[First draft: October 24, 2014]

Export Ban Pass-through on Retail and Wholesale Prices: A Case Study of Maize Markets in Kenya and Tanzania

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Abstract

This paper systematically evaluates the price effects of export bans on maize considering both wholesale and retail prices in 13 market locations in Kenya and Tanzania. Considering the period from January 2006 to February 2014, which witnessed three periodic bans on export from Tanzania, we find a drop in average wholesale prices by almost 17% in Tanzanian markets and a surge in average retail prices by almost 20% during the ban period. In Kenyan markets export bans result in a drop in average wholesale prices by 20%. The outcomes are robust across different specifications and models. The diverging margin of retail-wholesale maize prices suggests a welfare loss for both consumers and producers.

Keywords: Export ban, Trade Policy, Agricultural Market, Tanzania, Kenya

JEL codes: Q17, Q11, F15, F14, N77

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The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. This study was financed by the generous support of the Trust Fund for Environmentally and Socially Sustainable Development (TFESSD) managed by the World Bank. Anchali Singh has provided excellent research support. The authors are responsible for any remaining errors.

I. Introduction

The objective of this paper is two-fold. First, it systematically evaluates the price effects of trade regulations (export ban in our case) on maize export in both the source country (Tanzania) and the receiving country (Kenya). Second, it considers the retail-wholesale maize price margins and studies the price co-movements resulting from an export ban. Together, they identify the export ban pass-through on market prices of maize and its possible welfare consequences.

Maize is the principal staple food commodity exported by Tanzania to Kenya (EAGC-RATIN, 2008/2009). Kenya receives large shares of maize export from Tanzania, albeit the trade flow fluctuates subject to varying climatic or political circumstances (FEWSNET 2009). Since July, 2003 until October, 2011, Tanzania imposed an export ban on maize for a total period of 72 months. The longest period of ban was for 33 months starting from January, 2003 until October, 2011 (Porteus, 2012). Dorosh, Dradri & Haggblade (2009) find that protectionist measures such as export bans, in general, result in high price volatility. While for Tanzania temporary export bans feature its national interests to retain agricultural production in the country, most farmers in Tanzania perceive this protectionist measure as a production disincentive (Pannhausen and Untied, 2010). Exporting maize to Kenya, Zambia or Uganda is more profitable for them compared to low prices that they receive from sales within Tanzania, mainly due to high transport costs arising out of the poor transport facilities prevailing in Tanzania.

The standard textbook model predicts an upwards pressure in maize prices in Kenya resulting from a negative supply shock in maize due to a ban on maize export imposed by Tanzania. Theoretically, along the same line one would expect that Tanzania's attempt to ensure the domestic food supply and protect its citizens from global price volatility would put a downward pressure on maize prices in Tanzania. In a recent study, closest to ours in spirit, Diao, Kennedy, Mabiso and Pradesha (2013) find that the effect of ban on cross-border maize trade by Tanzania has lowered the food prices in Tanzania by .6 - 2.4 percent, which is enjoyed mostly by the urban population. However, their computable general equilibrium (CGE) model outcomes indicate that the maize producer prices also decrease by 7–26 percent, depending on the region. Moreover, export ban leaves pernicious effects in the form of a lower wage rate for low-skilled labour and the returns to land. This phenomenon is associated with an increase in poverty in Tanzania. Going one step further, Ahmed et al (2012) find that export ban increased poverty in Tanzania as the imposition of export ban hurts its prospects to take advantage of higher global prices and potential earnings. Studies show that export ban by Tanzanian also adversely affected the critical food situation in Kenya in 2009 (Pannhausen and Untied, 2010).

The ineffectiveness of export ban in stabilizing staple prices in home country has been echoed in other studies. By developing a structural model using price data from 12 countries in East and Southern Africa over a period of 10 years, Porteous (2012) shows that bans do not have a statistically significant effect on the price differences between markets. Moreover, his findings indicate an equivalent price increases in both destination and origin countries resulting from an export ban. In a similar study, Chapoto and Jayne (2009) fail to establish any statistically significant relationship between export ban and price stabilization in Zambia. Another study by Dorosh, Dradri and Haggblade (2009) indicate similar results of government trade restriction measures in Zambia. Thus, despite a recent surge in studies examining the welfare effect of export ban, the empirical evidence to price effects of export ban is ambiguous, at best.

In this study, we analyse this phenomenon from fresh perspectives and expect this study to make contributions to the literature in the following ways.

First, we examine the price effects of export ban on maize imposed by Tanzania on wholesale market prices both in Tanzania and Kenya, but to a limited number of markets (cities) that are likely to be directly affected. In this sense, this is a cross-border region-wide study. We consider four market locations from Kenya (Eldoret, Mombasa, Kisumu and Nairobi) and nine market locations from the northern part of Tanzanina (Arusha, Babati, Dodoma, Moshi, Musoma, Mwanza, Singida, Shinyanga, Tanga). This is choice is justified based on the following facts. First, maize exports to Kenya mostly comes from the northern provinces of Tanzania; as a result, in the absence of export ban maize prices are likely to be affected only in the northern and north-western markets; Second, maize production from the southern region alone accounts for more than 35% of total maize supply in Tanzania and caters to the deficit zones’ needs. Thus, an export ban is less likely to have price effects in all market locations (country-wide effect) in Tanzania.

Second, unlike previous studies, we consider both retail and wholesale maize prices to analyse distribution margins between consumers and producers. Recent empirical literature (Nakamura, 2008; Goldberg and Hellerstein, 2007) highlights the importance of the link between retail and wholesale prices for understanding pricing models and their welfare consequences. Moreover, studies provide evidence for the use of price level data at the product level to have a precise understanding of pricing behaviour (Bils and Klenow (2004); Nakamura and Stensson, 2008). This motivates us to consider maize and related product prices (both retail and wholesale) across market locations in Kenya and Tanzania.

Third, the literature on the welfare effects of price changes has predominantly been influenced by separating net producers from net consumers[1] due to the potential dual nature of households, being both producers and consumers of food crops. Despite its considerable merits, this methodology encounters measurement issues on variables such as income and consumption of own produce. As an alternative to this, in this study we compare co-movement of retail and wholesale maize prices between free export scenario and the period under export ban to understand the welfare implications of an export ban. While oscillations in wholesale prices are indicative of welfare gains or losses for producers, retail prices are pertinent to the consumers' welfare.

For empirical analysis, we consider wholesale maize data for the period from January 2006 to February 2014. During this period, Tanzanian imposed three periodic bans on maize export. To identify the effects of export ban on maize prices we compare the average prices in export ban and export free periods. We pay particular attention to the length of export ban spell by considering the first one month, the first three months and the entire export ban period. The OLS estimates show dampening effect on wholesale maize prices in most of the market locations in Kenya and Tanzania, particularly when the entre ban period is considered. The estimated suggest almost 17% and about 8% drop in average wholesale maize prices in Tanzania and Kenya, respectively. This implies a welfare loss for producers both in Kenya and Tanzania. As an attempt to isolate the true effect on export ban on maize prices, next we consider beans prices as counterfactual maize prices in the presence of export ban, and compare the average wholesale maize price differences. The DID outcomes provide robust support to OLS outcomes.

[1] The methodology was initially set up by Deaton (1989), then followed by Budd (1993), Barrett and Dorosh (1996), Minot and Goletti (1998, 2000), Ivanic and Martin (2008), etc.

Finally, we consider the retail-wholesale margin of maize prices to understand the direction of welfare consequences better. The estimated coefficients on retail prices suggest a surge in average retail maize prices by almost 20% resulting from export bans in the six selected market locations in Tanzania. This is likely to have a negative effect on the welfare level of consumers. We also find increasing divergence in retail-wholesale maize price margin across all market locations. An increasing margin of retail-wholesale maize prices has negative welfare consequences for both consumers and producers. The outcome is particularly significant when the entire ban period is considered. In the short-term (less than 3 months from the initiation of an export ban) the price effects are indefinite and insignificant statistically. Overall, the main outcomes of this paper are in line with the findings of Diao, Kennedy, Mabiso and Pradesha (2013); in addition it provides a disaggregated analysis of the welfare consequences for both consumers and producers.

The paper is structured as follows. Section II provides a brief account of the production and consumption of maize in Kenya and Tanzania and maize trade patterns between them. In the first part of section III, we describe selection of market locations and identification issues related to the effect of an export ban. In the second part of section III, we discuss empirical outcomes. Section 4 specifically deals with the co-movement between retail and wholesale prices and its relationship with export bans. We forward concluding remarks in section V.

II. A Brief history of maize trade between Kenya and Tanzania

A. Production and Consumption

The East African region is home to a thriving population of more than 130 million. Kenya enjoys a dominant position accounting for almost 46% of its regional GDP and Tanzania being the second with nearly half of that of Kenya (World Bank, 2009). While Kenya has gradually become a net importer of staple foodstuffs (maize, beans, palm oil), it managed to sustain a positive balance of trade with most of its trading partners in the East African region.

The agricultural trade patterns with regional partners in this region to some extent reflect the respective economic developments (Pannhausen and Untied, 2010). Maize is the main staple food crop both in Kenya and Tanzania (FAOSTAT, 2009; Ariga, Jayne and Njukia, 2010). Maize cultivation covers 45 % of total arable land in Tanzania, and generating income to more than 65% of the Tanzanian farmers mostly poor and smallholders (USAID, 2010; Nazir, et al., 2010). Although maize is grown in almost all the regions in Tanzania two areas, the southern region including Iringa, Ruvuma and Mbega (accounting for almost 35% of the total maize production) and the northern region including Arusha, contribute the most. Maize yields are typically low (0.88 tons per hectare) because smallholder farmers rely on traditional technologies and produce mainly for subsistence (MINAG 2004). However, unlike Tanzania, maize production and marketed sales in Kenya are highly concentrated. Almost 50% of the national marketed supply of maize comes from only 2% of the smallholder farmers (Jayne, Myers, and Nyoro, 2008). Between 2005 and 2007, Kenya on average produced almost 3 million tons of maize, annually. In Tanzania, the figure stands around 3.3 million per year (Barreiro-Harle, 2012).

[Table 2.1 is about here]

In Kenya, an average person consumes about 88 kg of maize products per year whereas in Tanzania it has declined steadily from 70 to 60 Kg per year over the period from 2000 to 2007 (Barreiro-Harle, 2012). Maize consumption accounts for 65% of total staple food caloric intake and 36% of total food caloric intake in Kenya. Table 2.1 reports maize self-sufficiency ratios, which is a ratio of production over total available supply of maize. In Kenya nearly 90% of the maize supply is produced domestically with the exception of 2009. In Tanzania, this ratio fluctuates from 74% to 130%. In some years, like in 2002 and 2004, the production resulted in surplus whereas in 2000 and 2003 Tanzania had to import maize to meet the domestic demand for maize. This indicates that despite its favourable agro-ecological conditions, Tanzania is often a net importer of cereals.

