Routledge
Taylor & Francis Group

Global agricultural trade liberalization: Is Sub-Saharan Africa a gainer or loser?

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ABSTRACT
This paper analyzes the potential impact of agricultural trade liberalization on Sub-Saharan Africa. We used the Agricultural Trade and Policy Simulation Model to estimate the potential effects of agricultural trade liberalization, mainly in the US and EU, on the world-market prices of agricultural commodities. We then used the estimated price changes to assess the impact of these reforms on net-food importers as well as other Sub-Saharan African countries that enjoy preferential trade agreements with the EU and US. The results indicate that the world market prices of all commodities imported by Sub-Saharan Africa are expected to rise while the prices of the key export commodities of the region would either decline or remain unchanged. Given that the prices of major food commodities are expected to rise, net-food-importing countries will experience increasing import bill, thus leading to welfare loss. Major Sub-Saharan Africa sugar exporters who are beneficiaries of preferential agreements such as the EU sugar protocol and US AGOA initiative will become losers as preferences erode due to global liberalization. Thus, the region is expected to generally become a net loser from the current WTO reform modalities.

1. Introduction

Trade theorists posit that liberalization leads to higher economic growth and a more equal distribution of income. That is, eliminating or reducing trade barriers creates market access, improves terms of trade, and expands the gains from trade (see Edward 1993; Trefler 1993; Panagariya 2000; Weintraub 2007; Urata 2009). In the case of agricultural trade, it is argued that reduction in domestic-support measures would increase world-market prices of the commodities subject to tariffs or subsidies, and induce efficiency which allows developing countries attract the necessary investments to enhance large-scale production and promote export (Tokarick 2008). Thus, critics of domestic agricultural support policies in developed nations have argued that removing these distortions would enable least developed countries (LDCs), including those in Sub-Saharan

Africa, lift themselves out of poverty through gains from agricultural trade (see Oxfam 2004; Nebehay 2006; Jensen and Zobbe 2006; Anderson and Masters 2009). Though this argument heightened the call for agricultural trade liberalization at the World Trade Organization (WTO) for more than a decade, a review of recent studies focusing on the poverty-reduction impact of liberalization revealed limited or ambiguous effects on poverty reduction in SSA countries (Arce et al. 2014). The conclusion of the December 2013 Bali Ministerial conference has, however, raised the prospect for liberalizing global agricultural trade, and reaffirmed developed countries' commitment to reducing tariffs and domestic support, and eliminating export subsidies, which had been blamed for creating distortions in agricultural commodity market of developing and LDCs.

However, while global agricultural trade liberalization through the WTO system is still underway, most developed countries have removed barriers to at least 98% of all LDCs exports, while China and India have adopted less expansive programs to improve market access for LDCs (see Matthews 2013). Sub-Saharan African agricultural exports also enjoy duty-free and quota-free (DFQF) access to the EU market through various Economic Partnership Agreements (EPAs), and the Everything But Arms (EBA) initiative which grants market access to 34 SSA LDCs. In addition, the US's African Growth and Opportunity Act (AGOA) provides DFQF access to 40 designated African countries, of which 26 are LDCs in Sub-Saharan Africa (see Elliott 2013).

But while substantial efforts have been made by developed and emerging economies to create market access for LDCs, many argue that Sub-Saharan Africa has not gained much from these market accesses. For instance, it is argued that about 90% of all imports recorded under US AGOA initiative are in oil, while a wide range of processed agricultural products, including dairy products, sugar, cocoa, and cotton, which are of interest to the region, are excluded (see Ancharaz and Laird 2013).[1] Moreover, non-tariff barriers such as sanitary and phytosanitary (SPS) and rules of origin (RoO) requirements under EU and US preferential agreements restrict African beneficiaries from fully utilizing gains from liberalization. Also, the structure of agricultural production and the limited scale of diversification of SSA agriculture limit the size of market for most of the beneficiary countries, and refrain them from utilizing the market accesses created through preferential trade arrangements provided by developed and emerging economies (see Basnett and Engel 2013). Furthermore, even though global agricultural market has experienced a transformation away from agricultural production to agri-food processing with private stakeholders actively involved, the region's agriculture remains struggling with productivity growth while private-sector involvement remains at the bare minimum, thereby limiting the region's ability to provide the appropriate volume of essential commodities to feed its growing population, and sufficiently participate in global agricultural trade. For example, in 2014, the total value of agricultural commodity exported by the region was just about 7% of EU's export during the same period.[2] Trade in agricultural commodities has reportedly experienced dismal performance because of the region's failure to respond to the changing demands of global integration (see Losch 2011).

Thus, while proponents of liberalization argue that agricultural trade liberalization would increase world prices and enable poor countries increase their income levels (see Frith 2005; Anderson and Valenzuela 2007; Binswanger-Mkhize and McCalla 2008; Heo and Doanh 2009; Anderson et al. 2010), critics argue that LDCs and net-food-importing countries benefit from the low food prices that result from the domestic agricultural policies of rich countries, and that reforms that lead to price rises will

further increase poverty in poor and net-food-importing countries (e.g. Moore and Zanardi 2009). It is further argued that poor countries do not benefit from increased world prices since low domestic production prevents them from taking advantage of the high prices resulting from the liberalization (e.g. Rodriguez and Rodrik 2000; Clemens and Williamson 2000; Vamvakidis 2002). In addition, some argue that tariff reduction resulting from liberalization reduces government revenue, and lead to significant fiscal instability that may affect government spending on development activities, which may further deteriorate national welfare (see Aizenman and Jinjarak 2009; Younas and Bandyopadhyay 2009). Given the region's enormous limitations, it remains doubtful as to whether it has got the intended benefits from existing market access, and whether further liberalization under the WTO would provide better incentives for expanding its gains from global agricultural trade.

But while African countries, in general, have shown some signals of satisfaction with how the discussion has progressed (see Imboden 2013), it remains unclear how global agricultural trade reform under the WTO system would affect the different interest groups in Sub-Saharan Africa. For instance, it is argued that some SSA beneficiaries of the AGOA program (e.g. Lesotho and Kenya) have realized massive increase in trade with the US with bilateral export volume increasing three-fold from 2000 to 2012 (Elliot 2013). But an earlier assessment of full WTO agricultural trade liberalization indicates that consumers in the West African region of Sub-Saharan Africa would tend to encounter net welfare losses (see Nuetah et al. 2011). Furthermore, major SSA beneficiaries of EU sugar protocol as well as the AGOA currently exporting sugar and sugar products to EU and US markets at guaranteed prices would be affected as the reform results in preference erosion due to expansion of duty-free, quota-free market access to all LDCs.[3] Thus, there remains uncertainty over the impacts of global agricultural trade liberalization on the different interest groups in Sub-Saharan Africa. As a result of this uncertainty coupled with recent global economic situations, some policy-makers on the continent have become considering the use of intra-regional trade as a buffer to some of the adverse global economic shocks. Such trade would also enhance the creation of market for the manufacturing outputs of the region. However, recent studies attribute limited intra-regional trade to the existence of high levels of non-tariff barriers (NTBs)[4] within the region (see Keane, Calì, and Kennan 2010; Ncube, Brixiova, and Meng 2014). These NTBs range from poor infrastructure which limits the free movements of goods across borders to export concentration in a few primary commodities which are mainly used as raw materials for the manufacturing industries in developed countries, and not essential for SSA countries.

The main purpose of this study, however, is to assess how agricultural trade liberalization in the global context would affect agricultural commodity prices, and how the price changes would affect primary-commodity-exporting and net-food-importing countries in SSA. We further consider how preference erosion due to global liberalization would affect SSA countries that enjoy special treatments from developed countries; and provide, through the findings of this research, insights into the potential impacts of the WTO reforms on the different SSA players in the agricultural commodity market. We then make a few suggestions on what could be of interest to Sub-Saharan Africa during the next rounds of global trade reform negotiations. In addition, though this study focuses on global liberalization, we make a few suggestions on the necessary actions for unlocking the intra-regional trade potential of the region to create markets for its processed outputs in preparation for a potential erosion of preferences enjoyed by the region.

The rest of this paper is organized as follows. In the section that follows, we discuss the Agricultural Trade and Policy Simulation Model (ATPSM) and the modifications made to the model as well as the simulation scenarios. Section 3 presents and discusses the simulation results, and how price changes resulting from the simulation affect the different groups of countries in the region. In the final section, we draw conclusions and make a few policy suggestions.

