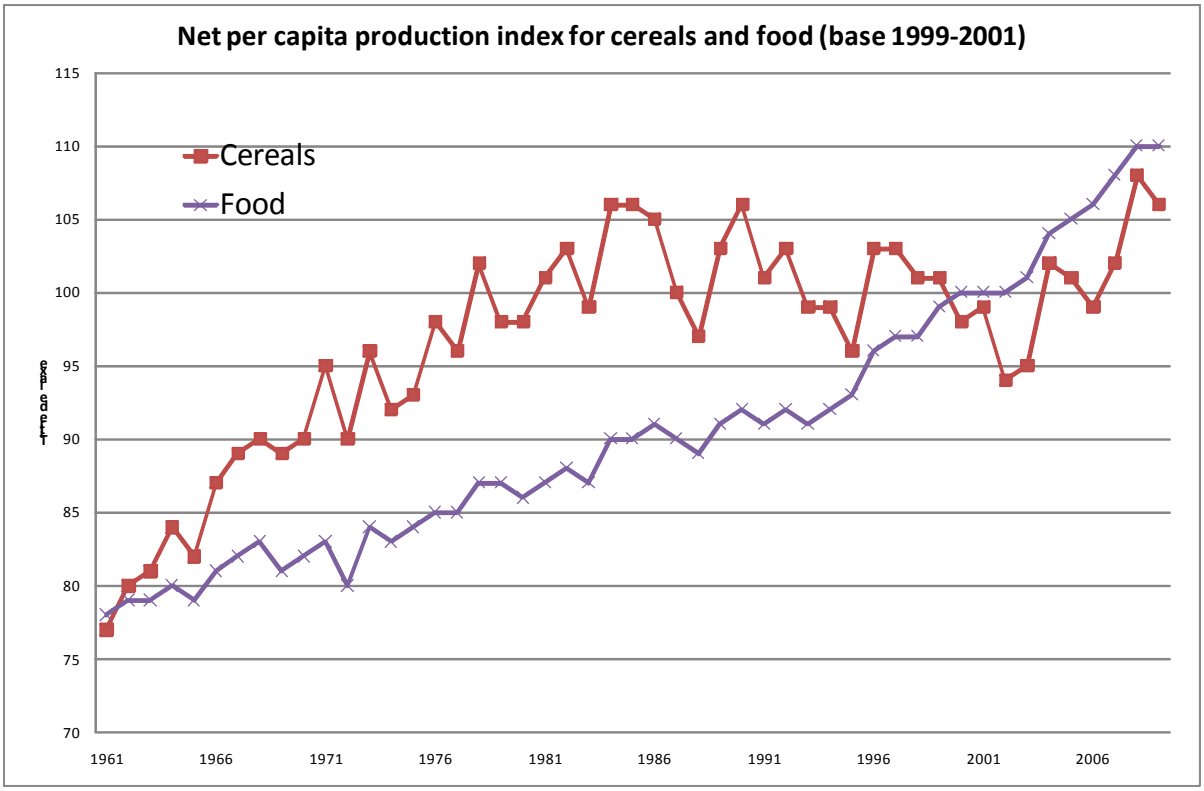
Source: USDA PSD

Gilbert ‘s (2010) statistical analysis of the relation between international prices and stocks for

the three cereals focuses on the relation between deviations from the estimated trend for real price (current price deflated by the U.S. consumer price index (CPI)) and the world stock to consumption ratio. Gilbert's (2010:11) conclusion is that "low stocks appear to have been necessary but not sufficient for high prices historically, suggesting that stocks provide at best partial explanation for price movements".

Is the cyclical dynamic observable at the production level? Partially, yes. Figure 6 presents the evolution of the net per capita world production index for cereals and food. The two indexes evolved with quite different patterns. World cereal production per capita clearly shows behavior quite similar to the world rice stocks behavior: production increases from early 1960s to the mid-1990s, then decreases until early 2000s and then increases again. World food production per capita (that includes cereals) does not show such sharp medium-term variations. However, production slowed (from the mid-1980s to mid-1990s) and then accelerated (since the mid 1990s).

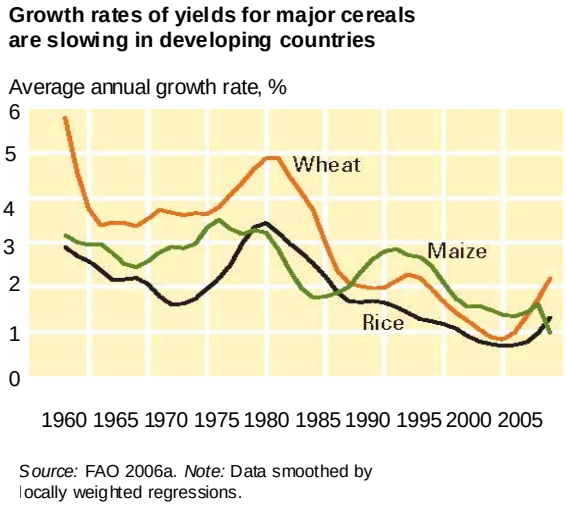
Figure 6: Net per capita food and cereal world production index



Source: FAOSTAT

Finally, cycles can be identified in the intensification dynamic of world agriculture. The figure 7, taken from the World Bank Development Report 2008 (World Bank 2007), presents the evolution of cereal yields growth rate since the early 1960s. Here we can see a long-term trend of decline punctuated by an alternation between phases when growth rates decreased (from the early 1960s until the early 1970s, from early 1980s until early 2000s) and increased (from early 1970s until early 1980s and, apparently, since early 2000s).

Figure 7: Growth rates of yields for major cereals

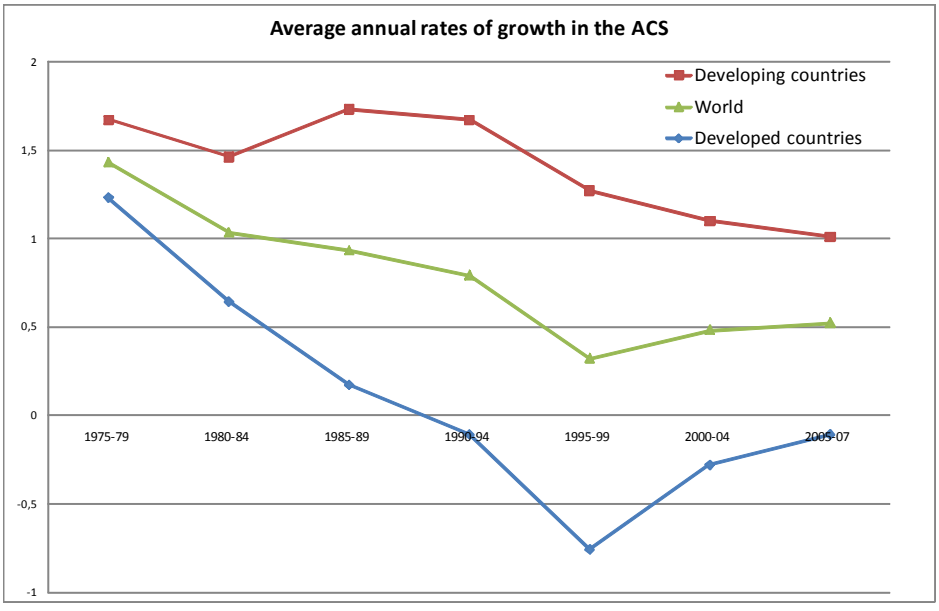


Source: World Bank 2007: 67

2. The decline of agricultural investment

The cyclical dynamic of international food prices and world agricultural production can be attributed to the mid-term evolution of public and private investments in agriculture. Figure 8 shows how the annual rate of growth in agricultural capital stocks (ACS) declined continuously at the world level between the end of the 1970s and the end of the 1990s, falling from about 1.4 per cent to 0.3 per cent on average. This slowing was mostly caused by changes to agricultural capital stock in developed countries, which actually decreased in absolute terms during the 1990s. Every region of the developed world has experienced a decapitalization process that affected agriculture (see table 5): North America came first, starting at the beginning of the 1980s, then Western Europe and Oceania in the early 1990s and finally, Eastern Europe and the Former Soviet Union (FSU). During this first period (1975-2000), the rate of growth in agricultural capital stocks evolved differently in developing countries. The growth rate stayed at quite a high level until the mid-1990s when growth decreased because of a fall in Latin America.

Figure 8: Average annual rates of growth in agriculture capital stock



Source : von Cramon-Taubadel, Anriquez et al. 2009:

Table 5: ***Average annual rates of growth in agriculture capital stock***

Region	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-07
World	1,43	1,03	0,93	0,79	0,32	0,48	0,52
Developed	1,23	0,64	0,17	-0,11	-0,76	-0,28	-0,11
N. America	1	-0,16	-0,23	0,05	0,14	-0,12	0,02
W. Europe	0,93	0,74	0,06	-0,5	-0,27	-0,14	-0,1
Oceania	-0,84	0,24	0,51	-0,17	-0,54	0,49	0,42
Transition	2,03	1,55	0,62	0,07	-2,77	-0,71	-0,31
Developing	1,67	1,46	1,73	1,67	1,27	1,1	1,01
Latin A & C	2,15	1,4	1,76	1,4	0,39	1,16	0,22
Near East & North Africa	0,93	1,76	1,99	1,87	0,71	0,93	0,99
Sub-Saharan Africa	1,68	1,42	1,23	1,86	1,65	1,64	0,96
East & South East Asia	1,75	1,37	2,04	1,8	1,86	1,35	1,73
South Asia	1,61	1,49	1,19	1,42	1,22	0,34	0,32

Source : von Cramon-Taubadel, Anriquez et al. 2009

Since the early 2000s the rate of growth in agricultural capital stocks is increasing again at the world level. This is due to a reversal of growth trends in the developed countries. The rate of agricultural capital stocks growth is still negative in Western Europe, Eastern Europe and FSU but much less than before and growth is now positive in Oceania and (slightly) in North America. On the contrary, the rate of growth in ACS is still decreasing in developing countries with very divergent evolution between developing regions. Since mid-2000, the rate of growth in Latin America, Sub-Saharan African and South Asia is much lower than in the 1970s. East and Southeast Asia is the only developing region where the rate of agricultural capital stock growth remained more or less stable.

3. The decline of public spending on agriculture

The slowing down in agricultural investment growth occurred during a period of restricted public support to agriculture. Fan and Saurkar (2009) used the IMF's *Government Finance Statistics* Yearbooks to calculate government expenditures in real dollars (set in 2000) in 44

developing countries. Table 6 presents a summary of the results of this study. For the whole group, agriculture expenditure increased with a rate of annual growth of 3.2 per cent between 1980 and 2002. Calculated as a percentage of agricultural GDP, public spending decreased from 11 per cent to 6.7 percent. Compared to developed countries, where the ratio was frequently more than 20 percent, this level is extremely low. In Africa, expenditure remained at a relatively stable level (6 to 7 percent). In Asia agricultural expenditure increased very slightly (from 8 to 10 percent), while in Latin America they decreased strongly (from 19 to 11 percent).

Table 6: Government expenditures in agriculture (44 developing countries)

	2000 international dollars, billions				***per cent of agricultural GDP***			
	1980	1990	2000	2002	1980	1990	2000	2002
Africa	7.3	7.8	9.9	12.6	7.4	5.4	5.7	6.7
Asia	74.0	106.5	162.8	191.8	9.4	8.5	9.5	10.6
Latin America	30.5	11.5	18.2	21.2	19.5	6.8	11.1	11.6
Total	111.8	125.91	190.89	225.61	11.2	7.9	6.9	6.7

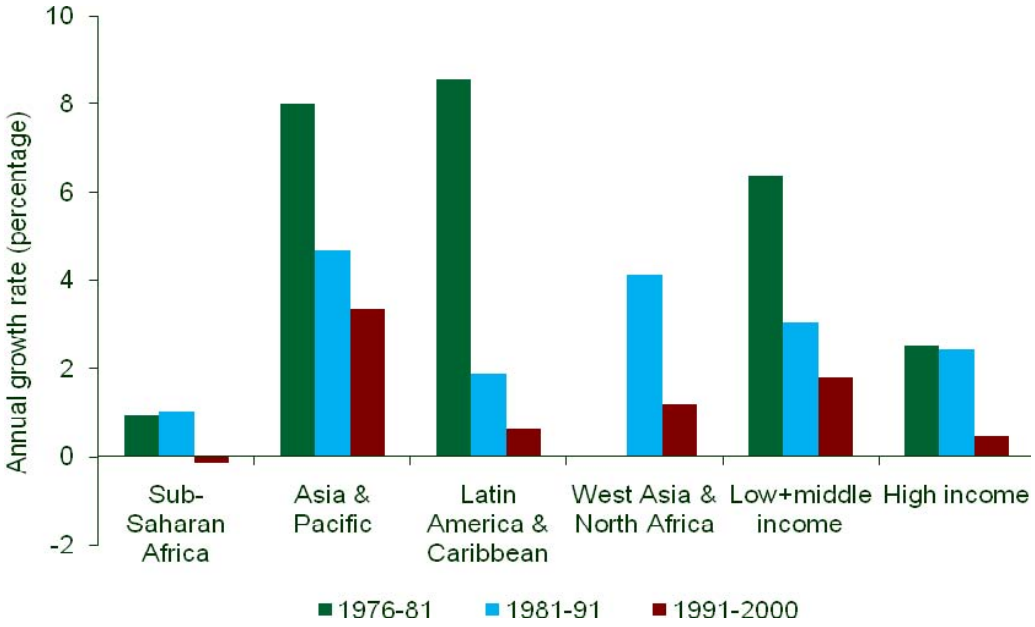
Source: Fan and Rao 2003; Fan and Saurkar 2006.

The growth rate of agriculture public expenditure for in developing countries was particularly slow between 1980 and 1990. Measured in 2000 international dollars, it fell by two thirds in Latin America and stagnated in Africa. Asia was the only developing region were public expenditure continued to grow quite steadily, more than doubling between 1980 and 2000.

This general slowing down of government expenditure did not spare agriculture research. Figure 9, taken from Beintema and Elliot (20009) shows the importance of decreased public investment in agriculture between 1981 and 2000. This trend was not equal across all regions of the world. In the Asian region, public investment in agriculture decreased but stayed quite high (around 4 per cent) mostly because of the high growth of agriculture research and development in China and India. In contrast, spending in Africa almost stagnated on average between 1980 and 2000 and actually diminished during the 1990s. In Latin America, public spending for agricultural R/D grew slightly in the 199Os (less than one per cent) after a

spectacular slowing down from the late 1970s.

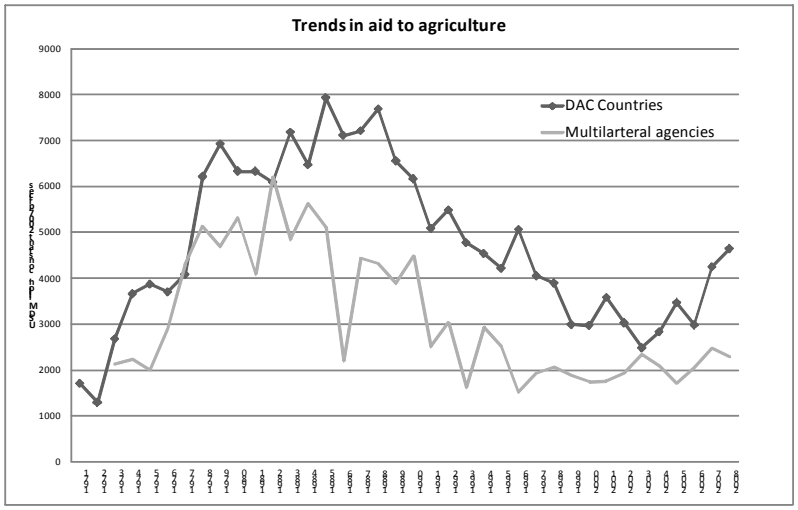
Figure 9: Growth rates in public agricultural research expenditures, 1981-2000



Source : Beintema and Elliott 2009.

Financial aid provided by OECD countries and multilateral agencies to developing countries did not counter this trend. Indeed, ODA certainly contributed to the trend away from public investment in agriculture in the poorest countries. Measured in constant terms, the aid provided by OECD countries for agriculture decreased almost continuously from the end of the 1980s to mid 2000s, reaching a quarter of its former level. Aid provided by multilateral agencies decreased earlier (mid-1980) and stabilized from the mid-1990s at a third their initial volume (See Figure 10).

