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Droughts, Cereal Prices, and Price Stabilization Options in Ethiopia

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ABSTRACT

Increases in cereal prices can have adverse effects on poor net food buyers. This is a particular problem in Ethiopia because of frequent natural calamities – especially droughts – that lead to significant price hikes. Conversely, falling domestic prices of some cereals (especially maize), typically at harvest time, can be detrimental to producers who are net sellers. Price stabilization efforts are therefore an important consideration for Ethiopian policy makers. This paper sheds light on options for cereal price stabilization in Ethiopia drawing on experiences of other developing countries. The international experience in food price stabilization shows that while some countries have achieved success, the efforts of many others have actually destabilized market prices at great fiscal cost. We assess the extent to which price stabilization efforts in Ethiopia were effective during the major El Niño induced drought of 2015/16 and find that opportunities were missed to enhance food security and consumer welfare through permitting private sector imports in order to curtail the rise in cereal prices and to reduce fiscal costs for the government and donors.

1. INTRODUCTION

Increases in cereal prices can have adverse effects on poor net food buyers. Conversely, falling domestic prices of some cereals (especially maize), typically at harvest time, can be detrimental to producers who are net sellers. Price volatility is especially problematic for Ethiopia because of frequent weather shocks. The country is often hit by droughts that result in major crop failures and, subsequently, price instability and severe hardship for farmers and consumers, especially the poor. Price stabilization efforts are therefore an important consideration for Ethiopian policy makers. This paper evaluates options for cereal price stabilization in Ethiopia drawing on the experiences of other developing countries.

Twice in the last fifty years, crop failures contributed to widespread famines in Ethiopia (1972-74 and 1984-85).[1] Because of their devastating effects, these famines received significant attention in the literature. In their analysis of the 1984-85 famine, Webb and von Braun (1994) identified four major causal factors. The most important factor was drought-induced crop failure.[2] The other three factors reflect longer term causes. In addition to misguided land policies and conflict,[3] markets in Ethiopia were not well integrated. The latter followed from market restrictions (particularly, regulation and bans on inter-regional movement of grain and labor), requirements for licensed private traders to make half of their purchases available to the Agricultural Marketing Corporation at fixed prices, and poor market infrastructure.

This paper assesses how Ethiopia tried to assure food security and to achieve food price stability during the major El Niño induced drought of 2016. A series of droughts and crop losses in 2015 and 2016 threatened the food security of an estimated 10.2 million people who were declared in need of emergency food assistance in addition to the 7.9 million already covered by the Productive Safety Net Programme (PNSP) (WFP 2016). Fortunately, the experiences of 2016 were very different from the earlier famines for

[1] See Annex Table A1 for a chronology of major food shortages in Ethiopia over the past 50 years.

[2] Per capita production of cereals fell from 154.1 kg/capita in 1982/83 to 122.6 in 1984/85 and then 91.2 and 100.4 in 1985/86 and 1986/87 (FAO data, including Eritrea: Note that FAO reports 1983/84 production as 1983 (Seyoum Taffesse et al. 2013)). Even taking account of increased imports (including food aid) of approximately 800,000 mt per year in 1985/86 and 1986/87, per capita cereal availability overall fell from 151.5 kg/person in 1982/83 to 100.1 kg/person in 1985/86 and 110.2 kg/capita in 1986/87.

[3] Government land reform policies, including abolishing private land ownership in 1975 and ceilings on private land access rights to 10 hectares per farm, were welcomed in much of central and southern Ethiopia, but subsequently government investment in agriculture was allocated mainly to state farms and producer cooperatives, instead of independent small farmers. Ongoing civil war between the Mengistu regime and both the Eritrean People's Liberation Front and the Tigray Peoples' Liberation Front resulted in loss of life and serious injuries, a reduction in labor availability for crop cultivation, and diversion of scarce public resources away from needed investments in agriculture, roads, and telecommunications.

several reasons. First, major reforms in government policies and massive public investments in agricultural extension and road infrastructure have contributed to substantial increases in cereal production (Bachewe et al. 2018). Second, the functioning of agricultural markets has significantly improved with most markets now being much more integrated (Minten et al. 2014; Hill and Fuje 2017). Third, the introduction of the well-targeted PSNP in the mid-2000's provided an effective means of providing access to food for many of Ethiopia's poorest households (Berhane et al. 2014).

The structure of the paper is as follows. In Section 2, we review the international experiences with cereal price stabilization policies. Section 3 includes an assessment of cereal price variability in the last decade in Ethiopia and a comparison of that price variability with the experiences of other East African countries. In Section 4, we analyze production shortfalls and policy responses in the case of the major El Niño-induced drought of 2016. We then present price stabilization options for the Ethiopian government in Section 5. We finish with the conclusions in Section 6.

2. INTERNATIONAL EXPERIENCE WITH CEREAL PRICE STABILIZATION

In light of the sharp rise in international cereal prices in 2007 and 2008 and a rethinking on the part of many developing countries on their policies regarding food prices, public sector food stocks, and reliance on international trade, it is helpful to review the experiences of countries that have implemented price stabilization policies. There are good reasons why governments intervene in markets to prevent excess price spikes or price declines. These include protecting the welfare of the urban poor and of rural net buyers by dampening price increases, enhancing incentives for domestic production and farmer incomes by preventing large price falls, and promoting political and social stability.

While the overall record on price stabilization is mixed, there are some success stories. Examples from south and south-east Asia include India, Pakistan and Indonesia, where price stability objectives have been achieved. However, price stabilization has often come at considerable cost to the public purse, along with distributional and leakage costs. Pressure from domestic farmer interest groups has led to sustained high levels of procurement (and subsequent distribution). For example, India's government procures 20 to 25 percent of total domestic wheat and rice production annually.

In east and southern Africa, several countries, including Kenya, Madagascar and Zambia, have enjoyed moderate success in raising price levels for farmers and reducing price volatility through their pricing, marketing, and trade policies. For example, the Kenyan National Cereals and Produce Board's purchases and sales of maize at administratively determined prices alongside competition from the private sector contributed to average prices for maize being 20 percent higher than they would have otherwise been between 1989 and 2004 (Jayne et al. 2008). Similarly, interventions by the Food Reserve Agency (FRA) in Zambia contributed to average maize prices being roughly 18 percent higher than they otherwise would have been between 2003 and 2008, while price volatility was over 30 percent lower (Chapoto and Jayne 2009). In both of these cases, however, there is also evidence that these countries could have done better if their policies had been characterized by transparency and predictability.

The importance of transparency, predictability, and, ultimately, more certainty is directly related to the price-stabilizing benefits of private sector international trade. When domestic prices rise above international prices (or the effective cost of imports as measured by the import parity price), there is an incentive for private traders to import. This results in a suppression of exceedingly high price spikes. For example, following severe flooding and a rice production shortfall in Bangladesh in 1998, private sector rice imports, made possible by earlier trade liberalization and investments in infrastructure and market development, effectively stabilized market supplies, as imported rice filled the gap, and prices, since international prices provided an upper price bound (Dorosh 2001, 2008). In relying on the international

market in this manner, price stabilization can be achieved in a low-cost manner without relying on government expenditures.

In order for international private sector trade flows to play a price-stabilizing role, however, governments need to minimize uncertainty related to their policies and interventions. For example, uncertainty about government intentions to import or about when or whether governments will alter import duties can result in traders worrying that they will incur financial losses if they do import and the government subsequently changes its policy. The consequence of this can be a temporary under-provision of imports when there is a domestic shortfall with resulting food shortages and price spikes above the cost of imports. On the face of it, the lack of the private sector imports may appear to reflect market failures and a weak private sector. However, a good case can be made that the behavior of private sector traders is a rational response to uncertainty.

This type of private sector response to uncertain policies has been documented in such countries as Kenya, Madagascar, Malawi, and Zambia. When Kenya was hit by maize shortfalls in 2008, private traders were reluctant to import maize because the 50 percent import duty made private importation uneconomical. The government's history of making sudden changes to the tariff (including zero-ratings), however, meant that grain traders also expected that a change was imminent. This indeed occurred in 2009 when the government eliminated the duty. The consequence of delays in government importation and in government's decision to maintain the 50 percent tariff on imports throughout 2008 was that maize prices stayed at very high levels in late 2008 despite the tumbling of world prices starting in October 2008 (Jayne and Tschirley 2009).

In Malawi, in response to what is now believed to be overstated official estimates of maize production in 2008 and 2009, the government purchased maize, encouraged exports, and restricted imports despite the private sector's difficulties in sourcing maize for government tenders and despite soaring prices. Suggesting that private maize traders had orchestrated the price rise, the government initially banned private maize trade and then required traders to operate within an official price band. But since market prices were well above the ceiling, traders stopped buying maize. In the end, the government eventually arranged with one large trader to supply maize to the government at prices well above the official ceiling price (Jayne and Tschirley 2009).

In Madagascar, when domestic production and imports were low in 2004, the government offered tenders for imports below the tariff-inclusive import parity price for rice while leaving open the possibility that the 45 percent tariff might be waived. In this case, government policy—in particular, its lack of transparency, the harassment of importers (including detaining ships with imported rice), uncertainty about tariff levels and enforcement, and an official selling price that made private sector imports paying full tariffs unprofitable—ultimately made the situation worse than would have been the case if there had been no intervention. Total rice imports in 2004 were 100,000 metric tons (mt) below the 2003 level despite domestic market prices rising above the import parity level (Minten and Dorosh 2006; Coady, Dorosh, and Minten 2009).

Finally, Zambia has experienced unintended price-instability effects of lags between policy announcements and implementation. For example, three times over the last decade (2002, 2003, and 2008/9), announcements of intentions to import maize resulted in market prices skyrocketing as private traders stayed out of the market for maize because they realized they could not compete against subsidized imports. Due to lags in implementing the imports, government stock levels dwindled, which contributed to panic, rationing, and rapidly rising maize prices, the opposite of the policy's intended effect. Simulations based on econometric estimates show that prices in Zambia have been more volatile with government marketing and trade policies than without them, but that this result was not due to the

government's purchases/sales. Rather, it was due to uncertainty over government policy and timing of implementation (Chapoto and Jayne 2009).

