AFRICA AGRICULTURAL MARKETS PROGRAM (AAMP)

Food price stabilization:

Lessons from eastern and southern Africa

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1 Introduction

1.1 Background

A major source of risk in developing countries is instability in the price of staple food commodities. This is particularly true for poor households that are connected to the market in sub-Saharan Africa. Three factors contribute to the strong link between food price volatility and risk for poor African households. First, the variation in staple food prices tends to be higher in sub-Saharan Africa than in other regions. Second, poor households allocate a large share, often more than 60%, of their budgets to food, so a given variability in food prices has a large effect on household income. Third, the share of the population that depends on agriculture for its livelihood is generally larger in sub-Saharan Africa than in other regions. Within rural areas, semi-subsistence farmers are partially insulated from the effect of fluctuations in staple food prices, while cash-crop farmers, commercial food crop farmers, wage laborers, and those with non-farm enterprises are more vulnerable.

Thus, it is not surprising that policymakers in sub-Saharan Africa (like those in other regions) have, over time, implemented a wide range of policies and programs to try to stabilize the price of staple food grains. In the 1970s and 1980s, many governments maintained consumer price controls, producer price supports, taxes and restrictions on international trade, restrictions on internal movement of grains, and public procurement and distribution of food. In many cases, state-owned grain trading enterprises were given a legal monopoly over buying, processing, and distributing staple grains and export crops, although it was often not possible to completely suppress private-sector trade in these commodities.

In the late 1980s and 1990s, the high fiscal cost of these policies, growing evidence of their ineffectiveness, and pressure from the international financial institutions led to a period of economic reform and liberalization. Macroeconomic reforms were implemented to reduce fiscal deficits, liberalize trade, and generally allow the market to play a greater role in the economy. In the agricultural sector, restrictions on internal movement of commodities were largely eliminated, price controls were limited to a few commodities, processing parastatals were privatized or closed, and agricultural marketing was opened up to private sector competition (Kherallah et al., 2000;). Because of the political sensitivity, however, liberalization of food markets has been slow, uneven, and subject to reversals. As a result, the state continues to intervene in staple crop markets in various ways. For example, in most countries in eastern and southern Africa, the state-owned enterprises continue to buy, sell, import, and export grain in competition with private traders (Jayne et al, 2002).

The role of these state-owned grain marketing enterprises is controversial. Some argue that they play a necessary role in stabilizing food prices in light of the weakness of the private sector, which is constrained by lack of credit and limited storage capacity. These enterprises can and should operate like a buffer stock, buying when prices are low and selling when they are high (Poulton et al, 2006; Timmer, 2010). Others argue that unpredictable interventions by these enterprises is one of the main constraints faced by private traders and that, in some cases, these interventions actually exacerbate the instability of food prices (Jayne et al, 2010).

The global food crisis of 2007-08 has revived interest in food price stabilization. A number of countries are increasing the size of their food reserves, and there is a debate about alternative approaches to creating new international food reserves (Murphy, 2009, von Braun and Torero, 2008). In this context, a review of the experience of the use of buffer stocks to stabilize food prices is timely.

1.2 Objectives

The goal of this paper is to describe the economic theory and experience related to the use of buffer stocks to stabilize staple food prices in eastern and southern Africa. In particular, we address the following questions:

- What are the causes of food price instability?
- How does food price instability adversely affect households, particularly the poor?
- How can buffer stocks and trade policy be used to reduce food price instability?
- What is the effect of price stabilization efforts on the private sector?
- What has been the experience with price stabilization policies in developing countries?
- What are the lessons for countries in eastern and southern Africa?

The first two questions will be address in Section 2. The experience of developing countries with price stabilization policies is the topic of Section 3. And Section 4 provides a summary of the results and lessons for the countries of eastern and southern Africa.

2 Food price instability

Before discussing the use of buffer stocks to stabilize prices, it is useful to provide some background on food price instability. We begin with a discussion of the measurement and size of food price instability in development countries. Then the sources of variability in food prices are reviewed. Finally, we examine the effect of food price instability on different types of households.

2.1 Measuring food price instability

Food price instability refers to variation over time in the price of food. In this paper, we focus primarily on instability in the price of maize, rice, wheat, and other staple grains in eastern and southern Africa. Although cassava and other root crops are important staples in many countries in the regions, they cannot be stored long after harvest and, as such, are not the focus of government efforts to stabilize food prices. As discussed later, cassava does play an important role as a means of adapting to grain price instability.

Food price instability is usually measured using the coefficient of variation (CV), defined as follows:

$CV = s/\mu$

where s is the standard deviation of the price over a given time period and μ is the average price over that period. An upward or downward trend in data creates an artificial increase in the coefficient of variation. For this reason, when there is a trend, it is better to use the adjusted CV (also known as the Cuddy-Della Valle index[1]), defined as:

Adjusted $CV = (s/\mu)(1-R^2)^{0.5,}$.

where R is the correlation coefficient when the price is regressed on a time trend variable. This is equivalent to calculating the coefficient of variation on prices after the time trend has been removed from the data series.

Food price instability can be measured at the producer, wholesale, or retail level. In sub-Saharan Africa, most food price data refer to wholesale prices, though retail and producer

[1] See Cudy and Della Valle, 1978.

prices are also available. If margins between producer, wholesale, and retail prices are a constant proportion of the price, then measuring the CV at any of the three levels will give the same result. However, if margins are fixed, then producer prices will have the highest CV and retail prices the lowest, with wholesale prices falling in between[2].

Instability can also be measured at different time scales: daily, monthly, and annually. In general, higher frequency price data will generate higher values of CV. For example, monthly price data will capture seasonal and annual variation, but annual data will hid seasonality.

2.2 Magnitude of food price instability

A review of food price behavior in sub-Saharan Africa used monthly data for 62 grain prices in nine African countries. The average CV for these prices was 33%. However, there was considerable variation in the degree of instability across markets: the CV varied from 8% to 63%, with most of the values falling in the range of 25% to 45%. The greatest instability was found in the price of maize and sorghum in Addis Ababa, while the least instability was found in the price of imported rice in Accra and Kumasi in Ghana.

Table 1. Coefficient of variation of monthly maize prices in eastern and southern Africa

	Instability in maize prices (coefficient of variation)
Ethiopia	51%
Uganda	43%
Kenya	29%
Tanzania	26%
Malawi	49%
Zambia	27%
Mozambique	31%
Avg of 7 countries	37%
Avg for southern and eastern Africa	36%

Source: Minot (2010c)

Food price instability in sub-Saharan Africa does not appear to be greater than in Latin America. Hazell et al (2005) found that several Central American countries had more stable grain prices, but Bolivia, Brazil, and Mexico had much greater volatility in prices. In these three countries, the CV of maize and wheat prices was greater than 65%. These estimates, however, spanned several decades and are therefore affected by periods of severe inflation and macroeconomic instability. Price instability in these three countries over recent years would presumably be much lower.