Figure 10: Trends in aid to agriculture, DAC countries and multilateral agencies, 1971-2008



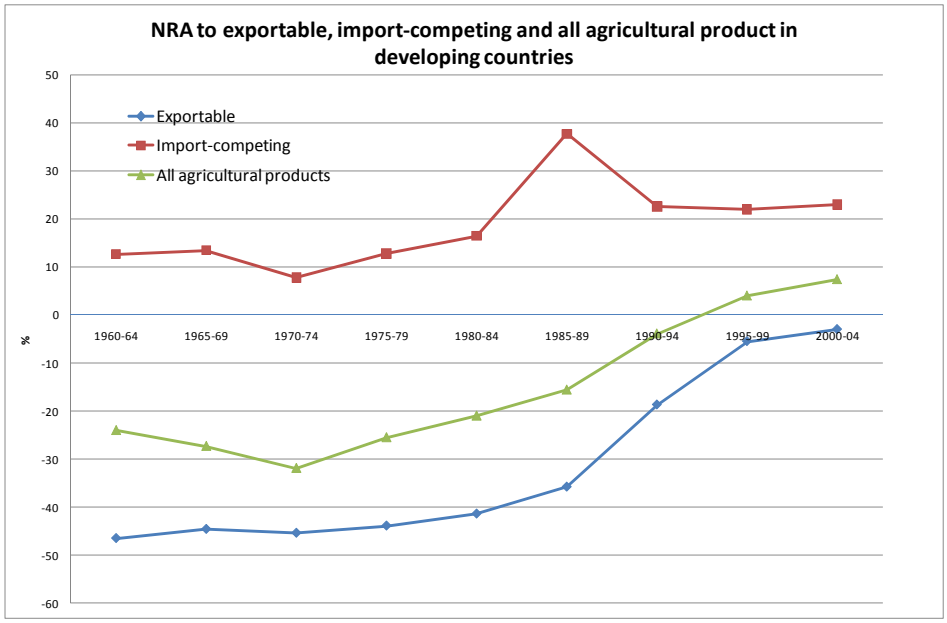
Source: OECD 2010

4. The decline of public support more broadly

The analysis of direct government expenditure of agriculture in developing countries must be completed by an examination of indirect support generated by public intervention on markets. Many works have been published on this topic. Perhaps the best-known measure is the PSE – the Producer Support Estimate – of the OECD. The PSE evaluates the monetary value of policy transfers, including both price support from border measures and budgetary payments. Kym Anderson and his colleagues from the Agricultural Distortion project developed a variation of this measurement for their recent long view analysis (Anderson, Croser et al. 2009). They calculated what they call the Nominal Rate of Assistance for 75 countries and 70 products, covering about the two-thirds of global farm production. The Nominal Rate of Assistance (NRA) is, "computed as the percentage by which government's policies have raised gross returns to farmers above what they would be without the government intervention (or lowered them, if NRA<0). Included are any product-specific input subsidies" (Anderson, Croser et al. 2009: 5).

For developing countries as a whole, the NRA has moved from about -25 per cent in early 1960, to a low point of -32 per cent in the early 1970s, and then, with a continuous increase, to +9 per cent during 2000-04. This evolution reflects especially NRA expenditures focused on exports. These were heavily taxed (explicitly or implicitly) from the 1960s to the 1980s, but now, on average, they are almost free of tax. The changes in monetary policy (for example, the end of dual exchange rates) explain a large part of this shift from negative to positive assistance rates. The evolution of NRA for import-competing products, which are the most important for food security, is much less drastic. Always positive, NRA increased strongly from 15 per cent to almost 40 per cent at the beginning of the 1980s when international prices started their fall. NRA levels then decreased and stabilized around 20-25 per cent (see Figure 11).

Figure 11: Nominal rate of assistance to exportable, import-competing and all covered agricultural product, developing countries, 1960-2004

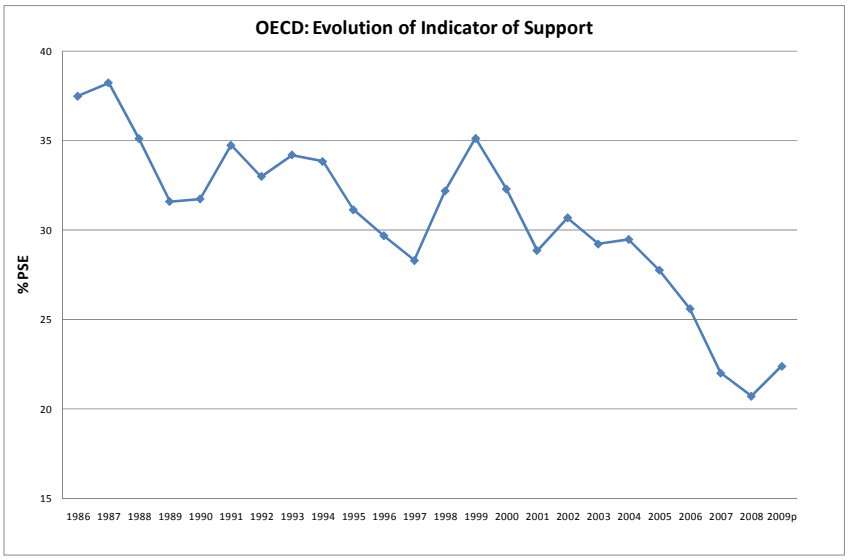


Source: Anderson, Croser et al. 2009

The changes in NRAs at the regional level are very divergent. For two regions, Latin-America and China-South East Asia, NRA increased noticeably from the early 1970s, when NRAs was negative, to become positive and superior to 10 percent. On the opposite side of the spectrum, South Asian NRA was very high in the 1960s, 1970s and 1980s (at about 40 per cent with a peak at 60 per cent on average during the 1985-89 period) and decreased during the 1990s to a low point of 15 per cent before increasing again, but without reaching the Green Revolution level. Finally, NRA in Africa has fluctuated around 10 per cent (except during the 1985-1989 when it jumped to almost 60 percent) but was reduced to only 2 per cent in early 2000s, a historically low level. These numbers suggest there is no easy relationship in which "distortions" on agricultural markets are somehow compensating for slow growth or the lack of public investment, since countries have very different policies in this regard. It could be the case for Latin America but certainly not for South Asia and Africa.

Finally yet importantly, public support to agriculture in OECD countries declined continuously from the mid-1980s. The PSE numbers are presented in figure 12 as a percentage of gross farm receipts. The PSE slipped from 38 per cent in 1987 to 26 per cent in 2006 and then fell again in 2007 and 2008 (due to the rise of international prices), to about 20 per cent..

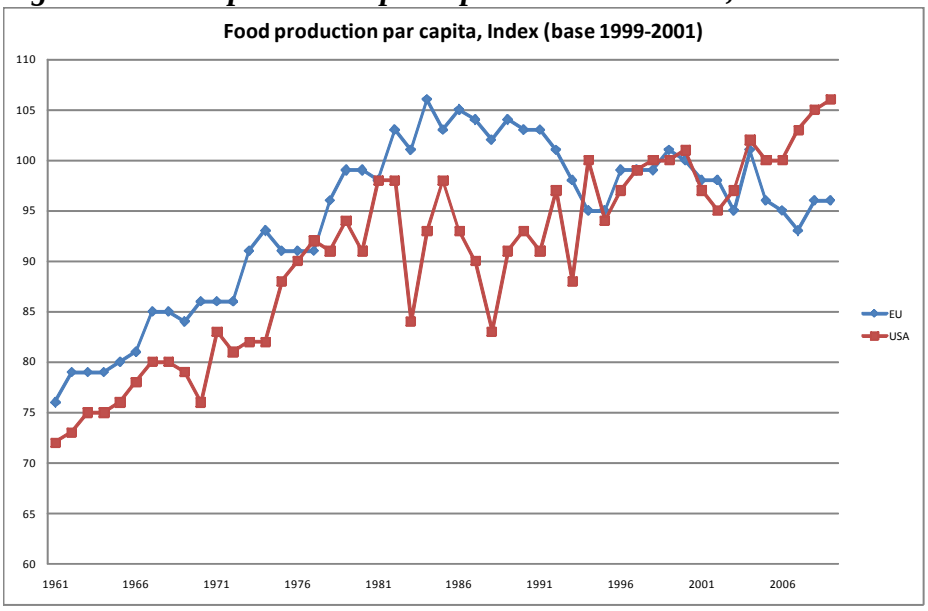
Figure 12: Evolution of indicator of support (per cent PSE) in OECD countries, 1986-2009



Source :OCDE PSE/CSD database

The numbers imply that OECD countries are pulling back from various kinds of support to producers that historically have contributed to significant agricultural commodity surpluses. These surpluses often ended up on international markets, sold at less than cost of production prices to the detriment of competing producers in developing countries (Ritchie, Murphy et al. 2003). Figure 13 below illustrates the fall-off in food production per capita in both the U.S. and E.U. as PSEs fell sharply at the end of the 1990s, and early in the 2000s

Figure 13: Food production per capita in EU and USA, 1961-2009



Source: FAOSTAT

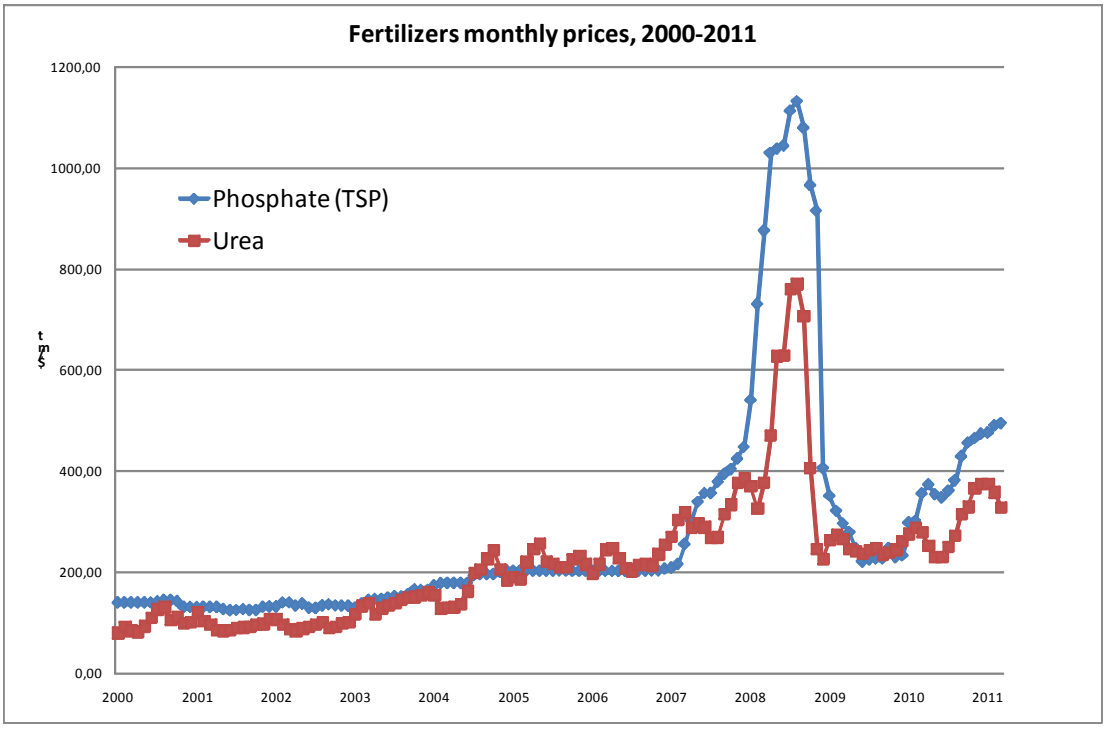
The massive public support for biofuels seems to be as the exception to the general movement to reduce financial aid to agriculture in OECD countries. In a quite incoherent way, the E.U. and USA have boosted demand for agricultural commodities, including food products, by their support for the biofuel industry at the same time as they have reducing support to agricultural production, at home and in the poor countries. In 2009, governmental support for biofuels reached about 8 billion dollars in the EU and USA (International Energy Agency 2010).

C. EMERGING SCARCITIES

Do the recent price increases signal a more radical change in the ability of world agriculture to supply a demand growth that seems to be without limit? Scarcity is the key word of this third interpretation of the food price rises, a word that can be found in a growing number of publications from a large range of observers: academics (Koning, Van Ittersum et al. 2008; Standing Committee on Agricultural Research 2011; McIntyre, Herren et al. 2009; Evans 2010), think tanks (Brown 2011 :60; Evans 2009), banks (Rabobank 2010; Schaffnit-Chatterjee 2009), CSOs (Heinberg and Bomford 2099), international organizations (IMF 2011). What is needed is to understand if the food crisis is indicative of the end of a long period of structural overproduction in international agricultural markets made possible by the extensive use of cheap natural resources (oil, water, biodiversity, phosphate, land). In other words, are we at the end of a period of historically unprecedented agricultural production growth that relied in effect on a strategy akin to mining?

The rapid fall of agricultural commodity prices in 2008 and 2009 tended to confirm the idea that the price rises of 2007/08 were another manifestation of the intrinsic volatility of food markets. However, today, in 2011, prices have again started to rise with the renewal of world economic growth. However, not only food prices are increasing. Since 2003, fertilizer prices have also climbed. They experienced the same spike as food prices in 2007-2008 and have again begun increasing since the beginning of 2010. In April 2011, the prices of phosphate (TSP) and urea are four times higher than in 2000 (see Figure 14).

Figure 14: Fertilizers monthly prices, 2000-2011



Source: World Bank

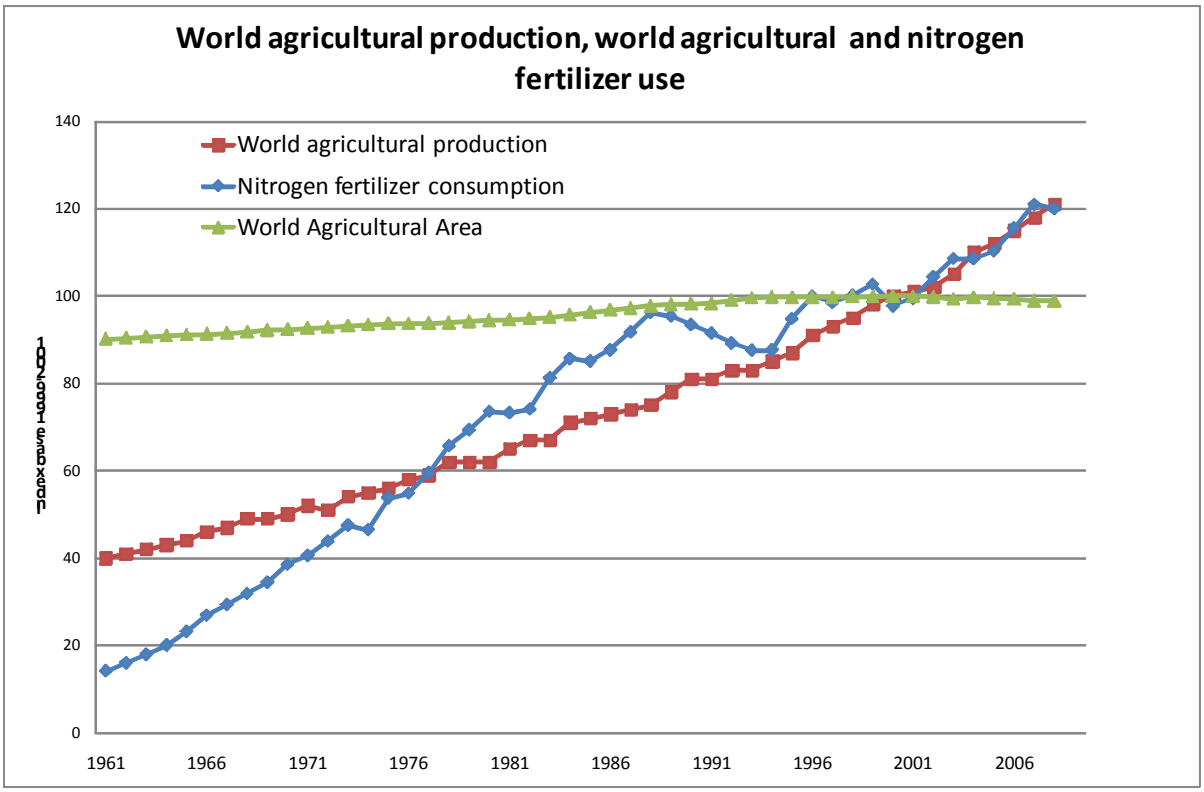
In the context of this third interpretation of why food prices increased, the word scarcity is used in a broad sense to mean, "not only an observed shortage of natural resources, but also a perceived dependency on natural resources and fear of their global depletion" (Passenier and Lak 2009: 17). It is a societal and not natural concept, "because scarcity depends on the level of demand" (Standing Committee on Agricultural Research 2011: 12); it is not that there are not enough resources to meet human **needs**, only that there are not enough resources to meet human **demand**.

1. When the green revolution met its limits

As it is well known, since the 1950s, the growth of agricultural production has been largely based on the growth of yields per hectare (ha), while the total cultivated area increased relatively little, from 1.4 to 1.5 million ha between 1950 and 2005 (McIntyre, Herren et al. 2009). This spectacular growth of agricultural yield is tightly linked to the increased use of inputs per ha, in particular the use of fertilizers. For instance, figure 15 shows how, since 2000, agricultural production has grown very closely with the growth in the use of nitrogen

fertilizers. In close relation with this increasing consumption of agricultural inputs, genetic improvement played a major role in agricultural growth providing a continuous stream of new cultivars for farmers

Figure 15: World agricultural production, world agricultural area, and nitrogen fertilizer use



Source: FAOSTAT

This model of agricultural growth, known in developing countries as the "green revolution" but also followed in developed countries, currently provokes much debates and questions. It is not possible to do justice to the literature on this topic in this paper. However, the following sections emphasize some of the trends that represent powerful limitations on the future of this model for raising agricultural productivity. This presentation of current constraints does not take into account the expected or projected effects of climate change, which will is expected to reinforce some of the trends towards depletion that already exist, particularly for water (IPCC).

a) Closing the yield gap

The evolution of the yield potential of new cultivars and the yield gap is the first concern.