The message coming out of international experiences in price stabilization policies is that rules-based approaches to marketing and trade policies may reduce levels of uncertainty and the price instability associated with them. But, ultimately, the approach that countries take in addressing price stabilization depends on the visions that policy makers have with regard to food markets. Jayne and Tschirley (2009) classify these visions into three models of how markets work and how the private and public sectors interact. These are described in Table 2.1.

Table 2.1. Competing visions of staple food market development

Model 1	Model 2	Model 3
Rely on markets with limited role of state	***Primary reliance on markets with rules-based role of state***	***Role for markets with discretionary state intervention***
• Role of state limited to: - Public goods investment - Regulatory framework - Strengthening of institutions and property rights - Policies supportive of private sector entry and competition	• Role for rules-based state operations: - Buffer stock release to defend stated ceiling price - Marketing board purchases at stated floor price announced in advance - Transparent rules for initiating state imports - Public goods investments	• Based on premise that the private sector cannot ensure adequate food supplies in response to production shortfalls • Justification for unconstrained role for state intervention in markets to correct for market failures

Source: Jayne and Tschirley (2009).

In **Model 1**, the role of the state is confined to providing public goods to strengthen markets. This vision relies on the private sector to carry out the main direct marketing functions and is close to the "Washington Consensus" around the desirability of an expansion of market forces within domestic economies, which is now generally out of favor. In **Model 2**, the role of the state is expanded to include direct marketing operations based on the premise that markets do fail in certain circumstances and that direct rules-based non-discretionary state operations are necessary to maintain good prices within reasonable bounds. The price bounds are typically defined by long-run import and export parity prices. Finally, **Model 3** is a vision in which discretionary state intervention provides the state with the flexibility needed to achieve state policy objectives. The staple food market policies of most governments in eastern and southern Africa are characterized by this vision in that they adopt highly unpredictable and discretionary trade policies.

While Model 3 is the most common vision underlying the approaches of governments in food markets, this discretionary approach to food price policy creates risks for the private sector and hampers the private sector from performing the functions envisioned of it in Models 1 and 2. Transitioning from Model 3 to Model 2 is likely to promote market predictability and lead to greater supplies and price stability in food markets during times of domestic production shortfalls. The challenge in moving from policies motivated by Model 3 to those consistent with Model 2, however, is convincing people of the credibility of governments' commitments to a rules-based approach given long histories of discretionary state intervention in food markets.

3. AN ASSESSMENT OF CEREAL PRICE VARIABILITY IN ETHIOPIA

To put Ethiopia's cereal price variability into perspective, we compare cereal price variability there with that in two other East African countries. In particular, we compare the variability of wheat and maize prices

in Ethiopia with variability of maize prices in Uganda and Kenya, as well as in the broader international, i.e., world, market over the period 2009 to 2018 (Table 3.1).

World wheat prices (measured in US dollars) in this period were on average 28.5 percent higher than world maize prices, and were also considerably more stable, with a coefficient of variation (CV) of 0.196 as compared to 0.287 for maize (column 1). Column 2 of Table 3.1 further shows that there was a relative difference in the coefficients of variation of nominal exchange rates across countries. Thus, the coefficients of variation of border prices of maize measured in local currency units are rather similar for the three countries (column 3). In all three countries, domestic maize prices (column 4) were on average slightly above border prices; wheat prices in Ethiopia were on average 46.9 percent above border prices, though, as discussed below, there were considerable periods in which domestic wheat prices were somewhat below border prices. Domestic prices measured in US dollars (column 5) were considerably more stable than domestic prices measured in local currency. Finally, real prices of both wheat and maize in Ethiopia in local currency units (calculated using the domestic CPI's as deflators) were much more stable that the nominal domestic prices of these commodities. Comparing across countries, Ethiopia's prices of maize are more stable than both Kenya's and Uganda's in real terms, although in nominal terms they are less stable than Kenya's, but more stable than Uganda's.

Table 3.1. Prices for wheat and maize in Ethiopia and maize in Kenya and Uganda, 2009 to 2018

	World price	Exchange rate	Border price	Domestic price	Domestic price	Border price/CPI	Domestic price/CPI
	$/ton (1)	lcu/$ (2)	lcu/kg (3)	lcu/kg (4)	$/ton (5)	lcu (2018)/kg (6)	lcu (2018)/kg (7)
Ethiopia Wheat							
Mean	262.12	19.12	5.53	8.07	418.74	8.41	11.86
Standard deviation	51.42	4.16	1.31	2.26	51.42	2.29	1.56
Coefficient of Variation	0.196	0.217	0.237	0.280	0.123	0.272	0.132
Ethiopia Maize							
Mean	204.02	19.12	4.32	4.86	254.38	2.57	2.60
Standard Deviation	58.54	4.16	1.12	1.36	40.65	0.84	0.56
CV	0.287	0.217	0.260	0.280	0.160	0.328	0.214
Kenya Maize							
Mean	204.02	90.81	21.05	31.42	348.28	27.92	40.73
Standard Deviation	58.54	9.49	4.74	7.78	67.33	8.61	9.50
CV	0.287	0.104	0.225	0.248	0.193	0.211	0.233
Uganda Maize							
Mean	204.02	2841.45	651.14	720.64	255.08	818.58	876.81
Standard Deviation	58.54	590.90	148.22	250.65	75.04	191.42	255.13
CV	0.287	0.208	0.228	0.348	0.294	0.234	0.291

Source: Authors' calculations from Dorosh et al (2015), EGTE, IMF and CSA (2018) data.
Note: CPI=Consumer Price Index; lcu=Local currency unit

Over this same period (2009-18), Ethiopia's overall domestic inflation (measured by the CPI), as well as the growth rate of domestic maize prices, were higher than those in Kenya and Uganda (Table 3.2). The average increase in the CPI in Ethiopia (0.98 percent per month) compared to only 0.60 percent per month in Kenya and 0.53 percent per month in Uganda. Likewise, the average growth rates in maize prices in Ethiopia was considerably higher than those in Kenya or Uganda (0.66, 0.35, and 0.49 percent, respectively). Over this period, Ethiopia's nominal exchange rate (relative to the US dollar) in Ethiopia increased by 0.64 percent per month. This was considerably less than the average monthly growth rate in the CPI, so the ratio of the exchange rate to the CPI (a crude measure of the real exchange rate that does not take into consideration changes in world prices), appreciated by 0.20 percent per month, almost identical to the change in this measure for Kenya (0.19 percent per month). This appreciation of the real

exchange rate encouraged imports and reduced export competitiveness. In contrast, Uganda's real exchange rate depreciated over this period.

Table 3.2. Exchange rates and cereal prices in Ethiopia, Kenya, and Uganda: Average monthly growth rates 2009 to 2018, percent

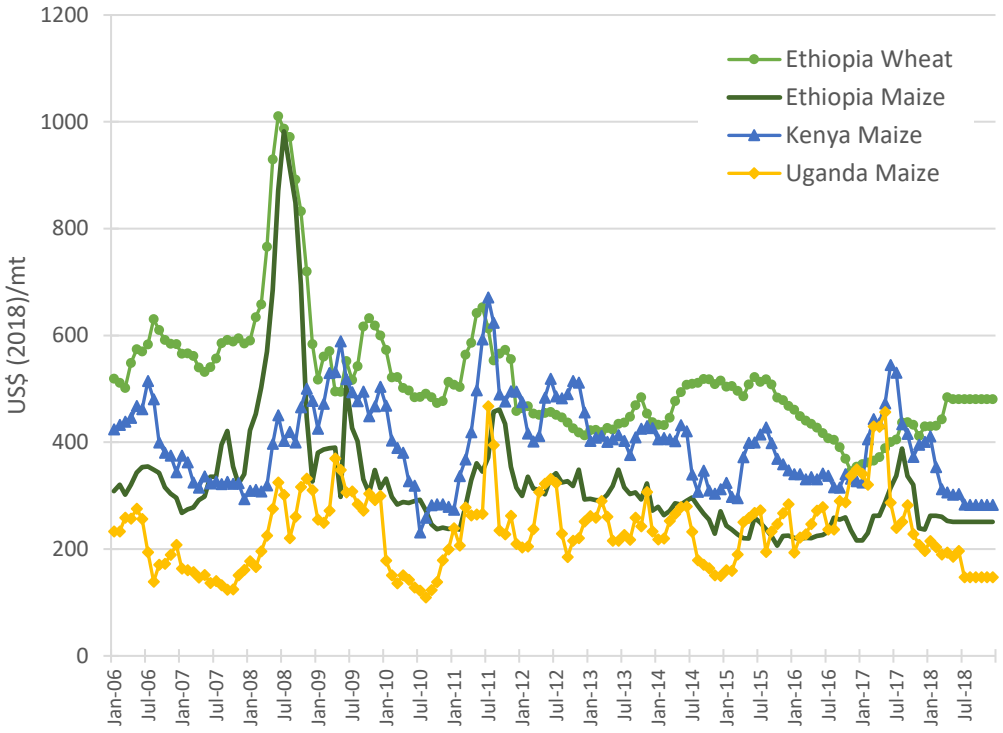
	Ethiopia	Kenya	Uganda
Nominal Exchange Rate (NER)	0.64	0.27	0.57
Consumer Price Index (CPI)	0.98	0.60	0.53
Real Exchange Rate (NER/CPI)	-0.20	-0.19	0.18
Price Maize	0.66	0.35	0.49
Price Maize / CPI	-0.31	-0.25	-0.03
Price Wheat	0.76	---	---
Price Wheat / CPI	-0.21	---	---

Source: Authors' calculations from Dorosh et al (2015), EGTE, IMF and CSA (2018) data.

Overall, real prices of maize and wheat in Ethiopia declined over time (growth rates of -0.31 and -0.21 percent per month), as did the real price of maize in Kenya (with a growth rate of -0.25 percent per month). Real prices of maize in Uganda were, on average, almost unchanged (a growth rate of -0.03 percent per month).

Much of the variation in Ethiopian prices occurred in 2007 and 2008, a period of substantial domestic inflation. As shown in Figure 3.1, US dollar prices of maize and wheat in Ethiopia spiked in mid-2008, but have been relatively much more stable since then. A faster decline in the dollar prices of wheat relative to those of maize in Ethiopia, however, has lowered the gap between these prices over time. Unlike in Ethiopia, there has been no spike in US dollar prices of maize in Kenya and Uganda during this period, although, as indicated by the numerical measures of variance described above, there has been substantial variation in these prices as well.