2. Methodology

In the existing literature, trade liberalization analysis is usually conducted using either a computable general equilibrium (CGE) or partial equilibrium (PE)-based model. The Global Trade Analysis Project (GTAP) as well as the LINKAGE models, which are based on general equilibrium, have been widely used to assess the impact of global trade liberalization (e.g. Hertel 1990, 1992, 1997, 2002; Anderson, Martin, and van der Mensbrugghe 2005; Hertel and Keeney 2006). But a review of results from these CGE-based models indicates lack of consensus on the magnitude of the gains from liberalization (Ackerman and Gallagher 2008; Arce et al. 2014). Aizenman and Jinjarak (2009), in their comparison of the partial equilibrium and general equilibrium frameworks, also indicate that most CGE-based models underestimate the magnitude of the cost of trade protection, and overestimate the welfare gains from liberalization. Though CGE-based models remain predominant in trade liberalization analyses, this study uses the standard version of the partial-equilibrium ATPSM[5] as an alternative to assess the potential effects of global agricultural liberalization on agricultural community prices.

The ATPSM is a comparative static global agricultural trade analysis model with no stochastic shocks or other uncertainties; and there is no specific time dimension to the implementation of the policy measures or to the maturing of their economic effects (see Peters 2006).[6] The preference of this model over the CGE-based GTAP model is based on its full coverage of individual countries within the region.[7] The model also contains data on 35 agricultural commodities of interest to the region, thus enabling proper assessment of the impact of global trade liberalization on each country. The comparative static nature of the model further allows comparing two states at a similar point in time, one with the policy change, and the other without. However, even though the model aims at estimating far-reaching details of the agricultural economy, it does not deal with the repercussions of barrier reductions on other parts of the national economy, such as the government budget (except for tariff revenues and subsidies to exports and domestic production), the industrial and service sectors or the labor market. Simplifying the model in these respects allows for a detailed specification of policies in a large number of countries for numerous commodities, and makes it easier to analyze the impacts of the reform on individual countries.

2.1. Equation system

The model base-period equilibrium requires that[8]:

$$\sum_{n=1}^{N}\{D_{i,r}(P_{i,r,d}, Z_{i,r,d}) + X_{i,r}\} = \sum_{n=1}^{N}\{S_{i,r(P_{i,r,s},P_{i[j],s},W_{i,r,s})} + M_{i,r}\} \tag{1}$$

$$P_{i,r,d} = P_{i,w}.(1 + t_{c,i,r}) \tag{2}$$

$$P_{i,r,s} = P_{i,w}.(1 + t_{p,t,r}) \tag{3}$$

where the subscripts i, j, r are defined as follows: i denotes commodities index in country r; j represents the number of other commodities that substitute in consumption; r is a country index. The letters D, S, X, M and P, respectively, denote demand, supply, exports, imports and price; $D(.)$ and $S(.)$ represent the domestic demand and supply functions, respectively, for commodity i and in country r; $M(.)$ and $X(.)$, respectively, denote imports and exports of commodity i in country r; $P_{i,r,d}$ represents the domestic demand price of commodity i in country r; $P_{i,r,s}$ denotes supply price of commodity i in country r; $\{j\}$ in the subscripts of the second price terms in the demand and supply functions denote the prices of other commodities that substitute or compete for resources for commodity i in country r; N is the total number of countries that produce and trade the commodity in question; the vectors Z and W denote other non-price variables that affect domestic demand and supply of the commodity i in country r, respectively. $P_{i,w}$ is the world price of commodity i, and t_c and t_p, respectively, denote the consumption and production tariff equivalent wedges between domestic and international prices for commodity i in country r. The endogenous variables are the quantities demanded and supplied, as well as the world prices. Exogenous variables are the demand and supply policy wedges, as well as all other variables that affect supply and demand.

After a trade policy change such as change in tariffs, export subsidies and/or domestic support is specified, the model calculates the new equilibrium. The standard equation system for all countries has four equations:

$$\hat{D}_{i,r} = \eta_{i,r}\left[\hat{P}_{wi} + \left(1 + \hat{t}_{ci,r}\right)\right] + \sum_{\substack{j=1 \\ i \neq j}}^{J} \eta_{i,j,r}\left[\hat{P}_{w,j} + \left(1 + \hat{t}_{cj,r}\right)\right] \tag{4}$$

$$\hat{S}_{i,r} = \varepsilon_{i,r}\left[\hat{P}_{wi} + \left(1 + \hat{t}_{pi,r}\right)\right] + \sum_{\substack{j=1 \\ i \neq j}}^{J} \varepsilon_{i,j,r}\left[\hat{P}_{wj} + \left(1 + \hat{t}_{pj,r}\right)\right] \tag{5}$$

$$\Delta M_{i,r} = D_{i,r}\hat{D}_{i,r} - S_{i,r}\hat{S}_{i,r} + \Delta X_{i,r} \tag{6}$$

$$\Delta X_{i,r} = \gamma_{i,r}\Delta S_{i,r} \tag{7}$$

where $\wedge$ denotes the relative changes and Δ the absolute changes; η denotes the own and cross elasticities of demand in country r; ε denotes the own and cross elasticities of supply in country r; γ denotes the ratio of exports to production.

Equations (4) and (5) specify that the new demand and supply are determined by the price changes, trade policy changes and the corresponding elasticities and cross-price elasticities. Equation (6) clears the market so that imports plus production equal domestic consumption and exports. Equation (7) requires that the change in exports in each market is some proportion of the change in production. This proportion is determined by the ratio of exports to production. For example, if all the initial production is exported, all the change in production is exported. If half the initial production is exported, half of the change in production is exported. This implies that the proportion of exports to production is maintained.

The absolute change in world market price is then calculated as

$$\Delta P_w = \hat{P}_w P_w \tag{8}$$

Table 1. Revised tiered formula for tariff reduction by developed and developing countries.

Tariff rates	Average reduction
Developed countries	
Ad valorem rates >75%	70
Ad valorem rates between 50% and 75%	64
Ad valorem rates between 20% and 50%	57
Ad valorem rates between 0% and 20%	50
Developing countries	
Ad valorem rates >130%	47
Ad valorem rates between 80% and 130%	43
Ad valorem rates between 30% and 80%	38
Ad valorem rates between 0% and 30%	34

Source: Revised draft modalities for further commitment, WTO (2008).

Given the linearity of the equations in (4)–(7), the change in the world price reflected in equation (8) can be obtained by matrix inversion (see also Poonyth et al. 2004; Peter and Vanzetti 2004; Peters 2006).

2.2 Modification of the ATPSM

The model simulation is based on the July Framework scenario which considers the initial draft modalities for agricultural trade reform.[9] This scenario adopts a Harbinson approach for reductions in tariff rates and domestic support in developed and developing countries. This approach is based on a tiered formula that includes sensitive plus special product provisions, and ensures that tariffs in higher tiers have larger cuts than those in lower ones. The original Harbinson formula sets three tiers for tariff reduction with maximum and minimum Ad valorem bound rates, respectively, at 90% and 15% for developed countries, and a maximum and minimum average reduction of 60 and 40 for the upper and lower bound. For developing countries, the maximum bound was set at 120% and 20%, respectively, with average reduction of 40% for upper bound and 25% for the lower bound. Domestic support reduction was set at 60% and 40%, respectively, for developed and developing countries. We changed these parameters to reflect those of the revised modalities of December 2008 (see Table 1), which was reaffirmed at the December 2013 Bali Ministerial conference. Furthermore, we modified the model equations to reflect the changes in parameters; the original model has equations that confound with the three tariff bounds so the modified equations account for the fourth tariff bound set with the revised modalities. We also updated the price data from 1999 and 2001 prices to September 2013 commodity prices published by the IMF. The absolute change in world-market prices is then simulated using the newly calibrated model containing the tiered reduction formula for trade-distorting domestic supports and tariffs, and the results are presented in Tables 1 and 2.[10]

Table 2 describes the bands for domestic support reforms, and sets reduction targets for all levels. From the review of existing literature, the EU reported domestic support expenditures within the range of the top tier, while the United States reported domestic support expenditures within the range of the second tier. In this study, therefore, we set the parameters for cut in domestic support at 80% for the EU, and 70% for the US while all

Table 2. Tiered reduction formula for overall trade-distorting domestic support (OTDS).