Yield potential is defined as the yield of a crop cultivar when grown in environments to which is adapted, with unlimited nutrients and water, and pests and diseases effectively controlled. The difference between yield potential and the actual yield achieved by farmers represents the exploitable yield gap.

According to Cassman et al's (Cassman, Dobermann et al. 2003) study, the evolution of yields for rice, wheat and corn, "while maintenance breeding continuously identifies new cultivars with yield potential equivalent to older cultivars there in no increase in yield potential per se". In other words, the best cultivars cultivated in the best conditions 30 years ago had a yield equivalent to the best cultivar cultivated in the best conditions today. This means that most of the genetic improvement has been dedicated to counter the increasing pressure of the environment (mostly disease and insect pressures). In front of this almost stagnant yield potential of the new cultivars, actual yields have been growing continuously at the world level. Actual yields have only improved because of changes to growing conditions that allowed producers to narrow the yield gap, not because any new cultivar with a higher yield potential has emerged. Currently, actual yields for rice in China, India and Indonesia and wheat in Mexico are reaching about 80 per cent of the potential yield, a level that is considered by Cassman et al (2003) as an on-farm maximum. The situation is particularly acute for rice and much less for maize. Actually, yield trends manifest evidence of stagnation in several Asian regions (McIntyre, Herren et al. 2009: 21).

b) Spoiling the input sources

The pursuit of the agricultural growth is also directly threatened by the depletion of many of the resources that sustained it. Since 1960, a third of the world's farmland has been abandoned because it has been degraded beyond use and it is estimated that about 10 million ha are destroyed every year (Schade and Pimentel 2010). Over-extraction of ground water is evident, particularly in North East and North Africa, where irrigation draws on fossil aquifers. In large areas of China and India, ground water levels are falling by to three meters per year (Global Perspective Unit (FAO) and Natural Resources Department (FAO) 2011). The future of irrigated agriculture is also threatened by salinization. However, estimates of the area likely to be affected by salinization vary significantly, ranging from 10 to 50 per cent of irrigated land.

Agriculture, like the rest of the economy, is confronted with probable scarcity of oil and natural gas. For the last 50 years, agricultural growth, and more generally the supply of food, has been based largely on the intensive use - direct and indirect - of these fossil fuels. The estimates of the performance of the agro-food system are very divergent. For some authors, more than seven calories – mostly from fossil fuel - are used by the U.S. agro-food system to deliver each calorie of food energy (Heinberg and Bomford 2099). Because of the importance of the energy consumption in transportation and transformation of the raw commodities, farming accounts for only 20 per cent of total energy use. However, with such a figure, agriculture consumes more calories than it generates. The same poor performance is estimated in the British food system (Lucas, Jones et al. 2006). A large part of the energy used at farm level is for fertilizers, particularly nitrogen fertilizers. In UK wheat bread production, half of the energy used is for fertilizers, 90 per cent of which is fro nitrogenous fertilizer production (Woods, Williams et al. 2010).

Phosphate is another essential input that could face depletion in coming years. Intensive agricultural production is dependent on phosphate fertilizers derived from mined rock. Since World War II, global extraction of phosphate rock has tripled. The world's phosphate rock reserves are concentrated in a very limited number of countries, including China, US and Morocco. The supply of phosphate fertilizers is threatened by shrinking reserves although estimates of the stocks are contradictory. Some studies claim that at current rates of extraction, reserves will be depleted in 50 to 100 years (Cordell, Drangert et al. 2009). Others claim an imminent phosphorus peak (Dery and Anderson 2007). Still others say that depletion is not very likely in the near term and that about only 40-60 per cent of the current resource base will have been extracted by the end of the century.

c) Polluting local and global commons

Nitrogenous fertilizer use, but also fixation via the cultivation of leguminous crops and the spreading of animal manure, is a source of concern regarding its interference with the nitrogen cycle. Human activities now transform more nitrogen from the atmosphere into reactive forms than all terrestrial processes combined. A large part of the reactive nitrate ends up in waterways and coastal zones, in turn contributing to their eutrophication. In humid regions, up to 30 per cent of nitrogen input into agriculture is leached into water systems. According to the first European Nitrogen Assessment (Sutton, Howard et al. 2011), the total cost of the

nitrogen pollution of water, atmosphere and of its impacts on ecosystems and climate change is estimated between 70 to 320 billion Euros a year, (150 to 736 Euros per person per year), which is more than twice the monetary benefits derived from agriculture.

Rosckström, Steffen et al. 2009) identified a number of environmental variables (climate change, ocean acidification, stratospheric ozone, biogeochemical nitrogen and phosphorus cycle, land system change, rate of biodiversity loss) as "the planetary boundaries"— the limit within which humanity is supposed to be able to operate safely. The study estimated that the current fixation of atmospheric nitrogen should be reduced to about 25 per cent of present industrial and agricultural fixation levels.

Nitrous oxide is also a greenhouse gases emitted by agriculture along with methane and carbon dioxide. In 2005, Greenhouse gas emissions from agriculture accounts to 10-12% of emissions (30% when deforestation is also taken into account). Methane and nitrous oxide – which are both potent greenhouse gases and closely associated with livestock production – contribute more to global warming than carbon dioxide. Agriculture, therefore, has a global warming effect equivalent to that of industry and superior to transport.

Of course, all these negative externalities of modern "agriculture" are - by definition - not included (or only marginally included) in production costs. They cannot then be invoked today to explain rising food prices. From this point of view, they a discussion of pollutions generated by agriculture may not belong in a report dedicated to price volatility. However, from a long term perspective that aims at the realization of sustainable development and food security means these costs will have to somehow be internalized. Indeed, the current food price rises, where they have not generated major problems on the consumer side, should be considered as an opportunity for public policy to at least begin this process of internalizing what are now known costs in industrial agriculture.

2. An unlimited demand for agricultural product

In front of a supply growth facing an increasing number of constraints, food demand seems to be without limits. Table 8 presents world consumption growth rates for three major products: cereals, vegetables oil and meals.

Table 8: World consumption growth rate for cereals, vegetable oils and meals, 1980-2009

		1980-89	1990-99	2000-2009
Cereals	Total world	1,8%	1,0%	1,8%
	World less FSU*	1,9%	1,9%	1,9%
Vegetable Oils	Total world	4,9%	4,5%	5,2%
	World less FSU	5,2	4,7%	5,3%
Meals	Total world	3,6%	4,2%	3,8%
	World less FSU	3,6	4,8	3,7

Source: data from USDA/PSD (*) FSU= Former Soviet Union

Table 8 shows first how the world cereal supply/demand balance has been made easier by the spectacular contraction of food demand in the Former Soviet Union and Eastern Europe. Cereal consumption in the FSU alone fell from 215 million metric tons in 1990 to 105 million metric tons in 1999 before recovering to about 130 million metric tons in 2010, still far below its 1990 level. Production also fell over this period, but by less and then grew again from 1999 to 2008. Because of this divergence, the FSU switched from being an importer of almost 50 million metric tons at the end of the 1980s to an exporter of 55 million metric tons in 2008. This dramatic evolution of the FSU trade in cereals, provoked by a totally contingent event, contributed decisively to delaying the international food price rise. For the rest of the world, the growth in cereal consumption has been very stable for the last 30 years, averaging 1.9 percent annual growth. Since 2000, with the stabilization of the situation in FSU, the growth of world cereal consumption recovered its rate of the 1980s.

The growth in vegetable oils and oilseed meals consumption has been less sensitive to the FSU economic crisis . The rate of growth in vegetable oil and oilseed meal consumption has also been higher: around 5 per cent for vegetable oils and around 4 per cent for meals.

a) Population growth and urbanization

Population growth has been the main driver of food consumption growth. Global population doubled between 1961 and 2001. However, because population growth is slowing down, its influence is declining. The population growth rate peaked at 2.2 per cent a year in 1963. It has

now fallen to about 1.2 percent. Most growth (90 per cent) is occurring in developing countries, particularly in Africa.

Urbanization is a major cause of change in food demand. In 2009, the number of people living in urban areas (3.42 billion) surpassed the number living in rural areas (3.41 billion). In 1950, the urban population was equal to just 23 per cent (732 million) of world population.

Urban populations are supposed to have lower food requirements than rural population because of their sedentary lifestyle. More importantly, all their food needs must be supplied by the market. Urbanization implies a transformation of diet including, in particular a shift to a more diversified foods and increased consumption of processed products that are easier to cook. Urbanization rules out – unless at a very high cost – the use of human excreta as a fertilizer.

b) Income growth, livestock products consumption and waste

Income growth, together with urbanization has been a major driver of change in food consumption. It is accompanied by a move toward sugar, vegetable oil and livestock products (Kearney 2010). Consumption of livestock products has been increasing dramatically in developing countries since the 1960s. Consumption of milk has almost doubled, consumption of meat has tripled and egg consumption has increased fivefold in the same period (FAO 2010). However, this growth is very unevenly distributed. The most impressive growth has occurred in East and South East Asia. In China, per capita consumption of meat, milk and eggs increased by a factor four, ten and eight respectively. Yet, in Sub-Saharan Africa, meat and milk consumption declined slightly. In developed countries as a whole, consumption of livestock products grew, but only very slightly – 0.6 per cent per capita and per year for meat, 0.5 per cent for milk and 0.6 per cent for eggs from 1995 to 2005. However, patterns were very different within each commodity group. For instance, meat consumption is still increasing in the USA (0.8 percent per year) but declining in France, the Netherlands and New Zealand. Despite the very rapid growth of livestock product consumption by populations in developing countries, the quantities consumed per capita are still very unequal. For example, in 2005, annual meat consumption per capita was equal to 127 kg in the U.S., 83 kg in Germany, 81 kg in Brazil, 59 kg in China, 5 kg in India and 4 kg in Burundi.

Food waste increased simultaneously with income and urbanization. In the UK it is estimated that about a third of the food bought by households is thrown away (WRAP 2009). Hall et al. (2009) calculated the energy content of all US food waste and show that per capita food waste increased by 50 per cent from 1974 to 2003, reaching more than 1400 kcal per person per day. Food waste has progressively increased from about 30 per cent of the available food supply in 1974 to 40 per cent in recent years.

c) New competing demand for agricultural products

Our fossil fuel dependent societies have been used to (almost) limit the demands they make on the biomass to food. Industrialized societies make little demand on the land for building materials and for clothing, no demand for heating, for transportation. This virtual absence of non-food demand was a radical departure from the situation in what is thought of as traditional society. The possible end of fossil fuel reserves, or the need to restrict their use because of the climate change, brings us to a new watershed.

We have already discussed the use of agricultural commodities in the production of biofuels. Actually, biofuels are just the first significant move to use biological resources (or biomass) for non-food purposes. Other uses are just getting started. What is at stake is the transition toward the bio-economy or a biobased economy (Langeveld, Dixon et al. 2010).

The move back to biological resources for the provision of goods and services previously provided by non-biological sources (for fuel, building materials, textiles…) is problematic. On the one hand, this is a potentially positive development. Dependence on fossil fuels creates crippling demands on scarce foreign exchange in many developing countries, and using the land to produce energy and other non-food needs has always been a feature of rural economies. On the other hand, a number of OECD countries have significantly increased their already unsustainable use of energy and natural resources by using public money to stick biofuels into existing patterns of energy consumption. At the same time, they have added rich countries' demand for energy into the mix with everybody's demand for food, increasing inelasticities of demand, as was described above.

The problem highlighted by biofuel consumption does not lie with biofuels *per se*; few of the

criticisms leveled at biofuels are inherent to the technology. The problem lies rather in the way the biofuels industry highlights inequities: between the energy consumption of those living in rich countries and the unmet demand for food in poorer countries; between the handful of transnational agribusinesses and energy companies invested in biofuels and the net food importing developing countries that rely on world markets for a share of their food supply.

While the use of biomass for energy is widespread across developing countries, the biofuel industry that competes for agricultural commodities is overwhelmingly based in industrial and emerging economies. The biggest biofuel users are the European Union, the United States, and Brazil, while China and India are also emerging as big users (IEA, 2007, p.15). Brazil and the United States jointly produce more than 75 per cent of the world's ethanol supply (Brazil uses sugarcane and the United States uses maize). The EU produces almost 80 per cent of global bio-diesel, with almost half of global bio-diesel production occurring in Germany alone, using canola (UNCTAD, 2006). National level price volatility and food security

II. Price transmission and its consequences for food security

A. The transmission of international price volatility to domestic markets varies across developing country domestic markets

Although raising food prices in global markets represents a serious threat to vulnerable people in developing countries, domestic food price inflation and volatility determine the poverty and food security impact of international food crises and not world food prices (Mousseau 2009). The consequences of international food price volatility on food security can be very different both across and within countries.

Studies on the transmission of the 2007/08 price spike indicate that most prices in developing countries exhibit incomplete pass-through of international price changes to domestic prices, characterized by a slow adjustment process with a limited response of national prices to world prices in the short-run, but a higher response in the medium-term (Dawe 2008; FAO 2009; Daviron, Auber et al. 2008; Minot 2010; Blein and Longo 2009; Dialo, Dembele et al. 2010).

Dawe (2008) analyzed the transmission of the recent increases in international cereal prices to

the domestic markets of seven large Asian countries by using the simple method of cumulative changes in international and domestic real rice prices between the fourth quarter of 2003 and the fourth quarter of 2007, i.e. before the end of the price rise. The results show that the increases in real domestic rice prices represented 6 per cent of the increases in real world rice prices in Philippines against 64 per cent in China (see table 9).

Table 9: Cumulative percentage changes in real prices, Quarter 4 2003 to Quarter 4 2007

Country	World price (US$)	World price in Domestic currency	Domestic price in Domestic currency	Pass through (%) = 3/1
Bangladesh	56	55	24	43
China	48	34	30	64
India	56	25	5	9
Indonesia	56	36	23	41
Philippines	56	10	3	6
Thailand	56	30	30	53
Viet Nam	39	25	3	11

Notes: Data for China compare 2003 and 2007; data for Viet Nam compare 2003 and 2006 (annual)

Sources: Table reproduced from Dawe, David (2008)

The pass-through percentages were used to classify the seven countries in two groups. The first group (India, Bangladesh, Indonesia, Philippines, and Viet Nam), includes countries defined as the "stabilizers," with the increases in domestic prices being less than half of the increase in world markets prices. These countries used policy instruments such as government stocks, procurement, distribution, and trade restrictions to disconnect their domestic prices from price increases in international markets. The second group of countries allowed the international price movements to be transmitted to their domestic markets. China and Thailand constitute this group with pass-through rates greater than half of the increases in international prices. Even though these countries used storage and procurement, domestic prices were allowed to mirror the movements of international prices. This result for China is quite surprising considering the trade policy pursued by the country (OECD 2009). It

illustrates higher domestic inflationary pressure within the country than a real transmission of the international price rise.

Blein et al's. (2009) review of studies analyzing the transmission of international prices to domestic markets for rice and maize during the 2007/08 price spike () concludes that most domestic markets have been less exposed to world price shocks, although the situation varies by country and region. For example, lately there has been high price transmission in Darfur, which makes sense in that it is almost entirely dependent on imports – largely explained by the fact that the Sudanese government has not implemented measures to control price transmission (FAO 2011). Where domestic and international prices move together, about 54 per cent of the increase in world prices is expected to be transmitted in domestic markets in Sub-Saharan Africa. While on average, one-third of the increase in international real rice prices was transmitted in Asian domestic markets. Strong price transmission was found for rice in Senegal, which depends on rice imports from Asian exporters for more than 83 per cent of its domestic consumption needs (Blein et al. 2009).

