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Economywide Impact of Maize Export Bans on Agricultural Growth and Household Welfare in Tanzania

A Dynamic Computable General Equilibrium Model Analysis

Xinshen Diao

Adam Kennedy

Athur Mabiso

Angga Pradesha

Development Strategy and Governance Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Xinshen Diao, International Food Policy Research Institute

Deputy Division Director, Development Strategy and Governance Division

X.Diao@cgiar.org

Adam Kennedy, International Food Policy Research Institute

Program Manager, Development Strategy and Governance Division

Athur Mabiso, International Food Policy Research Institute

Postdoctoral Fellow, Development Strategy and Governance Division

Angga Pradesha, International Food Policy Research Institute

Senior Research Assistant, Development Strategy and Governance Division

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ABSTRACT

In recent years, the government of Tanzania, like other governments in Africa south of the Sahara, has periodically banned the export of staple crops (maize) in an attempt to ensure the domestic food supply and protect its citizens from international food price hikes. While this policy seems to be a common response to domestic production shortfalls or to high prices in international or neighboring countries' markets, export bans not only have the potential to reduce producer prices locally but also, because the bans are often ad hoc, can cause significant market uncertainty for farmers and the private sector, ultimately making them less responsive in both supply and trade opportunities in the future. While complaints by farmers and traders regarding the export bans frequently appear in the newspapers in Tanzania, few rigorous analyses have been done to quantitatively measure the impacts of the policy. Given this knowledge gap and policy demand, we study the impact of export bans in Tanzania using a computable general equilibrium model.

We find that although maize is an important food crop in Tanzania, its contribution to food price inflation is rather limited, and that banning cross-border maize exports lowers the national food price index by only 0.6–2.4 percent compared with the free-export scenario. The benefits of lower prices are captured primarily by urban households, but maize producer prices decrease by 7–26 percent, depending on the region. We also find that the export ban decreases the wage rate for low-skilled labor and the returns to land, while returns to nonagricultural capital and wage rate for the skilled labor increase, further hurting poor rural households and thus increasing poverty for the country as a whole.

Keywords: export ban, Tanzania, trade policy, CGE modeling

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1. INTRODUCTION

In recent years, the government of Tanzania, like other governments in Africa south of the Sahara (SSA), has periodically banned the export of staple crops (maize) in an attempt to ensure the domestic food supply and protect its citizens from international food price hikes. Although this policy seems to be a common response to domestic production shortfalls or to high prices in international or neighboring countries' markets, export bans not only have the potential to reduce producer prices locally but also, because the bans are often ad hoc, can cause significant market uncertainty for farmers and the private sector and ultimately make them less responsive in both supply and trade opportunities in the future.

Though cross-border trade has a long history in Tanzania, the country has been a net maize exporter only in recent years. However, even in recent years, recorded formal exports in maize were not always more than imports. Tanzania's switch to becoming a net maize exporter is largely due to rapid increases in its maize production, primarily by expansion in maize area. Although the average level of maize yield in Tanzania is still far below that in Kenya, an indication for future growth through yield improvement, both yield and production growth rates have been higher in Tanzania than in Kenya (which is a net maize importer), an indication that Tanzania will increasingly become the key supplier of maize to Kenya's market. Given Tanzania's advantage in location (having a common border with Kenya), maize exports could become an important income source to farmers and a significant driving force for overall economic growth and poverty reduction. The export ban policy, regardless of its possible short-term benefits in reducing consumer prices, is not consistent with important longer term development goals.

Complaints by farmers and traders regarding the export bans frequently appear in the local newspapers; however, few rigorous analyses have been done to quantitatively measure the impacts of the policy. Our research comes at a time when Tanzania has recently signed G8 cooperation framework to support the New Alliance for Food Security and Nutrition, which aims to accelerate the flow of private capital to African agriculture and to scale up new technologies that can increase agricultural productivity. These commitments hearken to the need to develop increasingly transparent trade policy that boosts private-sector confidence.

This knowledge gap in the country and policy demand shows the need for research on the effects of a maize export ban policy in the context of Tanzania. Such an analysis would also be helpful for the government to consider other policy options for achieving national food security and food price stabilization goals. The following policy questions are the focus of our analysis:

1. Can controlling maize and other cereal exports keep domestic food prices low and, if yes, by how much?
2. Can maize export bans be helpful to national food security by improving food availability in the country?
3. Who would benefit and who would be hurt by periodic export bans?
4. What are the impacts of export bans on the poor?
5. What are the impacts of export bans on agricultural growth?