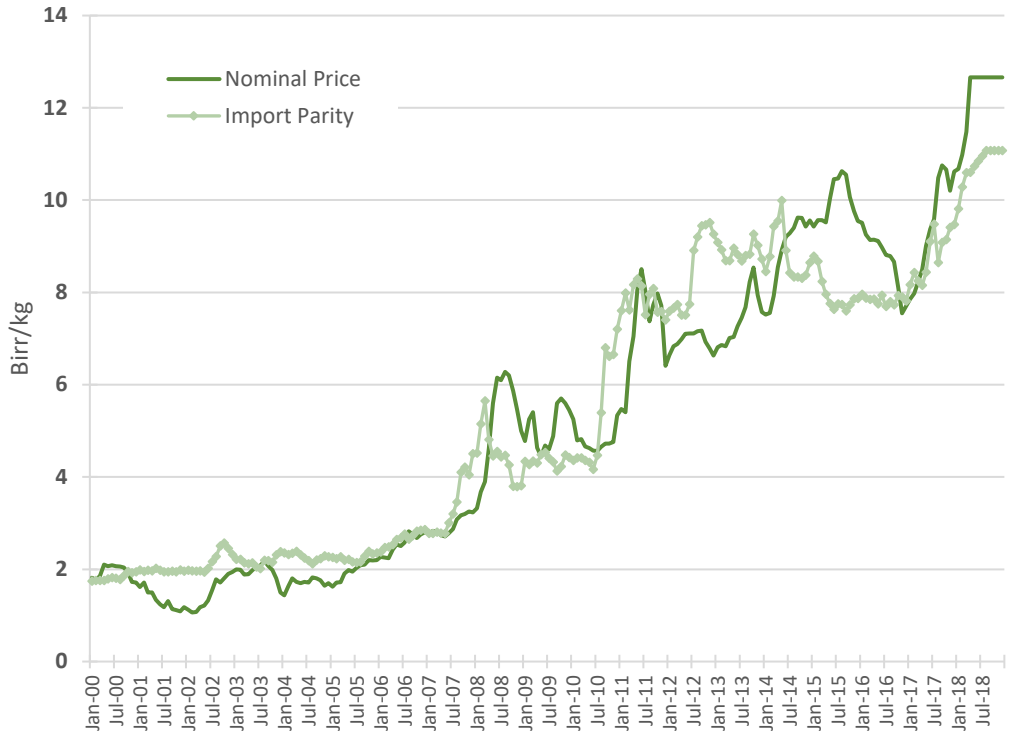
Figure 3.1. Cereal prices in Ethiopia, Kenya, and Uganda, 2006 to 2018



Source: Authors' calculations from Dorosh et al (2015), EGTE, IMF and CSA (2018) data.

Figure 3.2 shows the evolution of the nominal wholesale and import parity[4] prices of wheat in Addis Ababa over the period 2000 to 2018. In well-functioning integrated markets, domestic prices would not exceed the import parity prices of a product for an extended period of time if there are no restrictions on trade. Nominal prices of wheat were, in fact, equal to or lower than import parity from mid-2010 to mid-2014. However, from early 2008 to mid-2010, domestic wholesale prices were significantly higher than import parity prices because of a relatively poor harvest along with foreign exchange and wheat import restrictions that limited imports (Dorosh and Ahmed 2011). Moreover, domestic wheat prices were substantially higher than import parity prices from mid-2014 through mid-2016. As discussed below, if private sector import flows had been unhindered in this period, domestic prices could have fallen to import parity levels, thereby reducing the adverse effects of the drought that happened during that period on net wheat consumers.

Figure 3.2. Ethiopia wheat prices, 2000 to 2018



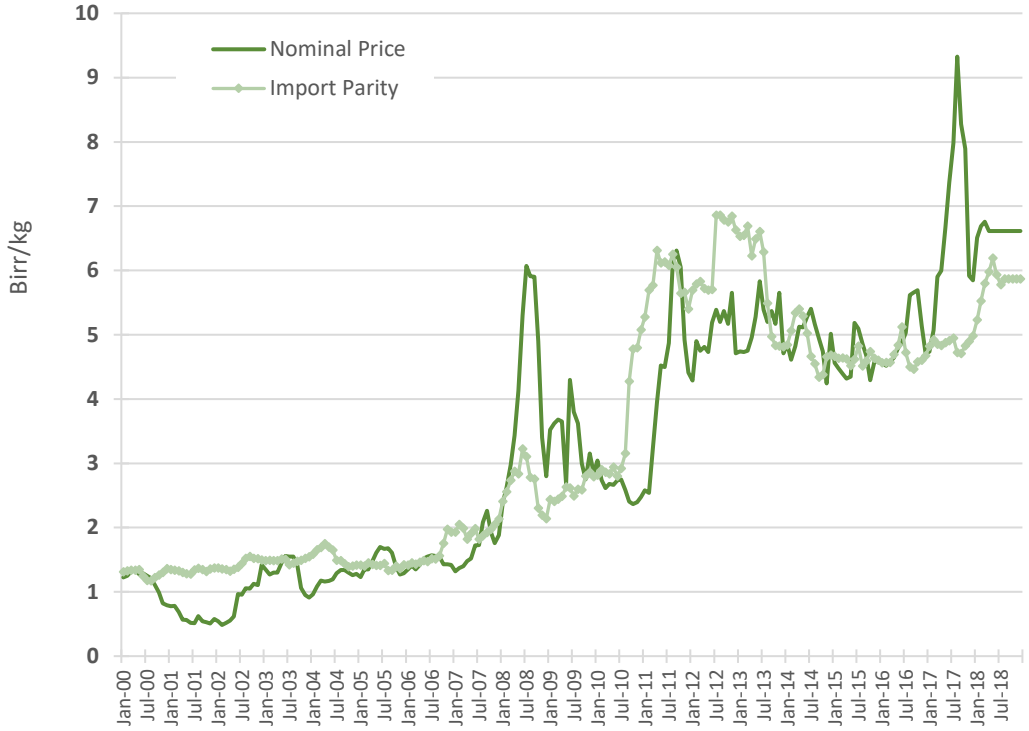
Source: Authors' calculations from EPAU, IMF and CSA (2018) data.
Notes: Import parity in Figure 3.2 is based on international wheat prices (US Gulf, Hard Red Winter) and international shipping costs.

Figure 3.3 presents a similar graph for maize. As in the case of wheat, domestic wholesale prices of maize were significantly above the import parity levels of maize coming from international markets through Djibouti to Addis Ababa in 2008 and 2009 and from mid-2017 to mid-2018. Nonetheless, there were no imports of maize in these periods, suggesting that foreign exchange and trade restrictions may have prevented these import inflows.[5] Note also that in early 2017 there were opportunities for exports of maize to northern Kenya where prices were extremely high due to poor harvests. (The export parity price in western Ethiopia, measured on the basis of prices in Kenya, was somewhat higher than the import parity price of maize measured on the basis of international market prices.)

[4] The import parity price is calculated as the import price of wheat at the port of Djibouti plus transport and other marketing costs to the Addis Ababa market.

[5] High transactions costs because of a lack of established trade links may also have hindered flows.

Figure 3.3. Ethiopia maize prices, 2000 to 2018



Source: Authors' calculations from EPAU, IMF and CSA (2018) data.

In summary, several key aspects of cereal price movements in Ethiopia should be noted. First, since the 2008 price spikes, wheat and maize prices have been relatively stable in Ethiopia, and overall price variability of maize is similar to that in Kenya and considerably less than in Uganda. Second, for wheat (for which there have been substantial, mostly public, imports), international dollar prices have been considerably more stable than domestic prices in Ethiopia, implying that macro-economic instability (movements in nominal exchange rates and periods of overall price inflation) played a large role in domestic wheat price fluctuations. Third, similar price movements of wheat and maize in Ethiopia suggest that the markets for these two cereals are closely linked (Rashid and Lemma 2015) and that, as discussed in the next section, interventions in wheat markets may help to stabilize maize prices and, therefore, overall cereal consumption. Fourth, there have been extended periods during which maize and wheat prices in Ethiopia have been above import parity prices, indicating restrictions on foreign exchange and trade.

4. DROUGHTS, PRODUCTION SHORTFALLS, AND POLICY RESPONSE: THE CASE OF THE 2016 DROUGHTS

4.1. Drought chronology and cereal production

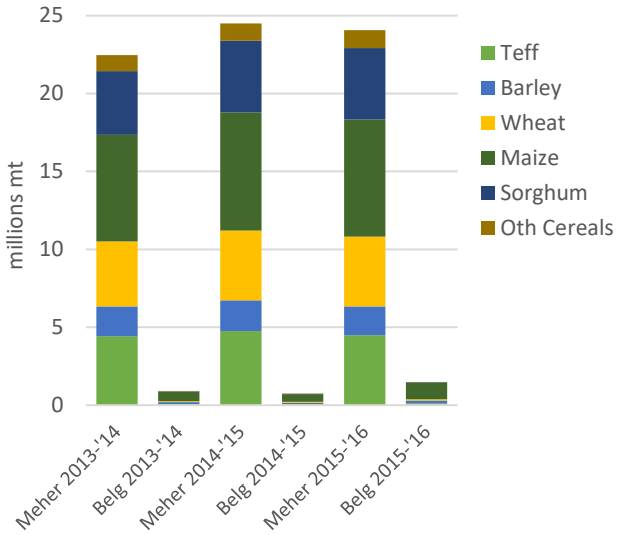
Cereal production in Ethiopia is concentrated in the *meher* season with the harvest between November and January. Meher crops accounted on average for 96 percent of Ethiopia's annual total production (24.4 million mt) from 2013/14 to 2015/16 (Table 4.1; Figure 4.1). Cereal production in the *belg* season, harvested between June and August, averaged only 1.04 million mt in this period, but was highly variable, ranging from only 0.74 million mt in 2014/15, but doubling to 1.48 million mt in 2015/16. The poor *belg* harvest in 2013/14, was due to "below average" March to May short-season rains, leading to water shortages and affecting food security, especially in the eastern part of the country. According to the July 2014 report of the World Food Programme (WFP), in these areas "pastures have not adequately regenerated, water sources are poorly replenished, and crops planted during the season have suffered huge losses from water stresses." (WFP 2014a).