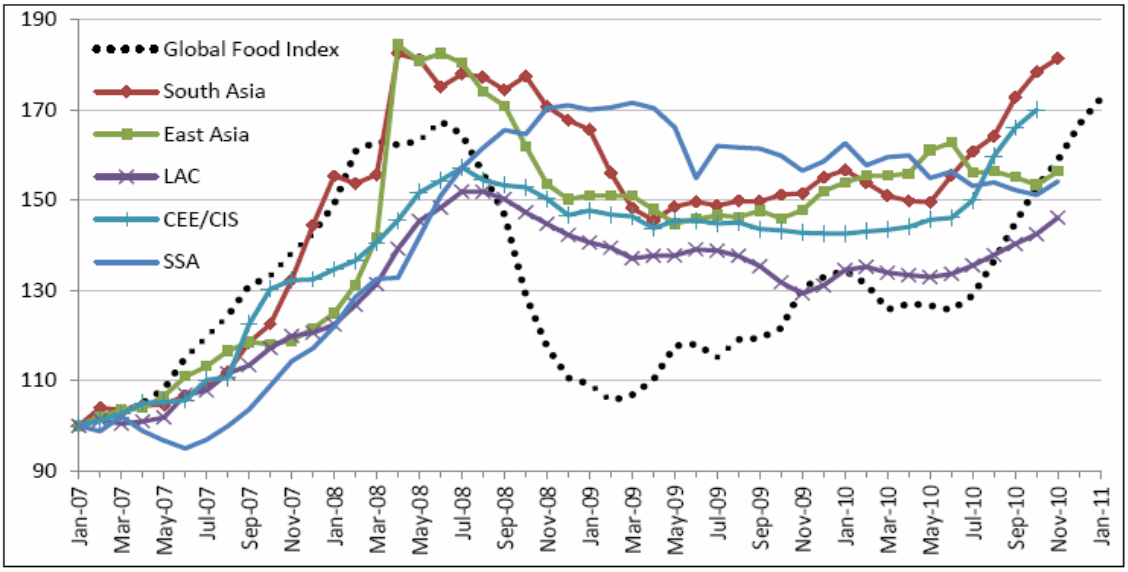
Minot (2010) examined the trends in food prices in sub-Saharan Africa over 2007-08 and found across 83 food prices in twelve African countries where the average increase was 63 per cent in US dollar terms between June 2007 and June 2008. On average, this increase represented 71 per cent of the rise in the price of corresponding commodities in international markets. The highest transmission of world price changes to national markets was recorded for Malawi and Ethiopia, where the domestic price increased more than world prices due to domestic policy factors and production shocks. South Africa, Ghana, and Cameroon experienced the lowest price increases, which represented between 25 and 39 per cent of the rise in world food prices. Across commodities, the transmission of world price changes to national markets in the twelve African was highest (111 per cent) for wheat and 112 percent for maize . The corresponding figure for rice was only 41 per cent, reflecting the predominance of eastern and southern African countries in the sample, where rice is less important in the total consumption mix compared to West Africa. Indeed, an examination of the transmission patterns by country and commodities shows that domestic rice price increases in Senegal represented on average 87 per cent of the increase in world prices compared to only 35 per cent in Mozambique.

This relatively optimistic vision of the consequences of the current international food price

rises is strongly nuanced, and even contradicted, by a recent UNICEF study (Ortiz and al. 2011). This study shows that, even if the rise was delayed in some continents (Africa, Latin America), the totality (and for some continent more than the totality) of the 2007/08 international price rise was transmitted to domestic prices. Moreover, it appears (see figure 17) that national price indices did not drop as sharply after July 2008 as did the international prices. On the contrary, in many continents, prices rose again as soon as international prices moved upward. Thus, price transmission to national markets was muted on the downside during the crisis, not just on the upside. Once international prices started to fall, through various mechanisms, the full extent of this fall was not transmitted in developing countries.

Figure 17: Local Food Prices by Regions, Jan. 2007-Nov. 2010 (or latest available)

(unweighted average index values; Jan. 2007=100)



Source: Figure extracted from Ortiz and al., (2011) in Escalating Food Prices, UNICEF, Page 8. FAO (2010f) and authors' calculations. Note: Sample includes 5 countries from South Asia, 5 from East Asia, 16 from LAC, 7 from CEE/CIS and 24 from SSA; MENA is not included since there is data for only one developing country from that region (Djibouti)

When comparing countries by incomes level, price data indicate that low-income countries have faced higher price increases than have middle-income and rich countries. This tendency of low-income countries to face greater price increases was magnified during the 2007-08

food crisis and again in the second half of 2010. For example, food prices were 8.3 per cent higher in low-income countries than in middle-income countries in August 2010 and the difference reached 12.6 in November 2010 (Ortiz and al., 2011). Food prices increased by 5 per cent on average in low income countries while they fell by 0.8 per cent in middle income countries between August 2010 and November 2010. This difference in the degree of price transmission reflects in part the fact that it takes resources to insulate domestic markets from international markets. Low-income countries had fewer resources to spend on limiting price transmission, so they faced more volatile prices.

B. But price volatility that results from domestic sources is also, a permanent problem in many poor countries

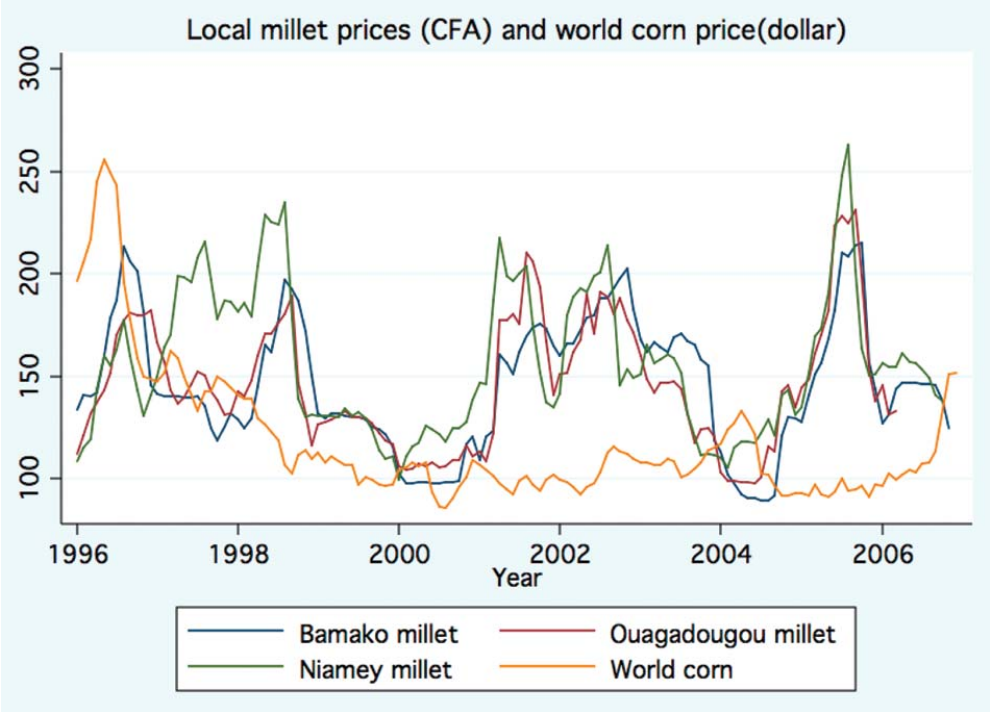
According to Galtier (Galtier 2009), price volatility in developing countries has two main sources: imported volatility from world markets and domestic sources of volatility. Studies conducted prior to recent international price rises indicate that international price variability explains a very small share of domestic price variability in developing countries, meaning that domestic price volatility is mainly of endogenous origin (Byerlee, Jayne et al. 2005).

Imported volatility operates only to the extent that international trade occurs and the country allows international prices to be transmitted into domestic markets. Landlocked countries and countries with high internal transport costs (typical of Sub-Saharan Africa) and marketing costs, or staple foods that are not traded internationally have much larger scope for endogenous price volatility without being able to rely on the potentially stabilizing effects of imports or exports. Therefore, these countries are more subject to domestic source of volatility than imported volatility.

The comparison of international and domestic prices prior to the 2007/08 crisis confirms that, in many developing countries, domestic volatility was strong. Brown and al (Brown, Hintermann et al. 2009) have analyzed (Figure 18 below) the inter-annual variation of the price of millet (a non-tradable in world markets) in three Sahelian countries and world maize prices between 1992 and 2006. They show that the volatility is more pronounced for the domestic price of millet than the world price of maize. Indeed, the prices of millet showed greater inter-annual variability than the international prices of maize in the three Sahelian

countries. Moreover, there seems to be no perfect correspondence between the peaks and the lows of these two price series. Therefore, these countries were well founded to use imports from the international markets to manage the instability of domestic production of non-tradable stables. This is was the case during the drought induced food crisis in the Sahel in 2004-05.

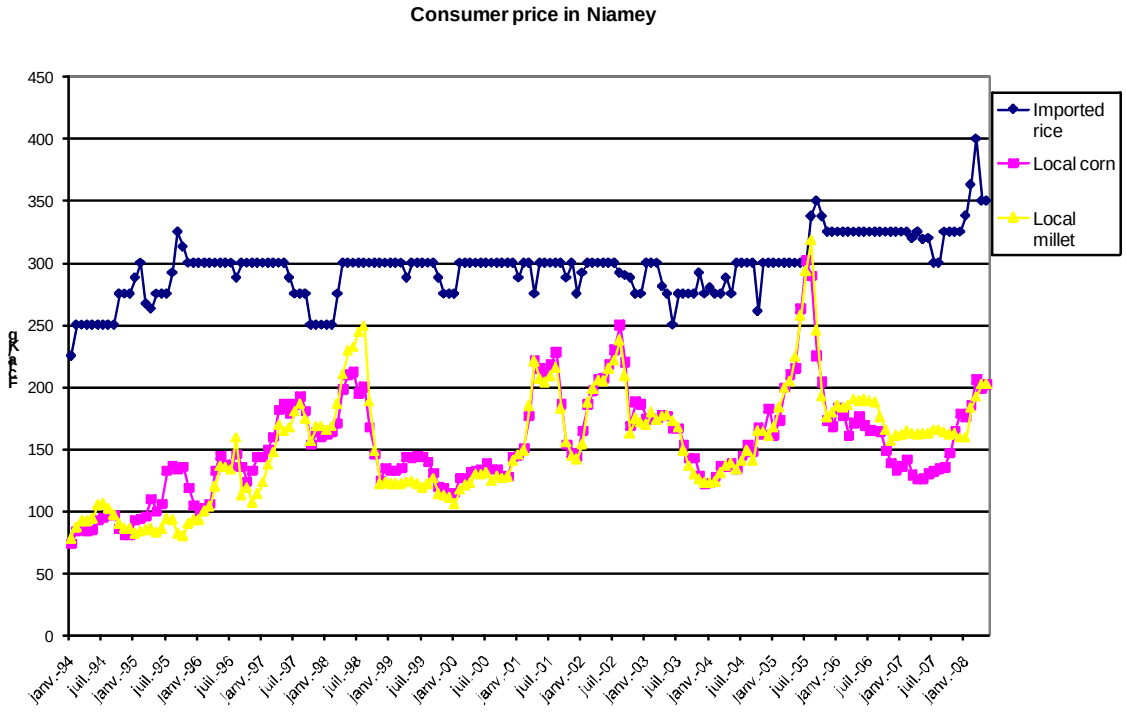
Figure 18: Millet prices in Bamako(Mali), Niamey (Niger) and Ouagadougou (Burkina Faso)



Source: Extracted from Brown et al. (2009) in Markets, Climate Change and Food Security in West Africa.

Daviron et al. (2008) also examined the pattern of the transmission of the changes in international food prices to national markets in four African countries (Senegal, Mali, Niger, and Madagascar) before the food crisis. The dynamics of markets for local coarse grains (millet and sorghum) in the Sahel were found to be completely disconnected from the international food prices. However, consumer prices of local coarse grains were much more unstable than consumer prices for imported rice - even though they were lower than international prices, reflecting domestic supply conditions and thin markets (see figure 19). Indeed, prior to the current international food price swings, these countries relied on international markets to gain some price stability at the consumer level.

Figure 19: Consumer prices in Niamey for imported rice, local corn and local millet



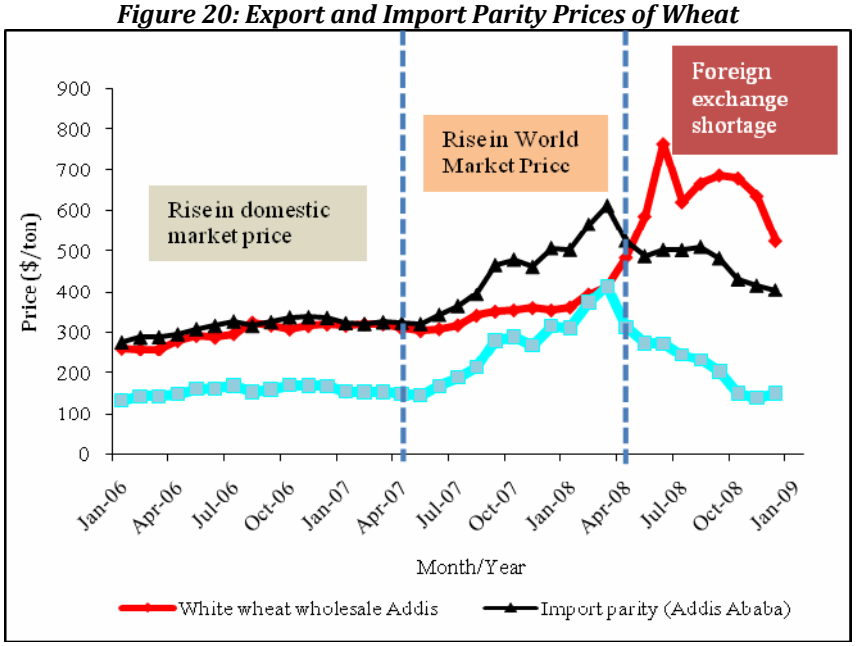
Source: Daviron et al. 2008

In Addis Ababa, from 1996 to 2003, when international maize prices were relatively stable, the wholesale price of maize varied from US$ 50 per metric ton to US$ 250 per metric ton (Byerlee 2005). Consumers in southern Africa (Malawi, Mozambique and Zambia) have also experienced highly variable retail prices for white maize between 1994 and 2004.

The existence of domestic sources of price volatility is not limited to Africa. Hazel, Shield and Shield (Hazel, Shields et al. 2005) compared international and producer price volatility between 1971 and 2003 for wheat and maize in importing developing countries. Indeed, coefficients of variation of more than 65 per cent have been recorded for maize and wheat in Bolivia, Brazil, and Mexico compared to coefficients of 23 and 29 per cent respectively on international markets.

Only Asia showed more stable prices, with coefficients of variation of 8 per cent for wheat in

Figure 20: Export and Import Parity Prices of Wheat



India (Hazel, Shields et al. 2005), 5 per cent for the producer price of rice in Viet Nam (Minot and al., 2000); and coefficients of variation for wholesale rice prices in six Asian countries ranging from 12 per cent in Bangladesh and 25 per cent in the Philippines.

The natural factors that exacerbate price volatility in developing countries are compounded by high-cost and risky marketing systems (which are in turn made more risky by erratic government policies that discourage private stock holding and cost-reducing investments in marketing infrastructure). A number of structural conditions in these markets contribute to their high cost and volatility. The markets in these countries tend to be very thin, as farmers sell only a small share of their production, which is mainly destined for self-provisioning. For example, farmers in Burkina Faso sell only 10 to 20 per cent of their cereal production - mainly at harvest (Brown, Hintermann et al. 2009).

When production falls, farmers reduce their sales more than they reduce production and, when production increases, farmers increase their sales more than they increase production. Given the inelastic nature of food demand, such large variability in marketed surplus of non-tradables will be associated with large price volatility. In addition to the thinness of the markets, demand and supply shift because many farmers who are net sellers during normal or good years become net buyers during bad years. This instability in demand and supply, coupled with poorly developed marketing infrastructure and institutions and the lack of market information for most actors amplify domestic price volatility. Furthermore, the structure of most urban markets for tradable agricultural products in Sub-Saharan Africa tends to be dominated by a few large operators with large import capacities who finance most of the domestic grain assembly, imports, and what little commercial storage activity that does take place.

Beside variations in domestic production due to natural and weather shocks and the poor performance of domestic agricultural markets, poor government policies contribute to domestic price volatility in developing countries. In many cases, governmental interventions discourage private stock holding and investment in marketing infrastructure that could contribute to more stable domestic markets. Examples of such poor policies include unstable trade policies, unpredictable government interventions, and Non-Governmental Organizations' (NGO) local procurement and food distribution practices in food markets.

Macroeconomic instability also leads to domestic food price instability. This was more obvious in the 1980s and 1990s in Latin American countries that experienced macroeconomic shocks, especially sharp devaluations of exchange rates and high domestic inflation. This is no longer common, but some countries did face sharp rises in both general and food CPI. Ethiopia is one such example, where two macroeconomic policy factors exacerbated the 2007/8 food price situation. During 2005-07, money supply outpaced overall growth in Ethiopia, resulting in overall nominal inflation (World Bank, 2007). In early 2008, due to a sharp increase in fuel subsidy bills, the government encountered a balance of payment shortage. To combat this problem, the central bank started rationing foreign exchange, which prevented private sector imports. As a result, domestic prices went way above the import parity level. Figure 19, which presents export and import parity prices of wheat, illustrates how these played out in domestic markets at different time periods. It is interesting to note that domestic price started increasing before global food crisis; did not follow world price during the global food crisis; and started increasing sharply long after the world prices nose-dived. Almost for two years, poor consumers suffered from this price shock.

To sum up, we can say that, in many developing countries, during the 1990 and first half 2000s, when international food price fluctuations were limited, international prices were more stable than domestic prices, or more specifically prices for imported food goods were more stable than prices for local goods. Food import offered a form of insurance for urban consumers - a source of security and stability. With successive international price rises, urban consumers have lost this security. In the absence of stabilization policies for local food prices, stability of international prices is essential for the survival (or at least welfare) of many poor urban consumers. However, the stabilization of international prices per se will not stabilize prices for local food, for either consumers or producers.

C. Consequences of price volatility on food security

There are too few studies written to be able to assess the impact of the recent international price rises on food security. One must note the contrast between the large number of models elaborated to estimate the impact and the scarcity of studies providing evidence of the actual consequences.

