The food security dimension of the African Continental Free Trade Agreement (AfCFTA)

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Abstract

The African Free Trade Agreement (AfCFTA) that came into effect in January 2021, holds a promise of boosting the economies of African countries. In addition, the agreement could help to alleviate the food security in various parts of the continent. In our study we assess a likely scenario for food security outcomes in the continent. To the best of our knowledge, no prior quantitative assessment of the agreement's food security outcomes exists. Our study fills this gap. We employ a global computable general equilibrium model MAGNET that includes a detailed representation of trade flows and agri-food production in African countries. With the model we simulate an explicit trajectory of reductions in tariffs and non-tariff measures (NTMs) between African countries.

Our results indicate that the AfCFTA has largely positive effects on African economies that will boost both economic growth and intra-African trade. These outcomes help to improve food security principally by increasing the household incomes. Food production becomes more concentrated geographically as the countries' are better able to exploit their comparative advantages. In addition, majority of the countries improve their food security by increasing their imports and are in some cases able to reduce their own production.

1. Introduction

Intra-African trade took a decisive step forward on January 1st 2021 when trading under the African Continental Free Trade Area (AfCFTA) officially started. Preliminary economic analyses of the agreement indicate large positive effects for the continent's economies. For instance, the most up-to-date analysis by the World Bank (2020) shows that the agreement could increase the incomes in Africa by 7% by 2035 when the transition period ends. Perhaps even more importantly, the agreement is hoped to increase intra-African trade as thus far the African countries have been dependent on trading partners outside their continent. In 2017 the share of intra-African exports of the total African exports was 16.6%, whereas the same figures were 68.1% for Europe, 59.4% for Asia and 55.0% for Americas (UNCTAD 2019). One factor contributing to the low share are the duties on place for intra-African imports: e.g. the mean *ad valorem* duties for commodities imported between African countries is 9% whereas the same figure for the imports from other regions is 2.3%. For agricultural commodities the corresponding figures are even higher, 18% for intra-African and 5.8% for extra-African imports. (Bouët & Dojo 2019.) The World Bank (2020) estimates that intra-African trade would increase between 50 and 132 percent due to the AfCFTA. Moreover African exports have been traditionally composed of a small range of commodities with little value added from their country of origin such as renewable and non-renewable natural resources. Thus more liberalized trade due to the AfCFTA could help many countries to be better able to exploit their comparative advantages and thus increase product specialization.

As Africa includes some of the most vulnerable regions in terms of food security, the economic benefits of the agreement could propel many people out of food deprivation. Accordingly, improving food security is among the main objectives of the agreement. As the

AfCFTA is predicted to improve the efficiency of intra-African trade, the efficiency improvements will be reflected in higher household incomes, which is one of the major indicators for improved food security. To the best of our knowledge, no prior quantitative assessment of the agreement's food security outcomes exists.

We base our analysis on CGE modelling, as it is a method uniquely well suited for assessing multiple interconnections between trade policies, food supply and household incomes at a sufficient regional detail. More specifically we employ a state-of-the-art multi-sector, multi-region recursive dynamic CGE model MAGNET (Modular Applied GeNeral Equilibrium Tool) (Woltjer and Kuiper, 2014) that includes the most important factors determining food security: detailed representation of agricultural and food sectors, limitations of relevant production factors such as land, and consumption possibilities of households in various regions in Africa. We construct a model baseline that reflects the main economic trends for global economic future until 2035 when the AfCFTA transition period ends. In our policy analysis this baseline is perturbed by explicit predictions of the implementation of the AfCFTA in tariff and non-tariff measure (NTM) cuts.

Our results are well in line with previous analysis of the overall economic effects of the AfCFTA. Both economic activity and intra-African trade are positively affected due to the agreement. Furthermore the results show that the AfCFTA has an overall positive effect on the main food security indicators in the vast majority of the African countries. The household incomes increase and food prices decrease due to less distorted trade, which indicate that food security is likely to improve to a large majority of the households on various income groups.

The paper is structured as follows. In section 2 we summarize the relevant literature. In section 3 we present our method in a more detail. In section 4 we summarize the main results, and in the last section we present the conclusions.

2. Literature review

The AfCFTA is already widely discussed in research literature. Given comprehensive characteristics of a continental market integration, a majority of the studies employ a global economic model. Computable general equilibrium (CGE) frameworks are especially well suited as they take into account the most significant interactions among all sectors through domestic, regional (and international) linkages.

Sandrey et al. (2011) and Jensen and Sandrey (2015) were pioneering studies on the economic effects of a more complete trade liberalization in Africa with an emphasis on food and agriculture. Sandrey et al. (2011) showed that sugar was the only agricultural sector with significant changes induced by limited continental trade liberalisation (by this time through the Tripartite Free Trade Area). Jensen and Sandrey (2015) covered a hypothetical free trade area (FTA) consisting of 21 African countries where they disaggregated agriculture to three sectors: primary agriculture, secondary agriculture (processed commodities) and sugar. Authors decompose trade costs into NTMs and trade facilitation. The set of scenarios contemplates many aspects of trade-related features of the FTA which include the elimination of tariffs among African countries, a cut by half of NTMs, and a reduction in transaction costs by one fifth. Scenarios are run independently and in a cumulative way in order to better understand the contribution of each group of trade restrictions. Results show positive development in food and agriculture for most but not all countries, driven by NTMs. Few countries, especially South Africa, dominate income gains. Some countries gain because of their better access to other African markets (e.g. South Africa) or by reallocating their production to more efficient sectors (e.g. Kenya). As expected, sugar appears as a key commodity which drives results in food and agriculture. The addition of tariff elimination and NTM reduction increases trade for all countries (except Zimbabwe) by contrast to the sole elimination of tariffs. GDP increases the most in Senegal (7.8%), Kenya (4.4%), Uganda (3.7%), Namibia (3.5%) and Tanzania (2.9%).