B. Formal and Informal Trade

[Figure 2.1 is about here]

Ariga, Jayne and Njukia (2010) show that domestic maize production has failed to keep pace with the growing demand in Kenya and the gap has been met by maize imports from Tanzania and Uganda. As evident from Figure 2.1, Kenya has been the major destination for Tanzanian maize exports over the period from 2005 to 2010. While Kenya receives the largest share of maize export from Tanzania, the trade flow is often interrupted by fluctuations in production due to variation in climatic conditions or trade interventions. Export ban has been commonly used by Tanzanian government in recent years with an intention to provide stability in its domestic maize market. Since July, 2003 until October, 2011, Tanzania imposed an export ban on maize for a total period of 72 months, periodically where the longest period of ban was for 33 months starting from January, 2003 until October, 2011 (World Bank (2009). A recent study by Diao, Kennedy, Mabiso and Pradesha (2013) find that the effect of ban on cross-border maize trade has lowered the food prices but only by .6 - 2.4 percent, which is enjoyed mostly by the urban population in Tanzania. This study also indicates that the maize producer prices decrease by 7–26 percent, depending on the region.

[Table 2.2 is about here]

Moving on, while some market disruptions appear as a result of an export ban, the effectiveness of protection measures like an export ban could be overshadowed by a significant presence of informal trade networks. According to estimates by ministries and industry associations, about 80% of trade in agricultural produce and food in the region is informally done. For example, the informal maize trade from Uganda and Tanzania to Kenya was 170,000 tons from January to July 2009 (EAGC-RATIN 2009). According to Pannhausen and Untied (2010) a number of factors contribute to informal trade, such as the complicated approval procedures, poor management of transport and border controls among others. In addition, statutory regulations, standards and harmonisation efforts within Regional Economic Communities (REC) do not apply to these informal trade corridors. Figure 2.2 shows discrepancies between reported trade volumes in COMTRADE database between Kenya and Tanzania. Since the differences are not systematic, this indicates the role of informal maize trading between these countries. Based on a recent report by FSNWG, FEWS (2012), it is found that the most recent export ban by Tanzania in 2011 did not have any adverse effect on prices in the destination markets but resulted in reduction in volumes of informal trade by small and medium scale traders because of high transaction and transport costs incurred in evading the ban. We discuss some of these issues in the next section.

[Figure 2.2 is about here]

C. Value Chain and Processing

Inadequate transport infrastructure in the East Africa is a serious obstacle to regional trade. Cross border trade is also affected by country-specific transport policies. Kenya does not allow back haulage; as a result the freight companies are not allowed to bring other goods back on the return trip from Kenya, which only contributes to market distortions incurring significant additional costs (Pannhausen and Untied, 2010). Transport costs are astronomical even within individual countries. For example, transport costs account for up to 80% of the value of mangoes from Mombasa that are sold in Nairobi. In a recent study on Nigeria and Ethiopia, Atkins and Donaldson (2012) find that intra-national trade costs are 7-15 times larger than similar estimates for the US. Farmers in Tanzania suffer from similar issues and it is regarded as an obstacle to the development of regional trade (Pannhausen and Untied, 2010). In Tanzania, initiatives have been taken by the World Bank, the African Development Bank (AfDB) and other international donors in building new corridors such as the Arusha-Namanga-Athi River road, which will connect central Tanzania and Kenya and facilitate in regional trade.

[Figure 2.3 is about here]

The left panel of Figure 2.3 shows crop map of Tanzania. Maize is predominantly produced in the southern and northern provinces of Tanzania; maize export to Kenya comes from the Northern provinces as indicated by arrows (in yellow) on the right hand panel of Figure 2.3. According to the Post Harvest Losses Information System (2009), in many East African countries post-harvest losses for maize ranged between 16 and 22 percent in 2008. For perishable crops such as fruits, vegetables and root crops this could reach even 50% (FAO 2003). While post-harvest losses are more formidable, at times hoarding of crops also could affect the prices. The rational expectations storage model (Gustafson 1958; Williams and Wright 1991) allows famers and traders to behave optimally facing a restrictive trade practices. As argued by Porteous (2012), traders in both destination and source countries must factor in their expectations about the ban duration when making storage decisions. The uncertainly of the ban duration often makes this supply response particularly viral, and this could a lead a higher maize prices especially in the source country if traders wait until the ban is lifted and then decide to sell it to destination countries only.

Finally, a host of non-trade barriers including insufficient access to market information, the poor implementation of food safety standards and unpredicted delays due to roadblocks could also cause a temporary, often stable, rise in staple prices. A study by ReSAKSS (2009) finds that roadblocks were the major non-tariff barrier in East African maize trade in 2008. Kenya had the highest number of roadblocks estimated as 11 at an average distance of 194 kilometres, followed by Uganda with 10 roadblocks at an average distance of 213 kilometres and Tanzania with six roadblocks at an average of 310 km (ReSAKSS 2009). The same study reported that more than 50% of the total maize transfer costs from origin to destination came from non-tariff barriers in Uganda whereas Kenya and Tanzania attributed about 35% and 12% of total maize transportation costs to various non-tariff barriers, respectively. Pannhausen and Untied (2010) find that lack of farmers' knowledge about marketing opportunities and channels also contributes to price distortions. The same authors also point out that other protectionism measures imposed by Kenya such as quality controls tests at the border check posts denying the certificates of the Bureaus of Standards in Tanzania leads to further delays in trade and likely to create a shortage of supply resulting in price hikes.

III. The price effect of bans on maize export in Kenya and Tanzania

A. Selection of markets with price data for analysis

To analyse the impact of export ban on maize, we use monthly price data for staples (maize and beans) across market locations in Kenya and Tanzania for the period from January 2006 to February 2014 available at the World Food Programme's VAM database[2]. To be consistent, we use wholesale and retail prices that are recorded in per kilogram in US dollars. Also, for the sake of uniformity, we converted prices in local currencies into US dollars based on OANDA database[3]. Data is available for five market locations in Kenya: Eldoret, Mombasa, Kisumu, Kitui and Nairobi. Kitui is dropped from our analysis, as it does not report data on maize prices. For Tanzania, data is available for 20 market locations, but for the purpose of this study we use data for only nine locations (Arusha, Babati, Dodoma, Moshi, Musoma, Mwanza, Singida, Shinyanga, Tanga). These nine location form the north-east part of Tanzania is selected based on the following reasons: First, maize exports from Tanzania to Kenya mostly comes from the northern provinces of Tanzania (Arusha) as depicted in Figure 2.3. Second, in the presence of an export ban, maize prices are likely to be affected only in the northern and north-eastern market locations. Third, the main production from the southern region accounts for more than 35% of total maize supply and caters to the need for the deficit zones.

Figure 3.1 provides a pictorial description of the locations selected for analysis in both Kenya and Tanzania. In Kenya, monthly wholesale prices on maize are collected from four major markets: Mombasa, Nairobi, Eldoret and Kisumu, all are located in southern parts of Kenya. In Tanzania nine markets are selected including Arusha, Babati, Dodoma, Moshi, Musoma, Mwanza, Singida, Shinyanga, Tanga located in the Northern part of Tanzania. The right hand panel of Figure 3.1 highlights regions in gray that are considered for this study. Since maize production and marketed sales in Kenya are highly concentrated, any price disruption resulting from an export ban is likely to affect the maize prices in all markets. For this reasons, we consider all the market locations available for Kenya.

[Figure 3.1 is about here]

[2] http://foodprices.vam.wfp.org/Analysis-Monthly-Price-DataADV.aspx (see appendix 2 for a detailed description of data availability)

[3] http://www.oanda.com/currency/historical-rates/

Figure 3.2 (gray plots) shows monthly time series trend of maize prices in four market locations in Kenya. On average, there is an an upward trend in wholesale maize prices in the period we study. The vertical grey bars indicate the periods (in months) that witnessed ban on maize export. We have three ban periods: from August 2006 to December 2006, from January 2008 to October 2010 and from May 2011 to October 2011. At the beginning of each ban period maize prices in all market locations in Kenya show an upward trend. This is consistent with theoretical prediction that a negative supply shock of maize in Kenya resulting from an export ban put upward pressure on maize prices. It also shows some oscillation and depicts a downward trend in maize prices towards the end of each ban period. The black time series plots in Figure 3.2 shows monthly maize prices nine market locations in Tanzania. The maize price during the ban periods in Tanzania shows a mean-preserving trend within the ban periods, albeit a downward trend consistent with theoretical prediction is also evident especially in the first ban period from August 2006 to December 2006.

[Figure 3.2 is about here]

Next, we compare the average monthly prices between free export and export ban periods for both Kenya and Tanzania (Figure 3.3). We divide the entire period of study into seven consecutive time frames from January 2006 to February 2014. The second, the fourth and the sixth period experienced export ban. The first export ban, from August 2006 to December 2006, results in a drop in average maize price in both countries; however, the average priced almost halved in Tanzania, from .25 USD to .14 USD per Kilogram. The average price shows an upward trend during the second export ban period, from January 2008 to October 2010, for both countries. While the upward trend in Kenya is supported by theory, the rise in average maize price in Tanzania due to export ban is somewhat inconsistent. This perhaps could be explained by other factors, including the global crisis that peaked around that time leaving the sub-Saharan countries as one of the worst hit areas with significant inflation in food prices. The third period of export ban, which started in May 2011 and lasted until October 2011, shows an upward price trend in Kenya whereas maize prices in Tanzania seem to stabilize.

[Figure 3.3 is about here]

The descriptive statistics we analysed so far are in line with the existing literature and only provides weak empirical support to the theoretical model predictions: a price surge in the destination country and price stabilization in the source country resulting from an export ban. This point to a more complex pricing model and suggest possible roles that several other factors play in obscuring the standard price transmission mechanism. Presence of such factors not only creates further price distortions but also makes it challenging for us to quantify and isolate the true effect of export ban on maize prices. We already discussed these factors in section 2 and some of these include: (1) informal trade across border, (2) quality of transportation and roadways, (3) non-trade barriers (such as road blocks, quality control at the border, etc), (4) storage and hoarding of maize crop and (5) local market demand and production of maize

B. Methodology and Empirical Model

B1. Wholesale Maize price - OLS model

We begin with a simple OLS model controlling for the abovementioned factors. Our baseline regression model takes the form of equation (1) below:

[1] $Price_t^i = \alpha + \beta_1 Ban_t^i + \beta_2 Season_t^i + \beta_3 Cost_t^i + \beta_4 Farmgate_t^i + \beta_5 Local_t^i + Year + \varepsilon_t^i$

Where $Price_t^i$ shows monthly wholesale prices of maize, Ban_t^i equals to 1 if export ban is imposed. *Season* controls for harvesting and marketing seasons of maize, *Farmgate* controls for farmgate prices for maize at different locations; *Local* controls for local production and self-sufficiency ratio at each location; *Cost* controls for border to wholesale market costs for Kenya and wholesale to border costs for Tanzania. *Year* is the year fixed effect whereas ε_t^i stands for the error term. The data for most of the control variables are taken from MAFAP-SPAAA (2012), Kenya Economic Update (2013) and Tanzania Economic Update (2013).

