Are there positive synergies between agricultural export promotion and food security? Evidence from African economies

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Abstract

Despite the high food price crisis of 2008 and 2012, most governments in developing countries continue to support an open trade stance with the rest of the world and promote agricultural exports. However, there is scarce evidence on the synergetic effects of promoting agricultural export on domestic food security, and more particularly on the distributional effects of such policies on food access by households. This study uses a micro-macro modelling approach to examine the impacts of enhanced agricultural export orientation on the four dimensions of food security in three structurally food insecure African economies: Ethiopia, Kenya and Uganda. Our findings suggest that agro-export promotion is likely to negatively affect staple food consumption by urban households while gains are observed for rural households. These effects are stronger for Ethiopia and Kenya. We also find that risks associated with international commodity price and productivity failures can further deteriorate access to food in countries implementing agricultural export promotion policies.

Key words: *Agriculture, export orientation, domestic food security, Africa, economy-wide*

1. Introduction

1.1. Context on agricultural export and domestic food security

Agricultural and food prices have become increasingly volatile in recent years, while most developing countries, including those in Africa, are at growing state of urgency to reduce poverty and food insecurity. At the same time, these governments continue supporting agricultural exports and adapting a more open trade with the rest of the world. Proponents of export oriented agricultural production argue that increased production for export purposes will also encourage investment in other farm activities and improve access to inputs. They further argue that export production can help relax credit and financial constraints traditionally faced by farmers because exporting leads to increased incomes thereby allowing for an increased use of modern inputs; a kind of virtuous cycle which might otherwise not be possible if farmers are not participating in cash crop and export oriented production (Govereh and Jayne, 2003).

Resource poor developing countries also support export of agricultural commodities as a main source of foreign currency. There are, however, fears from a segment of the development community that support to the export sector could divert land, labor and other factors of production to export oriented agricultural activities to the detriment of domestic food production and food security.

Most of the empirical analyses on the impact of increased export promotion focus on the macroeconomic effects. The finding in this area is mixed, although the evidence that export promotes economic growth dominates. Allaro (2012), Ghatak *et al*. (1997) and Bbaale and Mutenyo (2011) are among the studies which examined the impacts of export growth on overall economic performance and observed pro-growth effects of export, supporting the neoclassical theory. However, the growth effect of export depends on the composition of exports (Poaster, 2012). Ghatak *et al*. (1997) tested this hypothesis on Malaysia and observed an evidence that processed and non-agricultural exports have typically positive impact on GDP growth. Similar evidence on the importance of the composition of exports is identified in sub-Sharan Africa (SSA) by Bbaale and Mutenyo (2011). Against the expectation, this study claims that growth in agricultural exports, and not manufacturing exports, is significantly associated with per capita growth in their sample.

Contrary to the dominant line of evidence, some scholars could not find a strong relationship between export promotion and economic growth. This finding prevails in the case of developing countries since most of them are heavily dependent on exports of primary commodities, which fetch lower prices in the global market and are mostly subject to large price and output fluctuations. For example, Yaghmaian and Ghorashi (1995) studied 30 developing countries and fail to support the neoclassical hypothesis that export leads to superior economic performance. Anwer and Sampath (1997) were also not able to get a positive impact of exports on economic performance for about 88 of the 96 countries in their sample. Kumari and Malhotra (2014) were also unable to observe an obvious link between exports and GDP per capita in the case of India. They associate this finding with the timing of changes in policies, the speed of reforms, and the nature of political governance in the country. This result on India is consistent with a previous study by Mishra (2011).

Despite this growing debate on the export-growth nexus in the theoretical and empirical literature, the synergetic effects of cash cropping and export promotion on other household activities, including food production, remain a relatively neglected aspect of export promoting

policies (Govereh and Jayne, 2003). Only very few studies have so far empirically examined the potential effects of cash crop of production on staple food production in the case of food insecure developing economies. Further, these studies are either exploratory or provide village level analysis without accounting for the economy-wide interactions. For examples, see Govereh and Jayne (2003), Govereh *et al*. (1999) Anderman *et al*. (2014), and von Braun (1995). Even when there are some evidences, the relationship between cash crop and food crop production is not conclusive (Govereh *et al*., 1999). Studies by Govereh and Jayne (2003) and Govereh *et al*. (1999) support the complementarity between high value cash crop production and food production in SSA. Wiggins *et al*. (2015) also reviewed several locality and village level studies in Africa on the food production impacts of cash crop production, although the studies do not specifically focus on export orientation. The studies reviewed provide some evidences contrary to the fear that promoting cash crops can compromise other agricultural activities. These studies show that food production sustain as cash crop output rises.

At the same time, a number of studies (von Braun and Kennedy, 1986; von Braun, 1995; Anderman *et al*., 2014) have observed a possibility of competition for resources between one another. Von Braun and Kennedy (1986) observed cases in a set of developing countries where cash crop production displaces food production, which in turn affects domestic food availability and nutrition. Negative and statistically significant relationship between cash crop income and nutrition also emerges from data on Kenya and Sierra Leone (von Braun, 1995). Further, Anderman *et al*. (2014) conduct a study on the tradeoffs between cash crop and food crop production on the case of Ghana, and find an indication that a household's intensity of cash crop production affects food availability significantly negatively.

Another more neglected aspect of export oriented policies is the synergetic effect that agricultural export can have on food security domestically, which can be measured by its four aspects: availability, access, utilization, and stability as declared in the 2009 World Summit on Food Security (FAO, 2009). There is also a lack of knowledge on how different household types can be affected in terms of access to food. Exports might not directly benefit the poor rural households as the people getting the income earned from agricultural exports might be those located downstream the value chain rather than those involved in production. Moreover, in most cases the foreign exchange is used as an indispensable means to finance the imports of capital goods. Even when part of the foreign exchange earnings is used to import food, it may not be staple food consumed by the poor but items preferred by better-off urban dwellers. It is this lack of understanding of and robust analyses on how the promotion of agricultural exports

by low-income food insecure countries affects food security domestically that motivates this study.

1.2. Study objectives

This study examines the synergies between export promotion, on the one hand, and food production and food security, on the other hand, in three structurally food insecure African economies of Ethiopia, Kenya, and Uganda. The study specifically answers the following specific questions:

(i) What are the overall production and income effects of agricultural export promotion?
(ii) Can agricultural export promotion strategies have considerable macro-economic impacts?
(iii) Can export oriented agriculture compromise food production and domestic food security?
(iv) How can the incomes of and consumption by different groups of households be affected by such an export orientation?

By answering these specific questions, this study fills a knowledge gap on export promotion of agricultural commodities and its subsequent implications on food production and food security. It specifically assesses household, sectoral and economy-wide level impacts of policies favoring agricultural export. As such, it provides useful information to policy makers interested in possible policy reform options. Further, as the role of trade for economic growth and poverty reduction is still under scrutiny and heavily debated, this study adds new information about the effects of agricultural trade in developing countries. By doing so, the study also offers insights on further research on the nexus between export orientation and domestic food security.

1.3. Scoping and definition of terms

By agricultural export orientation, the study refers to the production of agricultural commodities for the export market, which could potentially compete with the production of staple food crops, or the production of agricultural commodities destined to the domestic market. For clarity, we simplify our definition of export promotion as policy support to the production and export of commodities that has traditionally been, or recently emerge as export commodities in the countries trade accounts. In general, we consider four classes of agricultural export commodities: First, *cash crops* that are exclusively grown for sale, which include crops that are non-food, such as cotton, coffee, cocoa or tea. Second, *food crops* that are produced with a 'marketable surplus', which include crops that may be consumed by the farm household

or sold on the markets, such as oilseeds, wheat or maize.[1] Third, *non-traditional exports* (NTEs)[2] such as fruits and vegetables. Fourth, a group that combines all the previous three groups of agricultural commodities and treats the policy of promoting agricultural exports across the board. These agricultural products may be produced by small-scale family farms, or at larger scale on estates and plantations.