The State of Food of Insecurity in the World published by the FAO provides a yearly estimate of the number of undernourished people in the world. This number rose from about 850 million in 2007 to about 1023 million in 2009 (FAO 2010). However, this estimation is based mostly on food availability and not access. The actual number of undernourished people is, therefore, likely to be higher.

Compton, Wiggins and Keats (Compton, Wiggins et al. 2010) compared evidence form field studies with predictions made at the beginning of the 2007-2008 price spike and found that "poor net food importing counties – island nations such as Haiti, countries in conflict, and rice-importing areas of West Africa – were among the first to feel the effect of rising world food prices. However, high food prices were also recorded as having a serious impact on poor consumers in net food exporting areas such as Thailand, Uganda, and northern Mozambique" (Compton and al. 2010:12). The worst affected population groups were casual wage laborers (rural and urban), land poor farmers who produce no or a very small surplus for sale, and petty food traders and producers of commodities whose terms of trade declined against food grains. Salaried workers in the formal sector generally fared better than others.

Crompton et al (2010) found that "the prevalence of underweight and wasting in young children went up by about half in surveys in Bangladesh, Cambodia and Mauritania following food price rises (e.g. from 17% to 26% wasting in rural Bangladesh). Among the factors responsible were cutbacks on special complementary (weaning) foods, as well as reduced consumption of more expensive and nutritious foods. Food price rises led to widespread reduction in dietary diversity, which is a predictor of micronutrient malnutrition." (Compton and al. 2010: 56). However, the authors also point out that evidence on differential impacts within the household is scant because much of the reporting from the food crisis was blind to gender and other differences.

Finally, Crompton et al (2010) suggest long-term impact evaluation of the food price rises. Indeed, some short-term measures that protected the consumer could have long-term impacts on food security. For example, the reduction of import taxes reduces government incomes and its ability to provide public goods.

A study in Ethiopia, the Central African Republic, Sierra Leone and Liberia by Action Against Hunger in 2008 provides some information about the impact of the price rise on food

security(ACF 2009). The organization chose these countries because admission rates to feeding programs there increased early in relation to the seasonal norm. Their data show that, in Ethiopia, high prices were closely followed by an increase in malnutrition and under-five mortality rates. However, ACF also notes that "not all countries have been affected equally. Findings from the Central African Republic reveal only modest increases in prices and statistically insignificant increases in malnutrition. Research in Sierra Leone showed that even in Freetown, the capital city, prices and household reactions varied" (ACF 2009:15)

Endogenous instability is of course a serious cause of food insecurity. Devereux (Devereux 2009) has studied the effect of one specific dimension of endogenous volatility – namely food market seasonality - in Ghana, Namibia, Malawi, Ethiopia. Devereux points out how damaging this price volatility is for nutrition. In Malawi, for example, the causal linkage between maize prices and child malnutrition are dramatic: between October 2004 and January 2005, during which time maize prices doubled, admission for severe acute malnutrition increased by a factor of 7, falling back when maize prices started decreasing.

Endogenous instability also has a long term effect on investment in agricultural production and then on farmer incomes (Poulton, Kydd et al. 2006). As demonstrated by Cummings et al. (Cummings, Rashid et al. 2006) with Asia, "price stabilization was vital to widespread adoption of the new high-yielding wheat and rice varieties and both producers (through higher incomes) and the consumers (through low prices) benefited".

III. Policy options to address price volatility

A. International options

1. Slowing down speculation

Many governments have indicated their discomfort with aspects of current regulation of commodity markets. The Task Force on Commodities Futures Markets, for example, was formed by the Technical Committee Of The International Organization Of Securities Commissions in response to a G8 request to look at the functioning of several of the futures markets (particularly oil). Many governments are also now coming around to the idea that a

Financial Transfer Tax (FTT) could make an important contribution to improved market functioning and to depleted public coffers (GREMA 2010: 68). The sums of money in the speculative side of the futures market are huge, and some of the actors who depend on the markets (as farmers, traders or regulators) are sufficiently concerned to have sought tighter regulation. The transaction costs for all parties have been increased significantly with the volume of money now in the market. For countries whose food security depends in part on international markets and whose purchasing power (both as to how much they can spend, and how far ahead they can time their purchases) is significantly constrained, a precautionary approach seems warranted.

Gary Gensler, Chairman of the US Commodities Futures Trading Commission, told U.S. legislators in 2009, "record-high volatility has impaired the ability of many farmers and other businesses to use the futures markets to manage their price risks." (cited in Jones 2010).

The main demands from a number of NGOs and other commentators, some of them former traders include:

- Establishing tough regulatory oversight of commodity markets
- Increasing transparency by requiring exchange trading and clearing of most agricultural commodity contracts
- Providing government agencies with the authority to regulate over-the-counter derivatives. This oversight will prevent big banks from manipulating and cornering commodity markets
- Position limits
- Re-introducing rules that distinguish market operators (who want to buy or sell commodity) from speculators

The governments that house the major commodity markets (in particular) the U.K. and the United States) have a particular responsibility to the rest of the global community to ensure that the exchanges are serving all interests, and not just those of the largest investors. The G20 is being advised by the inter-agency working group to encourage developing countries to use forward contracting to secure grain imports at more stable prices. This makes the functioning of the commodity markets all the more important. So, too, does the policy advice given to NFIDCs to start holding futures contracts as a way to lock in imports at less volatile prices; it

takes considerable knowledge and finances to use commodities futures effectively. Neither are in large supply in many poorer countries. At the same time, even if speculation is only exaggerating inherent volatility in the market, those exaggerations can make a significant difference to the cost of a poor country's grain purchase on any given day.

2. Restoring confidence in the international trading system

Most countries depend on trade for some part of their food security. For a number of NFIDCS, food imports are critically important. The persistence of both volatility and higher prices in international agricultural commodity markets since the 2008 price crisis makes international trade rules a matter of serious public policy concern for many governments. The price crisis, and in particular the response of several dominant agricultural exporting countries to the crisis, signaled to importing countries that a food security strategy that was dependent on international markets had real drawbacks. Some of these problems are long-standing issues that have been in negotiation for a long time. Others were new.

The sources of mistrust stem from:

- Arbitrary use of export restraints and export bans :
- The failure to make progress on multilateral trade talks
- The paucity of provisions for development in investment treaties or bilateral trade agreements between unequal countries
- The weakness of food aid and funding support mechanisms as an alternative to securing food imports in periods of shortages
- The deficiency of information about the real state of food reserves around the world
- The lack of institutional devices to guarantee commercial commitment of food exporters

a) WTO rules

The WTO houses the agreements that create binding rules for international trade, as well as for intellectual property rights. It also houses the Dispute Settlement Mechanism, which has the authority to impose sanctions on member states that do not complying with their treaty

obligations. The WTO does not have universal membership: there are 153 members and 30 countries that are somewhere along the often-lengthy accession process. For much of the past 15 years, governments have insisted that the WTO is the premier, indeed the only, forum where trade might be discussed. This has complicated the WTO's role in some respects, because it has had to debate a number of issues for which it has little appetite (or competence), such as the environment, emergency food aid and employment creation.

Moreover, negotiation on agriculture, since the Uruguay Round, has been conceived and conducted in the context of a structural overproduction. Because of this situation, trade conflicts between exporting countries was seen as the problem to be solved. The objective was to guarantee fairness of competition between suppliers and market access, market access for exporters not for importers. In other words, WTO negotiations on agriculture were exporting countries oriented. A number of commentators have noted the imbalance in the WTO Agreement on Agriculture between restrictions on imports and on exports. The AoA was designed by large agricultural exporters to increase their market access and to limit the damage that European and U.S. export subsidies were causing. There was very little interest in countries that might need to support and expand agricultural production, because the dominant interests at the time were preoccupied with the damage that such support eventually caused, if the resulting food was dumped in world markets. At the same time, many countries have significantly increased their dependence on imports to complete their food supply.

For a decade, one of the biggest fights in the WTO negotiations has been between agricultural exporters pushing for increased market access, and food importers insisting on their right to be allowed to raise as well as lower tariffs to protect their producers from price shocks. It was somewhat ironic then, when in 2007-2008 it was importers that lowered their tariffs, while exporters limited global supplies. Twenty-five exporting governments imposed export restrictions, taxes and even outright export bans. The message was not lost on food importers, many of whom are under significant domestic political pressure to increase food self-sufficiency, to provide more support to domestic producers, and to reduce dependence on food imports. Moreover, the crisis showed that export supplies are not inexhaustible, that global stocks of a number of commodities are now low enough to cause concern, and that competing demand from the feed and biofuel industries was putting poorer countries' food requirements at risk. If food markets are now in a situation of shortage, on a long-term basis or with frequent periodic crisis, another perspective must be adopted by WTO negotiations,

one that puts food security at the top of the agenda.

In global trade terms, perhaps the most lasting impact of the food price crisis has been to take what little wind was left from the Doha Agenda's sails. From the start of 2011, a growing chorus of voices has started to suggest that the Doha Agenda needs to be abandoned because it has no hope of being agreed, and because it is standing in the way of necessarily multilateral trade reforms and agreements. While the G20, the BRICS and other international meetings of country groupings continue to call for a conclusion to the Doha Round as soon as possible, it is clear that the governments involved in the negotiations in Geneva are not yet prepared to find common ground. Some governments are openly asking how an agenda agreed in 2001, itself a response to an agenda devised in 1986 and concluded in 1994, can possibly respond to a world that has changed so much in the interim (South Africa, April 2011).

With or without a conclusion to Doha, the trade-based responses in 2007-2008 were uncoordinated and abrupt, exacerbated volatility in the international markets and hurt the interests of the most vulnerable. The system did not do its job well enough to persuade importing countries (who are the majority) that the international markets were sufficiently reliable in a crisis.

If the WTO manages a transition to a place for trade negotiating that does not depend on rounds, a number of issues that are not on the Doha agenda might usefully be put on the trade agenda. They include:

- The establishment of stricter rules on export restrictions: notify intent in advance, make measures time-limited (as special safeguards are); require some independent assessment that food security is at risk (a role for the proposed Rapid Response Team at the CFS?); exempt LDC food imports and food emergency contracts;
- Clearer exemptions to protect humanitarian assistance (food aid and emergency stocks) from commercial considerations;
- Flexibility to raise tariffs according to conditions defined in advance;
- Flexibility for countries to use production incentives so long as certain conditions were satisfied (e.g. targeting of small-scale producers (especially women);

diversification of food security crops; strengthening of strategic food stocks; perhaps also limits on exports of such production, or the requirement of export taxes to avoid dumping).

b) Import facilities

Food price volatility increases the vulnerability of those living in poverty. It also increases the vulnerability of whole countries that depend on international markets for a significant share of their food supply. In the international market, the most vulnerable buyers are countries with high levels of imports, little diversity of foods and no cushion in their foreign exchange reserves. There are some financial facilities in place to support these countries, but they have not worked until now. They are either too slow to disburse (as STABEX was) or have not even been invoked because of a narrow interpretation of the rules. There are a number of proposals already out for consideration. The question governments must ask is whether the multilateral community is prepared to ensure the financial mechanisms they have often discussed and sometimes established actually work, and if not, what can be changed to ensure they will work in the future.

c) Information on market fundamentals

Market transactions depend on information, institutions and infrastructure. Globalization has seen a tremendous expansion in infrastructure, facilitated by the advent of container ships and storage facilities that protect perishable goods, such as food, and cut delivery times significantly. Information is arguably both more and less available than it used to be. Technologies such as satellite imagery and the possibilities offered by the Internet for cheap, fast and accurate information sharing make some kinds of information much more readily available than they have ever been before. On the other hand, the elimination of most public stocks in OECD countries and the privatization of most state-trading enterprises has concentrated knowledge about how much of which agricultural commodity is available where in the hands of a small number of tightly controlled companies that depend on secrecy to thrive. As discussed above, some of the tools that are meant to provide information on the market, such as futures markets, are also in question due to the levels of financialization of those markets.

d system nor the various funds established to help developing countries pay for sudden increases in food import bills work particularly well. Inadequate funding and overly restrictive rules governing the release of aid are among the problems that developing countries have encountered. There is no reason these problems cannot be overcome, so long as the donor countries are willing.

(1) World Food Program

The World Food Program relies on money to buy the food aid it needs to do its work on international markets. Furthermore, most of its funding is provided after the need is declared, necessitating purchases on the spot market, often when prices are highest. Excessive and unexpected volatility cripples the agency's capacity to respond to human need. Upward price spikes have the same effect as a budget cut for WFP. In March 2008, WFP made an extraordinary appeal to cope with soaring food and fuel prices because the number of people who needed their help was rising rapidly just as their U.S. dollar-based budget was buying less and less in the market (http://www.wfp.org/node/7904).

To address this problem, the WFP has already piloted projects to source the food it needs from local suppliers in the regions where it is working. In 2010, 14 per cent of the food in the 20 countries where the program (Purchase for Progress) has been put in place was bought from small-scale producers in the region. (http://www.wfp.org/purchase-progress). The program in part aims to stabilize local food production, while at the same time it lessens the WFP's dependence on international markets. The program explicitly aims to strengthen the productive and marketing capacity of small-scale producers in food insecure countries.

The WFP piloted a regional stocking program in 2008, called the Forward Purchase Facility, in East and Southern Africa (http://home.wfp.org/stellent/groups/public/documents/resources/wfp202623.pdf). The strengths of the system include cost savings by having some control on when to buy and buying in bulk; reduced delivery times because the food is already in place in the region; more accurate provision because of reduced time lags between request and delivery; and, increased flexibility. WFP identifies some constraints, most of which could be overcome by

donors. They include funding to expand the pilot; eliminating the restrictions donors place on food aid; and, increasing the availability of advance financing in particular.
The G20 are this year considering a proposal that would expand the pilot into something permanent—the inter-agency report recommends that:

> "G20 governments support the World Food Programme in the development of a cost-effective system of small, strategically positioned humanitarian food reserves by the end of 2011." (inter-agency report, 14 March 2011. Price Volatility in Food and Agricultural Markets: Policy Responses)

Another of the G20 proposals under consideration is the establishment of a code of conduct that would protect humanitarian food supplies. One of the concerns in light of the 2007-2008 crisis is to protect emergency food assistance from export constraints. Another is to ensure full transparency and accountability, to ensure that countries do not abuse humanitarian food for political gain.

(2) Food Aid Convention

The Food Aid Convention could play a very useful role were it to be fundamentally reformed. The convention currently comprises Argentina, Australia, Canada, the European Union and its member States, Japan, Norway, Switzerland and the United States. The convention is meant to provide a framework for negotiations on what counts as food aid, how much food aid each member of the convention will commit to humanitarian responses that year, and how to make sure nobody cheats, for example, by promoting exports under the guise of humanitarian aid. In the same way that the WTO negotiation on agriculture, the Convention, from its very beginning, has been very influenced by the exporting countries overproduction problems and the search for fair competition between them. Indeed, food aid has been mostly used to eliminate surpluses like the well-known inverse relation between the level of world grain stocks and the volume of food aid shows (OCDE, 2005; Barret and Maxwell, 2006).

The FAC has struggled over the last decade, waiting for the Doha Round to end, governments said, so that new parameters for how food aid would be distinguished from commercial trade could be put in place. As Doha drags on, the FAC negotiators have focused harder on finding

agreement among themselves and it is widely hoped they will finally renew the convention in 2011 (six years behind schedule).

Proposals for reform include greater transparency, flexibility, a commitment to food volumes to protect capacity to deliver from volatile prices, a broader definition of what comprises food aid, and a role for recipient countries and the organizations engaged in food aid delivery in the treaty's governance. In addition, the Canadian Food grains Bank has proposed that signatory countries' contributions to regional emergency stocks should count towards their FAC commitments. Properly managed, such stocks could provide some insurance against volatility in world markets.

e) A last comment on trade

This section on trade was organized and written with one simple idea: that confidence in international trade can be restored with some relatively light changes in the existing international food regime. It could be argued, however, that decision-makers should consider the possibility that the problem of confidence is more serious for at least two reasons:

- The radically new situation created by the development of biofuel use - still supported by public subsidies and incentives but maybe already or soon, economically viable without such support. Biofuel development has created a new demand that can outbid poor countries and food insecure populations. This situation poses a real threat to any country that is relying on international markets to achieve food security.

- The self-reinforcing incompleteness of market liberalization in the context of high price volatility. Anderson and his colleagues could be right to say that a deeper liberalization of agricultural markets would reduce volatility. However, in the current context, no government can accept to expose a currently unexposed population to “foreign” instability. On the contrary, the situation confirms the views of those who refuse to link domestic prices to international prices. In this view, restoring confidence in international trade and limiting price volatility became a pre-condition of the pursuit of further liberalization, not one of liberalization’s outputs.

With at least a few governments now openly considering alternatives to the completion of the Doha Agenda at the WTO, it becomes extremely important for governments to decide their broader trade strategy anew. Is the moment ripe to deepen the liberalization commitments undertaken with the Uruguay Round, or are countries interested in a different approach to their multilateral trade obligations?

