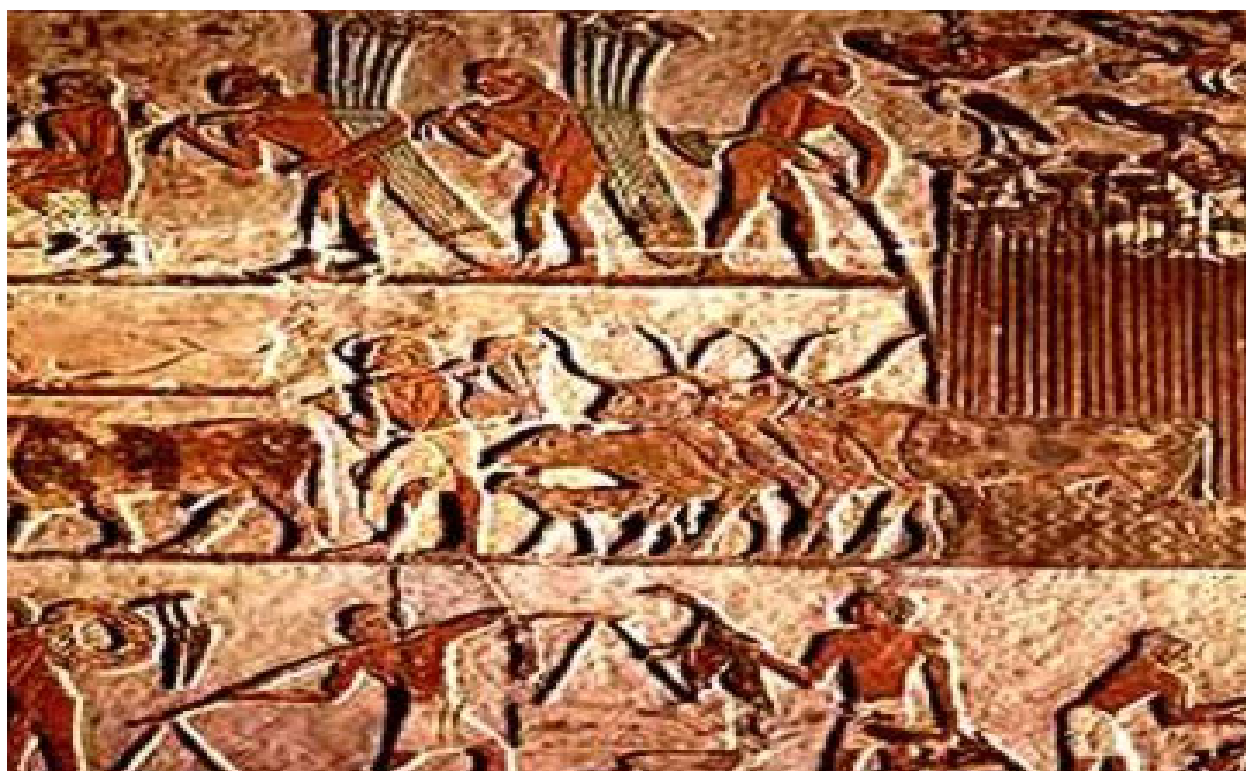


# Stockholding, price volatility, and food security: A review of proposals

Alex Halsema and Michiel A. Keyzer

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Study commissioned by the Ministry of Economic Affairs of the Netherlands





## Abstract

Stock adjustments can reduce price variability by bridging the gap between continuous food demand and periodic supply. Since the second half of the 1980s the public stockholding activity dropped significantly, due to the high cost of such operations and increased capacity to fill gaps through international trade. However, with the price hikes of 2007/8, 2010/11 and the spike of summer 2012, concerns about world food security re-emerged that inspired a series of proposals to coordinate stockholding at international level, with the aim to reduce price volatility and consequent negative effects on malnutrition and agricultural production.

The paper reviews these proposals against the background of analytical assessments and empirical evidence. Plans for keeping physical stocks appear to be too costly and have failed to mobilize critical support. The same applies for parallel plans to keep financial reserves or to establish formal arrangements for deliveries under emergencies such as production shortfalls and price hikes. This may not be much of a surprise, since stockholding is and always has been an intrinsic element of food delivery that can much less than in the past be dealt with as a policy variable.

Stock levels provide interesting indicators of scarcity at best, but they are not the buttons to manage food markets with, particularly not in an open economy. This is far from arguing that current concerns about food price volatility should be neglected, on the contrary, and particularly since this volatility can be expected to become more pronounced in the future – as consumers get richer and consequently less willing to adapt their demand, while output variations will be stronger due to climate change. The point would seem to be, however, that the world food system is nowadays far too connected to be controllable by public stock operations beyond their activation during emergencies.

Rather, much like for climate, also a machinery too large to control, policies should focus on mitigation and adaptation. Mitigation where policy-induced contributions to food price volatility can be eliminated, primarily by ensuring that spot and futures markets function well, and by gradually abolishing blending mandates for biofuels; adaptation where physical as well as financial instruments can help coping with volatility. Stocks are better used for adaptation with a small emergency reserve acting as first line of defense in case of a crisis along with pledges, of countries to give access to their stock, and to supply international agencies in charge of emergency relief with adequate structural funding.



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# Stockholding, price volatility, and food security: A review of proposals<sup>1</sup>

Alex Halsema and Michiel A. Keyzer

## 1. Introduction

Already in ancient Egypt public stocks were used for food security management to protect the people from the vagaries of food harvests (Keyzer and van Wesenbeeck, 2007). Political leadership derived its legitimacy from its capacity to protect the people from shocks they would be unable to address individually (nowadays referred to as self-protection and self-insurance), or jointly with family, friends and neighbors (mutual protection and mutual insurance). This defined very clear public tasks and responsibilities on food security management that also provided the authority necessary to tax the population and to act in other domains, say, to pay salaries, to feed the military during military campaigns, and to assist the poorest segments of the population to some degree. This illustrated by the picture on the front of this report that shows the cycle of field operations and their intricate interconnection along the seasons.

Another example, among several, is the Chinese imperial Ch'ing Dynasty that maintained a nationwide granary system to moderate seasonal fluctuations and to provide relief in case of famines (Wright, 2012).

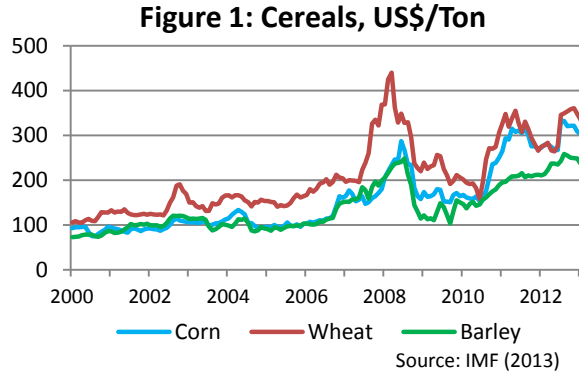
The need for governments to guarantee food security for their people has hardly faded since (for interventions in 2008 see Wiggins and Keats, 2010), nor has the distinction between the goals of providing overall stabilization of food availability on the market and of targeted assistance to the poor.

The price hikes of 2007/8 and 2010/11 and again in 2012 after droughts in the United States and Russia (see Figure 1) combined with declining per capita grain stocks<sup>2</sup> (Figure 2) highlighted the tight connection between both goals and sparked debate on food security in general and more specifically on the role of stocks, speculation and volatility of international food prices (see also Keyzer, 2009a, 2011a; SOW-VU, 2010, 2012).

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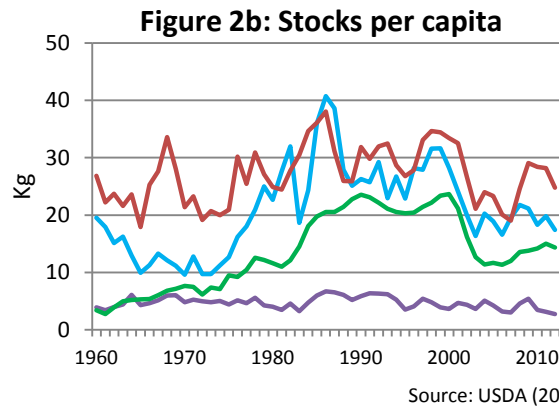
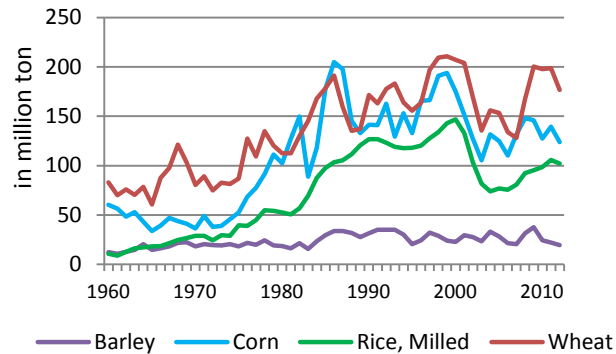
<sup>1</sup> The authors thank Gijs Zeestraten for his detailed review of two previous drafts and Max Merbis for his comments.

<sup>2</sup> This comprises both public and private stocks, as the USDA does not distinguish between the two. The percentage of stocks in public hands is not always clear and differs greatly per country, for example in the US approximately 2% is in public hands (FSA, 2012; USDA, 2012a) while the Public Distribution System in India (see section 2.4) requires that most of the stocks is publicly held.



Against the background of these developments the Ministry of Economic Affairs of the Netherlands commissioned the present study, to investigate whether “national, regional or international stock management can increase food security and whether these stocks can be used to achieve a more stable food supply and can help reducing price volatility”.

