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Potential effects of the African Continental Free Trade Area (AfCFTA) on African agri-food sectors and food security

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Interactive infographic
The reader is invited to consult the EC data portal of agro-economic modelling DataM at https://datam.jrc.ec.europa.eu for more details of the modelling results.
The interactive infographic about this study is under the PANAP section at https://datam.jrc.ec.europa.eu/datam/area/PANAP
Direct link: https://datam.jrc.ec.europa.eu/datam/mashup/AFCFTA/

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Abstract

The African Continental Free Trade Area (AfCFTA) agreement, which entered into force at the beginning of 2021, aims to boost intra-African trade and to accelerate economic development on the continent. This report complements previous continental economy-wide assessments of the impacts of the AfCFTA by providing a more comprehensive description of the trade agreement's effects on food systems and food security. The report employs a global, multiregional model to determine the trade creation and diversion effects of four liberalisation scenarios defined by various policy objectives. The main findings show that the trade agreement will be a positive contributor both to economic growth through higher value added production and to trade diversification. Food consumption across the continent will also increase. A coordinated liberalisation approach to promote trade in agri-food products will further boost food security outcomes. Nevertheless, food prices will increase slightly in most regions, showing the need for further consideration of food affordability aspects in lower-income groups. Results also highlight the importance of non-tariff measures and the capacity of the AfCFTA to reduce the non-tariff costs of intra-African trade.

Foreword

This study was conducted by the European Union's Joint Research Centre (JRC) at the request of the Department of Agriculture, Rural Development, Blue Economy and Sustainable Environment (DARBE) of the African Union Commission (AUC). The AUC is grateful for this generous support from the European Commission through the JRC. In seeking technical support from JRC, DARBE wanted to be armed with knowledge to be able to respond, with evidence, to questions that AU Member States may raise on the likely impact of the African Continental Free Trade Area (AfCFTA) on the agricultural sector in Africa – from production, to value addition, trade, and consumption. The study provides insights into all these areas, even though not all negotiations on the implementation of AfCFTA are concluded yet, especially on the common external tariff regime. The study has highlighted the importance of addressing non-tariff barriers across the continent to facilitate intra-Africa trade. The AU Commission will utilise the results of the study to organize discussions with regional economic communities (RECs). The findings of the report will also be presented at different platforms, including the 17th Comprehensive Africa Agriculture Development Program (CAADP) Partnership Program in November 2021. The study has further strengthened technical cooperation between DARBE and JRC.

This study is the first one of this kind developed by the JRC within the recently created Pan-African Network for economic Analysis of Policies (PANAP), which was established in 2019 under the aegis of the African Union (AU) - European Union (EU) partnership. PANAP is a network of academic, research and institutional partners developing research on agro-economics and policy issues. PANAP aims to strengthen the liaison between researchers/scientists and policymakers in Africa, and to stimulate their cooperation on selected topics linked to policy priorities that reinforce the stability of African agriculture and food sectors.

The JRC is grateful to support the AUC and its member states in their effort to provide policy makers and scientific communities with evidence-base and independent scientific support. The experience JRC has developed on supporting EU institutions on issues related to analysis of policies may be of foremost importance to develop similar experience in the African context and the JRC is at the forefront to share its knowledge with external partners.

We are confident that this is the first of many successful joint activities between the AUC and the JRC in the framework of PANAP.

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Executive summary

Signed by 54 of the 55 African Union (AU) member states, the African Continental Free Trade Area (AfCFTA) agreement entered into force on 1 January 2021 with the promise to boost economic development and to improve Africa's position in global trade by leveraging economies of scale and the cost decrease of imported products. Although this is not the first study to focus on the economy-wide effects of the agreement at a continental level, this report aims to provide a comprehensive description of the free trade agreement's impacts by focusing on the food sectors and on food security at multiple geographic scales (continental, regional and national).

The study employed a Global Trade Analysis Project (GTAP)-based economic model, which captured the impacts of the AfCFTA on trade flows at a bilateral level and across a wide range of merchandise and service groupings. The results cover a period up to 2035 and are evaluated against a multiannual socioeconomic development baseline, which is also described at length in this report. With the tariff offers still under consideration by the signatory countries, the analysis includes alternative liberalisation scenarios implemented across the continent, which have the objectives of government revenue maximisation on one hand, and the promotion of food security, of intermediate products or of revealed comparative advantage products, on the other.

Another area of uncertainty addressed in this report is the capacity of the trade agreement to reduce the costs related to non-tariff measures (NTMs). In the African context, the existing *ad valorem* estimations, although highly uncertain, highlight a higher burden of these costs on trade than the burden of tariffs. Therefore, the analysis includes results for both a 'tariff-only' reduction under the AfCFTA and a 'tariff and NTMs' liberalisation scenario. The latter anticipates that by 2035 the NTM-related costs for all intra-African trade will decrease by 50 %, whereas those for imports and exports from and to AfCFTA third countries will decrease by 25 %, to reflect wider gains from the harmonisation of standards at the border.

Main findings

The AfCFTA is likely to further strengthen the positive economic development across the continent. The gross domestic product (GDP) effects, although moderate, are predicted to be positive across all the countries and regions in Africa. However, the outcomes for trade, notably intra-African, and income are more remarkable. At a continental level, trade is predicted to expand in terms of total volume but also across commodity groups and destination regions. This intra-African trade growth is predicted to result in a reduction in trade concentration away from a small set of unprocessed or semi-processed commodities. Although it is expected that the key commodities specific to each country will continue to be important, the general diversification of exports enables an increased protection of national economies against volatility in the global bulk commodity markets.

From a food security perspective, the trade agreement is expected to lead to a rise in food availability and food consumption. However, agricultural production is predicted to become more concentrated in a few regions. For primary agricultural commodities, the output is predicted to increase most in Southern Africa but to decrease in central areas and many sparsely populated countries. A similar outcome can be seen for processed foods. There are a few exceptions to this pattern on a more detailed commodity level. Cereal output is predicted to decrease almost everywhere, the exceptions being increased wheat output in Eastern Africa and increased paddy rice output in Southern Africa. Oilseed output is predicted to increase, especially in Eastern Africa. Dairy production is predicted to grow notably in Nigeria and Côte d'Ivoire. The expansion of beef cattle production is predicted to be concentrated in Southern Africa, and the output of other meats is expected to increase, mostly in Southern and Eastern Africa. The output of fish is predicted to increase throughout Africa. The supply of services and food services is also predicted to increase throughout Africa, reflecting the change in income levels. The outcomes for food prices are mixed, with predicted decreases in prices in some regions and increases in others. The predicted increase in prices for some commodities and countries marks the need to address the issue of food affordability for low-income groups.

Both production and price changes in agri-food sectors reflect a reallocation of production means following the AfCFTA implementation as countries and regions steer trade towards products and services in which they have a comparative advantage. As a result, agricultural production at a continental level is predicted to grow less than GDP, indicating that, on average, non-agricultural sectors will become more important in the national economies and thus the share of value added in total output increases.

Overall, with tariff and NTMs liberalization intra-African trade is predicted to be 22 % above the baseline level by 2035, with all regions and countries experiencing an increase of in both exports and imports to and from the other AfCFTA members. On the exports side, the Economic Community of West African States (ECOWAS) countries are expected to have the highest growth rate, with a more uniform expansion across the other Regional Economic Communities (RECs). For imports, the largest growth in relation to the baseline is expected in Ghana (73 %), Côte d'Ivoire (58 %), Nigeria and South-Central Africa (both 50 %), whereas, at the other end of the spectrum, many Southern African Development Community (SADC) countries and some Arab Maghreb Union (AMU) countries are predicted to have the lowest expansion.

At REC level (Figure ES1), the ECOWAS is predicted to see the most significant increase in general exports (intracontinental and extracontinental), and the highest increase in export diversification away from agri-food trade. This will enable the largest increase in income per capita across the RECs (2.7 % above the baseline in 2035). At the same time, the GDP gains are expected to be in line with the AU average (0.4 %) and the corresponding positive welfare effect is predicted to be slightly reduced by an increase in food prices (1.0 % above baseline values); nevertheless, there are differences between member countries, with Ghana and Nigeria having negligible GDP gains, whereas the other countries obtain a much greater increase (0.7–1.6 % by 2035).

In the Common Market for Eastern and Southern Africa (COMESA), the predicted income expansion by 1.7 % is in line with the AU average, with GDP increasing by 0.3 %. The region is also predicted to have the second highest agri-food exports expansion (5.9 % above baseline values), facilitated by an increase in trade flows within the continent, with intra-African exports increasing the most in Rwanda (33.5 %), Uganda (29.5 %) and Ethiopia (27.0 %).

Partially overlapping COMESA, the East African Community (EAC) and the SADC have different expected outcomes resulting from the AfCFTA implementation. The EAC is predicted to benefit from above the average GDP gains, resulting from an increase in total exports. At the same time, the EAC is predicted to have the highest increase in food imports (5.7 % above the baseline) and food prices (1.4 %), whereas the food consumption growth (0.6 %) is predicted to be below the AU average.

The SADC is expected to have the second-highest increase in GDP facilitated by the rise in agri-food exports (6.2 % above baseline values in 2035), with Rwanda and Botswana expanding the most. However, the food security gains in the region are moderate; the food consumption expansion is below the AU average (0.65 % above the baseline) despite the second-highest decrease in food prices at a regional level (0.25 % below the baseline), although not uniform across member states.

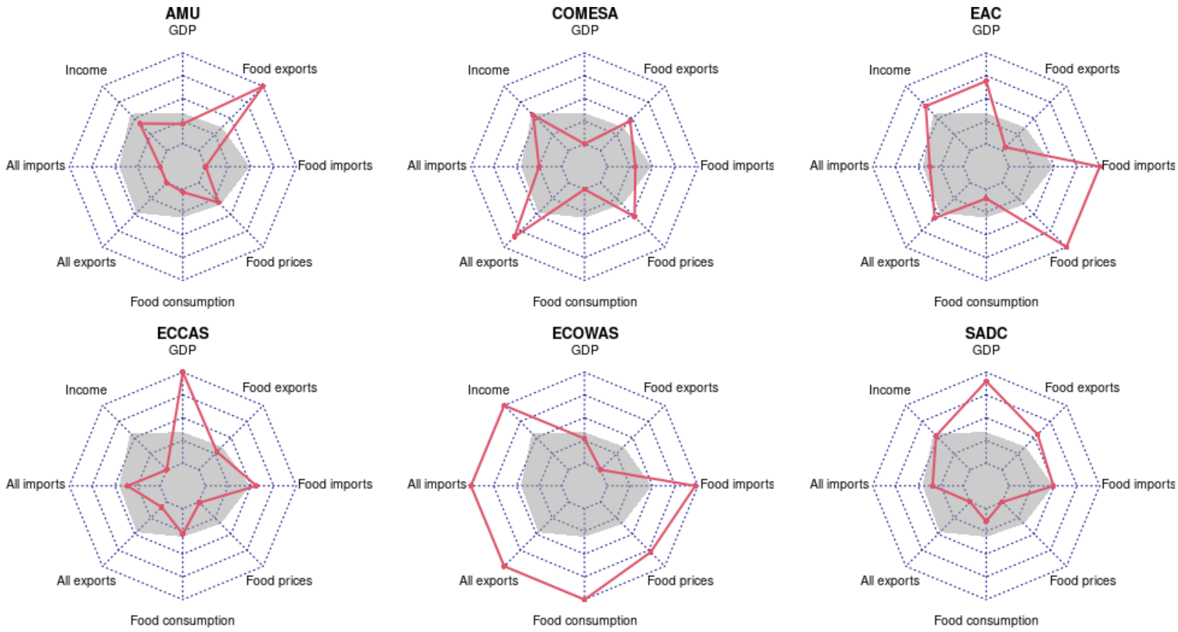

Figure ES1. A comparison of the economic and food security impacts of the AfCFTA across six RECs (2035; tariff revenue maximisation scenario with cost reductions from NTMs)

NB: The axis for a dimension expands from the minimum to the maximum percentage change occurring across the six RECs. The grey area represents the average percentage change across the AU. *Source:* Authors' calculation from Modular Applied GeNeral Equilibrium Tool (MAGNET) results.

The Economic Community of Central African States (ECCAS) is expected to have the largest GDP, but a moderate food consumption expansion compared to the other RECs. The region has the lowest expansion of total intra-African exports (11.4 % above the baseline in 2035), whereas the agri-food trade with the rest of the continent is predicted to expand above the AU average for both exports (20.3 %) and imports (28.0 %).

AMU is the REC in which the AfCFTA is predicted to have some of the lowest impacts on the economic and food security metrics. GDP, income, and trade are also estimated to be below the AU averages. The changes in trade diversification indices are lower than in the other RECs, although the countries in this region are already more integrated within the global trade networks. Nevertheless, by 2035, food exports expand at the highest rate of the RECs (5.6 % above the baseline), while food consumption increases by 1 %.

With very few exceptions, the tariff liberalisation results in a decrease in government tariff revenues relative to baseline levels, despite an increase in total trade volumes at the continental scale and across countries. Nevertheless, the AfCFTA stimulates general economic activity and thus indirectly generates additional fiscal revenue from other tax classes. When the effects of NTM liberalization are also included, this increase in non-tariff revenue is enough to compensate for the tariff liberalisation and to result in an overall positive impact on public finances in most countries.

Across the four liberalisation scenarios considered in this report, the one promoting trade in agri-food products results in the lowest food prices. This scenario also results in the largest increases in per capita food consumption. However, a trade-off comes from a slight reduction in the income gains. From a GDP perspective, the differences in impact across the scenarios, although small, are country and region specific and are dependent on the structure of each economy – at the REC level, the agri-food promotion liberalisation scenario leads to the highest GDP gains in the ECOWAS and the SADC, whereas a scenario promoting industrialisation through trade in intermediate products leads to better outcomes for COMESA, EAC and AMU.

An important aspect of food security is the affordability of food for the most vulnerable groups. We find that this indicator changes to positive on average, but in some regions basic food prices increase faster than the wages of low-income groups. This result indicates that due to the AfCFTA some regions could experience increase in food security risks in vulnerable groups. We also find that the negative effects can be mitigated if the regions uniformly choose to promote industrialization. Thus, our results suggest that promoting industrialization rather than low food prices is a better strategy for mitigating food security risks as it leads to a more positive income development in vulnerable groups. However, this result is not uniform across regions, and therefore non-uniform strategies, which take into consideration regional conditions, should be further investigated.

Related and future Joint Research Centre work

The results of this study show that the outcomes of the AfCFTA are highly dependent on if and how the NTM-related costs will be reduced through the agreement. Although the approach taken is in line with other state-of-the-art studies and relies on the latest information available through global trade databases, the inclusion of NTMs in economic modelling continues to cause data availability and methodological challenges and therefore the results should be considered accordingly. Future work should aim to improve the NTM data across the many AfCFTA member countries and to clarify the stakeholders involved and the nature of these measures.

At the same time, as the AfCFTA aims to improve poverty outcomes across African countries, the bilateral trade effects obtained in this continental-level study could be used to inform national and subnational assessments. At a lower geographic level and by using more disaggregated socioeconomic data, the distributional impacts of the trade agreement could thus be better represented. Furthermore, the framework applied in this study can be further expanded to account for a wider array of environmental effects and it can be applied to study the configuration of trade policies under various climate policy scenarios.

1. Introduction

The economic growth in Africa in the last decade (before the COVID-19 pandemic's negative impact) has been strong and sustained. Nevertheless, the aspiration of inclusive growth and sustainable development is still facing a series of emerging challenges that could endanger the long-term goals of eradicating poverty, ending hunger, and achieving food and nutrition security. These challenges come from economic growth that has not yet reached its full potential, a still-growing population, the effects of climate change and other negative exogenous shocks, such as the COVID-19 pandemic.

Although economic growth in agriculture has been strong and trade has been increasing continuously, it is widely believed that Africa is not nearly exploiting its full potential, especially that of its rich natural resources. Protective trade policies in comparison to other regions, high non-tariff barriers to trade and underdeveloped infrastructure within the continent point to a large potential for a pan-African agreement to foster intra-African trade. Access to a large, dynamic, and growing African market might enable the exploitation of economies of scale, decrease the costs of imported products and develop productive activities higher up the value chain, thereby increasing the amount of value added that is generated and the share of it that is kept inside Africa. Thus, the establishment of a continental free trade area is promising with regard to boosting Africa's trading position in the global market, accelerating growth of intra-Africa trade as an engine of economic and sustainable development, and contributing to poverty reduction. For all these reasons, the establishment of this free trade area became one of the flagship projects of Agenda 2063, the African Union's (AU's) blueprint for transforming Africa into the global powerhouse of the future, identified as key to accelerating Africa's economic growth and development as well as promoting African integration.

However, gains from integration will not be distributed equally across countries or within countries. Correspondingly, policymakers are concerned about potential negative effects, such as effects on selected industries, employment, poverty, inequality, government revenues and food security. This is especially important considering the disparities that still exist among members of the AU.

Although all recent studies on the establishment of the African Continental Free Trade Area (AfCFTA) find positive economic effects for the continent, they also highlight that those effects might differ between countries and citizens owing to these large disparities, justifying a closer look at the details.

The decision to establish a free trade area across the African continent dates to an assembly of the AU in January 2012, with negotiations beginning in June 2015. After 10 rounds of negotiations, the agreement establishing the AfCFTA was signed in March 2018, including protocols, and subsequently 54 of the 55 AU member states (all except Eritrea) signed the agreement (Signé and van der Ven, 2019).

The main objectives of the AfCFTA are the creation of a single market for goods and services, and free movement of people and investments to boost integration across the African continent; the promotion of intra-African trade between and beyond the Regional Economic Communities (RECs); and the improvement of competitiveness and facilitation of economic transformation (tralac, 2019). The agreement entered into force on 30 May 2019 once the threshold of signatory countries approving the ratification had been reached. To date, 37 AU countries have deposited their instruments of ratification ([1]).

Some final but key issues of Phase I of the AfCFTA are still under negotiation, including the schedules of tariff concessions, schedules of services commitments and rules of origin (Signé and van der Ven, 2019).

Phase II of the negotiations began in February 2019 and concerns the 'behind the border' trade issues of investment, competition policy and intellectual property rights, which might be extended by a protocol on e-commerce (Signé and van der Ven, 2019). Trade liberalisation under the AfCFTA started on 1 January 2021, after a 6-month delay caused by the COVID-19 pandemic.

General trade liberalisation modalities for the AfCFTA were agreed during the seventh meeting of African Union Ministers of Trade in Egypt ([2]). According to the General Agreement on Tariffs and Trade, Article XXIV, 'substantially all the trade' between the members of a free trade area should be liberalised. The AfCFTA takes this into account by requiring 90 % of the tariff lines, as classified by the Harmonized System (HS) (World Customs Organization), to be liberalised linearly over a period of 10 years for least-developed countries (LDCs) and 5 years for non-LDCs. Each country might designate 3 % of the tariff lines for exemption from

([1]) tralac, 'Status of Ratification', updated 13 July 2021 (https://www.tralac.org/resources/infographics/13795-status-of-afcfta-ratification.html).

([2]) tralac, 'African Union Ministers of Trade conclusively reach consensus on all outstanding issues on AfCFTA modalities for tariff liberalization', updated 18 December 2018 (https://www.tralac.org/news/article/13824-african-union-ministers-of-trade-conclusively-reach-consensus-on-all-outstanding-issues-on-afcfta-modalities-for-tariff-liberalization.html).

liberalisation, with the additional restriction that this might not exceed 10 % of the value of imports from other African countries, using a specified 3-year-period average trade value. The remaining 7 % of tariff lines can be declared as sensitive products, which get an extended liberalisation schedule of 10 years for non-LDCs and 13 years for LDCs, with LDCs having the option to delay the start of their liberalisation until year 6. Particularly vulnerable member states (currently Ethiopia, Madagascar, Malawi, Sudan, Zambia, and Zimbabwe) facing special development challenges get an extended liberalisation period of 15 years on the basis of the special and differential treatment principle.

Although detailed market access offers from each AU member state were expected by January 2020, no details had been published while drafting this report. The current expectation is that the offers will be published by the end of 2021.

Although the AfCFTA agreement explicitly acknowledges the eight existing RECs ([3]) as 'building blocks' for the establishment of the AfCFTA, the operation of the RECs continues independently. Most African countries are members of at least one REC, and often of two or even three. The AfCFTA explicitly states that, where RECs have a higher regional integration than what is provided under the AfCFTA, such higher levels should be maintained (AU, 2018; Article 19(2) AfCFTA). This adds complexity to the AfCFTA as, for instance, rules of origin differ between RECs and between RECs and the AfCFTA. Moreover, import tariff preferences are not to be automatically extended to all AfCFTA members. Therefore, the AfCFTA applies a non-traditional most-favoured nation (MFN) clause (Signé and van der Ven, 2019; Lunenborg, 2019). Accordingly, MFN preferences need to be reciprocal, meaning that one member state needs to grant MFN preferences only if the trading partner also does. This implies that one member state might apply different import tariff rates to different partners within the AfCFTA.

The AfCFTA agreement also includes the elimination of non-tariff measures ([4]) (NTMs) as an explicit objective. NTMs comprise all policy measures other than tariffs that can impede trade, such as regulations and procedures. The AfCFTA anticipates a continent-wide system ([5]) for reporting, monitoring and eliminating NTMs in which private individuals and companies can submit complaints online, which then automatically trigger a resolution mechanism involving the government of the trading partner.

African exports to the rest of the world tend to be concentrated on a few products, with a high share consisting of natural resources and unprocessed or semi-processed products (Bouët and Odjo, 2019; International Monetary Fund (IMF), 2019). According to the IMF (2019), over the period 2007–2017, about 75 % of these exports consisted of mineral products, such as crude oil and copper, whereas intra-African exports were more diversified and included larger shares of products with higher value added, particularly manufactured goods. Intra-African exports contain more value added than other international exports, although it is still limited.

This study focuses on the tariff- and NTM-reducing commitments of the AfCFTA and its impacts on African economies. The *Africa Agriculture Trade Monitor 2019* (Bouët and Odjo, 2019) provides an analysis of tariff data for 2016 (p. 29, Table 2.2). On average, African countries levy *ad valorem*-equivalent (AVE) import duties of 9 % on all products and of 18 % on agricultural products. These are higher than those levied in other regions, which are between 2.3 % and 5.8 % for all products and between 2.4 % and 13.3 % for agricultural products. On the export side, African producers face the lowest duties, of 3.1 % for all products and 9.1 % for agricultural products. However, the variability of both tariffs and NTMs across African countries is large. For trade within the African RECs, on the other hand, import tariffs are rather low (Bouët and Odjo, 2019, p. 49, Figure 3.1, for 2015 import data).

With respect to NTMs, the *Africa Agriculture Trade Monitor 2019* report finds, based on the World Bank's Doing Business 2019 index, that time and monetary costs for both importing and exporting in Africa are among the highest and in many cases even the highest of all regions in the world (Bouët and Odjo, 2019). This considers efforts required for documentation, customs, and domestic transport. Converting all the various cost types for importing and exporting agricultural products into AVE figures for each country reveals that import taxes are only a small fraction of the overall costs. For more than 40 of the 55 AU member states,

([3]) The AfCFTA recognises the following RECs: the Arab Maghreb Union (AMU), the Common Market for Eastern and Southern Africa (COMESA), the Community of Sahel–Saharan States (CEN-SAD), the East African Community (EAC), the Economic Community of Central African States (ECCAS), the Economic Community of West African States (ECOWAS), the Intergovernmental Authority on Development (IGAD) and the Southern African Development Community (SADC). COMESA, EAC and ECOWAS are also customs unions, and thus they make joint market access offers.

([4]) Following the more commonly used definition, we refer to these measures as non-tariff measures, although the official AfCFTA agreement text names these non-tariff barriers (NTBs).

([5]) https://tradebarriers.africa/home

import costs exceed 100 %, of which a large part is due to time for border compliance. For exports, costs do not exceed 40 % for at least 41 of the 55 AU member states, but here the largest parts are attributed to tariffs faced by exports, and, again, time for border compliance but also for document compliance.

Studies on the AfCFTA (e.g. Bouët and Odjo, 2019; IMF, 2019) agree that to truly boost intra-African trade, the agreement needs to complement the elimination of tariff barriers with a substantial reduction in NTMs as well as with investments to infrastructure upgrades, as these are larger impediments to intra-African trade than tariffs. They emphasise that this is even more important for landlocked and low-income countries.

Reducing non-tariff trade barriers could be even more important for agri-food trade, as transport time is especially crucial for perishable products. The IMF (2019) reports that customs revenues in Africa are low and only a small share originates from African trade. However, it also points out that there are significant differences between countries and that for some countries customs revenues can amount to more than 5 % of gross domestic product (GDP) and that regional imports account for a large share of that. Correspondingly, the AfCFTA might pose risks to some governments' revenues.

The aim of this study is to provide an assessment of the economic impacts of the AfCFTA on the agricultural and food sectors across the whole continent as well as at regional and country levels. Other possible relevant aspects of the trade agreement, such as the social and sustainability aspects, are only partially analysed.

The rest of the report is structured as follows: Section 2 reviews the literature on the AfCFTA, with a special focus on computable general equilibrium (CGE) model-based studies. Section 3 presents the model and data used for this study; Section 4 introduces the trade scenarios. Section 5 describes the main variables of the baseline and Section 6 presents the key results of the study. Section 7 concludes with a brief discussion of the key results and the main policy recommendations.

2. Review of the literature

There is already a significant literature on the economic effects of the AfCFTA. Given the diverse characteristics involved in such continental market integration, these analyses require the use of an economic model capable of representing all sectors in all participating countries. CGE frameworks consider all the interactions among all sectors through domestic, regional, and international linkages. They provide information about trade-offs between various sectors in the event of multiple trade partners. Indeed, they quantify trade-diverting and trade-creating effects because of market opening, driven by comparative advantage and feedback effects (e.g. structural adjustments). They enable a broad view across all those economies that are distinguished separately within the model and quantify which sectors might be affected, in which way and within which schedule. In contrast, partial equilibrium models adopt a more disaggregated commodity structure approach, focusing on one sector and introducing commodity-specific inter-relationships. Gravity equations can also predict changes in trade flows, typically based on countries' sizes, levels of development, and geographic and cultural proximities. Geographic and cultural proximities are the foremost tools to assess trade restrictiveness of NTMs, converted in AVE tariff rates and integrated later within a CGE framework.

2.1. Computable general equilibrium literature

Several studies using the CGE model analysed the potential effects of deeper trade integration in Africa. These works differ according to modelling assumptions, data calibration, commodity, and country coverage, envisaged time horizon and market integration. Well before the signing of the AfCFTA, intraregional trade integration within regional blocs and at continental level have been scrutinised. Based on an exhaustive literature review, this report aims to address the following gaps:

- no recent study disaggregates trade by agricultural and food commodities; rather, they disaggregate trade by services and manufacturing;
- a credible scenario of liberalisation is absent in previous analyses;
- only a few recent studies consider sensitive products, and if they do, they do not explicitly consider political economy and factual trade-offs;
- most recent studies use tariff protection from the Global Trade Analysis Project (GTAP) database version 10, which reflects applied bilateral tariffs as notified to the World Trade Organization by 2014 (i.e. they exclude tariff reductions since 2014);
- despite the importance of NTMs, no CGE study integrates contemporary agri-food commodity-based bilateral estimates.

Jensen and Sandrey (2015) conducted the most fundamental analysis with an emphasis on food and agriculture thus far. The authors use the GTAP model calibrated on the version 9.2 pre-release database (base year of 2011). They cover 21 African countries and aggregate agricultural sectors into primary agriculture, secondary agriculture (processed commodities) and sugar. Indeed, the preceding study (Sandrey et al., 2011) showed that sugar was the only agricultural sector with significant changes induced by limited continental trade liberalisation (through the umbrella of the Tripartite Free Trade Area ([6])). In constructing their baseline, Jensen and Sandrey (2015) used IMF projections (World Economic Outlook Database) from October 2014 and macroeconomic projections for the world economy from Fouré et al. (2012). Results correspond to differences between this baseline and the completion of the AfCFTA in 2025, expressed in real-value 2011 USD. The authors break down trade costs into NTMs and trade facilitation and recalibrate the GTAP database with further sources. For NTMs, data come from the World Bank, based on Balistreri et al. (2014a, 2014b). For trade facilitation, approximated by the concept of 'time in transit', data come from Minor (2013).

The set of scenarios in Jensen and Sandrey (2015) considers many aspects of trade-related features of the AfCFTA, which include the elimination of tariffs among African countries, a 50% reduction in NTMs and a reduction in transaction costs by one fifth. Scenarios are run independently and in a cumulative way to better understand the contribution of each group of trade restrictions. Furthermore, to consider the political economy and limitations to modelling (e.g. data availability), simulations are also run for a smaller number of participating countries (14 versus 21) that correspond to a second-best setting (gains in terms of income are 10 % lower than a continental integration).

The results of Jensen and Sandrey's (2015) study show positive development in food and agriculture for most but not all countries, driven by NTMs, of which there are more in agriculture than in manufacturing. A few

([6]) A free trade agreement between COMESA, EAC and SADC.

countries, especially South Africa, dominate income gains (Figure 1). 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 a reduction in NTMs increases trade for all countries (except Zimbabwe) in contrast to only tariff elimination. GDP increases the most in Senegal (7.8 %), Kenya (4.4 %), Uganda (3.7 %), Namibia (3.5 %) and Tanzania (2.9 %).

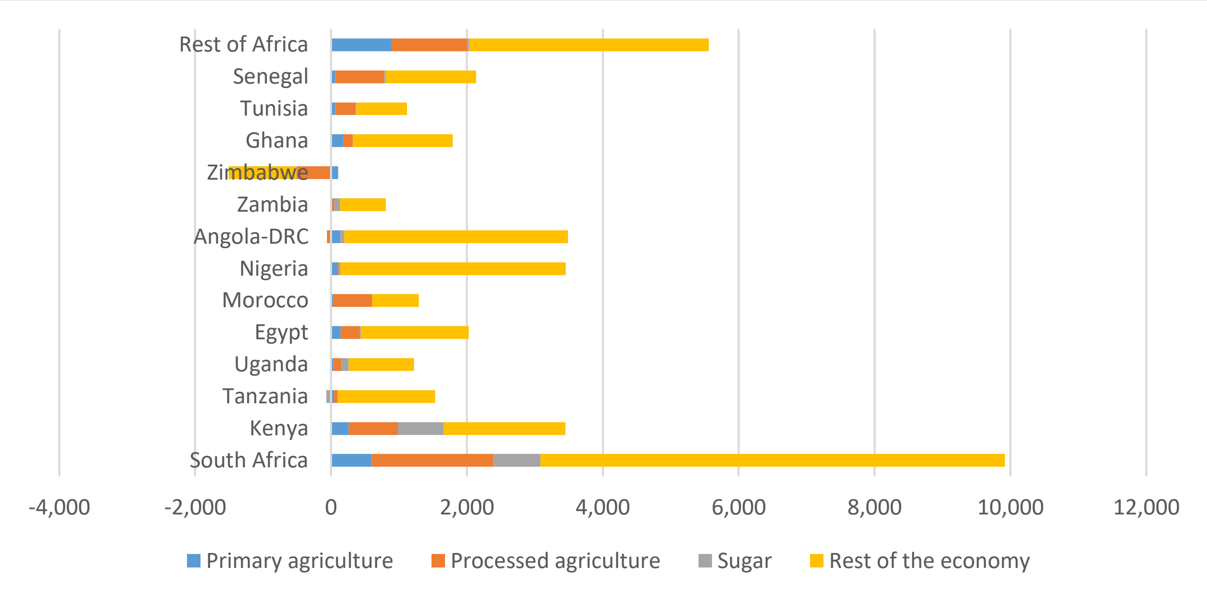

Figure 1. Contribution to welfare by groups of commodities for a selection of African countries (2025, million USD, 2011 prices, full tariff elimination and 50 % elimination of NTMs) ([7])
Source: Jensen and Sandrey (2015).

In this study by Jensen and Sandrey (2015), countries with high barriers (both tariff and non-tariff) to imports and exports are the most affected by liberalised trade, especially when they have existing trade ties with other countries. Tariff revenue losses are substantial for a few countries, such as Tanzania and Nigeria, but in general they are marginal. Indeed, losses are compensated by economic development and gains from greater trade. In general, it is complicated to generalise results to the whole continent, and an analysis should be done at both country and commodity level. The study shows that the gains are due to changes in trade relations for a few partners (e.g. Kenya's gains are concentrated on Tanzania, and Ghana's gains are concentrated on Nigeria) and are concentrated in a few products. Processed commodities contribute to income gains more than raw commodities, which is a positive result 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). Both research papers make use of the most recent GTAP database (version 10), with 2014 as the base year. They use a full GTAP commodity disaggregation but do not provide results by agri-food sector. They contemplate a full tariff elimination and a scenario with exemptions for 5 % of sensitive products. The exemptions yield 60 % lower trade effects than a full liberalisation, which reflects the high concentration of intra-African trade on a few products. In addition, the more products are exempted, the less the tariff revenues decrease. Importantly, Vanzetti et al. (2018) pay special attention to integrating NTMs in the analysis, and they treated them as AVE tariffs, taken from Cadot et al. (2015). They conclude that even if tariff barriers remain significant in intra-African trade, NTMs have a greater impact on trade flows and economic aggregates such as welfare and employment. Employing estimates of the time reduction in customs (de Melo et al., 2020), the African Development Bank (2019) comes to a similar conclusion, but again with no details on the food and agricultural sectors. More recently, Fusacchia et al. (2021) use an extension of the GTAP model accounting the value added structure of international trade. They find an increase of 3.7 % of AfCFTA member countries'

[7] The regions correspond to the GTAP regions, where Angola and the Democratic Republic of Congo (DRC) form the region of South Central Africa.

agri-food exports and provide an analysis of backward and forward integration in value chains. They assume a full tariff elimination with no consideration of NTM reduction or trade facilitation measures.

The abovementioned studies adopt a static CGE modelling framework (i.e. elimination of trade barriers between African countries instantaneously). In contrast to these long-run effects of policy changes, another set of studies uses dynamic models, which allow integrating the transitional effects in more detail. Shedding some light on food and agriculture, Mevel and Karingi (2013) and Depetris Chauvin et al. (2016) use the dynamic Modelling International Relationships in Applied General Equilibrium (MIRAGE) model to assess the effects of the continental trade liberalisation. They both use trade protection data from the Market Access Map (MAcMap) Harmonized System six-digit level (HS6) (2004 reference year in Mevel and Karingi (2013); 2007 reference year in Depetris Chauvin et al. (2016)).

Mevel and Karingi (2013) address the establishment of the AfCFTA and the deepening of two regional trade blocs. Income and trade gains from the former are higher than from 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 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, with 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 agricultural and food products. The study also applies a microsimulation model to evaluate the effects of price and wage changes on welfare for households in six countries (Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Madagascar, and Nigeria). This combination enables the studying of welfare effects at heterogeneous household level in terms of poverty, gender, and territory. The 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. They employ a CGE model from Costinot and Rodriguez-Clare (2014). Data on trade flows are taken from the Eora multiregional input–output database (base year 2015). Data on applied tariffs come from the GTAP Africa 2 database for the year 2014. AVEs of NTMs come from the Economic and Social Commission for Asia and the Pacific and World Bank database for 2016. Simulations consider full import tariff elimination and a tariff-equivalent reduction in NTMs by 35 % for 45 African countries. Authors also conduct a sensitivity analysis on the reduction in NTMs. An alternative scenario considers the same reduction in trade barriers (tariff elimination and 35 % reduction in NTMs) for imperfect competition market structures (Krugman and Melitz model cases).

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

Abrego et al. (2019) highlight that the world is predicted to be better off after the implementation of the AfCFTA (higher GDP and welfare) as a result of 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. Other studies show how the establishment of the AfCFTA can counterbalance negative impacts for Africa of external initiatives or trade developments such as the potential establishments of 'mega' free trade agreements (e.g. a European Union–United States agreement, the Trans-Pacific Partnership, the China–Japan–South Korea Free Trade Agreement) isolating African countries (Guimbard and Le Goff, 2014) or the collateral effects on Africa of a trade war between China and the United States (Bouët et al., 2019). Bouët et al. (2019) conclude that African countries can benefit more from these external trade tensions if they establish a free trade area.

The World Bank (2020) assesses the economic and distributional effects of the agreement by using a global CGE model (environmental impact and sustainability applied general equilibrium) and a microsimulation model Global Income Distribution Dynamics (GIDD). The study finds that the agreement would increase income in African countries by USD 450 billion (7 %) by 2035. The effects in individual countries range from 2 % in Malawi to 14 % in Côte d'Ivoire. The study also assesses trade facilitation measures in addition to tariff and NTM reductions. The authors find that trade facilitation comprises the bulk of the gain: USD 292 billion. In the simulations, the NTMs are cut by half within AfCFTA, and the exports from non-AfCFTA countries to AfCFTA member countries are subject to a 20 % reduction in NTMs. The authors measure the trade facilitation effect from the data on observed customs time, and they apply the improvement as changes in iceberg costs of importing. The improvement equals, on average, a reduction of 7 percentage points in trade costs. The microsimulation results show that the agreement has modest effects on income distribution, in which unskilled workers gain a higher increase in wages than skilled workers (10.3 % increase versus 9.8 % increase). Also, women's wages grow more in comparison with those of men (10.5 % versus 9.9 %).