3. Building stocks at the world and regional level

> "All spikes seen in the last 40 years have been associated with low stock-to-use ratios. Better information on stock levels and more awareness of the dangers of low ratios might help." (*Food Price Crisis FAQs*, Steve Wiggins, Julia Compton & Sharada Keats; October 2010 Update, ODI. UK)

Grain reserves are an obvious and practical tool that has been in use for thousands of years. There is considerable tension among economists on the relative merits of trade and reserves, in a debate that often assumes that the policies are somehow in contradiction with each other. The idea of food reserves tends to find favor among those who do not believe trade liberalization serves food security well. On the other hand, those that are persuaded by free trade arguments tend to see reserves as market distorting and an unnecessary public expense. In fact, trade and reserves policies can be complementary strategies. A well-run reserve provides an important response to the market failures that are typical of agricultural commodity markets.

Grain stocks are commonly understood to be that amount of grain in storage at the end of the marketing year. That grain becomes part of the supply for the following year. Grain stocks have two significant effects on prices. First, yearend stocks directly affect expectations of prices for the following year: a large yearend stock will create a downward pressure on prices, while low year-end stocks will tend to press prices up. Second, physical stocks are tangible and, usually, known. In a market where much of the information is uncertain, stocks add a degree of certainty that has a stabilizing impact on prices. Stocks are in some sense a cure-all for many of the causes of volatility (Galtier, 2011; Murphy 2009). "Typically, the same stocks can serve several purposes at the same time, i.e. they can function as working stocks for distribution programs, buffer stocks for price stabilization needs, or food security stocks for emergency relief." (Dorosh, 2009). Note, too, that this has also been one of the reasons that national stocks have failed: they have been used in attempts to solve too many problems

simultaneously. A stock is not likely to fit more than one purpose because different quantities of grain and different rules of operation are necessitated by different objectives.

Stocks can work well to counter short-term price changes (absorbing excess if prices fall, or releasing stocks if prices are spiking upward). Stocks are notably useful to counter speculative behavior by private stockholders, particularly the temptation to hoard when prices are rising and traders see an opportunity to increase their return by constraining supplies. Stocks are not suited to trying to influence long-term trends in supply, demand or prices; to succeed, stocks need instead to respond to these trends (Shaw, 2007). Importantly, stocks are not a solution to chronic hunger. They are designed for buffering short-term shocks, to stop the shocks getting worse or exacerbating an already fragile situation. A stock addresses supply concerns, not access to food, although it can contribute to a more stable environment that can in turn encourage increased production and investment in agriculture and more stable prices for consumers.

One of the arguments made against reserves if that public reserves discourage the private sector from holding reserves of their own. Yet private companies have little interest in holding stocks because of the expense. Of course, traders have to hold some level of stocks. Private companies will especially hold stocks if they expect prices to rise by more than the cost of storage (an interest that quickly leads to hoarding, a practice banned by most states but difficult to enforce). The private sector has proven unwilling, however, to hold the kind of stocks that can address volatility. Crucially, trader stocks are not transparent. Moreover, volatility is profitable for the largest traders because they tend to have better knowledge than anyone else, as well as access to both supply and demand across the globe. Therefore, the few companies that dominate agricultural commodity trade have no incentive to counter volatility. It is a high risk but highly profitable situation for those with the most information, deepest pockets and access to a global transportation and distribution infrastructure.

From a public policy perspective, there are reasons why an international reserve may make sense where in the past the technical difficulties and lack of political will proved too difficult to overcome. An international reserve offers a way to solve problems such as the opacity of today's commodity markets and the volatility that uncertainty brings in its wake. Even as technologies to understand better what harvests may be have improved, with satellite imagery and so on, the privatization of most state trading enterprises in exporting countries (only

Canada's besieged Canadian Wheat Board survives), and the continuing consolidation of the privately-held grain trade have reduced the flow of information available. Dramatic cuts to the funding for U.S. government services will strike a further blow to data collection and dissemination efforts.

Stocks are widely criticized by some economists and industrialized country governments for being too expensive. The undeniable costs of operating a reserve are too rarely set against the costs of humanitarian interventions, which are among the least efficient ways countries can spend its development assistance and much less the high costs in human suffering of doing nothing. Invariably, at the point when a situation reaches crisis level, some lives have already been lost and many others compromised beyond repair (children under two years of age), while short-term demands over-ride what might be smarter long-term investments for the establishment of a stable and profitable agricultural sector. For the countries that are prone to emergencies and the countries that pay for humanitarian assistance when emergencies arise, public policy measures such as stocks that can reduce volatility in international markets look like a good investment. (IFPRI, 2008, 2009)

Stocks can be designed to complement and strengthen well-functioning markets. They need not be in tension with them. There are several kinds of stock under discussion internationally.

- ***International emergency food reserves.*** The primary purpose of an emergency stock is to support a more rapid food assistance response. Donors may also be able to cut costs if they have some flexibility in the timing of food aid purchases. Recipient countries benefit from improved risk management because if timely, the emergency stock increases the volume of food available in-country. Emergency reserves have a limited local effect on markets because the volumes involved are small. The stocks protect at least a portion of the demand from vulnerable populations for food from international markets.

- ***Regional stocks.*** Several regions have joint efforts to coordinate a food reserve. ASEAN, for example, decided in October 2010 to convert their pilot reserve project into a permanent rice reserve. The volumes involved are small, and the member states are determined not to interfere with commercial markets, raising for some the question as to whether the reserve will ever be actually called upon.

Nonetheless, the reserve speaks to the concern in the region that the thin international rice market is not itself sufficient to allay all food security concerns in a region where rice is of overwhelming importance for food security. South Asia also has a rice reserve, though it has not ever been used. In West Africa, ECOWAS countries have discussed the possibility of coordinating their national strategic stocks to create a pool of shared food for emergency use in the region. The agreement is not yet in place to create the reserve, but the region has taken some first steps to establishing a mechanism, known as RESOGEST.

- ***International stocks*** have been proposed at various times by different governments. In 1954, governments asked the FAO to conduct a study of what was called a "world food reserve" (Shaw, 2007). However, neither then nor more recently (for instance in the early 1970s, at the first World Food Summit) has talk of an international reserve in multilateral circles led to one being established. In theory, an international stock need not involve all major players (importers or exporters) to have a significant effect. In part, the stock could work to reassure buyers and sellers that sudden and dramatic price changes were improbable because the stocks would at least buffer the effects of a sudden change in supply or demand. One proposal, explored in more detail below, is to have a multilateral fund hold contracts on grain that would establish minimum stocks to use ratios in a transparent, physically diffuse reserve system. The stocks would not be released or replenished according to a price signal, but rather according to the physical quantities of the commodity available.

To create a reserve, governments have (at least) four challenges:

1. How to fund the reserve.
2. How to govern the reserve.
3. How to deal with price interventions.
4. How to manage the physical stocks.

a) Global stocks

The most controversial ideas revolve around establishing some form of international strategic food stock, possibly built around exporter stocks but subject to some kind of multilateral

international commodity agreements, the scheme would not be based on the defense of a price band but the defense of a certain level of world stock, measured as a stocks to use ratio. McCreary proposes holding the stocks in exporting countries, where there is significant infrastructure already built and where the market signal would suggest the stocks were available for importers that needed them. Stocks in importing countries are not generally seen as available to other importers in the same way, although of course food stocks can be exported from importing countries, too.

b) Regional stocks

Support for initiatives such as RESOGEST in West Africa offers the donor community an important opportunity to allow a regional body (in this case ECOWAS) to take the lead on managing emergencies in the region. Slow to get off the ground, the proposal nonetheless has important virtues, including a proposed initial phase of staff exchanges and shared opportunities for training and learning that can start to familiarize the civil servants involved with what are very different national contexts and constraints.

4. Investing in an agro-ecological agriculture

As advocated by the World Development Report 2008 (published in 2007), investment in agriculture is imperative. The WDR was at the time defending the essential contribution of agriculture to poverty alleviation. Since the report's publication, the repeated food price rises have demonstrated that investing in agriculture is also a necessity to guarantee world food security.

Recently, significantly higher prices in global markets, uncertainty about future supply and

public mandates to increase biofuel consumption have encouraged a number of richer net-food importing countries and private investors to buy or lease land in developing counties. If the possibility that this wave of investments could generate a new phase of agricultural growth cannot be ruled out, it is also probable, because agricultural production is generating many externalities, that the wave will generate numerous social, environmental and food security problems. In part, this will require improved governance of foreign investment in agriculture, to safeguard the interests of local food producers, to protect natural resources and to guarantee access to food. Because in agriculture, underinvestment is, in a cyclical fashion, followed by overinvestment, some form of world coordination is highly desirable. Clarifying investment rules is part of solution but will be not sufficient. Public investment must also help to solve the problem.

It is very difficult to know which kind of policy will be more efficient in promoting models of agricultural production that respond to the growing ecological constraints. In the context of the Green Revolution, agricultural policies implemented to support farmer incomes, in both developed and developing countries, aimed to promote capital-intensive agriculture. Today much more labor and knowledge intensive agriculture is needed (de Schutter 2010; Swaminathan 2010; UNEP & UNCTAD 2008; http://www.rimisp.org/getdoc.php?docid=6440). Large scale experiments are necessary to elaborate what kinds of public policies can support such a transition.

Governments are rightly asking how best to raise productivity where it is too low, how to avoid waste and pollution (both of which problems plague industrial agriculture), how to avoid the "super-bugs" and "super-weeds" that have emerged in response to over-use of some pesticides, antibiotics and herbicides. As has been discussed elsewhere, this will require investment from bilateral donors and contributions to multilateral initiatives such as GAFSP. It should also encourage governments to look at the work on agro-ecology and some of the alternative ways of understanding the costs and benefits of investment in different models of agriculture (UNEP & U NCTAD 2008; http://www.rimisp.org/getdoc.php?docid=6440).

5. Curbing the growth of developed countries food demand

If we take the implications of the third interpretation of the current food price rise seriously,

then world food demand must also be subject to policy interventions. The same countries that seek significant new market liberalization through global trade talks (the U.S., Canada, Brazil) are also active users (and in some cases subsidizers) of biofuels. If there is no mechanism to restrain the demand from the energy sector when supplies are tight, as they have been, then it is difficult to see why a developing country would increase its dependence on international markets. Those markets are not just making new supply available—they are also introducing new forms of competition for scarce resources in the form of new demand.

In front of a supply growth encountering an increasing number of constraints the demand seems to be without any limit. Moreover, it is always analyzed as an exogenous variable that cannot be questioned. Indeed, reports says that, in 2050, consumption will have increase by 70% or even twofold, depending of the source. The immediate conclusion is that production will have to increase by the same amount before 2050. But many authors underline the fact that it will just be not possible (Schade and Pimentel 2010). Curbing food demand must be integrated as objective of developed country public policies.

Brian Wright has proposed what would in effect be a buying out of biofuel feedstock contracts when supplies are tight—governments would pay the biofuel industry to idle production, to protect the food supply for food.

Limiting the use of food to produce biofuel is the first objective to be pursued to curb demand. Mandate incorporation of biofuel in liquid fuel, and financial support, should be abandoned. However, livestock products consumption has to be curbed too. According to Pelletier et Tyedmers who used the FAO projections, by 2050 the livestock sector alone "may either occupy the majority of, or considerably overshoot, current best estimates of humanity's safe operating space (Pelletier and Tyedmers 2010). The "inescapability" of the so called "nutrition transition" should then be questioned. Does the developed world oblige such a quantity of meat with some many negative effects on health? Does the developing world really need to go through the same process?

Changing consumption patterns is a difficult task that needs a long term strategy. Differentiated taxation is one of the available instruments. It can be used also to promote the less resource demanding meats. However, maybe one of the easiest ways would be to create opportunities to choose a non-meat meal in situations where a choice can be offered, for

instance in school and company canteens and restaurants.

IV. National options

1. Assessment of national response to the 2007-2008 price spike

Mousseau (2009) and Demeke et al. (Demeke, Pangrazio et al. 2009) reviewed the different measures initiated by developing countries to contain food price volatility. These measures can be classified by the objectives sought by the implementing country. The first sets of interventions tried to prevent increases in domestic prices by limiting the transmission of the changes in international food prices to national markets. The second set supported the poor's access to food, while the third set supported short-term agricultural supply response.

a) Interventions to prevent increases in domestic food prices

These sets comprised trade/fiscal measures, management/release of public stocks, and price control/anti-speculation measures:

Trade and fiscal measures: These measures were widely adopted by developing countries. Of the 81 countries covered by FAO's census of measures adopted by developing countries, 76 countries adopted import-tariff-reduction measures to reduce domestic food price inflation in mid-2008. Twenty-two other countries reduced the value-added tax on imported food commodities. About 25 countries or 31 per cent of the countries surveyed banned or restricted cereals exports during the first half of 2008. Import tax reductions were less effective in containing domestic food price inflation because these taxes were already low because of structural adjustment programs that had slashed tariffs in developing countries. These measures were not only ineffective in containing food price spikes, but their budgetary costs were very high and unsustainable in many low-income countries.

Export bans and restrictions were found to be effective in containing consumers' food

price inflation, although the practice created panic buying among importing countries and amplified price volatility, especially for rice. Mousseau (2009) reports from his review of the literature that the main determinant of the difference in the price transmission from world to domestic markets in Asian countries was the governments' measures to limit exports in order to keep enough supplies in the domestic markets. Food prices decreased also in Tanzania in 2008 because of a good harvest, imports, and export bans, in contrast to its neighbor Kenya, where prices soared.

- ***Management/release of public stocks***

Countries with appropriate stock levels and well-defined rules of release were better able to stabilize their domestic food prices. These are countries that tend to have well developed food security strategies. Many Asian countries such as India, Indonesia, and Pakistan have been very successful in containing domestic food price inflation through the management and release of public stocks. The management and release of public stocks was implemented by 35 countries according to the FAO survey. This figure represents 43 per cent of the total of countries surveyed. The release of public stocks took three forms: subsidized sales, food assistance programs, and replenishment of community food security stocks, as in Mali. Depending on the size of the stocks and the speed of release into the domestic markets to limit hoarding by farmers, traders and consumers, public stocks are powerful tools to contain food price volatility, especially for landlocked countries, although the fiscal cost can be very high. Public stocks and community-level food security stocks have been the main mechanism to contain food price volatility in Mali since the food crisis of 2004-05, specifically the high seasonality of food prices. The mechanism has helped Mali manage the 2007-2008 food price shocks without experiencing any urban riots like those experienced in the neighboring countries of Senegal, Ivory Coast, and Burkina Faso. Dorosh (2009) also found that public stocks have helped countries in South Asia to prevent a "very large price increase." Indeed, India, Pakistan, and Bangladesh relied on existing public stocks to manage the food crisis and limit its negative impact on food security of their citizens.

- ***Price control/anti-hoarding measures***

Some countries have tried to control food prices through the implementation of anti-hoarding regulation. Other countries tried to negotiate with the private sector over the evolution of food prices. These negotiations were usually conducted with the big private exporters and importers either to limit exports or assure adequate supplies at prices accessible to the majority of consumers. This was the case in Mali, Senegal, Burkina Faso and Niger during the 2007-08 crisis. Experience of countries in West Africa indicates that this type of intervention failed to contain food price inflation. Indeed, in an environment characterized by of rapidly rising food prices, it had been difficult for importers to respect the prices agreed upon with government.

b) Interventions to support the poor's access to food.

These measures include responses from both governments and international organizations.

The interventions of governments and international organizations focused mostly on social safety net programs. Existing programs were scaled up in many countries, while new ones were implemented. For example, funding for safety net programs in Bangladesh increased from $688 million to $854 million with $300 million used to start a cash for work program (Monceau, 2010). The majority of these programs involved either cash or food transfer mechanisms and included school feeding interventions. Other programs focused on nutrition, targeting mainly children and pregnant and lactating women.

The most successful cash and food transfer interventions are found in Brazil, Mexico and some Asian countries. Many donors prefer cash transfer to food transfer programs because the former save on public-sector costs of food distribution and do not create distortions in domestic food markets. However, unless the program is indexed to food price inflation, the amount of the cash given to any household will buy less and less food as the price level continues to rise. Therefore, cash transfer programs are less effective when prices are rising rapidly, as was the case in 2008 in many developing countries, and they may be subject to mismanagement.

Cash transfers should not been seen as a substitute for other forms of government

interventions. In a situation of tight food supply, increased purchasing power arising from cash transfers needs to be accompanied by release from public stocks or commercial imports to add to domestic availability to contain the pressure on prices that will result from the added demand. In the absence of increased supply, injecting increased purchasing power into the system will mainly feed food price inflation. Therefore, the optimum intervention should combine price stabilization measures such as release from public stocks or facilitation of increased imports to augment food availability with cash transfers and rationing eventually to increase the poor's access to food (Dorosh, 2009).

c) Interventions to boost domestic food supply in the short run

Before the food crisis, most developing countries moved away from policies based on national food self-sufficiency to food security policies that advocate a combination of national production and trade, particularly regional trade that takes account of the complementarity of resources within sub regions. The recent world food price shocks, characterized by trade bans and restrictions, has raised the risks of a trade-based approach to national food security, and many developing are re-orienting their food security strategies towards greater national self-sufficiency in basic staples (Staatz et al., 2008).