Countries with high import tariffs or countries that face high export barriers (including NTMs) are the most affected by liberalized trade, especially when they present existing trade ties with other countries. Tariff revenue losses are substantial for few countries such as Tanzania or Nigeria, but in general they are marginal. Indeed losses are compensated by economic development and gains from deeper trade. The study shows that the gains are due to changes in trade relations for few partners (e.g. Kenya's gains are concentrated on Tanzania, and Ghana's gains are concentrated on Nigeria) and are concentrated in few products. Processed commodities contribute to income gains more than the raw commodities, which is a desirable results from the perspective of increasing the value added share of African production.

Other studies using the GTAP model include Vanzetti et al. (2018) and Saygili et al. (2018). They use a full GTAP commodity disaggregation but do not provide results by agri-food sectors. They contemplate a full tariff elimination and a scenario with exemptions for 5% of sensitive products. The exemptions yield 60% lower trade effects than full liberalization, which reflects the high concentration of intra-African trade on few products. Importantly Vanzetti et al. (2018) include NTMs in their analysis treating them as ad valorem equivalents tariffs. They conclude that even though tariff barriers remain significant in intra-African trade, NTMs have a greater impact on trade flows and further economic aggregates such as welfare or employment. Employing estimates of the time reduction in customs (de Melo and Sorgho, forthcoming) the African Development Bank (2019) comes up to a similar conclusion but again with no details on the food and agricultural sectors.

Above mentioned studies adopt a static CGE modelling framework, i.e. elimination of trade barriers among African countries instantaneously. In contrast to these long-run effects of policy changes, other studies use dynamic models, which allow integrating the transitional effects in more detail. In particular Mevel and Karingi (2013) and Depetris Chauvin et al. (2016) use the dynamic MIRAGE model to assess the effects of the continental trade liberalisation with a focus on agriculture and food sectors. They both use trade protection data from the MacMAp-HS6.

Mevel and Karingi (2013) pay special attention in addressing both the establishment of an AfCFTA and the deepening of two regional trade blocks. Income and trade gains from the former are higher than the latter. They assume that trade reforms are fully implemented by 2017, and compare results by 2022. For modelling NTMs through trade facilitation measures, they use a database on trade costs related to time for export and import processes (Minor and Tsigas, 2008). They show that intra-African trade as a share of Africa's total trade would increase by about half over the examined period, i.e. from 10.2% in 2010 to 15.5% in 2022, with significant differences at country level. Including trade facilitation measures, the share of intra-African trade would more than double, rising to almost 22% in 2022. They present results for 16 African countries and 12 agricultural and food products, sugar and dairy products being the most affected.

Setting apart NTMs and transaction costs, Depetris Chauvin et al. (2016) propose cumulative scenarios, which contemplate the elimination of tariffs separately for agricultural products, and all the products with a 50% cut in NTMs and a partial (30%) decrease in transaction costs for all goods. NTM estimates are adapted from Kee et al. (2009) and transaction costs from Minor and Tsigas (2008). For 17 African countries, all scenarios are implemented starting in 2017 with a linear phasing-in period of 10 years. Out of 21 sectors, 10 represent agriculture and food products. The study also applies a microsimulation model to evaluate the effects of price and wages changes on welfare for households in 6 countries (Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Madagascar, and Nigeria). This combination allows studying welfare effects at heterogeneous household level in terms of poverty, gender or territory. Conclusion highlights that smaller and highly protected economies would benefit the most in terms of income and trade gains. Still, NTMs and trade facilitation measures are key drivers of economic growth.

Abrego et al. (2019) deviate from the assumption of perfect market competition. Their study employs the CGE model of Costinot and Rodriguez-Clare (2014). Simulations consider full import-tariff elimination and a tariff-equivalent reduction in NTMs by 35% for 45 African countries. Authors also conduct sensitivity analysis on the NTM reduction. Interestingly, an alternative scenario considers the same level of reduction in trade barriers (full tariff elimination and 35% reduction in NTMs) for imperfect competition market structures (Krugman and Melitz cases).

Under imperfect competition, welfare gains are lower for most countries. This is driven by the disparity between prices and marginal costs, inducing that changes in import tariffs are not reflected in changes in market price (then do not automatically raise income). Under perfect competition, welfare effects from tariff elimination alone are rather small (increase of income by 0.05% at continental level). Reducing NTMs amplify significantly the effects, with an increase in continental welfare of 1.7%. Intra-continental trade is expected to expand by about 78% under imperfect competition (82% under perfect competition). Estimated revenue losses amount to 0.03% of GDP.

Abrego et al. (2019) highlight that the world as a whole is better off with the AfCFTA (higher GDP and welfare) due to global efficiency improvements. They show that the welfare gains in other regions are the result of scale effects, stimulated by higher imports from Africa. These dominate trade diversion effects. Interestingly some studies also link (quantify within a CGE framework) how the establishment of the AfCFTA can counterbalance negative impacts for Africa of external initiatives or trade development such as the potential establishments of “mega” free trade agreements (e.g., EU-USA, Trans-Pacific Partnership, China-Japan-Korea) isolating African countries (Guimbard and Le Goff, 2014) or the collateral effects on Africa of a trade war between China and the USA (Bouët et al., 2019). The latter concludes that African countries can benefit more from these external trade tensions if they establish an AfCFTA.