Table 1 and

Table 2 summarise the GDP and trade volume effects found in some of the studies on the AfCFTA. Our study indicates low effects on both aspects. One explanatory factor is that our study applies a higher-level commodity detail, which is known to reduce aggregation bias. For instance, Bektasoglu et al. (2017) have shown that CGE models can exaggerate the GDP effects on trade liberalisation studies if the database is less disaggregated. Also, we applied a more conservative assumption on the NTM reductions than, for example, the World Bank (2020) study.

Table 1. Effects on GDP in previous studies

Study	**Year**	**Tariff cuts**	**NTM reductions**	**Tariff rates (%)**	**Tariff and NTM rates (%)**
Mevel and Karingi	2012	All tariffs on intra-African trade	—	0.2	—
Jensen and Sandrey	2015	All tariffs on intra-African trade	50% reduction	0.7	1.6
Saygili et al.	2018	All tariffs on intra-African trade	—	0.97	—
Abrego et al.	2019	All import tariffs	35% reduction	0.037-0.053	1.89-7.6
African Development Bank	2019	All tariffs on intra-African trade	100% reduction	0.1	1.25
World Bank	2020	97% of tariffs on intra-African trade	50% reduction within Africa and 20% reduction on exports	0.13	2.24
Joint Research Centre (present study)	2021	97% of tariffs on intra-African trade	50% reduction within Africa and 25% reduction on exports and imports with non-African countries	0.05	0.42

Table 2. Effects on trade volumes in previous studies on the continental effects of the AfCFTA

Study	Year	Tariff cuts	NTM reductions	Effect on imports (%)	Effect on exports (%)
Jensen and Sandrey	2015	All tariffs on intra-African trade	50% reduction	—	6.28
African Development Bank	2019	All tariffs on intra-African trade	100% reduction	33.8	44.3
World Bank	2020	97% of tariffs on intra-African trade	50% reduction within Africa and 20% reduction on exports	19.58	18.84
Joint Research Centre (present study)	2021	97% of tariffs on intra-African trade	50% reduction within Africa and 25% reduction on exports and imports with non-African countries	3.66	2.33

2.2. Non-tariff measures

NTMs are policy measures other than ordinary customs tariffs that nevertheless affect trade. NTMs are classified according to their scope and/or design and include a wide range of instruments, such as sanitary and phytosanitary (SPS) measures, technical barriers to trade (TBTs), pre-shipment inspection and other formalities, contingent trade-protective measures, intellectual property rights and rules of origin (United Nations Conference on Trade and Development, 2015). In contrast to transparent and measurable tariffs, there is no common agreement on the aim, collection, quantification and modelling of NTMs. Agri-food sectors are among those that are subject to many different NTMs, especially SPS measures (Figure 2). Among agri-food sectors, meat, dairy, fruits, vegetables (and cereals to a lesser extent) are the commodities that are affected by the highest number of NTMs.

In the context of a lack of a global and consistent cross-country database on NTMs, quantifying NTMs is not trivial. Prior to integrating in a CGE model, NTMs are usually converted into an AVE tariff rate that would ideally affect trade to an extent equal to the effect of the NTMs. Gravity models are commonly used to calculate AVEs, but the model design (functional forms, price gap / quantity gap approaches, etc.) has a significant impact on estimation results, and gravity equations have obvious drawbacks (Beghin et al., 2015). Furthermore, an aggregation problem of NTMs results from establishing the right match between commodity-based NTMs and economic sectors of the CGE models.

Finally, the literature is not conclusive on the correct representation of NTMs within a CGE framework, and provides several options, including NTMs' representation as efficiency losses/gains, as rent for domestic/foreign producers and as additional trade costs. The most used database for AVEs in existing CGE assessments of the AfCFTA is adapted from Kee et al. (2009) and Cadot et al. (2015). Transaction costs expressed as time to export and import come from Minor (2013) and de Melo et al. (2020), based on Hummels and Schaur (2013), who estimate that each day in transit is equivalent to an AVE tariff between 0.6 % and 2.1 %.

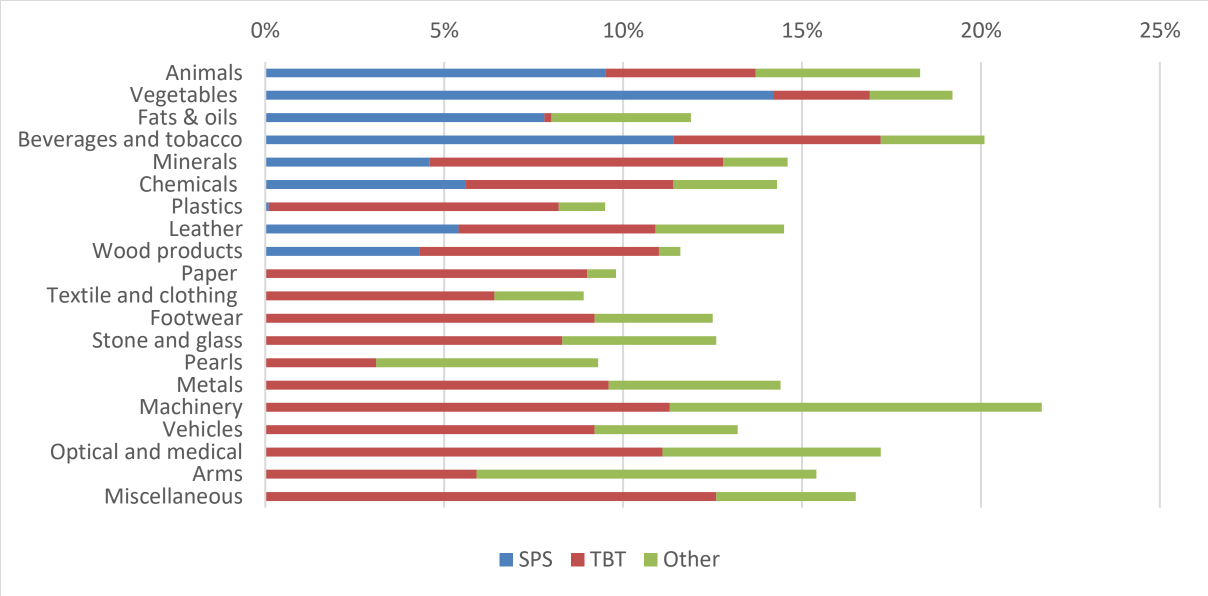

Figure 2. Decomposition of AVE NTMs by sector in Africa
Source: Cadot et al. (2015) using the United Nations Conference on Trade and Development Trade Analysis and Information System (TRAINS) NTM database.

To the best of our knowledge, the impact of NTMs on intraregional trade in Africa has not been addressed yet, and this is key for policymaking and trade negotiations aimed at opening opportunities of market access and enhancing intra-African trade. Estimation of specific African NTMs is complicated by the scarcity of data specific to the continent. In all three of the main databases that provide AVEs of NTMs, the coverage of African countries is limited. Among the most relevant studies on AVEs of NTMs, Kee et al. (2009) provide a database of unilateral AVEs of NTMs for 93 countries at HS6 level. However, only 17 of these countries are members of the African RECs, thus covering only 41 % of the countries of interest. Moreover, the data are not exhaustive (for all HS6 product lines) or consistent across countries (different product lines are covered by each country). Kee and Nicita (2016) further develop the methodology proposed by Kee et al. (2009) but consider in their AVE estimates only seven countries belonging to one of the African RECs. Ghodsi et al. (2016) provide a database including unilateral AVEs of NTMs, distinguishing nine NTM categories, which includes only eight countries belonging to the African RECs (Sanjuán et al., 2021).

Summing up, information on AVEs for NTMs exists for a limited number of African countries, but it is widely spread in terms of sectors. Mostly, the values are unilateral (i.e. unique trade cost when accessing the importer), although some bilateral outcomes are also available within the constrained sample of African countries. Finally, the United Nations Conference on Trade and Development Trade Analysis and Information System (TRAINS) – International Trade Centre database provides information about the number of measures applied by each reporter in each HS6 product line and up to four-digit NTM subcategories (United Nations Conference on Trade and Development, 2015) imposed unilaterally for any partner (most of the observations) or bilaterally for specific countries or regions. This latest release covers 92 countries, of which 22 are African (Sanjuán et al., 2021).

Summarising, sub-Saharan African countries impose, on average, 13.89 NTMs on a series of selected products (fish, sugar, tea, palm oil and maize), a figure that is significantly lower than the 41.32 NTMs imposed by all countries in the database. In comparison with other sectors, 11.84 NTMs are imposed by the selected African countries. This reveals that the selected countries impose fewer NTMs on the selected products in comparison with the rest of the world, but they impose more NTMs on the selected products than on other agri-food products. Of these countries, the Gambia, Mauritius, Guinea, Benin, and Cabo Verde are those imposing the most NTMs on the selected products (on average, for all Harmonized System four-digit level (HS4) product lines, they impose 28.37, 23.89, 17.59, 14.06 and 13.21 NTMs, respectively). In contrast, Côte d'Ivoire, Burkina Faso, Niger, Senegal, and Zimbabwe are the countries that impose the fewest NTMs on the selected products (on average, for all HS4 product lines, they impose 2.04, 4.02, 4.19, 4.30 and 4.59 NTMs, respectively). Differences according to product types are less pronounced. On average, for all the selected countries, most products have around 10–13 NTMs. Fish products (HS4 code 0303) stand out for the considerable number of

NTMs imposed (17.09 for all selected countries as a whole), whereas wheat (HS4 code 1001) and maize (HS4 code 1005) are the products with fewer NTMs (on average, 6.10 and 6.11 for all selected countries, respectively). Regarding the NTM categories considered, most are technical measures (on average, for all selected countries and products, 85 % are technical and 15 % are non-technical). Among the technical NTMs, there is a larger presence of SPS measures, more than double the number of TBTs (Sanjuán et al., 2021).

According to Sanjuán et al. (2021), contrary to some of the available secondary data on AVEs, intra-African technical and non-technical NTMs have a systematic trade-restricting effect. There is a tendency for non-technical measures to be more trade restrictive and costly for bilateral trade than technical measures. This result is in line with the general wisdom that non-technical measures pursue protective goals whereas technical measures address societal and health concerns. There is also a remarkable deviation of estimated AVEs for Africa from the overall mean AVEs in the sample of countries, highlighting that the main hotspots for NTMs in intra-African trade would be in sectors such as rice and sugar, and that the main policy actions need to address non-technical measures

Liberalising trade does not mean eliminating all NTMs. Many NTMs are not of a protectionist nature but serve legitimate purposes, such as food safety, address market failures (e.g. asymmetry of information between producers and consumers, externalities) or enhance consumer demand for goods by increasing quality attributes (e.g. production process requirements or standards). Eliminating those NTMs is not the objective of any trade negotiations. Therefore, quantifying the size of the reduction in NTMs due to the AfCFTA remains difficult. For instance, in Abrego et al. (2019), NTMs are cut by 35 %, whereas in the studies by Jensen and Sandrey (2015) and the African Development Bank (2019), NTMs are cut by half. In the study by the World Bank (2020), the NTMs are also halved within the AfCFTA, with an additional assumption that NTMs on exports outside of the AU decrease by 20 %.

Finally, non-members of a trade agreement (third countries) can also benefit from NTM harmonisation (reduction) if it decreases the cost associated with exporting to a newly integrated market. Quantifying this secondary (spillover) effect is difficult, and often neglected, although further bilateral or regional AVEs in the CGE models should be assessed for third-country exporters. For instance, EU exporters would benefit from the establishment of the AfCFTA by facing harmonized (decreased) NTMs across all African trade partners.

3. Methods and data

This section explains the choice of the modelling tool for the analysis of the AfCFTA and provides a brief description of the model. Furthermore, this section sheds some light on the caveats to the approach. Our analysis is based on CGE modelling. This modelling framework is especially well suited to the analysis as it can incorporate the most significant interactions within a wide array of sectors through domestic, regional, and international linkages. As a result, CGE models can quantify trade-diverting and trade-creating effects of market opening, driven by comparative advantage and feedback effects (e.g. structural adjustments). They enable a broad view across the modelled economies and to quantify the sectorial effects. By contrast, the partial equilibrium models, which concentrate in one sector, include more disaggregated commodities and more detailed production structures. In addition to modelling approaches, empirical analysis (e.g. using gravity equations) can also assess changes in trade flows, typically based on countries' sizes, levels of development and geographic and cultural proximities. This branch of analysis is the foremost tool to assess trade restrictiveness of NTMs. The approaches are interconnected, as the CGE models use estimated NTM rates in calibrating model databases.

3.1. The computable general equilibrium model: Modular Applied GeNeral Equilibrium Tool

The present study employs a state-of-the-art multisector, multiregional, recursive-dynamic CGE model named the Modular Applied GeNeral Equilibrium Tool (MAGNET) (Woltjer and Kuiper, 2014). MAGNET is widely employed to simulate the impacts of agricultural, trade, land, and biofuel policies on the global economy, as well as for long-term projections. The model was developed at Wageningen Economic Research and is applied and extended at Wageningen Economic Research, at the Thünen Institute and by the European Commission's Joint Research Centre (JRC). It is a core model of the integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP) (M'barek et al., 2012, 2015). Detailed information on the MAGNET tool and its use can be accessed on the European Commission's Modelling Inventory Database and Knowledge Management System (MIDAS) ([8]).

MAGNET is based on the GTAP model, which accounts for the behaviour of households, firms, and governments in the global economy and how they interact in markets (Corong et al., 2017) ([9]). A key strength of the MAGNET model is that it allows the user to choose the submodules of relevance to the study at hand. This incarnation of MAGNET captures the specificities of agricultural markets. The model includes a food supply chain from farm (as represented by agricultural sectors) – through food processing industries and food service sectors – to fork, considering bilateral trade flows between major countries and regions of the world.

The model has been employed in several trade studies (on free trade agreements between the EU and North Africa in Boulanger and M'barek (2013), between the EU and neighbouring countries in Rau (2014), between the EU and the United States in van Berkum et al. (2014) and between the EU and 12 non-member states and regions (Boulanger et al., 2016; Ferrari et al., 2021).

In CGE models, supply and demand of commodities and endowments meet in markets, which are perfectly competitive and clear through price adjustments. MAGNET is a recursive-dynamic model, in which each period inherits an updated database incorporating the previous period's solutions. Capital stock develops as a result of investment demand, which is determined by regional expected rates of return. The model closure thus corresponds to the GTAP expected rate of return closure, in which the regional savings rates are exogenous, and the trade balances adjust to accommodate the equality between savings and investments. Labour supply is determined exogenously by population projections.

To characterise the peculiarities of agricultural markets, the model accounts for the heterogeneity of land usage by agricultural activity; a regional endogenous land supply function; the sluggish mobility of capital and labour transfer between agricultural and non-agricultural sectors with associated wage and rent differentials; and the inclusion of explicit substitution possibilities between various feed inputs in the livestock sectors.

Trade is modelled in a way that domestically produced goods can be sold either on the domestic market or to other regions of the world. Similarly, domestic intermediate, private household and government demand for goods can be satisfied by domestic production or by imports from other regions of the world (i.e. the 'Armington assumption'). The Armington assumption implies that an increase in the domestic price relative to

([8]) See the European Commission's dedicated webpage on SIAs (https://ec.europa.eu/trade/policy/policy-making/analysis/policy-evaluation/sustainability-impact-assessments/index_en.htm).

([9]) The version of MAGNET employed in this study is based on GTAP model version 6.

import prices leads to an increase in demand for imports relative to domestic goods. Similarly, if imports from one source country become more expensive, these will be substituted with imports from another, cheaper, source country. Other regions are accounted for with their own import and export taxes. Sourcing of imports happens at the border, after which – based on the resulting composite import price – the optimal mix of import and domestic goods is derived.

3.2. Database and aggregations

This study employs a fully consistent and academically recognised global database based on contributions from members of the GTAP network and constructed by the GTAP team at Purdue University, United States (Aguiar et al., 2019). Version 10 of the GTAP database 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) for 65 activities and 141 regions for the year 2014. Our analysis employs an aggregation of the database that catches the most salient features of agri-food industries in various African countries. The aggregated database includes 40 tradable commodities (Annex 1) and 36 regions, of which 29 are in Africa (Annex 2). We report most of the analyses on the level of the RECs to make the results more comprehensive. However, this poses a challenge since some of the countries that belong to an aggregated GTAP region belong to several RECs. In those few cases, we needed to deviate from the actual REC composition by assigning the aggregated region to its REC that was economically the largest. However, the deviation is small, and we believe that our REC aggregation gives an adequate view of the REC-level results ([10]).

3.3. Baseline

The model baseline is based on the Shared Socioeconomic Pathways (SSPs), which are long-term projections of the world economy produced by various integrated assessment models. The baseline is based on SSP2, which is the middle-of-the-road scenario (Fricko et al., 2017). The baseline is driven by the following exogenous factors: population growth and GDP growth by region, endowment demand by region and endowment category (skilled and unskilled labour, capital, and natural resources ([11])), and productivity of land by region and agricultural sector. Population growth and GDP growth are based on the SSP2 scenarios, whereas the endowment growth is 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 from 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, whereas the natural resource use has a quarter of that growth rate. The baseline starts from the 2014 GTAP database version 10 (Aguiar et al., 2019), and we apply 5-year simulation steps starting from 2020 until the end of the AfCFTA transition period in 2035. The 2014 database is updated to 2020 with GDP and population projections coming from the IMF's *World Economic Outlook* (IMF, 2020) projections.

We assume that there are no changes in tariff rates or NTMs among both AfCFTA member countries and non-AfCFTA countries. The initial values of the tariffs are adjusted using the Altertax method (Malcolm, 1998) to 2014 values obtained from the MAcMap database (as explained in more detail in Section 4). The NTMs are modelled as a mix of *ad valorem* tax equivalents and iceberg costs. The Altertax adjustment target equals the sum of actual tariffs and the AVE share of NTMs in the NTM scenarios.

3.4. Caveats to the approach

Economic models provide a conceptual framework that enables the representation of the economy in a structured but schematic and simplified manner. 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.

([10]) See Annexes 1 and 2 for detailed commodity and regional aggregations, respectively. The GTAP database includes 56 African countries of which 26 as separate regions, whereas the rest are aggregated to five larger regions. Of the AU member states South Sudan is not included in any of the GTAP regions. Eritrea, which belongs to the AU, but has not signed the agreement, belongs to Rest of Eastern Africa (GTAP code XEF). In addition, the GTAP data includes Saint Helena (in Rest of Western Africa, XWF) and Mayotte (in XWF), which are not independent states or part of the AU. Our regional aggregation has Benin, Guinea and Togo aggregated together with the XWF, and the rest are included in their most disaggregated level. Annex 2 also includes a detailed description of the REC aggregation.

([11]) 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.

MAGNET enables policy experiments to be conducted, in which a reference scenario or baseline is first simulated over a future period and then, after changing one or more underlying assumptions (e.g. about policy settings or about exogenous macroeconomic developments, weather trends, etc.), a new scenario incorporating these changes is run over the same period. A comparison of the new scenario with the reference scenario at a given point in the simulation period, usually in terms of percentage differences, establishes the direction and relative magnitude of the impacts on all the endogenous variables of the change that is depicted in the hypothetical scenario at that point in time. In other words, the model is intended to compare, for the same moment in time (i.e. holding time constant), the outcomes prevailing in two or more different hypothetical 'states of the world' that might prevail at that point in time.

Although MAGNET could be used to project individual values of all variables, it must be stressed that it is not a forecasting model and users should be aware that the values projected may be unreliable as to what will happen in that year. Although this type of model is calibrated to fit a given year closely, its solutions become less reliable the further into the future it is used to simulate outcomes. Given the substantial 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 limitation relates to the coverage and the disaggregation of the countries and of the agricultural products in the database used to calibrate the model. The CGE model MAGNET has a comprehensive coverage of the world and of the economy, and thus of the agri-food sector and beyond. However, some of the most important cash crops and processed agricultural products that fall in another food category cannot be included in this analysis owing to data limitations. These products, which include coffee, cocoa, tea, and other cash crops, are typical flagship export products for various African countries. This limitation leads to underestimating the trade gains for the African agri-food sector in a broad sense. In addition, not all the African countries are included as individual countries in the database and some of them only appear aggregated in composite regions.

MAGNET also suffers from a typical caveat that applies to all CGE models employing the constant elasticity of substitution assumption: the so-called small share problem. The constant elasticity of substitution treatment underestimates trade creation opportunities when the import flow in the benchmark data is 'small'. When the GTAP benchmark data import share is 'small', significant tariff reduction might induce a fall in the price but, even when coupled with a large trade elasticity, changes to bilateral imports will still be negligible (Philippidis et al., 2014). This is the case in many trade flows among African countries within the GTAP database. This caveat also refers to trade in new products that might appear on the market in the subsequent years. When the initial trade in these products is zero, it will remain zero in the model. This could be particularly relevant in the context of a rapid industrialisation process in African countries and their potential to enter new industries and produce goods they are not producing now.

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 as iceberg costs. Typically, the required Altertax adjustment is much larger for NTMs than for tariffs. Therefore, the database deviates more from its original form in the case of the NTMs. The consequent changes in trade and income flows are a major weakness of the AVE approach ([12]). In addition, the Altertax method assigns all the rent generated by the NTMs as government income, which is hardly realistic and can lead to misleading changes in tariff revenues.

([12]) Although there are several ways to model NTMs in CGE models, none of them is perfect and they all have their unique weaknesses. See, for example, Fugazza and Maur (2008), Walmsley and Minor (2015), Walmsley and Strutt (2019, 2021) and Webb et al. (2020) for discussion.

4. Trade policy data and scenarios

4.1. Base year trade barriers data

The 2014 MAGNET database is modified to incorporate new data sets on import tariffs and NTMs. This section describes the construction of those data sets.

4.1.1. Tariff data

The import tariff data in the GTAP version 10 database (Aguiar et al., 2019) have been modified to work with a consistent set of information throughout. For all sectors and regions of this study, trade-weighted average import tariffs are calculated from the MAcMap ([13]) database for the year 2014 according to the year of the GTAP database adopted. MAcMap provides a consistent data set on bilateral import tariff protection (and import values) at HS6 classification covering 196 importing countries, including 52 AU member states ([14]). The tariffs provided are AVE tariff rates, which have been calculated as the tariff rate that is equivalent to the combination of the applicable *ad valorem* tariff rate, either MFN or preferential, as well as any specific tariffs and tariff rate quotas (see Bouët et al. (2008) for details on the MAcMap methodology).

4.1.2. Non-tariff measures data

Estimates of NTMs on merchandise trade are taken from the World Bank ([15]) and have been estimated according to the methodology described in Kee et al. (2009) and Kee and Nicita (2016). This methodology comprises AVE values for NTMs at the HS6 product level for 41 regions, including the EU as one region. The EU values are applied to all 27 EU Member States ([16]). For all other countries present in the MAcMap data set but missing from the NTM estimates, the simple average of the tariff line's NTM AVEs across all available regions is used. The NTM tariff equivalents are then aggregated by the products and regions of the study, using the import values from the MAcMap data as weights.

The NTM estimates are provided separately for technical (SPS and technical measures) and non-technical (all other measures) measures ([17]) and aggregated separately.

Service trade NTMs are extracted from Jafari and Tarr (2017). They estimate AVE for 11 broad service sectors for 103 countries and separately again for larger geographic regions. For countries absent from the data set, the NTMs are taken from the corresponding larger geographic region. The 11 sectors are mapped to the sectors of the GTAP version 10 database using the approach suggested by the World Bank (2020) and then further aggregated to the present study's sectors and regions, calculating averages weighted according to the GTAP database's bilateral import trade values.

The tariff and NTM *ad valorem* rates adopted for the base data of this study are summarised by the box plots in Figure 3. Here, an observation corresponds to one sector in one region, and observations are summarised by the broad sectors of agricultural (Agri.), processed food (Food) and other (Other) products. The figure shows that NTMs tend to be higher than tariffs but also that there is a large variation between sectors and regions. Processed food imports face the highest barriers from tariffs as well as from NTMs, whereas imports of other products the face the lowest.

([13]) Market Access Map, International Trade Centre (www.macmap.org).
([14]) Data for imports from Somalia, South Sudan and Western Sahara are missing.
([15]) Source: https://datacatalog.worldbank.org/dataset/ad-valorem-equivalent-non-tariff-measures.
([16]) In addition, the EU values are applied to the United Kingdom.
([17]) See 'Data description' at https://datacatalog.worldbank.org/dataset/ad-valorem-equivalent-non-tariff-measures.

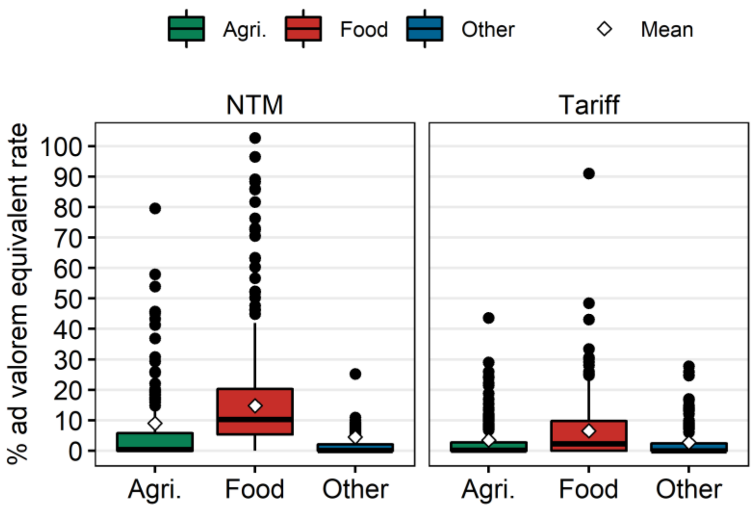

Figure 3. Box plots of intra-AU sectors' regional average AVE tariff and NTM rates adopted for the base data, by broad sector
Source: Authors' elaboration.

4.2. Scenarios

4.2.1. Import tariffs

As final tariff liberalisation offers from the AU member states detailing the exact tariff lines and rate cuts were not available at the time of drafting the report, several tariff liberalisation scenarios are constructed for each country separately while respecting regional trade blocs. Specifically, the scenarios are constructed utilising the information on the modalities on liberalisation of trade in goods agreed in the AfCFTA negotiations to date. The scenario construction allocates tariff lines into four lists of products: non-sensitive, non-sensitive G7 ([18]), sensitive and excluded. The details of the liberalisation commitments for each of the four lists differ by country category – non-LDC, LDC and G7 – and are summarised in Table 3. For the list of excluded products, the AfCFTA adopts a double-qualification approach, limiting the number of tariff lines to 3 % (or 156 lines) of all HS6 tariff lines, as well as limiting the value of intra-AU trade covered by selected lines to 10 %, measured using the average import value over the period 2014–2016 or 2015–2017. The basis for the tariff liberalisation is the MFN rates applied in 2019, the year the AfCFTA came into force (Lunenborg, 2019).

Table 3. AfCFTA liberalisation commitments and time frames

	Non-sensitive products	**Sensitive products**	**Excluded products**
Coverage rules	At least 90 % of tariff lines	Up to 7 % of tariff lines	Up to 3 % of tariff lines covering less than 10 % of value of imports from the AU
Non-LDCs	Cut by 100 % over 5 years	Cut by 100 % over 10 years	No cut
LDCs	Cut by 100 % over 10 years	Cut by 100 % over 13 years, start may be delayed to year 6	No cut
G7	85 % of tariff lines cut by 100 % over 10 years; 5 % of tariff lines cut by 100 % over 15 years, start may be delayed to year 11	Cut by 100 % over 13 years, start may be delayed to year 6	No cut

([18]) The 'G7' – Djibouti, Ethiopia, Madagascar, Malawi, Sudan, Zambia and Zimbabwe – are a group of particularly vulnerable Member States facing special development challenges.

Member states are tabling liberalisation offers individually unless they belong to an REC that is applying a common external tariff. The EAC, ECOWAS and the Southern African Customs Union (SACU) are customs unions, and the Central African Economic and Monetary Community (CEMAC) is in a late stage of forming one, so these four regional groupings are assumed to each table common offers (United Nations Economic Commission for Africa, 2018; Lunenborg, 2019). Considering some ambiguity about the negotiation and application details of the AfCFTA (Lunenborg, 2019), the following additional assumptions are made in the present analysis: the four customs union RECs are classified as non-LDCs (although they frequently include LDC countries), and each AU member state applies the same set of tariffs to all other AU member states, except if they belong to the same customs union.

4.2.1.1. Selection of product lines for the exclusion list

The construction of realistic tariff line scenarios, as they might emerge at the end of the AfCFTA implementation period for all member states after 15 years, involves selecting tariff lines according to the four lists of products considered here, as a hierarchical process with three steps: in step 1, a maximum of 3 % of tariff lines for the list of excluded products are selected; in step 2 – only in the case of G7 countries – a maximum of 5 % of non-sensitive tariffs are selected, with an extended and optionally delayed liberalisation period; and in step 3, a maximum of 7 % of sensitive products are selected, with an extended and optionally delayed liberalisation period. All remaining tariff lines are allocated to the list of non-sensitive products.

Two alternative assumptions about rules guiding governments' tariff line selection were considered for constructing scenarios. The first rule is maximisation of tariff revenue retained and the second rule is maximisation of the political economy-based index ([19]) developed by Jean et al. (2008), which combines preferences for retaining tariff revenue with preferences to continue the protection of products with high tariff rates. However, as differences in selected tariff lists turned out to be small, the decision was taken to proceed with the tariff revenue maximisation rule only.

In addition to the above guiding rule, four options regarding a primary objective for an import liberalisation strategy are considered, which imply complete liberalisation of a defined product group before applying the tariff revenue maximisation approach to the remaining tariff lines. These options are:

(a) no additional strategy (Tarrev),
(b) improving food access by liberalising agri-food products (Agrifood),
(c) promoting industrialisation by liberalising intermediate input products (Interm),
(d) increasing healthy competition by liberalising industries with revealed comparative advantage within the AU (RCA).

Governments' selection process in each hierarchical step as outlined above is formulated as a combinatorial optimisation problem, maximising the tariff revenue subject to the coverage limits summarised in Table 1 ([20]). For example, the list of excluded products has the limits of a maximum of 3 % of tariff lines and of a maximum 10 % share of intra-AU import value covered. Additional protection strategies are implemented by liberalising sets of tariff lines beforehand and excluding these from the tariff revenue-maximising selection procedure. For (b), all agri-food products are liberalised, for (c), all lines relating to intermediate inputs as categorised by the UN broad economic categories ([21]) are liberalised, and for (d), all lines of products with a revealed comparative advantage ([22]) (see Balassa, 1965) greater than 1 are liberalised.

For the purpose of the tariff line selection, the four RECs are each included as a single region instead of their member countries being included individually. It is assumed that REC members all get equal weight in the decision about the common tariff liberalisation offer, which is achieved by using democratic weighting during the calculation of average tariff revenue shares and import shares for the maximisation criteria. Note that since the double-qualification criteria are applied to each REC as a whole, individual countries might stay below the 90 % liberalisation target. Moreover, it is assumed that the formation of the four customs unions

([19]) The political economy-based index (PEI) is calculated by $PEI_i = v_i \frac{\tau_i^2}{1+\tau_i}$, with i denoting products and v_i, τ_i denoting the value of imports and the *ad valorem* tariff rate on imports, respectively.

([20]) More specifically, the problem is formulated as $max. \sum_{i \in I} \tau_i X_i$ subject to the constraints $\sum_{i \in I} X_i \leq 156$; $\sum_{i \in I} v_i X_i \leq 0.1 \sum_{i \in I} v_i$ and $X_i \in 0{,}1$, with I denoting a set of HS6 tariff lines available for selection, τ_i, v_i denoting the *ad valorem* tariff rate and the import value of product i, respectively.

([21]) Retrieved from https://unstats.un.org/unsd/trade/classifications/bec.asp on 22 May 2020.

([22]) The revealed comparative advantage index is calculated for product i and country k as $RCI_{ik} = \frac{x_{ik}/\sum_{j \in I} x_{jk}}{\sum_{l \in K} x_{il}/\sum_{j \in I}\sum_{l \in K} x_{jl}}$, were x_{ik} denotes a product's export value as a proportion of the country's total export value, and I and K denote sets of products and countries, respectively.

(EAC, ECOWAS, SACU and the CEMAC) is completed before the start of the AfCFTA so that the import tariffs within each of these four RECs are zero.

All tariff lines with zero imports are excluded during the maximisation process, but such tariff lines could be added arbitrarily afterwards to fill the limit of 156 lines for the exclusion list. This, however, would have no effect in the present study.

Regarding the timing of tariff line liberalisation, again tariff revenue maximisation is assumed so that liberalisation is delayed as much as possible according to the modalities presented in Table 1.

4.2.1.2. Resulting lists of exclusion

In the four scenarios, most countries exhaust the AfCFTA limits by selecting 156 tariff lines covering just under 10 % of intra-AU import value. If all countries follow solely the tariff revenue maximisation objective (Tarrev), the average tariff rate over all intra-AU imports drops by 74 %, from 4.2 % to 1.1 %, as shown in Table 4. Note that the calculations here consider only first-order effects of the tariff reductions and thus ignore how trade adapts in reaction to the trade barrier changes. Tariffs on agricultural products are cut by 45.8 %, whereas percentage cuts in food and in other products are much higher, at 67.4 % and 78.4 %, respectively. Thus, exclusively following a tariff revenue maximisation objective would result in agricultural and food sectors remaining the most protected.

On average, the member states retain 26 % of their initial tariff revenue from intra-AU imports, increasing the share of import value flowing free of tariffs from 46.3 % to 90.3 %, as required. How much tariff revenue the double-qualification condition allows individual countries to retain depends on their initial degree of import protection. Countries that initially protect most of their imports are required to reduce heavily. Countries with little protection might retain close to 100 % of tariff revenue, whereas those with the highest protection might achieve around 4 %. In any case, half of the countries can retain close to 50 % of their respective tariff revenues and a quarter can retain 77 %. This is reflected in the distribution of the shares of tariff revenue retained shown by the box plots in Figure 4. Under the Agrifood, Interm and RCA scenarios, many AU governments retain substantially less revenue, as illustrated by the large shifts of the boxes (corresponding to the interquartile range) to the left relative to the Tarrev box.

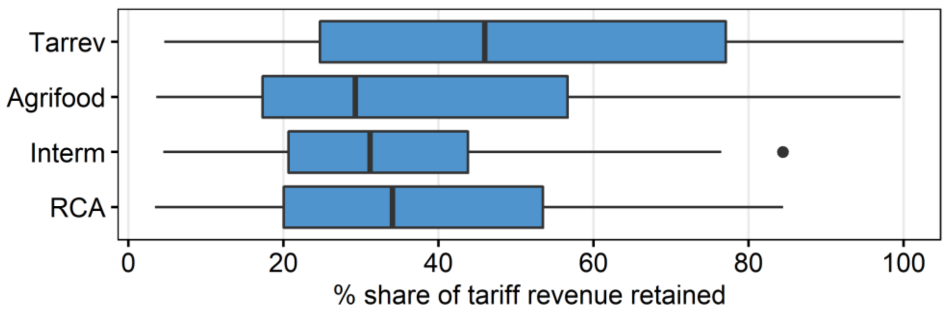

Figure 4. Distribution of national-level average proportions of tariff revenue retained
Source: Authors' elaboration.

Table 4 shows the average tariff rate cuts by broad sector and scenario after the liberalisations have been completed. In the Agrifood scenario, tariffs on agricultural and food products are abolished completely, whereas those on other products are decreased by 70.8 %. In the scenario in which imports of intermediate inputs are fully liberalised (Interm), tariffs are cut severely for other manufacturing (84 %) and agricultural (66.6 %) products and less for food products (62.5 %). Finally, restricting protection to products for which the country does not have a revealed comparative advantage (RCA) implies a smaller cut for agricultural products (45.4 %) and larger cuts for food (75 %) and other (77.7 %) products. Nevertheless, the cuts differ strongly from country to country, as illustrated by the box plots in Figure 5.