On the other hand, a number of countries in Asia have quite low levels of food price instability. Hazell et al (2005) reports that the CV of wheat prices in India was about 8%, while Minot and Goletti (2000) estimate that the CV of the monthly producer price of rice in

[2] With fixed margins, the standard deviation (s) of all three prices would be equal, but the mean (μ) will be highest for retail prices, followed by wholesale and producer prices.

Vietnam was 5%. David and Huang (1996) provide estimates of the CV of wholesale rice prices in six Asian countries, finding that it ranged from 12% in Bangladesh to 25% in the Philippines.

The world price of grains is more volatile than in Asia but within the central range of those for sub-Saharan Africa. In recent years, the CV of the monthly world price of maize (No. 2 yellow FOB Gulf of Mexico) was 33%, while that of wheat (No. 1 hard winter wheat, FOB Gulf of Mexico) was 36% and that of rice (5% broken, FOB Bangkok) was 42%. These estimates include the spike in commodity prices in 2007-08 (Minot, 2010c).

2.3 Sources of price instability

Food price instability can be caused by a number of factors, and the contribution of each factor varies across locations and commodities. The main sources of food price instability in a country are 1) variation in domestic production and 2) fluctuations in world prices, though other factors can contribute as well. Each source is described below.

Variation in domestic production

One of the most important causes of food price instability is variation in local production. Seasonal variation in supply is a major factor in the seasonality of food prices, particularly in countries with uni-modal rainfall and for commodities that are more perishable. In both cases, the high cost and risks associated with storage explain wide seasonal swings in food prices.

In addition, the size of the harvest varies from year to year as a result of random factors such as rainfall, pests, and disease, as well as policy variables. Variation in local supply is likely to be the main source of price instability in the following circumstances:

- In remote regions or areas with poor road infrastructure
- In landlocked countries
- In countries that restrict or heavily tax international trade
- For commodities that have a low value-bulk ratio, such as root crops, or are not internationally traded for other reasons

Under these conditions, surpluses from a good harvest are not easily transported out of the region or country and deficits due to a poor harvest cannot be alleviated by imports, so they have a strong effect on local prices.

Table 2 shows the coefficient of variation of annual maize and cassava production over the period 1980-2008 for seven countries in eastern and southern Africa. The CV of maize production ranges from 12% in Uganda to 32% in Zambia. Maize production seems to be less variable in eastern Africa than in southern Africa, perhaps because many of the eastern African countries have bi-modal rainfall and two harvest per year. If the harvest in the first season is small, farmers respond by planting more in the second season, thus smoothing annual variation.

Table 2. Instability in food production and prices

	Instability in production (coefficient of variation)	
	Maize	Cassava
Ethiopia	19%	*
Uganda	12%	22%
Kenya	14%	24%
Tanzania	22%	16%
Malawi	26%	63%
Zambia	32%	8%
Mozambique	26%	14%
Avg of 7 countries	22%	25%
Avg for southern and eastern Africa	30%	21%

Source: FAO, 2010a.

* Cassava is a minor crop in Ethiopia, so FAO does not report any cassava statistics.

The CV of annual cassava production ranges from 8% in Zambia to 63% in Malawi. The high CV in Malawi is related to a three-fold jump in estimated cassava production between 1999 and 2000, which may be a statistical anomaly. Cassava production tends to be less variable than maize production in the region as a whole[3]. In addition, it is likely that some of the variability in cassava production is not due to weather shocks, but is a response to maize variability, since farmers can choose to harvest cassava when the maize output is low (Prudencio and Al-Hassan, 1994; Dorosh et al, 2009).

To put these figures in context, a recent study estimated that the coefficient of variation of rice production was 5% in China, 10% in Thailand, and 18% in India (Pandey et al, 2007). The relative stability of rice production in these countries is partly a result of the widespread use of irrigation, but it is also because rice production is spread over a large geographic area, making it less likely that a drought would affect the production in all areas of the country.

Fluctuation in world prices

Another source of domestic food price instability is volatility in the world price of the same commodity. World prices are more likely to influence domestic prices of a given commodity in a given location if the commodity is regularly traded (imported or exported) on the world market. This is more under the following conditions:

- The commodity is regularly traded (imported or exported) on the world market
- Trade policy with respect to the commodity is relatively open
- The cost of transporting goods to and from the port is relatively low.
- The commodity is largely non-perishable and has a relatively high value-bulk ratio.

Thus, we would expect world prices to be a source of instability in the case of rice and wheat, particularly in coastal countries, and less so in the case of maize and cassava. Statistical

[3] There is little difference between maize and cassava output variability in the seven selected countries, but if the Malawi data are excluded, the average CV for cassava would be lower than for maize.

analysis generally confirms these expectations. Conforti (2004) examined price transmission from international to domestic grain markets in 16 countries , including three in sub-Saharan Africa, using an error correction model. In Ethiopia, he found statistically significant long-run relationships between world and local prices in four out of seven cases, including retail prices of wheat, sorghum, and maize. In Ghana, there was a long-run relationship between international and local wheat prices, but no such relationship for maize and sorghum. And in Senegal, he found a long-run relationship in the case of rice, but not maize. In general, the degree of price transmission in the sub-Saharan African countries was less than in the Asian and Latin American countries.

Hazell et al (2005) examined the contribution of world prices and domestic supply shocks to the variance in domestic prices in 12 African countries. In most cases, domestic supply shocks contributed a much larger share of the domestic price instability than did fluctuations in world prices.

And using an error correction model, Minot (2010c) found a statistically significant relationship between world prices of a commodity and domestic African prices in just 13 of the 62 prices tested. Just 10% of the domestic maize prices were linked to international prices, while half of the domestic rice prices were.

Thus, rice and wheat prices in Africa are linked to world markets and extreme shocks in world markets (such as the food crisis of 2007-08), but over the long term, the prices of most staple foods in sub-Saharan Africa are relatively insulated from fluctuations in world food markets.