World Bank (2020) assessed the economic and distributional effects of the agreement by using a global CGE model ENVISAGE and a microsimulation model GIDD. The study finds that the agreement would increase income in African countries by $450 billion (7%) by year 2035. The effects in individual countries range from 2% in Malawi to 14% in Côte d’Ivoire. The study also assesses trade facilitation (TF) measures in addition to tariff and NTM cuts. The authors find that TF comprise the bulk of the total gain, $292 billion. In the simulations the NTMs are cut by half within the AfCFTA, and also the exports from non-AfCFTA countries are subject to a 20% reduction in NTMs. The authors measure the TF effect from the data on observed time on customs, and they apply the improvement as changes in iceberg costs of importing. The improvement equals on average a 7 percentage point decline in trade costs. The microsimulation results show that the agreement have modest effects on income distribution where unskilled workers gain a higher increase in wages than skilled workers (10.3% vs. 9.8% increase). Also women's wages grow faster in comparison to those of men (10.5% vs. 9.9%).

3. Methods and data

Our analysis is based on computable general equilibrium (CGE) modelling. This modelling framework is especially well suited as it is capable of incorporating the most significant interactions among all sectors through domestic, regional (and international) linkages. As a result CGE models are able to quantify trade-diverting and trade-creating effects of market opening, driven by comparative advantage and feedback effects (e.g. structural adjustments). They enable to have a broad view across the modelled economies and to quantify the sectoral effects. By contrast the partial equilibrium (PE) models, which concentrate in one sector, are capable to adopt a more disaggregated commodity structures and more specific interrelationships. In addition to modelling approaches, empirical analysis (e.g. using gravity equations) can also predict changes in trade flows, typically based on countries' size, level of development, geographic and cultural proximity. This branch of analysis is the foremost tool to assess trade restrictiveness of NTMs. The approaches are also interconnected, as the CGE models typically use the estimated NTM rates in calibrating the model database.

3.1. MAGNET model

The present study employs a state-of-the-art multi-sector, multi-region recursive dynamic CGE model named MAGNET (Modular Applied GeNeral Equilibrium Tool) (Woltjer and Kuiper, 2014). MAGNET is widely employed in global impact studies of agricultural, trade, land use and biofuel policies, and in long-term projections of the related industries. The model has been developed at Wageningen Economic Research and is applied and further extended at Wageningen Economic Research, Thünen Institute and by European Commission's Joint Research Centre, being a core model of the integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP) (M'barek et al., 2012, 2015).

MAGNET is based on the Global Trade Analysis Project (GTAP) model, which accounts for the behaviour of households, firms, and the government in the global economy and their interactions in markets (Corong et al., 2017). The model includes a food supply chain from farm (as represented by agricultural sectors) - via food processing industries and food service sectors - to fork (as represented by a representative household) taking into account bilateral trade flows between major countries and regions in the world. The model has been employed in several trade studies e.g. on FTAs between the EU and North Africa (Boulanger and M'barek 2013), between the EU and neighbour countries (Rau 2014), between the EU and the USA (Berkum et al. 2014), and between the EU and 12 third countries and regions (Boulanger et al., 2016).

A key strength of the MAGNET model is that it allows the user to choose a la carte those sub-modules of relevance to the study at hand. This incarnation of MAGNET captures the specificities of agricultural markets, water and land use, natural resources and the main biofuels.

3.2. Database

This study employs a fully consistent and academically recognised global database that is based on contributions from members of the GTAP network and constructed by the GTAP team at Purdue University (Aguiar et al., 2019). The GTAP database, in its version 10, contains a complete record of all economic activity (i.e., production, trade, primary factor usage, final and input demands, taxes and trade tariffs and transport margins) disaggregated in 65 activities and 141 regions for the year 2014. Our analysis employs an aggregation of the database that is geared for catching the most salient features of agri-food industries in various African countries. In total the model includes 43 commodities and 36 regions of which 29 are in Africa.[1]

3.3. Baseline

The model baseline is based on the Shared Socioeconomic Pathways (SSP) long-term projections of the world economy produced by various integrated assessment models. In particular we apply the SSP2, which is the middle-of-the-road scenario (Fricko et al. 2017). The baseline is driven by following exogenous factors: population and GDP growths by region, endowment demand by region and endowment category (skilled and unskilled labour, capital and natural resources[2]), and productivity of land by region and agricultural sector. Population and GDP growths are directly based on the SSP2 scenarios, while the

[1] See Annexes 1 and 2 for detailed commodity and regional aggregations, respectively. The GTAP database includes 26 of the 51 African countries as single regions. The rest are aggregated to five larger regions. Our regional aggregation has Benin, Guinea and Togo aggregated together with Rest of Western Africa (xnf), while the rest are in their most disaggregated level.

[2] Our specification considers coal, crude oil and natural gas as separate natural resources. Their demand is determined endogenously on the baseline by the use of the related commodities.

endowment growths are derived from them. The overall labour supply is defined by the population growth and the split between skilled and unskilled labour comes from educational projections in the Wittgenstein Centre's data on global educational attainment (Goujon et al. 2016). The capital stock is assumed to have the same growth rate as the GDP, while the use natural resources have a quarter of that growth rate. The baseline starts from the 2014 GTAP database version 10 (Aguiar et al. 2019), and we apply five-year simulation steps starting from 2020 until the end of the AfCFTA transition period in 2035. The 2014 database is updated to year 2020 with GDP and population projections coming from the IMF's World Economic Outlook (IMF 2020) projections.

We assume that there won't be any changes in tariff rates nor NTMs at any region on the baseline. We adjust the initial tariff and NTM rates with the Altertax method (see Malcolm 1998) to the latest values obtained from the MAcMap database. As we model the NTMs as a mix of ad valorem tax equivalents (AVEs) and ice berg costs, the Altertax adjustment target equals the sum of actual tariffs and the AVE share of NTMs in the NTM scenarios.