2. Export promotion policies in Ethiopia, Kenya, and Uganda

Export promotion policies can be defined as those that induce economic agents to participate in export-oriented production and trading. These include those administrative and policy measures that intend to cut production costs and facilitate economic transactions thereby supporting the competiveness of the export sector. In view of realizing the perceived benefits of export promotion, the governments of Ethiopia, Kenya, and Uganda offered a wide range of export incentives through institutions such as The Ethiopian Investment Agency (EIA) in Ethiopia, Export Promotion Council (EPC) in Kenya, and Uganda Investment Authority (UIA) in Uganda in collaboration with customs and revenue authorities in the respective countries. These incentives can either be fiscal, financial and non-monetary incentives.

However, potential benefits of export promotion usually come at the expense of considerable monetary and non-monetary costs. One can identify four types of costs related to granting incentives for investors and the business community: (i) distortions between sectors granted incentives and those without incentives, (ii) forgone fiscal revenue and cost of financial support, (iii) competition for scarce administrative resources, and (iv) the social cost of possible corruption and rent seeking activities. Some existing cost estimates cover incentives for all activities (agricultural and non-agricultural). However, these fiscal and other incentives are by design more generous for export oriented activities.

An estimate (Woldegiorgis, 2012) shows that Ethiopia loses a tax revenue reaching to 3.9% (about US$1.3 billion) of its GDP in 2009 associated with tax incentives, although it stabilized at 3.4% of GDP since 2010. Others push the lost revenue further to 5.0% of GDP and 51.0% of tax revenue on average between 2005 and 2009 (Bora, 2013). Although it is difficult to

[1] These can further be classified as main exportable food crops such as oilseeds and other food crops such as wheat and maize.

[2] Non-traditional export is defined in Poaster (2012) as a commodity that is not traditionally produced in a particular country, or has been traditionally produced for domestic consumption, but now is exported. Hallam *et al.* (2004) identified exports of fruits, vegetables and other specially produced and processed commodities as non-traditional exports.

attribute all foregone tax revenue to exports, this indicates that a dollar of exports might have costed $0.47 to the country budget in terms of forgone tax revenue. Even under a conservative scenario by which only 25% of foregone tax is attributed to exports, realizing a $1 export would cost $0.12 in tax revenue foregone considering the data from 2005 to 2010. The IMF study estimates that tax incentives offered in Ethiopia for export-oriented firms reduces tax revenue by 2.8% of GDP yearly (IMF, 2015). In Kenya, tax incentives reach 3.1% (about US$1.1 billion) of the country's GDP, 27.8% of which is directly related to export incentives (IEA, 2012; Curtis *et al*., 2012). For Uganda, the African Development Bank (AfDB) estimates that the country lost a tax revenue of at least 2.0% of GDP or US$272 million in 2009/10 (Curtis *et al*., 2012). What is more, these figures could be considerably higher if all incentives were quantified and included. Moreover, export promotion packages may not yet be fully operational. For example, in Ethiopia, only less than 20% of the exporters take advantage of the export voucher package (Woldegiorgis, 2012). Had these export promotion schemes been fully used, foregone tax would have been substantially larger and increasing over time.

3. Modelling agricultural export orientation and food security

3.1. Linking agricultural export orientation to domestic food security

This section develops an analytical framework for assessing the impacts of agricultural export on local food security, following researches on the biofuel sector (Wiggins *et al*., 2008; and Elbehri *et al*., 2013). Drawing on such extensive literature, we show that agricultural export orientation can generate a mixture of positive and negative impacts on different aspects of household food security, where the net effect of the policy depends on the balance between the gains and the losses and how the net gains/losses are distributed across households.

Table 1 outlines the most obvious pathways through which export agriculture may affect the four dimensions of food security (i.e., availability, access, utilization, and stability) at the domestic economy level. The 2009 World Summit on Food Security (FAO, 2009) defines food *availability* as a supply side variable determined by the level of production, stocks and net-imports of food, whereas *access* to food refers to the economic and physical access to the available food, mainly from the household perspective. *Utilization* rather refers to the way individuals are able to consume food and is closely linked to nutritional status. *Stability* considers the maintenance of food security through time despite possible outside shocks such as food price volatility and harvest failures. FAO (2009) highlights the centrality of food

utilization and nutrition availability in the concept of food security. For technical reasons, this study principally focuses on the availability (supply) and access (income and price) aspects of food security. However, by translating the changes in household commodity consumption (as one key nutritional dimension) in response to simulated changes in the degree of agro-export orientation, we are able to examine the utilization aspect. We also investigate the impact of agricultural export orientation on stability of access to food by jointly considering exogenous shocks to international price and agricultural production.

Table 1: Export orientation and household food security – potential pathways and effects

	Potential positive pathways	**Potential negative pathways**
Availability	Export production relaxes credit and financial constraints and could increase the use of modern inputs for food production. Productivity spillovers to other agricultural activities as improved farm methods used in export oriented production can be imitated and applied. Increased capacity to import food using the foreign currency earned.	Diversions of land, labor and capital from food production or production for domestic supply, leading to reduced food availability domestically. Reduced domestic availability of food due to increased exports.
Access	Gains in incomes from increased agricultural operations. Increased incomes from the factor market due to higher wages, or increased demand for factors.	High food prices due to scarcity of domestic food supplies. Income uncertainty due to world price volatility for exportable.
Utilization	Increased food consumption leading to improvements in calorie intake.	High calorie food items could be expensive domestically, leading to reduced calorie intake.
Stability	Higher overall production, leading to increased incomes to withstand price disruptions.	Domestic access to food might be more subject to international price volatility and production shocks.

Source: Own compilation based on existing theoretical and modelling literature

3.2. Modelling strategy

The synergies between agricultural export orientation and food security in Ethiopia, Kenya, and Uganda are studied using a top-down micro-macro modelling approach. The core macro model, ultimately linked top-down to a survey based nutrition module, is an economy-wide, multi-sector static computable general equilibrium (CGE) model described in Aragie (2014). This model is an extension of the STAGE model (McDonald, 2007), which is a member of the

class of single country CGE models that are descendants of the approach to CGE modeling described by Dervis *et al*. (1982). Such models are used extensively in policy analyses, and provide adequate frameworks for capturing linkages between economy-wide changes or shocks; the sectoral structures of production, trade, and employment; and distributional outcomes (Ganuza *et al*., 2005). As such, the model employed for this study helps to identify the economy-wide impacts of agro-export orientation, which depends largely on the inter-sectoral linkages. This model is particularly tailored to economic analysis in developing countries as it accounts for some salient features of the rural economy such as production for own consumption by explicitly modelling households as joint producers and consumers (i.e., the presence of home production for home consumption). These modifications to the original model were desirable to better portray the production and consumption systems in peasant economies, such as those in SSA.

Production follows a multi-level nested structure where household and non-household enterprises are modelled as profit maximizers. All activities are generally assumed to use nested constant elasticity of substitution (CES) technology, but different activities may have different values of substitution elasticity. Specifically, the production nesting structure in the STAGE model discussed in McDonald (2007) is modified to account for the production nesting structure considered more appropriate for the economies under consideration. At the lowest strata of the production nest, physical land is combined with irrigation to form the *land-irrigation* aggregate. This aggregate input is then further combined with fertilizer to form *land-irrigation-fertilizer* aggregate. This way of aggregating land, irrigation and fertilizer across different stages helps capture the different rates of substitution among the inputs as well as the close substitutability across these inputs.