Table 4.1. Ethiopia cereal harvests by season, 2013-14 to 2015-16, million mt

	Meher* 2013/14	Belg 2013/14	Meher* 2014/15	Belg 2014/15	Meher* 2015/16	Belg 2015/16
			All Ethiopia			
Teff	4.43	0.05	4.76	0.05	4.48	0.11
Barley	1.91	0.14	1.96	0.11	1.86	0.20
Wheat	4.18	0.07	4.49	0.07	4.48	0.07
Maize	6.84	0.60	7.58	0.49	7.52	1.06
Sorghum	4.08	0.03	4.59	0.01	4.58	0.03
Other Cereals	1.02	0.01	1.11	0.01	1.14	0.01
Total	22.46	0.91	24.49	0.74	24.06	1.48
			Drought-prone highlands			
Teff	1.05	0.01	1.11	0.00	0.97	0.03
Barley	0.50	0.04	0.51	0.02	0.46	0.08
Wheat	0.90	0.00	0.95	0.00	0.94	0.02
Maize	0.66	0.05	0.68	0.04	0.66	0.21
Sorghum	1.35	0.00	1.55	0.00	1.52	0.00
Other Cereals	0.04	0.00	0.05	0.00	0.04	0.00
Total	4.50	0.10	4.85	0.06	4.59	0.34
			Rest of Ethiopia			
Teff	3.37	0.05	3.65	0.04	3.51	0.07
Barley	1.41	0.11	1.45	0.09	1.41	0.12
Wheat	3.29	0.07	3.54	0.06	3.53	0.05
Maize	6.18	0.55	6.90	0.46	6.85	0.85
Sorghum	2.73	0.03	3.05	0.01	3.06	0.03
Other Cereals	0.98	0.01	1.05	0.01	1.10	0.01
Total	17.95	0.81	19.64	0.67	19.47	1.14

Source: Authors' calculations from CSA data (2016).
* Includes commercial farms annual production.

Figure 4.1. Ethiopia, cereal harvests by season, 2013-14 to 2015-16



Source: Authors' calculations from CSA data (2016).
Note: The meher season includes commercial farms annual production.

The *belg* season rains were also late and erratic in 2015, marking the start of the most severe drought Ethiopia had experienced in 50 years (AKLDP 2016). Table 4.2 and Figures 4.2 show rainfall totals in

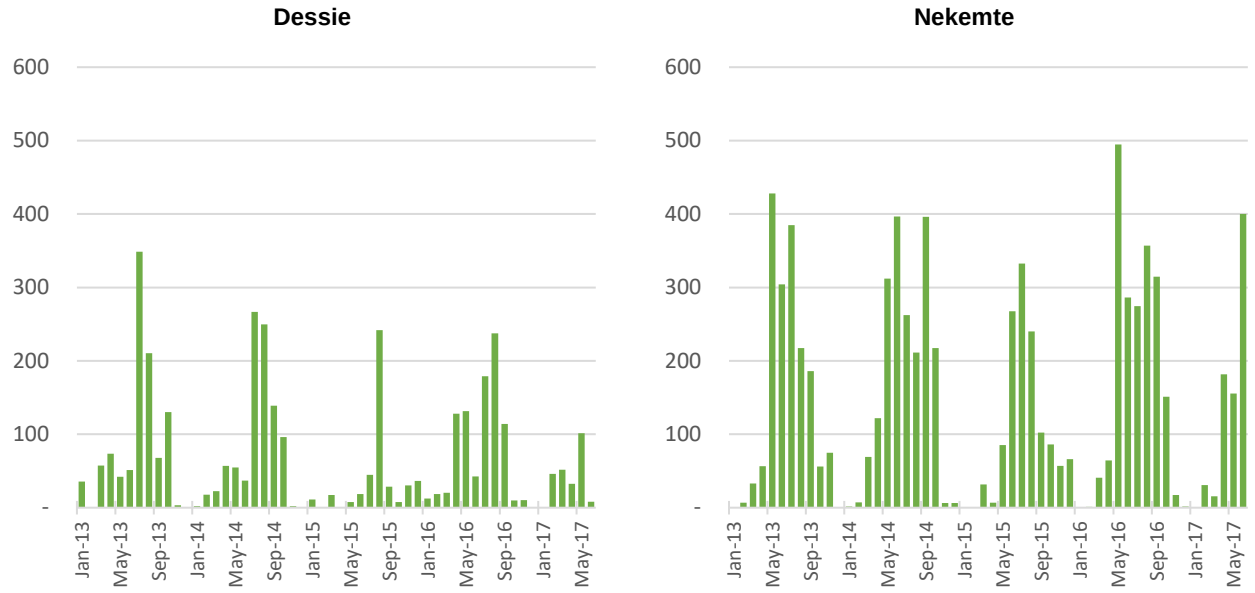
Dessie (a cereal deficit area in eastern Amhara) and Nekemte (a cereal surplus area in western Oromia) from January 2013 to June 2017. For both locations, a significantly lower level of rainfall is seen in 2015. Crops were heavily damaged in Afar, Amhara, eastern and central Oromia, and pockets of Southern Nations, Nationalities, and Peoples' (SNNP) regions. The drought worsened in the *meher* growing season (July to September), and harsh conditions spread to southern and central Tigray, as well as to the northern Somali region. In August, the government of Ethiopia made its first calls for emergency assistance and the WFP increased the number of people it was assisting from two to six million by November 2016 (Table 4.3).

Table 4.2. Annual rainfall in Dessie and Nekemte, January 2013 to June 2017, mm

Year	Dessie	Nekemte	Dessie, % change to year earlier	Nekemte, % change to year earlier
2013	1021	1749	--	--
2014	944	2008	-7.5	14.9
2015	444	1276	-56.5	-27.0
2016	905	2003	-11.3	14.6

Source: National Oceanographic and Atmospheric Administration (NOAA) data

Figure 4.2. Monthly rainfall in Dessie and Nekemte, January 2013 to June 2017, mm



Source: National Oceanographic and Atmospheric Administration (NOAA) data

Ultimately, the total smallholder *meher* cereal harvest was only 23.1 million mt in 2015-16, 2.0 percent less than the 23.7 million mt harvested in 2014-15. Production effects were felt far less in western Ethiopia than in the drought-prone highlands, where maize production was worst affected. *Meher* maize production in 2015/16 was down 5.8 percent in the drought-prone highlands from the year prior, compared to only 1.2 percent for Ethiopia as a whole (Table 4.4). *Meher* season teff and barley production shortfalls in the highlands were also larger: -13.1 percent and -10.1 percent in the highlands, respectively, compared to -5.9 percent and -4.9 percent for the country as a whole.

Table 4.3. Drought chronology for Ethiopia, 2014 to 2017

Period	Summary	Size of population declared as in need of emergency relief, millions
Mar-Oct 2014 (Belg '13/'14)	Below-average *belg* rains lead to water stresses and affect food security primarily in the east.	3.2
Mar-May 2015 (Belg '14/'15)	*Belg* rains are late and erratic, causing failed harvest.	2.9
Aug 2015	The government of Ethiopia makes its first calls for emergency assistance.	4.5
Nov 2015 (Meher '15/'16)	The main *meher* harvest is reduced by 50 to 90 percent in the drought affected highlands. Farmers' incomes decrease up to 60 percent compared to the year prior.	8.2
Mar-May 2016 (Belg '15/'16)	As in 2015, late and unevenly distributed *belg* rains cause flooding in the Somali region, and displacement, the disruption of public services and the spread of disease continue.	10.2
June-Sept 2016	Drought and food insecurity lessens in the northeast after improved *belg* rains, but worsens in the southeast pastoralist areas of Somali and SNNP regions.	9.7
Feb 2017	Distress migration, drought-induced school drop-outs and border tensions increase in primarily Somali pastoralist areas.	5.6
May 2017	The new 2016-17 drought continues to get worse as the year progresses.	7.8 (projected)

Sources: WFP reports from July 2014, October 2014, May 2015, November 2015, February 2016, April 2016, May 2016, July 2016, August 2016, Nov 2016, Feb 2017 and May 2017.

Table 4.4. Ethiopia and drought-prone highlands cereal production, 2015-16 versus 2014-15

	All Ethiopia				Drought-prone highlands			
	Meher	Belg	Commer-cial	Total	Meher	Belg	Commer-cial	Total
Cereal Production, 2015-16, millions mt								
Teff	4.47	0.11	0.01	4.59	0.96	0.03	0.00	1.00
Barley	1.86	0.20	0.01	2.06	0.46	0.08	0.00	0.53
Wheat	4.22	0.07	0.26	4.55	0.94	0.02	0.00	0.97
Maize	7.15	1.06	0.37	8.58	0.64	0.21	0.02	0.85
Sorghum	4.32	0.03	0.26	4.61	1.52	0.00	0.00	1.52
Other cereals	1.11	0.01	0.03	1.15	0.04	0.00	0.00	0.04
All cereal	23.13	1.48	0.93	25.54	4.56	0.34	0.03	4.91
Change Cereal Production, 2015-16 vs. 2014-15, millions mt								
Teff	-0.28	0.06	0.00	-0.22	-0.15	0.03	0.00	-0.12
Barley	-0.10	0.09	0.00	-0.01	-0.05	0.06	0.00	0.01
Wheat	-0.01	0.01	0.00	-0.01	0.00	0.02	0.00	0.02
Maize	-0.08	0.57	0.02	0.50	-0.04	0.17	0.02	0.15
Sorghum	-0.02	0.02	0.00	0.01	-0.02	0.00	0.00	-0.02
Other cereals	0.01	0.00	0.02	0.04	-0.01	0.00	0.00	-0.01
All cereal	-0.48	0.75	0.04	0.31	-0.28	0.09	0.02	0.02
Change Cereal Production: 2015-16 vs. 2014-15, percentage change								
Teff	-5.9	126.2	6.0	-4.6	-13.1	---	---	-10.5
Barley	-4.9	79.4	2.1	-0.4	-10.1	---	---	1.2
Wheat	-0.3	10.2	-0.7	-0.2	-0.4	---	---	1.9
Maize	-1.2	115.9	5.1	6.2	-5.8	---	---	21.1
Sorghum	-0.4	132.6	1.9	0.1	-1.5	---	---	-1.6
Other cereals	0.9	53.7	---	3.2	-27.4	---	---	-25.6
All cereal	-2.0	101.2	4.9	1.2	-5.7	---	---	0.4

Source: Authors' calculations from CSA data (2016).
Notes: --- indicates missing or uncertain data.