3.4. Policy scenarios

In the policy scenarios the tariff rates and NTMs are subject to sequential cuts agreed in the AfCFTA. The African countries start to implement the policy in 2020 by sequentially reducing the tariffs and NTMs until 2035 when the final rate of reductions is achieved. The AfCFTA requires the countries to liberalise 97% of their import tariff lines with the 3% of excluded lines covering a maximum of 90% of import value from other African countries. This nevertheless gives individual countries considerable room for tailoring import protection. In addition, the agreement nevertheless gives individual countries considerable room for tailored import protection. As official trade liberalisation schedule offers within the AfCFTA are not available yet, we construct several such schedules from detailed trade data for each country separately (respecting regional trade blocks), assuming that governments aim to maximize tariff revenue retained, possibly together with an additional import protection strategy. To our knowledge, this is the first study using an exact optimization model for the construction of such scenarios under double qualification. In particular, we examine four distinct strategies that countries could pursue: 1) sole maximization of government tariff revenues, or, in addition to revenue maximization, 2) liberalisation of agriculture and food sectors to improve food access, 3) liberalisation of intermediate input products to promote industrialization, and 4) promoting efficiency in competitive industries by liberalising sectors with revealed comparative advantage. In addition to the four uniform strategies, which we apply uniformly for each African country, we also consider an option, where each country chooses from the above-mentioned strategies the one that delivers it the highest economic output.

Whereas the schedules for tariff reductions are quite detailed in the agreement, the NTMs' treatment remains ambiguous. In addition, as the NTMs restrict trade more than tariffs, their reduction has more potential for generating economic growth. In our analysis, we assume that the NTMs are reduced to 50% of their current rates by 2035. In addition, in line with the World Bank (2020) study, we assign a reduction of 20% to African exports to third countries. However, there is a lot of variation in NTMs with respect to how they affect the economy. To this end, we adopt an approach that distributes the NTM reductions to both ad valorem tariff equivalents (AVEs) and iceberg costs, depending on whether they are rent-generating or not. We assume that technical measures and sanitary- and phyto-sanitary measures (SPS) are not rent-generating, whereas the remaining NTM categories (e.g. quotas and price-control measures) are rent-generating.

3.5. Caveats of the approach

Economic models provide a conceptual framework that allows representing the economy in a structured but schematic and simplified manner. By definition, they cannot reproduce the reality in its full complexity and thus have shortcomings and limitations, which should be appreciated and which affect the results of the studies based on such models. Some more detailed caveats merit a mention.

Although the model could be used to project individual values of particular variables, it must be stressed that it is not a forecasting model. Although this type of model is calibrated so as to fit a given year closely, its solutions become less reliable the further into the future it is used to simulate outcomes. Given the large number of assumptions, estimated or calibrated parameters, and stylised specification features that these models assemble, each of which is 'correct' only up to an (unknown) probability, it is impossible to establish confidence intervals or margins of error around individual projected numbers.

A further caveat deals with the aggregation at which tariffs are modelled. MAGNET specifies product categories at an aggregation (usually 6-digit level or higher) that is higher than the one used in designating tariff cuts (8-digit tariff lines). This means that our analysis is based on 'aggregated tariffs' for the corresponding aggregate commodities. The tariffs are calculated by using the trade weighted-averages for 8-digit tariff lines belonging to each 6-digit group. The 'aggregated tariff' is then subjected to the respective cut (depending on which tariff band the aggregated tariff falls into). This implies that the cut is too high for some 8-digit tariff lines and too low for the others. For example, in the pork sector, the ad valorem equivalent for 8-digit tariff lines ranges from 11.5% to 65.5% (ignoring zero tariff lines); therefore, the aggregate tariff of the 6-digit product group lies somewhere within this range. It follows that the tariff cut applied to the aggregated tariff is too high for some 8-digit tariff lines and too low for the others. Thus it is impossible to check if the effect is systematically over- or under-estimated the effect since it depends on the country's specific current level of bound tariff lines (at HS8) and the number of HS8 lines within each HS6 cell. For the treatment of tariffs under a TRQ regime, the MAcMap-HS6 methodology (Guimbard et al., 2012) was followed. The level of protection is equal to the in-quota tariff rate if the quota is not binding or to the out-of-quota tariff rate if the quota is binding- Fill rates are used to assess whether the quota is binding or not. When a fill rate is below 90%, the applied tariff is an in-quota tariff, and when a fill rate is higher than 98% the out-of-quota is the applied tariff. With fill rates falling between 90-98%, a simple average between the in-quota and out-of-quota tariff rate is calculated and applied.

One of the main limitations relates to the coverage and the disaggregation of the agricultural products in the models used: the CGE model MAGNET has a comprehensive coverage of the economy, and thus of the agri-food sector and beyond. However, as explained earlier, some of the most important processed agricultural products falling under the other food category cannot be included in this analysis for technical reasons. These products, which include e.g. sugar confectionery, cocoa preparations, preparations of cereals, bakers' wares and preparations of fruit and vegetables, are typical flagship exports products, representing EU key offensive interest in bilateral trade negotiations, and for which the EU normally expects to derive large benefits. This limitation leads to underestimating the trade gains for the EU agri-food sector in a broad sense.

Another notable caveat relates to the adjustment of the database to reflect the most up-to-date tariff rates between countries. As mentioned earlier, we apply the Altertax method by

Malcolm (1998) for this purpose. In addition, the same adjustment is required for NTMs when they are modelled as AVEs rather than ice berg costs. Typically the required Altertax adjustment for NTMs is much larger than for tariffs. Therefore the database to deviates more from its original form in case of the NTMs. The consequent changes in trade and income flows is a major weakness of the AVE approach.[3]

4. Results

In this section we summarize the main results of the policy simulations. We present the results at the level six regional economic communities (RECs) that are central building blocks of the AfCFTA: CEMAC, COMESA, EAC, ECOWAS, SADC and UMA[4]. In the results we refer to the total results as AU. We report two main scenarios, for mere tariff cuts and combined tariff and NTM reductions that is based on the mixed approach of AVE and iceberg effects. We denote the approaches as tar and tarNntmsMix, respectively. We present the results as deviations to the baseline for both main scenarios. As the tariff cut scenarios have mostly insignificant differences on the macro level, we present only the results that correspond to the basic tariff revenue maximization scenario.