Consumers behavior is defined by a two-stage consumption nesting such that household demand for commodities reflects the source of commodities as defined in the social accounting matrixes (SAMs) (see below). At the bottom of the consumption nest is a CES demand system where pair of notionally identical own produced and marketed commodities are combined to provide aggregate consumption of the commodity. Consumers decide on the optimal combination of these two types of commodities based on their relative prices, subject to the imperfect substitution elasticity defined effectively as part of the CES function. At the top of the nest, consumers maximize utility from the consumption of a set of composite commodities (from the lower nest) subject to their budget constraints and the linear expenditure demand systems (LES) derived from Stone-Geary utility functions. LES demand systems split

subsistence consumption, which is still a dominant phenomenon in low-income countries, from discretionary consumption where the amount of household budget on discretionary demand is a residual component of total household consumption budget and committed expenditure on subsistence demand.

The country model variables and parameters are calibrated to a set of standardized SAMs capturing the economic structures of the respective countries. The SAMs used in this study have several salient features as they: (i) split commodities into own account and marketed counterparts, and (ii) incorporate households as producing units in the activities account separating them from activities by non-household enterprises thereby properly reflecting the consumption and production structures of semi-subsistence economies. The SAMs are constructed in conformity to the recommendations of the System of National Accounts (SNA) that 'in situations where there is a significant amount of consumption represented by own account production, it would be useful to record the distinction between consumption expenditure by households on home production for home consumption commodities from commodities purchased in the market place' (ISWGNA, 2009, paragraph 14:65).

The SAM for Ethiopia (Aragie, 2014) reflects the structure of the economy in 2010, and includes 39 commodities of which 15 are home production for home consumption, 57 activity accounts, 35 representative household groups, and 88 factor types where about two-third are labor types classified into five skill levels for each regional state in the country. The SAM for Kenya (Boulanger *et al*., 2016) represents the economy in 2014 and constitutes 70 commodity accounts of which 19 are home consumed, 52 activity accounts, 6 representative households, and 14 factor types. On the other hand, as an updated SAM for Uganda was not available, we estimate our own SAM for the country representing transactions in 2013 and supply and use information in 2010. The newly estimated SAM incorporates 86 commodity classifications of which 29 are home consumed, 43 activity accounts, 8 representative households, and 25 factor classifications.

To more closely investigate the impact of agro-export promotion on nutrition, a nutrition module is developed and linked top-down to the CGE model. We use food consumption data and initial household calorie availability derived from the respective household surveys. We specifically use the 2009/10 Ethiopian Household Income and Consumption (HIC) survey, the 2005/06 Kenya Integrated Household Budget Survey (KIHBS), and the 2012/13 Uganda National Household Survey (UNHS). As the raw survey data obtained do not incorporate

caloric content for each food commodity, conversion factors obtained from FAO (1968) and FAO (2003) are used to convert physical consumption to calorie equivalent. Further, we used kilogram-equivalent measures reported as part of the Malawi Third Integrated Household Survey (IHS3) 2010/11 (World Bank, 2015) to translate non-standard units of measurement in the Kenya and Uganda surveys, although we recognize that this is not an ideal alternative due to socio-economic differences between the countries. For the Ethiopian survey, the data obtained have already been largely standardized. Once calorie intake at the household level is determined, per capita calorie availability at the base case is computed using national adult equivalent measures. Changes in food consumption quantities based on CGE simulations are then applied to the survey data to estimate changes in household calorie availability for each country. This is done for each of the simulation experiments. Changes in nutrition are analyzed at rural, urban, and national levels.

3.3. Simulation design

Choosing the appropriate entry point through which export promotion could affect an economy is a tricky exercise as one can identify alternative pathways. It could also depend on the specific incentive package provided by the respective countries. However, the following four options are compelling: (i) export subsidy; (ii) productivity enhancing support to the export producing sector; (iii) selective capital (factor) mobility (due to policy induced exogenous shocks) to the export agriculture; and (iv) land reallocation away from other (such as food) agriculture. While the later three options directly alter production, the export subsidy affects relative prices in the domestic and export market. This change in relative prices influences domestic outcomes (production composition, supply, and prices) endogenously, making it a more natural choice for analyzing economic adjustments in response to the export promotion policies reviewed in section 2. Hence, we assume a hypothetical 10 percentage point increase in export subsidy from base levels for all case study countries. We group the commodities which receive export subsidies as (i) the whole agricultural sector, (ii) cash crops only, (iii) food crops only, and (iv) NTEs only.

Export orientation in small developing countries is inherently liable to a number of risks. The main one appears to be price fluctuation in the international market. For example, international food prices have been strongly oscillating since the second half of the 2000s, increasing by 26 and 20% in 2007-08 and 2010-11, respectively, while jumping down by 20, 4 and 11%,

respectively, in 2009, 2012-14, and 2015-16 (FAO, 2016). To account for such price risks in the international market, a further simulation of a 10% decline in world prices of food and agricultural commodities is assumed while governments promote exports. Another risk considered is crop failure due to weather and climatic shocks. This is captured by reducing productivity in the agricultural sector by 10%, and endogenously examining the price and income responses, and their combined effects on food security. Although they can be viewed as avenues for result sensitivity analysis, these two set of extra simulations are mainly used in this study to assess the impact of increased export orientation on the stability dimension of domestic food security. Further set of simulation experiments are also designed to test sensitivity of results when productivity spillovers are allowed and alternative trade elasticities are assumed (see Online supplement 1 and Online supplement 2).

3.4. Macro-closure rules and market clearing conditions

In order to make the analysis as comparable as possible, we imposed standardized macro-economic closure rules and market clearing conditions in each country model. Such standardization is not unreasonable given the similarities in level of economic development across the three countries. This way, differences in simulation results per country are reduced to differences in economic structure (such as sectoral composition) and capacity to respond to relative price changes. Specifically, a small country assumption is imposed for each country vis-à-vis the rest of the world. In relation to the behaviors of saving and investment, an investment driven saving closure is considered, where the saving rate in each country is allowed to respond to changes in investment demand. As it is difficult for such small open economies to raise the required amount of foreign savings, fixed external balance is imposed where the exchange rate endogenously adjusts to clear the external balance. Further, each government is assumed to maintain its internal balance at the base level by allowing for consumption to freely adjust. We impose a simplified assumption with regard to factor markets. Factors of production are assumed to be fully employed, only implying that the transition from state of unemployment to employment, and vice-versa, is limited in apparently segmented rural settings of these countries. We, however, allow for factors to move between activities subject to changes in relative profitability.

4. Evidence on the impact of agricultural export promotion on food security

4.1. Food security effects of agricultural export promotion

Agricultural export versus food availability

Increased agricultural exports have overall positive production and commodity supply effects on the agricultural sector for all countries, irrespective of the group of commodities targeted (Table 2). Exceptions are policy support to promote overall agricultural and cash crop exports in Uganda and NTE commodities in Kenya where these could result in slight declines in agricultural and overall commodity supplies. Looking at the commodity production effects, consistent with the macroeconomic effects discussed above, reduction in export taxes of all agricultural commodities has superior effects on agricultural output, followed by export support to cash crops only. These effects are stronger for Kenya, where the agricultural sector can experience a 3.6% increase in output, while Uganda sees a 1.0% surge. While cash crops are the sole contributors of the gain in agricultural production in Kenya and Uganda, both the oilseed and cash crop sub-sectors have fair shares in the agricultural growth performance of Ethiopia. We also observe substitution towards the commodities targeted by the policy as producers respond to differences in profitability across production options within the agricultural sector and at the economy-wide level. The economy-wide reallocation of resources is evidenced by the slight reductions in industrial and service outputs, which contribute to an overall decline in output particularly in Ethiopia and Uganda. Kenya experiences a slight overall gain owing to a stronger positive response in the agricultural sector although both the industrial and service sectors slightly contract.

The direction of response in commodity supplies is largely consistent with changes in commodity production, mainly when the cash, food, or the whole agriculture sectors are supported. However, the magnitude of the changes is significantly reduced due to increased leakages of output away from the domestic markets resulting from an export expansion. Responses in commodity supplies remain relatively stronger for Kenya where agricultural supply increased by more than half a percent when exports of cash crops or all agricultural commodities are encouraged by the tariff reduction (Table 2). Unlike the changes in agricultural production for this country, expansions in overall agricultural supplies are contributed by field crops and cash crops.