In the following sections, we first provide a brief review of export ban analysis in the literature. We then introduce the Tanzania computable general equilibrium model and present the simulation results. We focus on the possible effects of export bans on prices, growth, and income in the discussion. In looking at the income effects, we consider different types of households in different locations and pay particular attention to the impacts on the poor. A short conclusion is drawn from the analysis at the end of the paper.

2. PREVIOUS ANALYSIS OF EXPORT BANS

A growing body of literature and empirical evidence shows that open trade and outward-oriented development strategies are associated with rapid economic growth (Dollar 1992; Frankel and Romer 1999; Johnson, Ostry, and Subramanian 2010). Several countries in Africa that liberalized their economies in the late 1980s and early 1990s under structural adjustment policies, and then maintained these policies, such as Ghana, Uganda, and Ethiopia, have experienced strong growth in the past decade. In fact, since the 1980s countries in SSA have largely reduced nominal rates of assistance to agriculture through structural adjustment reforms, though many countries are still in need of progress (Anderson and Masters 2009).

However, structural adjustment also left many countries vulnerable to international food price volatility. With the majority of rural households still depending on agriculture for their livelihoods, food price fluctuations affect their income directly through food sales and indirectly through wages from working in agriculture as hired labor. Staple foods still account for the majority of household expenditures for both rural and urban poor, and many poor farmers are also net buyers of staple foods during part of the year. Price hikes thus have the potential to jeopardize the food security of rural and urban poor consumers alike. After the sharp rise in international cereal prices in 2007 and 2008, many governments began to rethink a reliance on international trade. With this background, the government of Tanzania has more frequently used cereal export bans in an effort to stabilize prices for domestic consumer market.

Many studies, however, have found that export bans are not the best means of achieving reduced volatility and suppressing price increases. Porteous (2012) investigates the impacts of export bans on agricultural markets using price data from 12 countries in East and Southern Africa over 10 years. By developing a structural model he shows that export bans do not have a statistically significant effect on the price differences between markets and that export bans are correlated with equivalent price increases in both destination and origin countries due to a price surge on both sides of the border. Origin country prices continue to track destination country prices, despite the fact that trade is cut off. He believes that export bans push traders to store maize, causing prices in both origin and destination countries to rise higher than they otherwise would.

In their study of East Africa, Chapoto and Jayne (2009a) found similar results whereby Malawi and Zambia, countries pursuing interventionist and ad hoc trade policies, had the highest degree of price volatility and price uncertainty compared with the other countries in their assessment. Moreover, they find that Kenya's open-border policy has kept the country's prices more stable and predictable than those in the countries with ad hoc trade interventions such as Malawi and Zambia. In a separate study that looks at time series price data in Zambia, specifically using a standard ordinary least squares regression model, Chapoto and Jayne (2009b) could not find a statistically significant relationship between the export ban and suppressed prices, suggesting that informal cross-border trade is taking place to move surpluses into other countries. Simulation results of maize prices with and without government intervention find that government interventions have actually caused maize price instability over the period monitored. The "no intervention" coefficients of variation are 10–30 percent lower, depending on the market.

Studies on countries outside Africa have come to a similar conclusion. For example, utilizing a Markov-switching vector error correction model, a study by Goetz et al. (2010) on Ukraine and Russia, which implemented a series of export controls on wheat in 2007/08, finds that while market instability increased in world prices, market instability within the two countries increased even more, rendering the export bans ineffective. Others have found that when many countries implement export restrictions, their actions further accentuate prices spikes and are in effect offsetting because national markets continue to track international prices (Martin and Anderson 2010; Goetz et al. 2012). Thus, when taken together, global indicators show that market interventions have had little impact at reducing the instability of domestic prices compared with international markets (Anderson and Neglen 2012).

A high-risk environment marked by price instability can also discourage intensification of agricultural practices, locking households into low-risk, low-productivity production, which has implications for agricultural growth and for downstream processing (de Janvry, Fafchamps and Sadoulet 1991). For instance, Dorosh, Dradri, and Haggblade (2009), in modeling government trade policy in Zambia, found that a 30 percent increase in production from a bumper maize harvest with a closed border would decrease prices by 50 percent and farmers would reduce area planted with maize by a projected 15 percent. Given weather-induced uncertainties, the combination of a 15 percent decrease in planted area together with a drought the following season could lead to an exacerbated bust following the initial large harvest.