Other sources of domestic food price instability

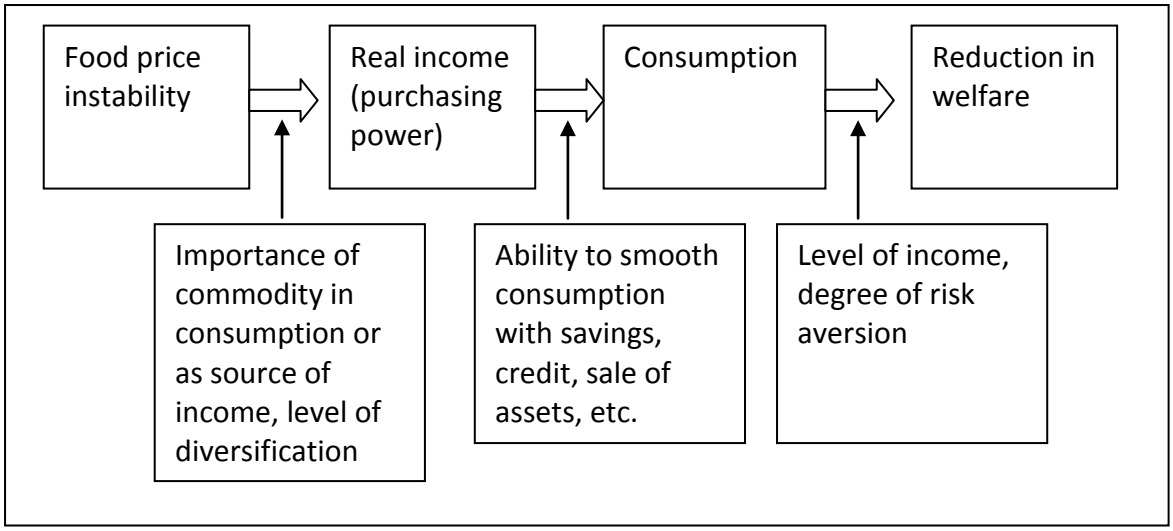
Other factors contribute to domestic food price instability. First, variation in demand can, in principal, be a source of variability in domestic food prices. For example, some holidays are associated with specific foods, creating a seasonal spike in demand. In practice, this is generally not an important source of price instability, partly because the change in demand is modest and partly because it is predictable. Second, changes in closely-related markets can affect domestic food prices. For example, a sharp increase in the price of rice and wheat may cause consumers to switch to maize, causing an increase in the maize price. Third, some price changes are caused by "endogenous" factors such as a speculative bubble, in which the price rises because people have become convinced it will rise so they stock up, thus making the belief self-fulfilling. The global food crisis of 2007-08 revived concern about the possible influence of speculative bubbles. It is clear that the policy reaction by governments (grain export bans and increased import orders) exacerbated the spike in prices, but the evidence that futures markets contributed to the crisis is mixed (Robles et al, 2009; Sanders et al, 2008).

2.4 Effect of food price instability on households

Conceptual framework

Food price instability has a negative effect on household welfare because it contributes to fluctuations in income and consumption. Studies of human behavior (and common sense) confirm that most people are risk averse, meaning that they prefer a steady level of income to a highly variable income that has the same average value. The relationship between price instability, income, consumption, and welfare can be illustrated as shown in Figure 1.

Figure 1. Diagram of effect of food price instability on household welfare



Based on this diagram, the effect of price instability of a given commodity on household welfare depends primarily on four factors:

- The degree of price instability. Generally, the greater the instability, the larger the effect on household welfare.
- The effect of a given level of price instability on real income (or purchasing power) of the household. The proportional effect on income depends on the net sales (or net purchases) of the commodity as a proportion of income. Households that spend a large share of their budget on the commodity are most affected, as are households that derive a large share of their income from the sale of the commodity.
- The degree to which the variability in income is translated into fluctuations in consumption (real value of consumption expenditure). Households with high income or valuable assets are better able to smooth consumption during income shortfalls by drawing on savings, borrowing, and selling non-productive assets. Poor households, and those with few assets, are not able to smooth consumption as easily, being forced to reduce non-food or even food consumption during hard times.
- The degree to which variability in consumption affects household welfare. Again, high-income households can experience a reduction in consumption with less adverse effect on welfare. Households close to subsistence cannot reduce consumption without risking health and malnutrition.

Turnovsky et al (1980) were one of the first to rigorously examine the effect of price instability on consumer welfare. They confirmed earlier results that a risk-neutral consumer actually gains from instability in consumer prices, provided the instability does not affect income. They also showed that for a consumer to be adversely affected from price stabilization of a commodity, he must be risk averse and the income elasticity of the commodity must be low. These conditions are likely to hold in the case food price stabilization and the poor in developing countries.

Newbery and Stiglitz (1981) pioneered methods for analyzing agricultural price risk and the effects of price stabilization programs. We highlight four of their findings:

- They emphasized the fact that the objective of policy should not be price stabilization *per se*. Rather price stabilization is only useful to the extent that it reduces the instability of the income of farmers and consumers.
- Second, price stabilization does not always stabilize income. Supply shocks create a negative correlation between output and prices: during good years, output is high but prices are low, and during bad years, the reverse is true. Thus, during bad years, price stabilization would lower farm income by not allowing the shortage to result in higher prices. Conversely, during good years, price stabilization would raise farm income by not allowing the surplus to depress prices. In other words, a program that is successful in stabilizing agricultural prices could actually destabilize farm income and reduce farm welfare.
- Third, food price stabilization is likely to have a positive effect on food supply, motivating farmers to produce more at a given price. However, if food is non-tradable, this will reduce the equilibrium price, transferring some of the benefits of price stabilization to consumers.
- And finally, one of their most important contributions was a method for estimating the welfare gain for farmers associated with price stabilization and assumptions about the degree of risk aversion, as measured by the Arrow-Pratt measure of relative risk aversion (R).

Estimates of the gains to food price stabilization

Newbery-Stiglitz (1981) applied their formula using a range of plausible parameters describing food markets in developing countries and the degree of risk aversion. Under a range of assumptions, the results showed that the gains to farmers from complete price stabilization is relatively small, about 0-3% of household income. They conclude that the benefits of price stabilization have been exaggerated and that government resources would be better off allocated to other types of programs.

Later studies that used the Newbery-Stiglitz approached confirmed that the static gains to price stabilization are quite small. For example, Jha and Srinivasan (1999) develop a multimarket model of the Indian grain economy with random supply fluctuations and use it to simulate the effect of alternative trade and marketing policies on price stabilization and welfare. They find that the policies with the most stable prices were not the ones that increased welfare the most.

Islam and Thomas (1996) compare free-trade and a partial stabilization policy in terms of their effect on rice farmers for five Asian countries: Bangladesh, Indonesia, Pakistan, the Philippines, and Thailand. Using historical data on rice price variability in each country and three alternative assumptions about risk aversion, they showed that the gains in risk reduction from price stabilization ranged from 0.5% to 5% of farm income. Adopting the middle assumption on risk aversion (R=1.5), the gains were 1.5% to 3.5% of farm income.