Table 4. Average national-level percentage cuts in import tariff rates by broad sector

Sector	Tarrev	Agrifood	Interm	RCA
Agriculture	45.8	100.0	66.6	45.4
Food	67.4	100.0	62.5	75.0
Other	78.4	70.8	84.0	77.7
Average	74.0	79.8	77.6	75.6

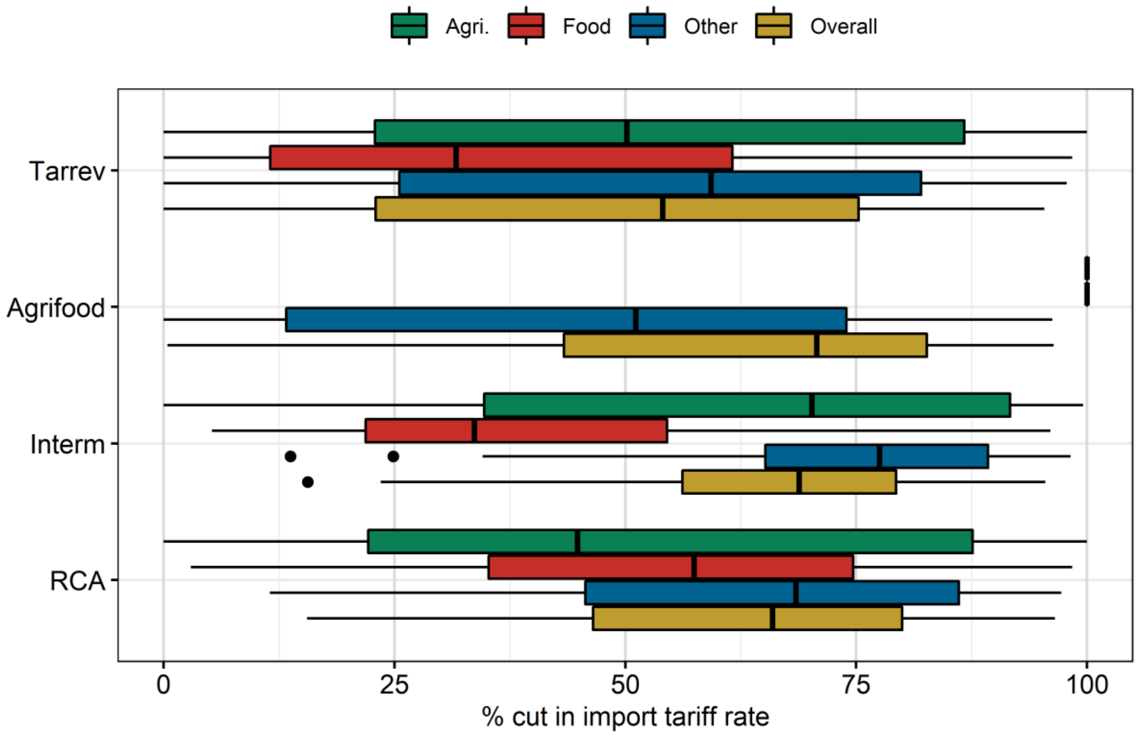

Figure 5. Box plots of national-level overall and broad sector average percentage tariff revenue cuts by scenario
Source: Authors' elaboration.

4.2.1.3. *Tariff liberalisation scenarios*

Figure 6 presents a summary of the various AfCFTA tariff liberalisation scenarios over time. It illustrates how the trade-weighted average within-AU tariffs for the broad sectors of agriculture, food, non-agriculture (other) is cut over the 15-year implementation period ([23]).

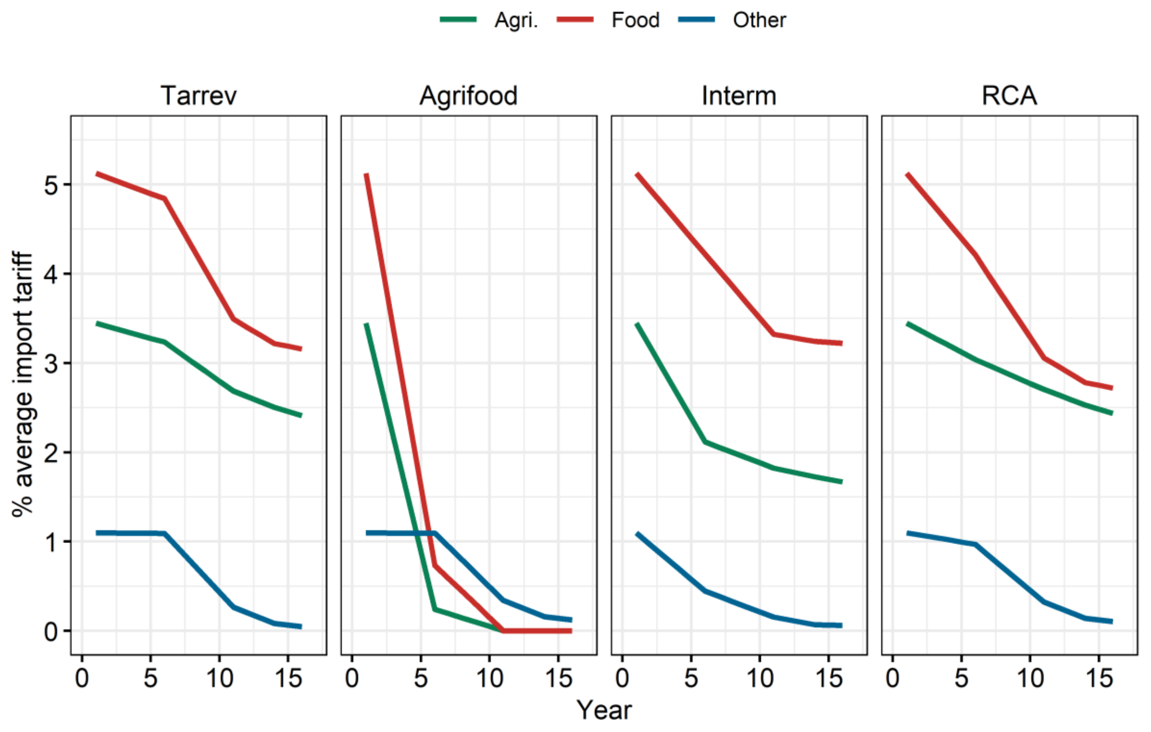

Figure 6. Evolution of average intra-AU import tariffs over the 15-year implementation period by broad sector
Source: Authors' elaboration.

Tariffs decrease gradually over time according to the assumption of linear cuts. The kinks in the lines are caused by the delayed start of and/or extended liberalisation periods for products associated with the three lists (non-sensitive, non-sensitive G7 and sensitive) depending on the countries classified as non-least developed, least developed or G7. The final tariff levels are determined by the lists of excluded products.

In terms of the three broad sectors, the Agrifood scenario concentrates the remaining protection on non-agricultural products and the Interm scenario concentrates the remaining protection on food. The strongest cuts for non-agricultural tariffs appear in the Tarrev scenario.

Note that, as illustrated by the previous graphs in this report, there is great diversity among countries and products, which is hidden behind these aggregate statistics.

4.2.2. Non-tariff measures

The AfCFTA will harmonise rules and regulations in many areas of merchandise and services trade (SPS standards, TBTs, etc.) and thereby reduce the cost of trading not only for trade within the AU but also for trade outside the AU. In the absence of information on how NTMs will be reduced by the AfCFTA, we assume that the scope of the AfCFTA facilitates a reduction of 50 % in NTMs on merchandise and services trade for all intra-AU states. The AfCFTA is also assumed to reduce the cost of trading with countries outside of the AU as a result of greater standardisation and harmonisation of rules and regulations and a corresponding reduction in costs of compliance with foreign rules and regulations. NTMs for all imports and exports between AU and non-AU countries are assumed to decrease by 25 %. The NTMs are reduced linearly, starting from the year 2020 and completing in 2035.

([23]) Excludes trade within each of the four customs unions.

NTMs on merchandise are distinguished between technical measures (SPS and technical measures) and non-technical measures (contingent trade measures, quantitative restrictions, price controls, finance measures) (see Kee and Nicita, 2016), and are treated differently in the implementation of the simulation scenarios. All NTMs on services are assumed to be technical measures.

To address variation in these types of NTMs and their effects, we assumed that the technical measures are cost generating and represented them as iceberg costs in the model, and that the non-technical measures are rent generating and represented them as *ad valorem* tariff equivalents. The NTM reductions in the scenarios are distributed accordingly.

5. MAGNET baseline

5.1. Baseline assumptions

A series of exogenous factors drive the baseline economic development: population and GDP growth rates by region, endowment demands by region and endowment category (skilled and unskilled labour, capital, and natural resources), and productivity of land by region and agricultural sector. In MAGNET, population growth is based on the United Nations' population forecasts, and GDP growth is based on the World Bank's projections. Land productivity projections are based on the yield projections of the Integrated Model to Assess the Global Environment (IMAGE) model. They are applied on land according to agricultural sector and they vary by crop and region. The baseline is presented in more detail as web info graphics on the JRC's Data-Modelling platform (see Annex 4 for details).

5.2. Overall economic development at the baseline

At the baseline, economic growth is exogenous at the regional level ([24]). It is strongest in Africa, where economies grow between 4–7 % per year in early 2020 (in real terms). At the same time, the growth in developed countries is less than 2 %, whereas Asian countries and other middle-income countries have growth rates between 3 % and 5 %. Developed and middle-income countries experience slowing growth, and in the latter group the growth is between 2 % and 3 % when approaching 2040 ([25]). In contrast, many African countries accelerate their growth in 2035 ([26]). This reflects both higher population growth and productivity improvements in Africa. Figure 7 summarises the GDP development in the African RECs. The largest RECs by economic activity are ECOWAS and COMESA. They also have the strongest growth rates.

([24]) For the purposes of clear exposition, we summarise a majority of the baseline development at the REC level. The RECs correspond as closely as possible to the actual RECs, but we have made some exceptions due to the GTAP aggregation level. It should be noted that because countries can be members of several RECs, the REC level results do not sum to the African Union results, which is also presented along the REC results. A detailed description of the REC aggregation is provided in Annexes 1 and 2.

([25]) See Annex 3 for the yearly growth rates by region.

([26]) According to the underlying GDP projections, economic growth continues high in majority of African countries also after 2035.

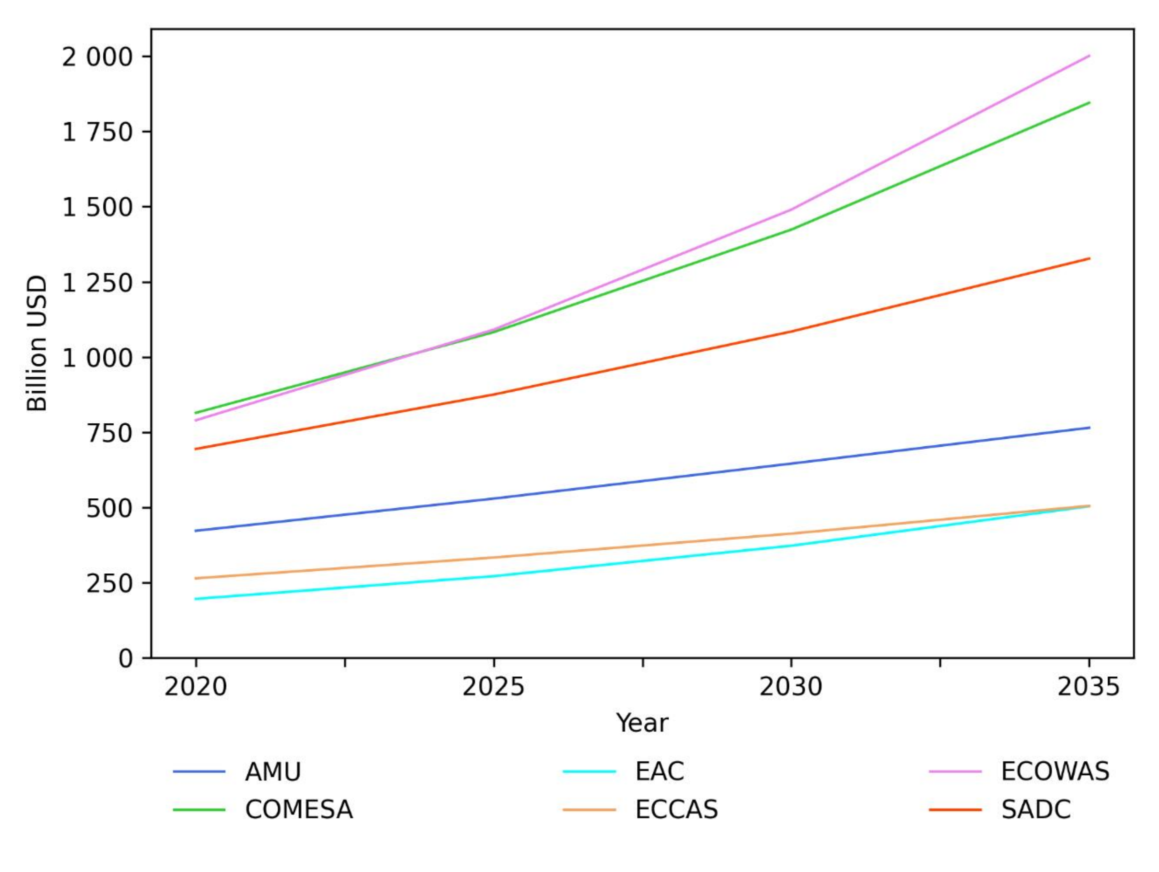

Figure 7. GDP growth baseline in real terms by REC
Source: Authors' calculation from MAGNET results.

Africa has the highest population growth in comparison with other continents, and its population is predicted to grow from over 1.3 billion in 2020 to more than 1.7 billion in 2035: a 30 % growth in 15 years. The most populous RECs are COMESA and ECOWAS, whereas EAC and ECOWAS are the fastest growing, with 38 % and 36.5 % cumulative growths, respectively (Figure 8).

As both GDP and population growth are exogenous at the baseline, GDP per capita is naturally exogenous too (Figure 9). AMU and SADC show higher per capita outputs than the other RECs, and the changes between the RECs are small.

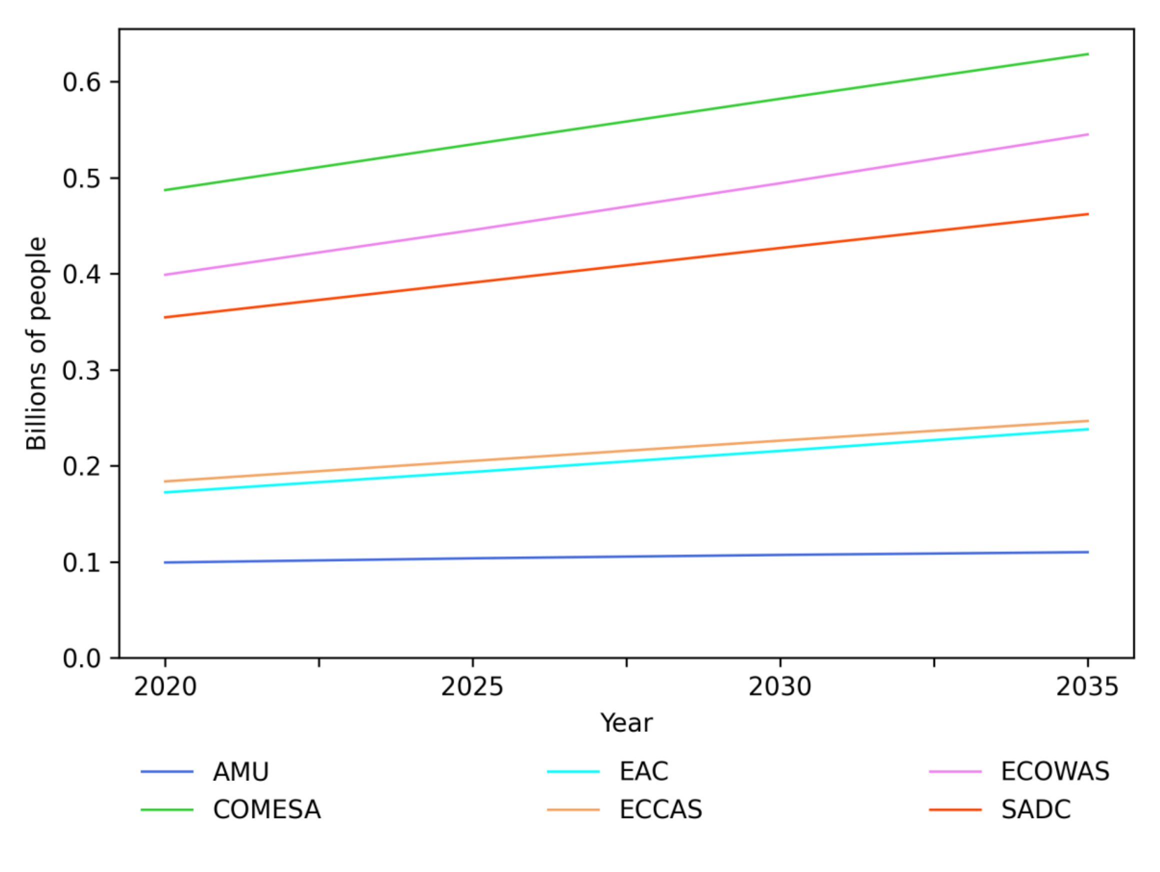

Figure 8. Population growth baseline by REC
Source: Authors' calculation from MAGNET results.

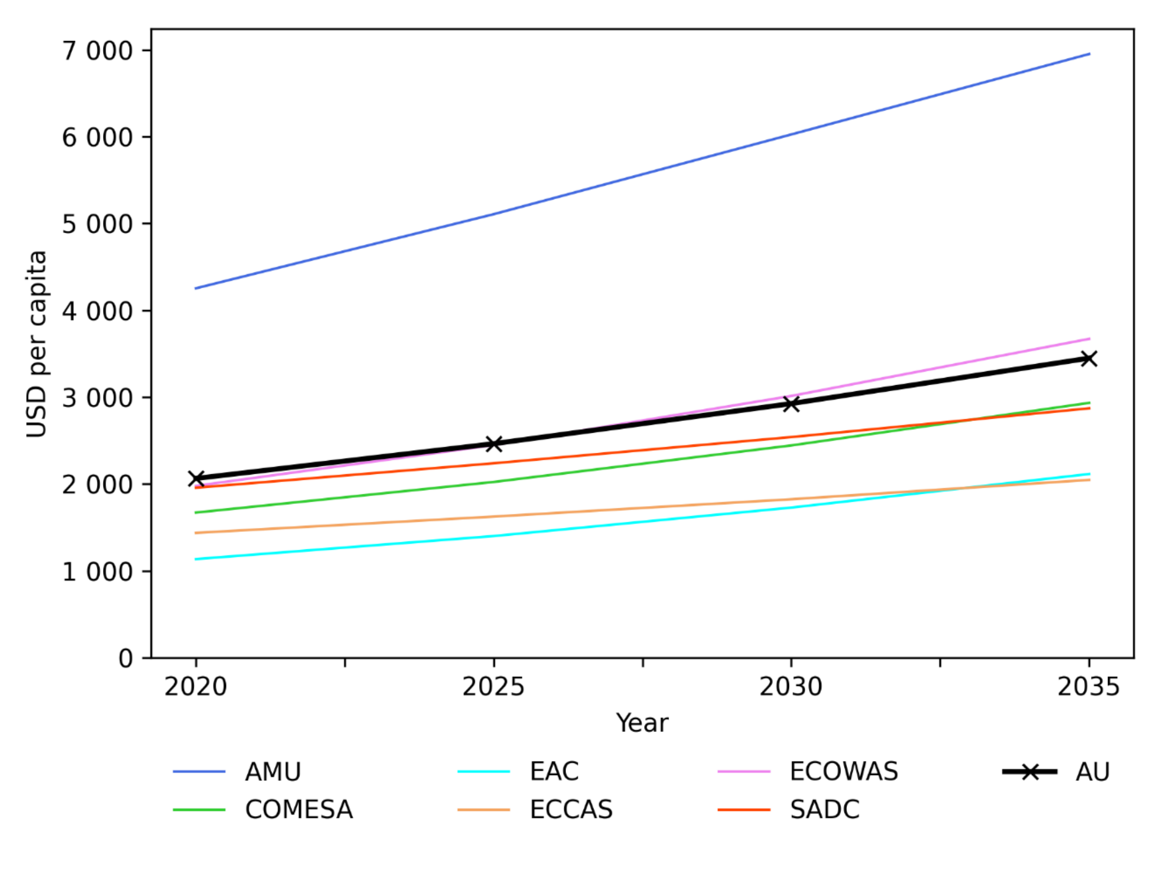

Figure 9. GDP per capita growth baseline in USD by REC
Source: Authors' calculation from MAGNET results.

The supply of both skilled and unskilled labour is exogenous at the baseline. The overall change in labour supply (Figure 10; measured in total wage bill), as a result of baseline assumptions, follows closely the population growth (as seen in Figure 8). Figure 11 depicts the trends of labour supply in total, and in the two skill categories, skilled and unskilled. Labour supply grows in both categories, but the share of skilled labour increases in all RECs, reflecting increasing educational attainment in Africa (Figure 12).

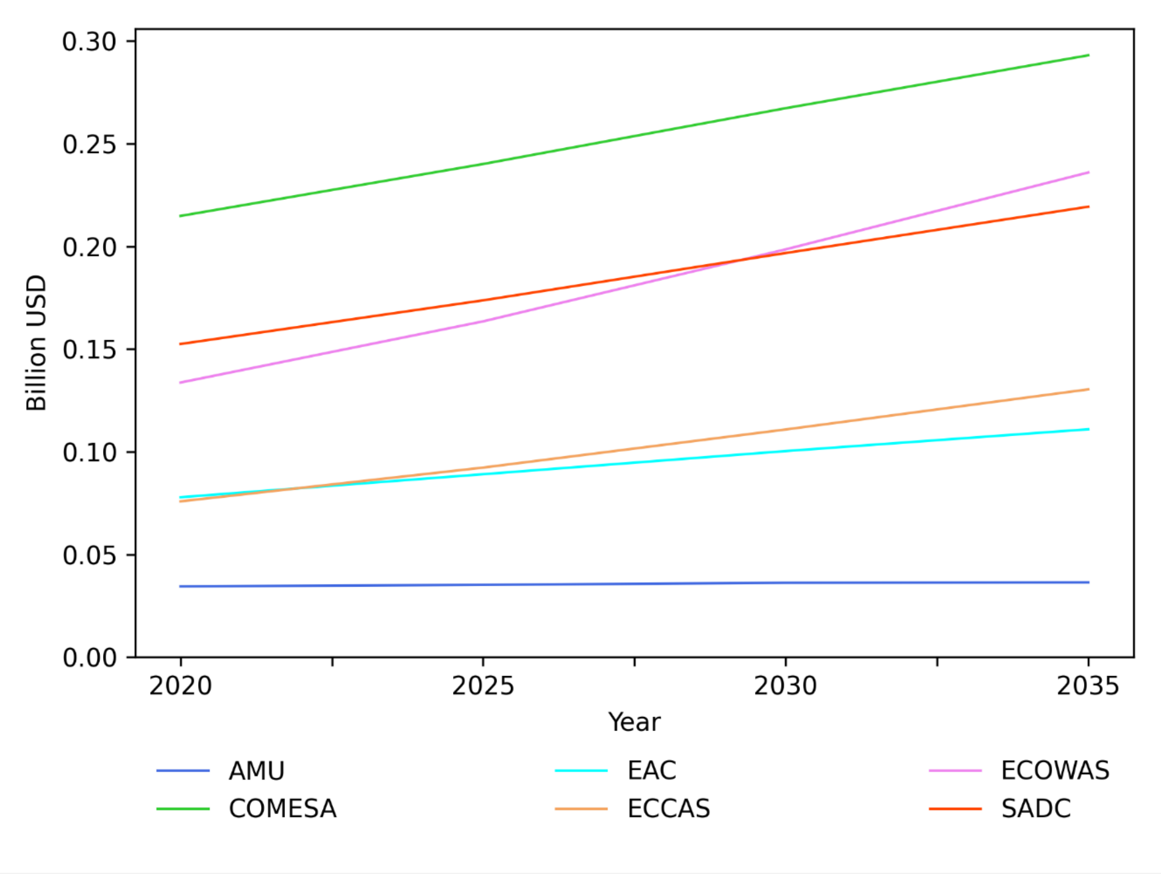

Figure 10. Labour supply growth baseline by REC
Source: Authors' calculation from MAGNET results.

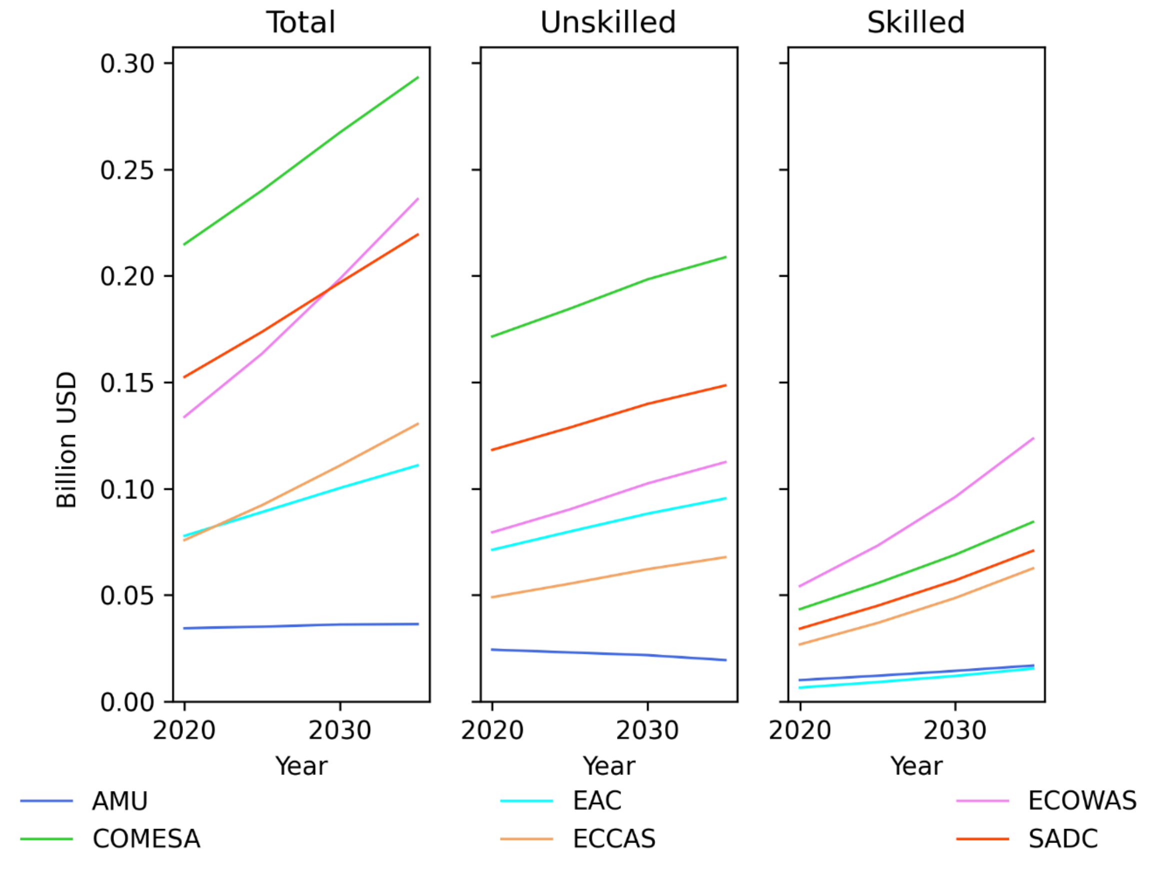

Figure 11. Labour supply growth baseline by REC and skill category
Source: Authors' calculation from MAGNET results.

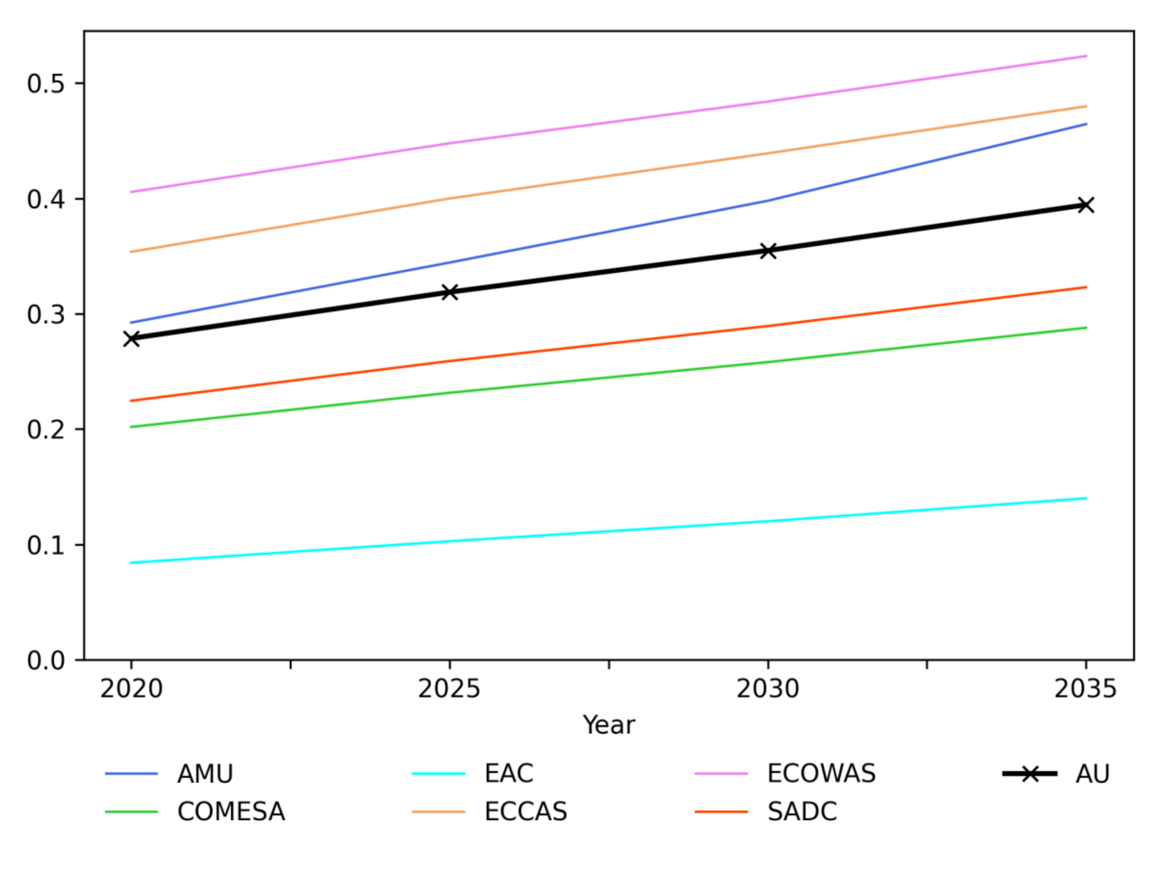

Figure 12. Growth of proportion of skilled labour in the total labour supply baseline by REC
Source: Authors' calculation from MAGNET results.

5.2.1. Structural change

African countries, grouped by RECs, have considerable differences in their production structures and in the sectorial compositions (Figure 13 and Figure 14). EAC, ECCAS and ECOWAS have higher shares in agriculture and food processing in the base year than the other regions. These shares are stable on the baseline, apart from COMESA and ECOWAS, for which the shares decrease slightly. ECCAS has a higher share of non-renewable natural resources than the other RECs.

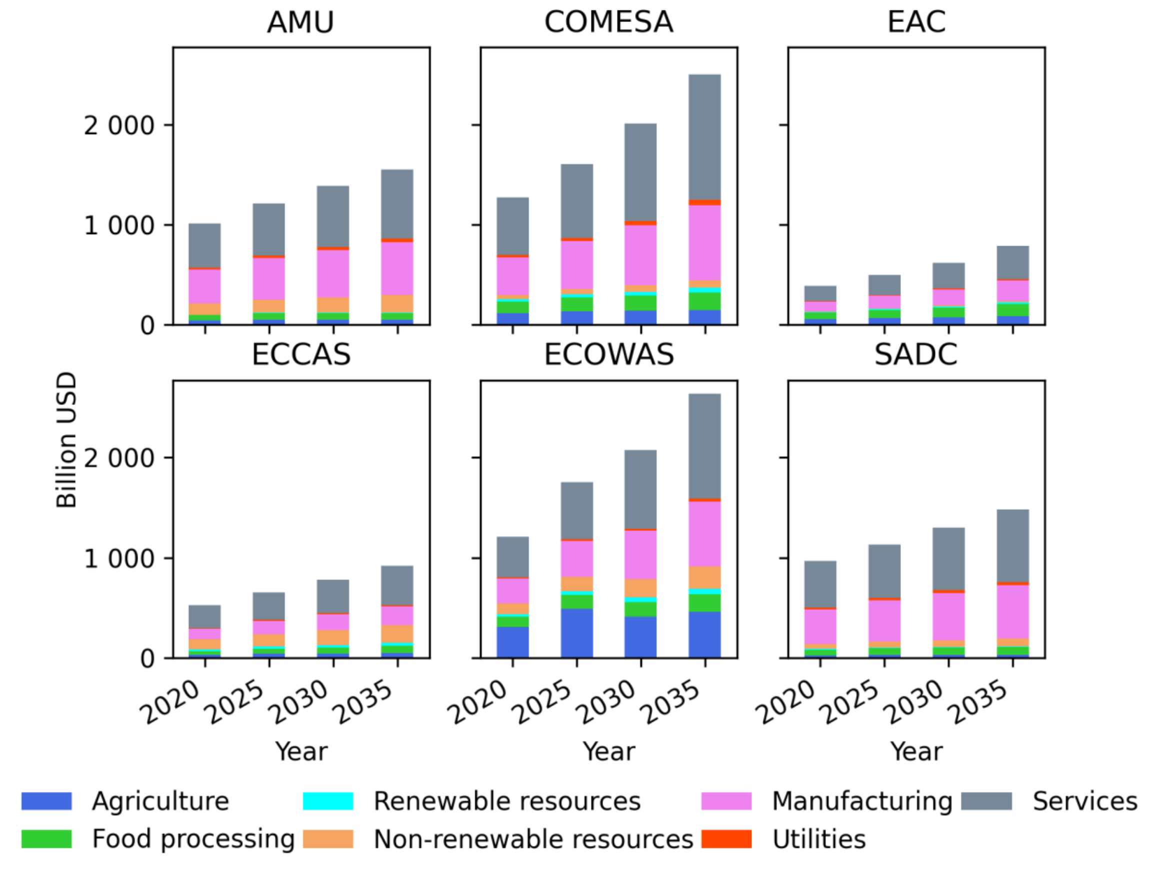

Figure 13. Output growth baseline by commodity category and REC (absolute values, billion USD)
Source: Authors' calculation from MAGNET results.

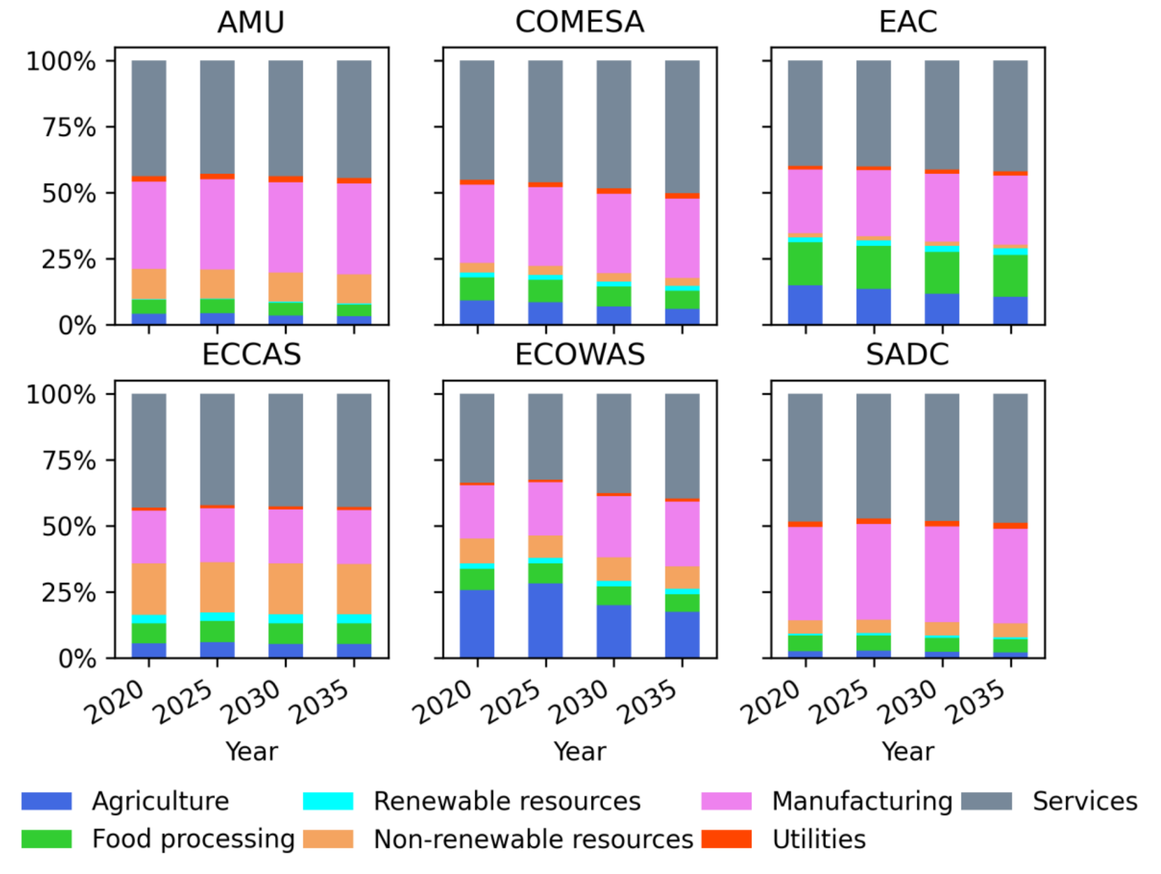

Figure 14. Output growth baseline by commodity category and REC (proportions)
Source: Authors' calculation from MAGNET results.