Supporting agricultural exports is not particularly commodity supply enhancing for Uganda since growth in net-exports outweigh gains in production. Also, it appears that the Kenyan

government should be cautious in supporting exports of NTEs as that might result in a 1.2% reduction in agricultural supplies due to the policy derived considerable surges in exports of both NTEs and cash crops (see Annex 2). This might not, however, have huge food security implications as supplies of staple food commodities stabilized. The reduced decline in per capita calorie availability reported in Table 6 supports this. The overall commodity supply implications of supporting agricultural exports is mixed across these countries: while overall commodity supply marginally declines for Ethiopia and Uganda, responses are slightly positive for Kenya typically when the policy targets cash crops and the overall agricultural sector.

Table 2: Simulated percentage changes in commodity production and supplies

	Ethiopia				Kenya				Uganda			
	Agric	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**
Changes in commodity production:												
Agriculture	**0.69**	**0.58**	**0.12**	**-0.20**	**3.66**	**3.60**	**0.08**	**0.76**	**1.10**	**1.02**	**0.14**	**0.17**
Field crops	0.32	0.12	0.21	-0.27	-1.83	-2.14	0.39	-1.48	0.04	-0.13	0.18	0.07
Cereals	-0.02	-0.20	0.19	-0.27	-1.16	-1.35	0.23	-0.93	0.07	-0.11	0.18	0.07
Pulses	0.19	-0.24	0.46	-0.27	-4.03	-5.49	1.81	-3.70	0.04	-0.15	0.19	0.10
Oilseeds	8.82	9.16	-0.31	-0.27	-2.86	-2.98	0.14	-2.10	-0.02	-0.16	0.14	0.05
Fruits and vegetables	0.60	0.48	0.13	-0.28	-0.87	-1.48	0.74	-0.48	0.08	-0.12	0.21	0.11
Cash crops	4.08	4.27	-0.20	-0.19	24.53	25.78	-1.53	7.70	14.28	15.32	-0.38	1.23
Livestock, poultry, forestry and fishing	-0.19	-0.21	0.02	1.18	-0.25	-0.38	0.16	-0.37	0.00	-0.16	0.16	0.08
Industry	**0.30**	**0.27**	**0.03**	**0.77**	**-0.53**	**-0.56**	**0.04**	**-0.84**	**-0.15**	**-0.25**	**0.09**	**0.04**
Food & agro-processing	0.29	0.25	0.05	2.95	-0.03	-0.13	0.12	-0.45	-0.07	-0.03	-0.04	0.01
Mining & other manufacturing	0.30	0.27	0.03	0.01	-0.69	-0.70	0.02	-0.96	-0.19	-0.37	0.16	0.06
Services	**-2.17**	**-1.96**	**-0.23**	**-2.73**	**-0.48**	**-0.44**	**-0.05**	**-0.30**	**-0.39**	**-0.30**	**-0.10**	**-0.04**
Trade & business services	-2.36	-2.13	-0.25	-3.14	0.22	0.20	0.02	0.36	-0.11	-0.13	0.00	0.02
Government services	-1.02	-0.93	-0.10	-1.90	-2.45	-2.27	-0.24	-2.17	-1.34	-0.89	-0.44	-0.25
All	**-0.15**	**-0.16**	**0.01**	**-0.29**	**0.37**	**0.36**	**0.00**	**-0.24**	**-0.03**	**-0.04**	**0.01**	**0.03**
Changes in commodity supplies:												
Agriculture	**0.17**	**0.11**	**0.07**	**0.04**	**0.63**	**0.51**	**0.14**	**-1.14**	**-0.02**	**-0.07**	**0.05**	**0.05**
Field crops	0.15	0.07	0.08	0.00	0.70	0.57	0.15	0.24	-0.22	-0.10	-0.13	0.09
Cereals	0.14	0.07	0.07	0.01	0.47	0.32	0.17	0.11	-0.20	0.04	-0.24	0.09
Pulses	0.13	0.05	0.09	-0.02	1.70	1.57	0.16	0.82	-0.07	-0.02	-0.04	0.10
Oilseeds	0.62	0.55	0.08	-0.36	0.69	0.62	0.08	0.23	-0.50	-0.63	0.14	0.08
Fruits and vegetables	0.36	0.31	0.06	0.27	-0.75	-0.94	0.22	-0.57	-0.01	-0.07	0.05	-0.03
Cash crops	0.11	0.05	0.06	0.00	22.67	23.52	-0.95	-42.25	0.33	0.46	-0.05	0.22
Livestock, poultry, forestry and fishing	0.14	0.10	0.04	0.08	0.02	-0.10	0.15	-0.09	0.08	-0.09	0.17	0.09
Industry	**0.75**	**0.67**	**0.08**	**0.54**	**0.79**	**0.78**	**0.01**	**0.04**	**0.30**	**0.18**	**0.12**	**0.08**
Food & agro-processing	0.47	0.41	0.06	0.34	0.47	0.38	0.11	-0.09	0.13	0.10	0.04	0.06
Mining & other manufacturing	0.79	0.71	0.08	0.57	0.85	0.85	-0.01	0.07	0.36	0.21	0.15	0.09
Services	**-1.42**	**-1.28**	**-0.15**	**-1.15**	**-0.21**	**-0.17**	**-0.06**	**-0.22**	**-0.31**	**-0.22**	**-0.10**	**-0.04**
Trade & business services	-1.47	-1.33	-0.16	-1.19	0.65	0.64	0.01	0.53	0.00	-0.01	0.00	0.02
Government services	-0.96	-0.87	-0.09	-0.79	-2.45	-2.27	-0.24	-2.17	-1.32	-0.88	-0.45	-0.25
All	**-0.16**	**-0.16**	**0.00**	**-0.18**	**0.34**	**0.34**	**0.00**	**-0.27**	**-0.02**	**-0.04**	**0.01**	**0.02**

Source: Simulation results based on single country models

Agricultural export versus access to food

The impact of agro-export promotion on access to food is evaluated by examining changes in commodity prices (Table 3) and purchasing capacity of households (Table 4). Commodity price changes suggest that further agro-export promotion could push domestic consumer prices for agricultural commodities up in many cases (see Table 3). An exception is the slight drop in overall agricultural price in Kenya when the subsidy covers food exports. Meanwhile, price surges are stronger for Kenya as agricultural commodity price can increase by more than 4.0%. Interestingly, consumer prices of cash crops slightly decline for all countries when a cash crop export promotion policy is adapted, while there is an overall increase in consumer prices for the respective group of commodities when exports of either all agricultural, food or NTE commodities are supported. However, the overall effect of agro-export promotion is marginally negative owing to proportionately stronger declines in consumer prices in the industrial and services sectors.

Table 4 takes on the impact of increased agricultural export on household income and expenditure. In line with the effects of agro-export promotion policy on economic activity, cutting down agricultural export tariffs by 10% works against incomes of urban households, except in the case of Uganda where the policy has virtually no impact. Urban Ethiopia and Kenya may lose up to 2.0 and 1.0% of incomes, respectively, due to poor performance of the typical urban sectors (i.e., industry and services). Conversely, rural households in all countries benefit from such policy measures as their incomes surge by noticeable rates; these surges are pronounced in Kenya where average rural incomes improve by up to 3.5%. Unambiguously, cash crop promotion is the most effective source of rural income growth in all countries. In net terms, agro-export promotion policy is national income enhancing, even without accounting for productivity spillover effects.

Household expenditure changes in the same fashion as incomes. However, expenditure gains/losses are slightly lower/higher than income gains/losses for Ethiopia and Kenya as private savings have increased significantly in these countries (Table 4). While urban households in Ethiopia and Kenya face contractions in their consumption expenditures by respective rates of 2.2 and 1.7%, specifically when cash crop export promotion policy is adapted, rural households experience increases in expenditures contributing to overall gains in consumption at national levels. For Uganda, household expenditure changes are very close to income changes as savings adjust only very slightly due to the minimal impact of agro-export

promotion policy in this country. The effect of the policy specifically on food consumption and utilization is not fully clear from this discussion and is addressed in the succeeding section.