More recently, Myer (2006) extended the Newbery-Stiglitz approach to incorporate the impact of food price stabilization on households that both produce and consume the commodity. He uses parameters describing four representative households: poor consumers, affluent consumers, poor producers, and affluent producers. With low levels of price instability (CV=0.1) and low risk aversion (R=1), the gains from price stabilization on all groups are less than 1% of income. With high price instability (CV=0.3) and high risk aversion (R=3), all four groups gain from price stabilization but the size of the gain varies. Affluent producers gain the most (9% of income) because they have large sales of the

commodity. Poor producers gain less from stabilization (3%) because their sales are a smaller share of income. Affluent consumers are hardly affected by price stabilization because the commodity represents only a small share of their budget. And poor consumers gain barely 1% from price stabilization.

These studies reflect the dominant view among economists that the benefits of food price stabilization are modest. These findings have contributed to the general skepticism regarding food price stabilization programs at the World Bank and other international donor organizations (World Bank, 2005).

There is, however, some dissent. One line of research explores possible dynamic effects of food price stabilization. In other words, food price stabilization may contribute to a higher rate of economic growth. Even a small contribution to economic growth would generate large benefits for food price stabilization, but several studies have failed to find such a connection (Myers, 2006).

Another approach is to question the relationship between income variability and welfare. The expected utility model (upon which the Newbery-Stiglitz results are based) is a simplification of people's complex preferences regarding risk, and some alternative models of risk lead to larger estimates of the benefits from price stabilization (Aizenman, 1998).

Finally, one study argued that the benefits of price stabilization may be greater than previously estimated if we examine price stabilization for multiple commodities. Bellemare et al (2010) uses panel survey data from rural Ethiopia to estimate the effect of price stabilization of seven staple foods. The benefits are estimated to be worth 6%, 15%, or 32% of household income, depending how risk averse farmers are assumed to be. On the other hand, the benefits accrue mainly to the richest 40% of rural households who are surplus farmers; the other 60%, many of whom are net buyers, gain less or actually lose as a result of price stabilization. In this sense, it confirms the results of Myers (2006) that food price stabilization may have the largest benefits for medium and larger farmers who are surplus food producers.

There is little doubt that food price stabilization is politically popular in many developing countries. When food prices rise, consumers exert strong political pressure on governments to bring prices down. The food riots that took place in a number of countries during the 2007-08 food crisis are an example of this pressure. Likewise, when food prices drop following a bumper harvest, producer organizations lobby for measures to support prices. Poulton et al (2006) argue that donors and researchers should work to improve the design price stabilization programs because "full liberalization is often not a credible strategy for political reasons." A key question is whether this political pressure for food price stabilization represents the real interests of society, responding to gains from stabilization that are not captured by current economic models? Or does it represent pressure from special interests, such a small number of well-organized commercial farmers, who would gain from price stabilization at the expense of taxpayers and the economy as a whole?

3 Principals of buffer stock management

Government-managed food stocks go by several names, depending on the objectives. A strategic grain reserve is defined by the FAO as a public stock of grain used to meet emergency food requirements, to stabilize food prices, and to relieve temporary shortages while commercial imports or food aid are being arranged (FAO, 1997). A buffer stock is a term used by economists to refer to public stocks held specifically for the purpose of price

stabilization. We will use the terms interchangeably, with a preference for the latter because of our focus on food price stabilization.

Buffer stocks (or strategic grain reserves) are generally operated by semi-autonomous state-owned enterprise. It can impose a floor price by offering to buy unlimited quantities at that price. Eventually, however, the stocks need to be disposed of, either through sales, exports, or donation as food aid. Similarly, it can set a ceiling price by offering to sell unlimited quantities at that price. Eventually, the public stock will need to be refilled, either by domestic purchases or imports. The buffer stock can also adopt a price-band policy, keeping the market price within a specified band by offering to sell at the ceiling price and buy at the floor price. This is the most common case and will be the focus of our discussion.

3.1 Criteria for market intervention

The cost, necessary storage capacity, and impact on the food prices can vary widely depending on the "triggers" adopted for purchases and sales. One important dimension of the buffer stock rules is the width of the price band.

- The wide price band would only involve purchases or sales in cases of an extreme shortage or a large surplus. Thus, government intervention in the market would only occur every few years. The cost and storage requirements would be relatively small, but the degree of price stabilization would also be modest. It would reduce inter-annual price instability but leave seasonal cycles largely unaffected.
- A more narrow price band would result in annual purchases during the harvest season when prices are lowest and annual sales during the off-season when prices are highest. This approach would reduce both inter-annual and seasonal fluctuation in food prices. If the width of the price band is less than the cost of seasonal storage, seasonal storage of grain would not be profitable, causing traders to withdraw from seasonal storage and preventing the buffer stock from being able to cover its costs.
- At the extreme, the buffer stock could attempt to eliminate all price instability by setting the buying and selling price arbitrarily close to each other. This would probably be infeasible from a cost point of view because the buffer stock could end up being forced to purchase or sell a large share of annual production. Furthermore, complete stabilization would probably be undesirable from an economic point of view because price variation helps farmers and consumers respond to surpluses and deficits, thus bringing the market to equilibrium.

Another dimension of the buffer stock rules is the level of the price band.

- If the price band is set too high relative to the market price, the buffer stock will be purchasing more often than it is selling, resulting in the accumulation of larger stocks each year. Storage capacity or budget constraints will eventually prevent further purchases, making it impossible to continue supporting the price.
- Conversely, if the price band is set too low, the buffer stock will be selling more often than it is buying. Eventually, the stock will be exhausted and it will be impossible to continue to defend the ceiling price.

Because of uncertainty regarding the "normal" market price, it is often recommended that buffer stocks use a moving average of the previous 3-5 years as the mid-point for the price band. By using a moving average, the price band will adjust upward or downward depending on long-term trends (Knudsen and Nash, 1990).

A third dimension is how the price "triggers" are set in different parts of the country. The cost and impact of the buffer stock depend on how many locations it maintains for its buying and selling operations and what price bands are used in each one. Here we consider three alternatives.