Six regions of the country were reported to be severely affected by the drought, and 10.2 million people were reported in need of food assistance by April 2016 (on top of the people that were already covered by the PSNP program). The drought significantly weakened coping capacities, further extensive floods caused displacement, diseases broke out, basic public services were disrupted, and over 1 million livestock died with 1.7 million more at risk. Combined, this amounted to approximately 3 percent of Ethiopia's total livestock population (see Table 4.5 for a chronology of the livestock losses during the drought). The April WFP 2016 report stated "The poorest 20 percent of the population can meet, on average, only 15 percent of their food needs through their own means, while 76 percent eat, on average, only one meal per day. 80 percent of the affected population are consuming fewer calories than the daily minimum recommended by WHO." (WFP 2016b).

Table 4.5. Livestock losses chronology for Ethiopia, 2014 to 2017

Period	Summary
April & May 2014	There are 4,000 livestock deaths in Afar region due to flooding, 2,000 livestock deaths in Oromia region due to drought
May 2015	Abnormal livestock deaths are on the rise in Somali region
March 2016	Over one million livestock die over the course of the poor 2015/16 meher season, largely in Afar and Somali regions, with 1.7 million more at risk.
Mar-May 2016	Belg rains are good, even in pastoral areas, greatly ameliorating dire conditions.
Nov 2016	There are 6,000 livestock deaths reported in Oromia just from October to November.
Jan 2017	Livestock death counts are in the tens of thousands again by January. In parts of Somali, 35 to 55 percent of total livestock holdings die.
May 2017	Hundreds of thousands of livestock owned by 1.9 million households critically require survival and supplementary feed as the 2017 drought gets worse.

Sources: FEWSNET reports including June 2014, May 2015, Outlook June 2016-17, and FAO reports from March 2016, November 2016 January 2017 and May 2017.
Note: In 2014, there was estimated to be a total of 54 million cattle, 26 million sheep and 24 million goats in the country (Leta and Mesele 2014). This would make the one million deaths at the end of the 2015-2016 drought almost one percent of the total livestock population, with closer to 2 percent at risk of death by March 2016.

April and May 2016 were marked by late and unevenly distributed spring rains. Nonetheless, *belg* maize production in 2016 was twice that of 2015 – 1.06 versus 0.49 million mt. In the drought-prone highlands, production increased from 0.04 to 0.21 million mt between the two years. Overall, total cereal production from the *meher* and *belg* seasons combined decreased by 2.0 percent between 2014/15 and 2015/16. In the drought-prone highlands, total cereal production considering both seasons combined fell very little.

By July 2016, the regions with the worst food consumption levels shifted to Somali and SNNP. May floods in the Somali region again left homes, fields, and more livestock destroyed. This was followed by a prolonged *hagaa* dry season, which quickly deteriorated food security and led to distress migration as pastoralists trekked further afield with their animals looking for water and grazing. The prolonged drought finally ended in late 2016, and good rains enabled a successful *meher* harvest throughout most of Ethiopia.

4.2. Market prices and government policy measures: Imports and safety nets

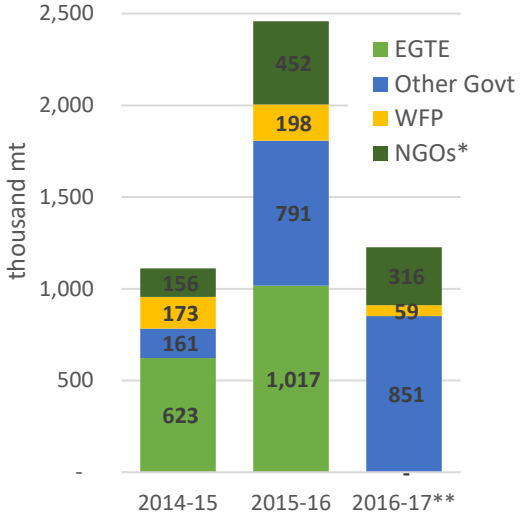
The main policy instrument used to counter the adverse effects of the drought and crop shortfalls was increased cereal imports that were used for humanitarian aid but also for expanded distribution through the Productive Safety Net Programme (PSNP). Ethiopia imported 2.76 million mt of wheat from October 2015 through September 2016, 1.80 million mt more than in the same period in 2014-15 (Table 4.6 and Figure 4.3). Nearly forty percent of this wheat (1.05 million mt) was imported by the Ethiopian Grain Trade Enterprise (EGTE), although only 573,000 mt were distributed through EGTE's own sales channels. The other 1.7 million mt were imported by the World Food Programme, other NGOs, or through other government channels (Figure 4.4).

Table 4.6. Ethiopia wheat imports and distribution, 2014 to 2017, thousand mt

	Cereal Imports	Wheat Imports	EGTE Wheat Imports	EGTE Wheat Imports	EGTE Wheat Distribu-tion	Change in Cereal Supply	Change in Wheat Supply	EGTE Wheat Distrib. minus Imports
Data Source:	*Customs*	*Customs*	*Customs*	*EGTE*	*EGTE*			
April - June 2014	55	29	-	n.a.	121	175	149	n.a.
July - September 2014	381	343	248	206	121	253	215	(85)
Oct. - Dec. 2014	335	320	157	240	137	315	300	(103)
Jan. - March 2015	320	268	177	137	123	267	214	(14)
Apr. - June 2015	182	181	40	116	151	293	292	35
July - Sept. 2015	225	188	172	46	126	178	142	79
Oct. - Dec. 2015	630	563	182	345	142	590	522	(202)
Jan. - March 2016	1,333	1,209	663	277	141	811	687	(137)
April - June 2016	631	498	-	246	148	778	646	(99)
July - Sept. 2016	604	485	-	185	142	746	628	(43)
Oct. - Dec. 2016	364	283	-	25	176	540	459	151
Jan. - Mar 2017	555	458	-	-	112	668	570	112
Oct. 2014 - Sept. 2015	1,062	957	546	540	537	1,052	948	(2)
Oct. 2015 - Sept. 2016	3,197	2,755	845	1,053	573	2,925	2,483	(481)
Oct. 2016 - March 2017	920	741	-	25	288	1,208	1,030	263
July 2014 - June 2015	1,218	1,112	623	699	532	1,127	1,021	(167)
July 2015 - June 2016	2,818	2,457	1,017	915	556	2,357	1,997	(358)
July 2016 - March 2017	1,524	1,227	-	210	430	1,954	1,657	220
April 2014 - March 2015	1,091	959	582	583	502	1,010	878	(81)
April 2015 - March 2016	2,369	2,141	1,057	785	560	1,872	1,643	(225)
April 2016 - March 2017	2,154	1,725	-	457	578	2,732	2,303	121

Source: Ethiopian Grain Trade Enterprise (EGTE) and Ethiopian Revenues and Customs Authority (ERCA) data.
Note: EGTE wheat imports as shown in customs data (column 3) differs from EGTE wheat imports shown in EGTE accounts (column 4). Delays between recording of data in customs and arrival of shipments in EGTE storage facilities may account for some of this difference. n.a. = not available.

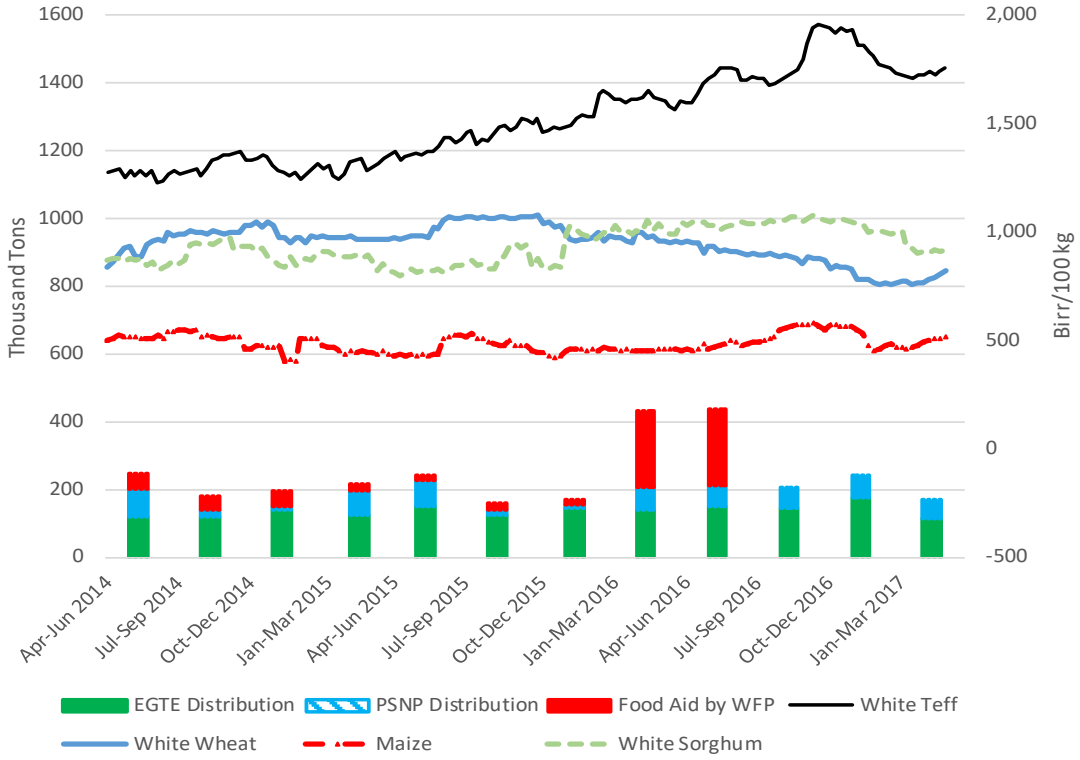
Figure 4.3. Ethiopia's wheat imports by import channel, 2014-15 to 2016-17



Source: EGTE and Government of Ethiopia customs (ERCA) data.
Note: Each set of years represents the months from July to June. EGTE = Ethiopian Grain Trade Enterprise; WFP = World Food Programme; NGO = Non-governmental organization.
* Includes private trade equal to 25,000 mt in 2014-15 and 2,000 mt in 2015-16.
** Data from July 2016 through March 2017.