Table 3: Simulated percentage changes in commodity prices

	Ethiopia				Kenya				Uganda			
	Agric	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**
Agriculture	**1.36**	**1.28**	**0.08**	**1.09**	**4.12**	**4.19**	**-0.08**	**2.89**	**0.83**	**0.41**	**0.40**	**0.14**
Field crops	1.37	1.29	0.09	1.06	2.68	2.70	-0.01	2.01	1.47	0.35	1.12	-0.03
Cereals	1.35	1.26	0.09	1.05	3.61	3.60	0.02	2.58	1.88	0.25	1.63	-0.06
Pulses	1.53	1.45	0.09	1.23	-0.38	-0.21	-0.21	0.16	1.41	0.49	0.94	-0.10
Oilseeds	0.85	0.75	0.12	-0.09	2.06	2.05	0.01	1.60	0.27	0.52	-0.26	0.19
Fruits and vegetables	1.66	1.62	0.04	1.45	5.55	5.79	-0.26	3.73	1.37	0.94	0.45	0.67
Cash crops	-0.19	-0.18	-0.01	-0.17	-0.38	-0.47	0.11	8.85	-4.01	-4.21	-0.02	-1.29
Livestock, poultry, forestry and fishing	1.56	1.49	0.08	1.34	4.65	4.63	0.02	4.18	0.35	0.47	-0.16	-0.04
Industry	**-1.58**	**-1.48**	**-0.10**	**-1.28**	**-2.05**	**-2.12**	**0.08**	**-1.17**	**-0.37**	**-0.20**	**-0.17**	**-0.12**
Food & agro-processing	-1.12	-1.05	-0.07	-0.92	1.01	0.99	0.02	0.96	0.03	-0.01	0.03	-0.07
Mining & other manufacturing	-1.65	-1.55	-0.11	-1.33	-2.69	-2.76	0.09	-1.61	-0.51	-0.27	-0.24	-0.14
Services	**-1.24**	**-1.18**	**-0.07**	**-1.05**	**-1.42**	**-1.45**	**0.02**	**-1.52**	**-0.37**	**-0.13**	**-0.23**	**-0.13**
Trade & business services	-1.28	-1.21	-0.07	-1.07	-1.22	-1.25	0.03	-1.37	-0.36	-0.10	-0.23	-0.12
Government services	-0.90	-0.88	-0.03	-0.83	-1.98	-1.98	-0.01	-1.93	-0.44	-0.23	-0.24	-0.14
All	**-0.35**	**-0.33**	**-0.02**	**-0.30**	**-0.72**	**-0.74**	**0.03**	**-0.61**	**-0.13**	**-0.05**	**-0.08**	**-0.07**

Source: Simulation results based on single country models

Table 4: Simulated percentage changes in incomes and spending

	Agriculture	Cash crops	Food crops	NTE
Changes in household incomes:				
Ethiopia				
Rural	1.40	2.10	1.25	1.89
Urban	-1.34	-1.99	-1.26	-1.88
National	0.64	0.96	0.55	0.83
Kenya				
Rural	2.31	3.47	2.24	3.37
Urban	-0.62	-0.92	-0.65	-0.98
National	1.00	1.50	0.94	1.42
Uganda				
Rural	0.49	0.77	0.28	0.45
Urban	-0.17	-0.25	0.06	0.09
National	0.27	0.43	0.21	0.33
Changes in household spending:				
Ethiopia				
Rural	1.34	2.02	1.20	1.80
Urban	-1.46	-2.16	-1.38	-2.04
National	0.61	0.92	0.52	0.79
Kenya				
Rural	1.77	2.68	1.68	2.56
Urban	-1.18	-1.72	-1.23	-1.80
National	0.46	0.73	0.39	0.63
Uganda				
Rural	0.50	0.78	0.30	0.48
Urban	-0.15	-0.22	0.09	0.14
National	0.30	0.46	0.23	0.37

Source: Simulation results based on single country models

Agricultural export versus food utilization

We start our discussion of the impact of agro-export orientation on food utilization and nutrition availability by examining the impact of the policy on commodity consumption as this appears to be the obvious and more direct impact pathway of the policy shock. Indeed, it helps establish the basis for micro-simulating the effect on food utilization using a full set of nationally representative households from the surveys available for each country.

Simulation results from the standard CGE model reveal that policies that encourage agricultural export affect commodity consumption by rural and urban households in contrasting ways. Urban households are highly likely to face reductions in consumption, while their rural counterparts tend to gain. The decline in consumption by urban households are stronger in Ethiopia and Kenya, specifically when the export promotion policy targets either all agriculture, cash crops, or NTE commodities (Table 5). Typically, households in urban

Ethiopia and Kenya could lose consumption of agricultural commodities by up to 1.7 and 2.1%, respectively, with potentially considerable implications on food security among the poor. Both price and income effects are into play for the decline in consumption of agricultural commodities in urban areas, while the income effect fully explains the loss in consumption of non-agricultural commodities among these households.

Meanwhile, rural households enjoy gains in consumption; the gains are stronger for non-agricultural commodities owing to declines in prices of these commodities coupled with expansions in incomes as agricultural production responds positively (see Table 2). Overall consumption in rural Ethiopia and Kenya expands by 0.9 and 1.5%, respectively, in response to the policy shock. Rural households in Uganda may, however, face slight reductions in food consumption. National level results reported in Table 5 show a potential for agro-export promotion to improve overall commodity consumption in all countries, while Kenya might experience slight declines in agricultural consumption. There are also very minimal economy-wide consumption effects on food and agricultural commodities, specifically for Ethiopia and Uganda.