While price instability creates a high-risk environment for farmers, policies aimed directly at improving price stability and thus improving productivity have not generated this expected outcome. In their analysis of trade policy and market interventions in East Africa, Chapoto and Jayne (2009a) find that Zambia, Ethiopia, and Tanzania, which have pursued food price stabilization and food security objectives through direct state operations over the past decade, have not been able to match the production growth in other SSA countries. While cereal production in the SSA region as a whole has increased by roughly 47.5 percent over the past 25 years, these three countries are scarcely able to achieve the maize production levels obtained in 1980s. In contrast, the other countries in their study, Mozambique and Uganda, have both experienced more than 100 percent gains in maize production over the past two decades while maintaining relatively open borders. Stabilizing prices therefore through more open trade policy has the potential to improve welfare for both farm households and consumers, and improve the overall agricultural economic performance (Meyers 2006; Ahmed 1988).

While high food prices impact the poor, the extent to which they do so depends on the structure of the economy and the whether the poor are net food buyers or sellers (Aksoy and Hoekman 2010). Invariably some households, who might also be poor farmers, can benefit from higher prices while some will lose (Swinnen 2011). Most cross-country studies generally come to the conclusion that high food prices hurt the poor as consumers because most of the poor are net food buyers (Ivanic and Martin 2008; Zezza et al. 2009; Wodon and Zaman 2009). However, when food prices also affect the rural wage rate, the joint effects of food price and wage rate increases on poverty is not that straightforward, as many rural poor who are net food buyers often depend on income earned from working for other farmers.

For instance, using a general equilibrium model, Coxhead, Linh, and Tam (2012) find that global price shocks can be beneficial in countries where agricultural staples are a large share of the economic activity and employment for the poor. In Vietnam, which is a rice-exporting country, they find that both national and rural poverty decreased with a 35 percent increase in rice prices. The gains are disproportionately captured by the poor rural workers and small farmers who benefit from employment and labor productivity gains but also downstream processors who use paddy as an input benefit. This study confirms early work by Minot and Goletti (1998), who use a multimarket spatial equilibrium model to analyze the impact of removing an export quota in Vietnam. They find that even though fewer than one-third of households in Vietnam are net sellers of rice, an increase in rice prices from liberalization reduces the incidence and depth of poverty by 1.2 percentage points. First, they find that producer prices rise more than consumer prices so even those that are marginal sellers still have net gains. Second, even though eliminating the quota would raise prices and hurt much of the country, especially consumers in the urban areas, poverty is still reduced because most net sellers are poor and they accumulate the benefits.

In Argentina, where agriculture generates 18.5 percent of gross domestic product and accounts for 35.6 percent of total employment, export taxes and quotas have been used to generate government revenue and to protect agro-industrial processors at the cost of primary producers. Research using both a World Bank general equilibrium model and microsimulations based on household consumption and income survey found that the elimination of export taxes would translate into 32.6 percent of additional agro-industrial growth. By adopting even conservative growth-to-poverty elasticity estimates, the elimination of export restrictions would lead to a decline in the incidence of poverty of 1.4 to 6.9 percent (Nogués 2008).

Research from Tanzania also calls into question the effectiveness of using an export ban to suppress food price and poverty increases. Using a general equilibrium model to look at historical maize production volatility under different trade regimes, Ahmed et al. (2012) find a number of years in which Tanzania has had positive maize production deviations that coincide with high global prices. Some of these instances came in years in which the country had implemented an export ban, and the authors find that in these instances, the export ban increased poverty. In years of a production shortfall, they find that the export ban had a negligible effect on prices, and in some years even when production was below average, the subsequent price increase in domestic maize was still below the import parity price and therefore the ban limited potential exports to countries that experienced even greater negative deviations. Their findings show that the implementation of an export ban will limit the country's opportunity to take advantage of higher global prices and potential earnings.

3. STRUCTURE OF THE TANZANIA COMPUTABLE GENERAL EQUILIBRIUM MODEL

The computable general equilibrium (CGE) model for Tanzania has first been developed at the International Food Policy Research Institute (Pauw and Thurlow 2011) for growth and poverty reduction linkage analysis with a focus on agriculture-led growth. For this study, this model and the dataset, the social accounting matrix (SAM), have been updated to represent the Tanzanian economy in 2009. Although in the original model only agriculture was disaggregated across Tanzania's 21 regions, in the updated model the entire economy (including all nonagricultural sectors) is disaggregated across regions. In this way, the economic interlinkages between agriculture and the rest of the economy can be better captured at both regional and national levels to fully assess the economywide impacts of restricted trade.

The CGE model disaggregates the economy into 58 subsectors, and all subsectors are further disaggregated to the 21 regions. Among the 58 subsectors, 26 are in the agricultural sector (Table 3.1), which covers four broad groups: (1) cereals, (2) root crops, (3) pulses and oilseeds, and (4) cash crops. Besides crops, the model also includes 3 livestock subsectors, namely cattle, poultry, and other livestock such as sheep, goats, and pigs; and 2 other subsectors capturing forestry and fisheries. At the regional level, crop and livestock production are also both further disaggregated by small- and large-scale producers. Consistent with Tanzania's 2009 agricultural census, small-scale farmers are defined as those harvesting less than 5 hectares of land. The larger-scale farmers are mainly commercial plantations.