Figure 15 and Figure 16 summarise the sectorial compositions for agriculture and other renewable resource sectors on the baseline in absolute values and proportions, respectively. They show that COMESA and ECOWAS are the biggest agricultural producers in the AU. The higher-income regions, SADC and AMU, have stable trajectories of agricultural output, whereas in the other RECs these industries grow strongly in absolute terms. SADC and AMU also already have a high share of food processing in the base year, whereas in the other RECs these shares increase in the baseline. ECOWAS has a high share of other crops, reflecting its role as a prominent cash crop producer. In all the RECs, the share of animal production is much lower than in more-developed countries, and that does not change significantly in the baseline. Other renewable resource industries are smaller than agriculture. However, fish production is a notable part of food output in ECCAS.

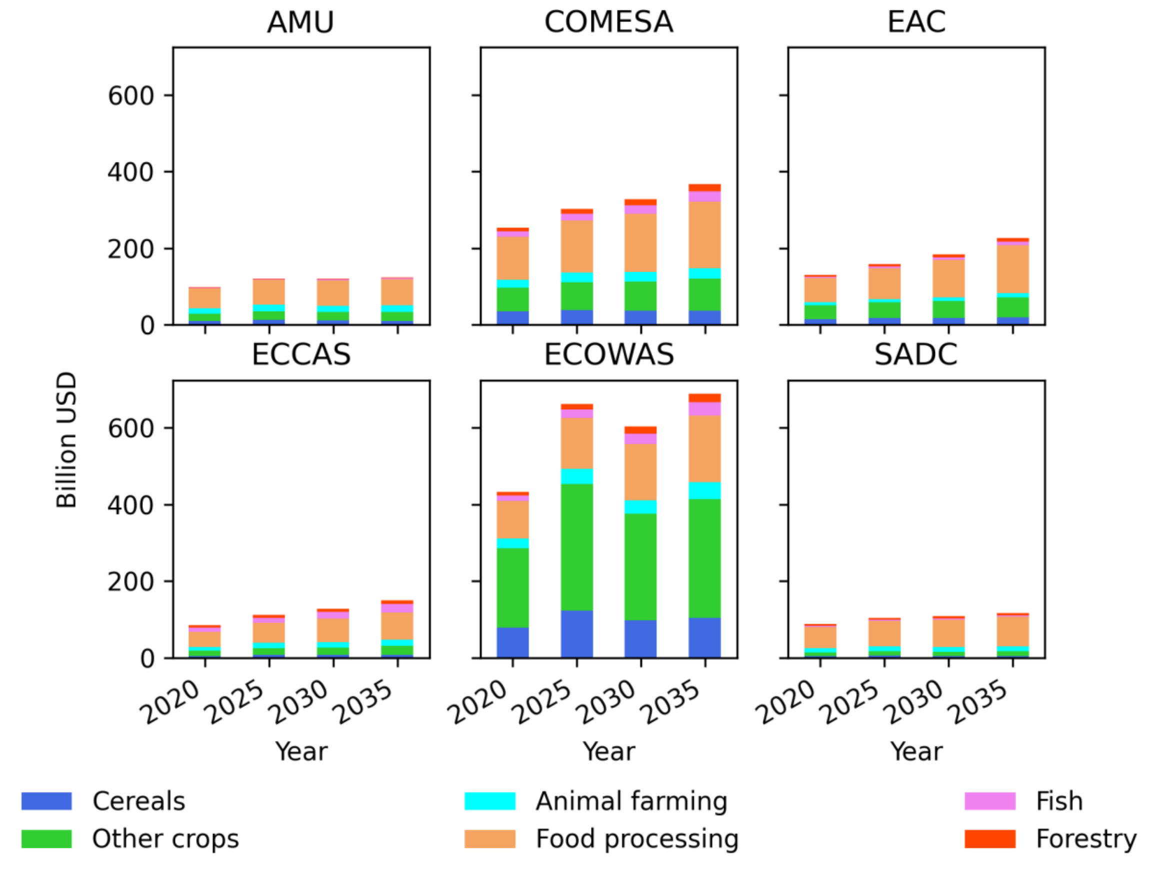

Figure 15. Growth of output of agriculture and renewable resources baseline

Source: Authors' calculation from MAGNET results.

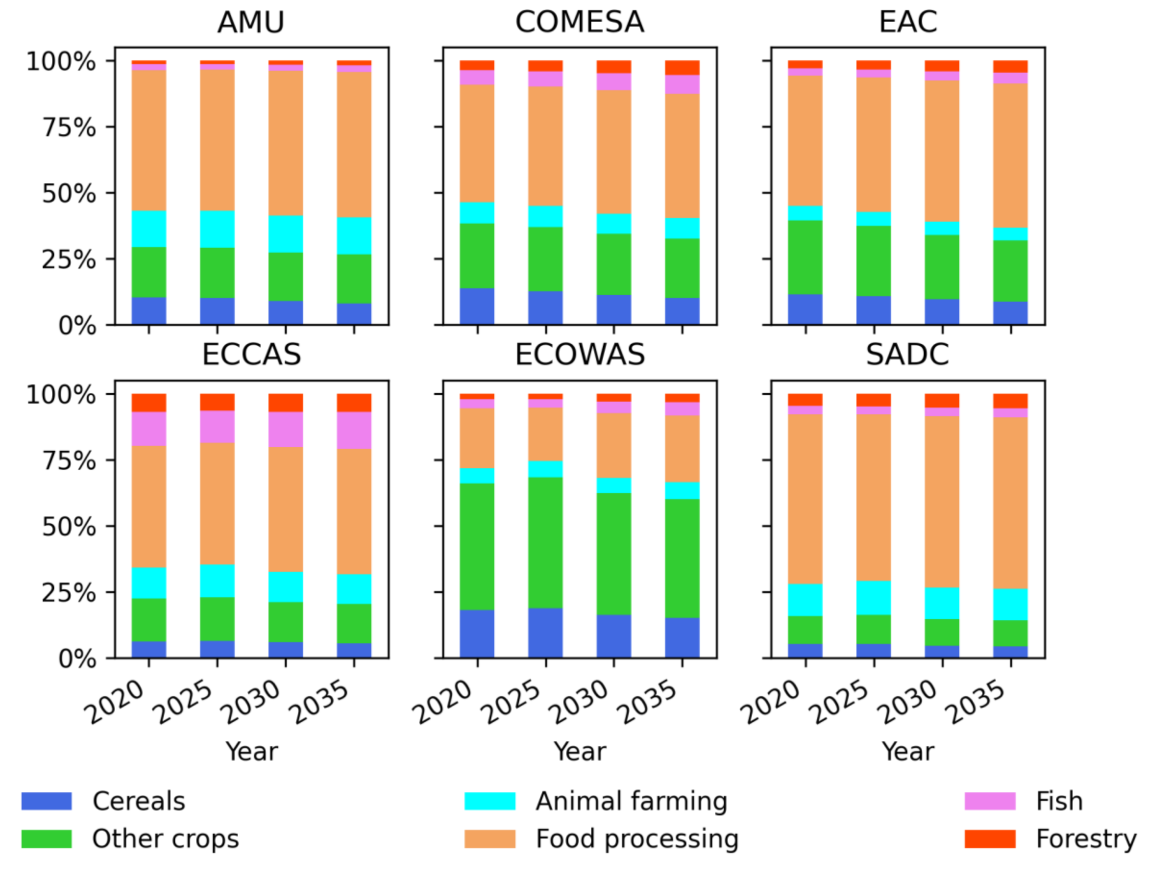

Figure 16. Growth of output of agriculture and renewable resources baseline (proportions)
Source: Authors' calculation from MAGNET results.

5.2.2. Trade

The trade volumes are assumed to increase in all African regions on the baseline. They increase both between the African countries and between African and non-African countries. Figure 17 presents the changes in imports of the African RECs as a total, from the other African countries, and from the rest of the world, respectively. The figures reveal the overall trend in the increase of trade, and the fact that most of the imports come from outside Africa. ECOWAS, AMU, and COMESA are leading importers, both in total and from the rest of the world, whereas SADC is the most prominent REC importing from other African countries. The intra-African imports increased moderately on the baseline.

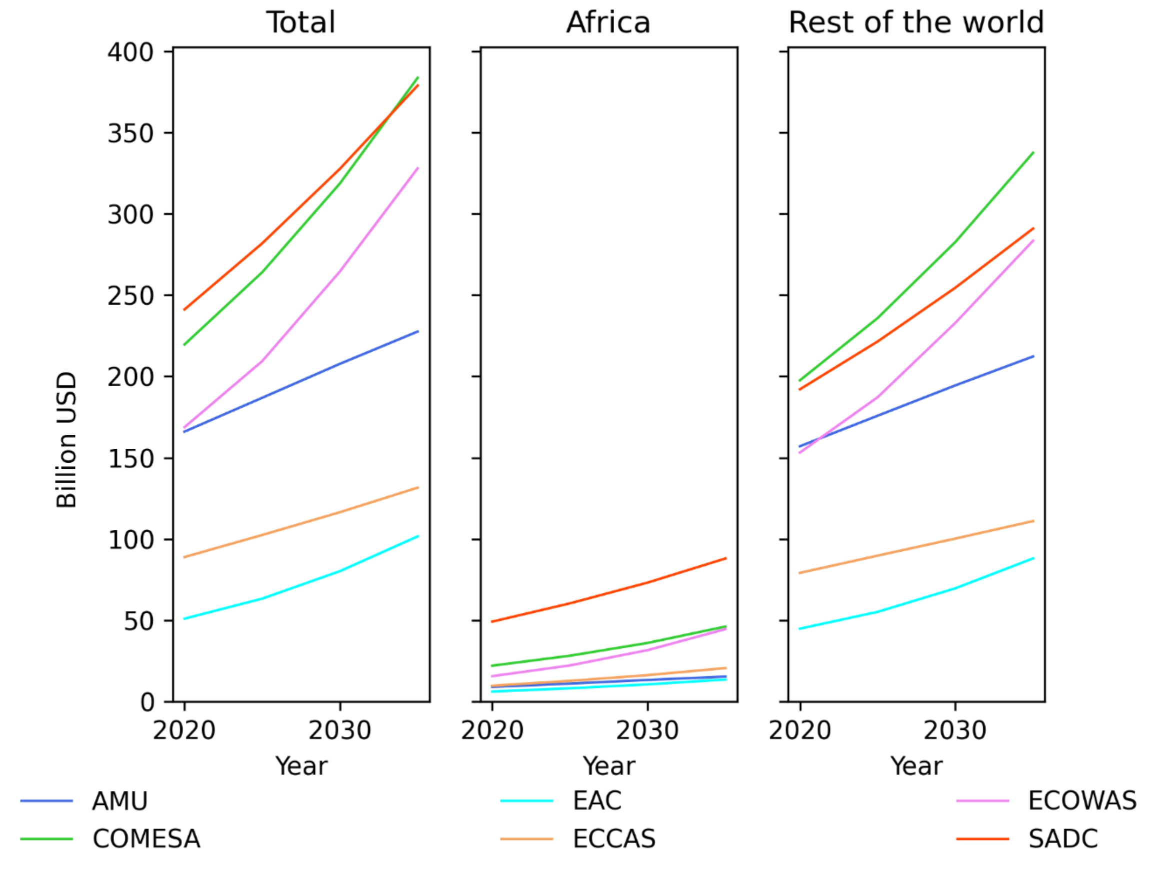

Figure 17. Growth in volume of imports baseline (total, from Africa, and from the rest of the world)
Source: Authors' calculation from MAGNET results.

Figure 18 presents the equivalent changes for export volumes. Like the imports, the exports have an increasing trend on the baseline. In addition, the exports to the rest of the world are much larger than exports to the other African countries. ECOWAS has the strongest overall growth in exports, which is partly explained by a strong demand for Nigerian oil in Asia. As with the imports, SADC has a dominant position in intra-African exports, although ECOWAS will increase its share in the baseline.

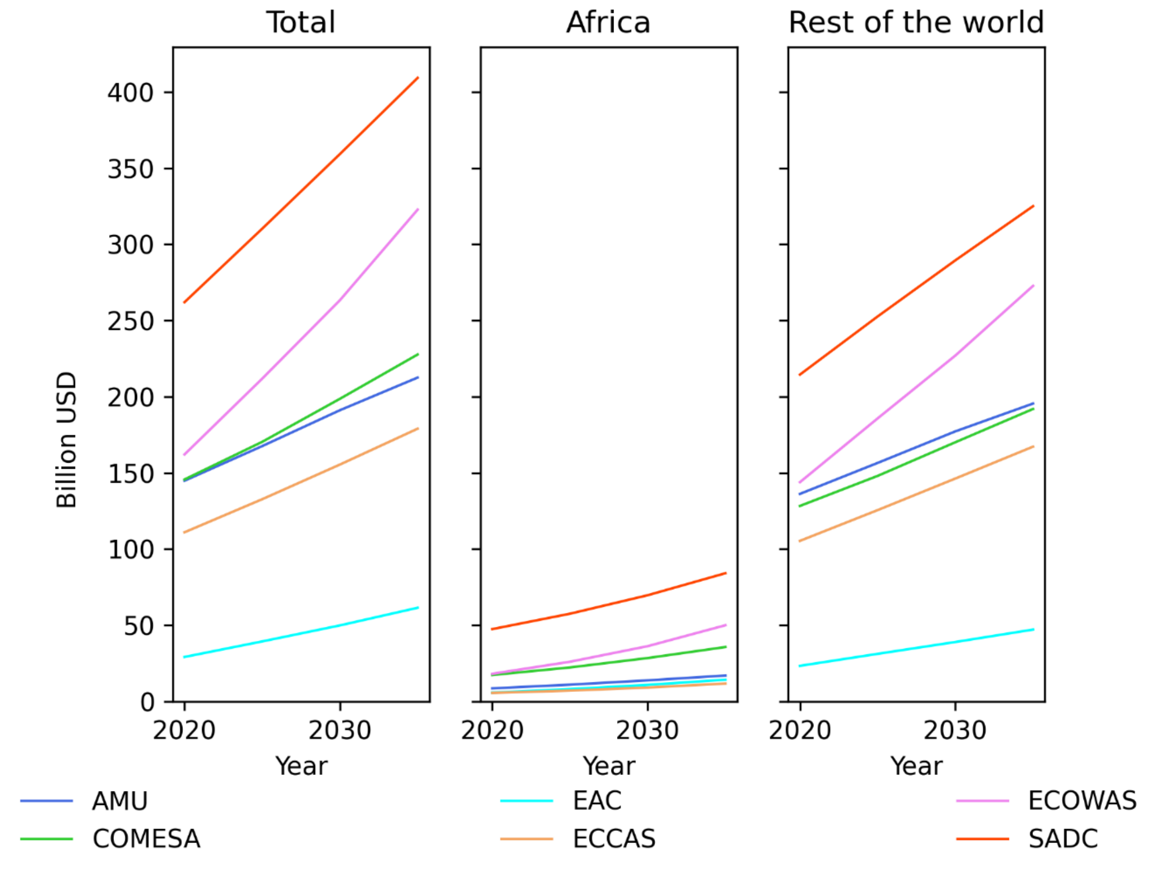

Figure 18. Growth in volume of exports baseline (total, to Africa, and to the rest of the world)
Source: Authors' calculation from MAGNET results.

Figure 19 summarises the development of the balance of trade at the REC level. ECCAS and SADC have trade surpluses, and for ECCAS trade grows slightly on the baseline. COMESA has the biggest trade deficit, which increases strongly on the baseline. The total trade deficit for the AU was USD 69 billion in 2020, and it will increase to USD 120 billion by 2035, a 74 % increase.

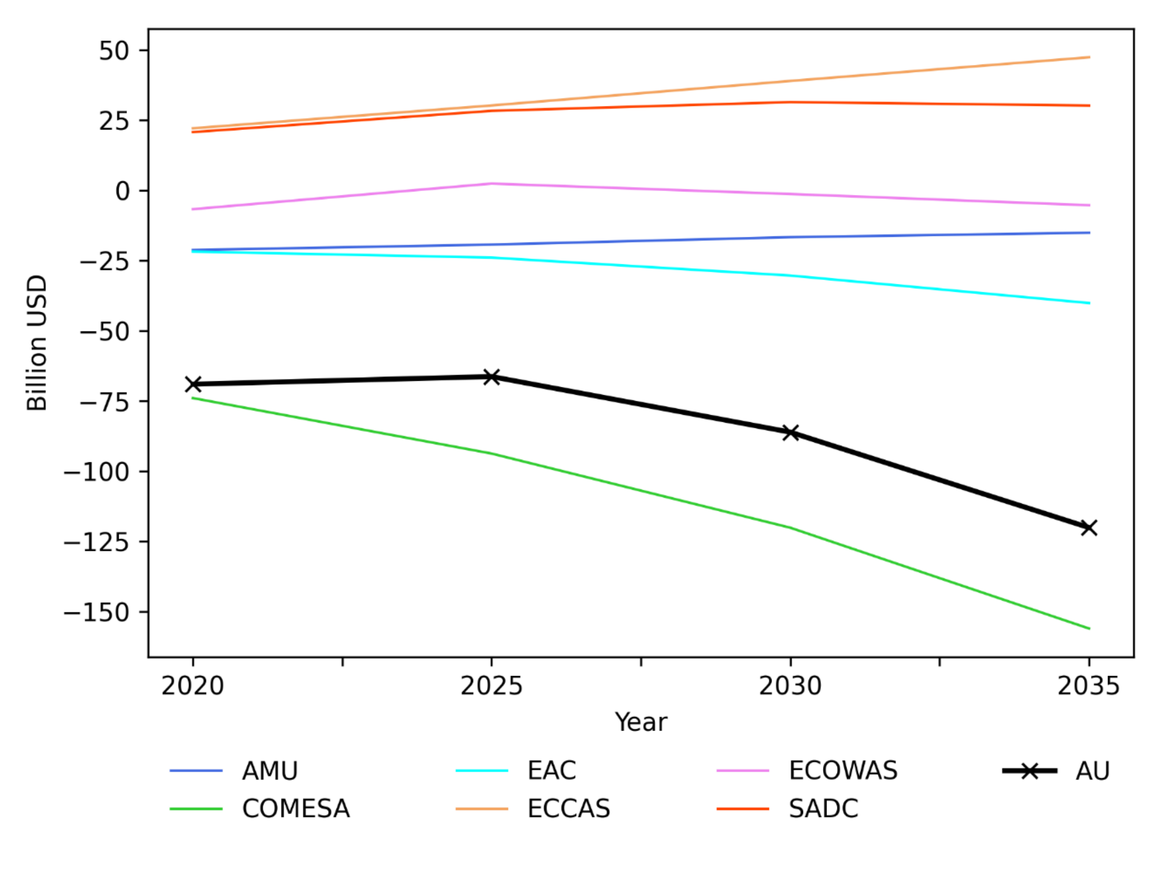

Figure 19. Change in balance of trade in the baseline by REC
Source: Authors' calculation from MAGNET results.

As Figure 17 and Figure 18 reveal, African countries trade much more with non-African countries than with other African countries. However, intra-African trade is bound to increase in both absolute and relative terms on our baseline. Figure 20 depicts the trajectories of intra-African trade shares by RECs for imports and exports, respectively. SADC has the highest share of intra-African trade throughout the baseline (20.4 % of imports and 18.1 % of exports in 2020), and its share increases by 2.4 and 2.8 percentage points for both imports and exports by 2035, respectively. Other RECs have markedly lower initial shares than SADC, but they all are predicted to increase on the baseline. ECCAS and ECOWAS increase their import shares by more than 4 percentage points, whereas ECOWAS and COMESA increase their export shares by 4.3 and 3.8 percentage points, respectively.

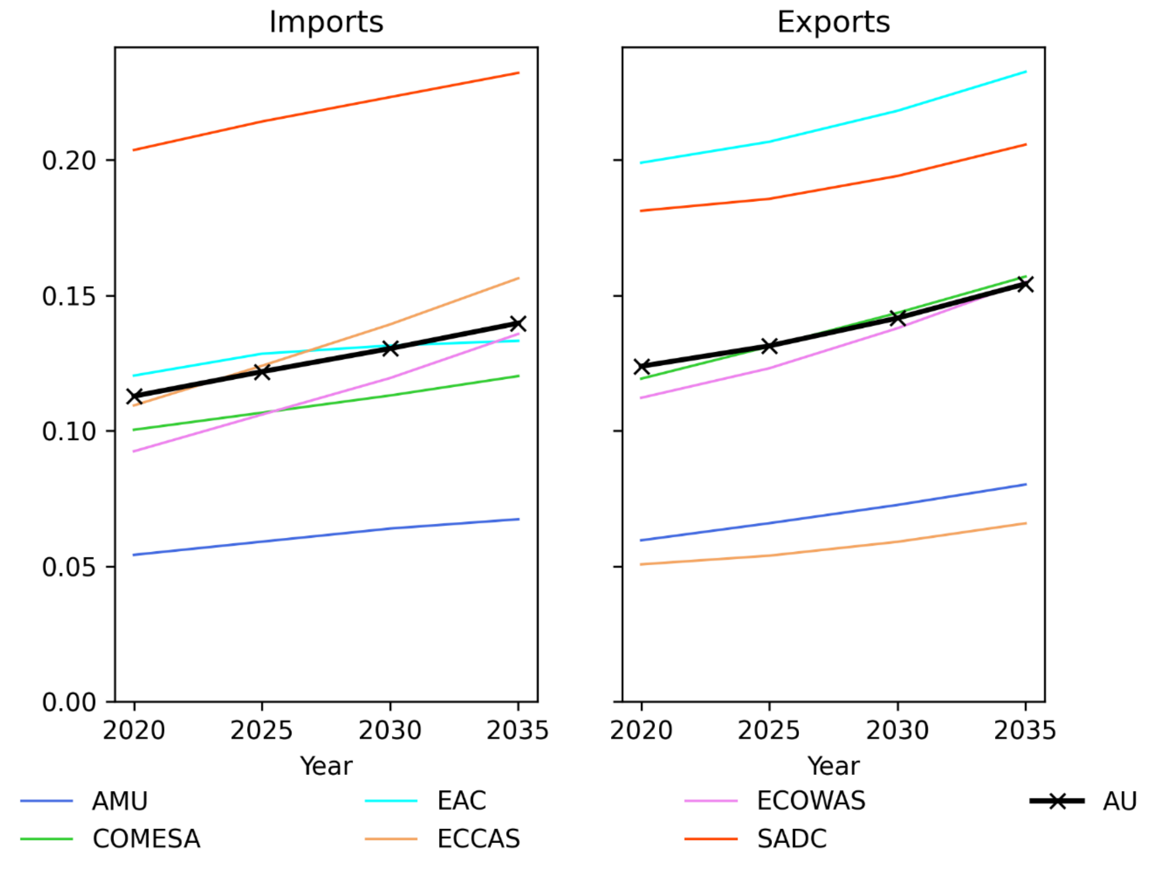

Figure 20. Changes in proportion of intra-African trade volumes baseline by REC
Source: Authors' calculation from MAGNET results.

African trade is characteristically concentrated on a few small sets of exported commodities, which can make it vulnerable to demand disruptions. Trade concentration is traditionally measured using the sectorial export concentration index (ECI) or the Herfindahl–Hirschman index. The ECI is calculated as:

$$ECI_j = \sqrt{\sum_c \left(\frac{x_{cj}}{\sum_c x_{cj}}\right)^2},$$

where x_{cj} is the exports of a commodity c from region j. The ECI ranges between zero and one, and a high value indicates export concentration.

An alternative measure is the export diversification index (EDI), which makes a comparison with the world average. The EDI is calculated as:

$$EDI_j = 0.5 * \sum_i \left| x_{ij} - \sum_i x_{ij} \right|,$$

where x_{ij} is the export volumes from region j to region i. The EDI also ranges between zero and one, and a value of zero would mean that a region's export structure matches the global average exactly.

Figure 21 depicts the development of the ECI and the EDI at REC level on our baseline. The two indices have similar trajectories overall, although they have some differences in detail. In the AU, we see that the ECI is stable, indicating a stable export concentration. However, the EDI results show that on average the AU becomes closer to global trade concentration levels, which means that on the baseline the global export concentration decreases. ECCAS and ECOWAS have the most-concentrated export structures on the baseline, whereas EAC, COMESA and AMU have the least-concentrated structures. When compared with global concentration, the EDI, SADC, COMESA are the closest, whereas ECCAS and ECOWAS deviate the most.

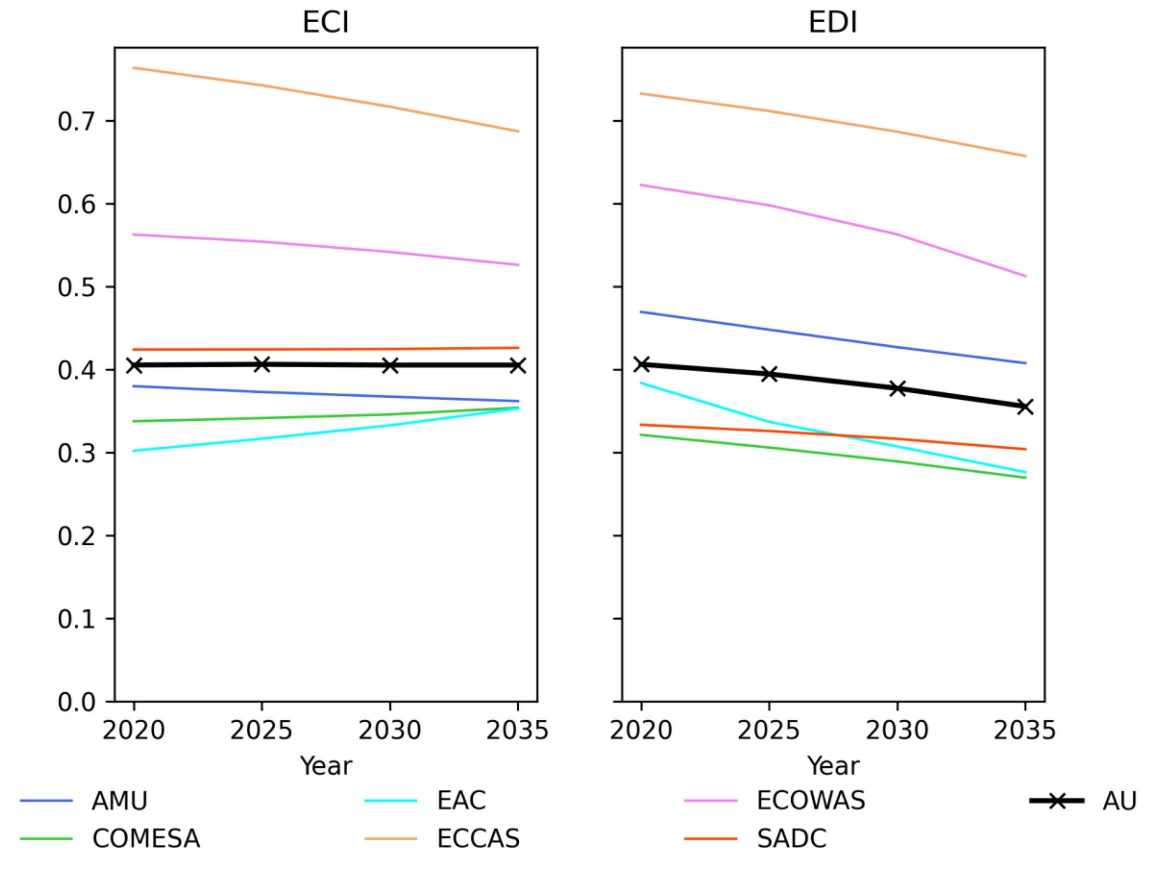

Figure 21. Change in ECI and EDI baseline
Source: Authors' calculation from MAGNET results.

5.3. Agriculture and food production on the baseline

5.3.1. Output of agricultural and food commodities

This subsection summarises the key aspects of agricultural and food production for selected commodities and their distribution within Africa. Figure 22 depicts the commodities that constitute the highest shares of the output, split by plant and animal products. Figure 23 and Figure 24 depict the regional shares of African output for the main crop and animal products ([27]). Nigeria is the most populous country in Africa, and it is also a major producer of several agricultural commodities.

([27]) Plant products include only primary agricultural products, whereas the animal products include processed food products such as meats and dairy products.

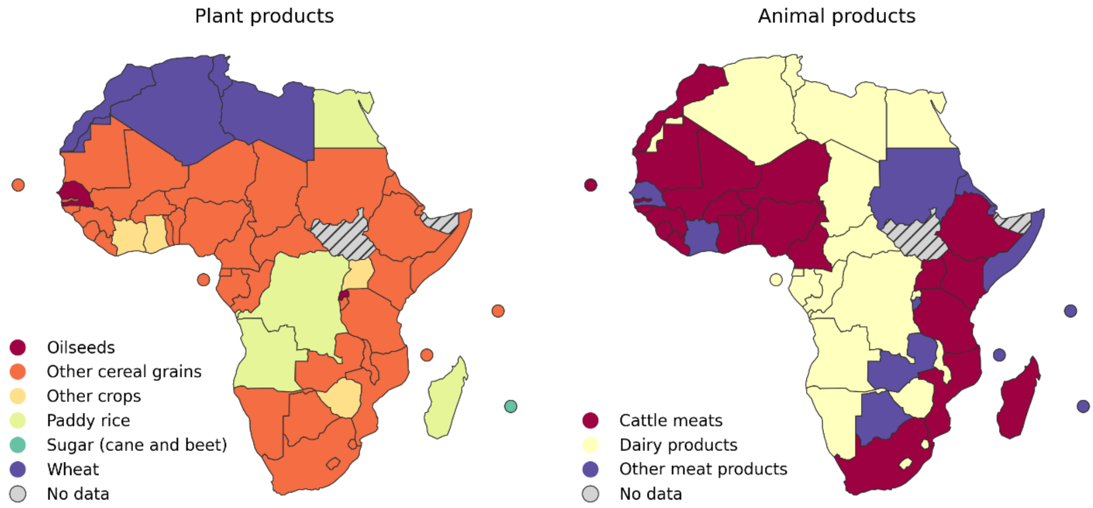

Figure 22. Agricultural products with the highest share in production value by region (2020) ([28])
Source: Authors' calculation from MAGNET results.

5.3.1.1. Paddy rice

Rice is the most important staple crop in many regions of Africa. In 2020, the value of African paddy rice production was USD 42.6 billion. The largest producer, Nigeria, produced 58.9 % of the total, and Egypt, the second highest producer, produced 18.4 %. The output of paddy rice increases to USD 49.1 billion by 2035, a 15.5 % increase. Nigeria's production increases in absolute values and it maintains its status as the largest producer in the continent, although its share decreases to 53.0 %. Africa's production is 12.7 % of the global production in 2020, and on the baseline that increases to 14.6 % by 2035.

5.3.1.2. Wheat

The value of African wheat production in 2020 was USD 17.3 billion. Egypt and Morocco were the biggest wheat producers in 2020, producing 41.0 % and 32.3 % of Africa's output, respectively. The output of wheat decreases on the baseline to USD 16.5 billion by 2035, a 4.6 % reduction. The Egyptian share decreases to 34.2 %, whereas Morocco increases its share to 33.7 %. Africa's production is 6.9 % of the world total, and that share increases to 7.3 % by 2035.

5.3.1.3. Oilseeds

African oilseed production is higher than rice production, with a value of USD 45.6 billion in 2020. Nigeria is the largest producer, with the share of 54.4 %, and other important producers are Kenya (10.6 %) and Egypt (8.5 %). The output will increase to USD 48.3 billion by 2035, a 5.9 % increase. Nigeria will remain the main producer in 2035, with a 53.0 % share. Africa's production was 12.9 % of the global production in 2020, and on the baseline that increases to 17.3 % by 2035.

5.3.1.4. Sugarcane

The value of the African sugarcane production was USD 12.0 billion in 2020. The biggest producers are Egypt (26.5 %), Nigeria (15.8 %) and Kenya (10.6 %). The output increases to USD 15.1 billion, a 26.1 % increase. Of the three biggest producers, Egypt and Nigeria decrease their share (to 23.3 % and 13.2 %, respectively),

([28]) Plant production does not include horticulture.

whereas Kenya's share increases slightly to 11.3 %. The value of Africa's sugarcane production was 7.5 % of the world sugarcane and sugar beet production in 2020 and it will increase on our baseline to 9.4 % by 2035.

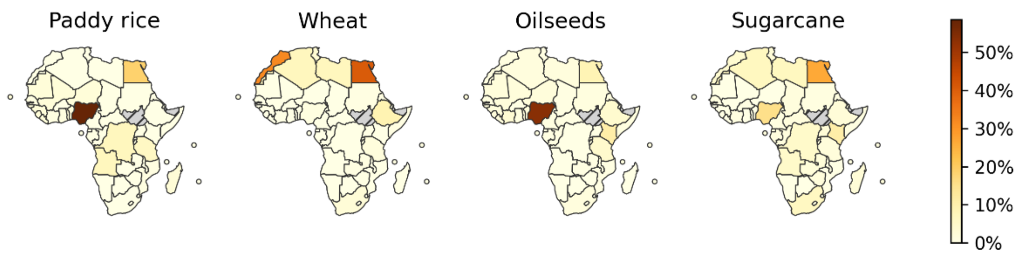

Figure 23. Regional proportions of output values for the main crop categories by region (2020)
Source: Authors' calculation from MAGNET results.

5.3.1.5. Ruminant meats

The MAGNET commodity of ruminant meats is the highest-value animal product category in Africa, with a value of USD 76.3 billion in 2020. The production is highly concentrated as Nigeria produces 62.3 % of the total. South Africa, as the second biggest producer, has a share of 7.0 %, and no other region has a share that exceeds 5 %. The value is predicted to increases to USD 98.8 billion by 2035, a 29.5 % growth. On the baseline, the shares become more evenly distributed, and Nigeria's share falls to 60.0 % in 2035, and South Africa's to 6.2 %. In 2020, the value of African production was 12.1 % of the world production and that share increases to 14.5 % by 2035 on our baseline.

5.3.1.6. Other meats

Non-ruminant meats (e.g. poultry and pork) had an output value of USD 24.6 billion in 2020. The production is more evenly spread among the countries, Nigeria again being the biggest producer with a 29.3 % share. South Africa produces 15.4 % of the total and the Rest of Eastern Africa produces 7.2 %. The total will increase to USD 33.5 billion by 2035, a 35.8 % increase, which reflects the fact that poultry production is growing in many parts of Africa. Africa's share of the world total was 3.3 % in 2020 and it increases to 4.2 % by 2035.

5.3.1.7. Dairy products

The second most valuable animal product category is dairy products, and their value in Africa was USD 34.6 billion in 2020. The biggest producers are in North Africa, with Egypt having 28.2 % of the total and the Rest of North Africa having 11.9 %. South Africa has 12.8 % and South-Central Africa has 11.7 % of the total. The value will increase to USD 44.8 billion by 2035, a 29.2 % increase. Africa's production was 4.2 % of the world total in 2020 and this will increase to 5.1 % on our baseline.

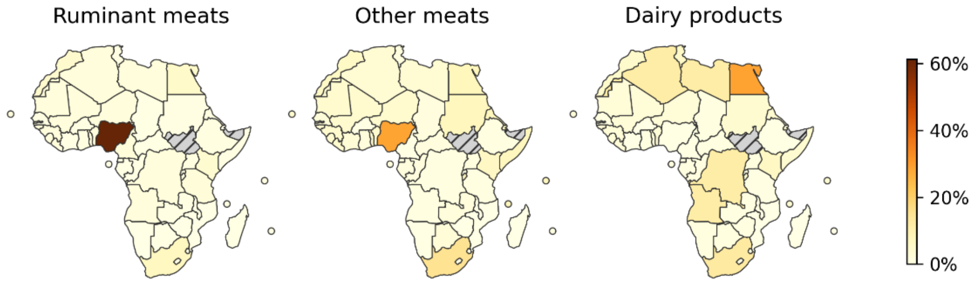

Figure 24. Regional proportions of total output values for the main animal product categories by region (2020)
Source: Authors' calculation from MAGNET results.

5.3.2. Trade in agricultural and food products

Trade in agricultural and food products happens mostly between African and non-African countries. Figure 25 and Figure 26 depict the import and export volumes for primary agricultural products for RECs. COMESA and AMU import agricultural products outside of Africa, and ECOWAS is strongly increasing its share along the baseline. On the export side, ECOWAS stands out in the exports to non-African countries, partly owing to cash crop production. In general, the shares of intra-African trade are higher for imports of agricultural products than for exports reflecting the leading role of cash-crop exports (Figure 27). EAC and SADC already import a large share of their primary agricultural products from other African countries.