[Table 3.1 is about here]

We define and use three measures of the duration of export ban (BAN). We consider the entire period of export ban (in months), the first one month from the ban period started and the first three months since the ban period started. In table 3.1, we provide mean difference for all market locations in Kenya and Tanzania for each of these three definitions of export ban period. Considering the entire ban period, maize prices are insignificantly different between the export ban and export free periods for market locations in Kenya. For market locations in Tanzanian we get a somewhat different picture, as seven out of nine market locations show statistically significant difference in average maize prices. Except Moshi, all other market locations show a drop in average maize prices. We get a completely different picture when the first three months of the ban periods are considered. For market locations in Kenya, maize prices are significantly lower, whereas a mixed outcome is found for market locations in Tanzania. This suggests that there could be a lagged positive effect of export ban on maize prices in Kenya. Table 3.2 reports the OLS outcomes of our baseline model. The pooled model outcomes for all locations in Kenya, Tanzania and in both countries are shown in the first three columns respectively. Across all models, the estimated coefficients suggest a significant drop in wholesale maize prices during the export ban period. For individual market locations in Kenya, we find robust support when the first three months of ban period is considered. For market location in Tanzania the results are particularly robust when the entire export ban period is considered. Overall, the regression outcomes after controlling for various factors are in line with descriptive evidence.

[Table 3.2 is about here]

B2. Wholesale Maize price - DID model

While the OLS estimates suggest a drop in maize prices during export ban periods, it does not draw a causal inference of export ban on monthly prices. As discussed earlier, the presence of the market related factors make it difficult to isolate the true effect of export ban on prices. However, the main problem remains in finding a counterfactual maize price that would prevail in the presence of all such factors but export ban. OLS estimates assume that fluctuations in maize prices across the export ban and export free periods are solely due to export ban, which may be not be sustainable if there is a strong presence of factors that influences maize prices likewise. As an alternative strategy, we use beans prices to construct counterfactual maize prices based on the following reasons.

Beans price as counterfactual maize prices:

First, maize and beans are the two main staple foods traded between Kenya and Tanzania. Maize remains the main commodity imported into Kenya from Tanzania, followed by beans (EAGC-RATIN 2008/2009). As far as planting area is concerned, maize is by far the largest crop with 3.1 million hectares planted, followed by beans with an estimated plantation area of 1.7 million hectares. The left panel of Figure 2.3 show crop production areas, and we find some overlapping between maize and bean production areas, especially in Arusha, Tanzania. The right hand panel indicates maize trade corridors between Kenya and Tanzania in the same region. Thus, these two staples show similarities both in nature and geographically, and the main source of exported maize and beans is Arusha, the north-eastern part of Tanzania.

[Figure 3.4 is about here]

Second, maize and beans are considered more as a complements rather than substitutes both in terms of diets and cropping patterns. In Kenya, for example, over 85 percent of the population depends on maize as their main source of calories. A meal made up of 25% of beans and 75% maize provides a good balance as maize and beans complement each other’s protein makeup (FAO, 2010). In tradition farming practices maize and beans are planted together, as beans fix nitrogen to the soil for maize utilization and maize provide stalks for beans to climb. As a result it is agronomically effective and this kind of intercropping is prevalent in many regions of East Africa. This provides us with some evidence that the price of maize is less likely to be affected by beans prices and vice versa, especially during normal harvests.

[Figure 3.5 is about here]

Third, as shown in Figure 3.4 beans prices move in tandem across Kenya and Tanzania. For most of the period in our analysis, beans prices are comparable across these countries despite the fact that overall there is an upward trend in average beans price. Combining Figure 3.4 with Figure 3.5 provides us with some anecdotal evidence on the proximate effect of ban on maize export on maize prices on both sides of the border. Figure 3.5 plots the gap between average price of beans and maize for Kenya and Tanzania. Predominantly, the price gap is higher for Tanzania compared to Kenya. Since beans prices are comparable across these countries, this gap could be attributed to volatility in maize prices only. If we can assume that volatility in beans prices account for indirect price transmission channels discussed above, then the differences in price gap between Kenya and Tanzania could be due to a lower maize price in Tanzania, a higher maize price in Kenya or a combination of both (as shown in Figure 2.7). From the existing information it is impossible to determine which effect is stronger and causing such price movements to hold.

[Figure 3.6 is about here]

Next we consider, average beans prices. Overall, the insignificant mean differences of beans prices across banned and non-banned periods suggest that beans prices are likely to be unaffected by export ban on maize and associated factors in the time period under consideration.

[Table 3.3 is about here]

Based on the above discussion we propose a difference-in-difference model, where the first difference (as shown in Figure 3.6) shows the average difference in prices between export ban and export free periods and the second difference shows the average difference in prices between maize and beans. The baseline model for each market location i for the period from 2006 to 2014 (total 98 months denoted as t) is as follows:

[2]

$$Price_t^i = \alpha + \beta_1 Ban_t^i + \beta_2 Staple_t^i + \emptyset Ban_t^i \times Staple_t^i + \beta_3 Season_t^i + \beta_4 Farmgate_t^i + \beta_5 Local_t^i + \beta_6 Cost_t^i + Year + \varepsilon_t^i$$

Where $Price_t^i$ shows monthly prices of staples, Ban_t^i equals to 1 if export ban is imposed $Staple_t^i$ equals to 1 if staple is maize, 0 if beans. In addition we control for a range of indirect factors (as discussed earlier). *Season* controls for harvesting and marketing seasons of maize, *Farmgate* controls for farmgate prices for maize at different locations; *Local* controls for local production and self-sufficiency ratio at each location; *Cost* controls for border to wholesale market costs for Kenya and wholesale to border costs for Tanzania. *Year* is the year fixed effect whereas ε_t^i stands for the error term.

[Table 3.4 is about here]

Table 3.3 shows baseline model outcomes on double-difference with all control variables. When considered the entire ban period, the price effect is negative for most of the market locations in both countries; however the magnitude of price drop is higher for market locations in Tanzania. Most of these negative effects disappear when we consider the first one month since the export ban enacted. Except for Dodomo (which is still negative and statistically significant), rest of the locations in both countries show insignificant DID coefficients. Overall, for both the first one month and the first three months periods, the evidence on price differences is weak in all market locations in both Kenya and Tanzania. Once the OLS estimates are compared with the DID estimates, in majority of the cases, DID outcomes conform to OLS results; however, the magnitude of estimated coefficients of DID are higher than that of OLS and more significant statistically.

B3. Retail Maize price - OLS model

To estimate the price effects of export ban, so far we only looked at the wholesale maize prices. For poverty impact it is often retail prices, which households face in the market, has a direct bearing on welfare outcomes. Moreover, recent empirical literature (Nakamura, 2008; Goldberg and Hellerstein, 2007) highlights the importance of the link between retail and wholesale prices for understanding pricing models and their welfare consequences. Unlike previous studies, in this section we consider both retail and wholesale maize prices to analyse distribution margins between consumers and producers. In other words, as an alternative to the net benefit analysis (Deaton, 1989) we compare co-movement of retail and wholesale maize prices between free export scenario and export ban period to understand the welfare implications of an export ban. While oscillations in wholesale prices are indicative of welfare gains or losses for producers, retail prices are pertinent to the consumers' welfare. Since data on retail maize prices is not available for market locations in Kenya, we consider retail prices for maize for only six market locations in Tanzania (Arusha, Dodoma, Singida, Mwanza, Shinyanga and Tanga) for the period from January 2006 to January 2011. We use disaggregated retail price data on three types of maize products: (1) maize grains, (2) maize floor market and (3) maize floor shops. We estimate the baseline OLS model (equation 1) using retail prices.

[Table 3.5 is about here]

Table 3.5 reports estimated coefficients on retail price effects of export ban. We consider three durations of export ban as before. When considered maize grain retail prices, the price effect is negative for the first one month and the first three months period for most of the locations. However, when considered the entire ban period, the effect on retail maize grain price is positive but not statistically significant. We find similar outcomes for other categories of maize products, maize floor retail price both in markets and shops. Overall, the estimated outcomes indicate a robust negative price effect of export ban within the first three months since the beginning of the ban period. However, the effect becomes positive when the entire ban period is considered, which in some case even lasted for more than 24 months.

Moving on, the estimated price effects between wholesale and retail prices markedly differ when we consider the entire period of export ban. While retail prices show positive but insignificant coefficients, the estimations based on wholesale prices show a negative and significant in a number of cases in various locations in Tanzania. The outcomes on wholesale prices confirm theoretical prediction of an export ban on the source country. However, the difference in findings could also indicate that wholesale prices and retail price respond to export ban differently. The second observation is that empirical outcomes are in line when we consider the first 3 month or less of a ban period. While the level of statistical significance varies across locations, the estimated coefficients using both wholesale and retail prices show a negative price effect of export ban. Together, one may argue that in the short run (first three months since the ban enacted) the price effect of export ban is negative for both retail and wholesale maize prices. But in the long run (more than three months since the ban enacted), retail prices go up whereas wholesale prices still show a negative effect of export ban. Thus theoretical predictions are more in line with wholesale prices in Tanzania. However, to assess welfare consequences fluctuations in retail prices perhaps provide a closer picture. To have a better picture we consider co-movement of retail and wholesale prices and estimate the price margin effect of export ban.

IV. The effect of Export Ban on Retail and Wholesale Maize Price differences

[Figure 4.1 is about here]

Figure 4.1 depicts the ratio of retail to wholesale monthly maize prices for six market locations (Arusha, Dodoma, Singida, Mwanza, Shinyanga and Tanga) in Tanzania for the period from January 2006 to January 2010. Despite frequent oscillations, in most of the period retail prices dominate wholesale prices by a significant margin. Equation 3 estimates the co-movement of retail and wholesale maize prices as a function of export ban.

$$[3]\ \log\left(\frac{Retail}{Wholesale}\right)_t^i = \alpha + \beta_1 Ban_t^i + \beta_3 Season_t^i + \beta_4 Farmgate_t^i + \beta_5 Local_t^i + \beta_6 Cost_t^i + Year + \varepsilon_t^i$$

Where $\log(Retail/Wholesale)_t^i$ shows the log ratio of retail to wholesale prices; Ban_t^i equals to 1 if export ban is imposed. In addition we control for a range of indirect factors (as discussed earlier). *Season* controls for harvesting and marketing seasons of maize, *Farmgate* controls for farmgate prices for maize at different locations; *Local* controls for local production and self-sufficiency ratio at each location; *Cost* controls for border to wholesale market costs for Kenya and wholesale to border costs for Tanzania. *Year* is the year fixed effect whereas ε_t^i stands for the error term.