Table 3.1—Agricultural and nonagricultural subsectors in the CGE model

Agriculture— Crops	Agriculture— Livestock	Other Agriculture	Industry	Services
Maize	Cattle	Fisheries	Mining	Wholesale & retail
Sorghum	Poultry	Forestry	Meat & fish processing	Hotels and catering
Millet	Other livestock		Maize milling	Transport
Rice			Rice milling	Communications
Wheat & barley			Other milling	Financial & insurance
Cassava			Other food processing	Business & real estate
Other roots			Sugar refining	Public administration
Pulses			Tobacco processing	Education
Coconuts			Beverages	Health
Oilseeds			Textiles & clothing	Other services
Plantains			Wood & paper products	
Fruits			Basic chemicals	
Vegetables			Fertilizer	
Coffee			Petroleum products	
Cashews			Rubber & plastics	
Cotton			Nonmetallic minerals	
Sisal			Metal products	
Sugarcane			Machinery & equipment	
Tea			Other manufacturing	
Tobacco			Electricity & gas	
Other cash crops			Water supply	
			Construction	

Source: Pauw and Thurlow 2011.

Agricultural commodities can be exported to foreign countries or consumed by domestic households in Tanzania. Many of these commodities are used as intermediate inputs for agroprocessing, which is among the manufacturing subsectors included in the model. The agricultural subsectors themselves also use intermediate inputs produced by the nonagricultural sector, such as fertilizer as a product of the chemical subsector. The marketing services to move agricultural commodities from farmgate to markets are provided by the trade and transport subsectors. A complete list of the subsectors identified in the model is provided in Table 3.1.

The CGE model also captures heterogeneity in terms of the regions' role in maize production. As shown in Figure 3.1, maize surplus regions highlighted are considered exporting regions, while deficit regions are in white and are designated as net importing. This classification is based on in-country consultation and will be further discussed in detail below.

Figure 3.1—Maize surplus and deficit regions in Tanzania CGE model

Source: Authors.

Besides the 58 agricultural and nonagricultural subsectors that are defined for 21 regions, households in the CGE model are also disaggregated by region, which allows us to endogenously assess the heterogeneous impact of the export ban on various household groups. The regional household groups are first defined as rural farm, rural nonfarm, and urban households and then by five income quintiles. That is to say, in the model are $21 \times 3 \times 5 = 315$ household groups total. Each of the 315 household groups represents sample households (weighted by sample weights) included in the 2007 National

Household Budget Survey (HBS). According to 2007 HBS data, the poverty headcount for Tanzania is 37.6 percent in the rural areas and 24.1 percent in the urban areas (and 16.4 percent in Dar es Salaam). Thus, the first two low-income quintiles in the rural area and the first lowest-income quintile in the urban area can be approximated as the representative poor households. All the sample households in HBS are further defined in a microsimulation module and mapped with their representative 315 households in the CGE model. This allows us to assess the poverty effect of an export ban through a micro-to-macro linkage approach.

Household income mainly comes from returns to factors and wage income. While land as a production factor is defined at the regional level specifically for smallholders and large-scale commercial farms, labor and capital are mobile economywide. Labor markets are segmented across four skill groups according to education level: (1) uneducated, low-skilled workers, (2) workers with primary education, (3) workers with some secondary schooling, and (4) professional workers with secondary or higher schooling. While labor is mobile between agriculture and nonagriculture across regions, it is not across labor categories. Moreover, skilled workers with higher education are employed mainly in nonagricultural sectors and make up the relatively rich urban households, while income for poor households is generated mainly from wage earnings from low-skilled labor provision. The technical description of a dynamic CGE model can be found in Diao et al. (2012).

The CGE model is calibrated to the initial production of each farm type in each of the 21 subnational regions based on the 2008/09 agricultural census data. Agricultural and nonagricultural subsectors then respond to changes in the demand for their products, which causes the reallocation of land, labor, and other factors across different crops and noncrop sectors. The factor reallocation and changes in agricultural and nonagricultural production are the result of different productivity or policy shocks such as the imposition of export bans, which forces some subsectors (such as maize) to reduce their production. By capturing changes in production at the subsector level across subnational regions, the CGE model effectively integrates the data on the different agents and activities into an economywide model that can assess the effects of an export ban at the national level, while taking into account the microlevel decisionmaking typically associated with a single sector but more detailed farm models. The CGE model for Tanzania is therefore an ideal tool for capturing the growth linkages and income and price effects resulting from a maize export ban.