Our results show that AfCFTA is likely to further strengthen the positive economic development in Africa that is predicted for the coming decades. GDP is moderately increased (figure 1) and there is a much stronger shift towards increased trade between African countries (figures 2 and 3). The reduction in tariff revenues is 12% at the AU level (figures 4).

[3] Although there are several ways to model NTMs in CGE models, none of them are perfect and they all have their unique weaknesses. See e.g. Fugazza and Maur (2008), Walmsley and Minor (2015) and Walmsley and Strutt (2019) for discussion.

[4] Due to RECS being overlapping and the fact that some of the individual countries can be presented only as a part in an aggregate region, our aggregation to RECs is not perfect. See the appendix for details.

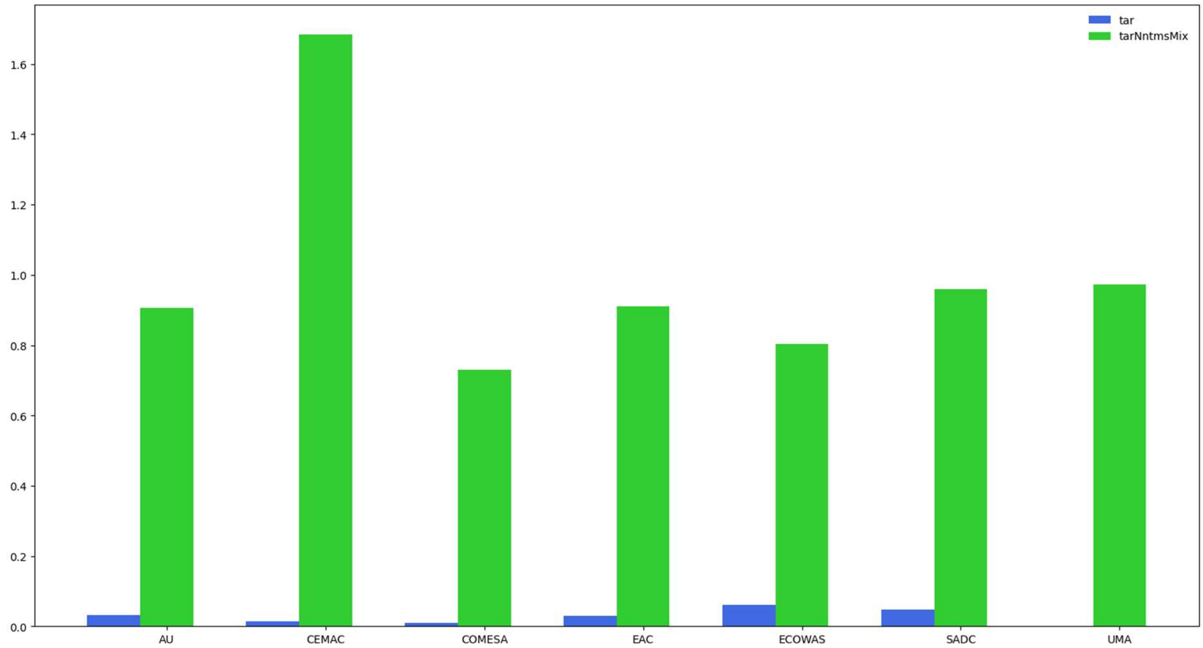

Figure 1. Changes in GDP by RECs and model regions (2035, tariff revenue maximization strategy).

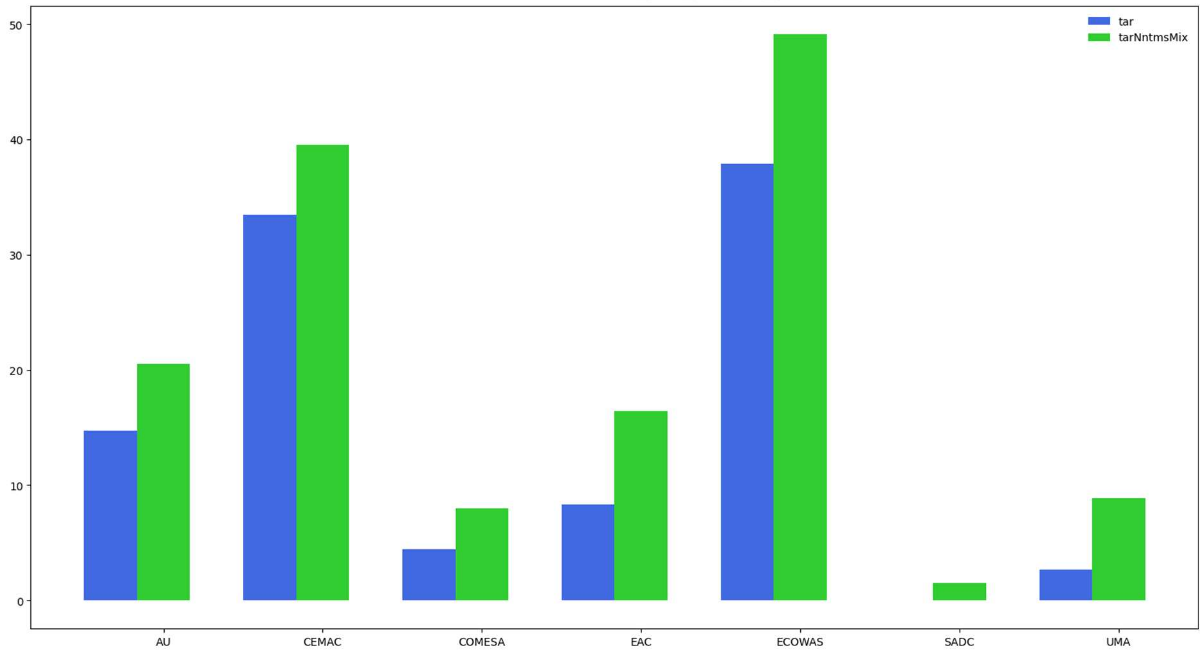

Figure 2. Changes in intra-African imports by RECs and model regions (2035, tariff revenue maximization strategy).