Table 5: Simulated percentage changes in commodity consumption

	Agriculture			Cash crops			Food crops			NTE		
	Rural	**Urban**	**National**	**Rural**	**Urban**	**National**	**Rural**	**Urban**	**National**	**Rural**	**Urban**	**National**
Ethiopia												
Agriculture	**0.58**	**-1.72**	**0.15**	**0.49**	**-1.64**	**0.09**	**0.10**	**-0.10**	**0.07**	**0.38**	**-1.45**	**0.04**
Field crops	0.57	-1.73	0.11	0.46	-1.65	0.04	0.12	-0.10	0.08	0.34	-1.47	-0.02
Cereals	0.60	-1.73	0.12	0.48	-1.64	0.05	0.12	-0.10	0.08	0.35	-1.46	-0.02
Pulses	0.52	-1.81	0.11	0.41	-1.74	0.03	0.12	-0.08	0.08	0.29	-1.53	-0.03
Oilseeds	-0.77	-0.49	-0.74	-0.79	-0.41	-0.75	0.02	-0.08	0.01	-0.27	-0.92	-0.34
Fruits and vegetables	0.62	-1.78	0.36	0.55	-1.72	0.31	0.07	-0.06	0.06	0.48	-1.49	0.27
Cash crops	0.18	-0.61	0.08	0.10	-0.58	0.01	0.08	-0.05	0.06	0.03	-0.52	-0.04
Livestock, poultry, forestry and fishing	0.68	-1.82	0.14	0.60	-1.71	0.10	0.08	-0.12	0.04	0.52	-1.51	0.08
Industry	**1.36**	**-0.44**	**0.67**	**1.20**	**-0.42**	**0.58**	**0.16**	**-0.02**	**0.09**	**0.99**	**-0.39**	**0.46**
Services	**1.39**	**-0.81**	**0.82**	**1.25**	**-0.76**	**0.74**	**0.14**	**-0.06**	**0.09**	**1.08**	**-0.66**	**0.63**
All	**0.91**	**-1.07**	**0.43**	**0.80**	**-1.02**	**0.35**	**0.12**	**-0.06**	**0.08**	**0.66**	**-0.90**	**0.27**
Kenya												
Agriculture	**0.73**	**-1.96**	**-0.22**	**0.62**	**-2.06**	**-0.33**	**0.13**	**0.13**	**0.13**	**0.17**	**-1.04**	**-0.26**
Field crops	1.18	-1.05	0.69	1.10	-1.10	0.61	0.10	0.06	0.09	0.43	-0.48	0.23
Cereals	0.72	-1.53	0.22	0.64	-1.58	0.15	0.10	0.05	0.09	0.17	-0.76	-0.03
Pulses	2.20	0.06	1.72	2.07	-0.04	1.59	0.15	0.13	0.15	1.01	0.16	0.82
Oilseeds	1.17	-1.12	0.67	1.11	-1.14	0.62	0.07	0.02	0.06	0.41	-0.54	0.21
Fruits and vegetables	0.02	-2.61	-1.15	-0.13	-2.76	-1.30	0.18	0.18	0.18	-0.34	-1.49	-0.85
Cash crops	-	-	-	-	-	-	-	-	-	-	-	-
Livestock, poultry, forestry and fishing	0.78	-1.68	-0.31	0.66	-1.76	-0.41	0.14	0.10	0.13	0.35	-0.79	-0.15
Industry	**1.92**	**-0.39**	**0.98**	**1.84**	**-0.42**	**0.92**	**0.08**	**0.03**	**0.06**	**0.79**	**-0.05**	**0.45**
Services	**1.81**	**-0.68**	**0.46**	**1.74**	**-0.72**	**0.40**	**0.09**	**0.04**	**0.06**	**0.96**	**0.08**	**0.48**
All	**1.51**	**-0.86**	**0.46**	**1.43**	**-0.91**	**0.39**	**0.10**	**0.06**	**0.08**	**0.65**	**-0.21**	**0.27**
Uganda												
Agriculture	**0.10**	**-0.29**	**0.02**	**-0.04**	**0.03**	**-0.02**	**0.15**	**-0.34**	**0.05**	**0.07**	**-0.21**	**0.01**
Field crops	-0.01	-0.47	-0.08	-0.01	-0.02	-0.01	0.02	-0.48	-0.06	0.10	-0.07	0.08
Cereals	-0.04	-0.59	-0.10	0.05	0.06	0.05	-0.08	-0.69	-0.15	0.11	-0.06	0.08
Pulses	-0.02	-0.52	-0.09	-0.04	0.07	-0.03	0.03	-0.63	-0.06	0.12	-0.04	0.09
Oilseeds	0.14	-0.28	0.01	-0.11	-0.21	-0.14	0.26	-0.08	0.16	0.06	-0.12	0.00
Fruits and vegetables	-0.01	-0.57	-0.12	-0.16	-0.09	-0.15	0.16	-0.52	0.03	0.01	-0.44	-0.08
Cash crops	2.60	2.67	2.62	2.54	3.07	2.69	0.17	-0.26	0.05	0.98	1.01	0.99
Livestock, poultry, forestry and fishing	0.40	0.16	0.34	0.15	0.18	0.16	0.27	-0.02	0.20	0.12	0.00	0.09
Industry	**0.54**	**0.01**	**0.38**	**0.31**	**0.20**	**0.28**	**0.24**	**-0.21**	**0.11**	**0.13**	**-0.04**	**0.08**
Services	**0.53**	**0.00**	**0.31**	**0.26**	**0.10**	**0.20**	**0.28**	**-0.12**	**0.11**	**0.13**	**-0.04**	**0.06**
All	**0.41**	**-0.04**	**0.27**	**0.20**	**0.12**	**0.18**	**0.23**	**-0.19**	**0.10**	**0.11**	**-0.07**	**0.06**

While the result discussed above provides the quantity responses in food consumption, it does not closely demonstrate how agro-export promotion may alter the actual nutrition status. Extrapolated approximations of the possible implications on per capita calorie intake are reported in Table 6. These results are extracted from the nutrition module discussed in section 3.2 and linked to the simulated changes in quantity consumption obtained from the economy-wide models. Even though percentage changes in calorie intake are largely consistent with the quantity responses for food consumption, the nutrition changes tend to be slightly lower. We however observe that urban households unambiguously face declines in calorie availability, further widening the per capita calorie intake gap for the poor. Export promotion is typically welfare reducing if the governments support the cash crop sector, where per capita calorie intake may decline by up to 1.6% in urban Ethiopia and Kenya. The effect is less worrying if the food producing sub-sector is the focus of the governments export promotion strategies. In line with the limited response by most economic variables for the country, the nutrition effect is very much contained in the case of Uganda.

Meanwhile, rural households in Ethiopia and Kenya could enjoy gains in mean per capita calorie intake in a range of 0.5-0.9% due to increased access to food as their incomes improve. However, the net-effect on nutrition is not strong for any of the countries studied as the loss in urban areas closely matches the gain in rural areas. These results suggest that the governments of Ethiopia and Kenya should ensure food access and availability in urban areas if their aim is to stimulate growth through export promotion.

Table 6: Extrapolated percentage changes in mean per capita nutrition intake

Source of export	Household group	Ethiopia	Kenya	Uganda
Agriculture	Rural	0.55	0.93	-0.07
	Urban	-1.54	-1.56	0.01
	National	0.13	0.03	-0.07
Cash	Rural	0.45	0.82	-0.07
	Urban	-1.43	-1.64	-0.03
	National	0.07	-0.07	-0.06
Food	Rural	0.10	0.13	0.09
	Urban	-0.09	0.10	-0.52
	National	0.07	0.13	-0.01
NTE	Rural	0.34	0.36	-0.06
	Urban	-1.30	-0.75	0.24
	National	0.02	-0.04	0.00

Source: Micro-simulation results based on single country models and corresponding household surveys

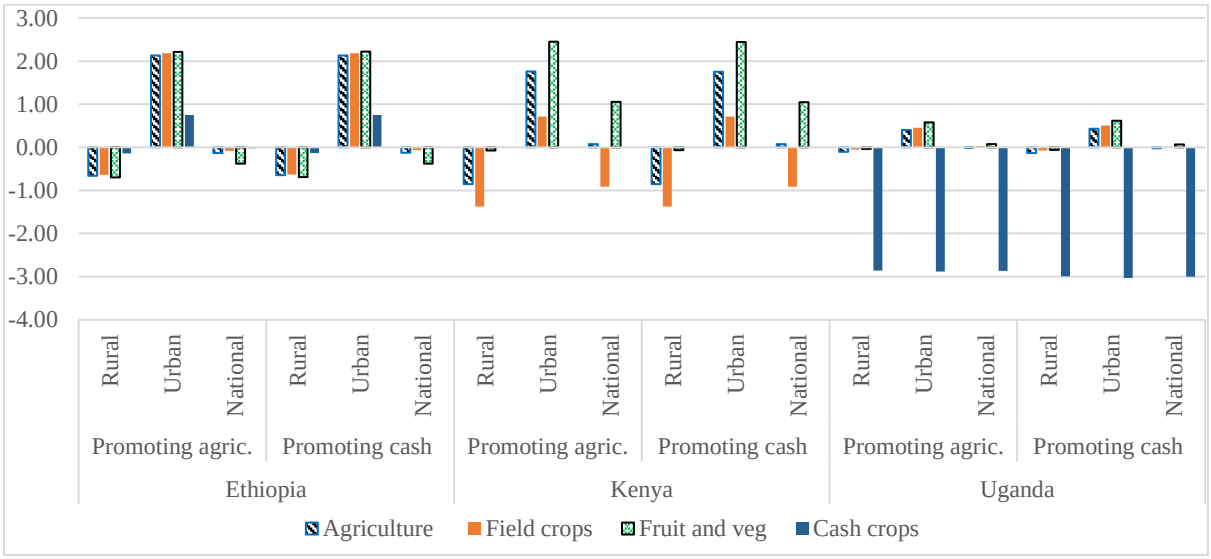
Agricultural export versus stability of access to food

The impact of agricultural export promotion strategy on stability of access to food is evaluated by examining changes in food and agricultural consumption while considering major temporal risks facing the agricultural sector in these economies. The risks taken into consideration include international price variations and productivity declines.