Domestic support	Percentage reduction
Greater than US$60 billion	80
Greater than US$10 billion and less than US$60 billion	70
Less than or equal to US$10 billion	55

Source: Revised draft modalities for further commitment, WTO (2008).

other countries are excluded. The analysis is based on two simulation scenarios. Scenario one applied reductions to the US and EU and exclude the rest of the world (ROW). In scenario two, we applied the reforms to all SSA countries and exclude the rest of the world. Scenario two is intended to assess whether liberalization by Sub-Saharan Africa can influence world-market prices of agricultural commodities.

2.3. Data sources

This study used macro-level data on production, import, export and consumption compiled from FAOSTAT database, while the tariff data are sourced from the United Nation Conference on Trade and Agricultural Development dataset. Data on export subsidies and domestic supports are provided by WTO member countries to the Agriculture Committee. However, it is reasonable to think that, in an attempt to protect national interest, countries may not have provided accurate information to the WTO on applied tariff rates and other official supports to the agricultural sector. Furthermore, because of the multiplicity of commodities and countries contained within the model, there are reasonable concerns about the quality and reliability of results from analyses using such data. But as previous users of the model (e.g. Vanzetti and Graham 2002; Peters 2006) have highlighted, these data provide useful information on the existing levels of trade distortions, and analysis using these data offers some insights into the potential effects of the proposed agricultural trade reform modalities on world-market prices of agricultural commodities.

3. Results and discussion

This section discusses the potential effects of the agricultural trade reform proposals of the Doha Development Agenda on the prices of agricultural commodities, and how changes in these prices potentially affect Sub-Saharan African countries. It begins with discussions of how the proposed reforms changes world-market prices of agricultural commodities, and proceeds with the implication of these price changes on the various commodity-market participants in Sub-Saharan Africa.

3.1. World market price effect

The results of the analysis indicate that liberalization of agricultural trade policies within the framework of the proposed Doha Development Agenda would have diverse impacts

Table 3. Percentage change in world prices after reforms.

Commodity	Reform by US and EU	Reform in SSA (without reform in ROW)	Commodity	Reform by US and EU	Reform in SSA (without reform in ROW)
Sheep meat	− 3.15	0.00	Hides and skins	20.05	0.00
Bovine meat	2.79	0.00	Citrus fruits	0.05	0.00
Pig meat	3.83	0.00	Bananas	0.00	0.00
Poultry	0.63	0.00	Other tropical fruits	0.01	0.01
Meat	2.417	0.00	Apples	0.46	0.00
Milk, conc.	18.29	0.01	Fruit	0.13	0.003
			Sugar, raw	1.39	0.00
Butter	8.86	0.00	Sugar, refined	2.47	0.02
Cheese	9.91	0.00	Sugar	1.93	0.01
Dairy products	12.353	0.003	Coffee, green	− 0.05	0.00
Wheat	2.55	0.00	Coffee, proc.	0.02	0.00
Rice	1.18	0.00	Cocoa beans	− 0.01	0.00
Barley	9.26	0.00	Cocoa, proc.	0.14	0.01
Maize	1.08	0.02	Tea	0.11	0.03
Sorghum	1.19	0.01	Beverages	0.042	0.008
Cereal product	3.052	0.006	Oilseeds, trop.	− 0.02	0.00
Pulses	0.07	0.01	Vegetable oils	0.70	0.00
Tomatoes	0.07	0.01	Oilseeds temp.	1.08	0.00
Roots and tubers	0.14	0.01	Vegetable and oilseeds	0.59	0.00
Vegetables	0.093	0.01	Rubber	0.00	0.00
Tobacco leaves	0.17	0.00			
Cotton	0.00	0.00			
Tobacco leaves and cotton	0.09	0.00			

Source: Authors' calculation from simulation results.

on the prices of agricultural commodities. While the world prices of most processed agricultural commodities would increase, producers of primary agricultural commodities do not gain as much as those of processed commodities (see Table 3). Furthermore, even though the reform modalities exclude SSA countries from any reform commitments, the results also show that reforming agricultural trade policies in Sub-Saharan Africa would have no impact on world market agricultural commodity prices due mainly to the region's limited share in global agricultural commodity trade. For instance, SSA's share of total global agricultural commodities trade averaged about 2.8% from 1995 to 2013, while its shares of import and export for the period averaged about 2.5% and 3.2%, respectively (see Table A1).[11] Furthermore, the region has become more dependent on the rest of the world for food imports. As a result, imports of agricultural commodities have been growing faster than exports, thus accounting for about 3.4% and about 3.1%, respectively, of total world import and export in 2013. With an anticipated increase in the prices of major import commodities of the region, its agricultural trading position is expected to deteriorate, as the prices of its key export commodities encounter either price decline or no price change.

As shown in Table 3, the potential effects of the reform on agricultural commodities would be different. The region's key import commodities – dairy products, cereal

products, meat sugar – would experience higher price increases, even though hides and skins would experience the largest price rises. For beverages, vegetable and oilseeds (and rubber – which is a major export commodity for some of the low-income countries in the region), there would be minimum or no price rises. These price changes are important to SSA economies, given that the region is a net importer of food commodities and recorded deficits in trade with the rest of the world in cereal, dairy, sugar, meat and meat products, and vegetable oil between 1995 and 2013 (see Table A2). In the discussion that follows, we focus on how changes in the prices of individual commodities potentially affect continental SSA, and individual countries where trade in a specific commodity is significant.

3.2. Potential impacts of commodity-price changes on individual countries

The results in Table A2 indicate that the SSA region has encountered net agricultural trade deficit with the rest of the world since 2005 when most developed countries began reducing domestic supports and eliminating export subsidies. Given that the prices of the key consumables of the region would rise while its primary export commodities – beverages and rubber – would experience either price decline or no change, the region's agricultural trade position is expected to further deteriorate. The net-food-importing countries will be the most affected by the price increases while gains to net exporters would be minimal. The following discussions highlight how the price changes for each commodity would potentially affect the different actors in the market for such commodity.

3.2.1. Dairy products[12]

Dairy products, which are key consumption commodities for Sub-Saharan Africa, are expected to experience an average price rise of about 12%. Milk is expected to experience the highest price rise followed by cheese and butter.[13] However, except for South Africa which has some levels of competitive advantage in trade in the commodity, and a limited number of other countries (Swaziland, Togo and Uganda who have begun registering trade surplus since 2011), the region remains a net importer, and recorded a trade deficit of about US$2,256 million in 2013. Furthermore, of the region's total trade in agricultural commodities between 1995 and 2013, annual trade in dairy products averaged about 9% of imports and 1.6% of exports. While the net exporters are expected to gain from the price increase (assuming perfect price transmission), net importers, which constitute the majority of countries in the region, will be adversely affected. For instance, although an 18% increase in the price of milk concentrate would increase South Africa's dairy product export revenue by about 14%, the rise in milk price would result in a higher import bill for net importers of dairy products. Moreover, while the impacts of a rise in milk price would be proportional on the dairy export revenue or import bill of some economies, the impacts on other economies would be either greater or less than the percentage change, given the significance of the commodity in the country's overall trade in dairy products (see Table 4). For example, an 18% rise in milk price would expand Angola's dairy product import bill by about 18% while Senegal's import cost would increase by about 20% point. Togo and Uganda would, respectively, experience about 18% and 17% increase in dairy product export revenue. However, given that the region is a net importer of milk, the minimum gain by a few countries from the price rise would be offset by net losses by other countries thus resulting in net loss for the region.

Table 4. Effects of milk price changes on major net exporting and importing countries.

Country	Price effect on milk export revenue/ import cost (US$'000)	Net dairy product trade revenue/import cost (US$'000)	Percentage change in net dairy product export revenue/import cost
Major net-exporting countries			
South Africa	33,399.57	239,252.83	13.96
Swaziland	56.54	772.52	7.32
Togo	2690.75	14,703.71	18.30
Uganda	3949.00	22,519.45	17.54
Major net-importing countries			
Angola	58,951.65	(319,558.69)	18.45
Congo	7559.86	(149,647.38)	5.05
Gambia	1561.17	(183,306.18)	0.85
Mauritius	16,822.62	(107,846.73)	15.60
Nigeria	62,463.58	(522,099.54)	11.96
Senegal	22,478.78	(108,682.15)	20.68

Source: Authors' calculation from UNCTAD data and simulation results.