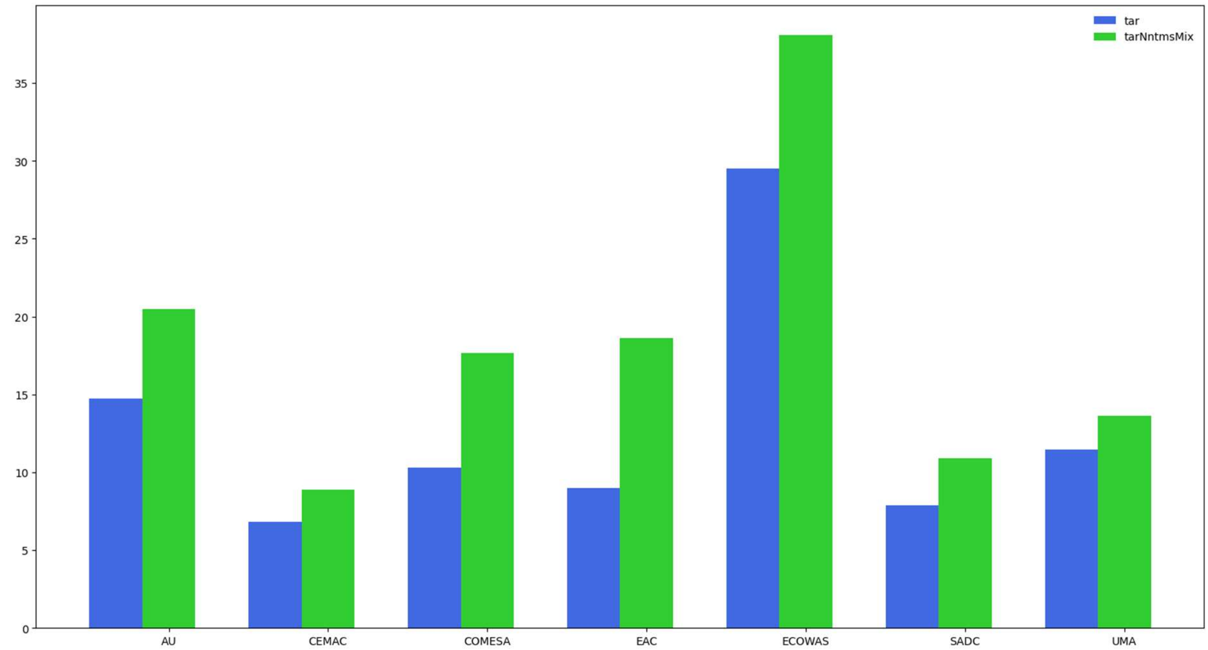

Figure 3. Changes in intra-African exports by RECs and model regions (2035, tariff revenue maximization strategy).

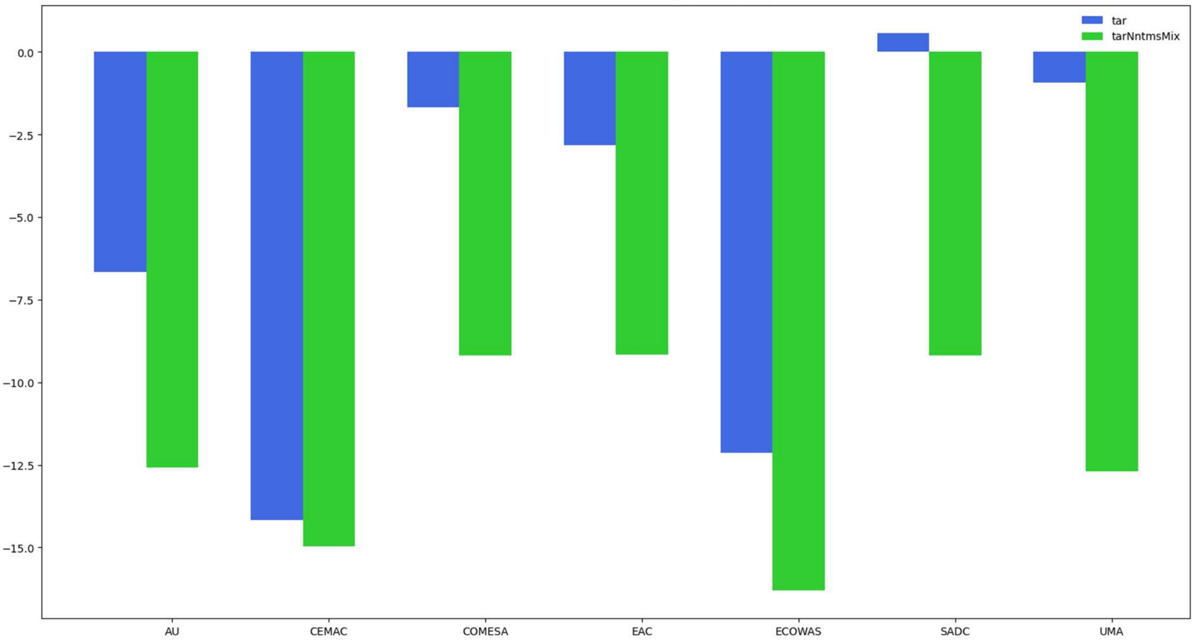

Figure 4. Changes in tariff revenues by RECs and model regions (2035, tariff revenue maximization strategy).