A striking example of the policy initiatives launched during the 2007/08 crisis is Senegal's "Grand Agricultural Offensive for Food and Abundance" (GOANA), aimed at moving the country from 20 per cent rice self-sufficiency in 2007/08 to 100 per cent self-sufficiency by 2015. Like Senegal, the Philippines also declared self-sufficiency in rice as a medium-term policy objective. Staatz et al. (2009) argue that these strategies of self-sufficiency have the merit of focusing attention on the agricultural sector and may lead to higher levels of productive investment in agriculture. However, they note that the risk of resource misallocation is very high with such policies, as they ignore the gains from both regional and international trade arising from comparative advantage.

Countries have used a large set of interventions to increase food production in the short to medium term with the objective of reducing dependency on high-cost and uncertain imports from the world markets brought about by the recent world food price shocks. According to Mousseau (2009), the main instruments used to boost agricultural supply during the crisis

were:

- Subsidies and distribution of agricultural inputs (fertilizers, seeds, etc.);
- Tax reductions, vouchers, and subsidies on fuel for irrigation pumps;
- Guaranteed minimum farm-level prices, along with government procurement;
- Expansion of extension services;
- Support for credit, insurance, and cancellation of farmers 'debts;
- Support for irrigation and storage infrastructure;
- Support for value chain management and market information.

The most widely used instrument across the developing world is the provision of subsidized inputs, mainly seeds and fertilizers. For example, Mousseau (2009) reports that FAO supplied agricultural inputs to 370,000 smallholders in some 80 countries, while the World Bank used its Global Food Crisis Response Program (GFRP) to assist 20 countries to supply their farmers with agricultural inputs.

The other implemented measures were support to irrigation investment and extension services, and the cancellation of smallholders' debts of $15 billion in 2008 by the Indian government. Price supports to farmers were more common in Asia than in other parts of the world, along with subsidized irrigation for marginal and poor smallholders. In West Africa, the set of policy measures focused mainly on subsidized fertilizer and seeds for rice and maize, extension services, improved access to credit, and subsidized farm and processing equipment in some countries.

It is difficult to evaluate the effectiveness of individual interventions because countries implemented packages of measures instead of individual measures. Nonetheless, the supply responses have been positive in many countries (Diallo et al., 2009), and most countries continue to implement some of these measures. Although the effectiveness of these measures is not questioned, it is their fiscal sustainability arising from the strong focus on subsidies that pose a serious problem. Another issue is whether the subsidies lead famers to adopt new technologies that reduce economic (not just the financial) unit costs of production or simply expand production at higher marginal cost along the existing supply curves without changing technologies? Even if the subsidies lead farmers to adopt cost-reducing technologies by

reducing the risk of trying out these technologies, can the governments phase out the subsidies over time? Answers to these questions are crucial for the design of fiscally sustainable input subsidies strategies.

2. National policy options to manage volatility

Price volatility generates food security problems because it affects household incomes and purchasing power. Thus, two big solutions can be contemplated to solve the volatility problem. The first one aims at stabilizing prices. The second aims at reducing the impact of price volatility on incomes and purchasing power (Galtier 2010). The instruments can be further divided into two groups: market-based instruments and state interventions in the markets. Combining the categories and types of instrument gives six classes of instruments (see below). The proposed typology constitutes a convenient way of organizing the multitude of policy instruments used by developing countries and advocated by different analysts during the recent world food price swings.

Policy instruments and types of interventions to achieve food security in the context of price volatility

Policy instruments	**Reducing the eventuality and size of price volatility**	**Coping with price volatility**
Market-support instruments	**1. Make markets work better in time and space** • Information systems • Transport and communication infrastructure • Increase competition in both domestic and import trade • Private sector storage development through improved access to financing • Grade and standards	**2. Financial products** • Crop/livestock insurance (index based) • Credit and savings associations**.** • Emergency loan programs - Access of importers to trade credit - Credit for producers and consumers
State interventions	**3. Balance supply and demand** • Trade interventions - Public stocks procurement and release - Price bands • Enhance productivity in smallholder farming - Input subsidies - Water control - Soil and water management to stabilize yields - Production for home consumption - Research/extension - Access to improved seeds	**4. Social safety nets for vulnerable** • Cash and food transfers • School feeding programs • Productive safety nets (Prevent asset sales by smallholders)

	- Local purchase for social program - Producer price stabilization	

Source: Based on Galtier 2010

The first class of instruments aims at **making markets work better in time and space.** The basic idea here is that if producers, traders, manufacturers and consumers who buy or sell food products react quickly and adequately, small price fluctuation will be sufficient to remedy disequilibrium. The instruments included in this class are supposed to facilitate the choices (regarding time, place, product and technology) make by the individuals. The instrument proposes are mostly material and institutional infrastructures of the market (information system, storage capacity, grading…)

The second class of instruments aims at giving, to producer, traders and manufacturers, the possibility **to cope with price risk**. Instruments are financial products, like contract exchanged on future market and crop/livestock insurances but credit given ex post, to reinforce the possibility to react after a shock.

The third class is about **direct interventions to balance supply and demand on the domestic market**. Interventions can be in the short term by using foreign trade (acting directly on import/export price or on the quantity exchanged) or public food reserves. Intervention can also aim at balancing supply and demand in the long term by enhancing agriculture productivity (Input subsidies, water control, and soil and water management to stabilize yields…)

Public stocks can be managed as a buffer stock or an emergency food reserve. Usually buffer stocks are used to stabilize domestic food prices within a price band, and benefit poor and non-poor consumers and farmers through minimum procurement and sale prices. The main constraint to their use is the high fiscal cost, which exceeds the budgetary capacities of many countries. This was the experience of Sub-Saharan countries in the 1970s, when the marketing boards that managed these stocks went bankrupt. The buffer stocks were consequently scaled down to become emergency food reserves or food security stocks that target mainly localized food crisis within countries. Another related constraint is the difficulty that arises when borders are porous and neighboring countries are not following similar price policies. A country that tries to implement a buffer stock policy is then forced to try to stabilize not only its domestic price, but that of all its neighboring trading partners—a situation that makes these operations even less financially sustainable.

Food security stocks address generally localized food crisis within a country, and that is why their management is dependent on the existence of warning systems. The Sahelian food crisis of 2004-05 shows that these stocks are not well adapted to large-scale, multi-country food crises. They are better able to handle local seasonal price spikes and localized production shortfalls, specifically when linked to community-level stocks. Given the inability of food security stocks to handle price volatility at the national level, developing countries' should consider transforming the current security stocks into buffer stocks linked to community-level reserves to reduce large seasonal swings in prices and other types of volatility in domestic markets. This will require very clear and transparent rules on acquisition and release prices; if these stocks are poorly managed, they can crowd out private storage; such private storage needs to be fully promoted to reduce the fiscal cost of limiting price volatility.

Regional trade has the potential to address effectively national food price volatility, as it broadens the scale of trade by making supply more elastic so that a change in national output due to the weather will not cause extreme price movements in the domestic market. However, the reliability of the regional markets as a food security instrument was seriously damaged during the food crisis when countries banned and restricted exports to regional markets both in Africa and Asia. Confidence will have to be restored in regional markets, requiring regional organizations to address this issue. For example, the sub regional CAADP (Comprehensive Africa Agricultural Development Program) approaches attempt to get more harmonized

national food security policies and develop regional programs to deal with regional trade barriers and important spillovers (e.g., regionally certified storage facilities as a way of trying to keep regional trade fluid during periods of high prices).

Instruments used to boost short supply and raise smallholders' productivity include provision of subsidized inputs, mainly fertilizers and seeds, extension services, and price support through procurement to reconstitute public stocks. These instruments were implemented vigorously through a heavy use of subsidies, and this raises issue of the fiscal sustainability of these measures. Indeed, an optimal food security strategy will combine domestic production, buffer stocks, and trade. For example, Mauritania, Senegal and Sierra Leone in West Africa have food security strategies based on a combination of large imports of Asian rice and imports of coarse grains (millet, maize and sorghum) from neighboring countries (Staatz et al., 2008).

Finally the fourth class includes the large variety of safety nets elaborated during the last decades: *cash and food transfers*, *school feeding programs*, productive safety nets such as ***food for work*** or ***food for training***. The food security impact of the recent world food price shocks has been severe in countries that were not able to provide food assistance to people who lacked purchasing power. The two-legged strategy implemented by most countries consisted of trying to limit increases in domestic food prices and ensuring that people who were priced out of the market did get access to food through enhanced safety nets schemes. Although there exists a wide range of types of safety nets, their objective is to help those who lack purchasing during food crisis to access food either through enhanced purchasing power (cash transfer) or direct food distribution.

Productive safety nets require that the beneficiaries provide either labor to build infrastructure that enhance the resiliency of local food production systems (such as small irrigation infrastructure, soil and water conservation, agroforestry, etc..) or attend training to augment their human capital that improves their productivity. School feeding and nutrition assistance programs are also powerful instruments for human capital development and if procured locally, they provide marketing opportunities for smallholders.

In the context of liberalization policies, instruments that aim at coping with price volatility (financial products and credit) and safety nets have been actively promoted as the optimal

strategy. Letting the prices fluctuate and treating the consequences was seen as the most effective and efficient way to solve the price volatility problem. Both classes of instrument appeared quite complementary, the first being mostly oriented toward producers and traders, the second toward consumers. However, the financial products to cope with food price volatility in developing countries did not develop as much as expected. Moreover, the safety nets appeared to be unable to avoid the decapitalization and weakening of the poorest households. The 2005 food crisis in Niger has been particularly revealing of this weakness.

Therefore the policy instruments proposed in the menu in table 2 should be combined to achieve the maximum impact and to fit the food security strategy of each country. Indeed, achieving food security in the end will require that developing countries develop food security strategies similar to those on poverty reduction. The goal of these strategies is to assure sufficient domestic supplies and to protect domestic prices from extreme variations to reduce the risks for both traders and smallholders and stimulate their investment in food production. These strategies need to be backed by coordinated policies and government actions at the sub-regional, regional, and international level. This is the case for the sub regional CAADP (Comprehensive Africa Agricultural Development Program) approaches that attempt to get more harmonized national food security policies and develop regional programs to deal with important spillovers (e.g., regionally certified storage facilities as a way of trying to keep regional trade fluid during periods of high prices).

3. Accounting for country specificities in managing food price volatility

The track records of policies dealing with price volatility have been at best mixed. One reason for such mixed results might be rooted in the fact that these policies failed to account for the dynamics and heterogeneity of the country contexts. Policy rationales are dynamic and hence the policy instruments need to adjust with the changing rationales. For instance, agricultural price policies that Asian countries adopted to promote the green revolution were formulated at a time when these countries lacked adequate infrastructure, price information, and institutions for risk managements. Many of these contexts changed and in the countries that did not adjust to the change, those policies became expensive or even counter-productive in some cases (Rashid, et al. 2008; Cummings et al 2009). Similarly, country contexts are diverse—there are wide variations across developing countries.

The very issue of an optimum policy directed at managing food price volatility is to find the right combination of the various instruments presented above. Such a combination, to be effective and efficient, must be adapted to the specificities of each country. Three country characteristics seem to be particularly relevant:

a) The nature of domestic price volatility

Domestic price volatility can be of domestic origin, such as weather-induced variability of domestic production and poor performing domestic markets, or imported from international markets through trade and integration to world markets, or both. Galtier (2009), after Byerlee (2005), argues that the optimal policy instruments used to contain price volatility will likely vary according to the source of the variability.

Actually, the relative importance of imported and endogenous volatility mostly depends on the degree of integration of the country with the international market (openness and tradability of the main staples) and of its macroeconomic condition.

b) The vulnerability of the country and household

Vulnerability due to international price shocks amplifies if the country spends a large share of import bills on food. In this case, high import bills can potentially create balance of payment problems, which in turn can lead to other macroeconomic problems / instability.

On the other hand, households with concentrated basket—that is, rely on 1-2 main staple—will be more vulnerable to domestic price shocks than the households with more diversified basket of consumption. The underlying idea is simple. When consumption is concentrated to one commodity—such as rice in Bangladesh or maize in Southern African countries—it accounts for a large share of households' expenditure; and hence a price spike can jeopardize the food security conditions of the poor. By contrast, if the consumption basket is diversified, fluctuations in supplies and prices in one commodity market can be partially absorbed by other markets. This is particularly true when households are used to consuming staples that

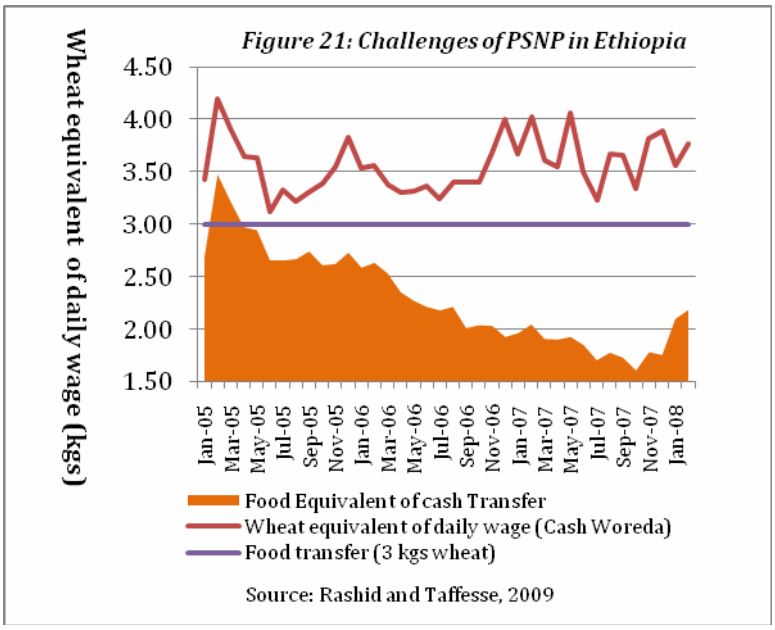
are non-tradable such as cassava, teff, and plantain. However Campon et all (2010) point out that the national level is not, in many countries, a relevant level to estimate the degree of diversification of the consumption basket. What is considered as a diversified consumption basket can actually be regional patterns of consumption.

c) *The institutional capacity*

The capacity to implement instruments managing price volatility varies widely across countries. Consider the case of implementing well targeted safety nets programs. These are justified policy interventions irrespective of the level of development and are indisputably advocated by all as an instrument to cope with the food price shocks. Some inevitable challenges of implementing these policies include national capacity to assess vulnerability, targeting beneficiaries, and effectively delivering transfers (food or cash). Two country examples can further illustrate this point. The first example comes from India, where, like other Asian countries, safety nets programs evolved out of government's agricultural price policies that involved procurement-stocking-distribution. Social safety net programs, such as Public Distribution System and Employment Guarantee Scheme, served as the outlets of the stocks that government procured under its price support program. Implementing these programs required building enormous institutional and human capacity that included a food logistic agency with warehousing infrastructure throughout the country, a dedicated ministry, and almost half a million ration shops. Yet, efficiency of the country's safety nets programs has been questioned on the grounds of leakage and high costs of transferring benefits to the poor consumers. It costs about US$ 7 to transfer US$ 1 worth of benefits to the beneficiaries of the Indian PDS and allegedly 20-30 per cent of the food intended for the safety nets beneficiaries are leaked to the market.

The second example comes from Ethiopia, where government launched one of the largest programs of its kind in Africa, called Productive Safety Nets Program (PSNP), in 2005. It was a bold move on the part of the government, especially because it involved both and cash and food transfer to the beneficiaries. Beneficiaries in remote areas received food transfer (3 kg of wheat) and the beneficiaries in the advanced areas received cash equivalent (6 Ethiopian Birr (ETB)). When the program started, benefits to food and cash recipients were equivalent. However, the country experienced a very high inflation in the following years, with food inflation reaching about 100 per cent in 2008. This means, cash recipients (getting ETB 6.0)

could buy only half of what they could buy in 2005, causing severe erosion of benefits to the households receiving cash transfers. This is illustrated in Figure 20, where black horizontal line represent the value of food (3 kg of wheat) and the red shaded area shows the value of cash in terms of how much household can buy with 6 Ethiopian Birr. If the price of wheat is ETB 2.0 per kilogram, benefits should have been equivalent (6 Ethiopian Birr can buy 3 kg wheat) to both types of beneficiaries. Therefore an adjustment was immediately needed to the benefits for both types of beneficiaries. However, government did not adjust the cash transfer rates for about two years due to the fear that it would further fuel inflation and that it would be difficult if they revised it downward afterwards.



Safety nets programs in these two countries evolved over decades; and perhaps these countries have the best institutional capacity to implement safety nets programs in the respective continents. In fact, there are countries where institutional capacity to implement safety nets programs is either weak or non-existent. A recent IFPRI study on the operational performance of Strategic Grain Reserves in Africa reports that a critical determinant of operational efficiency is whether the SGR are well integrated with the safety nets and emergency programs. In the absence of such linkage, cost of holding stocks (both direct financial costs and indirect negative impacts on markets) becomes exorbitantly high. Another key finding of the report is that links between SGR and an essential safety net programs—school feeding or food for education—are practically non-existent in some countries. Consider the following specific findings from the four countries: Ethiopia, Kenya, Malawi,

and Mali. In Malawi, scaling up the school feeding program is under serious discussion, while in Mali and Ethiopia, the size of school feeding programs are 4000 tons and 6500 tons, respectively. Given the size of total school enrollment, these numbers are minuscule. According to the estimates of that study, in order to feed the children who go to school hungry, total additional demand will be 450,000 tons in Ethiopia, 108,000 tons in Kenya, 152,000 tons in Malawi, and about 90,000 tons in Mali. These numbers suggest that there is a large latent demand for school feeding programs that can only improve human capital in the future.