As explained in section 3.3, we separately simulate (i) a 10% decline in world prices of agricultural exports, and (ii) a 10% decline in agricultural sector productivity for each country while the countries implement the export biased strategies considered earlier. We then compare the domestic access to food when the agricultural export policy is implemented against a situation where the export sector further faces each of these risk factors. We restrict our analysis to two of the export promotion policies, i.e., sector wide and cash crop export policies, as food and NTE oriented policies are found to have relatively smaller effects. We consider outcomes under export promotion policies as base case scenarios.

Figure 1 provides percentage point differences in changes to access to food from the base case scenarios as agricultural exports face negative price shocks in the world market. The effects appear heterogeneous across households depending on whether they are principally agricultural or not. The policy becomes welfare and consumption decreasing for rural households if implemented under scenario of declining boarder prices for agricultural commodities. The joint shock of tariff reductions and declines in boarder prices of agricultural commodities results in a 0.6-0.9 percentage points lower response in consumption of food and agricultural commodities in rural Ethiopia and Kenya, while effects are not as such significant in rural Uganda. However, there is a very strong (about 3.0 percentage points more) reduction in consumption of cash crops by both rural and urban households in this country. Meanwhile, urban households in all countries face increases in consumption of agricultural products due to the price effect whether a holistic agricultural sector export support policy or a cash crop export centered policy is adapted in the face of declining export prices in foreign markets. In net terms, despite such distributional consequences, international food and agriculture price risks have very minimal effect on overall access to food.

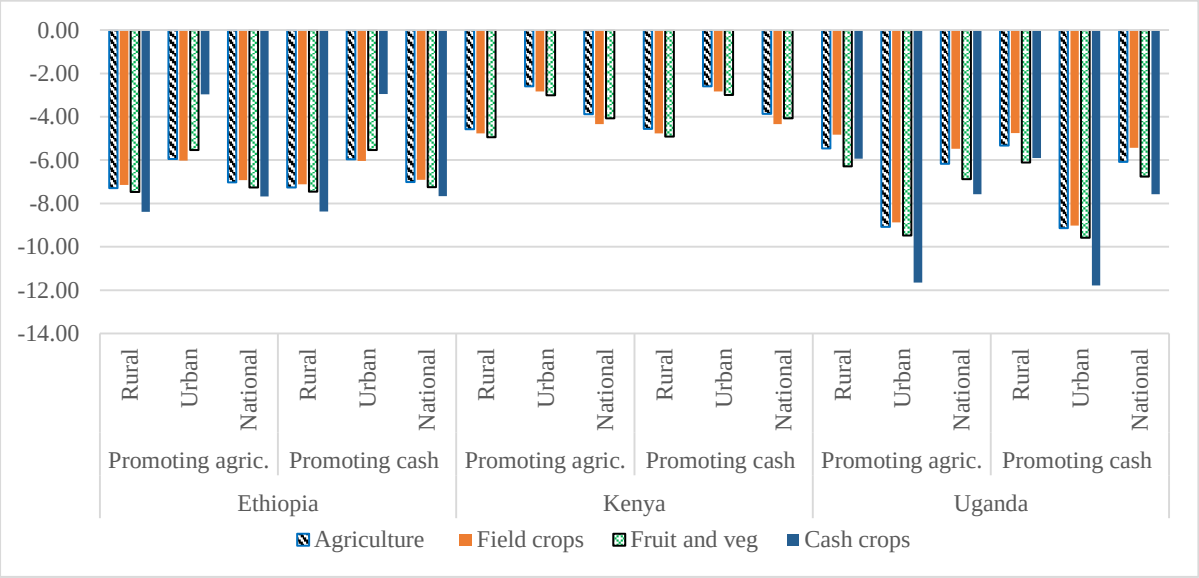
Figure 1: Simulated response of domestic access to food for negative shocks in the world market (percentage point difference in change from base case scenarios)



Source: Simulation results based on single country models

In contrast, negative productivity shocks in the agricultural sector are highly associated with further drops in consumption of agricultural and food commodities by urban households in all countries, while there is a change in sign with regard to response in consumption by rural households which declines even compared to the baseline (Figure 2). Rural households however enjoyed some gains in agricultural consumption in the base scenarios where only the tariff reduction is implemented. More specifically, a 10% reduction in agricultural productivity under a policy of agro-export promotion leads to up to a 7.1, 4.6, and 5.5 percentage point reduction in consumption of agricultural commodities in rural Ethiopia, Kenya, and Uganda, respectively. Meanwhile, urban Ethiopia, Kenya, and Uganda, experience a 6.0, 2.6, and 9.1 percentage point extra declines in consumption of these commodities, further worsening the food insecurity among the poor. At national level, the negative productivity shock avoids the slight gain in consumption discussed earlier, and leads to a 7.0, 3.9, and 5.4% reduction in food access in the three countries, respectively, compared to the case of no policy and external shock.

Figure 2: Simulated response of domestic access to food for negative shocks in agricultural productivity (percentage point difference in change from base scenario)



Source: Simulation results based on single country models

5. Conclusion

Despite growing uncertainties in world prices and acute problem of food insecurity domestically, governments in these countries continue supporting agricultural exports and adapting a more open trade stance vis-à-vis the rest of the world. They designed policies that support production for the export market including fiscal incentives, financial incentives, and non-monetary incentives. Estimates show that fiscal incentives alone amount to 3.9, 3.1, and 2.0% of the GDPs of Ethiopia, Kenya, and Uganda, respectively. However, a less understood aspect of these policies is the synergetic effect that agricultural export promotion has on food security domestically. There is also a lack of knowledge on how such policies can affect access to food by different household groups. Looking at the four components of food security, this study uses a micro-macro modelling approach and examines the impact of enhanced agricultural export orientation on food security in three structurally food insecure African economies: Ethiopia, Kenya, and Uganda.

Simulation results imply that export orientation could be pro-growth in the countries considered. However, the source of export growth appears to be heterogeneous. Whereas oilseeds are the main engine of export growth in Ethiopia, cash crops are behind the growth performance in Kenya and Uganda. Moreover, we find evidences in these countries that agro-export promotion tends to affect commodity consumption by rural and urban households in opposite ways. While urban households are expected to face reduced access to and utilization

of food, rural households tend to gain due to increases in incomes. These welfare effects are specifically stronger for Ethiopia and Kenya. The study also reveals that risks of international price and productivity failures under a context of export orientation could further alter access to food.

We note from the evaluation of country policies that export subsidies are broad and encompass a wide range of incentives. However, these policy measures are not backed-up by detailed analysis of the macroeconomic, sectoral, and distributional implications of the financial and opportunity costs involved. Assessment of the economics of a broader set of investment and export incentives is a potentially rewarding area of future research whereas the present study proposes a first step in this direction.

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Online supplement 1: Simulation design for result sensitivity analysis

When simulations are designed, it is also crucial to allow for productivity spillovers through improved farming practices emanating from information flows and access to agricultural inputs (such as chemical fertilizers, improved seeds, and insecticides) associated with increased export orientation. There is a wealth of literature stressing the positive externalities linked to exporting. Miller and Upadhyay (2002) examine the elasticity of total factor productivity (TFP) to export intensity (measured as the share of exports in GDP) by classifying countries into three income groups (low-, middle- and high-income) and four geographical regions (Africa, Latin America, emerging Asia, and developed countries). Using data from 1960-89, they find statistically significant elasticity estimates of about 0.1237, 0.0942, 0.0700, and 0.1771 for a set of all, low-income, middle-income, and high-income countries, respectively. In terms of geographic regions, these estimates are 0.0827 for Africa, 0.1482 for Latin America, 0.08226 for emerging Asia, and 0.0725 for the developed world. A similar study by Ji (2006) investigates the role of trade on TFP in 26 provinces of China and identifies productivity elasticity of trade of 0.187 (0.075 when FDI is ignored).[3] Given this wealth of literature, we consider an elasticity value of 0.08 as the most appealing for the case study countries in linking increased involvement in the international market to sectoral productivity in agriculture. This elasticity value is further altered by 25% in both directions and was subject to sensitivity analysis. Moreover, responses to export promotion policies could depend on the size of the elasticity of substitution and transformation parameters. Study results are tested using further sets of simulations with 25% higher and lower values of trade elasticities from the base levels.