**Figure 2a: Worldwide stocks for selected products**

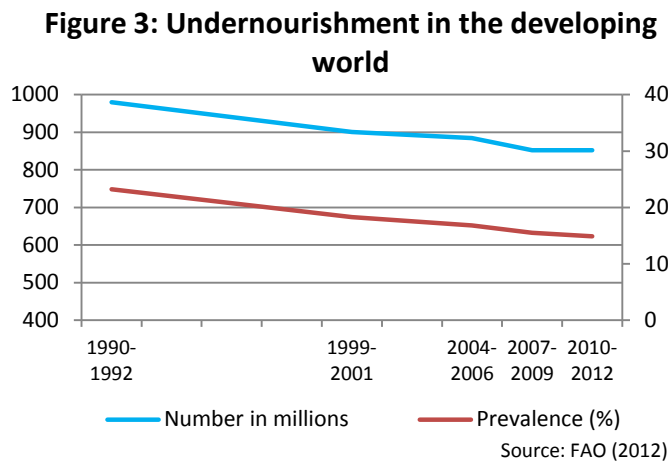


In addressing this question, it is important to first consider the basics of food insecurity, the impact of price volatility on society, agricultural growth, and climate change. We briefly review these before addressing the subject matter of stockholding itself.



### *Food insecurity*

Food insecurity depends on a wide array of primarily local factors, only some of which bear a direct relation to world food prices. World food prices in turn are affected by many factors other than global food production, such as macroeconomic cycles, energy prices and financial markets. According to the most recent FAO report (2012), there are now 870 million people undernourished – down from 1,000 million in 1990 but with the indication that the process of getting people out of hunger may have slowed down in recent years (Figure 3). At any rate, undernourishment still is a prime concern.



### *Impact on society*

The extent to which price volatility on international food markets impacts on local markets depends on various factors such as trade policies, transport costs and the share of the raw material component in the price.<sup>3</sup> On these local markets, the impact of price volatility varies among different groups in society. Urban poor are the first to suffer, particularly the unemployed and families with a large number of dependents. These groups can hardly produce food for their own consumption and are hard hit by price increases, albeit that recent estimates suggest (FAO, 2012) that their capacity to obtain food from other sources (e.g. food banks; Göpel, 2009) should not be underestimated. Yet, as their plight is highly visible (witness the food riots), the political process can be affected by it – for example by reinstating previously abolished food subsidies to make food affordable or by imposing export bans to lower domestic prices.

Farmers worldwide also tend to experience difficulties due to price volatility, especially those with a commercial orientation. Subsistence farmers who primarily produce to cover the needs of their households are generally less hard hit by price volatility, except in the lean season when

<sup>3</sup> For example in Sub-Saharan Africa only 13 out of an investigated 62 food prices have a long-term relationship with world prices (Minot, 2011), while in China transmission proves to be quite good in general, see Liu et al. (2012).

their own stocks dwindle. Clearly, grain and oilseed producers lose during downturns whereas those engaged in animal husbandry will see their feed cost rise and their profit fall during the upswings, much like the food processors along the chain, all this of course depending on the prevailing degree of competition. Monopolies, possibly the result of lobbying, make it possible for intermediaries to be more selective, and recent evidence (e.g. Campenhout et al., 2011; Minot, 2011) suggests that in past years price rises take far longer to reach farmers in developing countries than price falls, and conversely for urban consumers.

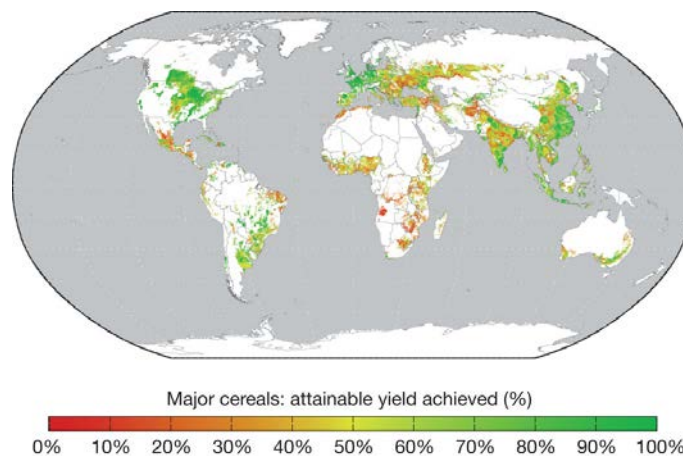
While a certain degree of price variation is essential to maintain competition among traders, beyond critical thresholds price movements may create intolerable risks along the supply chain that may discourage investment (G20, 2011). It remains unclear, however, whether this threshold was passed in recent years.

### *Insufficient agricultural growth*

While there is inconclusive evidence that price movements have become excessive, it is agreed that world food markets have been undergoing a transition from a period with high supply and low prices to a period with increasing demand and higher prices. At the same time, consensus has been emerging that investment in agriculture over past decades has been insufficient to cater to the future needs of a growing world population reaching a projected 9 billion by 2050 – with most of the growth taking place in developing countries.

Fortunately, it seems that the highest yield gains<sup>4</sup> can potentially be achieved in countries with the highest undernourishment rates (see Figure 4). Moreover, in many developing countries growth from investments in agriculture could be a major driver for growth of other sectors of the economy.

**Figure 4: Percentage of attainable yield achieved**



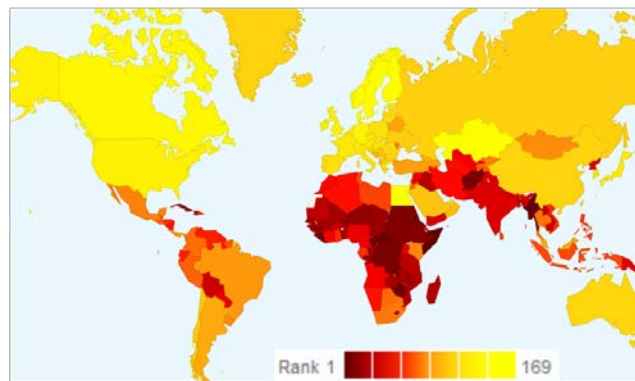
Source: Mueller et al. (2012)

<sup>4</sup> For a discussion on yield gaps, in particular in West and Central Africa, see Nin-Pratt et al. (2011).

### *Climate change*

Climate change is likely to make many poor rural communities more vulnerable (Figure 5). Given its weak resource base, smallholder agriculture is especially sensitive to rising temperatures, changing precipitation patterns, increasing risk of crop pests and diseases, and more frequent extreme weather events – all of which can raise the incidence of crop failure<sup>5</sup> and cause negative livelihood impacts (see also Fan et al., forthcoming).

**Figure 5: Agricultural productivity loss vulnerability: physical impacts adjusted for coping ability**



Note: Rank 1=highest vulnerability — Rank 169=lowest vulnerability.

Source: Center for Global Development (2012)

### *Control, mitigation and adaptation*

The planner's ideal would be to control a less desirable phenomenon such as price volatility,<sup>6</sup> possibly even eradicating it. However, the world food economy like most global systems cannot be controlled in this manner, essentially because of the system's interconnectedness.

Keeping public stocks affects private stockholding as well as prices; controlling prices by rationing affects stockholding and production, and so on. In such large systems, whether ecological or economic, only mitigation and adaptation or a mix of both are possible. Regarding mitigation the best intervention is to avoid human actions that cause distortions and lead the system astray. Second best is to design interventions that compensate for less desirable actions.

For example, in climate policy reduction of emissions belongs to the first category, carbon sequestration through afforestation to the second. Neither intervention aims to steer the trends in

<sup>5</sup> At present, models that link crop yields to weather data indicate that global corn and wheat production have declined by 4 and 5 percent respectively, relative to a counterfactual without climate trends between 1980 and 2008 (Lobell et al., 2011).

<sup>6</sup> Formally, volatility refers to changes in standard deviation of a variable. Here we use the term in the more informal meaning of "irregular variability", which for instance excludes variability due to fixed cyclical movements say, across seasons and variability according to a known density say, of the incidence of a disease among the population.

climate and to prevent climate change altogether, if only because the climate machinery is too powerful as well as too integrated for it. More or less the same applies to world food markets and to price volatility on it, with the difference that elimination would in principle be possible by closing down all markets, but the welfare costs of this or any other radical intervention would exceed the benefits by far.

After mitigation comes adaptation that seeks to help society cope with the phenomenon to the extent it cannot be prevented. Finally, major adaptation efforts may in view of the system's very interconnectedness also have mitigating impacts.

### *Overview*

The paper proceeds as follows. Section 2 covers stockholding itself. It starts with a presentation of the conceptual basics on stock formation in relation to stockholding, followed by an assessment of experience with past initiatives for public stockholding, and a summary and review of main stockholding proposals made in response to the price hikes. Section 3 discusses at a more general level the drivers and mechanisms of recent price volatility and comments on the main actions towards mitigation and adaptation. Section 4 concludes.

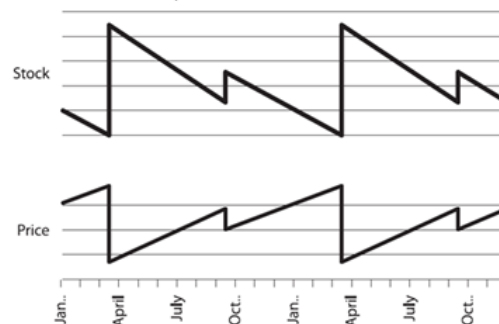
## 2. Stockholding

### 2.1 Conceptual basics of food stock and price adjustment

To provide the necessary background to assess various proposals for containing price volatility on world markets and their relation to stockholding, we briefly review the conceptual basics of the issue by recalling the market fundamentals of stock and price adjustment.