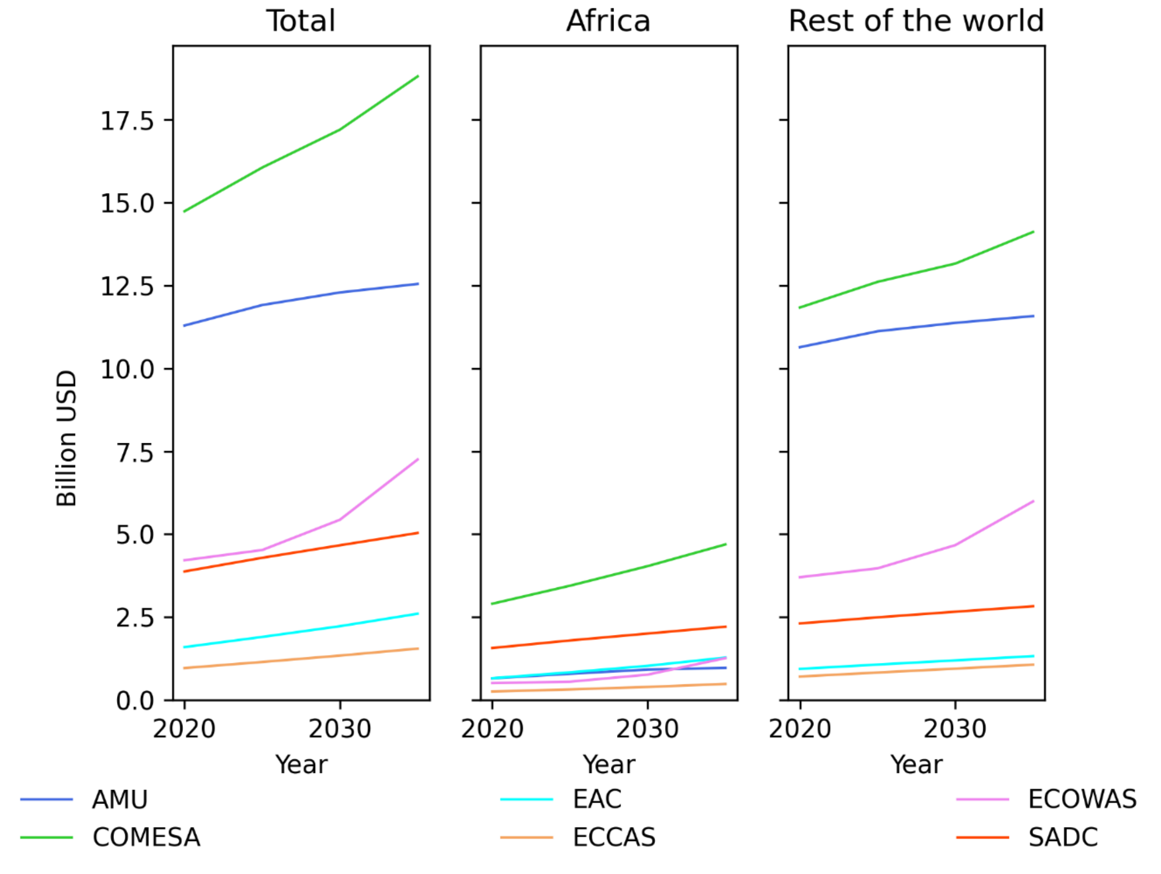

Figure 25. The volume of agricultural product imports baseline (total, to Africa, and to the rest of the world)
Source: Authors' calculation from MAGNET results.

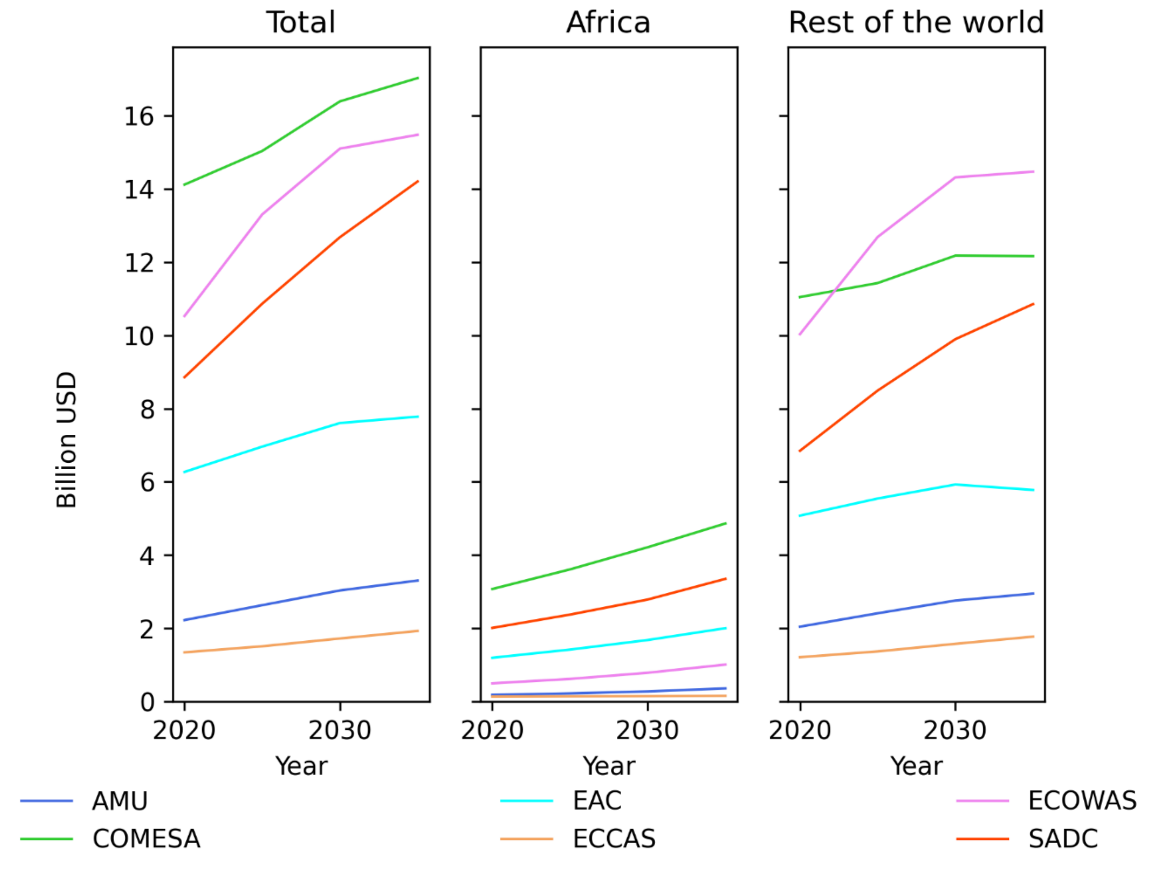

Figure 26. The volume of agricultural product exports baseline (total, to Africa, and to the rest of the world)
Source: Authors' calculation from MAGNET results.

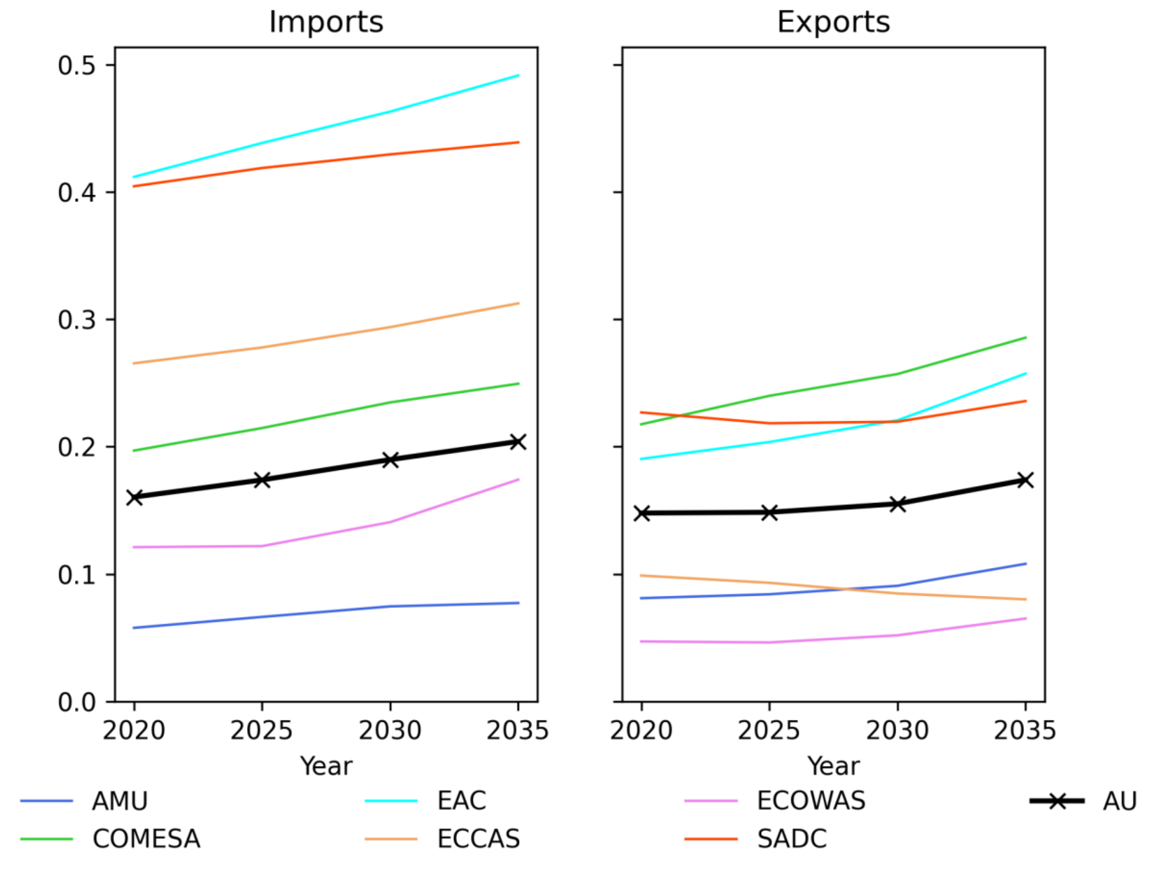

Figure 27. Proportions of intra-African agricultural product trade volumes baseline by REC
Source: Authors' calculation from MAGNET results.

Processed foods are traded more among African countries than the primary agricultural products are, as we can see in Figure 28 and Figure 29. ECOWAS is the main importer of processed foods. ECOWAS and COMESA are the main exporters of processed food products. For exported food products, the intra-African market is important. SADC and EAC export more than half of their processed food exports to other African countries (Figure 30).

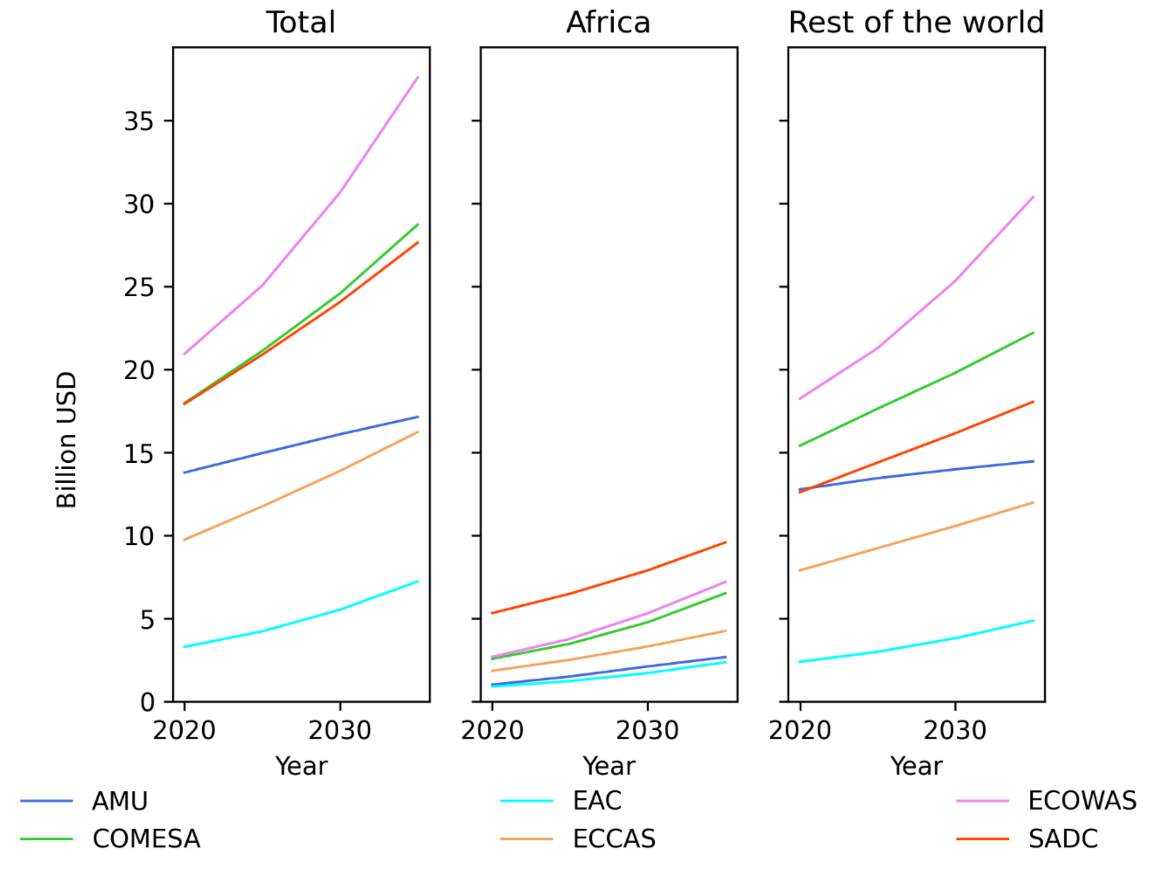

Figure 28. The volume of processed food product imports baseline (total, to Africa, and to the rest of the world)
Source: Authors' calculation from MAGNET results.

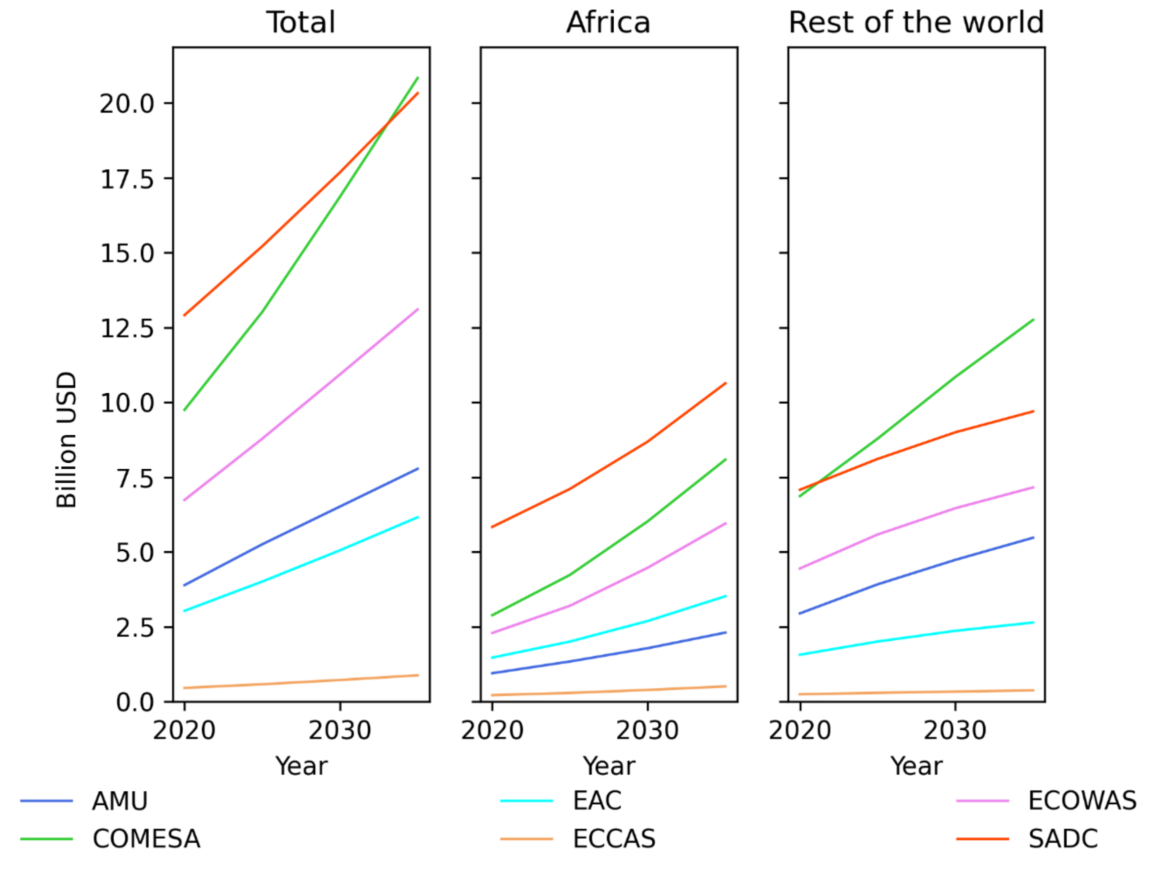

Figure 29. The volume of processed food product exports baseline (total, to Africa, and to the rest of the world)
Source: Authors' calculation from MAGNET results.

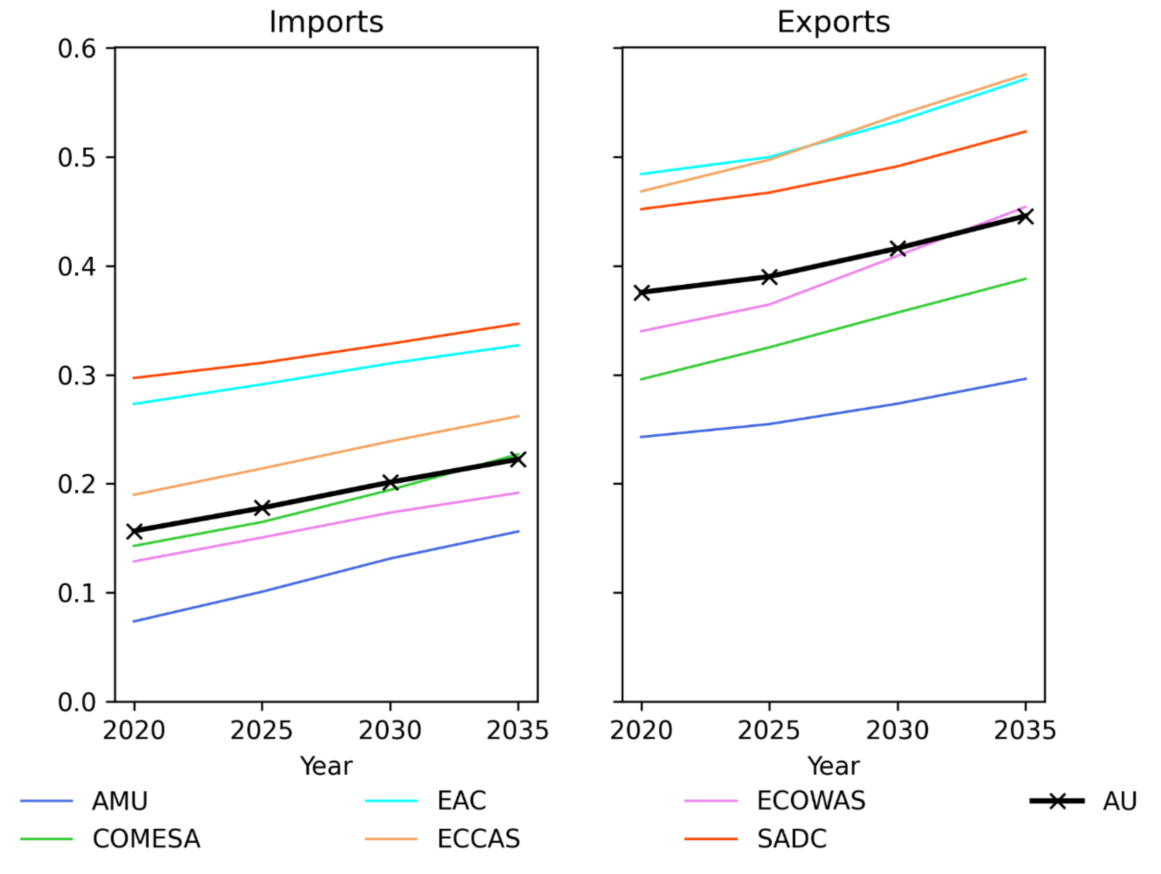

Figure 30. Proportions of intra-African processed food trade volumes baseline by REC
Source: Authors' calculation from MAGNET results.

5.3.3. Food security indicators

African countries are on a positive trajectory as regards their food security on the baseline. Overall food security is a factor that strongly correlates with disposable income of the population. Figure 31 and Figure 32 show the development of disposable incomes on the baseline in per capita levels and as indexed to the year 2020, respectively. ECOWAS has the most modest increase, and the remaining regions have a moderate but sustained disposable income growth on the baseline.

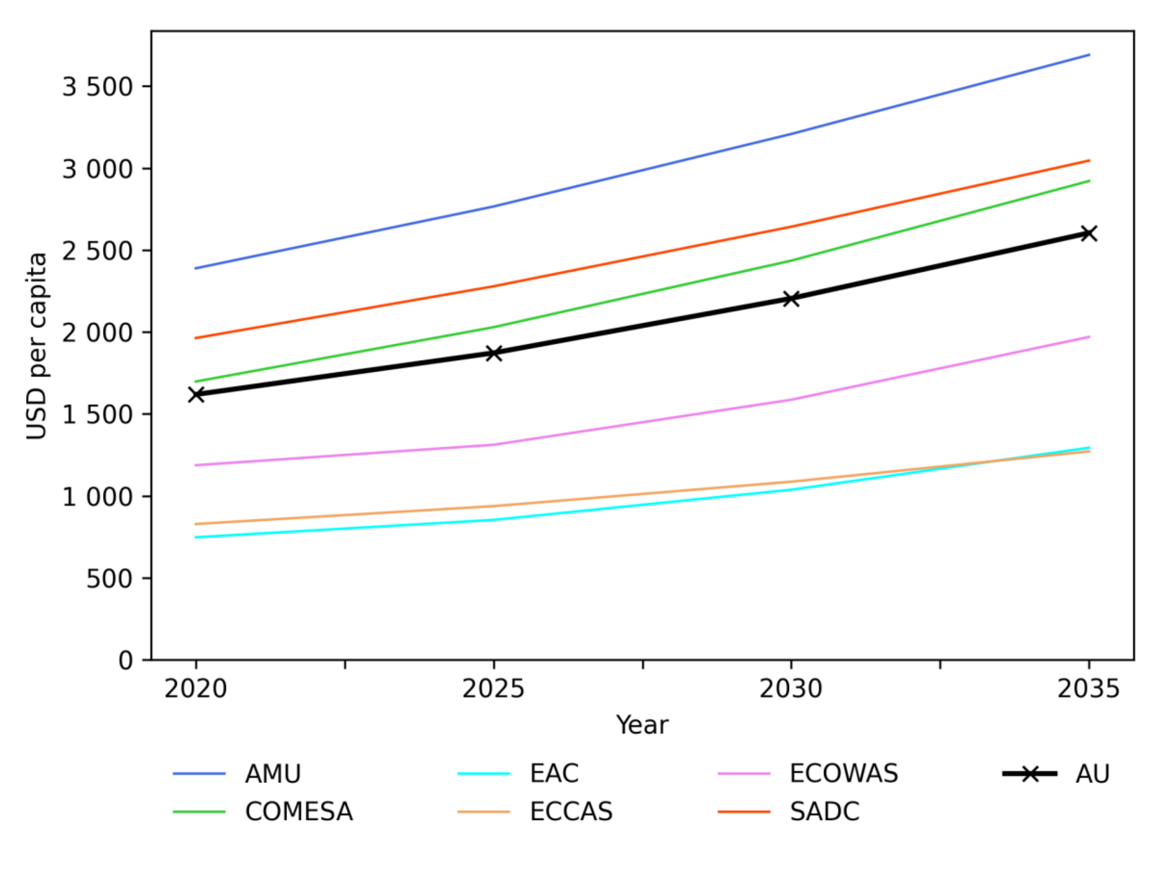

Figure 31. Disposable income per capita baseline (USD)
Source: Authors' calculation from MAGNET results.

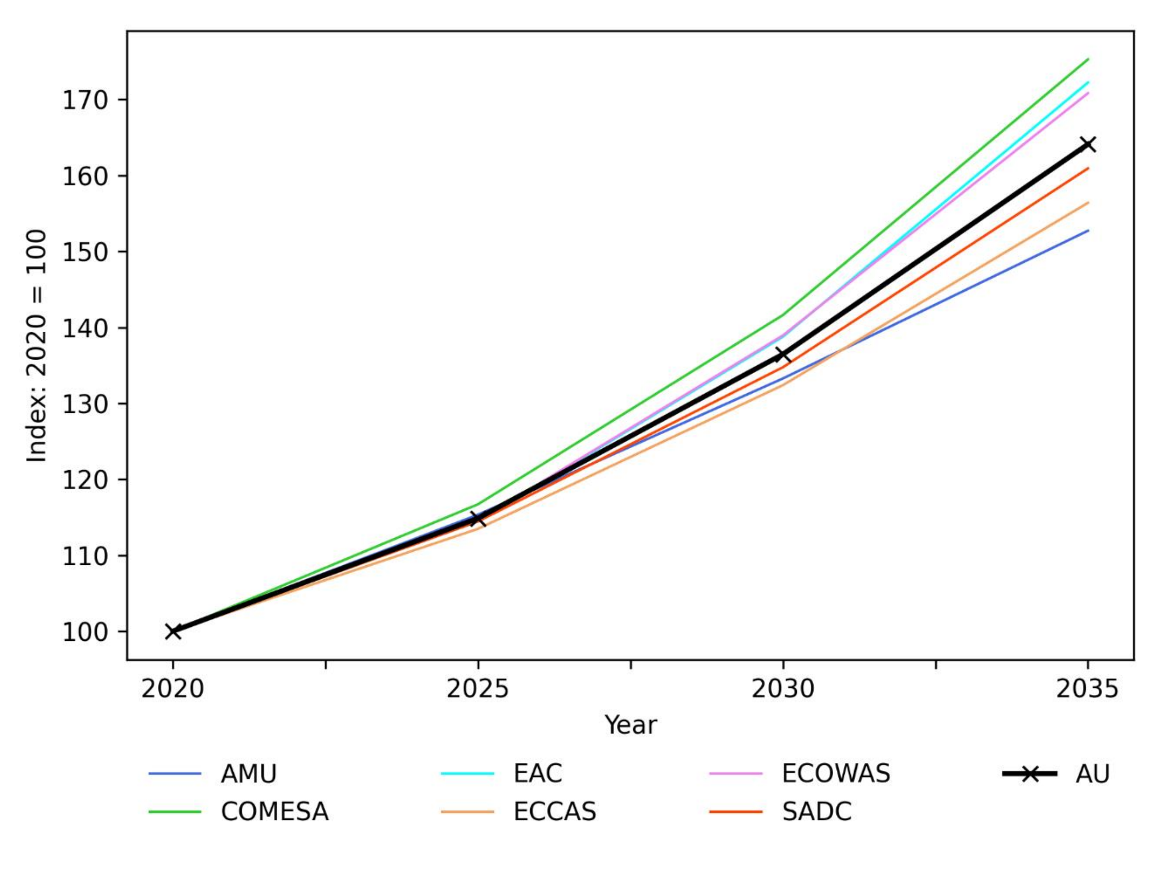

Figure 32. Disposable income per capita baseline (index: 2020 = 100)
Source: Authors' calculation from MAGNET results.

Figure 33 shows the trajectories of food consumption per capita, which are all increasing. The regions that start from a lower disposable income level have faster growth in food consumption, which is an expected result owing to Engel's law. An exception is ECCAS that has the slowest overall growth.

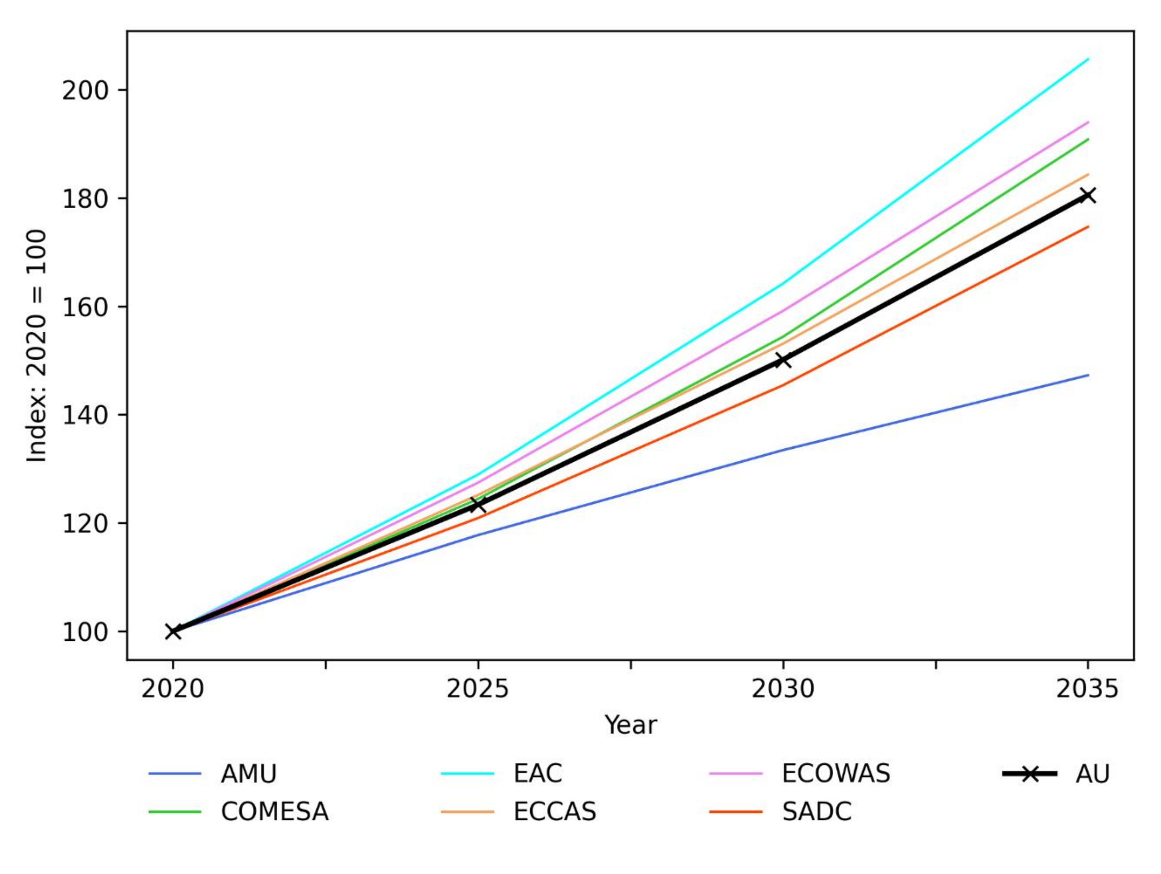

Figure 33. Food consumption per capita baseline (index: 2020 = 100)
Source: Authors' calculation from MAGNET results.

Figure 34 depicts the changes in food prices on the baseline. Initially the food prices decrease uniformly, but start to plateau or increase after 2025. In overall, the AU level food prices are 5.1 % lower in 2035 than in 2020. There are regional differences, and the highest increase happens in EAC, where the prices are 12.5 % higher in 2035. Higher food prices can be a food security risk if increases in incomes do not compensate the price increases. Figure 35 depicts the ratio of real wages as measured for unskilled agricultural workers with respect to cereal prices. There is an overall improvement (3.7 % at the AU level by 2035), but considerable amount of regional variation. For instance, in EAC and ECOWAS there are decreases (14.8 % and 11.2 %, respectively) that indicates a considerable food security deterioration for low-income groups in the absence of adequate income transfers.

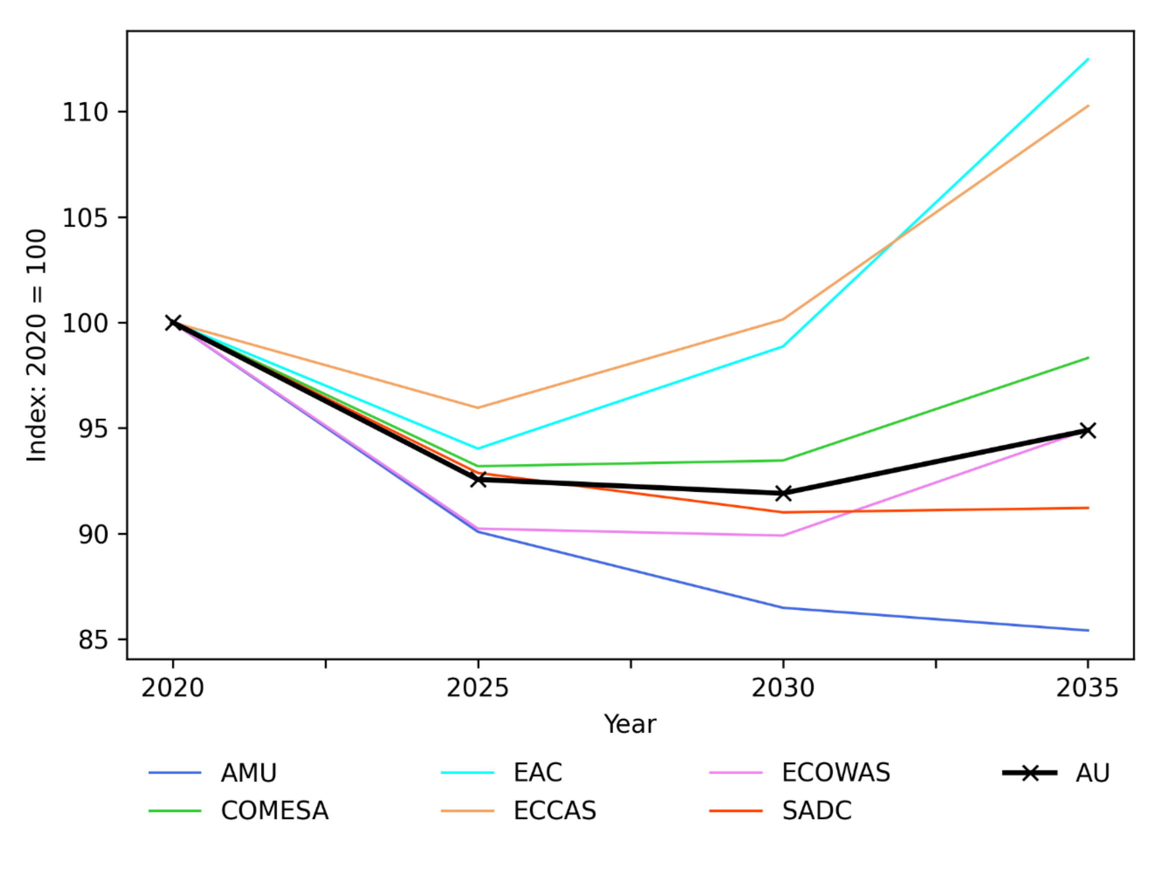

Figure 34. Food prices baseline (index: 2020 = 100)
Source: Authors' calculation from MAGNET results.

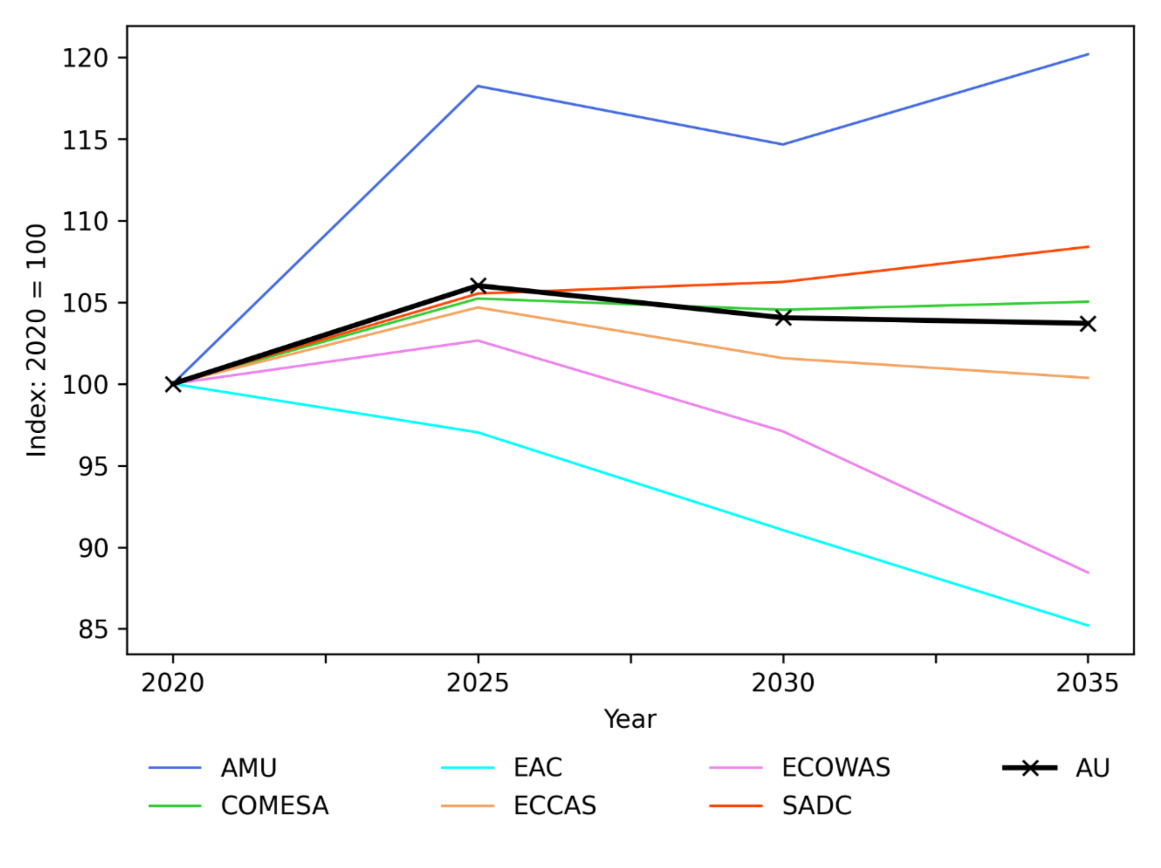

Figure 35. Real wages to cereal prices ratio baseline (index: 2020 = 100)
Source: Authors' calculation from MAGNET results.