Most of these imports (including some of the imports imported by the EGTE) were distributed through the PSNP, which benefitted 8 million people in 2015 (although more than 10 million additional people were reported to be in need of food aid due to the drought). Data from nationally representative surveys from before (2014) and after (2016) the drought indicate that the share of households residing in drought-exposed areas were 7.5 percentage points more likely, or more than twice as likely, to have received humanitarian assistance in 2016 compared to the year prior (2015). The share of households enrolled in PSNP also increased between 2014 and 2016 – increasing from 10 to 12 percent among the surveyed households (Hirvonen et al. 2018).

Figure 4.4. Addis Ababa cereal prices and national wheat distribution, 2014 to 2017



Sources: Authors' calculations from CSA data (2018), Ethiopian Grain Trade Enterprise (EGTE) data, Ethiopian Revenues and Customs Authority (ERCA) data, the IFPRI PSNPIV 2016 baseline survey, FAOStat data for recent years on food aid shipments (WFP), a USAID April 2016 report, and a March 2016 article found in Tesfanews.

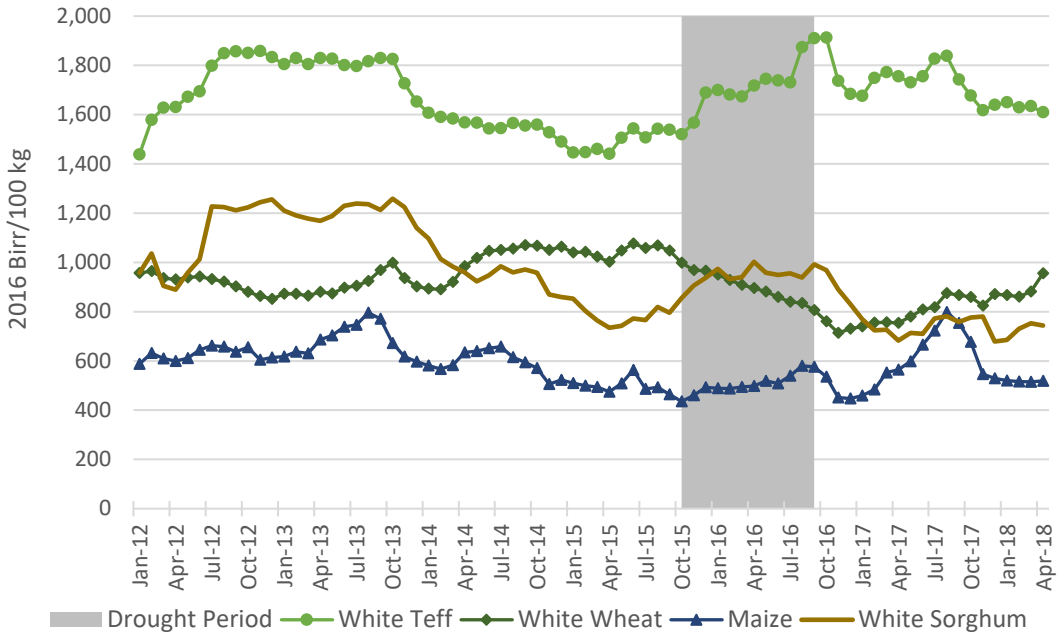
Monthly price movements during this period reflect the massive wheat import flows and overall changes in supply and demand. As wheat imports increased sharply in early 2016, the price of wheat (as recorded in the Addis Ababa retail market) fell below that of sorghum (Figure 4.4). The real price of wheat in Addis Ababa fell by 13.9 percent between 2014/15 and 2015/16 (Table 4.7 and Figure 4.5), while in Dessie, real wheat prices fell by 13.1 percent from 2014/15 to 2015/16 (Table 4.8). By contrast, the prices of teff, maize, and sorghum in Dessie rose by 11.3, 2.1 and 16.1 percent, respectively, during the *meher* season due to the drought's adverse effects on cereal production in that part of the country. The relatively small increase in real maize prices (only 2.1 percent as compared to the 11.3 and 16.1 percent real price increases for white teff and sorghum, respectively) reflected the relatively good maize harvest in 2015/16 in western Ethiopia.

Table 4.7. Addis Ababa market real wholesale prices for cereals, average, 2012 to 2018, 2016 Birr/100 kg

	White Teff	Mixed Teff	Red Teff	White Wheat	Maize	White Sorghum
Oct. 2012 - Sept. 2013	1,823	1,667	1,357	888	683	1,215
Oct. 2013 - Sept. 2014	1,610	1,450	1,250	980	618	1,039
Oct. 2014 - Sept. 2015	1,500	1,347	1,167	1,049	508	811
Oct. 2015 - Sept. 2016	1,712	1,542	1,302	903	507	945
Oct. 2016 - Sept. 2017	1,764	1,575	1,319	780	586	777
Oct. 2017 - April 2018	1,636	1,475	1,298	874	546	735
Annual real price change, percent						
2014/15-2015/16	14.1	14.4	11.6	-13.9	-0.2	16.5
2015/16-2016/17	3.1	2.2	1.3	-13.6	15.7	-17.7
2016/17-2017/18	-7.3	-6.4	-1.6	12.1	-6.8	-5.4
2012-18 annual growth rate	-0.2	-0.4	0.3	-2.1	-3.4	-7.5

Source: Authors' calculations from EGTE data.

Figure 4.5. Real wholesale cereal prices in Addis Ababa, 2012 to 2018



Source: Authors' calculations from CSA data (2018).

There is further evidence of improved functioning of markets and market integration among cereal products across regions, even in drought years (Minten et al. 2014, Hill and Fuje 2017, Bachewe et al. 2017). Remarkably, there was not a widespread increase in chronic or acute child undernutrition rates in Ethiopia due to this drought, as there had been in the famine of the early 1980s, *except* in areas characterized by limited road networks due to the drought (Hirvonen et al. 2018). This highlights the important role of market integration and public infrastructure for improved resilience to future droughts in the country. Mann et al. (2018) also show that the impacts of the droughts were focused on the drought-prone highlands and therefore areas that typically produce less cereals, leading to lower impacts on production and prices than initially feared.

Table 4.8. Dessie market real wholesale prices for cereals, average, 2012 to 2018, 2016 Birr/100 kg

	White Teff	Mixed Teff	Red Teff	White Wheat	Maize	White Sorghum
Oct. 2012 - Sept. 2013	1,221	1,139	998	548	467	964
Oct. 2013 - Sept. 2014	1,384	1,273	1,104	721	505	871
Oct. 2014 - Sept. 2015	1,529	1,411	1,226	920	470	788
Oct. 2015 - Sept. 2016	1,702	1,557	1,296	799	480	915
Oct. 2016 - Sept. 2017	1,770	1,559	1,334	693	556	786
Oct. 2017 - April 2018	1,727	1,556	1,396	880	561	638
Annual real price change, percent						
2014/15-2015/16	11.3	10.4	5.7	-13.1	2.1	16.1
2015/16-2016/17	4.0	0.1	2.9	-13.2	16.0	-14.2
2016/17-2017/18	-2.4	-0.2	4.7	27.0	0.9	-18.8
2012-18 annual growth rate	0.8	2.9	0.3	-8.3	3.0	2.8

Source: Authors' calculations from EGTE data.

4.3. The 2015/16 drought: Price effects of alternative policies

In order to estimate the effects of the drought and alternative policies on wheat consumption, imports, and market prices, we utilize a basic partial equilibrium framework with exogenous domestic production (Table 4.9). Supply of each cereal is calculated assuming 17 percent total losses for seed, feed and wastage. Household demand is modeled as a function of prices and (exogenous) income.[6] In simulations where imports are exogenous, the domestic price adjusts to equate supply and demand. In simulation 4 in which the model liberalized private sector trade, the domestic price is set equal to the exogenous import parity price and imports are endogenous.

Simulation 1 models the effects of the historically observed production shocks to the four major cereals in Ethiopia – teff, wheat, maize and sorghum.[7] According to the official data, wheat production was almost unchanged between 2014/15 and 2015/16, leading to a per capita drop in production of 2.1 percent. If wheat imports would have remained the same in 2015/16 as the previous year (0.948 million mt in 2014/15), then wheat supply per capita would also have fallen by 2.1 percent. At the same time, demand for wheat per capita is estimated to have risen by 4.0 percent, i.e., a 5 percent increase in per capita incomes multiplied by an income-elasticity of demand of 0.8. Given an own-price elasticity of demand of -0.95, domestic wheat prices would have risen by 6.2 percent.

Including production and imports of teff, maize, sorghum, and rice that are assumed to equal their actual 2015/16 levels, the total supply of cereals falls by only 0.1 percent since maize production actually increased in this period. However, given a sharp 6.6 percent fall in per capita supply of teff and an 11.0 percent increase in its simulated price, the weighted average simulated real price increase of all four major cereals is 6.8 percent.

[6] The model is a simplified version of the models utilized for Ethiopian wheat markets (Dorosh and Ahmed 2011) and Bangladesh rice markets (Dorosh and Rashid 2013). Own-price elasticities of demand for wheat, teff, maize, and sorghum are -0.952, -0.920, -0.735, and 0.743, respectively (weighted averages of urban and rural elasticities reported in Tafere et al. (2009) and Berhane et al. (2013)). Per capita incomes are assumed to have increased by 5 percent between 2014/15 and 2015/16. We use an average income elasticity of demand of 0.8.

[7] Note that the model does not capture potential cross-price effects of a change in price of one commodity (e.g., teff) on the production or demand for another crop (e.g., wheat).