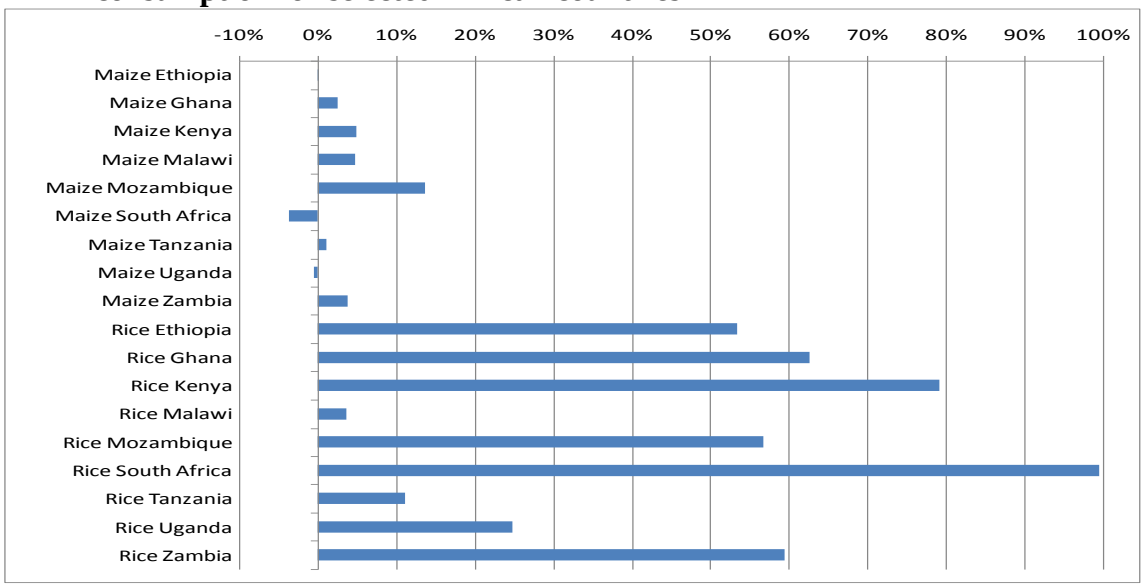
- If the buffer stock has just one buying and selling depot, the effectiveness of the price stabilization will decline with distance from the depot. More specifically, the effective floor price will decline with distance a rate determined by the cost of transportation, while the effective price ceiling will rise with distance from the depot at the same rate. In other words, the effective price band widens with distance from the depot until it no longer has any effect on local prices.
- Another option is for the buffer stock to maintain a network of depots, each defending the same price band. If the price band is binding in either the surplus or deficit zone, it will reduce or eliminate the incentive for private traders to move grain from one location to another. Depots in surplus zones will be paying above-market prices and will be forced to purchase the entire surplus. Meanwhile, in deficit zones, the depots will be selling at below-market prices, so they will be forced to supply large quantities of grain. The buffer stock becomes a grain marketing parastatal, responsible for all grain transport from surplus to deficit zones. Furthermore, the grain transport will be done at a loss because the price difference will be less than the cost of transport.
- The third option is for the buffer stock to maintain a network of depots, but with differing price bands. To avoid having the buffer stock handle all the distribution of grain within the country, the mid-points of the price bands would have to be set according to the normal market price in each location. This means that the price difference between locations would be large enough to motivate private traders to handle transport in normal years.

The above is an idealized view, in which the buffer stock has one objective (price stabilization) and makes purchases and sales based on a clearly defined price band. As discussed in the next section, the actual operation of public food reserves is more complicated.

4 Experience of food price stabilization

In the case of food price stabilization in developing countries, public food reserves usually consist of basic food grains such as rice, wheat, and maize. In eastern and southern Africa, they stocks handle maize, with smaller quantities of sorghum, beans, and other commodities in selected countries. Although cassava, yams, and plantains are important staple foods in the region, their perishability makes them unsuitable for buffer stock programs. Rice and wheat are politically sensitive commodities, often more widely consumed in urban areas, but they are not usually an important part of buffer stock programs in the region. This is because most African countries import a large share of their rice and wheat requirements, so it is easier to stabilize price through trade policy than with buffer stocks. In contrast, the traded volumes of maize are generally small relative to total consumption, so that trade policy is not generally an effective means to stabilize maize prices (see Figure 2).

Figure 2. Net imports of maize and rice as a percentage of apparent consumption for selected African countries



Source: FAO, 2009.
Note: Apparent consumption is defined as production plus net imports.

Most countries in eastern and southern Africa have a grain trading enterprise (see Table 3). During the 1970s and 1980s, many of these organizations were given a legal monopoly over domestic marketing and international trade of staple grains, as well as responsibility for enforcing price and movement controls. With the economic reforms of the late 1980s and 1990s, the role of these enterprises changed significantly. Instead of managing the distribution of food grains, they were pushed into the role of quasi-commercial trading enterprises competing with private traders. Ideally, the social functions would be separated and fully-funded by the government, while commercial operations would be required to cover their costs. In practice, some grain trading enterprises continue to have an awkward mix of social and commercial functions (FAO, 1997; Jayne et al, 2002).

However, they operate differently than a classic buffer stock in several ways. First, price stabilization is not their only (or in some cases their primary) objective. Other objectives include making grain available in the event of an emergency, such as a natural disaster or a surge in refugees, addressing regional inequality by providing food assistance to poor or remote areas, facilitating the distribution of food aid, and managing international grain trade, particularly government-to-government trade (FAO, 1997).

Table 3. State grain trading enterprises in eastern and southern Africa

Country	Name of grain trading enterprise
Ethiopia	Ethiopian Grain Trading Enterprise (EGTE)
Uganda	(1)
Kenya	National Cereals and Produce Board (NCPB)
Tanzania	Strategic Grain Reserve (operated by Ministry of Agriculture)
Malawi	Agricultural Development and Marketing Corporation (ADMARC)
Zambia	Food Reserve Agency (FRA)
Mozambique	(2)

(1) Uganda does not have a state grain trading enterprise.
(2) Mozambique does not have a state grain trading enterprise, but it will participate in a strategic grain reserved planned by the Southern African Development Community.

Second, grain trading enterprises generally don't follow consistent rules for intervention such as a price-band policy. As Poulton et al (2006: 343) note:

> Almost universally, governments recognise the importance of maintaining price ceilings and floors, but rarely do they formally commit to this. In practice, the food economy tends to be managed (often unsatisfactorily) by a mix of government stocks and related government import/export; commercial imports and food aid.

Third, their interventions in markets are not limited to purchasing and selling grain. Rather they are involved in a range of different types of activities, including importing and exporting grain, distributing food aid, supplying food to government institutions such as the armed forces, and occasionally enforcing food market regulations.

With this background, we briefly examine the experience of individual countries with grain reserves and price stabilization. The focus is on seven countries of eastern and southern Africa.

4.1 Ethiopia

The main staple foods in Ethiopia are maize, wheat, teff, and sorghum. Each contributes 10-21% of the caloric intake of the population on average (FAO, 2010b). There are little or no commercial imports of grain, although some 30% of the wheat consumed in the country enters in the form of food aid.

From 1974 to 1991, Ethiopia was ruled by the Derg, a one-party state dedicated to central-management of the economy. The Agricultural Marketing Corporation was formed in 1976 to manage all aspects of agricultural marketing, including distribution of agricultural inputs, marketing, processing, distribution, imports, and exports. However, the 1980s were characterized by drought, economic mismanagement, and political repression, during which one million people are estimated to have perished.