A first observation is that for seasonal crops there will be price variation within the cropping year even under perfectly certain circumstances, that is without any uncertainty about crop yields and with constant consumer demand throughout the year. The reason for this is that all harvested crop is initially kept in stock, only to be gradually released for sale to the consumer. Consequently, the cost of carryover (storage cost plus interest charge) accumulates over the year, causing the price to rise gradually after one harvest and to fall suddenly just before the next. Prices will therefore follow a rising saw-tooth pattern between consecutive harvests (see Figure 6). Conversely, stocks follow a falling saw-tooth pattern between harvests and reach zero level by the time the largest harvest comes in (see also SOW-VU, 2011, Keyzer, 2011b). Keeping stocks any longer than the time between two harvests would be technically possible but not profitable, as the old stock would not be able to compete with the fresh one. Within such a certain context, financial markets are only left with the task of supplying liquidity to farmers and to finance their inputs during the growing season as farmers have no need to hedge risks.

**Figure 6: Stocks and prices in the absence of shocks and uncertainty**



In the real world such perfectly certain conditions never occur, forcing farmers, traders, processors and all other parties involved to cope with uncertainty. Therefore stock levels do not necessarily follow the neat saw-tooth pattern described above. For instance, due to uncertainty it might happen that stock levels drop to zero before the largest harvest comes in. However, since consumers (and livestock) have a strong preference for consumption smoothing (they cannot fast for long) this is unlikely to occur, because traders know that the product might fetch a high

price if the harvest happens to fail. Due to the uncertainty of supply and almost fixed demand for food, various segments in the chain therefore always tend to keep positive stocks at the end of the season, albeit that these will have to be refreshed regularly, usually once every season, to prevent degradation.

As an illustration of the volumes involved, we show in Table 1 the worldwide average 2009-2012 grain harvest, the stocks at the end of the marketing season (excluding China) and their size as percentage of average stock – the average is calculated for the hypothetical case of two equal grain harvests, where one is harvested half a year later than the other combined with a gradual release throughout the year under fixed demand. This percentage indicates that present stocks are significant, even though they would be far from adequate for coping with a single complete harvest failure.

**Table 1: Overview of average yearly production, closing stocks and the possibilities to cope with a harvest failure.**

	<b>Wheat</b>	<b>Coarse grains</b>	<b>Rice</b>
<b>Production* (million ton)</b>	676.8	1134.1	467.6
<b>Closing stocks* (million ton)</b>	195.1	180.6	143.7
<b>Closing stocks*(excluding China)</b>	146.3	131.8	66.9
<b>Closing stocks (% of the average reserve **)</b>	86%	46.5%	57.2%

\* Average worldwide grain production and closing stocks for 2009-12, OECD/FAO, 2012.

\*\* The average reserve is calculated by assuming there are two equal harvests and fixed demand.

It may be remarked, however, that data on stock levels are notoriously unreliable.<sup>7</sup> Moreover, an agricultural product is specific relative to say, copper or gold, as it flows in one direction only, because processing irreversibly transforms it into a product of the next stage of the chain, with stocks and demand of its own that are seldom usable as input in an earlier segment. Hence, stocks of vegetable oil in the supermarket and feed grain stocks at a livestock farm can no longer serve as buffers, even though they will help cushion price and output variations upstream. As an indication of the size of the stocks already within the chain, the on/off farm ratio for corn is about 50/50 while it is about 30/70 for wheat (Wiggins and Keats, 2010) where off-farm stocks include those held at mills, elevators, warehouses, terminals and processors.

<sup>7</sup> China is a case in point. The initial 2001 estimate of their total corn stock was 32 million ton. However, after balancing stocks, production and consumption, USDA raised these levels to 80.5 million ton initially and later to 102 million ton (of total worldwide stocks reaching around 150 million ton). Later information made it clear that a substantive fraction had become unsuitable for human consumption, and was to be deferred for use as biofuel.

In relation to the uncertainty of supply, two distinctive features of agriculture relative to other sectors make their appearance that influence stockholding. First, the seasonality of agriculture implies, beyond a delay between planting and harvesting time, that uncertainty about weather conditions and hence about the yield is inevitable. Future climate change may increase weather variability and consequent yield uncertainty. Second, weather conditions primarily impact on supply but hardly affect demand, except for say, ice cream consumption depending on temperature. By contrast, supply in the energy sector is largely non-seasonal and hardly affected by weather conditions but instead seasonal on the demand side since energy consumption tends to rise in winter.

In view of their seasonal and hence cyclical nature, both agriculture and energy share the feature of having an hour of truth, when major information is revealed to the market and the puzzle for the current season falls into place.

For agriculture, this is the date of harvest, in particular of the major one when stock levels are structurally at their lowest. For cereals this is around March-April, that is around the date that the Northern Hemisphere sees its first harvest come in from the warmer zones (September-October is less relevant in this respect because the Southern Hemisphere has a much lower production).

In addressing this puzzle, price adjustment and stock adjustment, the two ways of bridging a gap between supply and demand, are often substitutes – the larger the stock adjustment, the smaller the price adjustment and vice versa.

At this juncture it is important to mention that there is a major difference between rich and poor consumers and the impact they have on prices and stock levels. All food consumers generally prefer to keep their food demand relatively constant throughout the year – except for days of fasting and of feast. However, the rich have sufficient income to meet their demand even when prices are high, in contrast to the poor who may have to tighten their belts to make ends meet. Consequently, the price pattern in Figure 6 will become steeper as consumers become wealthier and stock levels will in parallel be higher as well to ensure that the rich consumer's wishes can continue to be catered to. Hence stronger price volatility and higher end stock levels go hand in hand with economic development.

Traditionally stockholding has been a private as well as a public activity. Private operations serve the classical commercial functions, with farmers having to decide when to sell their stock, processors and traders when to buy, and also when to sell. This is where the possibility of speculation in the spot (physical) market emerges on the basis of future price expectations. Those who expect prices to rise will build up stock and postpone sales, and vice versa for price falls. Hence, on the spot market uncertainty about future prices inherently leads to subjective decisions based on future expectations, and, therefore, all parties with any discretionary power can be called speculators.

As long as price expectations are being realized stock adjustment will reduce price variation to a minimum, i.e. to the saw-tooth pattern described earlier. However, with increasing lack of realization of expectations, stock adjustment may have a less dampening role, and eventually turn into a mechanism that increases rather than reduces price variation while hoarding or dumping takes over.

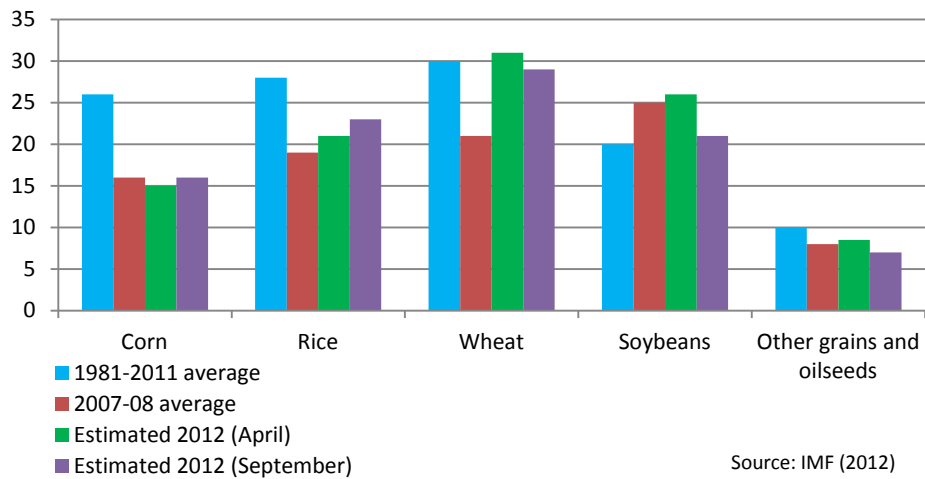
## **2.2 The role of stocks**

To account for the possibility of the private sector making collective errors in prediction, to counter speculation, to ensure stability, to promote the agricultural sector and to ensure availability of food across the territory in case of disaster, government authorities have throughout the ages kept public stocks in secure places.

### *Buffer for stabilization*

Government agencies may keep buffer stocks to contain price variation. Containing price variation is in the interest of both the consumer and the farmer by reducing their price risk. This is usually effectuated by means of a price band. When the price rises above the band, the government releases stock and when the price falls below a band it acquires stock. Adjustment of stock levels is thus used to balance supply and demand and to influence prices. However, this mechanism has both beneficial but also negative effects. Indeed, according to the OECD/FAO (2012), the World Bank (2011) and others, low stock-to-use ratios (see Figure 7) may have generated price volatility. The reasoning behind this claim is that low stock-to-use ratios signal to the market that little room is left for adjustment of flows, leaving price increases as sole adaptation mechanism to balance supply and demand. Even though such low stock-to-use ratios are mere statistical indicators that do not accurately reflect even the actual stock levels in the economy, they undeniably affect the market. Also recall from the introduction that stocks, whether end-levels or not, will not qualify as policy instrument.



**Figure 7: Global food stock-to-use ratio's**

### *Countering speculation*

Besides bridging the gap between supply and demand, stocks levels are also object of direct investment decisions, sometimes referred to as hoarding or speculation.

After the 2007/2008 crisis, index funds in particular have been blamed for the increase in food prices (de Schutter, 2010; Tang and Xiong, 2011; UNCTAD, 2011). The accusation was that their purchases on futures markets were driving up prices. Since they had no interest whatsoever in acquiring the physical goods, they had to offset their positions before the futures contract's expiry date, only to buy futures with an expiry date later in time. Hence, they remained in the market while expanding their positions with the influx of new money. The increased futures prices would subsequently increase spot market prices thereby hurting the poor.

Public stocks can be used for discretionary intervention to supply the market and keep prices within an acceptable range, particularly toward the end of the season, when private stocks reach their low. The intervention capacity, however, primarily aims to endow government with credible power to dissuade speculators.<sup>8</sup>

We postpone the discussion of this indictment until later, because it appears that the practices mentioned, which actually took place, were profitable only as long as a well defined deficiency could persist in futures market regulations. A deficiency that actually disconnected futures from spot markets made it questionable whether the spot markets could be so directly affected by financial speculation in the first place.

