Effects of stockholding policy on consumer price: Evidence from Zambia

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## Introduction

Volatile food prices can bring about economic and civil unrest ( Bellemare 2015; Fjelde 2014; Weinberg and Bakker 2015). In particular, households are vulnerable to price hikes for staple commodities. Many developing countries have intervened in their domestic agricultural markets to stabilize food prices, through domestic food subsidies, stockholding policies and export bans. In Zambia, the Food Reserve Agency While previous studies show

In this paper, we look at the effect of stockbuilding policies in Zambia on the local maize price in more than 30 markets during the lean season. As the major food staple, maize provides almost sixty percent of Zambians’ calorie intake . Therefore, reducing price fluctuations and increase food supplies during the lean season has been an important policy goal for Zambia where food represents about fifty percent of the household budget (Mason and Jayne 2009).

Maize prices are vulnerable to domestic production shocks as well as international price movements driven by world supply and demand. Domestically, volatile rainfall and a lack of irrigation systems lead Zambia to experience a poor harvest about once in every three years (Dorosh 2009). External shocks to domestic maize prices can also pose a threat to the already compromised food security in the country. During the 2007/08 food crises, when the international maize price reached exceptionally high levels, the Zambia maize retail price increased more than fifty percent on average compared to the previous year (Minot 2011).

The government of Zambia has repeatedly imposed bans on maize exports as a price stabilizing measure since the 1960’s. In the past two decades, Zambia restrained the issuance of export permits in 2002, 2005, 2008 and the end of 2013 to ensure domestic food security and access to food in times of maize production deficit. How effective is the export restriction at stabilizing local maize prices and isolating the domestic market from external price shocks from trade partners like Republic of South Africa (major producer of excess maize in Southern Africa)? The purpose of this research is to explain the maize price volatility in Zambia, by taking into account the domestic drought spells, policy changes, and external market shocks. In particular, this research seeks evidence on whether export bans can alleviate local price variability.

In theory, export bans can decrease price volatility generated by supply or demand shocks, which explains the prevalent and repeated use of such policies in recent years. Porteous (2012) argues that bans usually imply a significant rise in the cost to move the goods to the border. By lowering the export parity, the ban prevents the high international price from transmitting to the domestic market and also adds to the local grain supply. In this way, the export ban is expected to reduce domestic price fluctuations. Using a dynamic model, Gouel and Jean (2012) show that an optimal food price stabilization policy should involve some restrictions on exports. They argue that the price soothing effect generated through buffer stocks would leak to the external market when there is both a domestic production shock and an international price spike. This theory fits into the current situation in Zambia. The Food Reserve Agency in Zambia, established in 1996, has supported domestic maize prices received by farmers and holding maize stocks in case of production shortages (Govereh, Jayne, and Chapoto 2008).

If stabilizing policies are pursued in an unpredictable manner, the uncertainty in the policy itself may intensify rather than mitigate price volatility (Apergis and Rezitis 2011). Chapoto and Jayne (2009a) suggest that Zambia’s discretionary trade restriction and marketing policies may be the reason behind its higher degree of price volatility compared to neighboring countries, as these policies make the market unpredictable. Jayne (2012) concludes that in Eastern and Southern Africa, governments’ attempt to stabilize maize price often lead to unstable prices, and are particularly unable to prevent high food prices. Martin and Anderson (2012) find that the trade barriers imposed by governments are not helpful in maintaining stable food prices in the domestic market. Other studies suggest that participation in free trade, instead, can set both a lower bound and a price ceiling for staple prices, that in turn, decrease price volatility (Govereh, Jayne, and Chapoto 2008; García-Germán et al. 2013).

This paper tries to find the effects of stockholding policy in Zambia on the maize price level and volatility. The study period is Jan.2003 - Nov. 2009, when have both the market price, FRA buying/selling price and purchase quantity by district. We are comparing district maize price with FRA purchases in the same month with markets that don’t have FRA purcase at all.

The endogeneity issue at hand is multiple. First, several policies were at play and all to a certain degree endogenous to grain production and maize prices, including temporary export ban, import tariff and input subsidy program. Much of this is time variant and work on all the markets (control and treatment) alike, and can be controlled by adding in the policy variable when the policies are in place. Also by adding in the weather shocks in the previous year.

can be controlled by weather shocks at the local level. Local price matters because of the incomplete infrastrature and a lack of market information system.

The source of variation are seasonal price changes, across year production/stock changes, across year policy changes and across markets price differences within the same year.

This paper makes the following contributions to the literature. First, the MGARCH model with exogenous variables allows for both the influence of external market and domestic weather shocks. Given that Zambia relies on maize imports from South Africa in times of food shortage (Myers and Jayne 2012), it is plausible to assume that physical trade transmits volatility. Previous studies focus either on the local market conditions and on government policies (Chapoto and Jayne 2009b) or on the volatility spillovers from the international market (Rapsomanikis and Mugera 2011). Second, the model identifies the effect of the ban by controlling for weather shocks. Variations in agricultural yields is an essential part of agricultural price variation (Gilbert and Morgan 2010). Weather-induced production shocks usually motivate the implementation of export bans. Ignoring the weather effects will lead to biased estimates of the influence of the export ban. Despite authors who argue that discressionary trade policies may generate higher price volatility (Rapsomanikis and Mugera (2011) and Sassi (2015)), the frequent changing policy and unpredictable policy environment are likely to be the result of production shocks or price hikes from the international market. Hence, these studies may overestimate the effects of export bans on price volatility. Third, the drought index used in this paper offers a more accurate measure of drought in the country than the precipitation index used in previous papers, as it is based on cropland area compared to using .