5.4. Tariff revenues and public sector balances

Tariff cuts have a clear economic rationale in spurring economic activity and shifting economies towards a more efficient resource allocation. A common argument against tariff cuts is the cost in the form of lost tariff revenue. In Africa, tariff revenue is typically a significant share of public sector revenue. Figure 36 depicts the development of tariff revenues in billion USD at REC level on the baseline. Their overall trend is increasing. However, there is a lot of variation in tariffs' significance to the countries. Figure 37 depicts the share of tariff revenue of the public expenditures. Tariff revenues remain an important part of public finances for African countries, but their importance is decreasing on our baseline. In ECOWAS, almost 23 % of public sector expenditure was financed by tariff revenues in 2020, and the share decreases to 14 % in 2035. Tariff revenues are less important in other RECs. Tariff revenues' share of the GDP was between 2.1 % and 3.0 % in 2020 and this will decrease to 1.7–2.5 %. Thus, although tariff revenues increase in real terms, their importance is decreasing in both the public sector and the whole economy in all the RECs on our baseline.

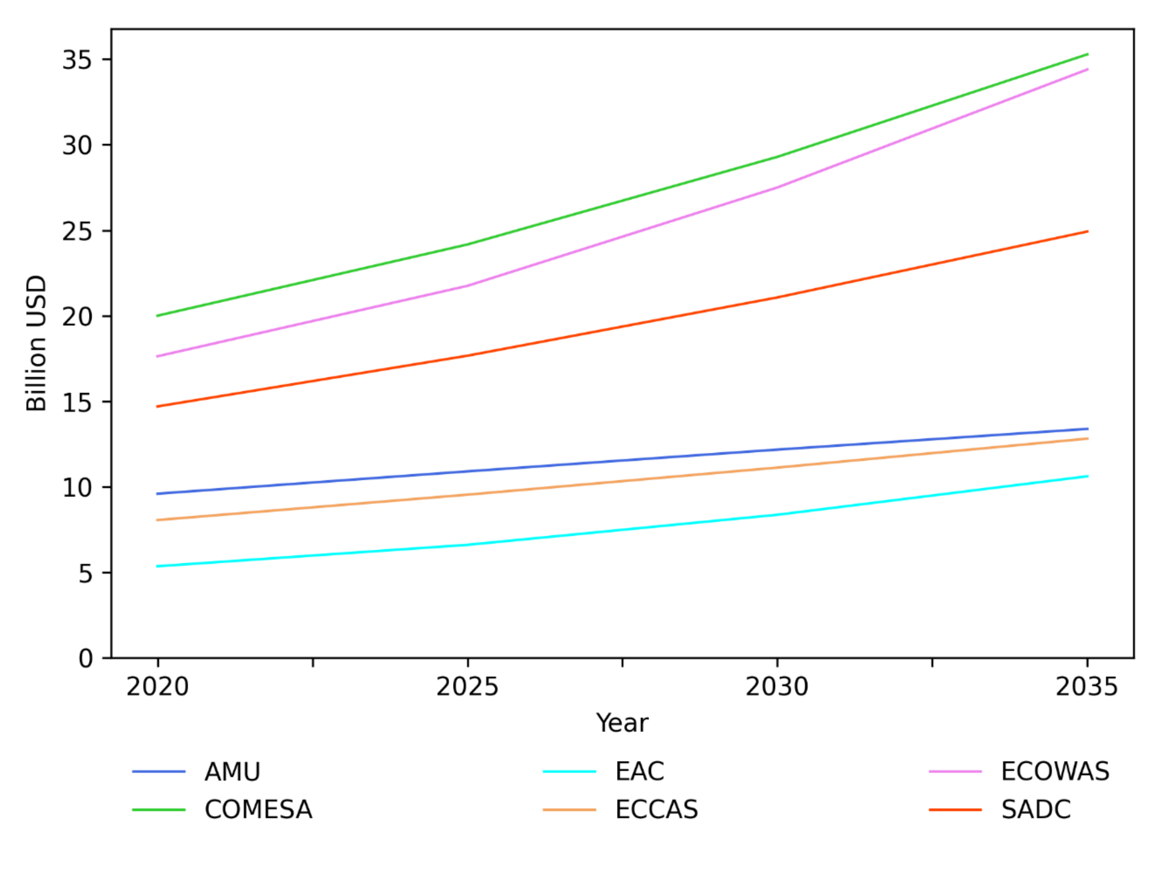

Figure 36. Tariff revenues baseline by REC
Source: Authors' calculation from MAGNET results.

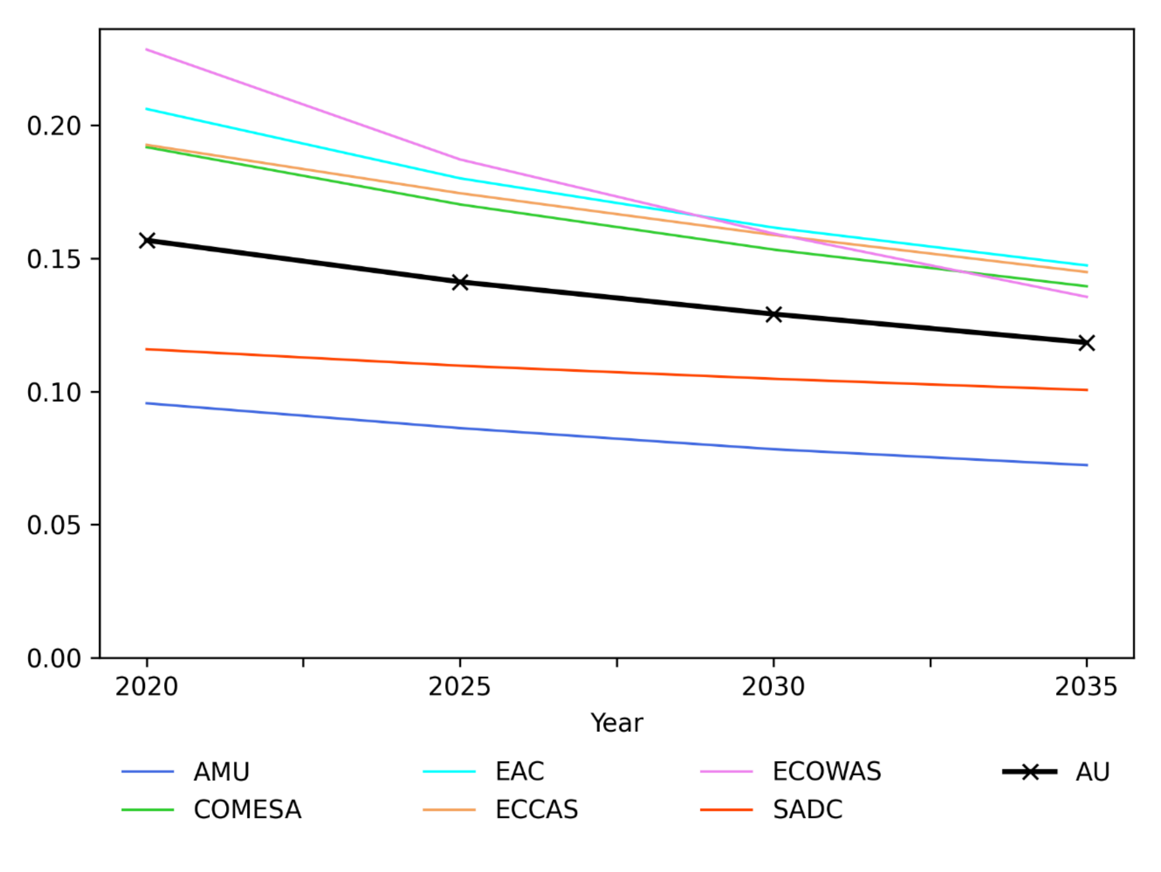

Figure 37. Tariff revenues as a proportion of the tax revenues baseline by REC
Source: Authors' calculation from MAGNET results.

5.5. Environmental indicators

Agricultural land and water uses are the main environmental indicators in our study. Expansion of the agricultural land is a threat to ecosystems and reduces forests' potential for carbon sequestration. Irrigation of agricultural lands is a major consumer of scarce water resources contributing to droughts and lack of safe drinking water. It is not unexpected that a rapid economic growth on the baseline has some negative effects for the overall land and water use and other indicators of environmental sustainability. Figure 38 presents the development of land use on the baseline. The agricultural land use increases from 11.5 billion hectares in 2020 to 13.3 billion hectares in 2035 (an increase of 15.3 %). The growth is fastest in EAC and ECCAS, 23.2 % and 22.6 %, respectively, while in AMU the growth is mere 2.1 %. Figure 39 depicts the changes in the agricultural water use on the baseline, and it shows that use of irrigation expands more than land use in the AU level, a 38.0% increase. The growth is especially strong in ECOWAS, a large cash crop producer that increases the water use by 85.6% by 2035.

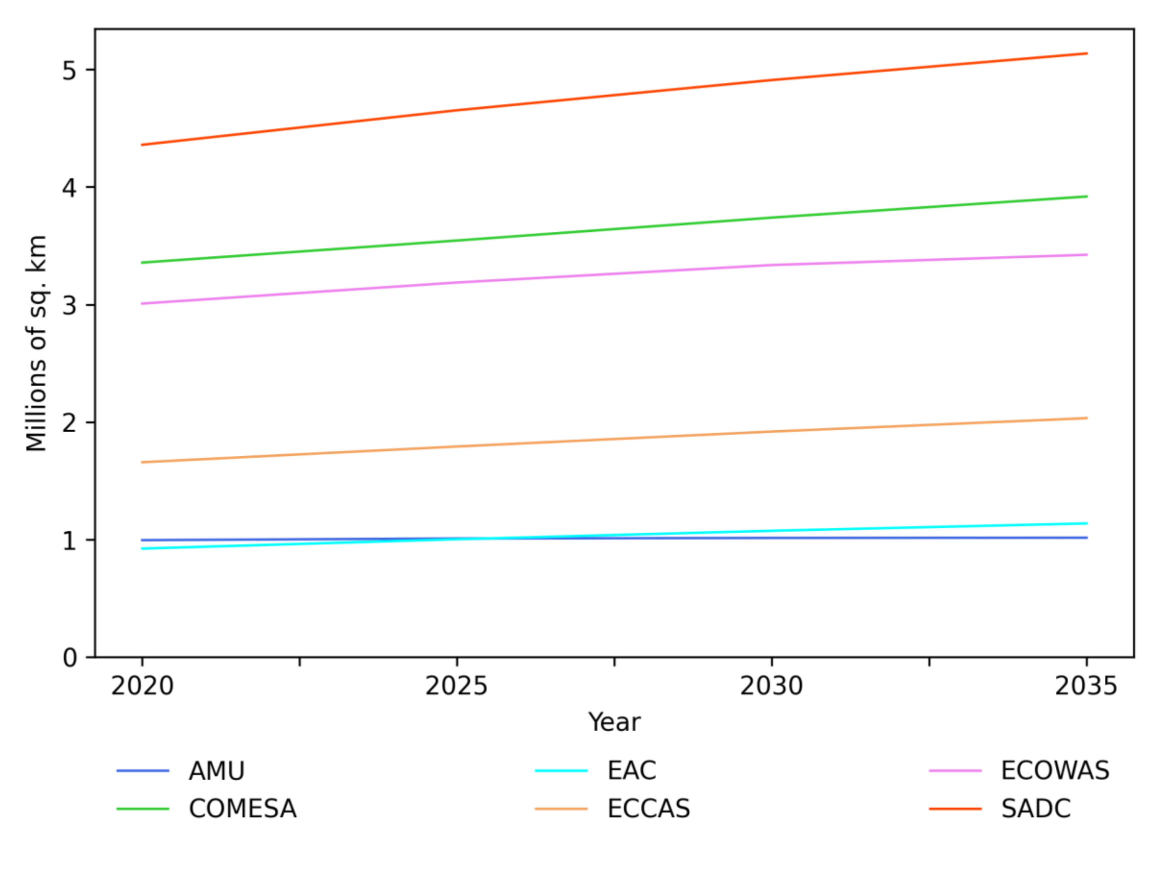

Figure 38. Changes in agricultural land use baseline by REC
Source: Authors' calculation from MAGNET results.

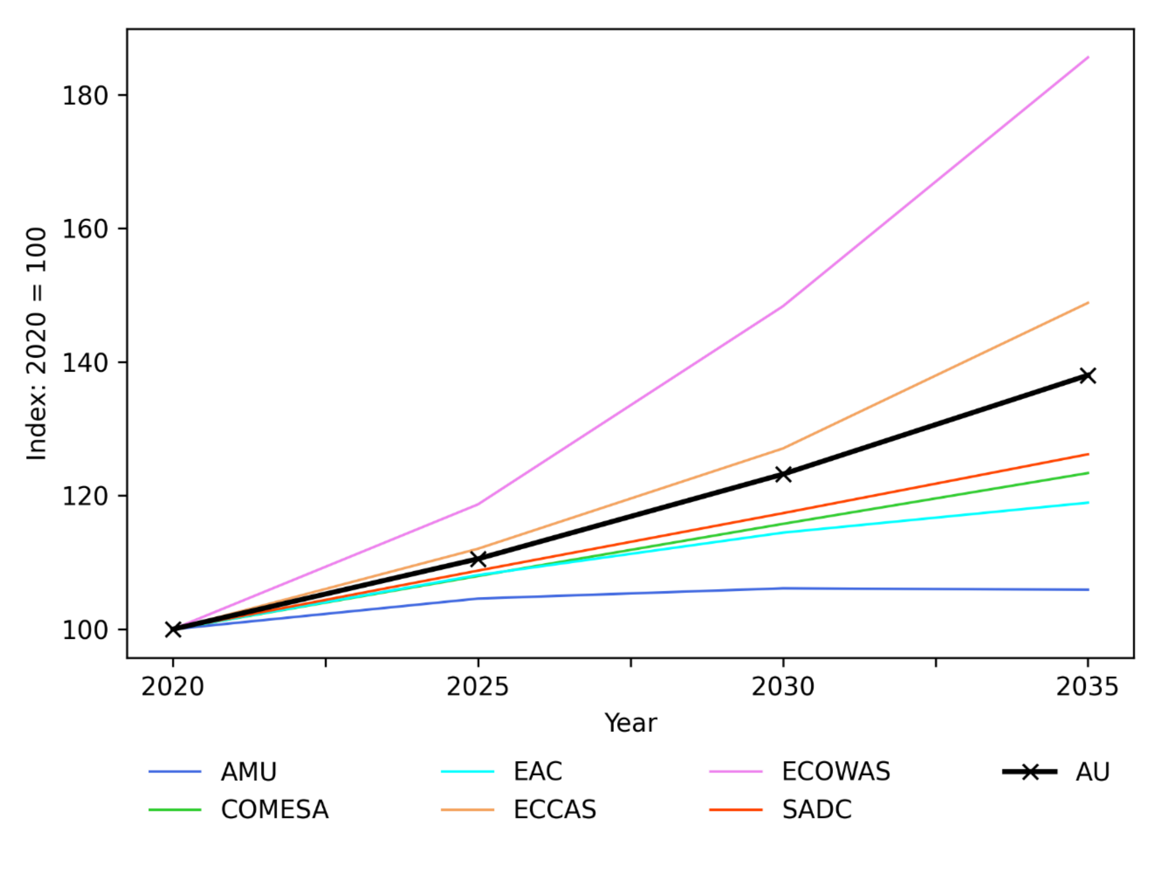

Figure 39. Changes in agricultural water use baseline by REC
Source: Authors' calculation from MAGNET results.

6. Results from policy simulations

In this section, we summarise the effects of the AfCFTA on various economic outcomes based on our MAGNET simulations. We compare the baseline described in the previous section to a set of policy scenarios. The policy scenarios have two main dimensions as we portray the effects of (1) tariff cuts alone and (2) tariff cuts combined with NTM reductions. The results are available at a more detailed level at the JRC's Data-Modelling platform (see Annex 4 for details).

We consider a few alternative scenarios of tariff cuts, which countries can implement within the limits imposed by the agreement. More specifically, we simulate the four alternative policy scenarios described in Chapter 4. In the scenarios, we assume that all the countries uniformly apply the strategies for their tariff cuts: maximisation of the tariff revenue (Tarrev), liberalisation of agri-food industries (Agrifood), promotion of industrialisation by liberalising trade in intermediate commodities (Interm) and promotion of sectors with revealed comparative advantage (RCA).

The NTM reductions are much more difficult to assess in advance, in both their magnitudes and distributions among NTMs and sectors. Therefore, we apply a more speculative assumption on NTMs: the countries decrease their NTMs on intra-African imports by 50 % and decrease their NTMs on imports and exports between African and non-African countries by 25 %. The reductions happen gradually over the transition period 2020–2035. We also address the heterogeneity of the NTMs by applying various modelling approaches for NTMs that we consider either rent generating or non-rent generating. Effectively, our measure of NTM reductions is a mix of import-augmenting technological change ("iceberg costs") and import tax (AVE) approaches. Both approaches have their strengths and weaknesses, which are related to the variety of the NTMs, their distinct features and the limitations imposed by CGE models themselves. In general, the AVE method is more likely to underestimate the effects, whereas the iceberg method is more likely to inflate them. Our approach is a mixed scenario in which the NTMs are divided into cost generating (modelled as iceberg costs) and rent generating (modelled as AVEs) NTMs ([29]).

This chapter summarises the main results on the various regional details. All the results are presented as percentage deviations from the baseline, and they are valued in real terms unless stated otherwise. Most of the figures present the results as bar graphs at REC level for both tariff cuts and combined tariff cuts and NTM reductions. In addition, a map is presented for the combined effects of tariff cuts and NTM reductions with the highest regional detail that we included in the model.

As the alternative tariff cut scenarios mostly yield results without notable differences, we report the results of the basic tariff maximisation scenario only. For some variables of interest, we also report comparisons of the tariff cut scenarios.

6.1. Key messages

The policy simulations show that AfCFTA is likely to further strengthen the positive economic development that happens in the baseline. The GDP is moderately increased and there is a strong shift towards increased intra-African trade. The reduction in tariff revenues is more than covered by increased tax incomes from other sources, and countries expand their public sectors.

Food security improves owing to better access to food in all the modelled regions. This is a direct result of strengthened intra-African trade, as many countries decrease their own food production and cover the increased food demand by imports. In addition to increased food consumption and disposable incomes, we found that food prices have more varied changes throughout the regions, which could undermine food security for lower-income groups.

In general, liberalised trade helps countries to better exploit their comparative advantages. As a result, African countries can move their resources from food production to other activities. In general, food production becomes more regionally concentrated as countries increase the production of the commodities for which they have a comparative advantage. Our results do not find significant differences in the outcomes of various tariff cut alternatives that countries have. The bulk of the effects are due to the NTM reductions; however, these are still speculative. Future research could benefit from better data on actual changes in NTMs and take

([29]) SPS and technical measures are considered to be non-rent generating, whereas the remaining NTMs are considered to be rent generating. See Chapter 4 for a more detailed description of assumptions behind the NTM estimates. We also ran simulations with both approaches uniformly, which confirmed the differences between the approaches: the AVE approach yielded smaller changes than the iceberg approach, while the mixed approach is typically between them. We consider the mixed approach as our most reliable estimate, and only report the results from those simulations.

a more detailed approach in allocating the NTM reductions between import and export costs, a strategy that has been shown to improve the analysis of NTM reductions (Walmsley and Strutt, 2021).

6.2. Overall economic effects

6.2.1. National output

Figure 40 depicts the cumulative GDP changes as a result of the AfCFTA in 2035. The GDP increases by 0.42 % at the AU level and ranges between 0.33 % and 0.59 % for all the RECs. ECCAS gains the largest GDP increase. The results show that tariff cuts alone have a small effect on GDP. The alternative tariff cut strategies do not produce significant differences in GDP (Figure 41). This is because the tariff cuts themselves have only a small effect on the GDP gains. However, some regional differences are worth mentioning. For instance, AMU is better off when the regions uniformly promote industrialisation.

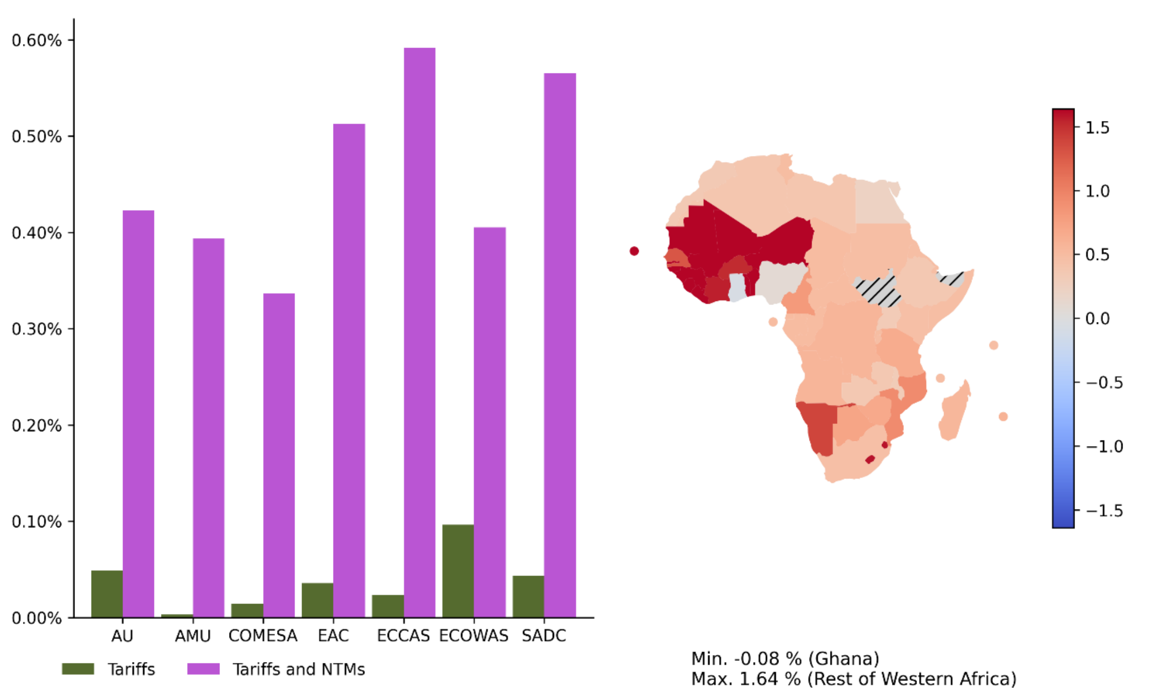

Figure 40. Changes in GDP by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

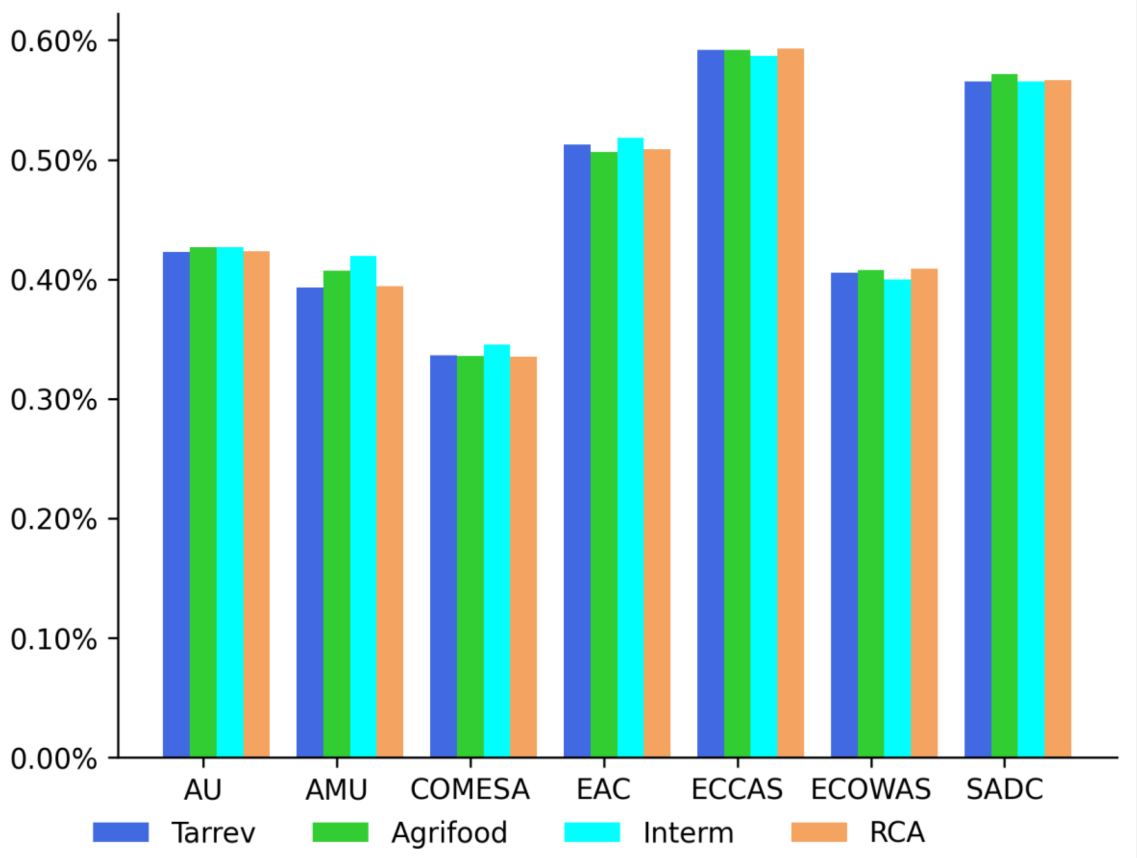

Figure 41. Changes in GDP by tariff reduction scenario and REC (2035, combined tariff and NTM cuts)
Source: Authors' calculation from MAGNET results.

6.2.2. Labour demand

The AfCFTA's effects on labour demand are small, with a negligible increase in the total (Figure 42). The range is between – 0.09 % and 0.14 % at the REC level, with SADC having the largest increase. Figure 43 depicts the changes in unskilled labour demand, which develops very similarly to overall labour. Demand for skilled labour decreases marginally (Figure 44). Overall, the changes in unskilled labour explain a large part of the changes in labour demand. Figure 45 depicts the changes in the share of skilled labour, and we see that there is a negligible shift towards unskilled labour as a result of the AfCFTA, although in ECOWAS the share of skilled labour demand increases. In SADC, the share of unskilled labour increases as a result of strong increase in demand for unskilled labour in some of the member states.

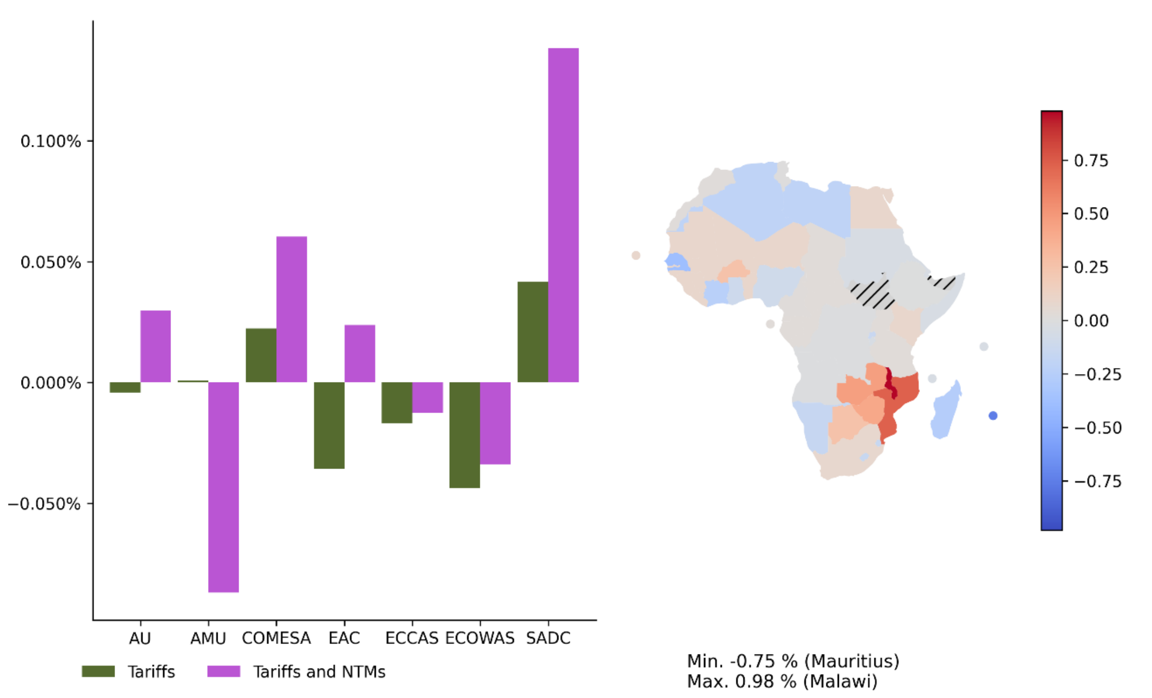

Figure 42. Changes in overall labour demand by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

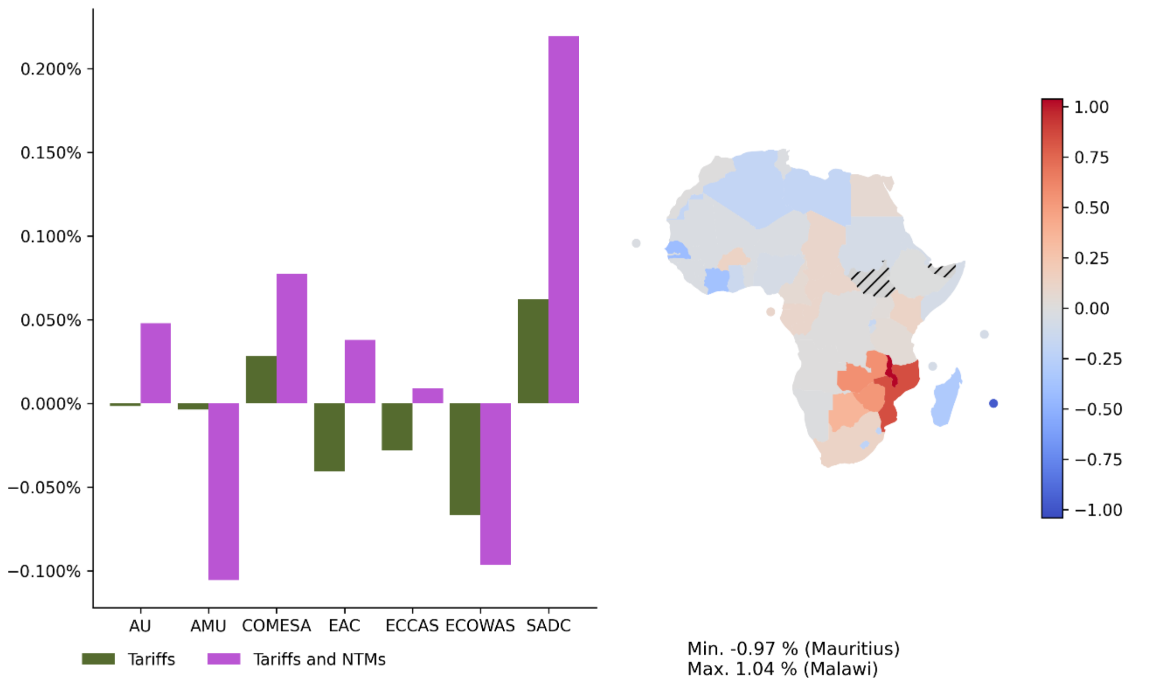

Figure 43. Changes in unskilled labour demand by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

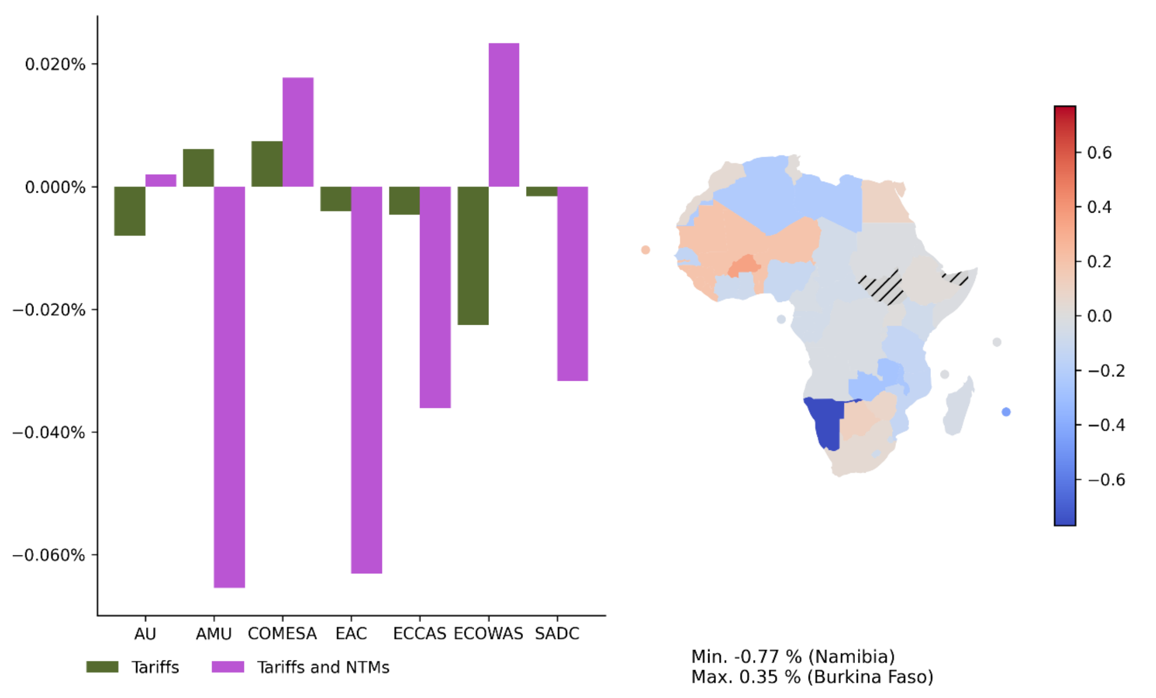

Figure 44. Changes in skilled labour demand by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

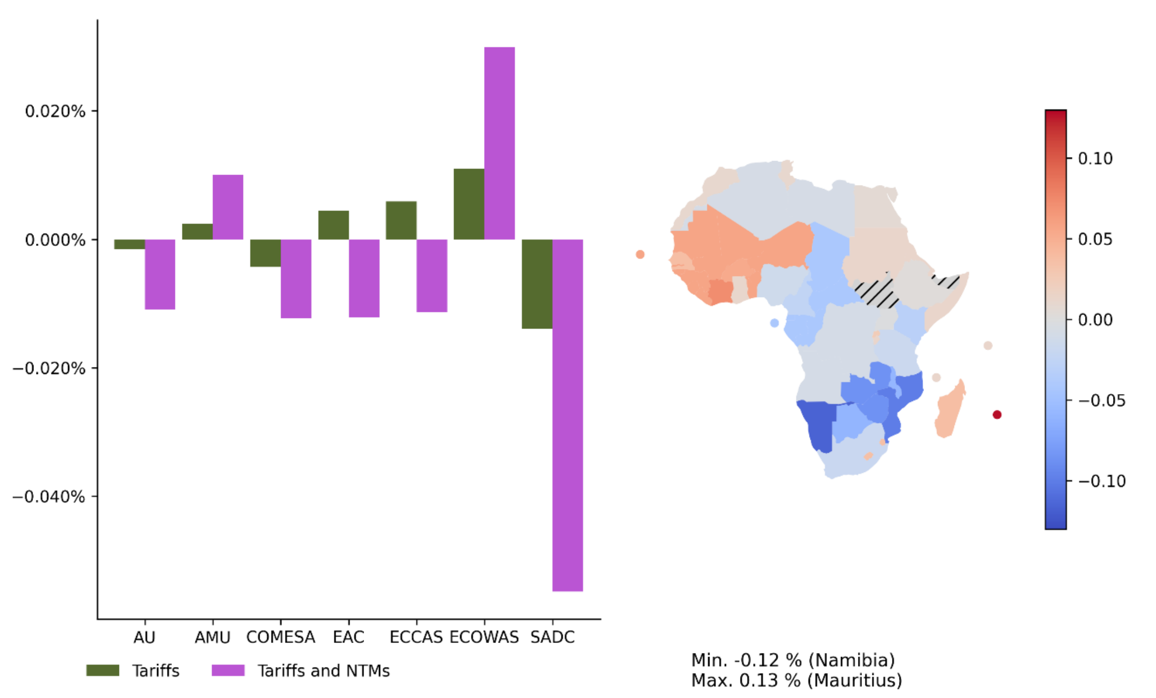

Figure 45. Changes in the proportion of skilled labour demand in percentage points by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.2.3. Trade

Our simulations show that African countries will increase trade as a result of the AfCFTA, and that a significant part of the increase comes from intra-African trade. However, there are some notable regional differences. Imports increase by 3.7 % at the AU level, and by between 2.2 % and 5.4 % at the REC level (Figure 46). At the same time, the intra-African imports (Figure 47) increase by 22 %; the changes between the RECs range between 9.7 % and 51 %. The increase is highest in ECOWAS. On the other hand, SADC, which has thus far been the most important region for intra-African trade, has the most modest increase in its share. The share of intra-African imports increases by 2.5 percentage points at the AU level (Figure 48). The change in intra-African imports is positive in each REC, and ECOWAS and ECCAS in particular increase their intra-African import shares.