With the fall of the Derg in 1991, a series of economic reforms were implemented, including agricultural market liberalization. The AMC was closed and replaced by the Ethiopian Grain Trading Enterprise (EGTE), with the mandate to stabilize grain prices, to generate revenue from grain exports, and to respond to emergency food needs. Unlike the AMC, the EGTE would operate primarily on a commercial basis and would compete with private traders, processors, and brokers. In order to reduce costs, the EGTE closed a number of its buying and selling stations throughout the country. As part of its mandate to stabilize prices, the EGTE announced floor prices before each harvest season. However, it was often not able to "defend" these floor prices because of insufficient working capital and the reduced number of buying stations.

In 1999-2000, its mandate was revised to de-emphasize price stabilization and focus its efforts on exports and emergency preparedness. Nonetheless, the government continues to rely on the EGTE to intervene on an ad hoc basis. In 2003, grain prices collapsed as a result of good rains, subsidized inputs, and easy credit. The EGTE was instructed to purchase maize and wheat to support prices.

During the period 2003-2007, the volume purchased and stored by the EGTE declined and its impact on grain markets became fairly modest. However, it returned to play a prominent role when grain prices rose to unprecedented levels in 2007-2009. The rise was originally attributed to cross-border exports, higher grain retention by farmers, or hoarding by farmers, a recent study pointed to a series of other explanations:

- Excessive monetary expansion and rising non-food prices suggest that inflation was part of the explanation.

- Household survey data and other evidence suggest that the harvest of 2007-08 was less than official estimates suggested. .
- The government responded to the surge in the cost of imported fuel by rationing foreign exchange, which prevented traders from importing grain and allowed wheat and maize prices to exceed import parity prices.

The EGTE and the World Food Programme imported 1.0 million tons of wheat and maize to address the high price, some of which was distributed through a new urban food rationing program, as monetized food aid, and as emergency relief. High grain prices continued well into 2009, in spite of the fact that international grain prices had fallen substantially by this time.

4.2 Uganda

The diet in Uganda is relatively diversified: plantains (*matoke*) accounts for 18% of the caloric intake and cassava 13%. Maize (11%) and sweet potatoes (9%) are are also important sources of calories (FAO, 2010b). The high water content of plantains, cassava, and sweet potatoes makes them relatively perishable and gives them a low value-bulk ratio. As a result, storage is not an option and there is virtually no international trade in these commodities. However, maize and beans are traded within the region.

In the 1980s, the state-owned Produce Marketing Board was given a legal monopoly on staple crop marketing, with authority to enforce food price controls. In the early 1990s, Uganda implemented a set of economic reforms that, among other things, liberalized agricultural marketing and removed price controls. Unlike many countries in the region, the state marketing enterprise was abolished rather than allowed to continue operating in competition with private traders. There are no significant public stocks of food (Rashid, 2010).

Another difference with other countries in the region is that international trade in staple foods is not restricted. The government does not impose bans, quotas, or duties on exports, and food imports are subject to a low tariff (10-13%). As part of the East African Community (EAC), Uganda is committed to gradual elimination of import duties from other EAC members.

Following the liberalization of agricultural markets, the degree of market integration has increased significantly (Rashid, 2007). Furthermore, Uganda has emerged as a regular surplus producer of maize and beans, exporting mainly to Kenya with smaller quantities going to other neighboring countries. The World Food Programme (WFP) has a local procurement program under which maize is purchased in Uganda for distribution as food aid in Sudan and other countries in the region.

Between January 2007 and July 2008, maize prices in Kampala rose 75%. This price increase was probably the result of increased demand in Kenya associated with the political turmoil there, rather than the global food crisis. Given the fact that maize accounts for just 9% of caloric intake and that consumers could shift to cooking bananas, cassava, and sweet potatoes, the impact on food security was modest. The government did not implement any special policies or programs in response to the price increase (Benson et al, 2008).

4.3 Kenya

4.4 Tanzania[4]

The most important staple foods in Tanzania are maize and cassava, contributing 33% and 15% of the caloric intake, respectively. By this measure, Tanzania is more reliant on maize than Uganda or Ethiopia but less so than Malawi or Zambia. Also important are rice, wheat, and sorghum, each representing 4-8% of the caloric intake. Tanzania imports about 90% of its wheat requirements and about 8% of its rice, but international trade in the other staple foods is relatively small (FAO, 2010b).

Maize is grown throughout the country, but the main surplus zone is the southern highlands, including the regions of Mbeya, Iringa, Rukwa, and Ruvuma. Since Zambia and northern Malawi often experience maize deficits, there is an incentive to export maize from the southern highlands to the south. However, the Tanzanian government bans the export of maize whenever any region of Tanzania is food insecure, which is most of the time. The semi-permanent ban on exports favors consumers at the expense of surplus farmers, particularly those in the southern highlands.

Tanzania formed a strategic grain reserve in the 1970s following the food crises of 1971-74. It was originally managed by the National Milling Corporation (NMC), a state enterprise that was given a monopoly on the procurement, processing, and distribution of staple food crops. With the liberalization of grain trade in the late 1980s, the NMC was forced to compete with private millers and trader, eventually losing 95% of its market share. In 1991, the Strategic Grain Reserve (SGR) was established as a separate entity. The objectives of the SGR are to advise the government on food security policy, supply food for emergency assistance, and stabilize staple grain prices. The SGR engages in procurement and distribution operations through seven depots, three in surplus zones in the southern highlands and four in deficit zones (Dar es Salaam, Arusha, Dodoma, and Shinyanga). The capacity of the SGR is 150 thousand tons, but in practice the quantities in storage have generally been in the range of 50-80 thousand tons (Mndogo, nd).

The SGR has not had much effect on grain prices in Tanzania. The volume of purchases and sales in a given year is generally less than 50 thousand tons, which is negligible compared to the volume of Tanzanian grain production (5 million tons) or even marketed surplus (roughly 1.25 million tons). In addition, the SGR suffers from bureaucratic procedures, political interference, under-utilization of capacity, and chronic operating deficits due to pricing policies that do not allow cost recovery. On the other hand, the global food crisis has increased the political support for tools to manage staple food price volatility.

In spite of the absence of an effective grain stabilization policy, the variability in maize prices is relatively low. The coefficient of variation in monthly maize prices in Dar es Salaam is 26%, the lowest among the seven countries listed in Table 1. This price stability may be related to the importance of cassava as a potential substitute staple, the location of Dar es Salaam on the coast, and the geographically dispersed production zones.

4.5 Malawi[5]

Maize is by far the most important staple food in Malawi, accounting for over half (54%) of the caloric intake. Of the countries in eastern and southern Africa, Malawi and Zambia are the most dependent on maize. Cassava and sweet potatoes are also important staples, representing 7-8% of caloric intake each (FAO, 2010b). The root crops are more drought

[4] This section draws heavily from Minot (2010b).
[5] This section draw heavily from Minot (2010a).

resistant than maize, so they particularly important in drier areas of Malawi and during low-rainfall years when the maize harvest is below average.