<sup>8</sup> The example of Japan announcing to release its rice reserves in 2008 is a point in case. Furthermore, the International Tin Council successfully fended off an attack (Anderson and Gilbert, 1988).

### *Encouraging agriculture*

Stocks are also a demand category in its own right. Oxfam (2011) has argued that lack of growth in agricultural production causes local communities to depend increasingly on international trade and corresponding price fluctuations. To turn the tides for local communities, it has proposed building up stocks from local production to improve local food security during periods of high prices and to promote local agricultural production during slumps. The proposed setup fits in a long tradition of marketing boards, which unfortunately has been one of many failures (Barrett and Mutambatsere, 2005). Marketing boards were established and maintained during the 1960s and the 1970s and came to almost complete extinction in the course of the 1990s in developed as well as in developing countries.

The demise followed a multitude of difficulties including financial deficits, physical losses, poor incentives for supplying good quality, high cost to consumers, emergence of local monopolies, bureaucracy and corruption that increased inefficiencies and transaction costs and parallel private markets that could not be controlled. All signals pointed in the same direction: there may be some advantages initially but eventually marketing boards fail. It is hard to imagine that any new design could change this. Moreover, the advantages of price stability to encourage agricultural development in itself are not all that obvious, as commercial trade needs some degree of price variation to maintain its profitability.

Furthermore, most empirical studies that have looked at agricultural price stabilization find that gains are generally small. For Bangladesh, India, Indonesia, Pakistan, The Philippines and Thailand the gains range from 0 to 3.5 per cent, while in Ethiopia there seem to be considerable gains for large farmers but losses were recorded for small farmers and consumers (World Bank, 2012 and the references therein). Estimated gains tend to be higher for large net sellers and for people in countries where food grains account for a large share of total consumer expenditure.

### *Ensuring national food security*

Much like Ancient Egypt, countries today still need to ensure food security. In the wake of the food crisis, the US and the EU have actually decided to treat food security as an intrinsic part of national security, which essentially means that it enjoys priority similar to that of national defense. Large importing countries, such as China and Japan, face special challenges in this regard. Since they are bound to influence world market prices in case of a sudden increase in demand, through for example an emergency, the danger looms for them of having to buy expensive imports. To prevent this, and to reduce their vulnerability to export restrictions imposed by other countries, they maintain large public stocks. Food rations are kept by the military to safeguard their operational capacity during a crisis.

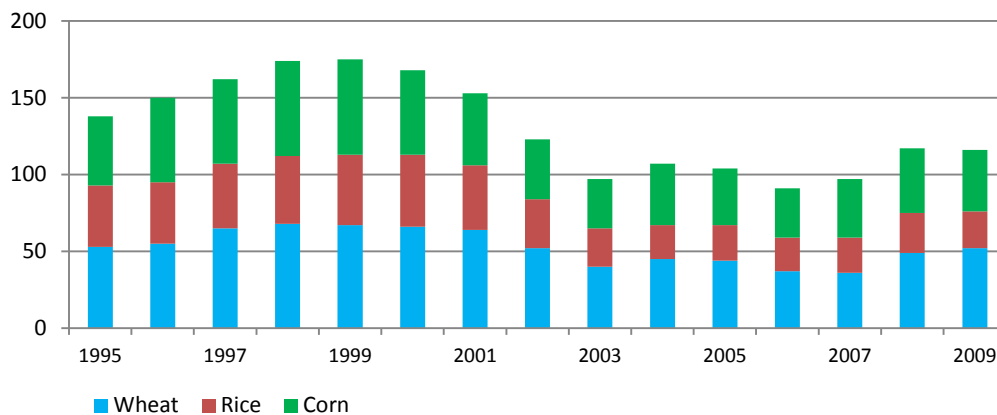
### *Addressing emergencies*

Emergency stocks are typically activated under a limited range of conditions. They fall under the control and responsibility of the national government for food security objectives, often in consultation and cooperation with the WFP, and play no role in stabilizing market prices. The stocks needed for this do not have to be located within the country that needs them, even though emergency stocks are most suitable for locations hard to reach.

### **2.3 Dwindling significance of public stockholding**

As noted earlier, overall the end-of-season stocks have been diminishing. Indeed, total reserves are by now far from sufficient to feed the world for one year in case of a completely failed harvest (see Figure 8). In this regard, isolated subsistence farmers often find themselves in a safer position than urban populations, since their stocks of food and live animals protect them from immediate starvation after harvest failure. We review the main reasons for this decline, in relation to the functions of stockholding that were just mentioned.

**Figure 8: Global grain stocks expressed in the number of days to supply each person with 1800 Kcal.**



### *Cost of public stockholding*

Public stockholding is costly (G20, 2011), particularly in warm and humid climates where it is unavoidable that a share of the stocks will perish. Even though it has often been asserted that a buffering program could be self-financing (Newbery and Stiglitz, 1981), postwar experience shows that due to the high costs of stockholding this is rarely the case. For example, annual costs

of stockholding – including tied-up capital (interest charge), storage costs and losses in store – range from US\$15 per ton in the United States to \$21 in Egypt and Bangladesh, \$33 in Ethiopia, \$42-\$44 in Tunisia, Qatar and Indonesia, \$49 in Malawi to \$75 in Zambia (World Bank, 2012; Wiggins and Keats, 2010). As an illustration of the effect of costs of stockholding resulting in the diminish of public stocks, consider the period between 1975 and 1980 in which several countries, including Burkina Faso, Mali, Mozambique, Niger, Ethiopia and Tanzania established food security resource stocks. When their government marketing boards, which possessed trade monopolies for certain grains, lacked the funds to finance their operations, they were forced to sell part of their reserves, leading to a gradual disappearance of these stocks and consequent inactivation of the marketing boards (Wiggins and Keats, 2010). Besides storage costs, stockholding also requires adequate grading and supervision, short of which corruption in the form of over-reporting of stock levels, and purchase of low grades will occur.

#### *Public stocks crowd out private operations*

The mere presence of public stocks tends to reduce private activity because there are less potential profits to be reaped since the public stock can provide supply in case of a deficit, limiting the price rise and thereby the premium for private actors, while at the same time the public stock can create demand in case of a surplus, limiting the scope for bargain purchases. Moreover, lack of competition will create an inefficiency in the mode of operation of public stock holding agencies. Furthermore, the tax needed to fund public stocks also causes the well known deadweight loss, due to the impossibility of raising taxes as lumpsum.

#### *Target of speculation*

Although public stocks can discourage speculation, they can also become the target of speculation,<sup>9</sup> due to their natural bounds of full depletion and full capacity. The storage capacity always tends to be too low on a globalized market where traders can buy and sell as much as they like. It is quite profitable to buy at a fixed ceiling price just before stock exhaustion and sell a day later when prices have moved far above the ceiling, and vice versa for selling.

#### *Shift to international trade*

Both international trade liberalization and improvements in transport, say by the introduction of bulk carriers and containers, made it easier for countries to rely on international trade to satisfy their import needs and to dispose of domestic surpluses. The more a country's food supply gets

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<sup>9</sup> In the past buffer stocks of for example gold, silver and tin each were attacked by speculators anticipating price increases (Sallant, 1983).

dependent on international trade, the more it becomes critical for this country to have assured access to this market at all times. Furthermore, large countries such as China and India are bound to exercise strong influence on world markets whenever they buy or sell. This explains their penchant for keeping national stocks, nonetheless, both to guarantee domestic supplies and to contain such price impacts.

### *E-trade as a new alternative*

Finally, introduction of electronic trade (e-trade) and improved practices on markets for futures and related financial products such as credit and insurance allowed traders and processors to ensure smooth delivery and reduced their need to keep stocks. Furthermore, the futures market has allowed large importing countries to ensure future deliveries that reduced their need for stockholding from a national security perspective.

## **2.4 Past and current experience with stockholding arrangements**

When food markets pass through a turbulent phase, it is not uncommon for policy makers to come up with new proposals for stockholding, as these involve tangible actions of the kind that the public expects from its leaders. In this regard not much has changed since Ancient Egypt. Under current WTO regulation public stockholding is permitted for food security purposes or genuine aid,<sup>10</sup> provided it is clearly linked to achieving nutritional objectives. The present section gives a summary of major initiatives in chronological order over the past fifty years.

### ***International Commodity Agreements (1940s)***

*Problem* Unstable prices.

*Description* International Commodity Agreements (ICAs) were proposed toward the end of the Second World War. ICAs were introduced to stabilize prices, in most cases via a buffer stock schedule defending a price band (buying at low price, selling at high price). One specific initiative was the International Wheat Agreement (IWA), operational from 1949 till the 1970s.

*Strength* In a period of stable economic growth and growing demand, the IWA succeeded in stabilizing prices.

*Weakness* In practice, most of these agreements faltered for reasons similar to those that led to the demise of marketing boards (financial deficits, physical losses, poor incentives

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<sup>10</sup> There are a number of conditions, such as financial transparency and acquirement and sale at market prices (see GATT, 1994).

for supplying good quality, high cost to consumers and speculative attacks).<sup>11</sup> For the IWA in particular it holds that the agreement was weakened due to stockholding outside the IWA agreement by the US and Canada that absorbed supply shocks, and after the turmoil of 1973/1974 with rising energy and food prices, the agreement collapsed.

*Literature* Gilbert (2011), McCreary (2011).

### ***India's Targeted Public Distribution System (TPDS, 1960s)***

*Problem* Food insecurity.

*Description* Originating from the Public Distribution System of the 1960s, India established the current TPDS in June 1997, and the program is operational to date. The TPDS offer a social safety net that targets the poor via "ration shops". The total yearly amount associated with this program is close to 35 million ton of rice and 27 million ton of wheat.

*Strength* These shops cover the whole country, including poorly accessible areas, which potentially allows for good targeting.