4. SIMULATION RESULTS OF TANZANIA DYNAMIC COMPUTABLE GENERAL EQUILIBRIUM MODEL

Using the dynamic CGE model for Tanzania described above, we assess the growth and welfare effect of maize export bans in order to address the policy questions discussed in the introduction: (1) Can controlling maize and other cereal exports keep domestic food prices low and, if yes, by how much? (2) Can maize export bans help national food security by improving food availability in the country? (3) Who would benefit and who would be hurt by the periodic export bans? (4) What are the impacts of export bans on the poor? (5) What are the impacts of export bans on agricultural growth?

We design two scenarios using the model to help address the above policy questions. In the first model scenario, economic growth is led by assumed exogenous productivity growth in both agricultural and nonagricultural sectors, together with exogenous labor growth and land expansion in crop production, both of which are based on historical trends and endogenous growth in capital accumulation. With productivity growth, exogenous labor growth, land expansion, and endogenous capital accumulation, both agricultural and nonagricultural production increase and household incomes grow. With increased agricultural production, besides formal maize export channels that are endogenous in the model, we further assume that cross-border maize exports that increase with production growth come only from maize surplus regions. Without detailed data and based on in-country consultation, such cross-border exports are assumed to be rather modest at 5 percent of regional maize production in the nine maize surplus regions (see Figure 3.1) in the base year (2011), with the proportion slowly rising to 21 percent of regional maize production by 2017. The slow increase in the proportion of cross-border exports in the maize surplus regions is chosen at a level where these exports should not cause maize producer prices to rise significantly in these regions. We call this first scenario the *free-export scenario*. In the second scenario, while all assumptions about productivity, population growth, and land expansion are exactly the same as in the free-export scenario, cross-border trade is banned for maize from 2011 until 2017. We call this the *export ban scenario*. The assessment of the impact of an export ban is conducted by comparing the model results obtained from these two scenarios.

Export Bans Have a Rather Modest Effect on the Food Price Index

The income elasticity of maize is less than one, and therefore as maize production increases, the domestic supply of maize grows faster than consumption. That is to say, with a 1 percent increase in income as a result of growth in both agricultural and nonagricultural production, domestic maize consumption demand will increase by less than 1 percent. Consumers will spend a smaller portion of their increased income on maize and more on nonfood products, particularly on manufactured goods. Thus, exports provide an important marketing channel to ensure that increased maize production will not cause maize prices to fall.

The export ban eliminates this important marketing channel for maize, therefore lowering total demand for maize produced domestically. As expected, this constraint on exports drives maize prices downward. However, at the regional level, the price effect of export bans differs between maize surplus and deficit regions, assuming that domestic markets are not fully integrated, which is a realistic assumption for Tanzania. The model simulations show that in the maize surplus regions, the producer price for maize is 18–20 percent lower than that in the free-export scenario in 2011, and even more so by 2017, decreasing by almost 25 percent. On the other hand, the export bans affect maize prices modestly in the deficit regions with producer price declining by 9 percent in 2011 (Figure 4.1).

Figure 4.1—Effect of export bans on maize producer prices across regions

Source: Tanzania dynamic CGE model result.

Given that maize going to the domestic market is supplied mainly from the surplus regions, the consumer price effect of export bans is driven primarily by the price effect in the surplus regions. For the country as a whole, export bans lower maize consumer prices by 13–16 percent depending on the period, benefiting those who purchase maize from the market. In addition, because of the general equilibrium effect, export bans also affect prices for other staples, but this effect is rather modest. While consumer price for sorghum rises slightly, consumer prices fall for all other food items. The short-term effect of this cross-price effect is less than 0.5 percent, while the medium-term effect is still less than 1 percent for most food items and more than 1 percent for only six food items. The negative effect on non-maize prices is larger for fruits than for other crops whereby fruit price declines by 3.7–4.8 percent depending on the period (Figure 4.2). A further assessment of the simulation results shows that export bans hurt one of the maize exporting regions, Manyara, more than the other regions. Manyara is also the most important fruit production region, accounting for one-third of national fruit production. As shown in Figure 4.7, the decline in the returns to farmland in Manyara is much larger than that which occurs in the other regions. Driven by the concentration of fruit production in Manyara and the general equilibrium effects of the declining returns to land (which is mobile across crops), when maize prices fall, the price for fruits falls more than that for other non-maize crops.

Figure 4.2—Effect of export bans on consumer prices for food commodities (percent change from free exports)

Source: Tanzania dynamic CGE model result.