Food security increases by a better access to food in all the modelled regions. This is a direct result from strengthened intra-African trade that allows many countries to decrease their own production. In addition to increased food consumption (figure 5), we found that food prices (figure 6) decrease in the majority of the regions making food better available to poorer population as well.

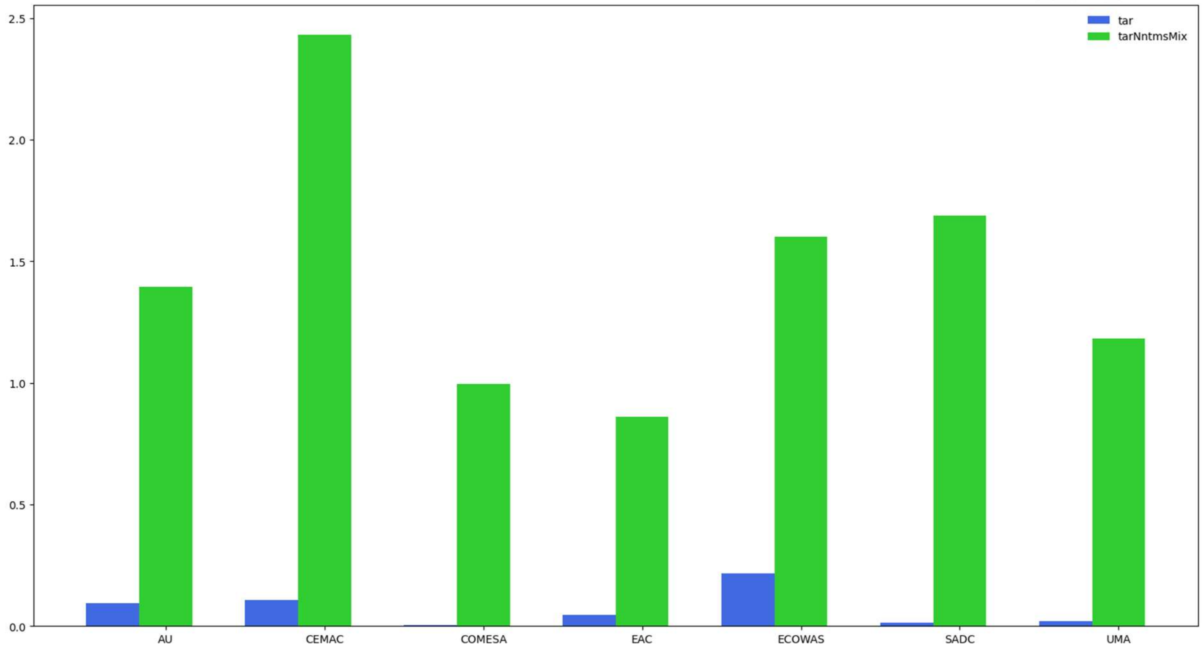

Figure 5. Changes in food consumption by RECs and model regions (2035, tariff revenue maximization strategy).

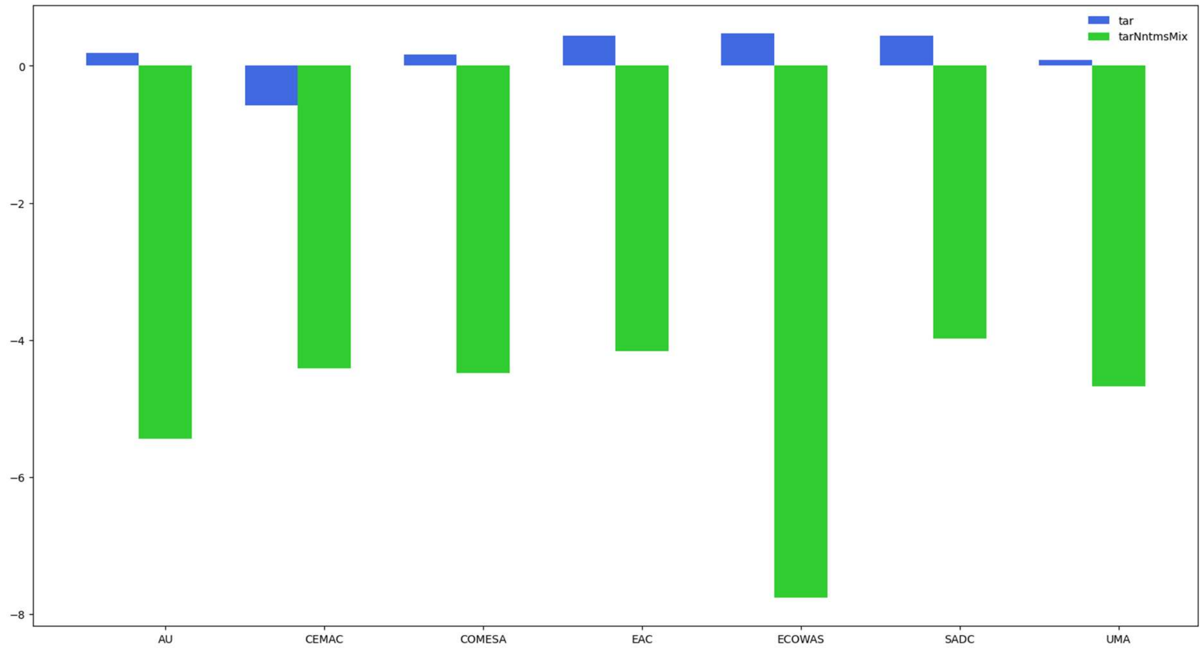

Figure 6. Changes in food prices by RECs and model regions (2035, tariff revenue maximization strategy).