*Weakness* Only 42% of the subsidized grain reaches the target group due to targeting errors, prevalence of ghost cards and unidentified households. Furthermore, because of the vastness of the rural areas, the shops have to keep significant stocks in reserve (even up to three months).

*Literature* Ministry of Food and Consumer Affairs (2012), Ministry of Food and Consumer Affairs in S. Mukherjee (2012), Government of India (2005).

### ***International Emergency Food Reserve (1974)***

*Problem* Food crises like the one in 1973/1974.

*Description* Following the World Food Conference in 1974, amidst a food and energy crisis, the United Nations General Assembly endorsed the International Undertaking on World Food Security. The aim was to create a global grain reserve to be held at strategic locations around the world. Under auspices of the WFP, an international emergency food reserve was created and filled through voluntary contributions.

*Strength* By keeping reserves at strategic points the reserve could act swiftly in case of crises.

*Weakness* The food reserve proved ineffective, because donors wanted to see their food commodities used for the emergencies that ranked highest on their agenda, and to consist of commodities they had on offer.

*Literature* Briones (2011).

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<sup>11</sup> As mentioned before, in the past buffer stocks of for example gold, silver and tin each were attacked by speculators anticipating price increases.

### ***ASEAN Plus Three Emergency Rice Reserve (APTERR, 1979)***

*Problem* Unstable prices.

*Description* In 1979, the Association of Southeast Asian Nations (ASEAN) member countries - Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam - established the Agreement on the ASEAN Food Security Reserve. The reserve in principle covered all stocks, including national stocks. In practice attention focused on rice. The Asian Emergency Rice Reserve (AERR) was made up of earmarked national stocks to address food emergencies and was governed by the ASEAN Food Security Reserve Board (ASFRB), comprising representatives from every member country. The AERR remained inactive for several reasons: (i) the reserves were too small, as they only offered the equivalent of 0.4 day of consumption; (ii) the AERR's secretariat was inadequately funded; and (iii) countries did not want to give up any autonomy in stockholding. Because of its ineffectiveness, AERR was reconsidered and a pilot was conducted in 2003 – East Asia Emergency Rice Reserve (EAERR) – , that raised the reserve level, and most importantly extended the agreement to China, Japan and the Republic of Korea. The pilot was formalized in 2011 to become the ASEAN Plus Three Emergency Rice Reserve (APTERR).

*Strength* The extension of the agreement was a significant step indeed. The mere announcement of Japan to release its rice reserves ended the price hike for rice in 2008. Furthermore, a larger part of the national stocks are now earmarked under APTERR reducing the need to apply for stocks outside the agreement.

*Weakness* It is dependent on the financing of Japan, without it the agreement would falter.

*Literature* Briones (2011), Clarete (2012), Wright (2008).

### ***South Asian Association for Regional Cooperation (SAARC) Food Security Reserve (1987)***

*Problem* Food emergency.

*Description* SAARC, a regional association formed by Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, established a food security reserve in 1987 – Afghanistan joined in 2007 – to be called upon by a member country in case of national food emergency. Up to 2007 no releases were made because member countries were reluctant to declare a state of emergency. In 2007, a new agreement was signed establishing a food bank that allows withdrawals in the far less controversial situation of a plain emergency. The food bank itself does not hold reserves but individual members earmark part of their national stock for it.

*Strength* The advantage over national reserves would be that due to the wide geographical spread of the reserves it becomes less likely for all members to experience deficits at the same time.

- Weakness* Member countries still have not reached an agreement as the food bank still has not become operational.
- Literature* Briones (2011), SAARC (2012).

### ***SADC Food Reserve (2002)***

- Problem* Growing poverty and vulnerability.
- Description* In 2002, the South African Development Community<sup>12</sup> expressed its intention to enact its own reserve. The idea was to let individual countries keep a mandatory percentage of stocks above national needs to meet regional commitments and to provide assistance during crises (SADC, 2012).
- Strength* Like the SAARC food security reserve, the enlargement of the geographical region makes it less likely that the whole region is hit by shortfalls.
- Weakness* It never came to implementation even though the idea was taken up once more after the price spike of 2007/2008.
- Literature* SADC (2012).

In sum, stockholding programs can have potential benefits for the poor but costs and administrative difficulties are main obstacles to their effective management.

## **2.5 Proposals based on stock management after the food crisis of 2007/2008**

The 2007/2008 crisis resulted in numerous proposals to curb price volatility and to ensure food security for the poor such as the recommendations made by the G20 in 2011.

### ***Summary of the recommendations made by the G20 in 2011***

- Strengthen long term productivity of the agricultural system worldwide
- Establish an Agricultural Market Information System
- Improve transparency in futures and OTC markets
- Improve trade discipline
- Allow the purchase of humanitarian food without export restrictions
- Remove provisions of national policies that subsidize/mandate biofuel production/consumption
- Set up an emergency food reserve system
- Ensure access to credit for low income countries for food purchases during price crises
- Provide risk management tools
- Strengthen policy coordination

<sup>12</sup> SADC members are Angola, Botswana, DR Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.



Below we give an overview of the stock based proposals made after the 2007/2008 crisis. Although most of the following proposals that were put forward on the international scene never reached the stage of actual implementation, we include them as reference material.

### *Mitigation and adaptation*

Major stock interventions aiming for adaptation can have a mitigating impact as well. Below we discuss proposals belonging to this category, in order of decreasing geographical scope, concluding with a proposal that focuses on tracking stocks rather than on investing in them.

#### ***Internationally Coordinated Public Grain Reserves***

*Problem* Unstable prices and speculative attacks.

*Description* Lin, Chief Economist of the World Bank at the time, made a proposal to hold internationally coordinated public grain reserves. Held under a UN agreement all countries would hold public stocks as a percentage of their annual domestic demand and release these as and when a price spikes develops. No indication is given on the size of the reserve.

*Strength* Once credibility of the arrangement is well established, it can mitigate volatility and stabilize prices. Furthermore, a speculative attack can be prevented by mere announcements. The arrangement will also contribute to adaptation by securing delivery to poor importers.

*Weakness* Besides the fact that past efforts on stabilizing prices have generally been unsuccessful, the arrangement needs a credible commitment to be upheld also at times that not releasing the stocks would be in a country's short term interest.

*Literature* Lin (2008).

#### ***Regional reserves***

*Problem* Unstable prices and lack of social safety nets.

*Description* Several proposals were issued for stockholding at regional level, particularly in vulnerable areas, such as the pilot study for ECOWAS and the earlier mentioned SADC Food Reserve. The ECOWAS regional reserve would give poor deficit countries access to physical food distributed through safety net schemes, thereby strengthening systems of national and regional resilience providing a critical additional line of defense. The ECOWAS regional reserve could be implemented at an estimated initial cost of US\$44.3 million and annual recurring costs of US\$16.6 million.

*Strength* A positive aspect of this kind of arrangement over national reserves would be that due to the wide geographical spread of the reserves it becomes less likely for all

members to experience deficits at the same time. Under this arrangement also announcement effects could go a long way in mitigating speculation.

*Weakness* Commitment, funding and discipline are major limitations here.

*Literature* ICTSD (2011).

### ***Improved information***

*Problem* It has been argued that the recent episodes of high price volatility were also attributable to poor quality of public information available on global food supply and demand – including stocks – as this has reduced confidence in markets, and promoted speculation, particularly via futures markets.

*Description* To enhance food market transparency and encourage coordination of policy action in response to market uncertainty the Agricultural Market Information System (AMIS) was enacted. AMIS aims to achieve this by monitoring the market, provide analysis and statistics, build capacity and engage in policy dialogs.

*Strength* Better data can reduce uncertainty and by it the need for stocks. They can also inform interventions during a crisis and hence contribute to adaptation.

*Weakness* It is important to select the correct indicators and be selective. Trying to secure comprehensive information on supply, demand, stocks and prices is impossible<sup>13</sup>, and the very attempt could disrupt the functioning of markets. Finding adequate indicators is critical.

*Literature* AMIS (2012), G20 (2011), UNCTAD (2011).

### ***Adaptation***

Stock operations of limited size will primarily serve adaptation, proposals in this category are discussed below and ranked in decreasing order of the likely size of their physical stock.

### ***International Agency for Food***

*Problem* Hampered supplies.

*Description* Member states would develop protocols for international collaboration assuring that supplies reach all of them in case of a disruption in deliveries. This would mimic an International Energy Agency (IEA) organization for food.

*Strength* It can act as a first line of defense.

*Weakness* There are key differences between the IEA and an International Agency for Food. First, whereas OECD members have the fiscal means to hold oil reserves, developing countries might find it difficult to hold similar food reserves. Secondly,

<sup>13</sup> See box 3 and 4 in AMIS (2011) for the multitude of data and indicators required.

in case of emergencies it is imperative that food reserves be located in the vicinity of the emergency and be accessible without delay, which seems unlikely under the proposed arrangement. Thirdly, the IEA only responds to supply shortages and it does not act on price fluctuations, as would be necessary for food. Finally, there are major technical differences between petroleum and food products: whereas demand for both is fairly inelastic, rationing is easier for petroleum.

*Literature* Evans (2009), Wright (2012).

### ***Emergency Reserve for Food Aid***

*Problem* Short term supply in case of an emergency.

*Description* In 2009, the International Food Policy Research Institute (IFPRI) proposed to maintain an international public stock of 300 000 to 500 000 ton of grain (around 5% of international aid flows) to improve the international community's capacity to cope with emergencies. At a storage cost of US\$15 per ton (at the low end of the range) the annual stockholding cost (interest plus storage) of such a reserve would amount to around US\$7.5 million. Furthermore, there are costs associated with restocking the reserve (due to the difference between post- and pre-crisis prices). Stocks are to be kept at strategic points near or in major developing-country regions using existing national storage facilities locally. The World Food Program (WFP) would be responsible for managing the stocks, to be used exclusively for humanitarian and emergency purposes. Furthermore, the WFP would have access to cereals at pre-crisis market prices.