While maize is an important food crop in Tanzania, its contribution to food price inflation is rather limited. For the country as a whole, the consumption patterns of wealthier households drive the average budget shares of consumer spending on different food and nonfood items, as about 50 percent of maize and maize flours is consumed by 20 percent of the richest households. These households also spend more income on higher-value food items such as meat and processed food products. Nationally, maize and maize flour accounts for only 7.4 and 8.5 percent of total food spending, respectively (Figure 4.3). Using the national consumption shares as weights in constructing the food price index, the model results show that banning cross-border maize exports lowers the national food price index by only 1.9–2.2 percent compared with the free-export scenario (Figure 4.4). An export ban therefore has only a limited effect on controlling overall food price inflation, the primary goal to be achieved by adopting this policy.

Figure 4.3—National food consumption share (total food expenditure is 100)

Source: Tanzania 2009 SAM.

Note: O.Livestock= Other livestock; O. milled grain= Other milled grain; O. Process food= Other processed food.

Figure 4.4—Effect of export bans on consumer price indexes

Source: Tanzania dynamic CGE model result.

Notes: CPI—consumer price index (including prices for both agricultural and nonagricultural goods and services); Agr. CPI—an index for consumer prices for agricultural products; Food CPI—consumer price index for food products including processed foods.

Export Bans Hurt the Rural Poor and Benefit the Urban Rich

While export bans allow consumers to enjoy relatively lower maize prices and to consume more maize, the economywide effect on total household consumption and hence welfare is mixed across different types of household groups. The benefits of export bans, measured as the change in real income, are disproportionately accumulated by urban households, while rural households benefit little or are hurt. Thus, the benefits to urban consumers come at a cost to rural households (Figure 4.5).

Figure 4.5—Income effect by quintile, percent change from free exports

Source: Tanzania dynamic CGE model result.

Note: q1–q5—income quintiles defined by per capita income at the national level; q1—the poorest 20 percent of households (the national total households are 100); q5—the richest 20 percent of households.

These outcomes are a consequence of two factors. First, in the general equilibrium setting, the decrease in the maize price lowers wages for low-skilled labor (Figure 4.6), upon which many of the poor depend to supplement household income. Second, the export ban negatively affects the returns to farmland, which is one of the primary assets for the poor farmer households (Figure 4.7). The impacts on land returns are significantly larger than those generated by the lower returns to unskilled labor. Export regions suffer far more than nonexporting regions, with the returns to land declining more than 10 percent in some cases. The returns to nonagricultural capital and wage rate for skilled labor increase, benefiting primarily the urban wealthy.

Figure 4.6—Returns to different types of labor, percent change from free exports, 2011

Source: Tanzania dynamic CGE model result.

Figure 4.7—Returns to smallholder farmland, percent change from free exports, 2011

Source: Tanzania dynamic CGE model result.

To fully understand the differential effects of export bans on rural and urban households in maize surplus and deficit regions across different income groups, Figure 4.8 displays the model result as changes in real income for different household groups in two regions. Mara is chosen as a maize deficit or maize nonexporting region, and Mbeya is a typical major maize surplus region. The figure clearly shows that the income lost to rural poor households in the maize surplus region, Mbeya in this case, is much more than the income gained by the urban households in the maize deficit region (Mara).

Figure 4.8—Household income effect of export bans in the selected two regions

Source: Tanzanian dynamic CGE model results.

Notes: Rural Ag—rural farm households; Rural Nonag—rural nonfarm households; Urban—urban households.

Export Bans Cause Poverty to Rise

Using a micro-to-macro linkage approach, we have created a microsimulation module that links to the CGE model to assess the impacts of an export ban on poverty. All sample households of the 2007 Household Budget Survey (HBS) are included in this microsimulation module. The 58 commodities consumed by each individual sample household in the microsimulation module are consistent with the

commodities in the CGE model. A monetary measure of household welfare is calculated from the households' actual consumption patterns in the 2007 HBS. This monetary measure changes over time as individual household consumption expenditures change on different commodities. By comparing this monetary measure with a level representing the poverty line, poverty rates can be calculated both initially, which is consistent with the poverty profile of 2007 HBS, and for the years following in the simulations.

The model result shows that the national poverty rate is 33 percent in 2010 and falls to 26.2 percent by 2017 under the free-export scenario. With export bans, the 2017 national poverty rate will be 26.6 percent, slightly higher than in the free-export scenario. This increased poverty rate is driven by a higher poverty rate in the rural areas as a result of lower unskilled wages and declined returns to land as discussed above, whereas the urban poverty rate in 2017 is slightly lower with the export ban (Table 4.1).