3.2.2. Cereal products

Cereals products are important dietary commodities for all Sub-Saharan African countries. Between 1995 and 2013, the region imported about US$134 billion worth of the commodity from the rest of the world but exported only about US$15 billion, thus recording a deficit of about US$119 billion.[14] Given that the proposed Doha reform is expected to increase the average price of cereal products by about 3%, with the key agricultural commodities imported by the region – rice, maize and wheat – respectively experiencing price rises of about 1.18%, 1.08% and 2.55%, net importers would be adversely affected. The price rise means that cereal import bills of economies in the region would increase, while major exporters would enjoy revenue increases. However, except for South Africa and Zambia who registered surpluses in maize trade for the period assessed, the rest of the region is a net importer. Thus, the 1.18% increase in rice price would raise Nigeria's (which imported about 20% of SSA's total rice imports in 2013) cereal import bill by about 0.38%, while Liberia, which accounted for about 0.17% of SSA's 2013 rice imports, would experience about a percentage-point rise in its cereal import bill. For South Africa, which is a net exporter of maize, a 1.08% increase in maize price would reduce its cereal trade deficit by about 2%, while Zambia's net cereal trade revenue would increase by about a percentage point.[15] Thus, though South Africa and Zambia could gain from increase in maize price, only Zambia could become a net gainer while South Africa and the rest of the SSA countries would experience net losses.

3.2.3. Meat products

Meat products are expected to experience an average price rise of about 2.42% with the largest increase arising from pig meat followed by bovine meat and poultry, while sheep meat (mutton) would encounter price decline. In SSA, however, only four countries had enjoyed surpluses in meat trade between 1995 and 2012, while two of these countries – Kenya and Ethiopia – recorded deficits in 2013. Namibia and Botswana are the largest meat exporters from the region, together accounting for about 78% of the region's bovine meat export between 1995 and 2013. Their combined bovine meat exports in 2013 constituted about 62% of total exports of the region, even though the region recorded a deficit of about US$3.2 billion with Angola and South Africa, respectively, accounting for about

35% and 14% of the deficit (see Table A3). With an expected increase of about 2.8% in the price of bovine meat, Botswana's net meat trade revenue would increase by about 3.8% while Namibia's would rise by about 3.5%. For the largest importers, Angola and South Africa, meat trade deficits will, respectively, increase by about 0.5 and 0.2 percentage points, while the meat trade deficit of the region will worsen by 0.4 percentage point. Thus, while the net exporters of the commodity will enjoy total net meat trade revenue increase higher than the price increase, the impact on the region's net meat trade would be minimal.

3.2.4. Hides and skins

Hides and skins are expected to enjoy the largest increase in the prices of agricultural commodities resulting from agricultural trade reform. However, it contributed only about 1.3% of the region's total agricultural trade between 1995 and 2013, with South Africa accounting for about 40% of net trade revenue during this period. While an anticipated price rise of about 20% would have proportionate impact on some net exporting countries, the impact on other countries would be less or greater than the price change. For instance, the net trade revenue of South Africa and 24 other countries would rise by about 20%, while Uganda's deficit would reduce by about 13%. For Ethiopia, a former exporting country, which has expanded its imports due to expansion in its shoe manufacturing industry, a 20% price rise would translate into a 30% deficit in hides-and-skins trade, while Cote d'Ivoire and Djibouti would, respectively, encounter deficits of 38% and 22%. For the net importing countries, while the price rise would lead to an expansion of the deficits proportional to the price rise, others would experience deficit expansion greater than the price rise. For instance, Angola, Nigeria, Seychelles, and Sierra Leone would experience about 20% increase in their trade deficit, while Lesotho's would expand by about 42%. Thus, even though the commodity's share is insignificant in the total agricultural trade of the region, the price rise would result into a proportionate expansion in the region's 2013 hides-and-skins net trade revenue, representing about 12% of the region's net agricultural trade revenue between 1995 and 2013.

3.2.5. Sugar[16]

Sub-Saharan Africa is a major trader of sugar and sugar products. Between 1995 and 2013, the region's total sugar trade amounted to about US$60 billion while it recorded a deficit of about US$9.7 billion in 1995 and about US$1.8 billion in 2013. However, even though the region remains a net importer of the product, four key trading countries – Swaziland, Mauritius, Zambia, and Malawi – benefit from trade in the commodity, and have been net exporters since 1995. Cote d'Ivoire, Mozambique, South Africa and Zimbabwe have also cumulated net surpluses over the period 1995–2013 (see Table A4). The total value of sugar trade of the four large trading countries accounted for about 58% of the region's total sugar trade in 2013 and about 66% of its sugar export. The revenue generated by these countries also contributes significantly to annual GDP. For instance, Mauritius, one of the largest sugar exporters from Sub-Saharan Africa, accounted for about 24% of the region's total export for the period 1995–2013, and about 16% of export in 2013. Even though Mauritius's sugar export contracted by about 6% in 2013,[17] its net revenue from sugar trade amounted to about 2.5% of its 2013 GDP of about US$11.9 billion. With global reforms, sugar is expected to experience an average world-market price increase of about 2% with refined sugar price rising by about 2.5%. While the increase in

refined sugar price would raise the region's sugar export revenue by less than a percentage point, its refined sugar import cost would increase by the percentage rise in price. This implies that net sugar-importing countries would experience about 2.5% increase in their sugar import bills, thus increasing the annual sugar trade deficit by about 2%. Nigeria, Somalia, Ghana and Angola would experience the largest expansions in their deficits with the deficits of Nigeria and Somalia, respectively, increasing by about 25% and 18%; Ghana and Angola would experience deficit increases of about 16% and 11%, respectively.

However, what matters to major sugar exporters who benefit from preferential trade agreements, such as the sugar protocol with the European Union (EU), and Africa Growth and Opportunity Act (AGOA) initiative with the United States, is not what happens to world-market prices, but to what happens on the EU and US markets where guaranteed prices are above the free-market price of the commodity. Given that 12 of the 20 beneficiaries of the EU sugar protocol are from Sub-Saharan Africa while a number of SSA countries benefit from the US's AGOA initiative, exporters from the region tend to be more affected by price changes on the US and EU markets. With the current reform proposal expected to harmonize global agricultural commodity prices into a common world market price, beneficiaries of guaranteed prices would experience income losses as sugar revenues decline due to reduced prices ensuing from the reform. For instance, even though the reform would potentially increase free-market price of refined sugar by about 2.5%, the resulting price remains far below the guaranteed prices on the US and EU markets (see Figure 1). With global reforms that lead to preference erosion resulting in the removal of guaranteed prices, prices on the EU and US markets from 2014 could, respectively, fall by about 34% and 18%. This implies that the major EU beneficiaries – Mauritius, Swaziland, Zambia, Mozambique and Zimbabwe – would lose about US$200 million annually, while the major AGOA beneficiaries – Ghana and Niger – would lose about US$58 million annually due to preference erosions (see Table A5).[18] The average annual projected revenue lost by Mauritius between 2015 and 2016 would represent
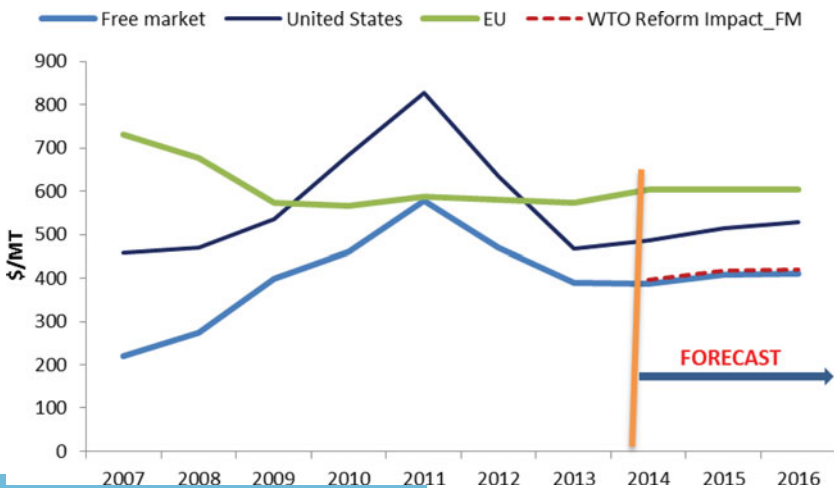
Figure 1. Sugar free-market and preferential prices (actual and forecast) 2007–2016.
Source: Authors' calculation from IMF price data.

about 0.7% of its 2013 nominal GDP, while Zambia's revenue lost for the same period would be about 0.3% of GDP. This finding is consistent with the argument of Milner et al. (2011) that a successful conclusion and implementation of the Doha Round agreement will adversely affect SSA countries who benefit from guaranteed prices on sugar exports to EU markets.