Table 4.1 reports the OLS outcomes on retail-wholesale maize price margins. The first two columns show estimated coefficients and R^2 for each of the six market locations in Tanzania and a pooled Tanzania model for the entire export ban period. Overall, it suggests divergence between retail and market prices and the outcome are robust and statistically significant. When consider shorter durations of export ban period, the first one month and the first three months, we get a completely different picture. In majority of the cases estimated coefficients are insignificant statistically and in some models it even suggests a lowering of the retail-wholesale margin. A notable exception being the market location of Mwanza; it shows robust evidence on increasing retail-wholesale margins across all time frames of export ban incidence. An increasing retail-wholesale margin is likely to have negative welfare consequences for both consumers (with a higher retail prices) and producers (with a lower wholesale price). Overall, it suggests that an export ban for a longer period is increasingly detrimental for the general welfare level.

[Table 4.1 is about here]

V. Conclusion

Historically, Kenya and Tanzania has shared a long-standing trade relationship. Among other things, it is shaped by the drought-prone semi-arid climatic conditions prevalent in almost three-quarters of Kenya. The demand for maize in Kenya has been meet by regional trade flows from surplus zones of maize production, such as the Arusha and Lake Victoria regions in Tanzania (EAGC-RATIN 2008/2009). It complements Tanzania's surplus maize production, providing it an outlet to escape crop loss resulting from the poor transportation facilities in Tanzania. However, trade flows are often disrupted by trade barriers, such as export ban, which is the focus of this paper.

In this paper we examine maize price (both wholesale and retail) fluctuations in the period from January 2006 to February 2014, which witnessed three periodic export bans enacted by Tanzania. To identify the effects of export ban on maize prices we compare the average prices in export ban and export free periods. To distinguish between the short-term and long-term effects of export ban, we also consider the first one month, the first three months and the entire export ban period as periods of export ban. The OLS estimates show dampening effect on wholesale maize prices in most of the market locations in Kenya and Tanzania, particularly when the entre ban period is considered. This implies a welfare loss for producers in Tanzania, however the estimated lower prices in market locations in Kenya is in contrary to the theoretical model prediction. While these outcomes are in line with the literature, the OLS estimates fail to isolate the true effect of export ban on prices in the presence of other factors associated with the market prices. As a next step, we consider beans prices as counterfactual maize prices in the presence of export ban, and compare the average wholesale maize price differences. The DID outcomes are in line with OLS estimates, providing robust support to drop in wholesale maize prices resulting from an export ban.

To get a better understanding on the welfare consequences of such export bans, next we consider both the retail prices and wholesale prices. The estimated coefficients suggest an increase in retail prices resulting from export bans in the six selected market locations in Tanzanian. This conceivably hurts the welfare level of consumers. Analysing the co-movements of retail and wholesale maize grain prices also suggests increasing divergence across all market locations. An increasing margin of retail-wholesale maize prices has negative welfare consequences for both consumers and producers. The outcome is particularly significant when the entire ban period is considered. Overall, this study provides evidence on the detrimental effects of export bans on market as a whole, hurting the welfare levels of both consumers and producers.

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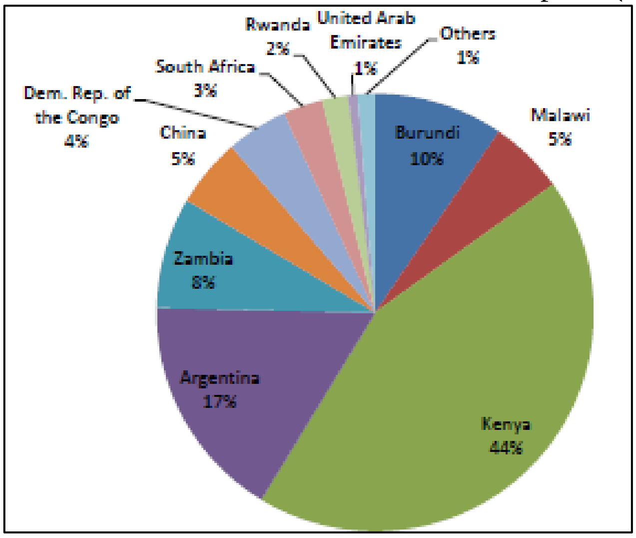
Table 2.1: Maize Self-sufficiency ratio, Kenya and Tanzania, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Kenya	-	-	-	-	-	92%	93%	93%	90%	62%	90%
Tanzania	74%	101%	125%	77%	130%	87%	92%	98%	-	-	-

Source: adapted from Short and Witwer (2012) and Barreiro-Harle (2012)

Figure 2.1: Main destinations of Tanzanian Maize exports (2005-2010)



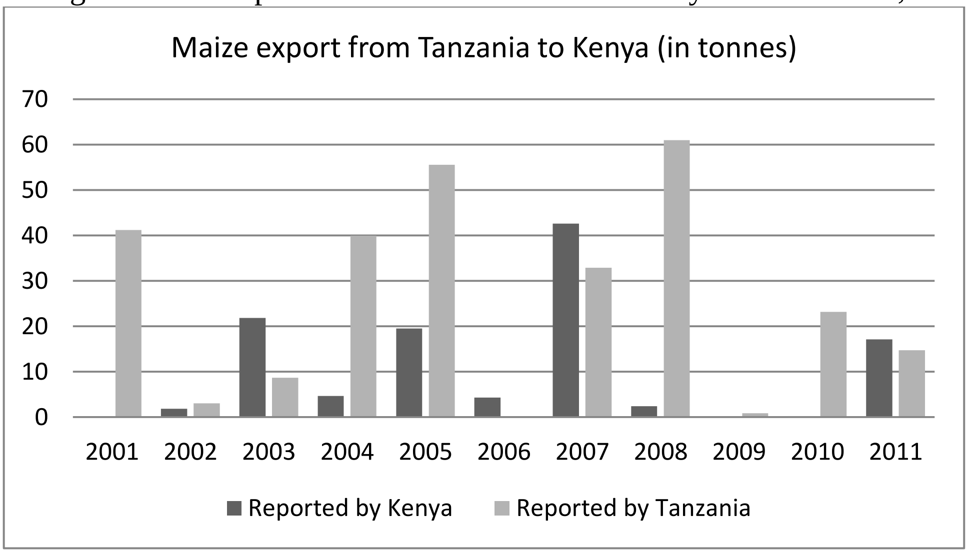
Source: Adapted from Barreiro-Harle (2012); main source UN COMTRADE

Table 2.2 Maize-trade interventions between Kenya and Tanzania

Type of intervention	Imposed by	Stat month	End month	Duration (in months)
Export ban	Tanzania	2003 July	2006 January	30
Export ban	Tanzania	2006 August	2006 December	4
Export ban	Tanzania	2008 January	2010 October	33
tariff waivers	Tanzania	2008 January	2008 May	4
tariff waivers	Kenya	2009 February	2009 December	10
Export ban	Tanzania	2011 May	2011 October	5
tariff waivers	Kenya	2011 June	post 2011	

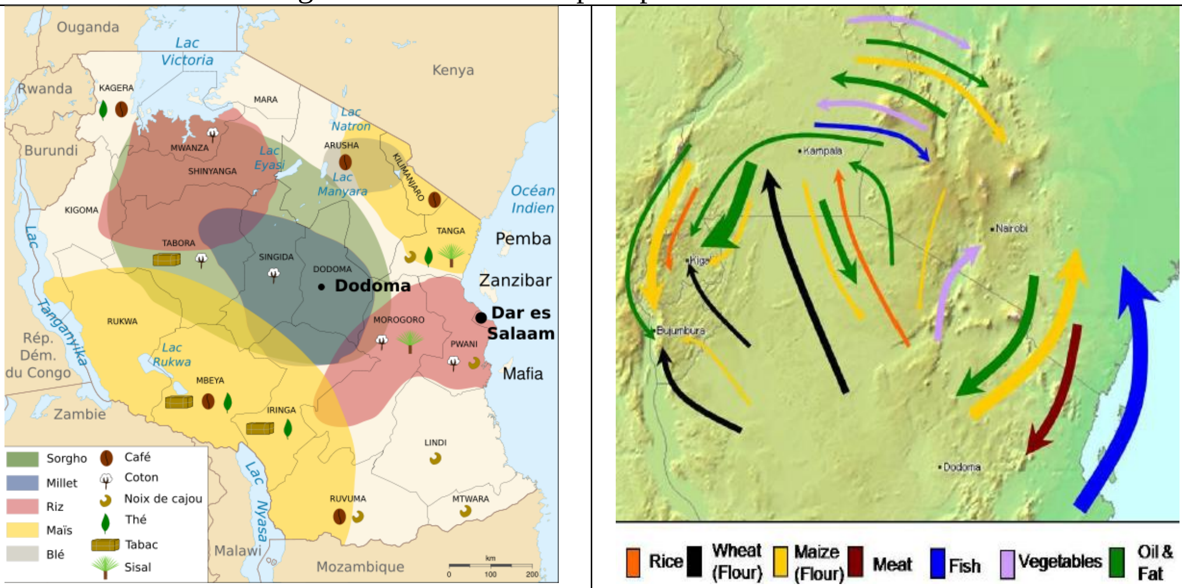
Source: adapted from World Bank (2009) and Porteus (2012)

Figure 2.2 Irregularities in reported trade volume between Kenya and Tanzania, 2001-2011