Table 4.1—Poverty effect of export bans

Poverty rate (%)	2010	2017	
		Free exports	Export bans
National	32.86	26.21	26.59
Rural	36.80	29.53	30.18
Dar es Salaam	15.48	10.81	10.73
Other Urban	21.04	16.22	15.80

Source: Tanzanian dynamic CGE model results.

Looking further at poverty at the regional level, the model results show that the rural poverty rate increases mainly in the maize surplus regions, as farmer households are hurt more. In total the export ban causes an increase in the population of rural poor of more than 210,000 by 2017, compared with the free-export scenario (Table 4.2). Two-thirds of the increased poor are from the maize-exporting regions. For the urban households as a whole, the number of poor falls by approximately 49,000 by 2017 due to the export ban, indicating that this policy primarily benefits urban households.

Table 4.2—Change in the number of poor due to export bans, 2017

Maize-exporting regions		Nonexporting regions	
Arusha	0	Coast	–8,139
Iringa	32,000	Dodoma	–9,478
Kigoma	0	Dar es Salaam	0
Mbeya	13,879	Kagera	–15,021
Morogoro	0	Kilimanjaro	0
Manyara	40,792	Lindi	0
Rukwa	26,735	Mara	9,274
Ruvuma	–22,273	Mtwara	0
Tanga	43,781	Mwanza	0
		Shinyanga	27,148
		Singida	47,651
		Tabora	23,819
Total	134,915	Total	75,254
Rural total	210,169		
Urban	–48,624		
National total	161,544		

Source: Tanzanian dynamic CGE model results.

Notes: A positive number indicates an increase in the number of poor; a negative number means a decrease in the number of the poor.

Export Bans Have Negative Longer-Term Effect on Growth

By reducing the profitability of the maize sector by instituting the ban, the incentives to invest in maize production are reduced. The export ban therefore negatively affects growth in maize production over time (Figure 4.9). With an export ban, maize production decreases by approximately 3 percent in nonexporting regions and more than 7 percent annually in exporting regions in 2017. By 2017, annual maize production in these regions will be 7.5 percent lower than without the ban. Thus, regional agricultural GDP in the maize surplus regions is also negatively affected (Figure 4.10). Short-term food security (maize availability) therefore comes at a cost to longer-term food (maize) availability and economic growth.

Figure 4.9—Growth effect of export bans on maize production across regions (percent change from free exports)

Source: Tanzanian dynamic CGE model results.

Figure 4.10—Impact of export bans on regional agricultural GDP (percent change from free exports)

Source: Tanzanian dynamic CGE model results.

5. CONCLUSIONS

Maize is an important crop in Tanzania. It is grown by almost all of the country's farmers, most of whom are smallholders and many of whom are poor. Agricultural growth in Tanzania has been supported by rapid growth in maize production in the recent years. Given that broad-based, agriculture-led growth is the key for poverty reduction and overall economic growth, promoting maize growth is a key for a successful agricultural development strategy as well as for poverty reduction in Tanzania. On the other hand, maize is often treated as a political crop, given that it is consumed by almost all households, rich and poor alike. Although maize may not lead to overall food price inflation, high maize prices for consumers often create political pressure on the government to directly intervene with policies to cope with a price hike. These policies in general—and export bans in particular—are often at a cost to long-term development goals, while the short-term benefit is rather limited. Moreover, when these interventions are periodically imposed, market uncertainty discourages private investment and market development in maize production and trade, which in turn causes more price instability in the future, hurting both producers and consumers.

In this study, a dynamic CGE model is developed for Tanzania and used for quantitatively assessing the impact of maize export bans in the country. This general equilibrium approach allows us to understand the interlinkage effects of export bans, which explicitly show who benefits and who is hurt and to what degree. The model results show that export bans can hurt the rural poor and in fact increase the number of people living in poverty in the rural areas, particularly in maize-exporting regions. While some urban poor households benefit, the increased number of poor in the rural areas is far greater than the number of those who benefit in the urban areas, resulting in an increase in the poverty rate for the country as a whole. Moreover, the dynamic feature of the analysis shows the interlinkages or trade-offs between short-term and longer-term effects of export bans. Even without considering the negative investment effect due to the uncertainty generated by the periodic imposition of export bans, the negative medium-term growth in maize production is quite significant.