3.2.6. Beverages, vegetables and fruits and rubber[19]

Sub-Saharan Africa enjoys competitive advantage in trading beverages, vegetables and fruits, and rubber. Of the total agricultural trade between the region and the rest of the world from 1995 to 2013, the combined values of the three commodities constitutes about 82% of all exports and about 16% of imports. Cocoa beans and Coffee exports alone account for about 46% of total agricultural commodity exports, while vegetables and fruits, and rubber exports, respectively, constitutes 27% and 9% of export over the period. Furthermore, revenue generated from the export of these commodities represents significant percentage of the nominal GDP of some small agriculture-based economies in the region. For instance, even though Nigeria and Cote d'Ivoire, respectively, accounted for about 44% and 35% of the region's rubber export in 2013, export revenues accounted for about 0.32% and 2.55% of GDP in Nigeria and Cote d'Ivoire, respectively, in 2013. However, for Liberia whose rubber export revenues constituted about 5% of the region's export, its export values represented over 5% of GDP for the trading period. In the case of trade in beverages, Ghana and Cote d'Ivoire accounted for 28% and 29%, respectively, of total exports, which translated to about 8% and 13% of their respective 2013 GDP. For vegetables and fruit trade, South Africa and Ghana, respectively, contributed about 42% and 16% of the region's total export value in 2013, but their exports represent only about 1% and 3% of their respective GDP, while export revenue generated by Guinea-Bissau and Cameroon, who accounted for 2% each of the region's total export, represents about 23% and 10% of their respective GDP in 2013.

Although these commodities represent an integral part of SSA agricultural trade, the reform is expected to either result in minimal or no price increase, while some commodities would experience price decline. For instance, vegetables and fruits would experience an average price rise of about 0.13%, while the average price of beverages would rise by 0.04%. The unprocessed forms of beverages – green coffee and cocoa bean – which are mainly exported by SSA countries – would experience price declines, while rubber price would remain unchanged (see Table 3). Thus, while trade reform would lead to a rise in the prices of the region's imports, its major export commodities would experience price declines or no change – resulting in a net loss in agricultural commodity trade by the region.

4. Conclusions

The findings of this research lead to a number of conclusions on the potential impacts of industrialized countries' agricultural trade liberalizations on Sub-Saharan Africa. First, the price changes resulting from the proposed reforms negatively affect commodities produced by Sub-Saharan African countries. That is, while the proposed reforms tend to increase the world prices of some agricultural commodities, producers of primary agricultural commodities do not gain as much as those of processed commodities. SSA consumers are expected to pay more for the importation of processed agricultural commodities, while producers would be losing due to reductions in the prices of primary

commodities. Second, with the expected increases in almost all food-commodity prices as a result of the reforms, import bills of countries within the region are expected to rise. The rise in import bill means that the net-food-importing countries would encounter welfare losses. Third, beneficiaries of preferential treatment granted by developed nations would tend to be losers as a result of preference erosion due to liberalization. For example, the major sugar exporters of the region will experience export revenue losses if liberalization results into removal of guaranteed prices in the US and EU, and extension of duty-free, quota-free access to other LDCs. Thus, while the impact of liberalization may be diverse across countries, in general, net-food importers would become worst off. Given that most SSA countries are net importers of food commodities, the region therefore stands to be potentially negatively affected by full implementation of the current WTO reform proposal. This conclusion is consistent with conclusions of Ackerman and Gallagher's (2008) and Arce et al.'s (2014) reviews of results of earlier CGE-based models used to assess the impact of liberalization on SSA, and Polaski's (2006) projection of net loss for SSA from global trade liberalization.

Given the diversity of the potential impacts on SSA countries, future agricultural trade reform negotiations would be critical to the diverse interest groups in the region. However, for the region to benefit from global liberalization, African governments should focus, in the next rounds of negotiation, on attracting the necessary investments to improve productivity and change the structure of agricultural trade. Particularly, at the national levels, countries should focus on supporting the production of commodities of interest to food security to reduce import bill on food items. Moreover, countries should take advantage of the ongoing drive for African industrialization to mobilize the necessary human and physical resources to develop or improve their agro-processing industries. This will not only help improve their markets for processed agricultural commodities but also expand gains from agricultural trade by benefiting from the higher prices of processed commodities. In addition, though it remains unclear whether Sub-Saharan African agriculture fully benefits from the existing preferential agreements,[20] SSA or the beneficiaries of preferential agreements should consolidate efforts, in the next rounds of negotiation, to ensuring that preference-granting countries are not only allowed some levels of flexibility to shield specific products from the normal cut as a way of reducing the rate of preference erosion associated with MFN liberalization, but also ensure that agricultural commodities of greater interest to the region are included into existing agreements. Or, for countries adversely affected as a result of the preference erosion, efforts should be made through the multilateral system (such as the Aid-for-Trade program) to provide some compensations. Finally, the region should encourage more intra-regional trade by removing non-tariff measures that hinder trade. Removing non-tariff measures will not only lead to market creation in preparation for preference loss that may result from successful conclusion of the ongoing WTO reform negotiations, but also encourage intra-regional trade which could serve as shock absorber in the face of global economic crisis.

Acknowledgement

the original paper for submission. We are also thankful to the anonymous reviewers whose comments enhanced the quality of the paper for acceptance for publication.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. India's duty-free trade preference (DFTP) scheme also excludes a number of products such as fruit and vegetables, nuts, coffee, tea, maize and tobacco products, and provides limited concessions on several others (cut flowers, vegetable oils, and clothing), which commodities are of key export interest to African LDCs. Similarly, while 99% of all LDC imports into China in 2011 were under the duty-free scheme, China has imported little beyond oil, and a few other commodities, from African LDCs (see Ancharaz and Laird 2013).
2. Authors' calculation based on UNCTAD trade data for the period under consideration.
3. Twelve of the 20 members of the EU sugar protocol beneficiaries are SSA countries: Republic of Congo, Ivory Coast, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe. The sugar protocol commits the EU to purchasing 1.3 million tons of sugar from these countries annually at guaranteed prices.
4. According to United Nations Conference on Trade and Agricultural Development, non-tariff barriers (NTBs) are measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both.
5. The Agricultural Trade and Policy Simulation Model was developed by the United Nations Conference on Trade and Agricultural Development and the Food and Agricultural Organization to assess the potential effects of agricultural policy liberalization.
6. Even though the model assumes no stochastic shocks, a positive shock that increases export would result in increase of income generated from agricultural trade. But given the size of the region's share in global agricultural commodity trade, such shock will have no significant impact on prices which we assessed using the model.
7. The 2013 updated GTAP database contains data on 22 of the 48 countries in SSA, unlike the ATPSM which covers all 48 countries.
8. Poonyth et al. (2004) used a similar model formulation to assess the impact of domestic and trade policies on the world cotton market.
9. The ATPSM has five simulation scenarios: the default (Uruguay Rounds scenarios, the Conservative scenario, the Harbinson scenario, the revised Harbinson (July 2007 Package), and the Swiss scenario). Each of the scenarios has specific reform modalities.
10. The Harbinson proposal exempts LDCs from tariff reduction requirements, and proposes a 100% cancellation of export subsidies for both developed and developing countries. These provisions are retained by the Falconer versions.
11. The respective values are based on the Author's calculation from UNCTAD 2014 trade data.
12. Dairy products cover milk, butter and cheese (see compositions of commodity groups in Table 3).
13. The price rises for dairy products are consistent with Bouet et al.'s (2007) findings that full liberalization of agricultural trade will create larger price effects for dairy products and meat.
14. The deficit represents about 88% of the region's import value for cereal products, and about 38% of its total agricultural commodity imports for the period.
15. These estimates and other proceeding trade gain or loss estimates are based on 2013 trade figures with the assumption that the same trade value would be recorded in 2014.
16. Sugar includes both raw and refined products. Most of the sugar exported by the region is in the form of raw sugar, while its imports come as refined sugar.
17. Information provided by Mauritius Ministry of Finance and Development Planning (http://statsmauritius.gov.mu/English/StatsbySubj/Pages/natmarch2013.aspx). Accessed 28 August 2014.
18. Mauritius, Mozambique, Swaziland, Zambia, and Zimbabwe are beneficiaries of the EU sugar protocol, and Ghana and Niger benefit from the US AGOA initiative.
19. Beverages here refer to trade in coffee green and cocoa beans, and their processed forms along with tea. But SSA exports mainly the unprocessed forms and imports the processed.