This discussion underscores one fact: **Unless attentions are given to the heterogeneity of institutional capacity across countries, commonly recommended policy instruments may not yield the desired results.** While the illustration is only for safety nets programs, exact same argument can be made about weather insurance, regional stocks, or even strategic grain reserves or trade control measures.

The three different country characteristics – nature of domestic price volatility, vulnerability and institutional capacity - presented before could be used to develop a comprehensive typology. Compton, Wiggins and Keats (2010) underline the importance, for international organizations and national governments, of quick and accurate prediction regarding the countries and populations most affected by a food price shock. Such a typology would be very useful in improving the speed and accuracy of action. The World Bank (2005) attempted it, but it fell short of identifying and ranking the countries in terms of their exposure to global price shocks and associated vulnerability. There are other reasons to further develop the earlier World Bank typology exercise. The WFP now undertakes vulnerability assessment works in many countries, inputs from these studies will enrich the typology exercises. The more important inputs to incorporate into the typology will be the lessons learned from the 2007-08 global food crises. Country case studies on how governments responded to 2007/08 food crisis are being increasingly available. This will provide rich information about how countries responded and whether the institutional capacities were adequate to implement the policies.

In a very complementary way, policies to manage price volatility should be included in comprehensive food security strategies. After all, price volatility is a challenge because it affects food security and accordingly should be seen as part of the food security strategy. Surprisingly, neither growth strategies nor poverty alleviation strategies of the developing

countries appear to include such a strategy. The Poverty Reduction Strategy Support Program (PRSP) documents of most countries pay very little attention to the issue—so much so that in some countries the term *food security* appears only a handful time in those thick documents. Table 10 presents results from such a simple exercise, where key terms related to food security are counted in the PRSP documents of 14 different countries. This is not a scientific exercise, but it gives an idea how little attention is paid to food security strategies. Note that the key terms like *Social Safety Nets* and *Child Nutrition* do not even appear in half of the sample countries. Again, these are very crude measures, but they give indications that PRSP documents misses out key aspects of food security, namely *access* and *utilization* of food.

One way to address this would be develop country level Food Security Strategy Program (FSSP), which will not only fill the gap, but also bring about detail currently unavailable information about the heterogeneities this note has emphasized.

Table 10: Common policy interventions adopted by countries to address the 2007608 food crisis

	Africa	Asia	LAC	Overall
Countries surveyed	**33**	**26**	**22**	**81**
1. Interventions to prevent price increases				
Trade policies:				
Reduction of tariffs/custom fees				
On imports	18	13	12	**43**
Restricted or banned exports	8	13	4	**25**
Domestic market measures:				
Suspension/reduction of VAT/Taxes	14	5	4	**23**
Release public stocks at subsidized prices	13	15	7	**35**
Administered prices	10	6	5	**21**
2. **Interventions to support the poor' access to food**				
Safety net programs				
Cash transfer	6	8	9	**23**
Food assistance	5	9	5	**19**
Increase disposable income	4	8	4	**16**
3. Interventions to boost domestic food supply in the short run				
Production support(input subsidies)	12	11	12	**35**
Production safety nets	6	4	5	**15**
Fertilizer/seed programs	4	2	3	**9**
Market interventions	4	9	2	**15**

Source: Demeke, Pangrazio and Maetz, (FAO) 2009

References:

Abbott, P. (2011). Stabilisation policies in developping countries after the 2007-08 Crisis. Paris, OECD**:** 54.

Abbott, P., C. Hurt, et al. (2008). What's driving food prices? Oak Brook, Il., Farm Foundation**:** 80.

ACF (2009). Feeding Hunger and Insecurity: The Global Food Price Crisis. New York, ACF**:** 16.

Anderson, K. (2009). Asia'role in stabilizaing food and agricultural prices. Adelaide, The University of Adelaide**:** 39.

Anderson, K., J. Croser, et al. (2009). Agricultural distorsion patterns since the 1950's: what neetds explaining. Washington, World Bank**:** 55.

Beintema, N. and H. Elliott (2009). Setting meaningful investment targets in agricultural research and development: Challenges, opportunities and fiscal realities. Roma, FAO**:** 29.

Blein, R. and R. Longo (2009). Food price volatility - how to help smallholder farmers manage risj and uncertainy. Discussion paper prepared for the Round Table organized during the Thirty-second session of IFAD's Governing Council.

Brown, L. R. (2011). World on the edge. New York, W.W.Norton&Company.

Brown, M. E., B. Hintermann, et al. (2009). "Markets, Climate Change and Food Security in West Africa." Environmental Science and Technology **43**(21).

Byerlee, D., T. S. Jayne, et al. (2005). Managing Food Price Risks and Instability in an Environment of Market Liberalization. A. a. R. D. Department. Washington, World Bank**:** 80.

Calvo, G. (2008). Exploding commodity prices, lax monetary policy, and sovereign weath funds, Vox : reserearch-based policy analysis and commentary from leading economist.

Cassman, K. G., A. Dobermann, et al. (2003). "Meeting Cereal Demand While Protecting Natural Resources and Improving Environmental Quality." Annual Review of Environment and Resources **28**: 315-58.

Compton, J., S. Wiggins, et al. (2010). Impact of the global food crisis on the poor: what is the evidence? London, ODI**:** 99.

Cordell, D., J.-O. Drangert, et al. (2009). "The story of phosphorus: Global food security and food for thought." Global Environmental Change **19**: 292-305.

Cummings, R., S. Rashid, et al. (2006). "Grain price stabilization experiences in Asia; What have we learned?" Food Policy **31**: 303-312.

Daviron, B., M. Auber, et al. (2008). Les mécanismes de transmission de la hausse des prix internationaux. Paris, Fondation Farm.

Dawe, D. (2008). Have recent increases in international cereal prices been transmitted to domestic economies? The experience in seven large Asia Countries. ESA Working Paper. Rome**:** 12.

Dawe, D. and T. Slayton (2010). The world rice market crisis of 2007-2008. The rice crisis: markets, policies and food security. D. Dawe. London, Earthsan and FAO**:** 15-29.

De La Torre Ugarte, D. and S. Murphy (2008). The Global Food Crisis: Creating an Opportunity for Fairer and More Sustainable Food and Agriculture System Worlwide. Bonn, Miseror, the Heinrich Böll Foundation with the Wuppertal Institute.

de Schutter, O. (2010). Agroecology and the right to food. Genève, United Nations Human Rights Council**:** 21.

de Schutter, O. (2010). Food commodities Speculation and Food Price Crises. Geneva, United Nation

Special Rapporteur on the Right to Food**:** 14.
Demeke, M., G. Pangrazio, et al. (2009). Country responses to the food security crisis: Nature and preliminary implications of the policies pursued. Roma, FAO**:** 29.
Dery, P. and B. Anderson (2007). "Peak phosphorus." Energy Bulletin **13**.
Devereux, S. (2009). Seasonality and Social Protection in Africa, Future Agricultures & Centre for Social Protection**:** 28.
Dialo, B., N. N. Dembele, et al. (2010). Transmission des hausses des prix internationaux des produits alimentaires en Afrique de l'Ouest: Leçons de la crise de 2007-08 pour l'expansion de la production.
Domanski, D. and A. Heath (2007). "Financial investors and commodity markets." Bank of International Settlements Quaterly Review: 53-67.
Easterling, W. E., P. K. Aggarwal, et al. (2007). Food, fibre and forest products. Climate Change 2007: Impact, Adpatation and Vulnerability. Contribution of Working Group II to the Fourth Assesment Report of the Intergovernmental Panel on Climate Change. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson. Cambridge, Cambridge University Press**:** 273-313.
Evans, A. (2009). The Feeding of the Nine Billion: Global Food Security for the 21st Century. London, Chatham House**:** 59.
Evans, A. (2010). Gloabilization and Scarcity: Multilateralism for a world with limits. New York, Center on International Cooperation, New York University**:** 62.
Fan, S. and N. Rao (2003). Public spending in developping countries: trends, determination and impact. Washington, IFPRI**:** 42.
Fan, S. and A. Saurkar (2006). Public spending in developing countries: trends, determination and impact. mimeo.
FAO (2008). The State of Food and Agriculture 2008. Biofuels: prospects, risks and opportunities. Roma, FAO.
FAO (2009). The State of Agricultural Commodity Markets: High food prices and the food crises - experiences and lessons learned. Roma, FAO.
FAO (2010). The State of Food and Agriculture 2009: Livestock in the balance. Roma, FAO.
FAO (2010). State of Food Insecurity in 2010. Rome, FAO.
FAO (2011). Global Food Monitor. Roma, FAO, The Global Information and Early Warming System on Food and Agriculture (GIEWS).
Frenk, D. (2011). Excessive Speculation. Excessive Speculation in Agricultural Commodites: Selected Writings from 2008-2011. B. Lilliston and A. Ranallo. Minneapolis, IATP.
Galtier, F. (2009). How to manago food price instability in developing countries? Montpellier, Cirad/MOISA.
Gardner, B. L. (1979). Optimal stockpiling of grain. Lexington, Mass, Lexington Books.
Ghosh, J. (2010). "The Unnatural Coupling: Food and Global Finance." Journal of Agrarian Change **10**(1): 72-86.
Gilbert, C. (2010). An assesment of international commodity agreements for commodity price stabilization. Paris, OECD**:** 36.
Gilbert, C. (2010). Speculative Influences on Commodity Futures Prices 2006-2008. Geneva, UNCTAD**:** 33.
Gilbert, C. and C. W. Morgan (2010). "Food price volatilty." Philosophical Transactions of the Royal Society(365): 3023-3034.
Global Perspective Unit (FAO) and Natural Resources Department (FAO) (2011). Rising vulnerability in the global food system: environmental pressures and climate change. Safeguarding food security in volatile global markets. A. Prakash. Roma, FAO**:** 66-86.
Gouel, C. (2010). "Agricultural price instability: a survey of competing explanations and remedies." Journal of Economic Survey: 1-34.
Hazel, P., G. Shields, et al. (2005). The nature and extent of domestic sources of food price instability and risk. Washington, World Bank**:** 25.

Headey, D. (2011). "Rethinking the global food crisis: The role of trade shocks." Food Policy **36**: 136-146.
Headey, D. and S. Fan (2010). Global food crisis: How did it happen? How has it hurt? And how can we prevent the next one ? Washington, IFPRI**:** 122.
Heinberg, R. and M. Bomford (2099). The food and farming transition: toward a post carbon food system. Sebastopol, CA, Post Carbon Institute**:** 41.
Hertel, t. and J. Beckman (2010). Commodity Price Volatility in the Biofuel Era: An examination of the Linkage between Energy and Agricultural Markets. Agricultural&Applied Economics Association's 2010 Joint Annual Meeting, Denver.
Huchet-Bourdon, M. (2010). Developments in commodity price volatility. Paris, OECD**:** 51.
IMF (2011). World Economic Outlook. Washington, IMF.
International Energy Agency (2010). World Energy Oultook 2010. Paris, IEA**:** 731.
Jones, T. (2010). The great hunger lotery. How banking speculation causes food crises. London, World Development Movement.
Kearney, J. (2010). "Food consumption trends and drivers." Phil. Trans. R. Soc. B **365**: 2793-2807.
Koning, N., M. Van Ittersum, et al. (2008). "Long-term global availability of food: continued abundance or new scarcity?" NJAS Wageningen Journal of Life Sciences **55**(3): 229-292.
Langeveld, J. W. A., J. Dixon, et al. (2010). "Development Perspective of the Biobased Economy: A Review." Crop Science **50**: 142-151.
Lucas, C., A. Jones, et al. (2006). Fuelling a food crisis: The impact of peak oil on food security. Brussels, The Greens European Free Alliance**:** 38.
McCreary, I. (2011). Protection the Food Insecure in Volatile International Markets. Food reserves and other policy options. Winnipeg, Canadian Foodgrains**:** 43.
McIntyre, B., H. Herren, et al. (2009). Agriculture at the Crossroads: International Assesment of Agricultural Knowledge, Science and Technology for Development. Washington, Island Press.
Minot, N. (2010). Transmission of World Food Changes to African Markets and its Effects on Houshold Welfare. Washington, IFRPI.
Mitchell, D. (2008). A note on rising food prices. Washington, World Bank**:** 20.
Mitra, S. and J.-M. Boussard (2008). Storage and the Volatility of Agricultural Prices: A model of Endogenous Fluctuations. Bronx, NY, Department of Economics, Fordham University**:** 21.
Mousseau, F. (2009). The High Food Challenge: A Review of Response to Combat Hunger. Oakland, The Oakland Institute & The UK Hunger Alliance.
OECD (2008). Biofuel Support Policies: An economic assesement. Paris, OECD**:** 138.
OECD (2009). Agricultural Policies in Emerging Economies: Monitoring and Evaluation. Paris, OECD.
OECD (2010). Measuring Aid to Agriculture. Paris, OECD**:** 7.
Ortiz, I., J. Chai, et al. (2011). Escalating Food Prices: The threat to poor households and policies to safeguard a Recovery for All. New York, UNICEF**:** 38.
Passenier, A. and M. Lak (2009). Scarcity and transition: Research questions for future policy. The Hague, Ministy of Housing, Spatial Planning and the Environment and Ministry of Foreign Affairs**:** 74.
Pelletier, N. and P. Tyedmers (2010). "Forecasting potential global environmental cost of livestock production 2000-2050." Proc Natl Acad Sci USA **107**: 18371-18374.
Poulton, C., J. Kydd, et al. (2006). "State intervention for food price stabilisation in Africa: Can it work?" Food Policy **31**: 342-356.
Prakash, A. (2011). Safeguarding food security in volatile food markets. Roma, FAO**:** 554.
Rabobank (2010). Sustainability and security of the global food supply chain. Utrecht, Rabobank Group**:** 45.
Regmi, A., M. S. Deepak, et al. (2001). Cross-Country Analysis of Food Consumption Patterns. Changing Structure of Global Food Consumption and Trade. A. Regmi. Washington, USDA**:** 14-23.
Ritchie, M., S. Murphy, et al. (2003). US Dumping on World Agricultural Markets: Can Trade Rules Help Farmers? Minneapolis, IATP.

Rosckström, J., W. Steffen, et al. (2009). "Planetary Boundaries: Exploring the safe operating space for humanity." Ecology and Society **14**(2).
Sanders, D., S. Irwin, et al. (2008). The adequacy of speculation in Agricultural Futures Markets: Too Much of a Good Thing? Urbana-Champaign, Department of Agricultural and Consumer Econoimcs ,University of Illinois**:** 34.
Schade, C. and D. Pimentel (2010). "Polpulation crash: prospects for famine in the twenty-first century." Environ Dev Sustain **12**: 245-262.
Schaffnit-Chatterjee, C. (2009). The Global Food Equation: Food security in an environment of increasing scarcity. Frankfurt am Main, Deutsche Bank Research**:** 38.
Seale, J. L., A. Regmi, et al. (2003). International Evidence on Food Consumption Patterns. Washington, USDA**:** 67.
Slayton, T. (2009). Rice crisis: How Asian governments carelessly set the world rice market on fire. Washington, Center for Global Development**:** 41.
Standing Committee on Agricultural Research (2011). The 3rd SCAR Foresight Exercise: Sustainable food consumption and production in a resource-constrained world. Brussels, European Commission**:** 149.
Steenblick, R. (2010). Estimating support to biofuels: lessons learned. OECD Expert Workshop on Estimating Support to Fossil Fuels, 18-19 November 2010, Paris.
Sutton, M., C. Howard, et al., Eds. (2011). The European Nitrogen Assessment: Sources, Effects and Policy Perspectives. Cambridge, Cambrige University Press.
Swaminathan, M. S. (2010). From Green to Evergreen Revolution: Indian Agriculture, Performances and Challenges. New Delhi, Academic Foundation.
Timmer, C. P. (2010). "Reflections on food crises past." Food Policy **35**: 1-11.
Tyner, W. (2010). "The integration of energy and agricultural markets." Agricultural Economics **41**(s1): 193-201.
UNCTAD (2009). Trade and development report 2009. Geneva, UNCTAD**:** 218.
von Cramon-Taubadel, S., G. Anriquez, et al. (2009). Investment in developing countries' food and agriculture: Assessing agricultural capital stocks and their impact on productivity. Roma, FAO**:** 29.
Wolf, M. (2007). "The danger of living in a zero sum world economy." Financial Times **18 December 2007**.
Woods, J., A. Williams, et al. (2010). "Energy and the food system." Phil. Trans. R. Soc. B **365**: 2991-3006.
World Bank (2007). World Development Report 2008: Agriculture for Development. Washington, World Bank.
World Bank (2009). Global Economic Prospects 2009: Commodities at the Crossroads. Washington, World Bank**:** 140.
WRAP, W. R. A. P. (2009). Household Food and Drink Wast in the UK, [http://www.wrap.org.uk/retail/case_studies_research/report_household.html].
Yang, J., H. Qiu, et al. (2008). "Fighting global food price rises in the developing world: the response of China and its effect on domestic and world markets." Agricultural Economics **39**: 453-464.