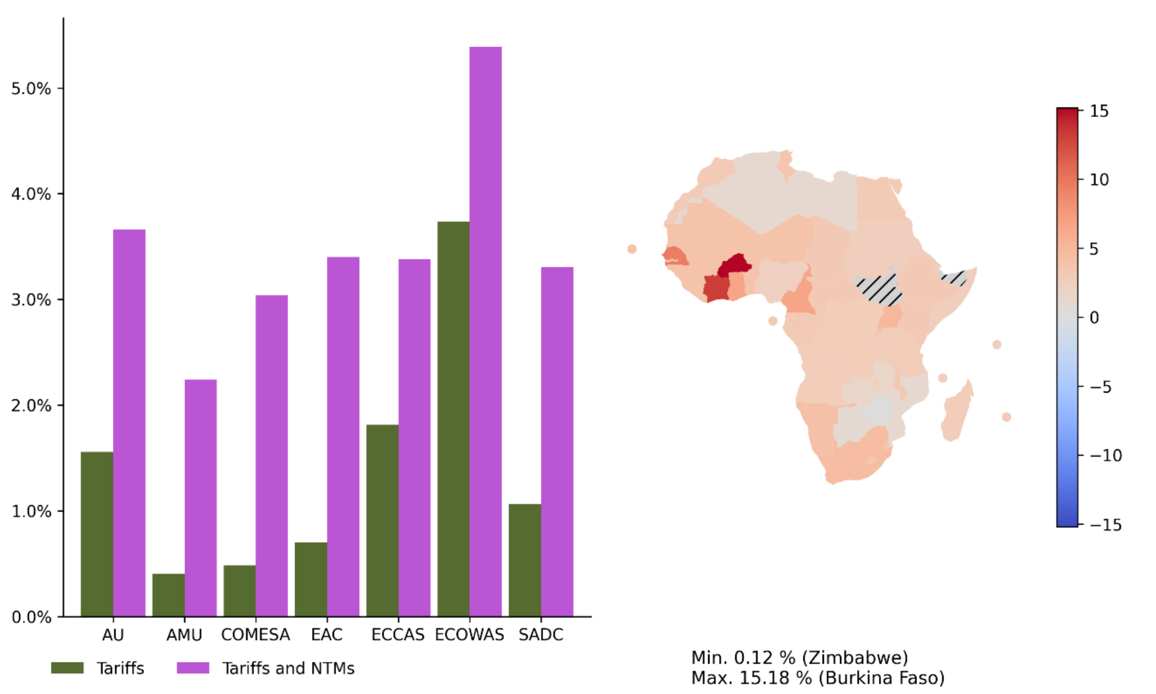

Figure 46. Changes in total imports by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

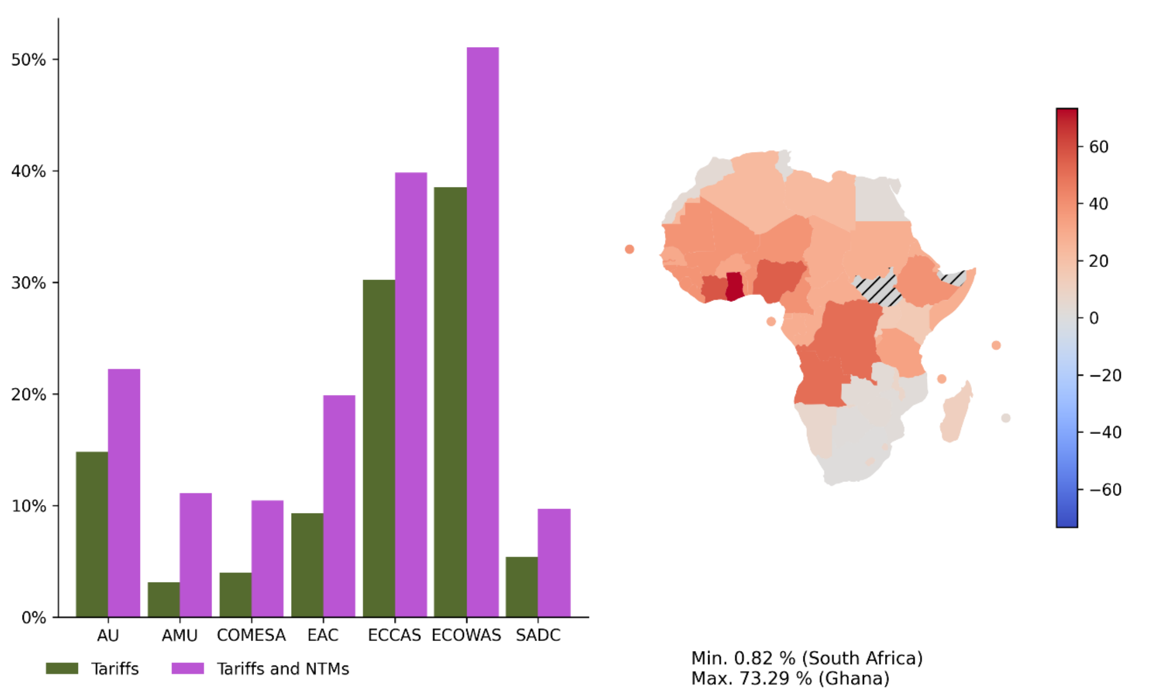

Figure 47. Changes in intra-African imports by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

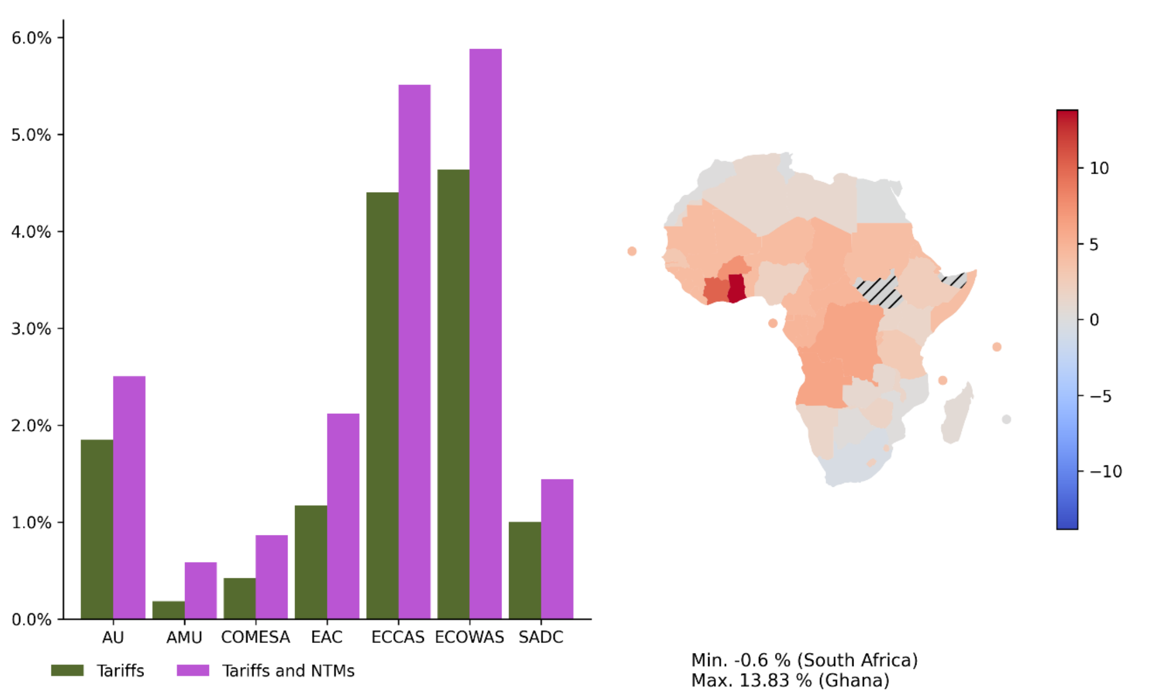

Figure 48. Changes in the proportion of intra-African imports in percentage points by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

Our simulations also show that the AfCFTA increases African exports in general. Exports increase by 2.3 % in total and between 1.5 % and 3.2 % at REC level (Figure 49). Again, the increase is predominantly in exports to other African countries (Figure 50), as intra-African exports increase by 22 % in total and by between 11 % and 41 % at the REC level. Intra-African export shares increase in all the RECs, and most notably in ECOWAS (Figure 51). The total increase is 3.0 percentage points, and the increase ranges between 0.63 % and 5.7 % at the REC level.

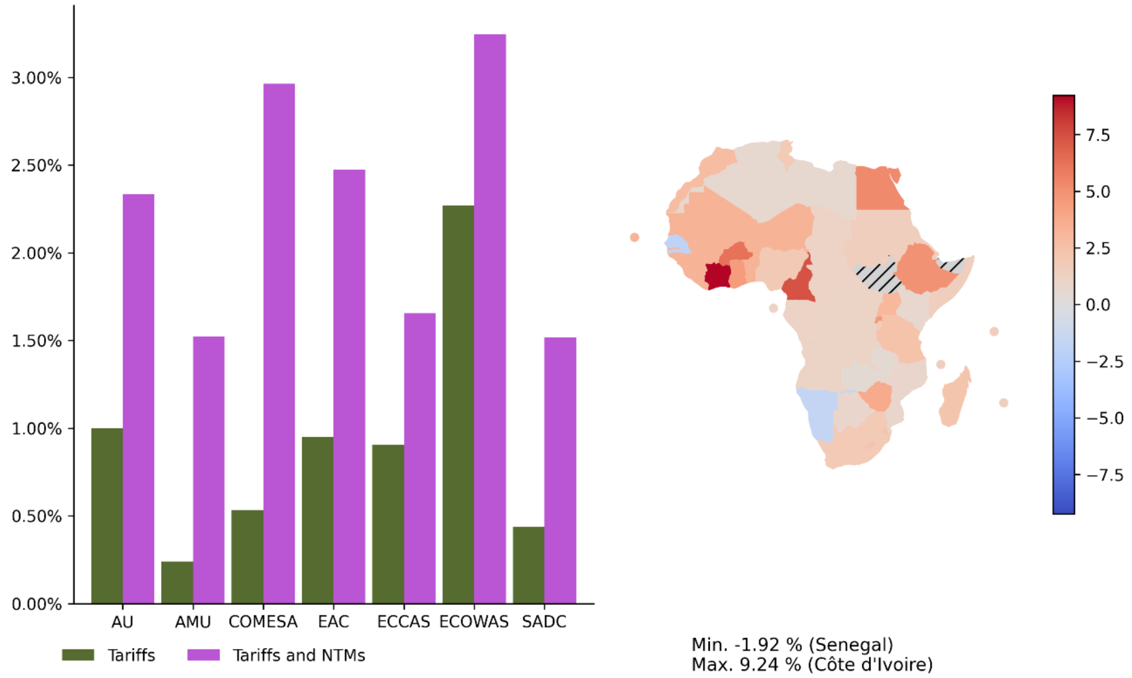

Figure 49. Changes in total exports by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

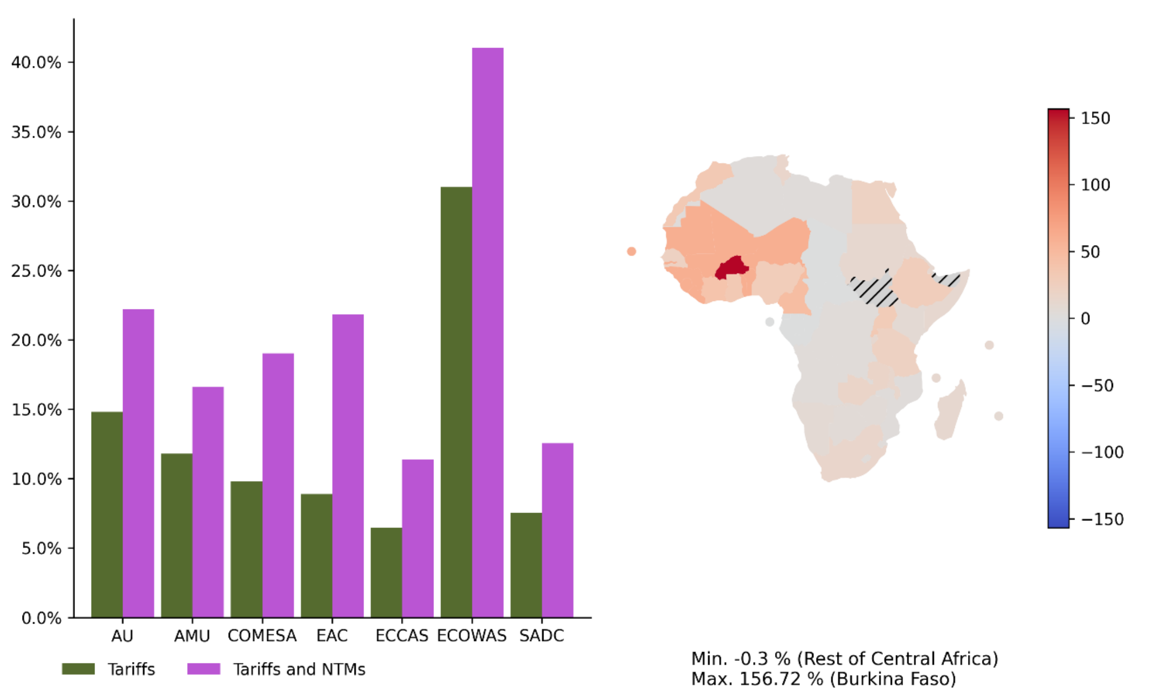

Figure 50. Changes in intra-African exports by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

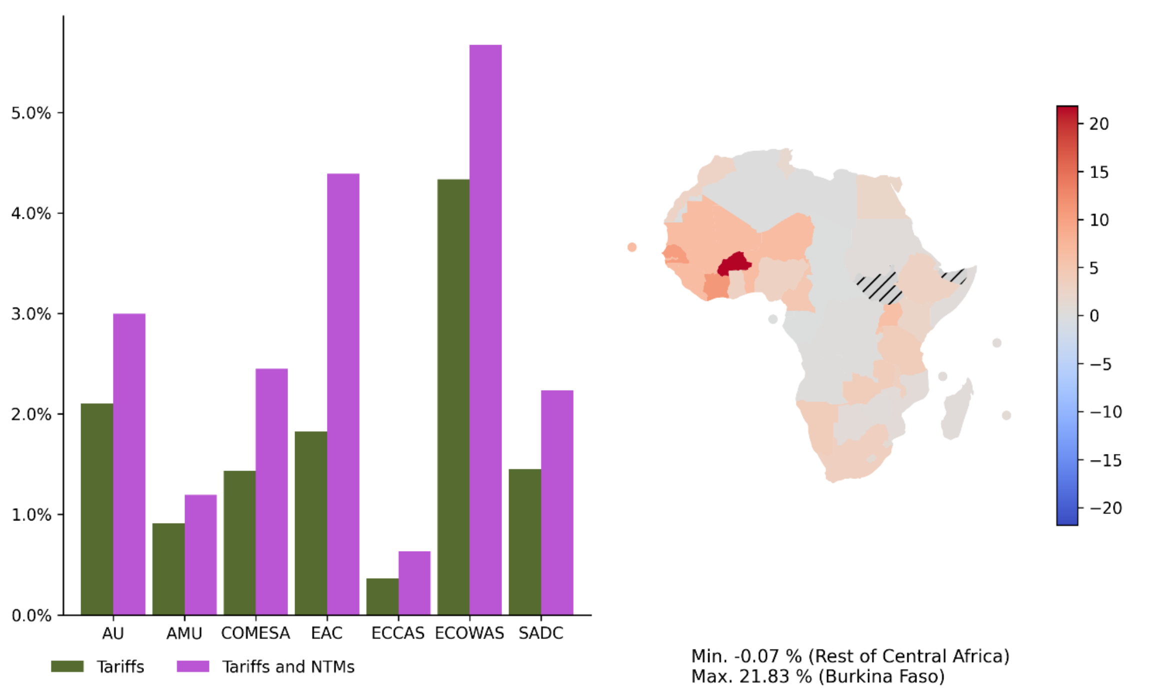

Figure 51. Changes in the proportion of intra-African exports in percentage points by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

Although both imports and exports increase, the effect on balance of trade is negative in almost every region (Figure 52). The trade deficit increases by USD 20 billion. The decrease is largest in ECOWAS, and almost all countries experience a deterioration of the balance. Figure 53 and Figure 54 show trade balances split by intra- and extra-African trade, respectively. AMU, COMESA, and SADC gain trade surpluses in intra-African trade, whereas ECCAS is the only REC to gain a surplus in trade with non-African countries. ECCAS's trade surplus consists mostly of increased oil exports.

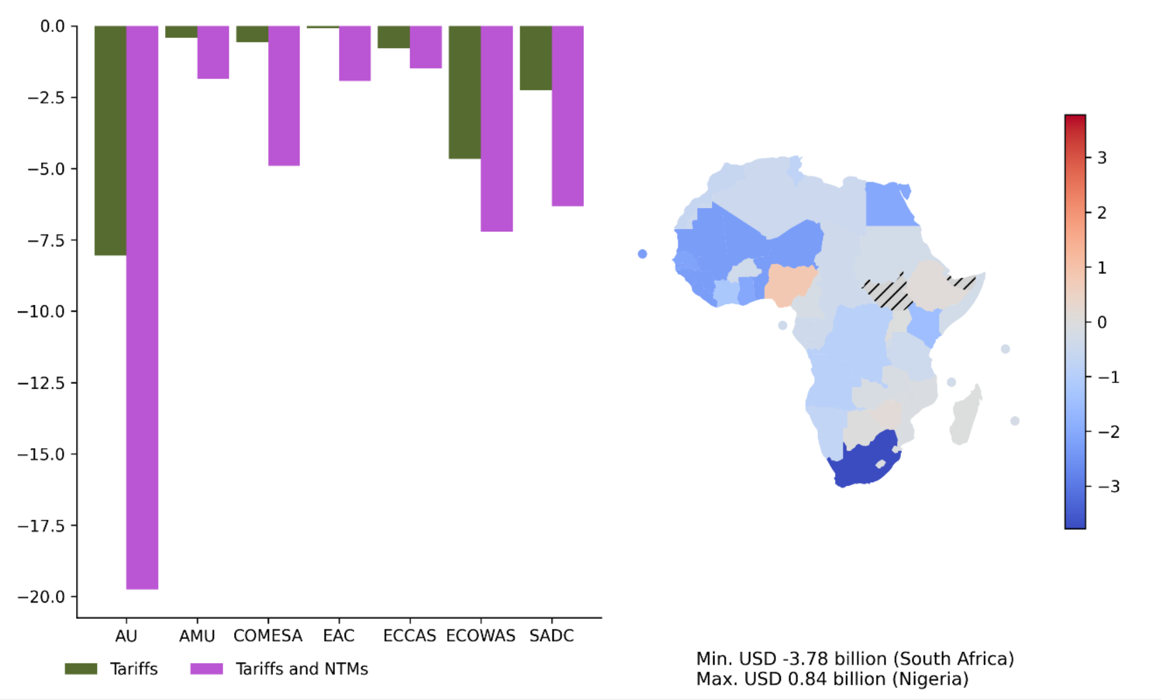

Figure 52. Changes in the balance of trade (billion USD) by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

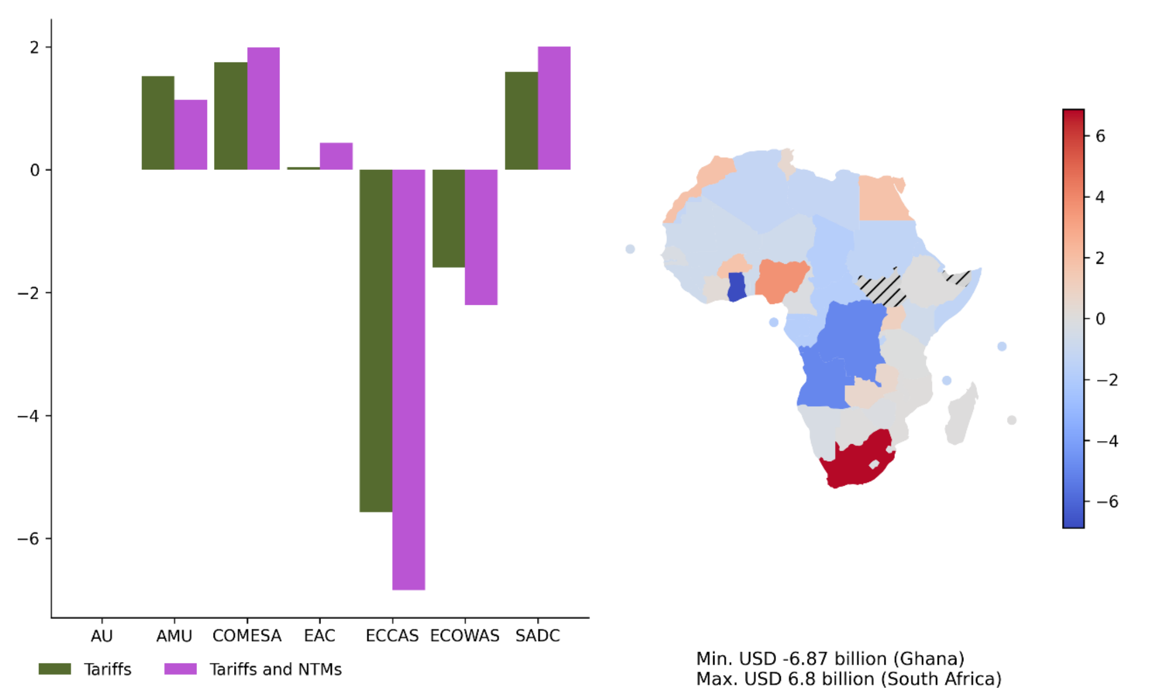

Figure 53. Changes in the balance of trade (intra-African trade only) (billion USD) by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

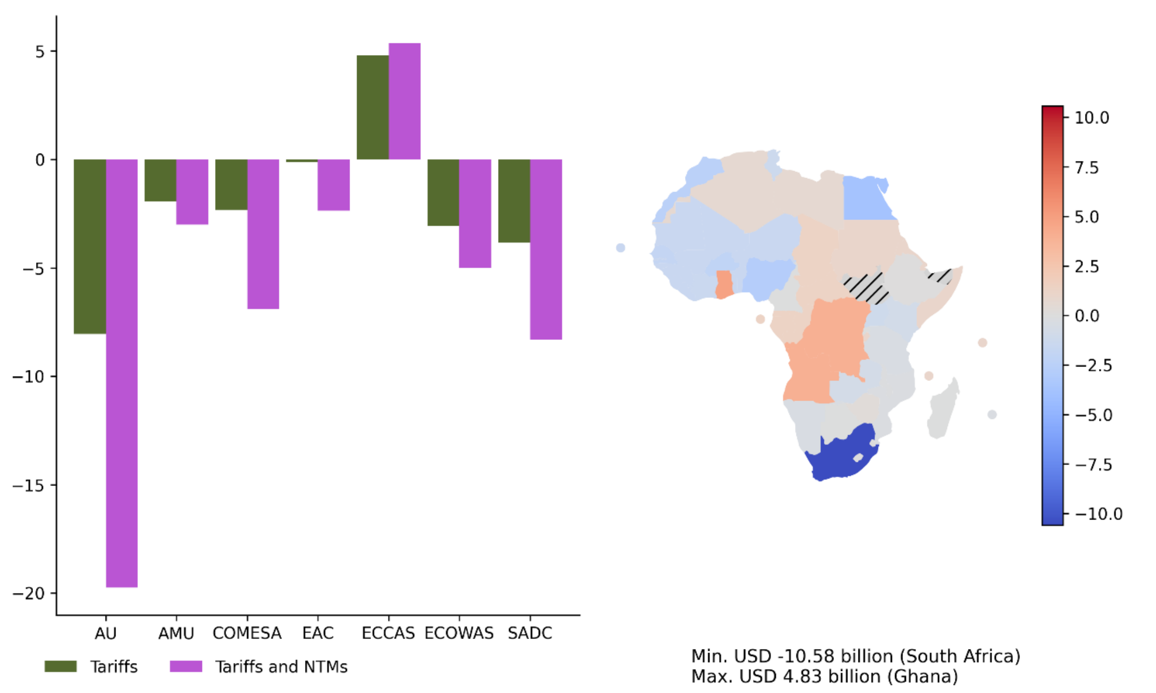

Figure 54. Changes in the balance of trade (extra-African trade only) (billion USD) by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

Figure 55 and Figure 56 depict the changes in the ECI and the EDI, respectively. Both show that export concentration decreases in most of the regions in Africa at the REC level as a result of the AfCFTA. However, there are exceptions at the regional level, and exports become more concentrated on several countries in Western Africa. The EDI indicates that the trade concentration approaches the global averages as a result of the agreement. These are expected results, since more open trade and resulting lower exporting costs mean more opportunities to trade with export destinations.

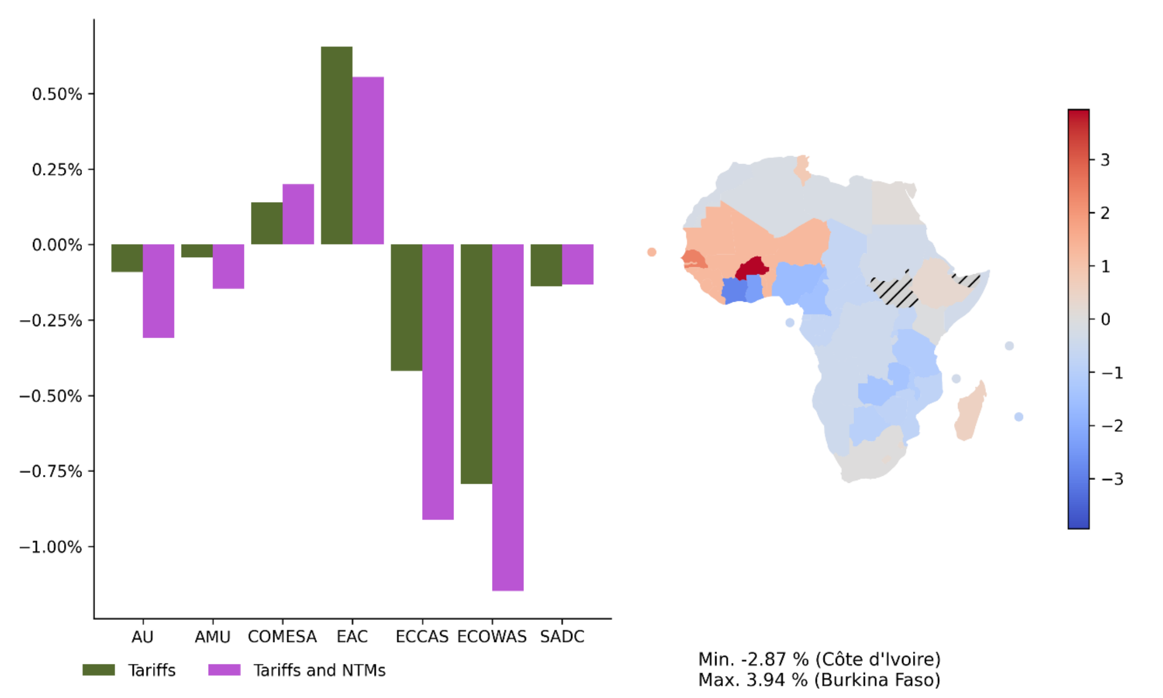

Figure 55. Changes in the ECI in percentage points by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

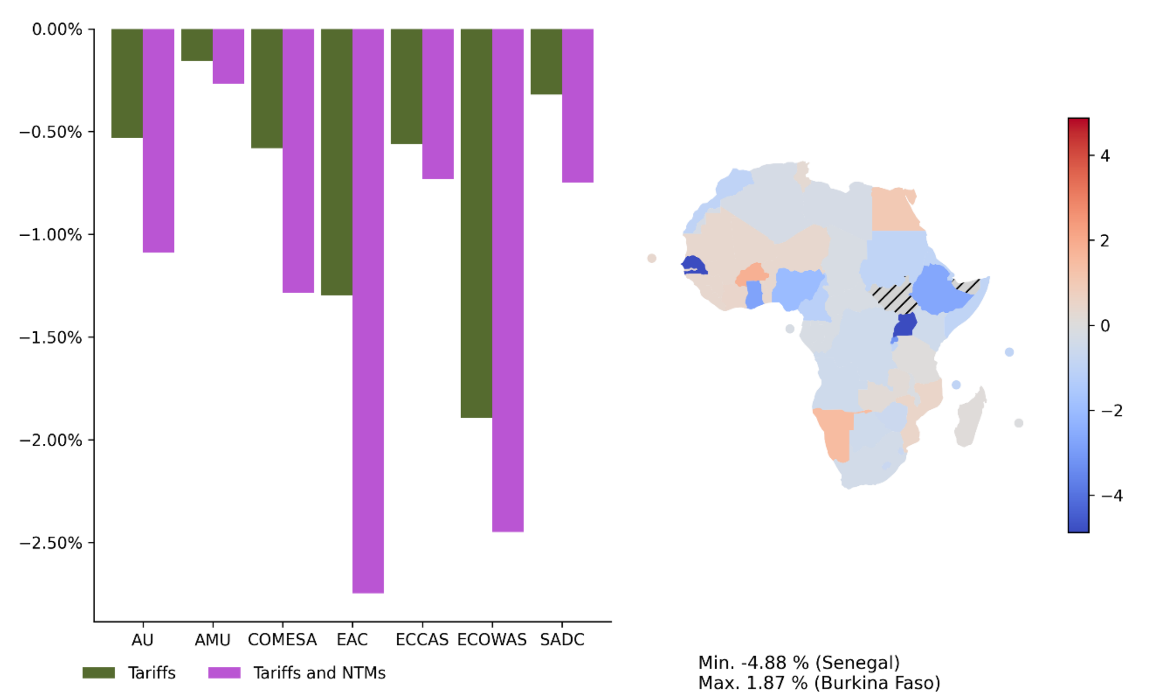

Figure 56. Changes in the EDI in percentage points by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

6.3. Effects on agriculture and food production

Our simulations show that the AfCFTA affects agriculture and food production in Africa in many ways. The opening of trade between African countries makes each region's comparative advantages a stronger predictor of their production and trading patterns. Agricultural production increases slightly, but not uniformly across the regions. In a few regions, domestic agricultural production decreases, especially when the countries' comparative advantages are in other sectors. Therefore, agricultural production becomes more concentrated.

The positive baseline development of food security is enhanced by the AfCFTA. Almost all food security indicators are positively affected. As some of the regions decrease their domestic production, importing food becomes a more crucial factor in food security. Although the AfCFTA decreases domestic food production in some regions, food consumption is positively affected throughout Africa. Although the overall effects are positive, increased regional concentration could pose risks during crises and other rare events. Countries that are heavily dependent on natural resources could have significant risks in such scenarios.

6.3.1. Output of agricultural and food commodities

Figure 57 and Figure 58 depict the changes in domestic outputs of primary agricultural and processed food commodities, respectively. The change in primary agricultural output is 0.52 %, which is less than the total GDP change. Thus, because of AfCFTA, African economies become less dependent on agriculture and increase the value added shares in the total output. The changes range between – 0.9 % and 1.1 % at the REC level. Many individual regions decrease their domestic food production. Reduction is highest in resource-rich regions such as ECCAS. SADC is the only REC with a substantial increase in its food production. The output of processed foods increases slightly more, at 0.74 %. It ranges between – 1.3 % and 1.5 % across the RECs. The regional pattern is similar to that of primary agricultural products, but overall higher changes indicate that the AfCFTA helps to increase the value added share of the food produced in Africa.

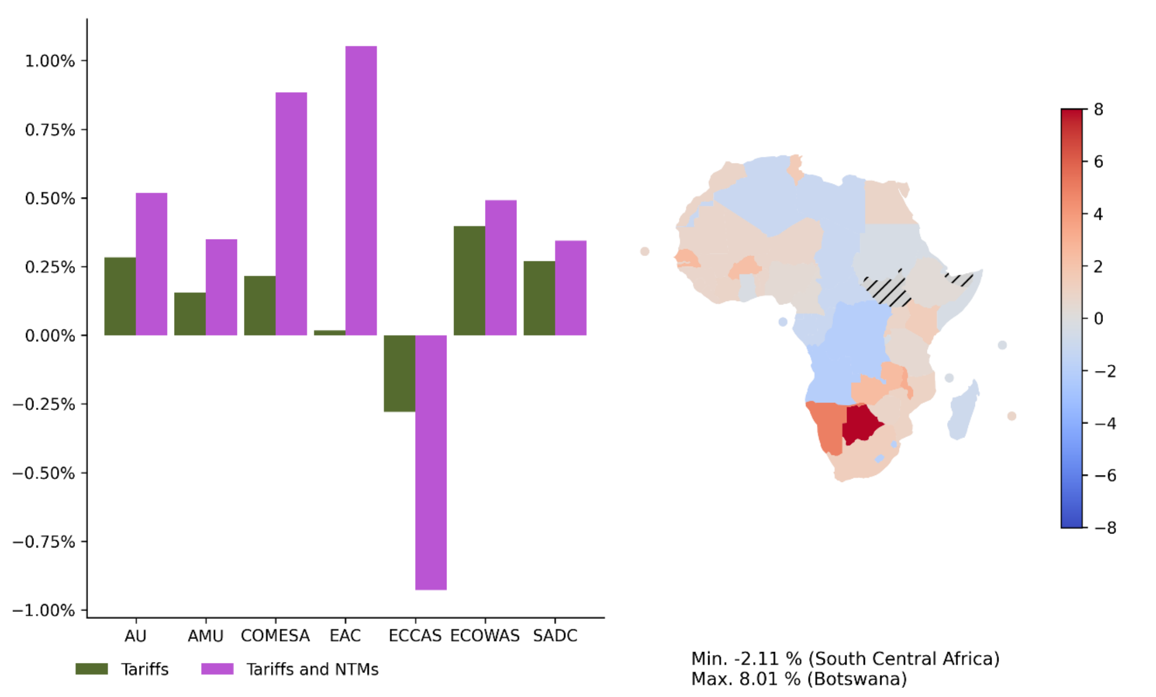

Figure 57. Changes in domestic primary agricultural production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

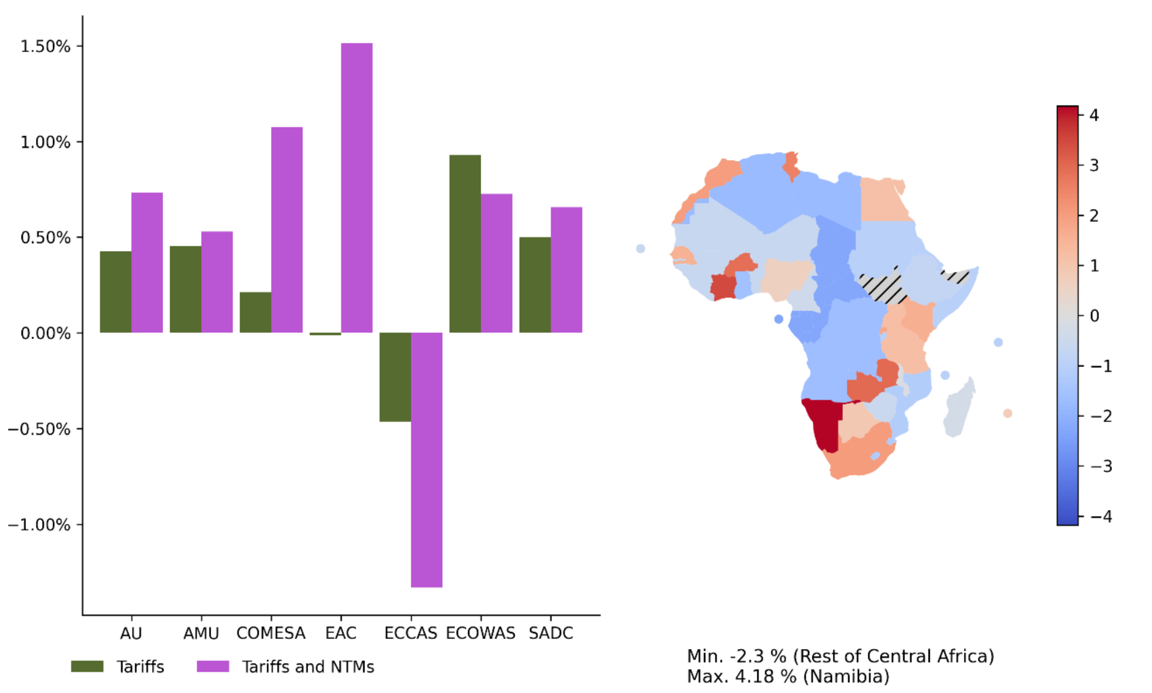

Figure 58. Changes in domestic processed food production by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

The effects presented above conceal some commodity-level differences. The following sections summarise the findings on the most important agricultural and food products. In plant production, Africa will increasingly switch from cereals to higher value added crops such as oilseeds and sugarcane. In addition, the output increases for the main animal products, which also indicates growing demand for higher-value food products.