Source: Authors' calculation based on COMTRADE database

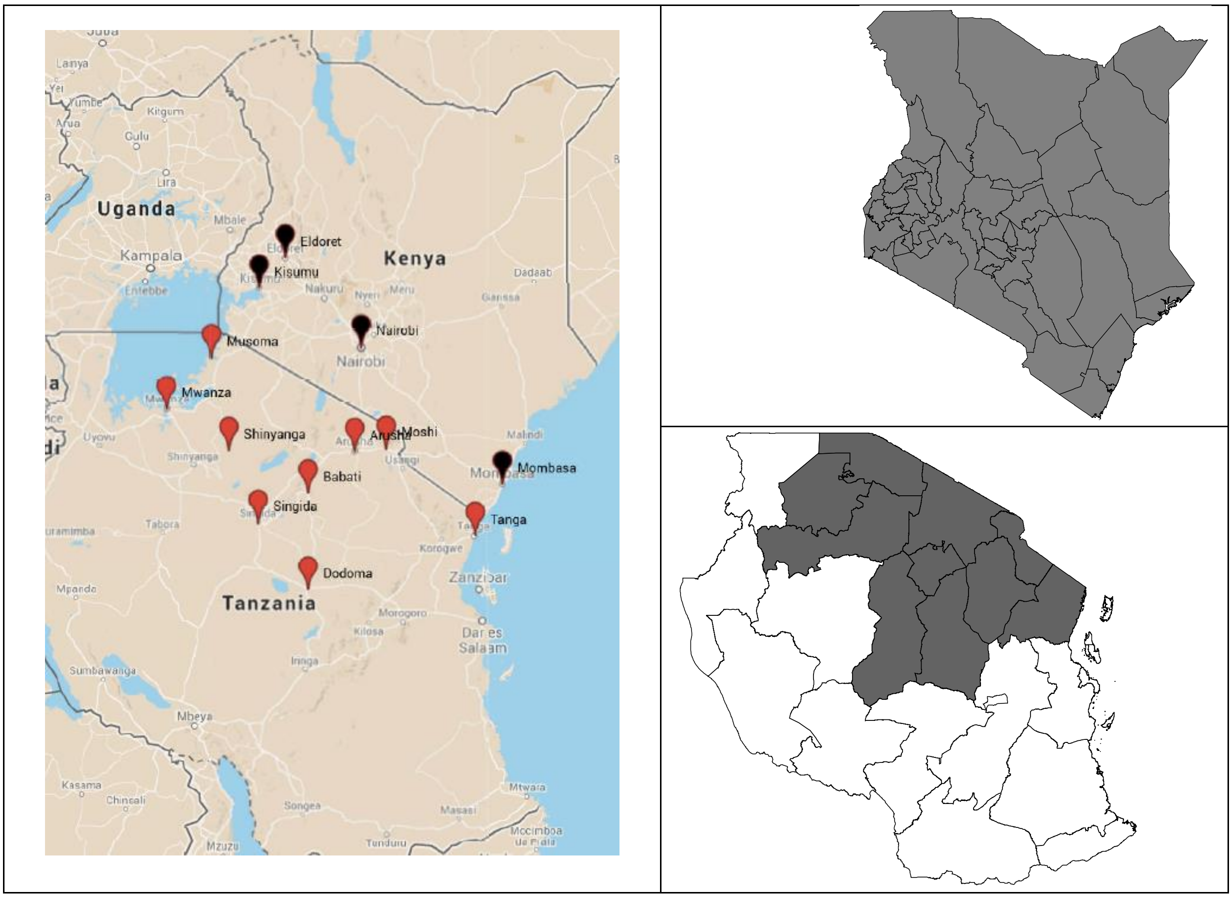
Figure 2.3 Tanzania crop map and trade corridors



A: Maize production areas in yellow and bean sproduction areas in gray	B: Maize trade corridors are indicated by yellow arrows

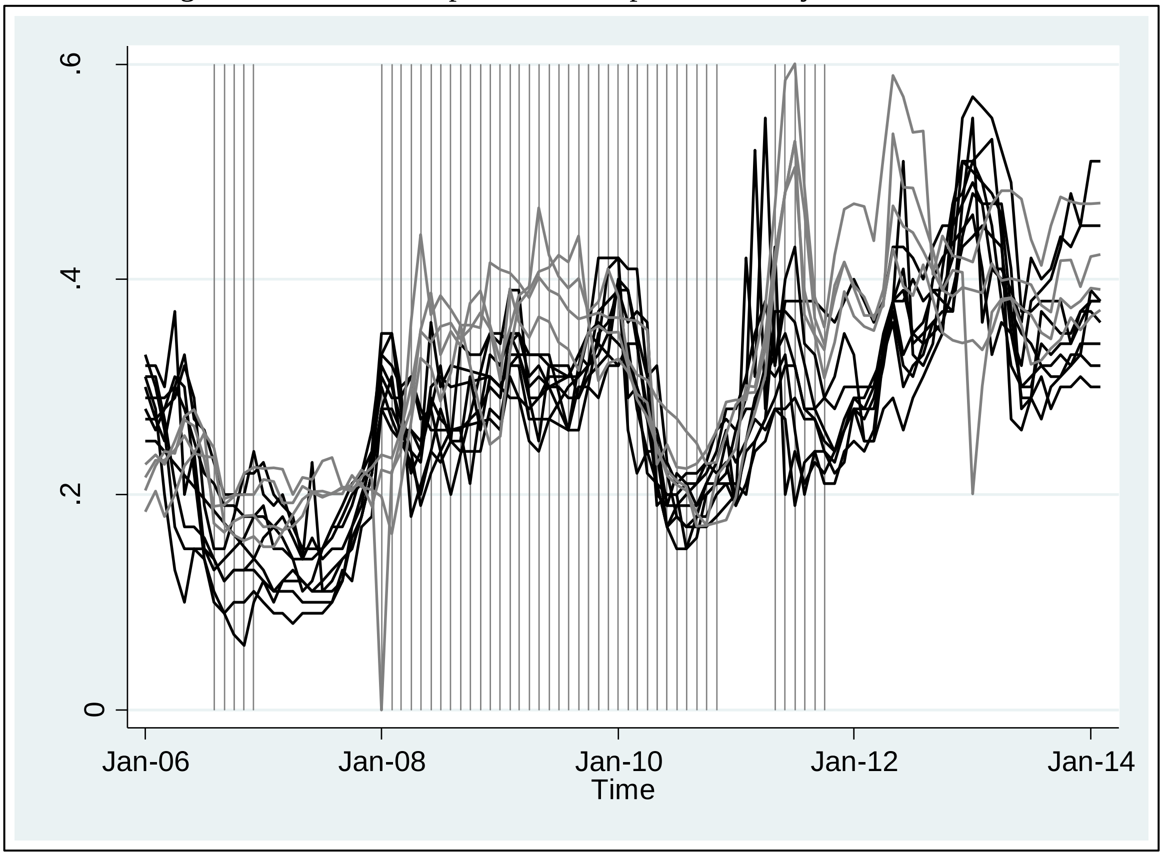
Source: University of Marine, Farmington (2010); Pannhausen and Untied, 2010 (B)

Figure 3.1 Location of Price data and regions of analysis



Note: Price data available for nine market locations in Tanzania: Arusha, Babati, Dodoma, Moshi, Musoma, Mwanza, Singida, Shinyanga, Tanga four market locations in Kenya: Nairobi, Eldoret, Kisumu and Mombasa.

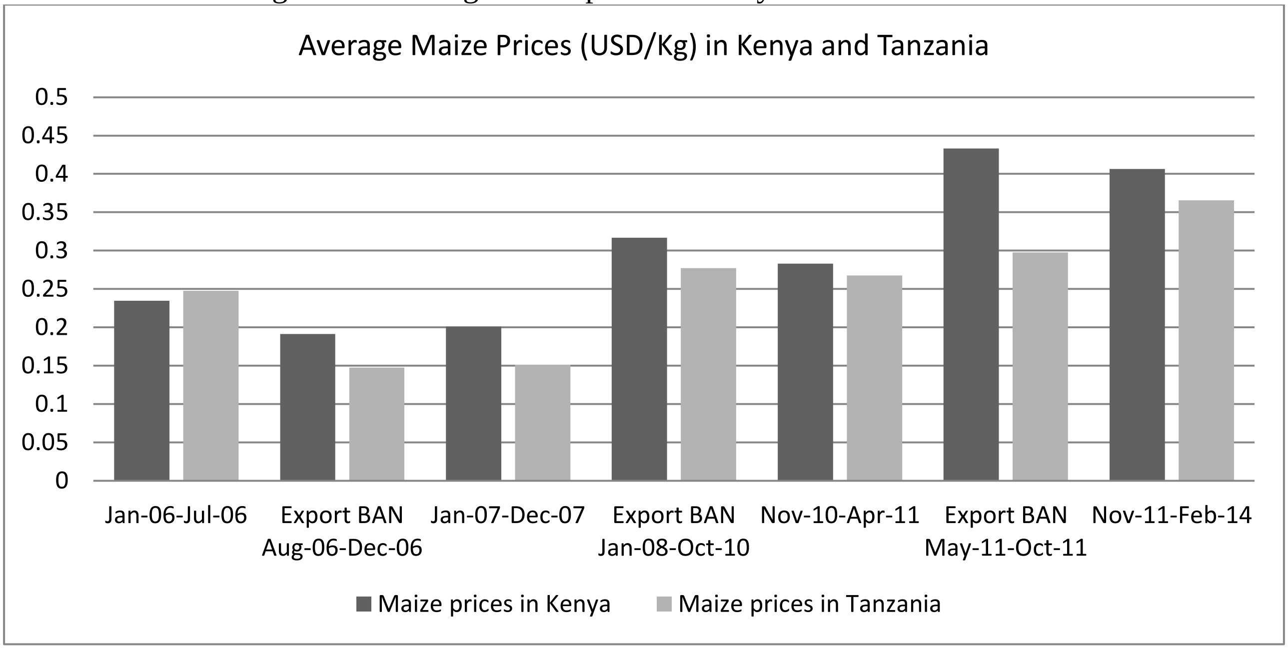
Figure 3.2 Time series plot of Maize prices in Kenya and Tanzania



Source: Authors' calculation based on VAM, WFP database

Note: Kenyan markets (shown in grey); Tanzanian markets (shown in black)

Figure 3.3 Average maize prices in Kenya and Tanzania



Source: Authors' calculation based on VAM, WFP database

Table 3.1: Average Maize prices (USD/Kg) in selected markets in Kenya and Tanzania

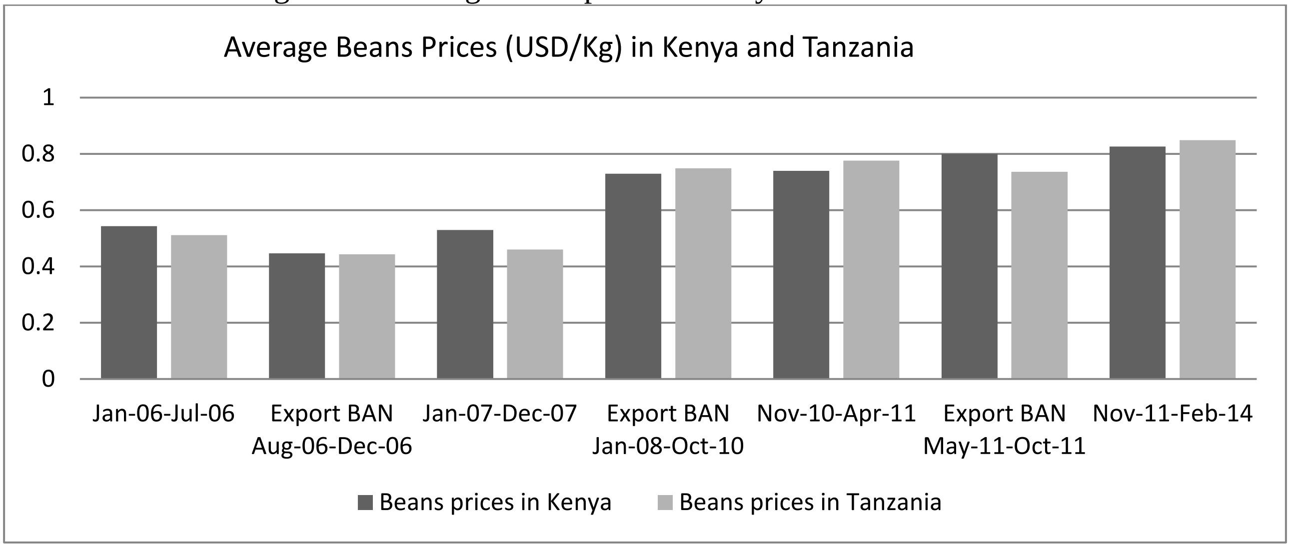
	Ban: entire period			Ban: First 1 month			Ban: First 3 months		
	No ban	Ban	t-statistic (p value)	No ban	Ban	t-statistic (p value)	No ban	Ban	t-statistic (p value)
Eldoret	0.287	0.300	.45	0.294	0.217	.22	0.300	0.190	.00
Kisumu	0.363	0.338	.29	0.357	0.094	.01	0.363	0.173	.00
Mombasa	0.308	0.308	.98	0.310	0.205	.09	0.315	0.207	.00
Nairobi	0.326	0.336	.59	0.332	0.233	.13	0.337	0.222	.00
Arusha	0.271	0.260	.01	0.267	0.209	.33	0.270	0.205	.06
Babati	0.253	0.239	.02	0.248	0.185	.36	0.251	0.179	.07
Dodoma	0.292	0.281	.61	0.288	0.233	.48	0.291	0.222	.13
Moshi	0.281	0.287	.02	0.283	0.280	-	0.284	0.272	.82
Musoma	0.307	0.282	.02	0.297	0.224	.25	0.301	0.217	.02
Mwanza	0.336	0.293	.02	0.318	0.271	.48	0.322	0.253	.08
Shinyanga	0.299	0.268	.07	0.286	0.268	.77	0.287	0.258	.40
Singida	0.283	0.254	.11	0.270	0.218	.41	0.273	0.219	.15
Tanga	0.282	0.254	.19	0.271	0.213	.44	0.275	0.194	.06