Table 4.9. Simulated price effects of production shocks and increased imports, 2015/16 versus 2014/15

Simulation:	S1	S2	S3	S4
	Wheat production shock	Wheat production shock with higher imports	All cereals production shock with higher imports	All cereals production shock with free trade
Wheat production[a], million mt	4.550	4.550	3.849	3.849
Wheat production per capita, % change	-2.1	-2.1	-17.2	-17.2
Wheat imports, million mt	0.948	2.483	2.483	3.103
Wheat supply[b], million mt	4.724	6.259	5.677	6.297
Wheat supply per capita, % change	-2.1	29.7	17.7	30.5
Wheat price, % change	6.2	-26.0	-13.8	-26.8
All cereals supply[c], million mt	19.586	21.460	20.140	20.760
All cereals price, % change	6.8	-4.4	3.2	-0.5

Source: Model simulations.
Notes:
[a] Production includes commercial farms' production.
[b] Supply is calculated as production minus a 17 percent adjustment for seed, feed, and wastage, plus imports.
[c] Supply of all cereals includes supply of wheat, maize, sorghum, teff, and rice. Supply of these non-wheat cereals is fixed at the 2015-16 level in Simulations S1 and S2. In simulations S3 and S4, production of teff, maize and sorghum are each reduced by 5 percent relative to their 2015-16 levels.
Sim S3: The wheat production shock is set at the level at which wheat (real) price change matches historical value of -13.8 percent.
Sim S4: Wheat imports are adjusted so that wheat (real) price change matches historical value of the percentage difference between 2014/15 wholesale price and estimated 2015/16 import parity price.

Simulation 2 models the effects of increased distribution of wheat from wheat imports (2.483 million mt, an increase of 1.535 million mt over 2014/15).[8] Given this increase in imports, net wheat supply per capita increases by 29.7 percent relative to 2014/15. The simulated wheat price falls by 26.0 percent relative to 2014/15, far greater than the historical real price decline of only 13.8 percent (Simulation 2). Again, assuming that the levels of production and imports of teff, maize, and sorghum are unchanged relative to their actual 2015/16 levels, the average price of cereals falls 4.4 percent.

In simulation 3, we reduce wheat production another 15.4 percent, for a total decline in per capita production of 17.2 percent, so that the simulated price fall (13.8 percent) matches the historical price fall. Net wheat supply per capita is then 17.7 percent greater than in 2014/15. We also model a 5 percent reduction in production of teff, maize, and sorghum in this simulation. As a result, the average price of all cereals rises by 3.2 percent.

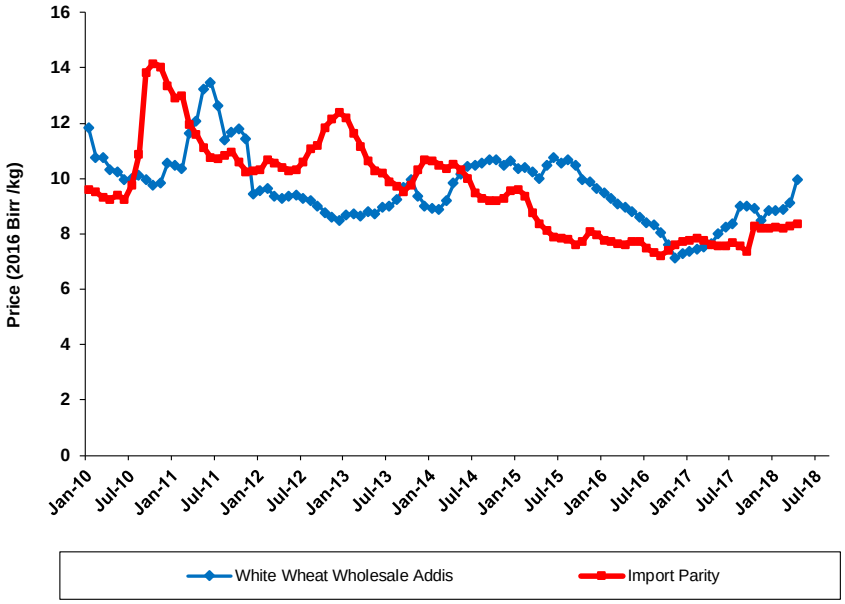
Finally, in simulation 4, we simulate the counterfactual policy of allowing private sector wheat trade at the import parity price (without tax), which was substantially below domestic prices from mid-2014 through mid-2016 (Figure 4.6).[9] In this scenario, the Government of Ethiopia and NGOs procure wheat for the PSNP and other programs in the wholesale market at the prevailing (import parity) price. Here, we maintain the same reduced level of wheat production as in simulation 3 and fix the domestic price level at the estimated import parity price, which was 26.8 percent below the historical value of the wholesale domestic price of wheat in 2014/15.[10]

[8] These wheat import figures are the estimates of wheat imports actually released by EGTE for these years. See Table 4.6 (change in wheat supply due to imports).

[9] In this scenario, the Government of Ethiopia and NGO's procures wheat for the PSNP and other programs in the wholesale market at the prevailing (import parity) price.

[10] 7.68 (2016) Birr/kg import parity in 2015/16 as compared to 10.49 (2016) Birr/kg average wholesale white wheat price in Addis Ababa in 2014/15.

Figure 4.6. Wheat – domestic wholesale and import parity prices, 2010 to 2018



Source: Authors' calculations from CSA (2018) and Ethiopian Policy Analysis Unit (EPAU) data.
Notes: Import parity in this figure is based on wheat originating from Black Sea ports, reflecting the major source of wheat in recent years. Note that the import parity prices in Figure 3.2, which covers a longer period, are based on wheat shipped from US Gulf ports (Hard Red Winter).

In the case of simulation 4, total wheat imports rise to 3.1 million mt and net wheat supply per capita is 30.5 percent higher than in 2014/15. Compared to simulation 3, in which net wheat supply per capita is only 17.7 percent higher than in 2014/15, wheat supply per capita in simulation 4 is 10.9 percent higher (12.8 percentage points higher). In consequence, the wheat price is 15.1 percent lower, benefitting net wheat consuming households purchasing from domestic markets. As in simulation 3, we again model a 5 percent reduction in production of teff, maize and sorghum. Given the sharp reduction of the wheat price due to increased wheat imports, the average price of cereals actually falls by 0.5 percent, as compared to the 3.2 percent rise in simulation 3.

Using more inelastic demand parameters, which may better reflect the behavior of consumers and markets in the short-run, produces broadly similar results (Table 4.10). Relatively high wheat production with 2.48 million mt of imports results in an even greater price decline (57.1 percent) than with the base parameters (26.0 percent) (Simulation 2a). To achieve a price reduction that matches the historical change (-13.8 percent), requires a slightly larger reduction in production (-28.4 percent instead of -17.2 percent), (Simulation 3a). Finally, with the alternate parameters, liberalized private sector trade leads to a smaller increase in imports (306,000 versus 620,000 mt), (Simulation 4a).

Thus, liberalizing private sector wheat imports in 2015/16 could have provided even greater stability of supply and price. To the extent that the private sector could import wheat and bring it to wholesale markets in Addis Ababa or other major cities at a lower cost than the Ethiopian Grain Trading Enterprise (EGTE) or international agencies, the Government of Ethiopia could also have reduced costs of its distribution programs.[11] However, it is not always the case that the import parity price is less than a target domestic price level. When international prices are very high, stabilizing domestic prices requires either a drawdown of public stocks, food aid inflows, or subsidized sales of government commercial imports.

[11] There was no explicit trade restriction in 2015/16, but private traders were not granted import licenses and foreign exchange to import wheat.

Table 4.10. Simulated price effects of production shocks and increased imports, inelastic parameters, 2015/16 versus 2014/15

Simulation:	S1a	S2a	S3a	S4a
	Wheat production shock	Wheat production shock with higher imports	All cereals production shock with higher imports	All cereals production shock with free trade
Wheat production[a], million mt	4.550	4.550	3.327	3.327
Wheat production per capita, % change	-2.1	-2.1	-28.4	-28.4
Wheat imports, million mt	0.948	2.483	2.483	2.789
Wheat supply[b], million mt	4.724	6.259	5.244	5.550
Wheat supply per capita, % change	-2.1	29.7	8.7	15.0
Wheat price, % change	8.4	-57.1	-13.8	-26.8
All cereals supply[c], million mt	19.586	21.460	20.297	20.603
All cereals price, % change	9.3	-13.6	0.5	-3.3

Source: Model simulations.
Notes:
[a] Production includes commercial farms' production.
[b] Supply is calculated as production minus a 17 percent adjustment for seed, feed, and wastage, plus imports.
[c] Supply of all cereals includes supply of wheat, maize, sorghum, teff, and rice. Supply of these non-wheat cereals is fixed at the 2015-16 level in Simulations S1a and S2a. In simulations S3a and S4a, production of teff, maize and sorghum are each reduced by one percent relative to their 2015-16 levels.
Sim S3a: The wheat production shock is set at the level at which wheat (real) price change matches historical value of -13.8 percent.
Sim S4a: Wheat imports are adjusted so that wheat (real) price change matches historical value of the percentage difference between 2014/15 wholesale price and estimated 2015/16 import parity price.

5. PRICE STABILIZATION OPTIONS FOR ETHIOPIA

5.1. Effective price stabilization policy

The above review of the international experience with price stabilization and the case of the policy response to the 2016 cereal production shortfall and resulting drought suggests several important principles in designing an efficient price stabilization strategy for Ethiopia. The most important elements for such a strategy are discussed below.

5.1.1. International markets

Access to international markets to add to domestic supplies and lower prices through imports or to reduce domestic surpluses and support higher prices through exports can greatly reduce the cost of a price stabilization policy. The alternative is to build up large stocks through domestic procurement in excess of distribution.

International trade in wheat through food aid and government commercial imports already constitutes a major source of wheat supplies for Ethiopia. In contrast, Ethiopia's current levels of international trade in teff, sorghum, and maize are small. The lack of an international market for teff – Ethiopia is essentially the only major producer and consumer of teff globally – would make it very difficult and costly to stabilize teff prices, as it would require very large stocks. International trade in sorghum is much larger. Sudan has exported several hundred thousand mt in some years to countries in the Middle East. The US is also a major exporter and a potential source of sorghum supplies for Ethiopia. Nonetheless, the international market for sorghum is rather thin. For maize, there is a broad international market. Any maize exports or imports by Ethiopia would represent only a small fraction of total international trade.

Currently, high transport costs relative to the value of the grain make the import parity – export parity price band for Ethiopia very wide. As described in the previous section, Ethiopia's domestic prices for

maize have generally been well above export parity and mostly – but not always – below import parity. This has made both exports and imports of maize unprofitable for the private sector in most years.

5.1.2. Promoting private trade

The international experience (such as in Bangladesh the late 1990s) suggests that facilitating and promoting private international trade is often the least costly, most efficient, and quickest means of enhancing and maintaining market supply and promoting price stability. The private sector can usually react much more quickly to potential domestic supply shortfalls than can public institutions. Moreover, private sector imports involve no direct costs to the government. Ethiopia's private sector international trade in cereals remains very small, however, mainly limited to imports of rice and high-gluten and other specialty wheat types suited for pasta or for baking purposes.