20. For the US's AGOA initiative which is expected to expire in 2015, it is reported that about 90% of all imports recorded under this program are in oil, while it excludes a wide range of processed agricultural products, including dairy products, sugar, cocoa, and cotton where most SSA LDCs could enhance their comparative advantage; India's Duty-Free Trade Preference (DFTP) scheme excludes a number of products such as fruit and vegetables, nuts, coffee, tea, maize and tobacco products, and provides limited concessions on several others (cut flowers, vegetable oils, and clothing), which commodities are of key export interest to African LDCs; under its DFQF arrangement, China has imported little beyond oil, and a few other commodities, from African LDCs (see Ancharaz and Laird 2013); in the case of EU-SSA trade agreements, most SSA beneficiaries have not been able to fully benefit from these due to SPS requirements (Pearson 2013).

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Appendix

Table A1. World and SSA agricultural commodity trade, 1995–2013.

Year	Total world agricultural trade (billion US$)	SSA total agricultural trade (billion US$)	SSA share of global agricultural trade (%)
1995	1186.14	28.56	2.41
1996	1219.91	30.38	2.49
1997	1197.13	31.51	2.63
1998	1147.11	30.50	2.66
1999	1121.52	29.34	2.62
2000	1106.38	27.86	2.52
2001	1113.14	29.44	2.64
2002	1177.97	31.36	2.66
2003	1353.56	38.76	2.86
2004	1563.13	42.82	2.74
2005	1698.72	46.77	2.75
2006	1875.49	51.78	2.76
2007	2221.82	61.18	2.75
2008	2609.52	73.74	2.83
2009	2279.52	72.07	3.16
2010	2638.37	83.31	3.16
2011	3233.74	111.29	3.44
2012	3190.27	108.57	3.40
2013	3340.28	108.79	3.26
Average	1856.51	54.63	2.83

Source: Authors' calculation from UNCTAD data (2014).

Table A2. Sub-Saharan Africa net agricultural commodity trade (million United States dollars), 1995–2013.

Year	Cereal products	Dairy products	Sugar	Meat and meat products	Hides and skins	Beverages	Vegetables and fruits	Vegetable oil	Rubber	SSA
1995	(2138.62)	(582.55)	132.52	(188.15)	130.34	4569.59	1240.82	(295.15)	314.81	3183.60
1996	(2429.40)	(530.55)	272.17	(257.27)	125.68	4716.78	1306.54	(397.30)	338.66	3145.32
1997	(2465.16)	(567.55)	104.88	(230.77)	131.57	4655.07	1408.57	(446.75)	249.08	2838.94
1998	(2638.98)	(617.69)	1.48	(249.37)	92.25	4925.72	1171.27	(481.75)	193.51	2396.44
1999	(2612.11)	(687.58)	144.48	(209.82)	81.49	4197.51	1322.40	(526.37)	212.76	1922.76
2000	(2158.48)	(557.31)	116.65	(232.50)	112.28	3273.31	1348.90	(459.03)	209.30	1653.11
2001	(2656.25)	(660.93)	78.96	(241.05)	168.84	3438.65	1333.35	(495.30)	247.35	1213.60
2002	(2817.81)	(563.49)	50.55	(345.64)	136.41	4572.08	1500.37	(621.99)	243.75	2154.22
2003	(3555.05)	(753.91)	32.40	(577.29)	113.57	5262.74	1910.26	(956.16)	376.83	1853.40
2004	(4152.40)	(891.17)	130.62	(767.62)	145.41	4976.82	2329.90	(1059.25)	363.91	1076.22
2005	(4995.29)	(1212.39)	(45.58)	(1003.54)	158.56	4945.66	2163.80	(1098.49)	470.38	(616.88)
2006	(5417.75)	(1484.05)	(292.87)	(1032.39)	174.44	5767.13	2198.56	(1337.42)	587.08	(837.28)
2007	(7012.74)	(1775.94)	(451.77)	(1390.42)	193.85	7109.46	2536.34	(1969.20)	794.06	(1966.36)
2008	(9297.85)	(2052.76)	(714.09)	(1793.10)	185.61	8563.89	2978.85	(2770.02)	953.77	(3945.69)
2009	(7188.39)	(1473.84)	(601.06)	(1677.78)	136.00	10,396.65	3165.78	(1927.50)	872.72	1702.57
2010	(7604.66)	(1794.63)	(1361.18)	(1758.72)	194.44	12,136.44	3795.58	(2608.42)	1057.53	2056.40
2011	(11,199.39)	(2789.54)	(2090.43)	(3005.16)	225.63	12,508.86	3850.42	(4115.07)	2078.13	(4536.57)
2012	(11,820.93)	(2344.63)	(1791.23)	(3417.30)	207.38	11,409.82	3967.57	(3657.45)	1309.69	(6137.08)
2013	(13,120.95)	(2258.46)	(1801.37)	(3190.09)	384.57	10,557.58	4680.09	(3200.40)	1419.22	(6529.80)
Total	(105,282.20)	(23,598.97)	(8084.86)	(21,567.98)	3098.34	127,983.74	44,209.37	(28,423.03)	12,292.54	626.94

Source: Authors' calculation from UNCTAD data (2014).
(.) indicates negative values.

Table A3. Percentage share of net commodity trade.