Table 3.2 Panel and Individual Market OLS model outcomes

		Entire ban period		First 1 month		First 3 months	
		coeff	R2	coeff	R2	coeff	R2
	Kenya	-0.015*	0.657	*-0.083***	0.688	-0.088***	0.744
	Tanzania	*-0.046****	0.615	-0.010	0.589	*-0.025****	0.596
	All	-0.036***	0.630	*-0.033**	0.619	-0.044***	0.637
k1	Eldoret	0.001	0.691	-0.022	0.693	-0.063***	0.736
k2	Mombasa	*-0.040***	0.728	*-0.071****	0.734	*-0.084****	0.809
k3	Nairobi	-0.003	0.765	-0.045	0.775	-0.069***	0.825
k4	Kisumu	*-0.018*	0.528	*-0.196**	0.683	*-0.135****	0.709
t1	Arusha	-0.044	0.641	*-0.016*	0.615	-0.025	0.622
t2	Babati	*-0.047**	0.695	-0.011	0.671	*-0.022*	0.675
t3	Dodoma	-0.035	0.690	*-0.002*	0.679	-0.018	0.682
t4	Singida	*-0.048*	0.621	-0.013	0.582	*-0.014*	0.584
t5	Moshi	0.066***	0.793	*-0.001*	0.768	-0.005	0.769
t6	Musoma	*-0.059****	0.614	-0.034	0.560	*-0.054****	0.599
t7	Mwanza	-0.035*	0.531	*-0.001*	0.506	-0.027	0.520
t8	Shinyanga	*-0.036*	0.388	0.021	0.366	*0.012*	0.365
t9	Tanga	-0.100***	0.735	*-0.019*	0.638	-0.052	0.661

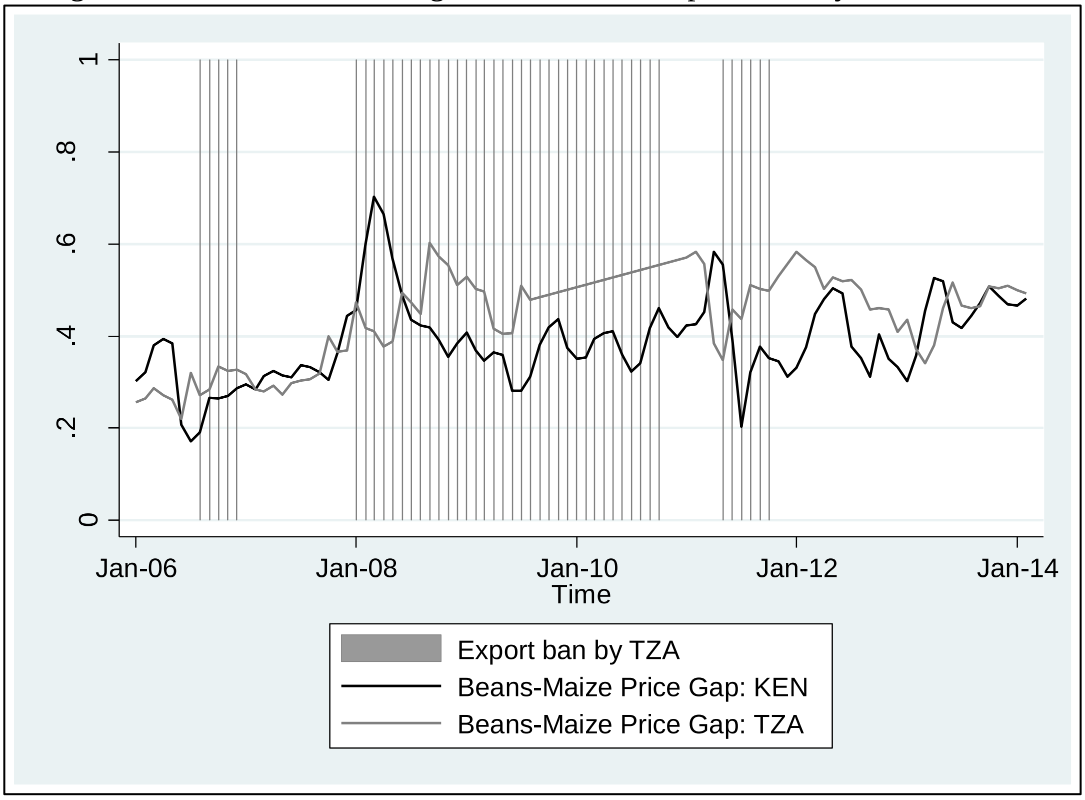
Note: *** implies significant at 1%, ** implies significant at 5% and * implies significant at 10%. Estimation with robust standard errors. Controls include dummy variables for harvesting and marketing seasons of maize; farmgate prices for maize at different locations; local production and self-sufficiency ratio at each location; border to wholesale market costs for market locations in Kenya and wholesale to border costs for market locations in Tanzania.

Figure 3.4 Average beans prices in Kenya and Tanzania



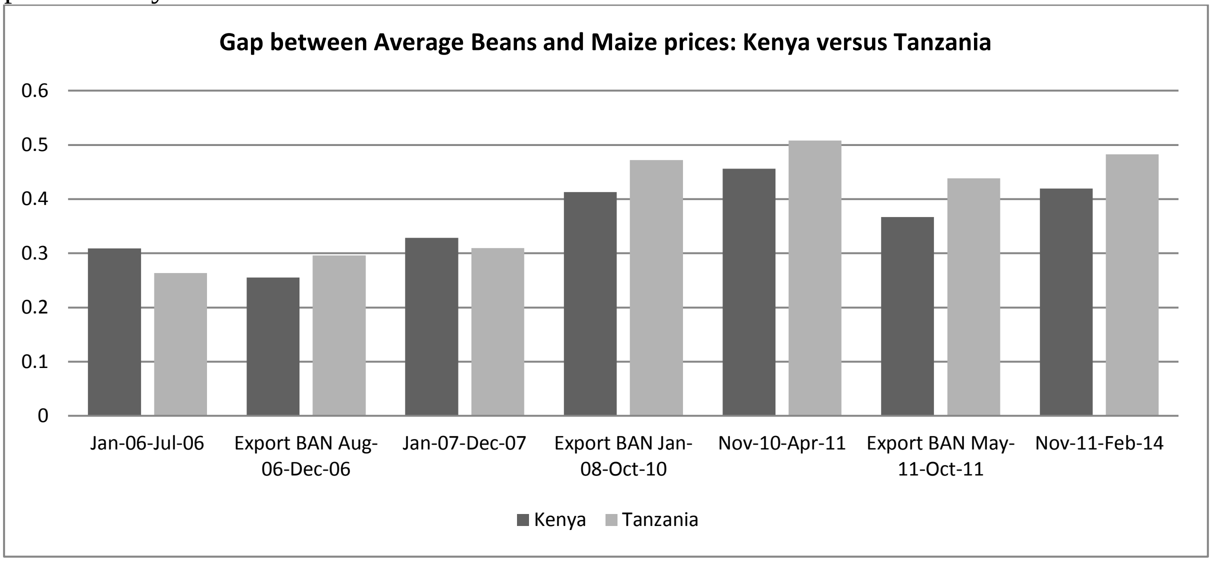
Source: Authors' calculation based on VAM, WFP database

Figure 3.5 Difference in average beans and maize prices: Kenya and Tanzania



Source: Authors' calculation based on VAM, WFP database

Figure 3.6 First difference: Average difference (by periods) in average beans and maize prices: Kenya and Tanzania



Source: Authors' calculation based on VAM, WFP database

Table 3.3 Average Beans prices (USD/Kg) in selected markets in Kenya and Tanzania

	Ban: entire period			Ban: First 1 month			Ban: First 3 months		
	No ban	Ban	t-statistic (p value)	No ban	Ban	t-statistic (p value)	No ban	Ban	t-statistic
Eldoret	0.743	0.666	.10	0.713	0.416	.07	0.721	0.494	.02
Kisumu	0.771	0.784	.71	0.780	0.426	-	0.777	0.772	.95
Mombasa	0.650	0.686	.16	0.669	0.577	.31	0.670	0.615	.29
Nairobi	0.674	0.707	.21	0.693	0.528	.07	0.696	0.590	.05
Arusha	0.658	0.715	.16	0.681	0.641	.75	0.685	0.616	.36
Babati	0.655	0.681	.61	0.668	0.543	.42	0.677	0.519	.08
Dodoma	0.719	0.734	.79	0.725	0.702	.89	0.730	0.641	.41
Moshi	0.815	0.880	.29	0.836	0.766	-	0.841	0.720	.38
Musoma	0.688	0.681	.85	0.690	0.524	.14	0.699	0.533	.01
Mwanza	0.754	0.708	.29	0.741	0.622	.36	0.750	0.590	.04
Shinyanga	0.662	0.600	.17	0.643	0.532	.40	0.650	0.529	.13
Singida	0.684	0.687	.95	0.687	0.608	.59	0.693	0.585	.21
Tanga	0.680	0.649	.48	0.672	0.591	.54	0.676	0.591	.27

Note: *** implies significant at 1%, ** implies significant at 5% and * implies significant at 10%. Estimation with robust standard errors. Controls include dummy variables for harvesting and marketing seasons of maize; farmgate prices for maize at different locations; local production and self-sufficiency ratio at each location; border to wholesale market costs for market locations in Kenya and wholesale to border costs for market locations in Tanzania.