*Strength* In remote areas with poorly developed banking facilities, high chance of robbery and poorly functioning food markets, transfers in kind remain preferable and stockholding is a necessity.

*Weakness* Although the WFP might be a natural candidate to manage this fund, it would need to acquire a statutory financial reserve rather than having to mobilize donors after every emergency as is currently the case. Furthermore, cash transfers to households are generally considered less costly and they offer higher flexibility for individuals to adapt the composition of their food basket and possibly to buy other high priority items, such as pharmaceuticals.

*Literature* Von Braun and Torero (2009), IEG (2011).

### ***Food Import Financing Facility***

*Problem* Low income countries have insufficient funds to buy food in case of an emergency.

*Description* Sarris proposes to enact a Food Import Financing Facility that provides financial aid for low income countries to finance their food imports. Finance is provided under specified conditions. The average financing needs of the facility are in the range of US\$200 to US\$420 million. The finances would be raised by borrowing on AAA

terms, with loans backed up by guarantees from a number of countries. Concerning the operational costs of the facility no estimation is given but the proposal takes them to be covered by WTO member contributions or by borrowing on AAA terms and placement of these funds by the facility in higher-earning assets. The arrangement bears close resemblance to the Food Financing Facility that was established in 1981 by the IMF, which aims to help impoverished countries acquiring financial means for additional imports to prevent consumption shortfalls.

- Strength* There is no need to keep expensive physical stocks.
- Weakness* It is not made clear in the proposal whether the facility will be an independent entity or needs to be brought under the umbrella of an existing institution (like the WTO). Further concerns include the administrative complexity; costs, terms and conditions of such lending. To illustrate the impact conditions can have on the functioning of the facility, take the case of the IMF Facility which has hardly been used in the past and was not at all called upon during the 2007/2008 food crisis. This is presumably due to the tight conditions imposed by the IMF – countries with existing balance of payment weaknesses cannot access the facility without a parallel fund-supported adjustment program. To improve this facility the IMF proposed two modifications: (i) to ease the conditions for short term and emergency financing and (ii) to eliminate some facilities to simplify the administrative process.
- Literature* Sarris (2009), Shaw (2007), Von Braun et al. (2008), Wiggins and Keats (2010).

Overall, the proposals for easing market access to food tend to involve stockholding as part of broader packages including finance, better trade discipline, guaranteed supplies, as well as more accurate and timely information.

Keeping physical public stocks will require large sums of money to compensate for financial as well as physical losses. Furthermore, the stocks themselves might crowd out private stockholdings and could also become target of speculation. Establishment of a small reserve can act as a first line of defense, though, in case of an emergency. Furthermore, reserves can be used as a social safety net as well – like in the ECOWAS project.

Keeping stocks amounts to inevitable physical loss leading to additional demand for agricultural product thereby assisting farmers. More important though is the reverse mechanism, whereby investments in storage facilities, trucks and road infrastructure reduce these losses, while investments in greenhouses or irrigation reduce variability of yields and hence the need for keeping stocks.

## 2.6 General assessment

Stock levels are largely outcomes of complex interactions of a larger system. They provide useful indicators of scarcity for sure, but addressing low stock levels by keeping more stocks amounts to little more than curing a symptom, and is likely to be very costly and ineffective. Furthermore, the world food system is nowadays far too connected to be controllable by public stock operations beyond their activation during emergencies. Rather, much like for climate, policies should focus on mitigation and adaptation.

In summary, we conclude from this review of proposals that the multitude of proposals put forward at various forums in response to crises makes it increasingly difficult to keep policies well focused in a balanced package. Consequently, political leaders are led to listen and to react to a wide array of loose ends and spend their scarce time on ad hoc decisions that are only warranted under outright emergencies. Food security management deserves better.



### 3. Other proposals and plans for reform

Having noted the impossibility of controlling the stocks in the market and having reviewed the consequent difficulties of mitigating price volatility via stocks operations, we will now discuss a number of other proposals and plans for reform that opted for a different strategy, often as a mix of mitigation and adaptation. We distinguish between proposals towards improving the functioning of food markets; proposals for temporary diverting foodgrains from biofuels and animal feeds; for eliminating biofuel mandates altogether; for improving the functioning of futures markets; and finally, for better adaptation.

#### 3.1 Mitigation proposals to improve functioning of food markets

The first two proposals below aim to reduce price volatility by reduction of price distortions.

##### *Enhanced trade discipline*

*Problem* Unilateral export bans.

*Description* During the food crisis of 2007/2008, export bans were imposed by India, Russia and Ukraine among others, which resulted in higher food prices. Russia imposed an export ban again in 2010/2011 with similar effects, and in 2012 the mere announcement by Russia that it was considering an export ban raised prices. During the G8-Summit of 2008 and the World Food Summit of 2009, FAO members agreed to abstain from imposing export restrictions for purchases of humanitarian nature and to maintain a public emergency stock, which already fits present WTO regulations.

*Strength* This enhanced trade discipline would improve the functioning of the market and ensure better access to food.

*Weakness* No member state has challenged export restrictions so far within the WTO, or initiated new legislation in this domain.

*Literature* G20 (2011).

##### *International Grain Clearing Agreement*

*Problem* Default on a delivery contract.

*Description* The International Grain Clearing Arrangement would guarantee grain trade contracts. By linking various commodity exchanges around the world, it would ensure delivery of the same quantity at a desired location, as local clearing houses would transform part of their financial reserves in physical reserves. It is estimated

that a physical reserve is needed of around 1 million ton with the associated stockholding costs. Operations are financed by charging a “good faith margin” on each contract.

- Strength* The arrangement tries to ensure proper functioning of the market.
- Weakness* There is a need for appropriate exchanges in different geographic locations. Furthermore, it is essential that food importers hedge their purchases at these exchanges.
- Literature* Sarris (2009).

In short, the proposals might work but enforcing better disciplines is politically difficult and implementation of the international clearing agreement would be costly.

### **3.2 Diverting cereals from biofuels and animal feed**

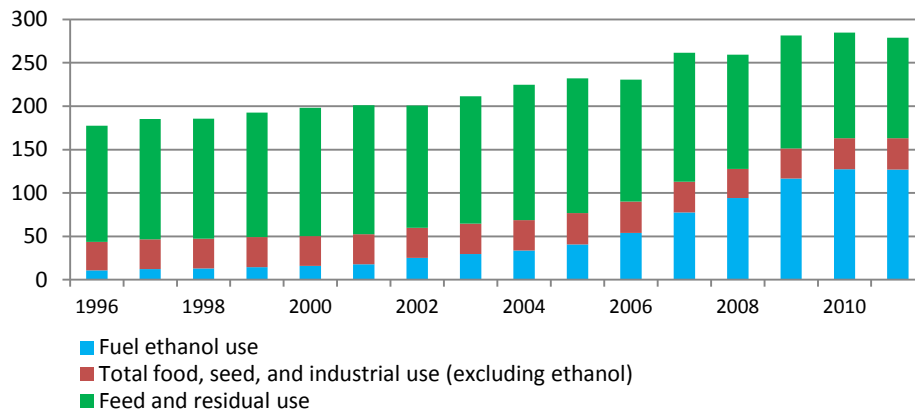
Since 2005 biofuels have become an important demand category on agricultural markets that significantly affects price trends as well as price volatility (Keyzer et al., 2008; Keyzer, 2011c; Blanco Fonseca et al., 2010). In a similar vein, demand for animal feeds has diverted produce for much longer. Proposals (e.g. Wright, 2012) have been put forward to control both channels so as to interrupt the outflows of food under extreme situations to reduce the pressure on food markets. We review the current situation on biofuel mandates and the specifics of US policies before discussing these proposals which essentially take the mandates as given and seek to mitigate price volatility though only the abolishment of biofuel policies would really mitigate the price volatility that is induced by the mandates.

#### *Biofuel mandates*

Around 12% of world corn production and 20% of world sugarcane production are currently being used for bioethanol production (OECD/FAO, 2012). The US, world’s largest bioethanol producer, uses 30-40% of its corn production to this end. Bioethanol is blended in gasoline both to substitute for earlier octane boosters and to substitute for fossil fuels (Figure 9). Similarly biodiesel, primarily produced from oilseeds and palm oil, currently absorbs 12% of vegetable oil production, a share that is expected to rise to 16% by 2021 (OECD/FAO, 2012). Hence both bioethanol and biodiesel have become major demand categories for agricultural produce, and by their lack of price elasticity exercised significant upward pressure on prices and contributed to their volatility (Runge and Senauer, 2007), primarily via the blending mandates.

This blending mandate, a standard component of biofuel policies worldwide, introduces something like a quota system on food markets and requires fuel used in transport to contain a minimum percentage of biofuel.



**Figure 9: Use of corn (in million ton)**

Key players in the area of biofuels are Brazil, the EU and the US. Brazil already started experimenting with biofuels in the 1970s, essentially bioethanol from sugarcane, and significantly invested to let its fleet run on fuels with a high ethanol content. In 2008 it raised the blending range for all its cars to E25-E100<sup>14</sup> (UN-Energy, 2011).

The EU has no specified range on blends, but it expresses its mandates, currently 4.5% for EU27, as obligations to fuel suppliers, implemented via certificates. Producers of biofuels receive certificates for their biofuel production that are sold to fuel suppliers. Fuel suppliers in turn deliver these certificates to supervising authorities as proof that they fulfilled their mandate. In 2003, the first directive was issued allowing for ethanol up to E5; in 2009, E10 was accepted and introduced in France, in 2011 in Germany and in 2012 preliminary introduction has begun in the Netherlands. Sweden has E10 but also offers flexfuel of E85. Since 2009, the EU has in response to the food crisis relaxed the regulation by allowing for biofuel mandates to be swapped for production of renewable energy in other sectors (e.g. through wind turbines). In 2012 the EU has signaled its intention to reduce the biofuel component in the renewable energy strategy and commitments.