REFERENCES

- Ahmed, R. U., 1988. "Rice Price Stabilization and Food Security in Bangladesh." *World Development* 16, 1035–1050.
- Ahmed, S. A., Diffenbaugh, N. S., Hertel, T. W., and Martin, W. J. 2012. Agriculture and Trade Opportunities for Tanzania: Past Volatility and Future Climate Change. *Review of Development Economics*, 16(3), 429–447.
- Aksoy, M. A., and B. Hoekman, eds. 2010. Food Prices and Rural Poverty. London: Centre for Economic Policy Research for the World Bank.
- Anderson, K., and W. A. Masters, eds. 2009. Distortions to Agricultural Incentives in Africa. Washington DC: World Bank.
- Anderson, K., and S. Nelgen. 2012. "Trade Barrier Volatility and Agricultural Price Stabilization." *World Development* 40 (1): 36–48.
- Chapoto, A., and Jayne, T. 2009a. The Impacts of Trade Barriers and Market Interventions on Maize Price Predictability: Evidence from Eastern and Southern Africa. Michigan State University International Development Draft Working Paper 102.
- Chapoto, A., and T. S. Jayne. 2009b. "Effects of Maize Marketing and Trade Policy on Price Unpredictability in Zambia." Food Security Research Project Working Paper No. 38. Lusaka, Zambia. Michigan State University.
- de Janvry, A., M. Fafchamps and E. Sadoulet 1991. "Peasant Household Behavior with Missing Markets: Some Paradoxes Explained." *The Economic Journal* 101: 1400-1417.
- Diao, X., J. Thurlow, S. Benin, and S. Fan. 2012. *Strategies and Priorities for African Agriculture: Economywide Perspectives from Country Studies*. Washington, DC: International Food Policy Research Institute.
- Dollar, D. 1992. "Outward-oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976–85." *Economic Development and Cultural Change* 1992:523–544.
- Frankel, J. and D. Romer. 1999. "Does Trade Cause Growth?" *American Economic Review* 89 (3): 379–399.
- Goetz, L., Glauben, T., and Brümmer, B. 2010. Impacts of Export Controls on Wheat Markets during the Food Crisis 2007/2008 in Russia and Ukraine. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association 2010 AAEA, CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010.
- Goetz, L., Qiu, F., Gervais, J., and Glauben, T. 2012. Export Restrictions and Multiple Spatial Price Equilibria When International Prices Spike: Export Quotas for Wheat in Ukraine. Invited Paper, IATRC Annual Meeting, San Diego, USA, December 9-11, 2012, 1–42.
- Coxhead, I., V. H. Linh, and L. D. Tam. 2012. "Global Market Shocks and Poverty in Vietnam: The Case of Rice." *Agricultural Economics* 43 (5): 575–592.
- Ivanic, M., and W. Martin. 2008. "Implications of Higher Global Food Prices for Poverty in Low-Income Countries." *Agricultural Economics* 39: 405–416.
- Johnson, S., J. D. Ostry, and A. Subramanian. 2010. "Prospects for Sustained Growth in Africa: Benchmarking the Constraints." *IMF Staff Papers* 57:119–171.
- Kilima, F. T. M., C. Chung, P. Kenkel, and E. R. Mbiha. 2008. "Impacts of Market Reform on Spatial Volatility of Maize Prices in Tanzania." *Journal of Agricultural Economics* 59 (2): 257–270.
- Martin, W., and K. Anderson. 2010. "Trade Distortions and Food Price Surges." Contributed paper for the 30th Anniversary Conference of the International Agricultural Trade Research Consortium (IATRC), Berkeley CA, 12-14 December 2010.
- Minot, N., and F. Goletti. 1998. "Export Liberalization and Household Welfare: The Case of Rice in Vietnam." *American Journal of Agricultural Economics* 80 (November): 738–749.

- Myers, R. J. 2006. "On the Costs of Food Price Fluctuations in Low-Income Countries." *Food Policy* 31:288–301.
- Nogués, J. J. 2008. The Domestic Impact of Export Restrictions: The Case of Argentina. Position paper. Agricultural and Rural Development Policy Series. International Policy Council (IPC), Washington DC.
- Pauw, K., and Thurlow, J. 2011. Agricultural Growth, Poverty, and Nutrition in Tanzania. *Food Policy*, 36(6), 795–804.
- Porteous, O.C. 2012. "Empirical Effects of Short-Term Export Bans: The Case of African Maize." Working Paper, Dept of Agricultural Economics, University of California, Berkeley.
- Swinnen, J. 2011. "The Right Price of Food." *Development Policy Review*, 29(6), 667–688.
- Wodon, Q., and Zaman, H. 2010. "Higher Food Prices in Sub-Saharan Africa: Poverty Impact and Policy Responses." *The World Bank Research Observer*, 157–176.
- Zezza, A., Davis, B., Azzarri, C., Covarrubias, K., Tasciotti, L., and Anriquez, G. 2009. The Impact of Rising Food Prices on the Poor. Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16-22, 2009.

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2033 K Street, NW
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Fax: +1-202-467-4439
Email: ifpri@cgiar.org