Table 3.4: Difference-in-difference outcome with a full set of controls

		Entire ban period		First 1 month		First 3 months	
		DID	R2	DID	R2	DID	R2
k1	Eldoret	-0.078***	0.864	0.127	0.864	0.021	0.865
k2	Mombasa	*-0.067****	0.923	*0.000*	0.919	*-0.041*	0.922
k3	Nairobi	-0.046*	0.900	0.072	0.903	-0.004	0.907
k4	Kisumu	*-0.068***	0.848	*-0.039*	0.854	*-0.219*	0.856
t1	Arusha	-0.150***	0.919	*-0.044*	0.890	-0.025	0.890
t2	Babati	*-0.149****	0.874	0.011	0.846	*0.033*	0.850
t3	Dodoma	-0.107**	0.815	*-0.092*	0.806	-0.028	0.803
t4	Singida	*-0.165****	0.879	-0.001	0.844	*0.027*	0.847
t5	Moshi	-0.276***	0.953	*-0.013*	0.899	0.028	0.904
t6	Musoma	*-0.072***	0.896	0.029	0.883	*0.015*	0.892
t7	Mwanza	-0.038	0.872	*0.024*	0.866	0.043	0.873
t8	Shinyanga	*-0.057**	0.832	0.023	0.820	*0.016*	0.821
t9	Tanga	-0.080**	0.879	*-0.022*	0.851	-0.047	0.854

Note: *** implies significant at 1%, ** implies significant at 5% and * implies significant at 10%. Estimation with robust standard errors. Controls include dummy variables for harvesting and marketing seasons of maize; farmgate prices for maize at different locations; local production and self-sufficiency ratio at each location; border to wholesale market costs for market locations in Kenya and wholesale to border costs for market locations in Tanzania.

Table 3.5 Regression outcomes on Retail prices Tanzania only

		Entire ban period		First 1 month		First 3 months	
		coeff	R2	coeff	R2	coeff	R2
Maize grain price	Tanzania	0.062***	0.272	-0.030*	0.247	-0.018	0.246
	Arusha	0.124*	0.442	-0.068	0.365	-0.036	0.361
	Dodoma	0.058	0.351	-0.026	0.324	0.002	0.321
	Singida	0.036	0.230	-0.009	0.217	-0.012	0.218
	Mwanza	0.073	0.359	0.043***	0.312	0.019	0.307
	Shinyanga	0.097	0.197	-0.024	0.137	-0.004	0.135
	Tanga	-0.019	0.232	-0.096***	0.266	-0.078**	0.288
Maize floor market price	Tanzania	0.105***	0.335	-0.010	0.290	0.004	0.290
	Arusha	0.161**	0.345	0.085	0.257	0.078	0.269
	Dodoma	0.090	0.366	-0.043	0.342	-0.029	0.342
	Singida	0.079	0.371	-0.064***	0.349	-0.032	0.346
	Mwanza	0.178**	0.336	0.016	0.175	0.024*	0.178
	Shinyanga	0.091	0.310	0.024	0.259	0.029	0.263
	Tanga	0.031	0.414	-0.075	0.418	-0.048	0.418
Maize floor shop price	Tanzania	0.110***	0.360	-0.007	0.312	-0.017	0.313
	Arusha	0.145*	0.291	0.085*	0.216	0.067	0.222
	Dodoma	0.103	0.415	-0.094*	0.396	-0.08***	0.406
	Singida	0.082	0.367	-0.071***	0.344	-0.06**	0.352
	Mwanza	0.188**	0.319	0.024	0.140	0.027**	0.143
	Shinyanga	0.080	0.318	-0.012	0.276	-0.022	0.279
	Tanga	0.060	0.401	0.026	0.389	-0.024	0.390

Note: *** implies significant at 1%, ** implies significant at 5% and * implies significant at 10%. Estimation with robust standard errors. Controls include dummy variables for harvesting and marketing seasons of maize; farmgate prices for maize at different locations; local production and self-sufficiency ratio at each location; border to wholesale market costs for market locations in Kenya and wholesale to border costs for market locations in Tanzania.

Figure 4.1 Ratio of Retail to Wholesale Maize prices in selected Tanzanian cities

Table 4.1 Regression outcomes on Retail - wholesale maize price margin and export ban

	Entire ban period		First 1 month		First 3 months	
	coeff	R2	coeff	R2	coeff	R2
Tanzania	0.281***	0.414	*-0.055*	0.366	0.079	0.371
Arusha	0.424**	0.305	*-0.100*	0.195	0.074	0.197
Dodoma	*0.303***	0.447	-0.034	0.377	*0.165*	0.409
Singida	0.158*	0.660	*0.071*	0.645	0.070	0.648
Mwanza	*0.246**	0.434	0.195*	0.410	*0.245***	0.451
Shinyanga	0.172	0.364	*-0.153*	0.350	-0.066	0.343
Tanga	*0.384****	0.650	-0.300***	0.589	*-0.004*	0.552

Note: *** implies significant at 1%, ** implies significant at 5% and * implies significant at 10%. Estimation with robust standard errors. Controls include dummy variables for harvesting and marketing seasons of maize; farmgate prices for maize at different locations; local production and self-sufficiency ratio at each location; border to wholesale market costs for market locations in Kenya and wholesale to border costs for market locations in Tanzania.

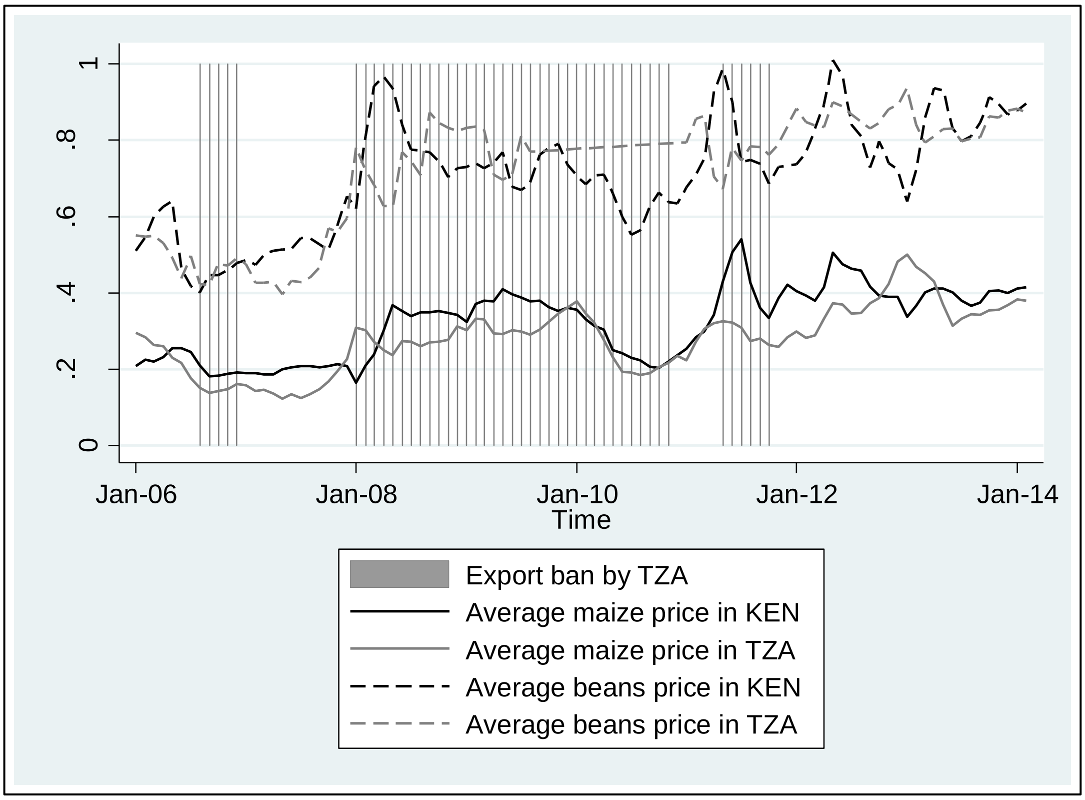
Appendix 1: Availability of data on wholesale Staple prices in Kenya and Tanzania

Table 1. Summary of the available data on wholesale prices

Country	Region	Crop	Year								
			2006	2007	2008	2009	2010	2011	2012	2013	2014
Kenya	Eldoret	Beans	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mombasa	Beans	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nairobi	Beans	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Kisumu	Beans	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tanzania	Arusha	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Babati	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Dodoma	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Moshi	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Musoma	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Mwanza	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Shinyanga	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Singida	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Tanga	Beans	✓	✓	✓	✓		✓	✓	✓	✓
		Maize	✓	✓	✓	✓	✓	✓	✓	✓	✓

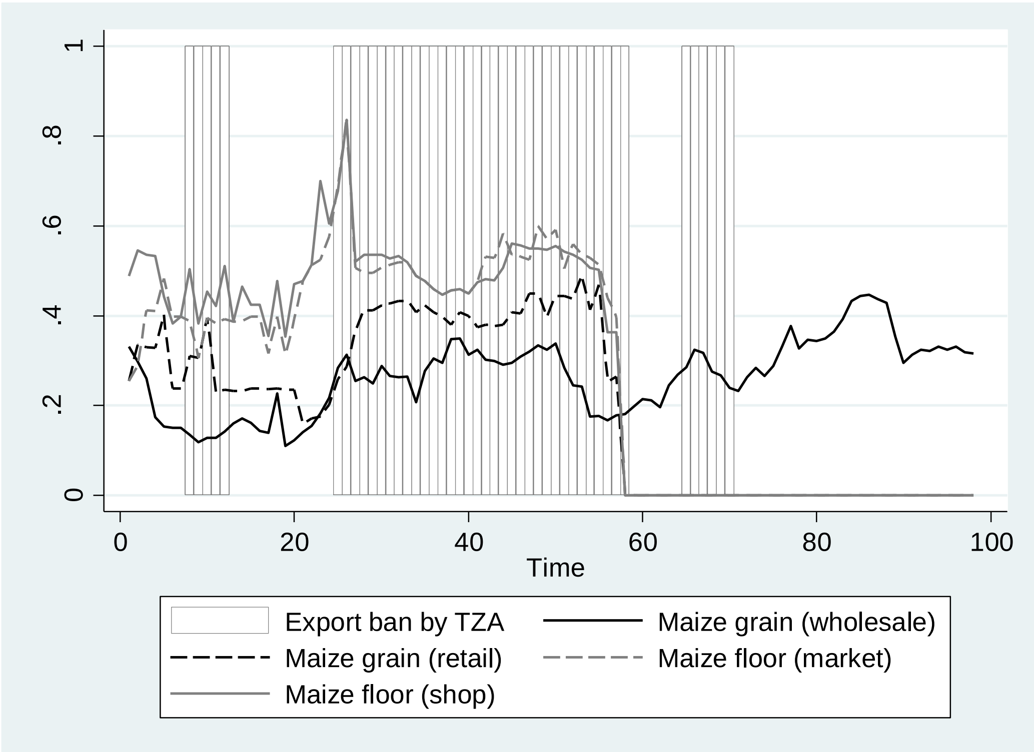
Note: Retail maize prices are available for only six market locations in Tanzania (Arusha, Dodoma, Singida, Mwanza, Sinyanga and Tanga) for the period from January 2006 to January 2011.