In the US the first cars ran on bioethanol as early as the 1920s, but the present mandates were set in 2007 when the US, much like the EU, introduced tradable certificates – called Renewable Identification Numbers (Rins). These Rins can also be banked for future use. Banked Rins can in principle be used as a buffer to substitute for physical biofuel production when corn is relatively expensive, making demand for corn as an input for biofuels more price elastic.

Most OECD countries have adopted biofuel mandates of some kind. Similarly, China has engaged in biofuel production (Qiu et al., 2011), but after having run down public stocks of food

<sup>14</sup> i.e. 25-100% ethanol. Note that engines that can operate on E100, can operate on E25 but not vice-versa.

of lesser quality chose to keep its use of domestic feedstock limited. It now increasingly restricts production of crops for biofuels to marginal lands, importing the remainder.

As mentioned earlier, these biofuel mandates divert significant volumes of agricultural produce away from food markets, thereby raising international prices. At the same time, since the percentage of biofuel is usually relatively small (except in Brazil where some cars can run on E100), and since fuels are also heavily taxed through excise, the unit price of gasoline and diesel will hardly be affected by the cost of biofuel, which makes demand for biofuels very price inelastic.

### *Specifics of US policies*

The US, has implemented specific regulations that introduce price volatility of a particular kind and, therefore, need further discussion here.

Until 1-1-2012, the US applied a variable<sup>15</sup> subsidy on ethanol, through which ethanol becomes an economically perfect substitute for fossil fuel hence establishing a firm link between crude oil and agricultural markets. Since the crude oil market is much larger it dominates the agricultural markets it is linked to. The crude oil market is to a significant extent controlled by producer quotas as well. It also exhibits stock variation, because of the cyclical demand across the season and the uncertainty of weather conditions mentioned earlier, but also because of large distances between producing and consuming areas and dangers of interrupted deliveries. Hence its international market prices vary significantly and impacted on agricultural markets, particularly corn and oilseeds.

However, the link between energy and food markets has not been permanent, due to technical limits on substitutability between fossil fuel and ethanol, commonly referred to as the blending wall. This is effectuated through the E10 ceiling introduced by the Environmental Protection Agency (EPA) plus the technological limitations of older cars and it cuts the direct subsidy link between the fossil fuel market and the agricultural markets (SOW-VU, 2012). The blending wall was first hit in 2009 when the car fleet in the US could in general only technically operate on blends containing up to 10% of ethanol (E10), with the exception of the small segment of flex-fuel cars that can operate on 85% of ethanol (E85).

In 2012, the US abolished biofuel subsidies and at the same time relaxed the blending wall, as the EPA approved the use of blends in the range of E10-E15. In principle this could re-establish the substitutability and reactivate the link, however, consumer and producer concerns as well as the required investments have, up to now, restricted the roll-out of E15.

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<sup>15</sup> The level of the subsidy – the result of prevailing corn and fuel prices – was negotiated and laid down by acts (Cato, 2010)

This substitutability is strengthened by the multiple pump setup at an increasing number of gas stations (also in Europe), and cars that can run on E0, E5, E10, E15 and E85. This effectively allows the owners to choose the favorable blend, balancing cost and performance, thereby determining the price of ethanol and in turn the price of grain. Hence, next to the trade in certificates, the substitutability operates as a mechanism that may mitigate price volatility on food markets, but only at the expense of importing to food markets the volatility of crude oil markets.

Likewise proposals (e.g. Wright, 2012) were issued to divert animal feeds. Around 40% of corn production is used for animal feed and could be diverted from this use as well, particularly in the non-ruminant sector, where the diminish in livestock can be restored relatively quickly. Prices of corresponding livestock products would rise as a consequence, and hence farmers might not even need to be compensated much for reduced output, whereas only richer consumers would lose. Proposals along these lines have been advanced for decades already but they never materialized and seem, moreover, harder to implement than for biofuels.

#### *Assessment of proposals to divert cereals from biofuels and animal feed*

In addition to the mitigation mechanisms induced via certificates and substitutability, proposals have been put forward to let biofuels and animal feeds contribute directly to supply stabilization on food markets, and by this to mitigation of price volatility. The idea is to introduce temporary cuts in biofuel demand and feed demand in periods of scarcity.

In 2012 the possibility for a biofuel mandate waiver in the US was under discussion, although it was unlikely that ethanol producers would temporarily shut down their processes under a waiver because restarting the production line later on is quite expensive (EPRINC, 2012). Adding to that, the mere possibility in the US to bank Rins limits the scope and need for intervention, since this gives ethanol plants the incentive to buy corn when its price is low, and sell Rins or biofuel stocks when prices are high.

At any rate, these proposals on mitigation would seem to fall in the category “*if you can't beat them, join them*”, because they accept the mandates as such, which are a major cause of price volatility in the first place, not even mentioning other negative impacts so far, such as the illegal or socially unwarranted appropriation of land worldwide. Indeed, voices calling for reduced biofuel mandates have been growing stronger as the effects of biofuel policies on food availability and food prices are more apparent (Keyzer 2009b, 2010, 2011d, 2012; G20, 2011; Bobenrieth et al., 2012; InterAction, 2012; de Schutter, 2012; Oxfam, 2012).

### 3.3 Financial instruments and regulation

#### *Improved monitoring and regulation financial markets*

Arrangements that operate via the financial markets need effective operation of these markets. Revisiting the sequence of events in the wake of and during recent food crises, bottlenecks in futures markets and their link to spot markets were observed. These bottlenecks were a major cause of the observed price volatility (Keyzer, 2009b, SOW-VU, 2010). In the US, futures markets are run by the CME group (Chicago Mercantile Exchange/Chicago Board of Trade), a private company, operating under supervision of the Commodity Futures Trading Commission (CFTC) of the US Government. CME operates markets worldwide, but Kansas and Chicago are key places for wheat, oilseeds and corn.

Futures markets operate via licensed brokers who act on behalf of their clients subject to tight CFTC approved rules. Most of these rules are safeguards to ensure that contracts will be fulfilled, and that commitments to pay or to deliver a commodity will be effectuated. Some of these safeguards are financial. For example, a client promising to buy (the buyer of a futures contract) has to transfer a certain amount of cash to his account with CME (margin call). The balance of this account has to increase as the date of expiration approaches and is corrected for changes of the futures price.

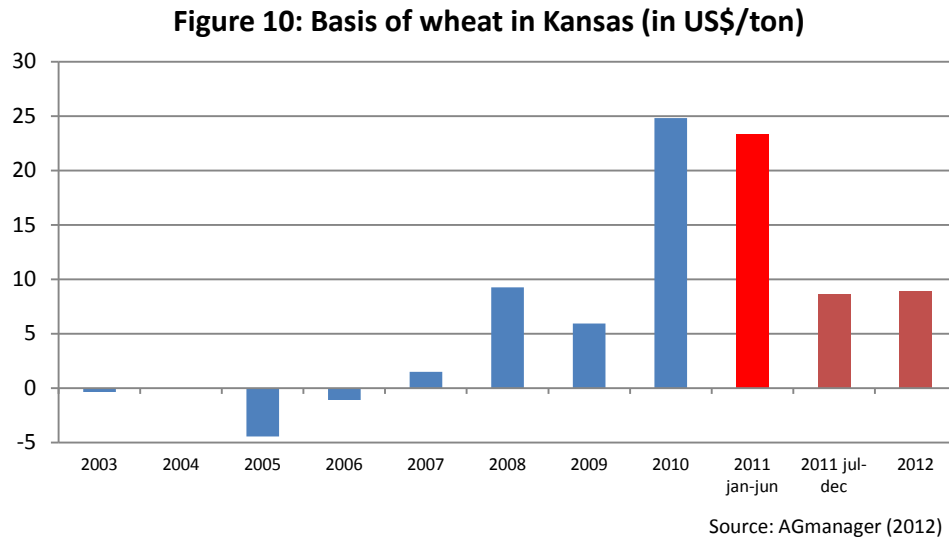
In addition, towards the date of expiration the buyer's broker had until recently to provide evidence - in the form of elevator, train, truck and barge certificates - that sufficient capacity to accept the physical delivery of stock had been secured.

Such certificates were imposed to guarantee the marketplace's smooth operation and were in no way intended to constrain trade. However, with rising volumes of trade, they gradually became serious constraints.

Most importantly, in 2005 after a deregulatory change in CFTC rules a large numbers of non-commercial appeared on the scene – these traders are not interested in acquiring the physical good for which the futures are bought, but are purely operating financially in futures, options and other derivatives. The activities of the non-commercial traders led to bottlenecks in the market because these traders often refrained from evacuating the warehouses upon expiration of the contract, not because they did not have the necessary transport certificates but because they wanted to postpone sale by engaging in a new future contract or because they did not know to whom to sell. Consequently, owners of elevators and means of transport became reluctant to sell certificates to them, these certificates became scarce and carried a premium, possibly also because some of the operators have colluded. This increased the cost of futures as compared to spot prices and caused non-convergence, as expressed through a margin or rent, also referred to as basis, shown in Figure 10 for wheat traded at the Kansas City Board of Trade (KCBT).

In 2007 CBOT initiated proceedings to change its rules of operation. The new rules impose variable storage costs in case of a glut, to force evacuation of CBOT-related warehouses, the allowance of “virtual” certificates and the possibility to store elsewhere; so as to reduce the market power of individual certified elevator companies at ports on the Illinois River. The modifications took some time, since this required approval by CFTC and other parties, but they eventually proved effective since the basis at CBOT has significantly dropped leading to good convergence by April 2011 and prices that are more stable. KCBT that only started similar proceedings in 2010, with eventual implementation of rules similar to those of CBOT by September 2011, kept a significant basis in the first half of 2011 and showed a similar improvement in the second half of 2011 that was maintained in 2012 (Figure 10). The lack of convergence has most likely contributed to the flaring up of futures prices, as they disconnect from the spot prices and, although not only because of this, indeed the price hike of 2010-2011 was most pronounced for wheat.