In 1971, several state-owned agricultural enterprises were merged to form the Agricultural Development and Marketing Corporation (ADMARC), with responsibility for purchasing, processing, and marketing agricultural products; stabilizing food prices; and maintaining food security reserves. Through ADMARC, the government maintain pan-territorial and pan-seasonal prices for maize and other food crops grown by smallholders. Although there was criticism that the system taxed smallholders and favored the export-oriented estate sector, Malawi was generally food self-sufficient and enjoyed healthy rates of economic growth in the 1960s and 1970s.

However, the oil crisis of 1979 and the interruption of trade by the war in Mozambique caused a severe economic crisis in Malawi. The government was forced to turn to the World Bank and the International Monetary Fund (IMF) for financial support, which entailed agreeing to policy conditions (Chirwa, 2006). Under a series of structural adjustment programs in the 1980s, Malawi carried out reforms to liberalize the economy:

- Over 1982-86, the price bands at which ADMARC would buy and sell were revised annually and moved closer to parity with international prices.
- In 1987, the monopsony power of ADMARC over small-holder food crops was eliminated and private trade was legalized, subject to licensing. The prices of most crops were liberalized, leaving ADMARC in the role of buyer of last resort (Smith, 1995).
- In 1997, the licensing requirement for agricultural traders was eliminated, with the exception of those trading in maize.
- In 1999, the National Food Reserve Agency (NFRA) was created to manage emergency food stocks, in theory allowing ADMARC to focus on commercial activities.
- In 2000, ADMARC abandoned the maize price band, but it continues to intervene in maize market trade and marketing on an *ad hoc* basis.

Malawi maize policy is characterized by a large fertilizer subsidy program whose size and design varies from year to year, purchases and sales by ADMARC on behalf of the NRFA, occasional maize export bans, government-sponsored maize imports, and continued suspicion of private traders. Malawi has experienced three spikes in maize prices in recent years, contributing to one of the highest levels of maize price instability in the region (see Table 1). Here we provide a brief description of each of these spikes.

The price spike in 2001-02 originated in the depletion of the NRFA food stock just before it became clear that a second harvest in a row would be poor. The government ordered 150 thousand tons of imports, but logistical and administrative problems delayed its arrival. In the meantime, the price of maize reached US$ 500 per ton. The spike was widely blamed on earlier advice from the World Bank and the IMF to reduce the reserve from 167 thousand tons to 30-60 thousand tons. But the IMF attributes the crisis to 1) the sale of the stock before the 2001 harvest assessments had been completed, 2) the sale of the entire stock rather than reducing it to the recommended level, and 3) the lack of good information on size of the shortfall. They also note that the sale of the stock was not authorized by the government, leading to a corruption investigation (IMF, 2002). However, private imports could have prevented the price spike except that 1) traders lacked information about the size of the NRFA food stock until it was exhausted and 2) the government's stated intention to import a large quantity scared off private importers, until the extent of the delay became clear (Rubey, 2003).

The second maize price spike was in 2005-2006. In large part, this was caused by poor rains in the 2004-2005 growing season. In addition, it was expected that the new government would implement an expanded fertilizer subsidy program, so many farmers waited to purchase fertilizer. Private fertilizer dealers were reluctant to import given the expectation of a large subsidy program. The implementation of the subsidy program was delayed by debate with the government and reduced in size due to funding constraints. By the end of October, barely one third of the fertilizer needed for planting was available (FAO-WFP, 2005; Rubey, 2005). This contributed to the 24% decline in the 2005 maize harvest, below an already low 2004 harvest. Although the 2005 harvest (1.2 million tons) was much smaller than in 2001 harvest (1.7 million tons), the price spike in early 2006 was much less severe than in early 2002. In the absence of a government plan to import maize, the private sector was able to arrange imports and prevent a larger rise in prices.

The third period of high maize prices occurred in 2007-08. The combination of good rains in the 2006-07 agricultural year and the newly expanded fertilizer subsidy program led to a bumper crop in 2007, estimated at 3.4 million tons of maize. The government issued tenders to traders to assemble 450 thousand tons for export to Zimbabwe. By late 2007, the government had exported 283 thousand tons. However, in the process, the price of maize was bid up 65% over the second half of the year, causing the government to suspend the procurement program. In fact, prices in Malawi rose above those in neighboring countries, resulting in an inflow of maize from Mozambique and Tanzania through cross-border trade (Jayne et al, 2008).

In 2008, the government reported another bumper harvest, with an estimated surplus even larger than in 2007. As ADMARC began its procurement program, it was forced to raise the buying price numerous times in order to compete with traders. By August, ADMARC and NFRA were only able to purchase 60 thousand tons, and the maize price in Lilongwe had risen to close to US$ 400 per ton. Reflecting the widespread view that the high prices were the result of hoarding by traders, the government banned private trade in maize in August 2008, effectively restoring the legal monopoly of ADMARC on maize trading. Later, the ban was partly relaxed to allow small-scale trade, provided the price ceiling of 52 MK/kg is respected (Jayne et al., 2008; FAO, 2009d; ANN, 2008).

Jayne et al. (2008) argue that official crop production estimates for 2007 may have been overestimated. They note that high prices, maize imports, and rationing by ADMARC "are difficult to reconcile with the official estimates of a record maize harvest of 3.4 million tons in 2007." If so, the combination of inaccurate estimates of the harvest and government procurement for export contributed to the spike in maize prices.

4.6 Zambia

As in Malawi, the diet of Zambian consumers is dominated by maize. Over half the caloric intake (57%) is from maize consumption, while cassava contributes 13% and wheat 7% (FAO, 2010b). Maize is the main staple in southern and eastern Zambia, while cassava is more important in parts of the north. Consumption of wheat, which is considerably more expensive than maize on a per calorie basis, is concentrated among higher-income households in urban areas.

Maize production is highly variable; in fact, maize production instability is the highest among the seven countries shown in Table 2. As a result, Zambia tends to import maize following a poor harvest and occasionally exports a surplus after a particularly good year. Cassava is not traded on any significant scale, but there is some cross-border export of dried cassava to the Democratic Republic of the Congo. Wheat production is relatively stable because much of it

is produced by large-scale farmers using irrigation. Although Zambia has traditional imported a significant portion of its wheat requirements, wheat production has been expanding to the point that the country is approaching self-sufficiency (Chapoto et al, 2010).

Given the importance of maize in the Zambian diet, it is not surprising that food policy in the country focuses heavily on maize. Throughout the 1970s and 1980s, the National Agricultural Marketing Board (NAMBOARD) managed the agricultural sector. It distributed subsidized fertilizer and other inputs, guaranteed a pan-territorial purchase price for maize, produced maize meal at state-owned mills, and marketed the maize meal at subsidized prices to urban consumers. This costly system was undermined by the collapse of world copper prices in 1986. Without this revenue and under pressure from the international financial organization, Zambia abolished NAMBOARD and attempted to phase out consumer subsidies. The economic reforms were accelerated with the new government in 1991.