[3]Not all results find statistically significant estimates. For example, Kim *et a*l., (2007) obtained no significant impact of export intensity on productivity in South Korea for the period 1980-2003.

Online supplement 2: Result sensitivity analysis under productivity spillovers and alternative trade elasticities

Agricultural export versus access to food under productivity spillovers

Given the brief review of estimates in section 3.3 on the impact of exports on productivity, we assume a baseline externality parameter of 0.08. This level is varied by 25% in either direction for sensitivity analysis. To make the analysis more comparable with the literature on the impact of support to cash crop production on food crop production, we restrict the discussion here on export subsidies to cash crops only.

As reported in Table 7, accounting for the possible productivity spillover effect of increased exports on the rest of the agricultural sector slightly alters access to food by both farming and non-farming households. Productivity spillovers could improve access to food in all case countries, where gains are relatively bigger for rural households due to rapid increases in their farm incomes. We also noticed that consumption changes symmetrically as we consider spillover elasticities of 25% above and below the baseline spillover elasticity of 0.08.

Table 7: Simulated percentage changes in commodity consumption with productivity spillover effects and higher trade elasticities

	Baseline solution			With productivity spillover effect			Higher trade elasticities		
	Rural	**Urban**	**National**	**Rural**	**Urban**	**National**	**Rural**	**Urban**	**National**
Ethiopia									
Agriculture	**0.49**	**-1.64**	**0.09**	**0.52**	**-1.61**	**0.12**	**0.48**	**-1.63**	**0.08**
Field crops	0.46	-1.65	0.04	0.49	-1.62	0.07	0.44	-1.64	0.03
Fruits and veg.	0.55	-1.72	0.31	0.59	-1.70	0.34	0.52	-1.74	0.27
Cash crops	0.10	-0.58	0.01	0.14	-0.56	0.05	0.13	-0.82	0.00
Kenya									
Agriculture	**0.62**	**-2.06**	**-0.33**	**0.82**	**-1.92**	**-0.16**	**0.62**	**-2.18**	**-0.38**
Field crops	1.10	-1.10	0.61	1.29	-0.98	0.79	1.10	-1.23	0.59
Fruits and veg.	-0.13	-2.76	-1.30	0.07	-2.63	-1.13	-0.15	-2.88	-1.36
Cash crops	-	-	-	-	-	-	-	-	-
Uganda									
Agriculture	**-0.04**	**0.03**	**-0.02**	**0.04**	**0.13**	**0.05**	**-0.13**	**0.10**	**-0.09**
Field crops	-0.01	-0.02	-0.01	0.05	0.07	0.06	-0.10	0.02	-0.08
Fruits and veg.	-0.16	-0.09	-0.15	-0.08	0.02	-0.07	-0.29	-0.01	-0.24
Cash crops	2.54	3.07	2.69	2.61	3.19	2.78	1.30	1.62	1.39

Source: Simulation results based on single country models

Note: The baseline solution is percentage change in commodity consumption without accounting for productivity spillover effects and under baseline trade elasticities.

Agricultural export versus access to food under various trade elasticities

Here, we alter the baseline international trade elasticities by 25% in each direction to check for the sensitivity of model results under alternative degrees of trade responsiveness. We use cash crop promotion as a case for sensitivity analysis since it has comparable impacts with the promotion of sector wide agricultural export (see Table 5, for example). Table 7 above presents evidence that domestic food availability is not very sensitive to the size of trade elasticities, specifically when both inward (improved substitution between domestically supplied and imported commodities) and outward (improved transformation of domestic production in to domestic supply and export supply) oriented trade facilitations are assumed. There is a tendency that domestic availability of cash crops for which the export promotion policy is implemented show some changes from the base level responses as 25% higher trade elasticities are considered. As trade becomes more elastic under a context of policy support to the export market, access to food becomes more constrained for urban households. The response on commodity consumption remains marginal for Uganda. Deviation in results are symmetric to the case of a 25% increase in trade elasticities when we examine a 25% decline in the ease to which imports are substitutable to the domestically supplied counterparts, and domestic production is transformed to the export market. Furthermore, only outward oriented trade facilitation approximated by improved export trade elasticity is considered. However, changes in access to food remain closely consistent with changes under altered import and export elasticities.

Annex 1: Simulated percentage changes in commodity exports

	Ethiopia				Kenya				Uganda			
	Agric	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**	**Agric**	**Cash**	**Food**	**NTE**
Agriculture	**5.18**	**4.69**	**0.50**	**3.40**	**21.21**	**21.51**	**-0.42**	**6.34**	**10.44**	**9.80**	**1.05**	**1.19**
Field crops	8.96	5.79	3.28	-3.08	-3.01	-10.34	8.46	-7.40	3.99	0.26	3.74	-0.03
Cereals	5.16	-2.51	7.87	-1.98	-2.47	-9.90	8.30	-6.60	3.55	-0.79	4.36	0.00
Pulses	4.72	-2.93	7.88	-2.58	-3.17	-11.46	9.62	-7.64	3.65	-0.96	4.61	0.10
Oilseeds	12.19	12.71	-0.47	-3.80	-2.46	-2.64	0.21	-6.55	6.21	6.01	0.20	-0.28
Fruits and vegetables	5.34	4.20	1.18	5.97	-1.23	-9.73	9.73	2.25	4.16	-0.71	4.90	4.66
Cash crops	5.64	5.88	-0.26	6.29	24.71	25.98	-1.54	7.54	22.84	24.41	-0.59	1.80
Livestock, poultry, forestry and fishing	-2.94	-2.78	-0.18	-2.40	-9.01	-9.29	0.37	-8.82	-0.89	-0.90	0.02	-0.06
Industry	**-2.09**	**-1.88**	**-0.22**	**-1.38**	**-5.02**	**-5.12**	**0.15**	**-5.81**	**-1.25**	**-1.37**	**0.06**	**-0.09**
Food & agro-processing	-0.14	-0.14	0.00	-0.07	-6.98	-7.22	0.31	-7.04	-0.25	-0.09	-0.15	-0.08
Beverages	-0.27	-0.26	-0.01	-0.18	-5.25	-5.47	0.27	-4.04	1.02	1.11	-0.03	-0.27
Other agro-processing	0.04	0.04	0.00	0.07	-7.54	-7.79	0.33	-8.01	-1.00	-0.79	-0.22	0.02
Mining & other manufacturing	-2.21	-1.99	-0.23	-1.46	-4.85	-4.94	0.13	-5.70	-1.96	-2.27	0.22	-0.10
Services	**-3.71**	**-3.34**	**-0.40**	**-2.69**	**-2.44**	**-2.50**	**0.08**	**-0.80**	**-0.73**	**-0.75**	**-0.04**	**-0.02**
Trade & business services	-3.73	-3.36	-0.40	-2.70	-2.44	-2.50	0.08	-0.80	-0.72	-0.76	-0.03	-0.01
Government services	-1.86	-1.69	-0.19	-1.41	-	-	-	-	-0.80	-0.61	-0.18	-0.13
All	**0.41**	**0.38**	**0.02**	**0.18**	**5.77**	**5.83**	**-0.09**	**0.60**	**0.78**	**0.61**	**0.19**	**0.14**

Source: Simulation results based on single country models