Private sector wheat imports could substantially reduce the cost of price stabilization in Ethiopia. To a large extent, private sector wheat imports that would otherwise have been profitable have been hindered by foreign exchange rationing, displaced by public sector imports, or made too risky because of uncertainties over government policy (Dorosh and Ahmed 2011).

5.1.3. Transparency and predictability

Uncertainty over government policy is a major disincentive to private sector investment and both international and domestic trade. Yet, price stabilization regimes with frequent and abrupt policy changes are common. Such regimes characterize what is often the least efficient price stabilization alternative, when compared to the promotion of international trade using rules-based price stabilization policies (see Table 2.1). Unfortunately, a lack of transparent and predictable policy has characterized price stabilization efforts in much of East Africa and resulted in unnecessary price instability in Kenya, Malawi, and Zambia, with important fiscal costs as well as adverse effects on the food security of poor consumers.

One option for promoting transparency and predictability of policies and for fostering trust between the private sector and government is to establish a platform for discussions of current market conditions, current and planned government policies, and ideas for promoting more efficient markets, such as investments in key infrastructure.

5.1.4. Administrative and market prices

Administratively setting prices can seriously distort prices. This was seen during Madagascar's rice price crisis of 2004/05 when official prices were set below import parity levels, effectively ending incentives for private sector imports. Price targets are best achieved through market mechanisms by either adding to supply or making purchases from the market to increase demand. Thus, it is important to communicate that the target price (or better, a target price band) is a policy objective, but not a binding restriction on market transactions.

5.2. Guidelines for implementation of cereal price stabilization

Setting clear objectives and specific rules for interventions could contribute to successful cereal price stabilization in Ethiopia. The following elements as part of such a strategy should be considered.

5.2.1. Price targets and market interventions

Annual target ceiling and floor prices for wheat, maize, and sorghum could be set. Current policy involves a government sales price and an implicit target (ceiling or floor) price that is not necessarily equal to the government sales price. The implicit goal of the interventions is often to reduce private market prices to the target ceiling price levels. Setting the target ceiling price for imported commodities at long-term import parity levels will ensure that the marginal cost of domestic production is equal to the long-term opportunity cost of alternative supplies from the international market, thus promoting an efficient use of resources. In years of relatively low import parity prices, keeping the target ceiling price at the higher long-run import

parity price will provide incentives for private sector imports and make public interventions unnecessary. In years of high import parity prices, subsidized sales of government imports may be required to maintain market prices at the target long-run import parity level.

The margin between floor and ceiling prices should be wide enough to give incentives for private sector storage and trade. If the band is too narrow, the government may crowd out most private sector trade, buying substantial amounts of grain to defend the floor price and then later selling grain to defend the ceiling price. This pattern of government interventions in cereal markets is seen in Pakistan where public procurement and subsequent sales, usually within the same crop marketing year, accounts for more that 20 percent of total wheat production, crowding out the private sector and entailing huge fiscal costs. Setting a low price with a wide margin between the floor and ceiling prices can avoid the need for any domestic procurement.

5.2.2. Management of public stocks

Public stocks are needed for an effective government price stabilization program. Stock levels should be kept to a minimum, however, to avoid excessive costs of storage, which include implicit interest, stock management, quality deterioration, and stock rotation costs. Food security reserve stocks are typically set according to the volume of likely distribution needs, allowing for a three to four-month lag between the decision to import (if necessary) and the arrival of grain at distribution points. Ethiopia's emergency food reserve stocks have generally been small relative to domestic production and consumption and have been effectively managed (Graham, Rashid, and Malek 2012). Incorporating price stabilization objectives to this system would imply a need for larger stocks.

Price stabilization need not require huge stocks, however. As shown in Table 5.1, total stocks for Bangladesh averaged 2.9 percent of total wheat and rice production. Given that Bangladesh has two major rice harvests (and the risk of a production shortfall in both seasons in the same year is very small), this ratio of stocks to production may be rather small. India's stock to production ratio of 21.1 percent is likely excessively large, even given the fact that India is such a large country that it would have difficulty obtaining massive imports if it had a major shortfall. A better guideline might be the stock to production ratio of Pakistan with stocks at 5.7 percent of production.[12]

Table 5.1. Cereal stock levels in selected Asian countries, average 2001 to 2007

	Pakistan	India			Bangladesh		
	Wheat	Wheat	Rice	Total	Rice	Wheat	Total
Production, million mt	20.33	70.51	87.23	157.7	25.68	1.21	26.89
Stocks, million mt	1.16	17.06	16.4	33.5	0.54	0.23	0.77
Stocks/Production, %	5.7	24.2	18.8	21.2	2.1	19.0	2.9
Per capita stocks, kg	7.6	16.2	15.4	31.6	1.7	3.8	5.5

Source: Dorosh (2009).

5.2.3. Enhancing market efficiency through transparency and predictability of interventions

There is a need for clear announcements of overall policy objectives and instruments to promote efficient private markets. This includes, first, clear annual announcements in advance of the (*meher*) planting season of target ceiling and floor prices for wheat, maize, and sorghum. Secondly, clear announcements of quantities of planned public imports and exports are required so as not to discourage private trade (both

[12] Note that in Bangladesh, India, and Pakistan public stocks serve dual purposes: price stabilization and to provide grain for public food distribution programs. Since the early 1990s, Bangladesh has used trade policy as well as market interventions and stocks to stabilize prices.

imports and exports). Although, as noted above, when import parity prices are lower than the target ceiling price, private imports are more cost-effective, and they generally involve no costs to the government.

6. CONCLUSIONS

Increases in cereal prices can have adverse effects on poor net food buyers. Conversely, falling domestic prices of some cereals (especially maize), typically at harvest time, can be detrimental to producers who are net sellers. Price stabilization efforts are therefore an important consideration for Ethiopian policy makers. This paper sheds light on options for cereal price stabilization in Ethiopia drawing on experiences of other developing countries. The international experience in food price stabilization shows that, while some countries have achieved success, the efforts of many others have actually destabilized market prices at great fiscal cost. Ethiopia's interventions in wheat markets (there have been no major interventions in maize markets in Ethiopia in recent years) have met with limited success.

In this paper, we assess the extent of cereal price variation in Ethiopia. For the period 2009 to 2018, coefficients of variation (c.v.) of nominal wheat prices (which benefitted from international trade) and maize (which did not) were both 0.280. The coefficients of variation for real prices were only 0.132 for wheat and 0.214 for maize. While real maize price volatility is similar in Kenya (c.v. = 0.233), it is more variable in Uganda (c.v. = 0.291). The upshot is that a significant part of the variation in cereal prices in Ethiopia is explained by general inflation.

One of the major causes of price variability is also weather shocks which lead to lower production. In this paper we assess the extent to which Ethiopian stabilization efforts were effective during the major El Niño-induced drought of 2015/16. The consequent crop losses threatened the food security of an estimated 10 million people who were declared in need of emergency food assistance in addition to the 8 million already covered by the Productive Safety Net Program (PSNP). Ultimately, a major food crisis was averted through a combination of a timely large-scale government and donor response along with substantial private market flows of cereals from surplus to deficit regions. Nonetheless, opportunities were missed to enhance food security and consumer welfare further by allowing private sector imports of cereals to minimize the rise in cereal prices that occurred in 2016 and to reduce the fiscal costs to the government and donors.

In general, Ethiopia's policy options to further enhance cereal price stability vary by crop. Because Ethiopia imports wheat (either through food aid or through government commercial channels) in most years, liberalization of private sector wheat imports can often provide a low-cost mechanism for providing a price ceiling at the import parity price. Enhancing price stability in other years through direct domestic market interventions, however, may be costly in fiscal terms and in terms of discouraging private sector storage and trade. Given that Ethiopia's maize price is typically far below import parity (and far above export parity), private external trade in maize will generally not contribute to price stability. Moreover, interventions in domestic maize markets may be even more problematic for maize than for wheat because storage losses for maize are typically greater than those for wheat. Interventions to stabilize teff prices may be especially difficult, since very little teff is traded on the international market. Nonetheless, as urban markets for teff grow, private sector commercial storage may increase over time and help stabilize market prices.

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ANNEX

Annex Table A1. Historical account of major food shortages in Ethiopia, geographic location, and attributed cause

Date	Region Affected	Attributed Causes and Severity
1971-1975	Ethiopia	Sequence of rain failures. Estimate 250,000 dead. Fifty percent livestock lost in Tigray and Wollo.
1978-1979	Southern Ethiopia	Failure of *belg* rains
1982	Northern Ethiopia	Late *meher* rains
1983-1985	Ethiopia	Sequence of rain failures. Eight million affected. Estimated one million dead. Much livestock loss.
1987-1988	Ethiopia	Drought of undocumented severity in peripheral regions
1990-1992	Northern, eastern, and southwestern Ethiopia	Rain failure and regional conflicts. Estimated 4 million people suffering food shortage
1993-1994	Tigray, Wollo, Addis Ababa	4 million people requiring food assistance, including demobilized army and Somali refugees. New droughts.
1997-2000	Eritrea, northern Tigray	Localized food shortages due to conflict
2002-2003	Ethiopia	Drought-induced crop shortages
2009	Southern Ethiopia	Localized drought
2014-2015	Eastern Highlands, drought-prone lowlands	Localized droughts lead to *belg* harvest shortfalls; losses of livestock
2015-2017	Highlands, drought-prone lowlands	Localized drought reduces *meher* and *belg* harvests; 10.2 million people in need of relief in mid-2016

Source: 1971-1994: Webb and von Braun (1994), p. 21.; Rashid et al. (2013) (Table 5.3).

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The Ethiopia Strategy Support Program is an initiative to strengthen evidence-based policymaking in Ethiopia in the areas of rural and agricultural development. Facilitated by the International Food Policy Research Institute (IFPRI), ESSP works closely with the government of Ethiopia, the Ethiopian Development Research Institute (EDRI), and other development partners to provide information relevant for the design and implementation of Ethiopia's agricultural and rural development strategies. For more information, see http://www.ifpri.org/book-757/ourwork/program/ethiopia-strategy-support-program; http://essp.ifpri.info/; or http://www.edri-eth.org/.

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