	Meat products	Hide and skin	Beverages	Vegetables and fruits	Dairy product	Sugar	Vegetable oil	Cereal
Angola	35.27	0.01	− 0.32	− 6.12	11.05	21.80	9.35	6.53
Benin	6.58	0.03	− 0.05	2.58	0.93	0.83	3.21	1.41
Botswana	− 5.67	3.03	− 0.30	− 2.85	0.33	5.99	1.07	1.38
Burkina aso	0.06	0.57	− 0.11	0.63	4.19	2.67	0.58	1.40
Burundi	0.03	0.51	0.63	− 0.11	0.56	0.86	0.19	0.39
Cameroun	1.04	0.27	5.29	6.46	2.68	6.08	0.62	4.68
Cape Verde	0.98	0.01	− 0.05	− 0.72	1.46	1.40	0.60	0.42
CAR	0.07	0.03	0.05	− 0.03	0.27	0.63	0.21	0.40
Chad	0.39	0.51	− 0.05	− 0.24	1.12	3.93	0.56	1.10
Comoros	1.88	0.00	0.11	− 0.19	0.43	0.65	0.32	0.49
Congo	6.33	− 0.01	0.10	− 1.02	2.46	0.34	1.60	2.35
Cote d'ivoire	4.25	0.11	37.83	1.60	3.51	− 1.97	− 5.70	6.50
Djibouti	0.05	0.42	0.01	− 0.25	0.30	1.32	1.17	0.35
DR. Congo	7.40	0.12	0.37	− 1.28	3.61	10.95	1.41	2.55
E. Guinea	4.76	− 0.01	0.01	− 0.51	1.11	1.10	0.70	0.47
Eritria	0.04	0.51	− 0.10	− 0.71	0.50	5.50	1.21	1.94
Ethiopia	− 1.24	7.98	6.08	5.04	0.84	7.43	5.61	4.78
Gabon	5.67	0.00	− 0.08	− 0.01	2.27	0.42	1.05	1.06
Gambia	1.33	− 0.05	− 0.12	− 0.49	1.23	2.85	1.21	1.01
Ghana	6.27	− 0.19	24.85	9.05	3.31	25.12	2.47	4.43
Guinea	0.32	0.24	0.45	− 0.24	0.64	4.74	0.90	0.04
Guinea Bissua	0.12	− 0.19	− 0.06	2.85	0.24	0.61	1.20	0.94
Kenya	− 0.12	6.38	11.19	12.15	0.13	10.90	5.74	− 5.31
Lesotho	2.74	0.27	− 0.13	− 0.91	0.90	3.81	0.81	1.48
Liberia	0.10	0.00	0.04	− 0.02	0.05	0.08	0.05	0.08
Madagascar	0.04	1.98	2.49	1.89	0.70	5.40	2.64	1.52
Malawi	0.13	0.47	0.84	0.83	0.82	− 10.08	1.14	0.88
Mali	0.01	0.74	− 0.36	− 0.06	2.27	4.27	1.40	1.27
Mauritinia	0.52	0.40	− 0.30	− 0.85	2.86	9.08	2.66	1.57
Mauritius	3.43	0.04	− 0.19	− 2.21	5.55	− 58.07	1.75	1.76
Mozambique	1.36	0.31	− 0.12	1.27	1.68	− 1.61	2.93	3.20
Namibia	− 2.43	3.97	− 0.22	1.06	1.51	9.96	0.59	1.30
Niger	0.12	0.34	− 0.14	0.75	1.79	2.78	1.65	1.49
Nigeria	1.79	0.23	4.08	− 2.86	29.89	67.11	5.20	24.12
Rwanda	0.03	4.05	0.96	− 0.37	0.17	3.65	1.70	0.68
Senegal	1.07	2.67	− 0.35	− 0.76	5.52	8.17	0.90	5.77
Seycelles	0.61	0.00	− 0.03	− 0.46	0.67	0.39	0.51	0.26
Sierra Leone	1.09	0.05	0.26	− 0.32	0.75	1.14	0.30	0.92
Somalia	− 0.89	6.00	− 0.07	− 1.89	1.09	21.49	1.54	1.74
South Africa	13.97	40.17	− 1.54	71.25	− 1.84	− 26.74	21.85	4.68
Swaziland	0.70	0.14	− 0.15	0.56	1.11	− 45.08	0.50	0.93
Tanzania	0.34	5.18	2.85	6.61	0.74	9.92	7.65	2.60
Togo	0.49	0.01	0.95	− 0.18	0.00	2.17	1.19	0.62
Uganda	0.11	4.12	4.97	0.16	− 0.06	6.86	3.20	1.37
Zambia	0.11	2.11	0.04	− 0.24	0.50	− 13.93	1.38	− 0.22
Zimbabwe	− 1.22	6.49	0.39	1.17	0.15	− 14.92	3.16	2.69

Source: Authors' calculation based on simulation results.

Table A4. Major Sub-Saharan Africa sugar traders, 1995–2013.

Year	Swaziland	Zambia	Malawi	Mauritius	Cote d'ivoire	Mozambique	South Africa	Zimbabwe	SSA
1995	147.50	18.60	17.17	359.43	(17.31)	(11.04)	271.25	93.79	128.96
1996	142.99	19.59	42.21	436.81	10.53	(33.48)	283.51	118.39	275.32
1997	160.09	26.83	18.37	350.37	10.03	(20.09)	296.55	97.15	103.18
1998	174.23	18.86	25.70	353.12	(13.47)	(35.89)	264.14	96.47	(6.97)
1999	149.28	10.29	21.36	305.63	10.36	(35.55)	253.05	76.15	130.88
2000	126.63	24.42	21.83	198.01	27.99	(10.51)	253.94	83.77	75.86
2001	231.06	46.23	42.20	274.69	16.69	(16.39)	285.00	47.34	20.46
2002	108.09	31.17	28.83	277.32	3.04	(9.76)	204.07	59.77	15.94
2003	180.76	32.85	76.92	290.58	14.39	(19.48)	84.12	42.17	(79.28)
2004	278.54	31.80	46.63	348.07	24.38	(14.23)	116.12	71.78	51.97
2005	243.80	52.20	36.12	333.31	18.28	12.22	123.04	60.23	(129.51)
2006	297.20	65.42	47.43	331.95	1.51	38.66	170.30	50.03	(399.79)
2007	290.22	88.27	56.85	279.61	0.94	22.65	28.96	35.97	(644.99)
2008	284.34	69.68	60.79	274.70	7.69	27.24	(28.38)	71.96	(836.80)
2009	306.87	96.03	64.39	202.02	8.58	(10.05)	149.24	109.52	(761.36)
2010	337.51	157.45	61.83	244.45	(2.62)	6.97	147.80	29.60	(1375.31)
2011	347.06	184.95	140.80	268.17	9.12	60.01	(42.65)	145.91	(2276.07)
2012	282.18	168.92	87.85	221.25	20.58	106.66	(36.22)	161.72	(2179.05)
2013	280.31	206.94	79.99	278.97	40.60	97.73	(231.98)	(6.05)	(1805.35)
Total	4368.67	1350.51	977.26	5628.46	191.31	155.65	2591.85	1445.67	(9691.91)

Source: Authors' calculation from UNCTAD data (2014).

Table A5. Potential impact of preference erosion on Sub-Saharan African countries.

Year	Export volume (MT)	Free market price	US guaranteed price/MT	EU guaranteed price/MT	Post-reform WM price/MT	Sugar revenue (million US$)/FM	Sugar revenue (million US$)/US	Sugar revenue (million US$)/EU	Sugar revenue/post-reform effects (million US$)	Revenue loss to preference erosion (million US$)	EU price decline (%)	US price decline (%)
						Mauritius (EU sugar protocol)						
2007	344,250	219.05	456.79	732.26	219.05	75.41	157.25	252.08	75.41	176.67	(0.70)	(0.52)
2008	382,534	273.95	469.11	677.95	273.95	104.79	179.45	259.34	104.79	154.55	(0.60)	(0.42)
2009	317,988	399.31	535.39	572.32	399.31	126.98	170.25	181.99	126.98	55.02	(0.30)	(0.25)
2010	427,029	459.60	683.13	565.68	459.60	196.26	291.71	241.56	196.26	45.30	(0.19)	(0.33)
2011	442,145	577.18	826.59	586.63	577.18	255.20	365.47	259.38	255.20	4.18	(0.02)	(0.30)
2012	427,378	470.24	635.70	579.94	470.24	200.97	271.68	247.85	200.97	46.88	(0.19)	(0.26)
2013	432,184	389.33	466.36	572.26	389.33	168.26	201.55	247.32	168.26	79.06	(0.32)	(0.17)
2014	433,902	388.08	487.30	602.80	397.67	168.39	211.44	261.56	172.55	(89.01)	(0.34)	(0.18)
2015	465,647	408.65	513.70	602.80	418.74	190.29	239.20	280.69	194.99	(85.71)	(0.31)	(0.18)
2016	479,424	410.30	528.00	602.80	420.43	196.71	253.14	289.00	201.57	(87.43)	(0.30)	(0.20)
						Swaziland (EU sugar protocol)						
2007	24,003	219.05	456.79	732.26	219.05	5.26	10.96	17.58	5.26	12.32	(0.70)	(0.52)
2008	83,656	273.95	469.11	677.95	273.95	22.92	39.24	56.71	22.92	33.80	(0.60)	(0.42)
2009	68,472	399.31	535.39	572.32	399.31	27.34	36.66	39.19	27.34	11.85	(0.30)	(0.25)
2010	56,972	459.60	683.13	565.68	459.60	26.18	38.92	32.23	26.18	6.04	(0.19)	(0.33)
2011	33,012	577.18	826.59	586.63	577.18	19.05	27.29	19.37	19.05	0.31	(0.02)	(0.30)
2012	52,819	470.24	635.70	579.94	470.24	24.84	33.58	30.63	24.84	5.79	(0.19)	(0.26)
2013	47,601	389.33	466.36	572.26	389.33	18.53	22.20	27.24	18.53	8.71	(0.32)	(0.17)
2014	44,477	388.08	487.30	602.80	397.67	17.26	21.67	26.81	17.69	(9.12)	(0.34)	(0.18)
2015	48,299	408.65	513.70	602.80	418.74	19.74	24.81	29.11	20.22	(8.89)	(0.31)	(0.18)
2016	46,792	410.30	528.00	602.80	420.43	19.20	24.71	28.21	19.67	(8.53)	(0.30)	(0.20)
						Zambia (EU sugar protocol)						
2007	135,062	219.05	456.79	732.26	219.05	29.58	61.69	98.90	29.58	69.32	(0.70)	(0.52)
2008	98,216	273.95	469.11	677.95	273.95	26.91	46.07	66.59	26.91	39.68	(0.60)	(0.42)
2009	155,053	399.31	535.39	572.32	399.31	61.91	83.01	88.74	61.91	26.83	(0.30)	(0.25)
2010	273,679	459.60	683.13	565.68	459.60	125.78	186.96	154.82	125.78	29.03	(0.19)	(0.33)
2011	257,730	577.18	826.59	586.63	577.18	148.76	213.04	151.19	148.76	2.44	(0.02)	(0.30)
2012	286,026	470.24	635.70	579.94	470.24	134.50	181.83	165.88	134.50	31.38	(0.19)	(0.26)
2013	340,598	389.33	466.36	572.26	389.33	132.60	158.84	194.91	132.60	62.31	(0.32)	(0.17)
2014	368,481	388.08	487.30	602.80	397.67	143.00	179.56	222.12	146.53	(75.59)	(0.34)	(0.18)
2015	331,701	408.65	513.70	602.80	418.74	135.55	170.40	199.95	138.90	(61.05)	(0.31)	(0.18)
2016	346,927	410.30	528.00	602.80	420.43	142.34	183.18	209.13	145.86	(63.27)	(0.30)	(0.20)