Addressing non-convergence limits the rents that can be made on certificates and has restored the strong link between the spot and the future market needed by commercial parties.



To sum up, the monitoring of agricultural futures and associated derivatives, like for regular traffic, should focus on the fluidity of transactions rather than their volume. Bottlenecks in product flows should be prevented or addressed as soon as they are signaled while easily monitored financial flows should not be obstructed too much to prevent a growth in capital flows that are difficult to monitor. For example, in order to prevent future bottlenecks of product flows, thereby possibly resulting in an increase of basis, a new train-loading grain-handling facility is constructed near Kansas (World Grain, 2012), also illustrating the pivotal role of stockholding and transport in the world food system.

Indeed, the jump of the price of corn at the first sign of harvest failures in the US and Russia and the overall flat pattern of futures price adjustment (see Figure 11) seems to indicate that the reforms have been quite effective in mitigating volatility as it allows futures markets to factor in the news quickly, and consequently to reduce the scope for speculation.

Nonetheless, there are other futures markets in the world, and there are commodities not traded by CME. Extending the network of market hubs where futures and spots can come together, could particularly with improved electronic trade contribute significantly to market efficiency and reduced price volatility.

**Figure 11: Daily corn prices (Oct 2011-Nov 2012)**



Source: CME (2012)

### *Assessing financial instruments and regulation proposals*

The introduction of e-trade and improved practices on markets for futures and related financial products such as credit and insurance have enhanced capacities to adapt to price variations, especially for traders and processors, while higher incomes and improved social safety nets reduced the vulnerability of consumers, limiting the need for mitigation through stock operations.

The changes in regulations and the infrastructural developments initiated in parallel are prime examples of effective interventions, albeit that it might have been better to consider them prior to admitting non-commercial traders. These changes also confirm that the choice is not necessarily between more and less intervention: for the certificates a loosening was needed and for the margin calls a tightening. They also confirm that stockholding plays a central part in the world food system but one that is actually so central, so much part of the main circulation of this system, that it cannot be controlled effectively by insignificant reserve programs, while major interventions run the danger of turning a bottleneck into an infarct.

### 3.4 Other adaptive measures

Several other adaptive measures have been proposed.

#### *A global Virtual Reserve*

<i>Problem</i>	Disadvantages of keeping physical stocks.
<i>Description</i>	Countries participating in this reserve need to commit funds that can be used to operate on the futures market. When prices surge, short positions can be taken that are backed up by the funds. These interventions should reduce prices and drive speculators from the market, freeing the stocks kept by these speculators, which could have some mitigating effects as well. Estimated costs are in the range of 12 to 20 billion US dollars.
<i>Strength</i>	The virtual reserve could mitigate volatility and stabilize prices, thereby increasing food security, via the futures market. It could also contribute to adaptation by enabling poor member countries to hedge against price rise.
<i>Weakness</i>	The proposal hinges on the heavily debated premise that the futures market significantly affects the spot market and that speculators play a major role in price formation. Moreover the fund itself might become object of speculation as speculators know when the fund will intervene and what type of intervention will be effectuated. Moreover, the costs are gigantic.
<i>Literature</i>	Meijerink et al. (2012), Robles et al. (2009), Von Braun and Torero (2009).

#### *Crop insurance*

<i>Problem</i>	Failed harvests.
<i>Description</i>	In the US, farm policy has been undergoing transition from direct income support to governmental subsidized crop insurances. Under these insurance schemes, farmers have to commit their entire cropped area to the program. On the basis of the average yield in the region and past yields of the farm, a target yield is applied to the cropped area. The insurance policy will pay compensation if is less than 85% (for grains) of the target yield is attained. This part deals with the weather component of the insurance. Regarding prices, farmers can choose between a (fraction of the) reference price and the realized price at a target date. Hence, harvest failure can be quite rewarding.
<i>Strength</i>	It is an insurance against weather and physical adversity with a price component.
<i>Weakness</i>	Given that almost everyone is eligible and because the government is also the reinsurer this can in the long run prove to be unsustainable.
<i>Literature</i>	Babcock (2012), USDA (2012b).

### ***Contracts within the chain***

<i>Problem</i>	Volatile prices.
<i>Description</i>	Commercial insurance contracts require farmers to buy a policy at the beginning of the season, which may be difficult for those who are heavily cash and credit constrained. Contracts within the input and processing chain avoid this by letting the partner segments of the chain share in the risk through sharecropping arrangements or conditional pricing. In reaction to the recent price volatility on dairy markets but also in anticipation of upcoming elimination of milk quotas, the French government has recently introduced a regulation whereby milk processors should keep the price paid to farmers above a preset floor level, for given quantities (replacing the quotas). This arrangement is the precursor of a more general stance towards “contractualisation”, whereby price volatility for farmers should be reduced through government approved modalities in contracts within the chain. Government has expressed its intention to extend the arrangement to bovine meat and vegetables, and if the retail can be involved as well possibly to field crops that for the time being should benefit from area premiums and high international prices as promoted by the EU’s biofuel mandates. In fact, government endorsement of this “contractualisation” is a sector wide regulation that like the biofuel mandate formalizes a cartel arrangement and acts as a substitute for public subsidy.
<i>Strength</i>	Price volatility is absorbed by the chain.
<i>Weakness</i>	The arrangement has also been eliciting resistance, particularly from small farmers who fear the dominance of processors and large farmers in the cartel (and may consequently come under scrutiny of the European Commission and WTO).
<i>Literature</i>	Danel et al. (2012).

### ***Risk management tools***

<i>Problem</i>	The inability of vulnerable households to cope with price and weather shocks.
<i>Description</i>	The G20 summit also committed to scale up efforts to provide vulnerable households (including producers), communities and governments with effective, market based risk management options to help them deal with price and weather shocks. This amounts in practice to a promotion of subsidized insurance schedules, particularly price-weather insurance for farmers.
<i>Strength</i>	Risk management tools can help to adapt to price volatility thereby improving resilience in turn improved resilience is a prerequisite for productive investment.
<i>Weakness</i>	These insurance contracts generally need to be subsidized as most households are too poor to pay the premium ahead of the expiration date, and also lack the liquidity needed for it.
<i>Literature:</i>	G20 (2011), Molini et al.(2010).



Most adaptive measures either run the risk that they become financially unsustainable or require subsidization; except for utilization of contracts within the chain. This “contractualisation” has specific implications in the Netherlands that we briefly point to. The situation in the Netherlands is of particular interest at the present juncture, because the Dutch government is currently completing the process of dismantling its semipublic market organizations in agriculture (“productschappen”) while at the same time considering “contractualisation” for its post-2013 CAP: a system of agreements to be reached within producer organizations and along the product chains to be applicable to non-participants in the agreement as well (“algemeen verbindingsverklaring”). Like in any cartel arrangement, this is to avoid free riding by non-participants who would enjoy the benefits of high and stable prices without having to endure the restrictions of production quotas and financial contributions.

As of June 2013 the issue remains contentious among member states. While Germany and the United Kingdom have expressed opposition to strong forms of market intervention, the post 2013 CAP is expected to leave the details of many previously uniform regulations to the discretion of the member states. Whether contractualisation that directly touches upon competition policy will be recognized as belonging to this category remains uncertain, however.



## 4. Conclusion

Stock adjustments can mitigate price adjustments in bridging the gap between a continuous food demand and periodic supply. Public stocks, however, diminished significantly due to, among others, costs of stockholding and an increased reliance on international trade. The price hikes of 2007/8, 2010/11 and the spike of summer 2012 have been denounced as threats to world food security and inspired proposals for managed stockholding to reduce price volatility and consequent negative effects on malnutrition and agricultural production. The paper reviewed these proposals against the background of empirical evidence. Plans for keeping physical stocks appear to be too costly and have failed to mobilize critical support. The same applies for parallel plans to keep financial reserves or to establish formal arrangements for deliveries under emergencies such as production shortfalls and price hikes.

This may not be that surprising since stockholding is and always has been an intrinsic element of food delivery that can much less than in the past be dealt with as a policy variable. While globalization via international trade and improved logistics makes it possible to save on stockholding, it also limits the scope for intervention through public stocks. Price volatility is a feature that can be expected to become more pronounced in the future as consumers get richer and consequently less willing to adapt their demand while output variations will be stronger due to climate change. Policy-induced contributions to price volatility should be eliminated, primarily by ensuring the well functioning of spot and futures markets, and by gradually abolishing blending mandates for biofuels. Although this can partly mitigate variability, volatility is there to stay.

Therefore, just like in ancient Egypt, adapting to the eternal cycle of the seasons and to the prevailing volatility is the more realistic course, while keeping on a small emergency reserve to face the beginning of a crisis, and providing adequate structural funding of international agencies in charge of emergency relief, with in addition an adequate commitment to keep markets open as long as possible, and to invest in agriculture worldwide.

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## List of acronyms

AERR	East Asia Emergency Rice Reserve
ASFRB	ASEAN Food Security Reserve Board
AMIS	Agricultural Market Information System
APTERR	ASEAN Plus Three Emergency Rice Reserve
ASEAN	Association of Southeast Asian Nations
CBOT	Chicago Board of Trade
CFTC	Commodity Futures Trading Commission
CME	Chicago Mercantile Exchange
EAERR	East Asia Emergency Rice Reserve
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
ICA	International Commodity Agreements
IEA	International Energy Agency
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IWA	International Wheat Agreements
KCBT	Kansas City Board of Trade
OECD	Organization for Economic Co-Operation and Development
Rins	Renewable identification numbers
SAARC	South Asian Association for Regional Cooperation
SADC	South African Development Community
USDA	United States Department of Agriculture
WFP	World Food Program
WTO	World Trade Organization

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