Appendix 2: Time series plots of wholesale maize and beans prices in Kenya and Tanzania

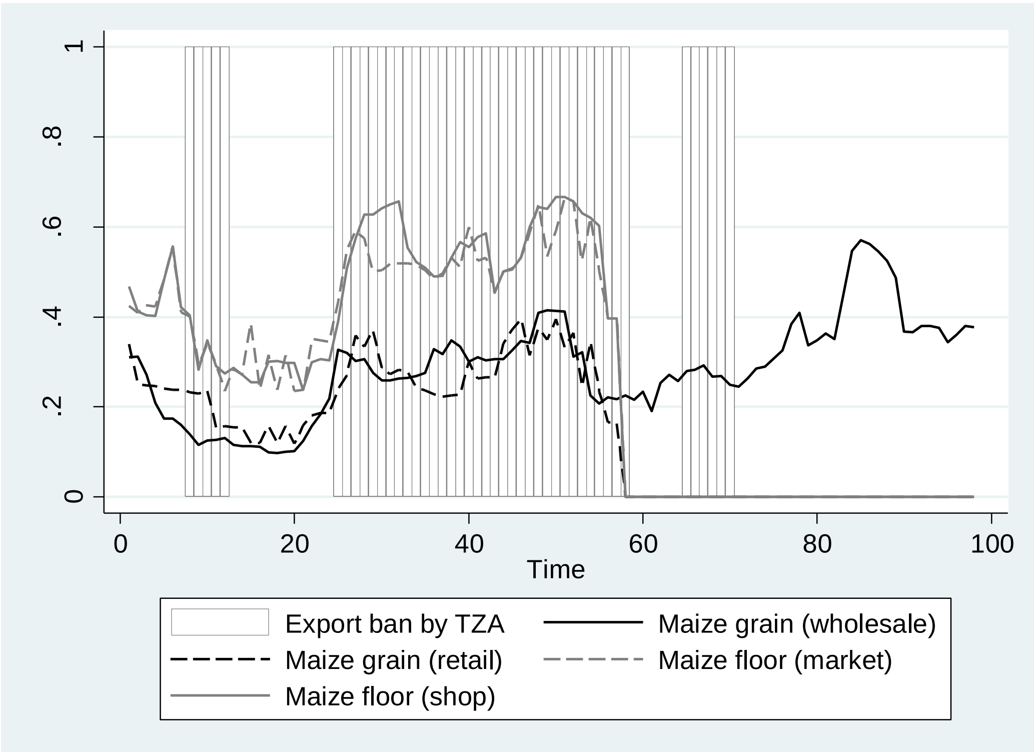


Appendix 3: Retail and Wholesale Maize Prices in selected cities in Tanzania

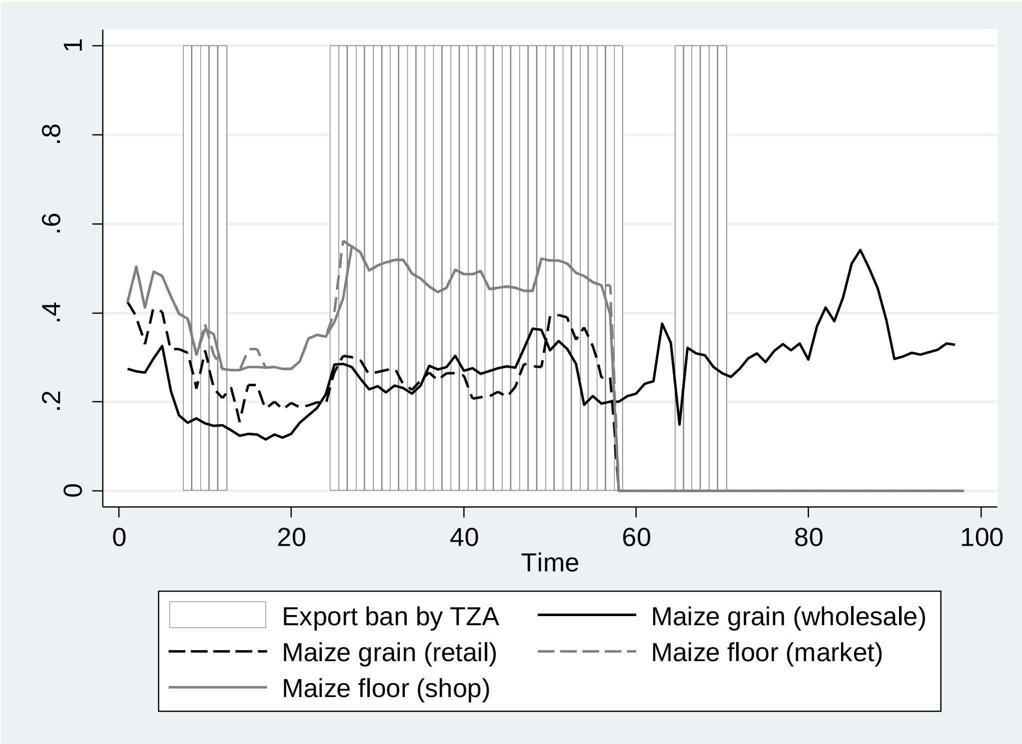
Arusha (Maize)



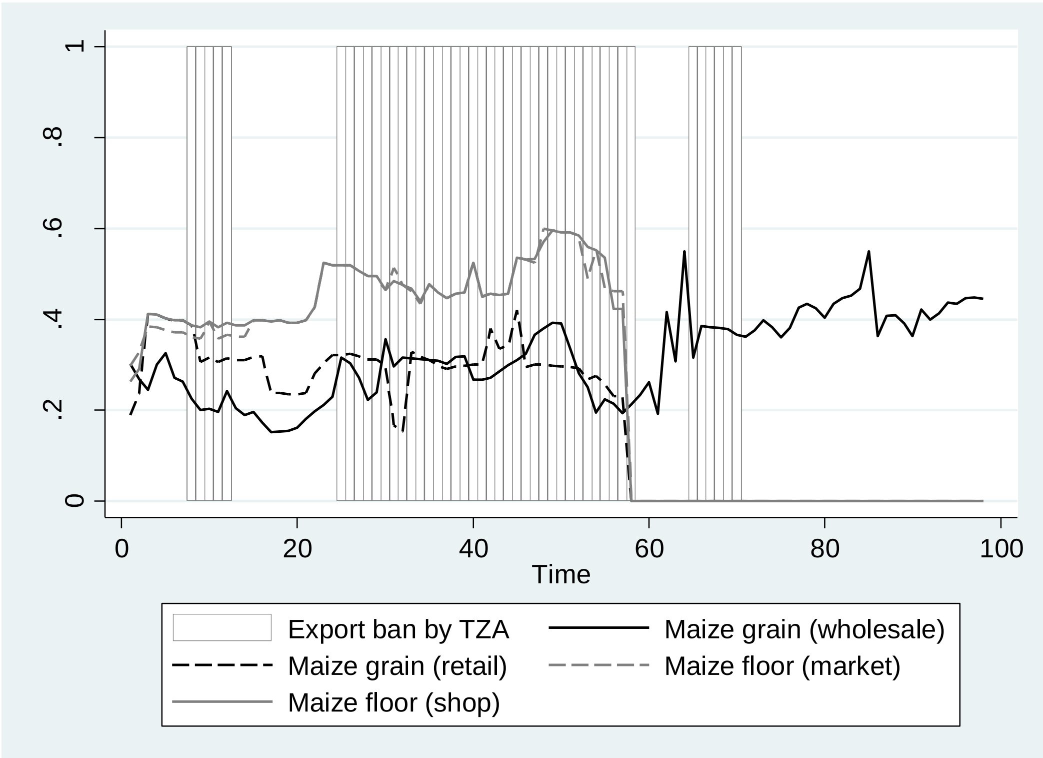
Dodoma (Maize)



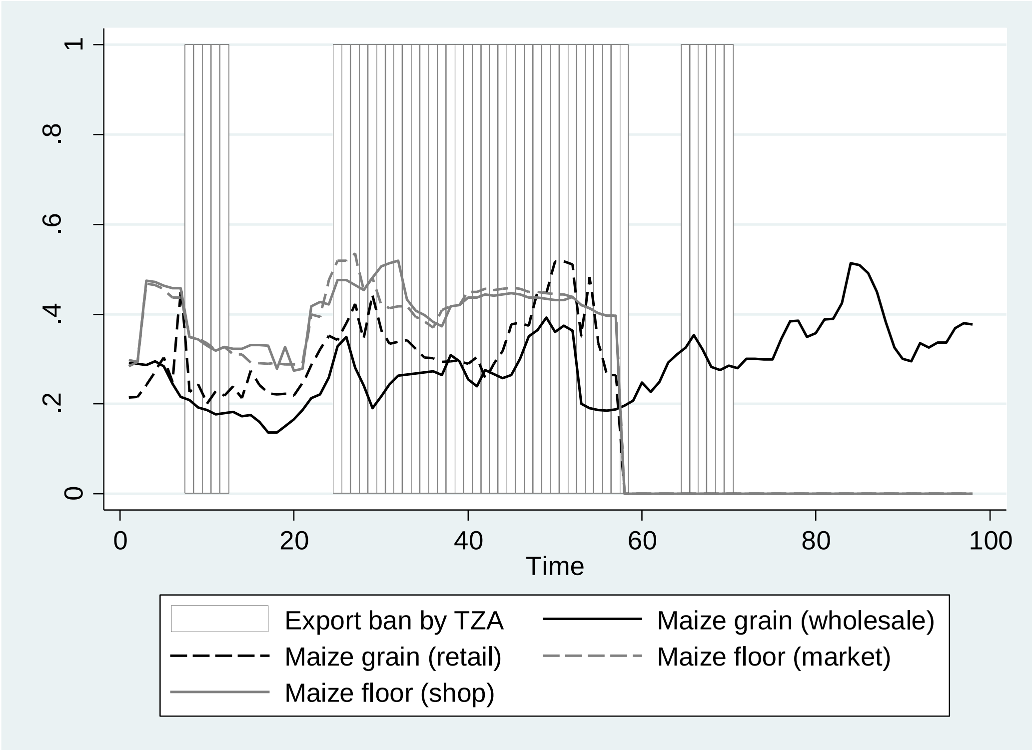
Singida (Maize)



Mwanza (Maize)



Shinyanga (Maize)



Tanga (Maize)