Understanding the nature and the changes in price variability is essential to ensure political and social stability in developing countries (García-Germán et al. 2013). Mitigating the effects of price instability on smallholder farmers and rural consumers has been longstanding concerns of developing countries. This paper provides empirical evidence on how governments’ efforts intervening in agricultural trade may have affected price volatility. Research results have relevant policy implications and can guide future domestic policies aiming at improving domestic food security.

The paper is structured as follows. Section 2 gives background information on the Zambia maize market and relevant policies. Section 3 illustrates the empirical strategy by describing the conditional mean and conditional variance used in the MGARCH model. Section 4 includes description of data and a discussion of the empirical results. Section 5 concludes with the main findings of the paper and relevant policy implications.

## Background

Zambia ranks 139 out of 188 countries in the 2015 UNDP Human Development Report and is classified as a lower middle-income country by the World Bank (Cammelbeeck 2015). With sixty percent of its population below the poverty line and almost fifty percent malnourished, the country suffers from a prevalent poverty and food insecurity (Sitko et al. 2011).

The agricultural sector in the country comprises of roughly 1.5 million smallholders and 2,000 large-scale farmers. More than ninety percent of maize productions and eighty percent of total maize sales come from smallholder farms (Tembo et al. 2009). Maize production is not evenly distributed across farms. Around two percent of the small and medium farmers generate roughly half of maize output. A large number of small farm households are still net buyers of maize (Sitko et al. 2011). The dependence on the volatile rainfall and a lack of irrigation systems make the agricultural output extremely unstable. Years of drought, flood, and insufficient input supply, which represent on average one year out of three, lead to deficient maize production to satisfy food demand at the national level (Dorosh, Dradri, and Haggblade 2009). Since weather shocks are localized, certain production regions experience more severe shocks than others. Substantial production shortages result in the domestic maize price rising to the Republic of South Africa’s maize import parity (Myers and Jayne 2012). Trade is thus a potential valuable tool to stabilize the domestic price.

However, past maize price fluctuations and the consequent social unrest have led the government of Zambia to believe food prices are far too strategically and politically important to leave to the market (Chapoto 2012). The government mistrusts private traders in their ability to bring in enough maize to stabilize the market (Myers and Jayne 2012). Private traders, on the other hand, blame the government for implementing unpredictable policies on tariffs, import licenses, and maize import subsidies. Short-term export bans are often imposed to restrict maize outflows to ensure food security and access to food when the country experiences a maize production deficit. These export bans are often carried out in an ad-hoc, stop-go nature (Chapoto & Jayne 2009). The effects of export bans on domestic price volatility are not clear. While in some countries such as India, export bans appear to have decreased prices and price volatility (Baylis, Jolejole-Foreman, and Mallory 2013), in other countries such as Russia the restriction on exports actually increases the food price at the exporting market because of a higher transaction cost (Porteous 2012; Welton 2011).

Stockholding is expensive for poor economies, which makes trade the usual alternative. However, the uncertainties in imports and the transmission of shocks from other countries makes trade a less reliable tool to address domestic food shortage. Besides, storage is needed to supply the market before imports arrive. Consequently, developing countries have been rethinking their policies on grain storage and dependence on international trade to secure domestic food security (Dorosh 2009). There were reports of Zambia traders suggesting to the government the existence of sufficient amount of local stocks, which would make maize imports unnecessary (Chapoto 2012). However, the series of agricultural and trade policies that the government of Zambia has conducted in the recent years suggest a turn to the option of building more grain stocks.

The Food Reserve Agency (FRA) was established in 1996 with the aim of building and managing national grain stocks (Govereh, Jayne, and Chapoto 2008). The buffer stocks are intended to stabilize maize price and provide available maize supply to the market. The FRA purchases substantial maize from small households in various geographic regions since the 2003/04 marketing year (corresponding to the study period in this paper). The high pan-territorial buying price (uniform price in ) makes the FRA the dominant buyer in the market (Mason and Myers 2013). In 2006 and 2007, the FRA bought more than half of the surplus maize by smallholder farmers (Ricker-Gilbert et al. 2013), which helps to build higher maize stocks. In part to protect the dominant market position of the FRA, the government implemented a series of policies including export bans, import tariffs, and imports through the FRA (Tschirley and Jayne 2010). According to grain traders, millers also get subsidized maize stocks from FRA. These measures to build higher stocks have led the national maize stocks to reach historically high levels after 2009 (shown in Figure 1). But the stock building comes at a considerable financial cost. The procurement and selling of maize at subsidized prices along with the input subsidies account for over 43% of the total agricultural budget (Nkonde et al. 2011).

## Theoretical Model

imports maize and sells it to select large-scale millers at below-market prices.

a government

sell low during season and buy high during lean season

## Method

#### Spatial model : more markets

Use annual data instead of monthly

Focus consumer price during the lean seasons

consider temporary export ban too

foucs on the FRA sales effect: how it decreases its spatial lag due to cost

partial control

differentiate the effect

model: differnetiate the FRA buying and selling effect

use a road-distance based, continous treatment effect

effects on previous year’s FRA purchase

apart from the FRA sales, also need to consider the exports and imports

FRA purchase months: 6-10, FRA sales month: 12-4 , sold at the nearest district market, so no distance measure is needed.

Lean Season 2-4

1. Panel regression

Price\_lean - Price\_year\_average = imports\_t-1 \* distance + FRA\_sales\_t + FRA\_purchase t\_1 (locally) + annual stock + weather\_i,t-1

FRA purchase price , the same through out the year

The identification strategy is to make use of the step by step roll out of the FRA throughout the years. The intensity of treatment is measured in terms of FRA purchase as % of smallholder maize sales at the district level, No. of districts they are buying (as it affects to the price transmission and price expectation).

## Empirical Application

The variables of interest are maize price levels, price spread between district market and Lusaka, and coefficient of variation of district level maize price.