The AfCFTA boosts structural change in Africa, and as a result several countries move their resources from food production to other activities. In general, food production becomes more regionally concentrated as countries increasingly focus on producing commodities that have export markets within Africa.

Our results do not find significant differences in the outcomes of various tariff reduction alternatives that countries have. Bulk of the effects is due to implementing AfCFTA as planned. However, we could not evaluate the different strategies in cutting NTMs in any detail, and doing that in future research could shed more light on whether different strategies have significantly different outcomes.

5. Summary and discussion

Our study has shown that the AfCFTA is likely to have largely beneficial effects on economic growth, further integration of intra-African markets, and the food security of the African people. The impact on the structural change of the continent's economies is highly positive. At the same time, the emerging trade patterns portray a continent of more geographically concentrated production and a higher local value added. In order to reap the benefits of the structural change, the governments need to be ready to pro-actively facilitate the structural change by ensuring a smooth transition of both labour moving from agriculture to other sectors (urbanization) and in general from unskilled to skilled occupations. Placing the focus of economic policies on the sectors that have comparative advantages is likely to be even more advisable than before the agreement.

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Annexes

Annex 1. List of commodities in MAGNET simulations

Commodity	MAGNET
Paddy rice	pdr
Wheat	wht
Cereal grains nec	gro
Horticulture	hort
Oil seeds	osd
Sugar (cane and beet)	c_b
Crops nec	ocrops
Plant-based fibers	pfb
Poultry	pltry
Beef cattle	bfctl
Cattle nec	ctl
Animal products nec	oap
Raw milk	rmk
Wool, silk-worm cocoons	wol
Beef cattle meat	bfcmt
Poultry meat	poum
Bovine meats	cmt
Meat products nec	omt
Vegetable oils and fats	vol
Dairy products	mil
Processed rice	pcr
Sugar	sugar
Feed	feed
Oilcake	oilcake
Crude vegatable oil	cvol
Other food products	ofd
Beverages and tobacco products	b_t
Forestry	for

Fishing	fish
Coal	coa
Oil	oil
Gas	gas
Light manufacturing	LightManuf
Manufacturing	Manuf
Petroleum and coal products	petro
Electricity	ely
Gas distribution	gas_dist
Food services	foodserv
Services	serv
Fertilizers	fert
Biodiesel	biod
Biogas	biog
Distiller's dried grains with solubles	ddgs

Annex 2. Regional aggregation of the African countries[5]

	GTAP	MAGNET	REC
Egypt	egy	egy	COMESA
Morocco	mar	mar	UMA
Tunisia	tun	tun	UMA
Algeria	xnf	xnf	UMA
Libya	xnf	xnf	UMA
Western Sahara	xnf	xnf	UMA
Benin	ben	xwf	ECOWAS
Burkina Faso	bfa	bfa	ECOWAS
Cameroon	cmr	cmr	CEMAC
Côte d'Ivoire	civ	civ	ECOWAS
Ghana	gha	gha	ECOWAS
Guinea	gin	xwf	ECOWAS
Senegal	sen	sen	ECOWAS
Togo	tgo	xwf	ECOWAS
Cape Verde	xwf	xwf	ECOWAS
Gambia	xwf	xwf	ECOWAS
Guinea-Bissau	xwf	xwf	ECOWAS
Liberia	xwf	xwf	ECOWAS
Mali	xwf	xwf	ECOWAS
Mauritania	xwf	xwf	ECOWAS
Nigeria	nga	nga	ECOWAS
Niger	xwf	xwf	ECOWAS
Saint Helena	xwf	xwf	ECOWAS
Sierra Leone	xwf	xwf	ECOWAS
Central African Republic	xcf	xcf	CEMAC
Chad	xcf	xcf	CEMAC

[5] The columns GTAP and MAGNET show the GTAP and MAGNET aggregations of African countries, respectively. The column REC shows how the countries are aggregated to the various RECs: COMESA, EAC, CEMAC, ECOWAS, SADC and UMA. The rest of the world is aggregated in the following the seven regions: EU-27, United Kingdom, Rest of Europe, North and South America, Asia, Middle-East and the ROW (rest of the world).

Congo	xcf	xcf	CEMAC
Equatorial Guinea	xcf	xcf	CEMAC
Gabon	xcf	xcf	CEMAC
Sao Tome and Principe	xcf	xcf	CEMAC
Angola	xac	xac	CEMAC
Congo, Democratic Republic of the	xac	xac	CEMAC
Ethiopia	eth	eth	COMESA
Kenya	ken	ken	EAC
Madagascar	mdg	mdg	COMESA
Malawi	mwi	mwi	COMESA
Mauritius	mus	mus	COMESA
Mozambique	moz	moz	SADC
Rwanda	rwa	rwa	EAC
Tanzania	tza	tza	EAC
Uganda	uga	uga	EAC
Zambia	zmb	zmb	COMESA
Zimbabwe	zwe	zwe	COMESA
Burundi	xec	xec	COMESA
Comoros	xec	xec	COMESA
Djibouti	xec	xec	COMESA
Eritrea	xec	xec	COMESA
Mayotte	xec	xec	COMESA
Seychelles	xec	xec	COMESA
Somalia	xec	xec	COMESA
Sudan	xec	xec	COMESA
Botswana	bwa	bwa	SADC
Namibia	nam	nam	SADC
South Africa	zaf	zaf	SADC
Eswatini	xsc	xsc	SADC
Lesotho	xsc	xsc	SADC