(Continued)

Table A5. (Continued)

Year	Export volume (MT)	Free market price	US guaranteed price/MT	EU guaranteed price/MT	Post-reform WM price/MT	Sugar revenue (million US$)/FM	Sugar revenue (million US$)/US	Sugar revenue (million US$)/EU	Sugar revenue/ post-reform effects (million US$)	Revenue loss to preference erosion (million US$)	EU price decline (%)	US price decline (%)
						Zimbabwe (EU sugar protocol)						
2007	53,066	219.05	456.79	732.26	219.05	11.62	24.24	38.86	11.62	27.23	(0.70)	(0.52)
2008	97,602	273.95	469.11	677.95	273.95	26.74	45.79	66.17	26.74	39.43	(0.60)	(0.42)
2009	131,800	399.31	535.39	572.32	399.31	52.63	70.56	75.43	52.63	22.80	(0.30)	(0.25)
2010	112,000	459.60	683.13	565.68	459.60	51.48	76.51	63.36	51.48	11.88	(0.19)	(0.33)
2011	88,000	577.18	826.59	586.63	577.18	50.79	72.74	51.62	50.79	0.83	(0.02)	(0.30)
2012	110,600	470.24	635.70	579.94	470.24	52.01	70.31	64.14	52.01	12.13	(0.19)	(0.26)
2013	103,533	389.33	466.36	572.26	389.33	40.31	48.28	59.25	40.31	18.94	(0.32)	(0.17)
2014	125,889	388.08	487.30	602.80	397.67	48.85	61.35	75.89	50.06	(25.82)	(0.34)	(0.18)
2015	136,009	408.65	513.70	602.80	418.74	55.58	69.87	81.99	56.95	(25.03)	(0.31)	(0.18)
2016	121,810	410.30	528.00	602.80	420.43	49.98	64.32	73.43	51.21	(22.21)	(0.30)	(0.20)
						Mozambique (EU sugar protocol)						
2007	8317	219.05	456.79	732.26	219.05	1.82	3.80	6.09	1.82	4.27	(0.70)	(0.52)
2008	5941	273.95	469.11	677.95	273.95	1.63	2.79	4.03	1.63	2.40	(0.60)	(0.42)
2009	6422	399.31	535.39	572.32	399.31	2.56	3.44	3.68	2.56	1.11	(0.30)	(0.25)
2010	11,114	459.60	683.13	565.68	459.60	5.11	7.59	6.29	5.11	1.18	(0.19)	(0.33)
2011	11,114	577.18	826.59	586.63	577.18	6.41	9.19	6.52	6.41	0.11	(0.02)	(0.30)
2012	10,792	470.24	635.70	579.94	470.24	5.07	6.86	6.26	5.07	1.18	(0.19)	(0.26)
2013	12,437	389.33	466.36	572.26	389.33	4.84	5.80	7.12	4.84	2.28	(0.32)	(0.17)
2014	12,936	388.08	487.30	602.80	397.67	5.02	6.30	7.80	5.14	(2.65)	(0.34)	(0.18)
2015	13,622	408.65	513.70	602.80	418.74	5.57	7.00	8.21	5.70	(2.51)	(0.31)	(0.18)
2016	14,688	410.30	528.00	602.80	420.43	6.03	7.76	8.85	6.18	(2.68)	(0.30)	(0.20)
						Ghana (AGOA initiative)						
2007	237,000	219.05	456.79	732.26	219.05	51.91	108.26	173.54	51.91	121.63	(0.70)	(0.52)
2008	234,000	273.95	469.11	677.95	273.95	64.10	109.77	158.64	64.10	94.54	(0.60)	(0.42)
2009	101,200	399.31	535.39	572.32	399.31	40.41	54.18	57.92	40.41	17.51	(0.30)	(0.25)
2010	82,000	459.60	683.13	565.68	459.60	37.69	56.02	46.39	37.69	8.70	(0.19)	(0.33)
2011	225,400	577.18	826.59	586.63	577.18	130.10	186.31	132.23	130.10	2.13	(0.02)	(0.30)
2012	169,569	470.24	635.70	579.94	470.24	79.74	107.79	98.34	79.74	18.60	(0.19)	(0.26)
2013	197,942	389.33	466.36	572.26	389.33	77.06	92.31	113.27	77.06	36.21	(0.32)	(0.17)
2014	246,058	388.08	487.30	602.80	397.67	95.49	119.90	148.32	97.85	(50.47)	(0.34)	(0.18)
2015	254,631	408.65	513.70	602.80	418.74	104.06	130.80	153.49	106.63	(46.87)	(0.31)	(0.18)
2016	289,932	410.30	528.00	602.80	420.43	118.96	153.08	174.77	121.90	(52.87)	(0.30)	(0.20)

(Continued)

Table A5. (*Continued*)

Year	Export volume (MT)	Free market price	US guaranteed price/MT	EU guaranteed price/MT	Post-reform WM price/MT	Sugar revenue (million US$)/FM	Sugar revenue (million US$)/US	Sugar revenue (million US$)/EU	Sugar revenue/ post-reform effects to preference erosion (million US$)	Revenue loss to preference erosion (million US$)	EU price decline (%)	US price decline (%)
						Niger (AGOA Initiative)						
2007	8835	219.05	456.79	732.26	219.05	1.94	4.04	6.47	1.94	4.53	(0.70)	(0.52)
2008	20,609	273.95	469.11	677.95	273.95	5.65	9.67	13.97	5.65	8.33	(0.60)	(0.42)
2009	20,609	399.31	535.39	572.32	399.31	8.23	11.03	11.79	8.23	3.57	(0.30)	(0.25)
2010	37,893	459.60	683.13	565.68	459.60	17.42	25.89	21.44	17.42	4.02	(0.19)	(0.33)
2011	15,573	577.18	826.59	586.63	577.18	8.99	12.87	9.14	8.99	0.15	(0.02)	(0.30)
2012	34,321	470.24	635.70	579.94	470.24	16.14	21.82	19.90	16.14	3.77	(0.19)	(0.26)
2013	40,675	389.33	466.36	572.26	389.33	15.84	18.97	23.28	15.84	7.44	(0.32)	(0.17)
2014	30,190	388.08	487.30	602.80	397.67	11.72	14.71	18.20	12.01	(6.19)	(0.34)	(0.18)
2015	48,736	408.65	513.70	602.80	418.74	19.92	25.04	29.38	20.41	(8.97)	(0.31)	(0.18)
2016	39,867	410.30	528.00	602.80	420.43	16.36	21.05	24.03	16.76	(7.27)	(0.30)	(0.20)

Source: Authors' calculation from FAO, IMF, Bank of Ghana, US Department of Agriculture Data.