In 1995, the government created the Food Reserve Agency (FRA) to manage food security stocks. Purchases remained a small share of annual production (0-9%) for the first ten years of its existence. In 2005, the FRA was given a larger mandate and budget, allowing open 600 buying station and to expand maize procurement to about 25% of total production. The pan-territorial procurement price is often above the local wholesale price, providing a significant advantage to those able to sell to the FRA (Dorosh et al, 2009).

Imports and exports of maize and wheat require permits that specify the quantity to be traded. In recent years, most of the permits have been issued to the FRA. Thus, the FRA has come to play a dominate role in both domestic maize marketing and international grain trade.

Between mid-2007 and mid-2008, maize prices rose 40% in US dollar terms. In response, the government banned the export of maize and increased the size of the fertilizer subsidy to stimulate production the following year. The government also offered FRA maize to the large-scale millers at a significant subsidy. The intention was to allow the millers to keep the price of maize meal low, but it surprised and undercut private importer-suppliers. The subsidy was later withdrawn in the face of accusations that the millers were not passing the savings on to consumers (Chapoto et al, 2010).

Because of this dominant role and the unpredictability of maize policy, the private sector is reluctant to participate in or invest in cross-border trade. This, in turn, leads policymakers to see private traders as unreliable and unable to take responsibility for trade in this strategic commodity. This mutual mistrust means that trade is not fulfilling its potential as a mechanism to stabilize maize prices. Dorosh et al (2009) use an agricultural sector model of Zambia to simulate the effect of a drought that reduces maize production by 30% on 10 households types under different food policy regimes. They show that private cross-border trade and substitution into cassava could offset two-thirds of the consumption effect of a drought year on poor households.

4.7 Mozambique

Cassava is the main staple in Mozambique, contributing 33% of the caloric intake. Maize is the second-most important, accounting for another 22% of caloric intake. Rice and wheat are also important staples, particularly among higher-income urban households (FAO, 2010b). Cassava is particularly important along the coastal plain of Mozambique, while maize production is important in the interior.

There is virtually no international trade in cassava because of its perishability and low value-bulk ratio. In contrast, maize is both imported and exported. Maputo and southern Mozambique is a maize deficit area, but shipping maize from the surplus zone in the north is not profitable, so about 10% of the maize requirements for the nation is imported from South

Africa. The maize surplus zone in the north is an occasional exporter to Malawi, particularly in poor-rainfall years. Almost all wheat and roughly 60% of the rice is imported.

During the 1980s and early 1990s, the government purchased and sold maize and other foods at controlled prices through two state-owned enterprises, AGRICOM and later the Cereals Institute of Mozambique (ICM). As part of a broader agricultural reform program, the ICM withdrew from direct intervention in food markets and price controls were abolished in 1997 (Donovan and Tostão, 2010).

Currently, agricultural and food markets in Mozambique are largely liberalized. International trade is unrestricted, though there are modest tariffs on imported goods, including maize. The government does not maintain a strategic grain reserve or attempt to stabilize food prices. Tshirley et al (2006) found that maize prices in Mozambique were more stable than in any other country in the region. More recent estimates for Maputo show that maize price variability is no longer the lowest in the region, but it is still below average (see Table 1).

Between mid-2007 and mid-2008, retail maize prices rose 62% in Maputo and 123% in Nampula (Minot, 2010c). In response, the government developed an Action Plan for Food Production (PAPA) which focused on measures to increase crop productivity. The Plan also calls for the creation of public-private food reserves in three areas. The government will build storage facilities, contract private traders to purchase grain for the stores, and provide subsidies or loan guarantees to motivate private-sector participation (Chapoto et al, 2010).

Even after world grain prices began to fall in late 2008, the price of maize remained high in Maputo and elsewhere in Mozambique. The persistence of a large margin between the SAFEX price of maize in Durban and the price in Maputo requires further analysis.

5 Summary and discussion

5.1 Summary

Ethiopia has a relatively diverse set of staple foods, including maize, wheat, teff, and sorghum. Agricultural marketing has been substantially liberalized since the early 1990s. The Ethiopian Grain Trading Enterprise no longer has the financial resources or branch network to defend a price band or even a price floor over time. Nonetheless, it is used by the government for occasional intervention in grain markets, particularly when prices are unusually low or unusually high. The recent rise in grain prices appears to be the result of a combination of general price inflation, harvests that were smaller than estimated, and a foreign exchange "shortage" caused by the government's reluctance to allow the currency to depreciate. Policy responses included a grain export ban, government grain imports, and the creation of a system for distributing subsidized grain rations in urban areas. Private grain imports could have mitigated the spike in grain prices, but traders were unable to access foreign exchange and hesitant to try to compete with subsidized government imports.

Uganda also has a diversified diet that incorporates four major staples: cooking bananas, cassava, maize, and sweet potatoes. Uganda follows a more market-oriented agricultural policy than many other countries in the region. There is no strategic grain reserve, nor any price stabilization policy. Food marketing and cross-border trade are relatively unrestricted. The stable policy environment and open borders has allowed the development of maize surpluses which are sold to the World Food Programme and exported to Kenya and other neighbors. The price rise of 2007-08 seems to be more closely related to political turmoil in Kenya than events in world markets.

Malawi is highly dependent on maize, so the maize price is politically sensitive. Although agricultural markets have been liberalized, AMARC continues to play an important role in

maize marketing and trade, particularly when prices are high. Malawi is characterized by one of the most interventionist maize policy in the region, yet maize price instability is one of the highest in the region (see Table 1). Although variation in the size of the harvest is an important factor, maize price instability appears to have been exacerbated by the lack of transparency in the size of public stocks, over-estimates of the maize harvest, inappropriately-timed ADMARC procurement campaigns, and delays in carrying out announced government imports.

In Zambia, the Food Reserve Agency plays an active role in domestic grain marketing and trade with the goal of stabilizing maize prices. Yet, there is evidence that the *ad hoc* nature of these interventions creates an unpredictable policy environment for grain traders This uncertainty inhibits their participation in various activities, particularly maize imports and storage, which in turn exacerbates maize price volatility in Zambia.

Mozambique has pursued a market-oriented staple food policy, with no state grain trading enterprise, minimal barriers to staple crop imports and exports, and no efforts to stabilize food prices. Grain prices were quite stable in the early 2000s and relatively stable in recent years. The rise in prices in 2007-08 associated with the global food crisis has, however, led the government to plan the creation of a public-private food reserve.

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