6.3.1.1. Paddy rice

Production of paddy rice decreases by 0.36 % on total in our simulations (Figure 59). There are considerable regional differences, and most of the regions decrease their rice production. The highest decrease of 5.7 % happens in ECCAS, which in general decreases its primary agricultural production. South Africa is a notable exception, increasing its production by 10 %.

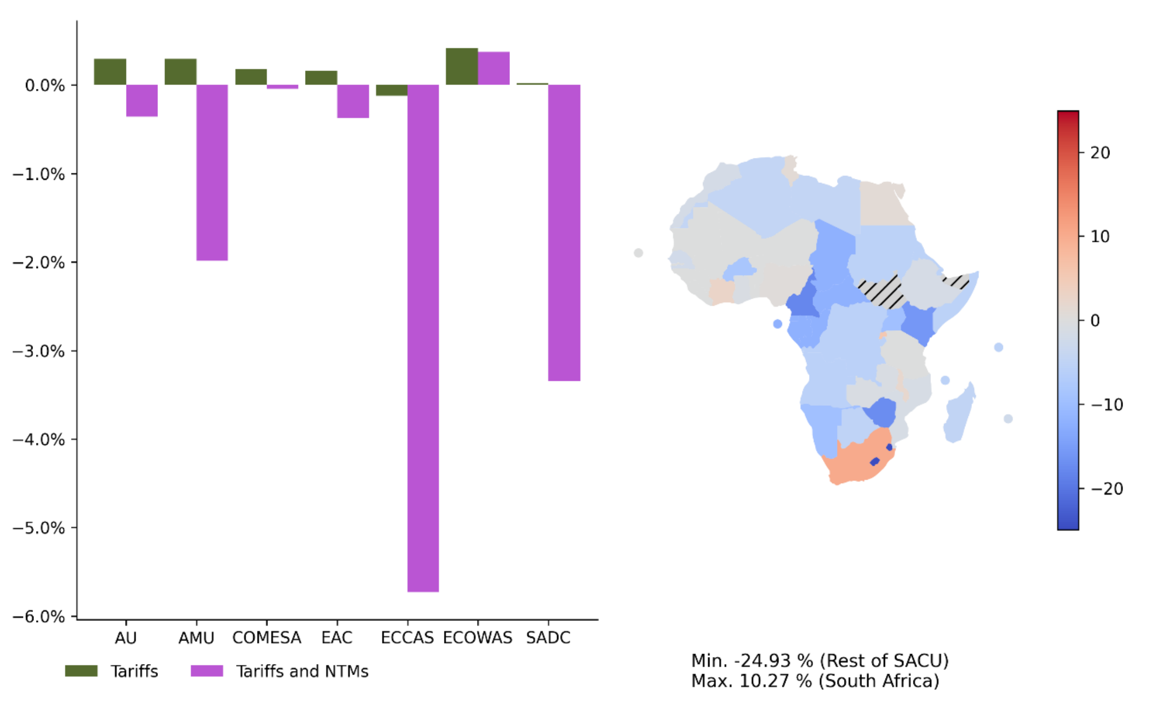

Figure 59. Changes in paddy rice production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.2. Wheat

Simulations indicate only a moderate change in wheat production: a – 0.24 % decrease in total (Figure 60). Nevertheless, there are notable exceptions, and EAC increases its output by 0.4 %, whereas the rest of the RECs decrease it, the highest decrease happening in ECCAS, – 1.5 %.

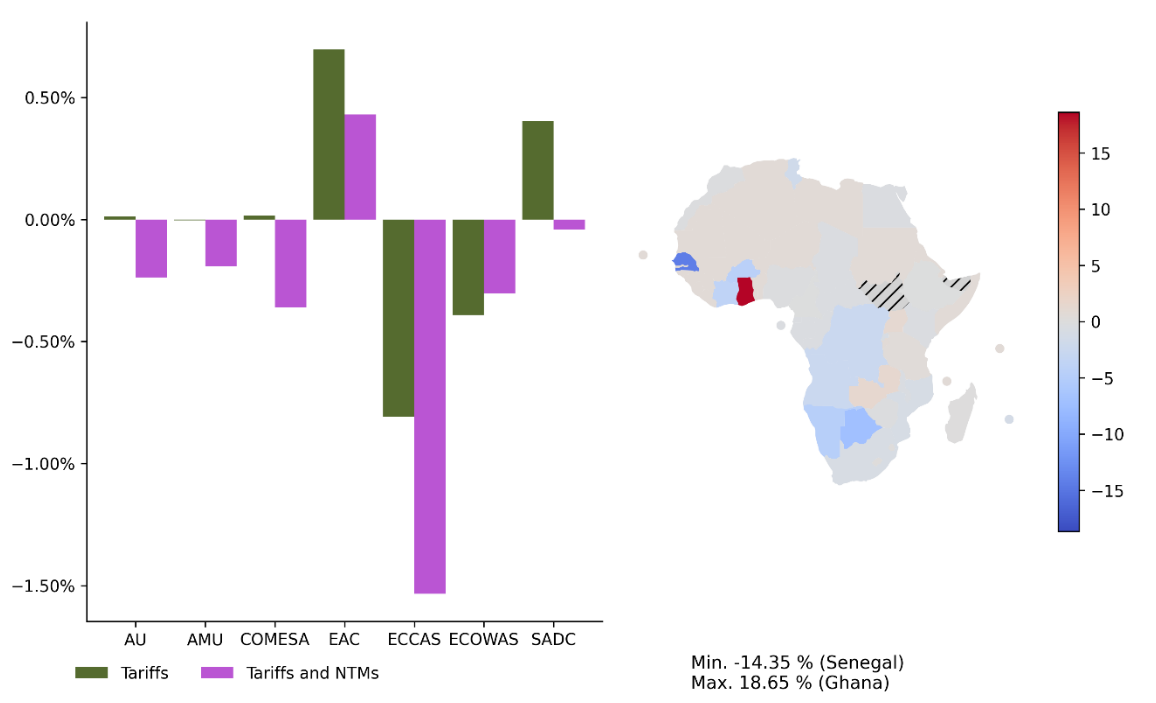

Figure 60. Changes in wheat production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.3. Oilseeds

Simulations show that the production of oilseeds increases by 0.63 %, with the changes ranging between – 0.3 % and 2.0 % at the REC level (Figure 61). The production is concentrated on several COMESA countries and Côte d'Ivoire.

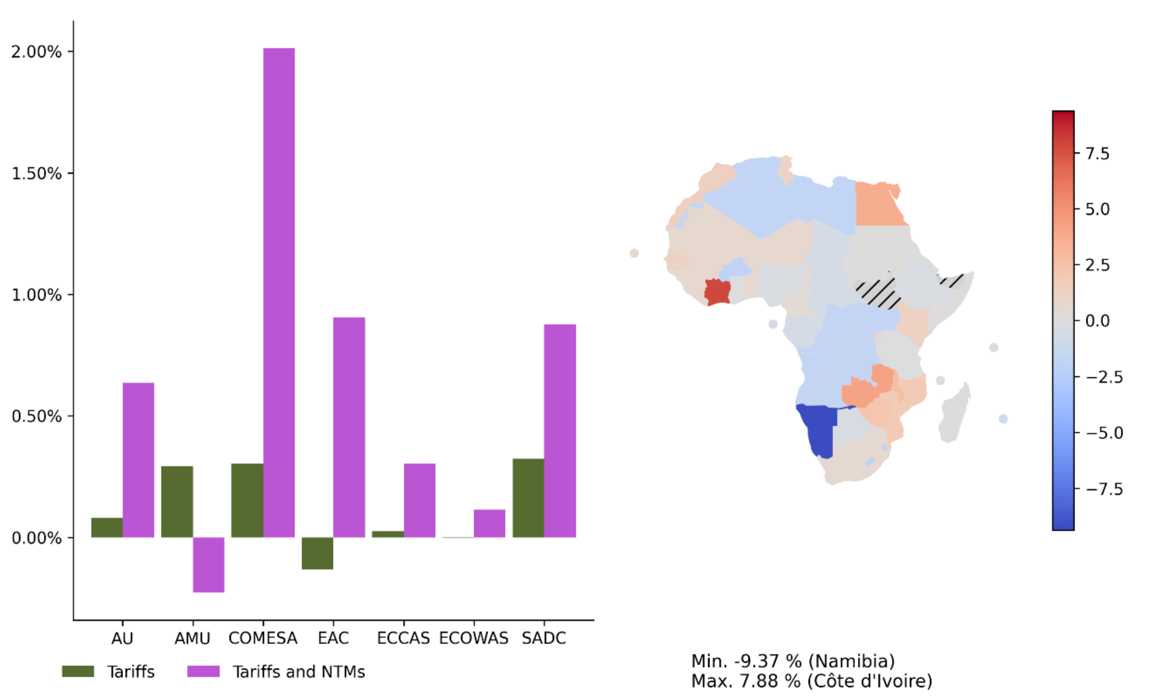

Figure 61. Changes in oilseed production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.4. Sugarcane

Simulations indicate that sugarcane output increases by 0.64 % (Figure 62). The increase is more evenly spread than with oilseeds. ECCAS reduces its output by 2.1 %. Results show a substantial increase in Namibia, but as the current level of production is low, the increase is not as dramatic as it seems.

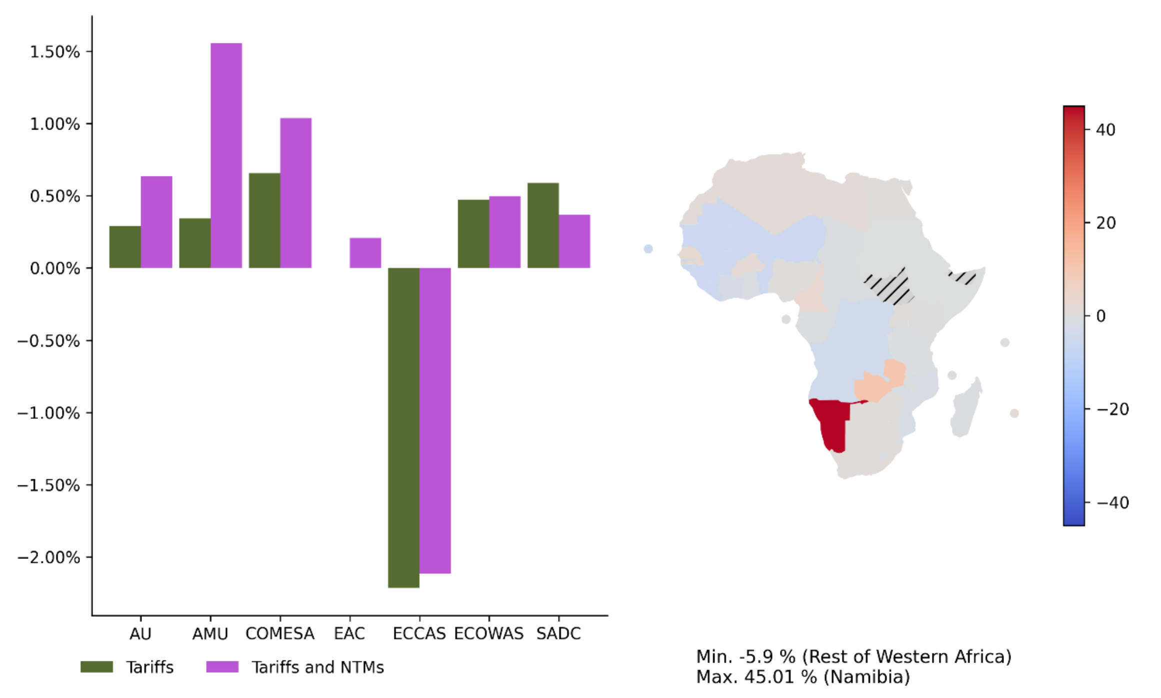

Figure 62. Changes in sugarcane production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.5. Ruminant meats

Simulations show that the output of ruminant meats increases by 0.64 % (Figure 63). The increase is highest in SADC, at 2.1 %, whereas AMU and ECCAS have sizable decreases.

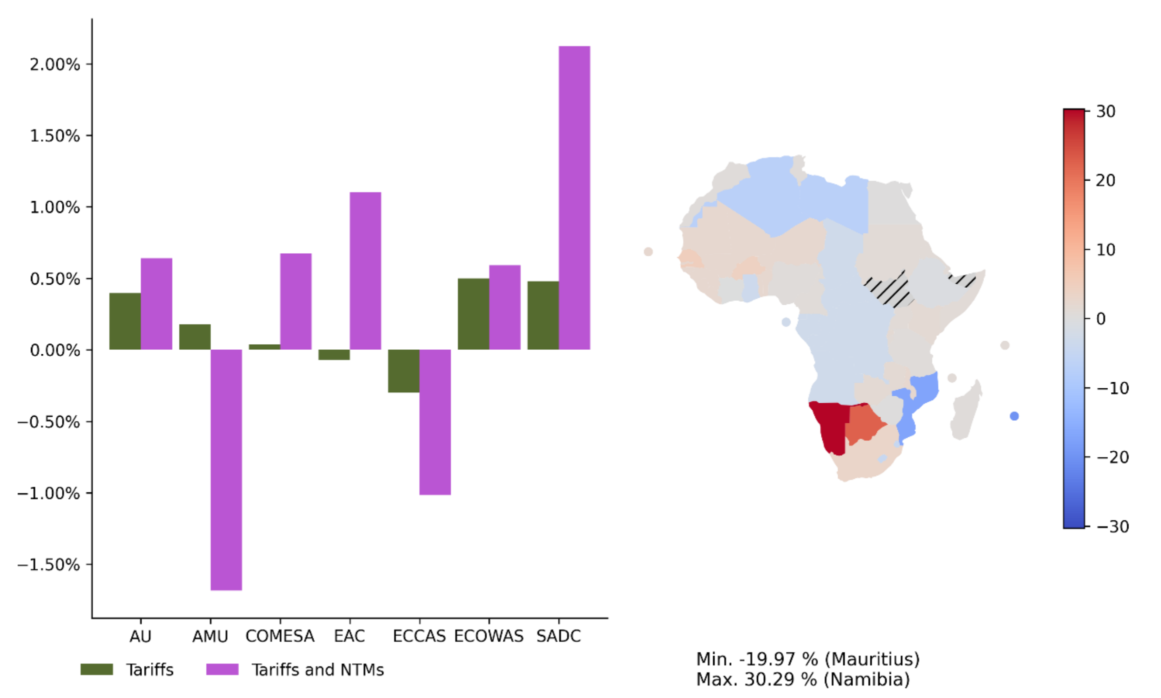

Figure 63. Changes in ruminant meat production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.6. *Other meats*

Simulations show that the output of other (non-ruminant that includes poultry and pork) meats increases slightly, by 0.32 % (Figure 64). There is a sizable decrease in ECCAS, whereas changes in other regions are less pronounced.

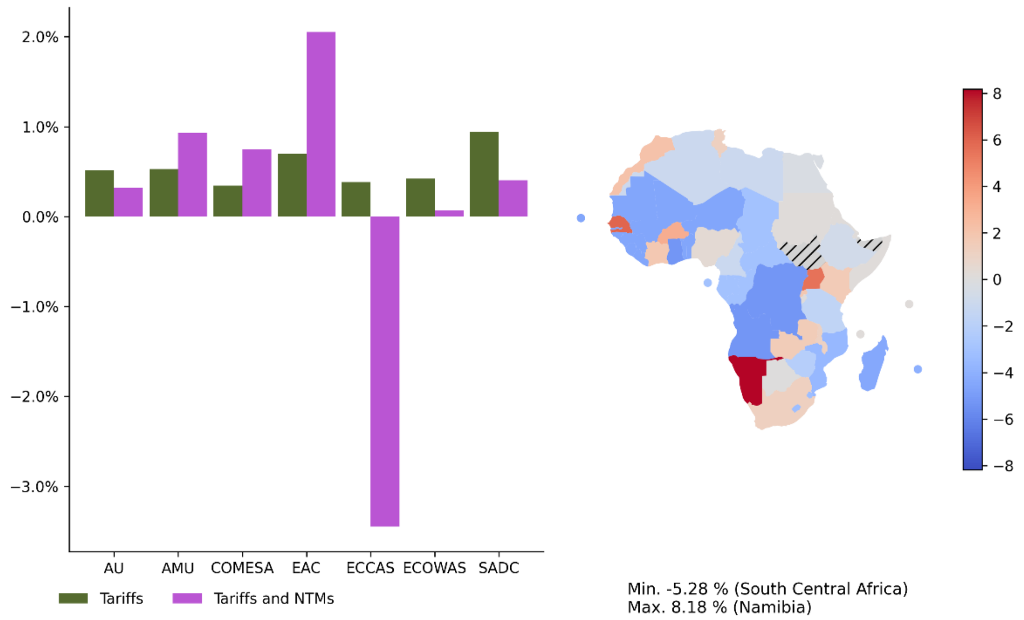

Figure 64. Changes in other meat production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.1.7. *Dairy products*

Simulations show that dairy production increases moderately in many regions (Figure 65). The overall increase is 0.44 %, with the changes ranging between – 0.86 % and 0.85 % at the REC level. Regional differences are pronounced for dairy products, and both Nigeria and Côte d'Ivoire have large increases.

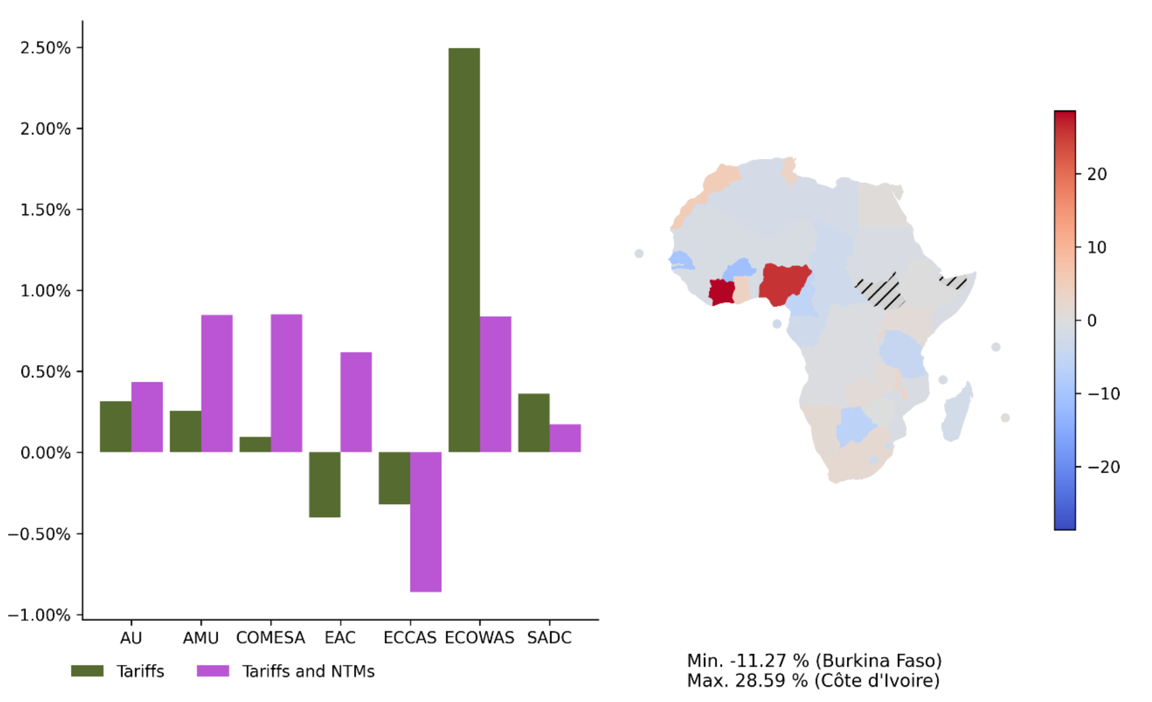

Figure 65. Changes in dairy production by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.2. Trade in agricultural and food commodities

Results indicate that domestic agricultural production is moderately affected by the AfCFTA, and that there are larger regional differences. The more concentrated production structure can be explained by increased trade in agricultural and food products. Our results show that trade in agricultural products increases in most of the cases, although not as uniformly as the overall trade. Also, trade in processed foods increases more than trade in primary agricultural products, which can be explained by an increased demand for higher value added products owing to increased income levels.

Figure 66 and Figure 67 depict the results for imports and exports of the primary agricultural products, respectively. All the RECs increase their imports, and the overall increase is 1.8 %. EAC increases its agricultural imports most, by 8.3 %. The result for exports is far less uniform, which is caused by the more regionally concentrated agricultural production in Africa. The total exports increase, although moderately when compared with imports, by 0.31 %. COMESA increases its exports most, by 2.8 %.

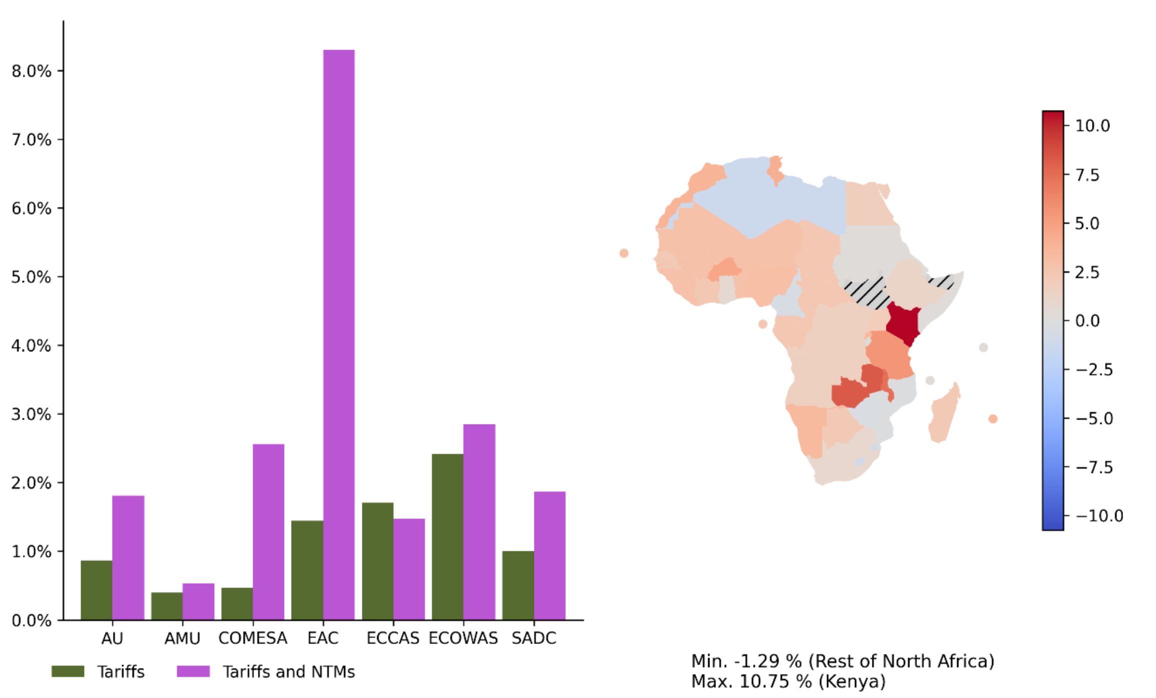

Figure 66. Changes in the imports of agricultural products by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

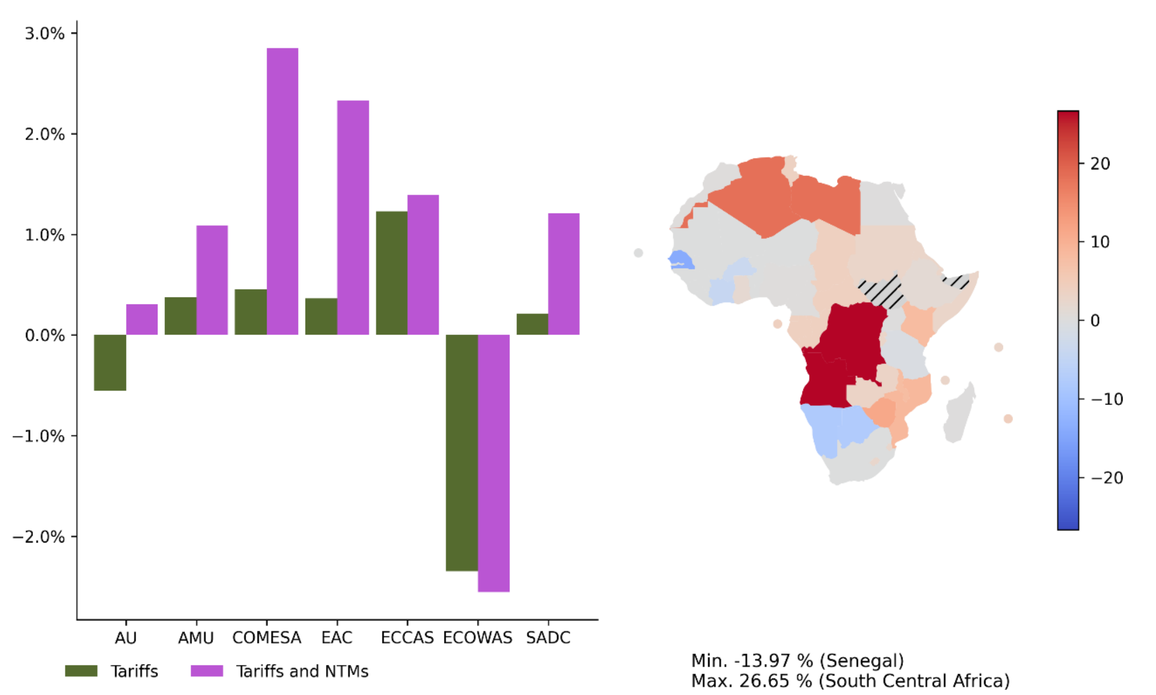

Figure 67. Changes in the exports of agricultural products by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

The change is stronger and more uniform for trade in processed foods, for which both imports and exports increase more than for primary agricultural products. Figure 68 and Figure 69 depict these changes. The increase is 4.5 % for imports and 10 % for exports. All RECs increase imports and exports of processed foods.

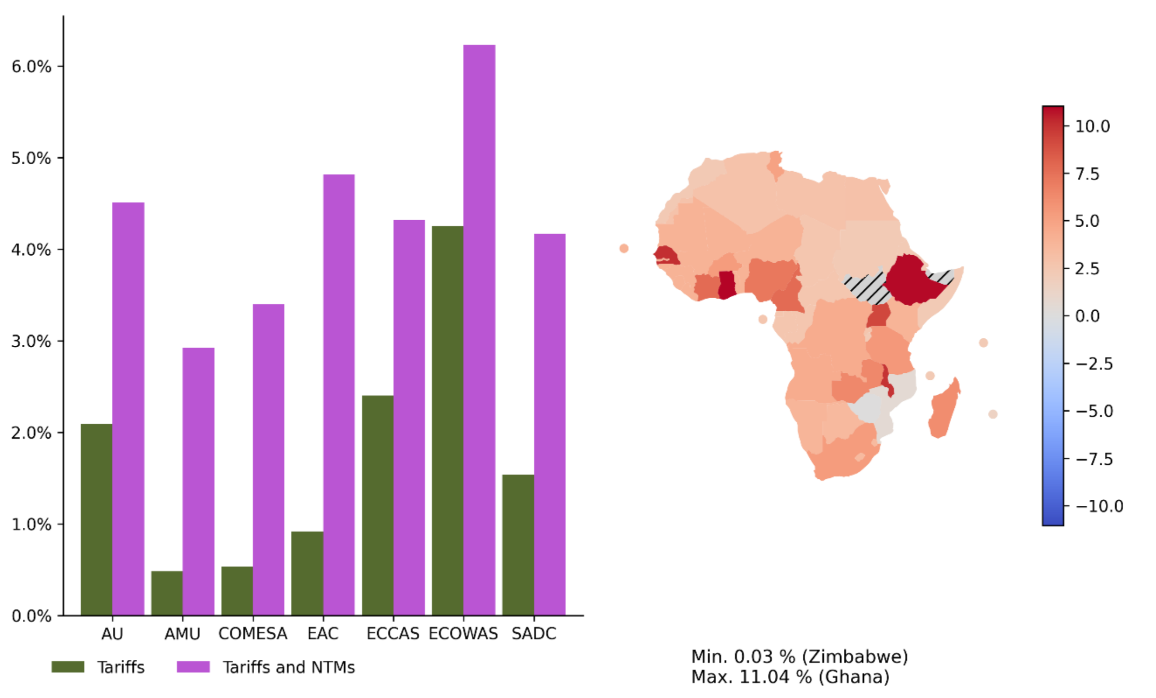

Figure 68. Changes in the imports of processed food products by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

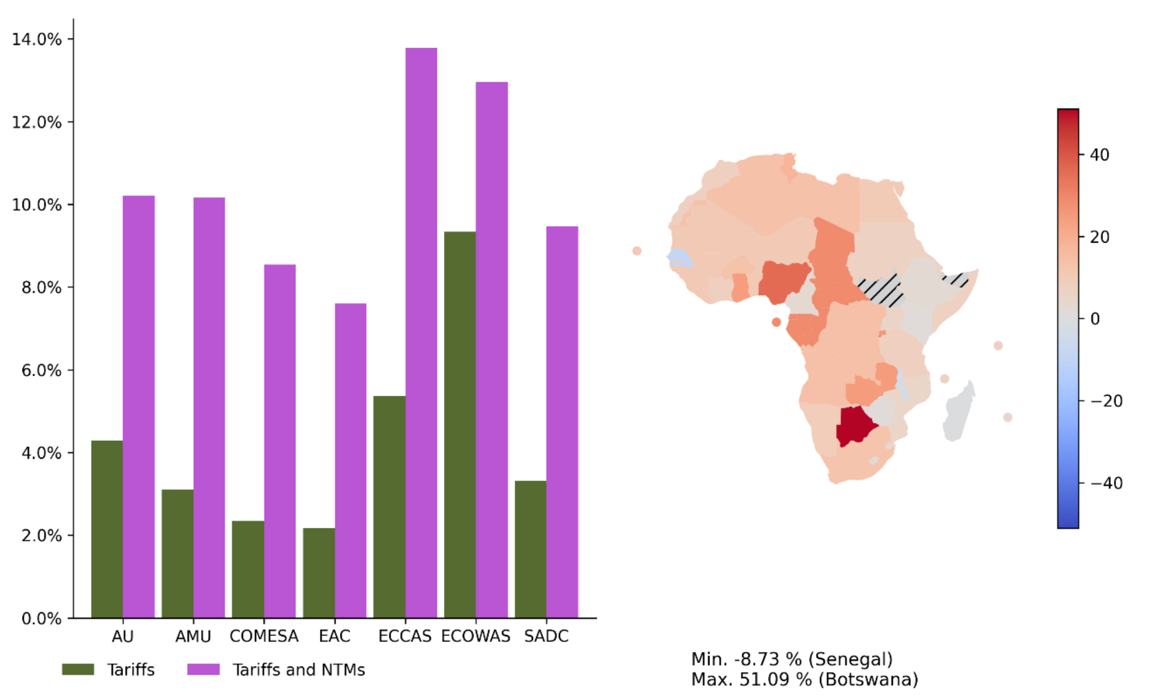

Figure 69. Changes in the exports of processed food products by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.3.3. Food security indicators

Simulations indicate improvements for food security indicators. Disposable incomes and food consumption both increase throughout. On the other hand, food prices increase in some of the regions, which could mean negative food security effects on lower-income groups, which could increase the need to channel public expenditure to income support or similar programmes.

Figure 70 and Figure 71 depict the changes in disposable income in comparison with the baseline by shock decomposition. The changes are higher than for the GDP, the overall increase being 1.7 %. The effects range between 0.53 % and 2.7 % at the REC level. The tariff reduction strategies have markedly different outcomes on disposable incomes across the RECs (Figure 72). EAC has better outcomes with uniform tariff revenue maximisation and industrialisation scenarios, whereas all RECs except AMU have their worst outcomes with the uniform agri-food liberalisation scenario.

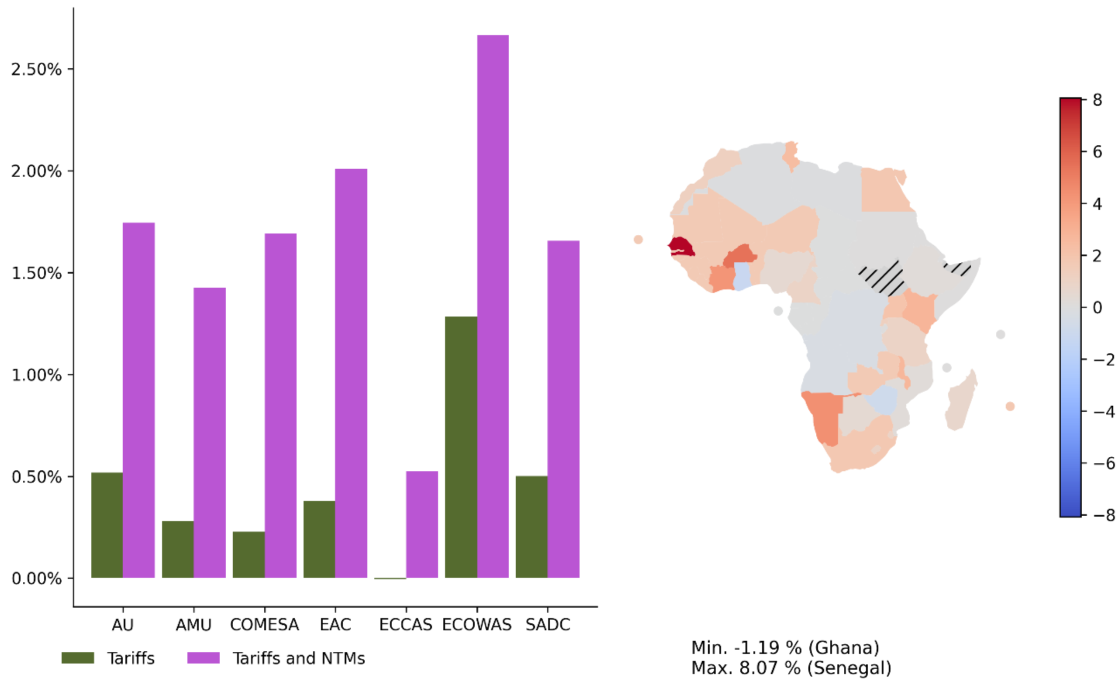

Figure 70. Changes in per capita disposable income by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

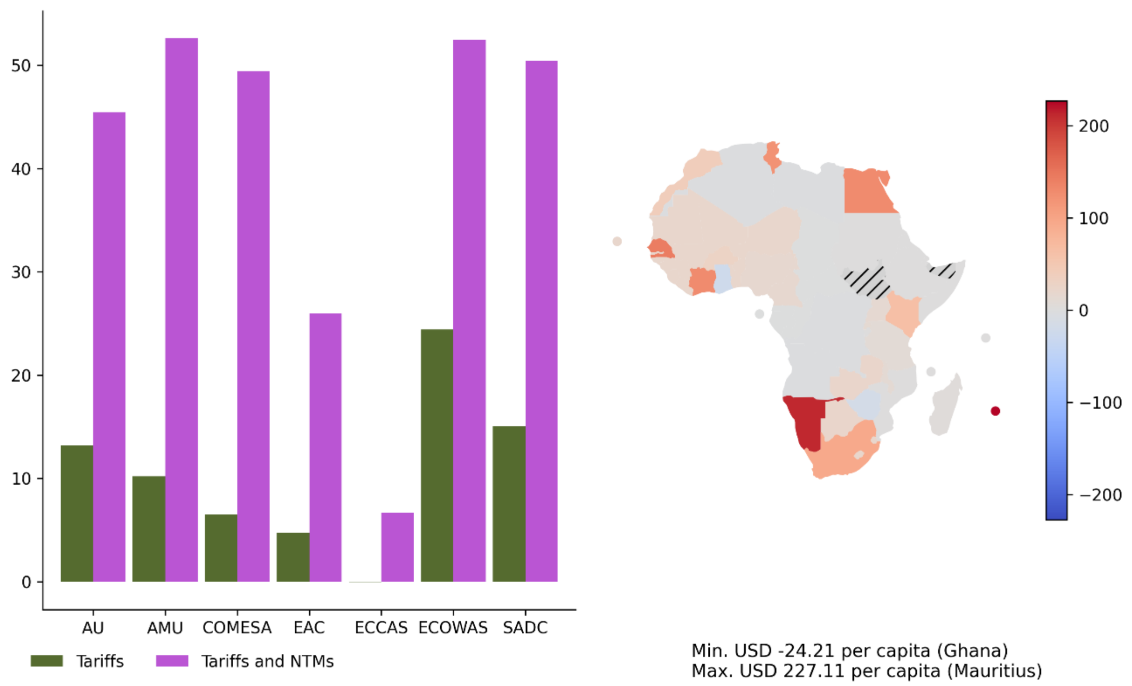

Figure 71. Changes in per capita disposable income in USD by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

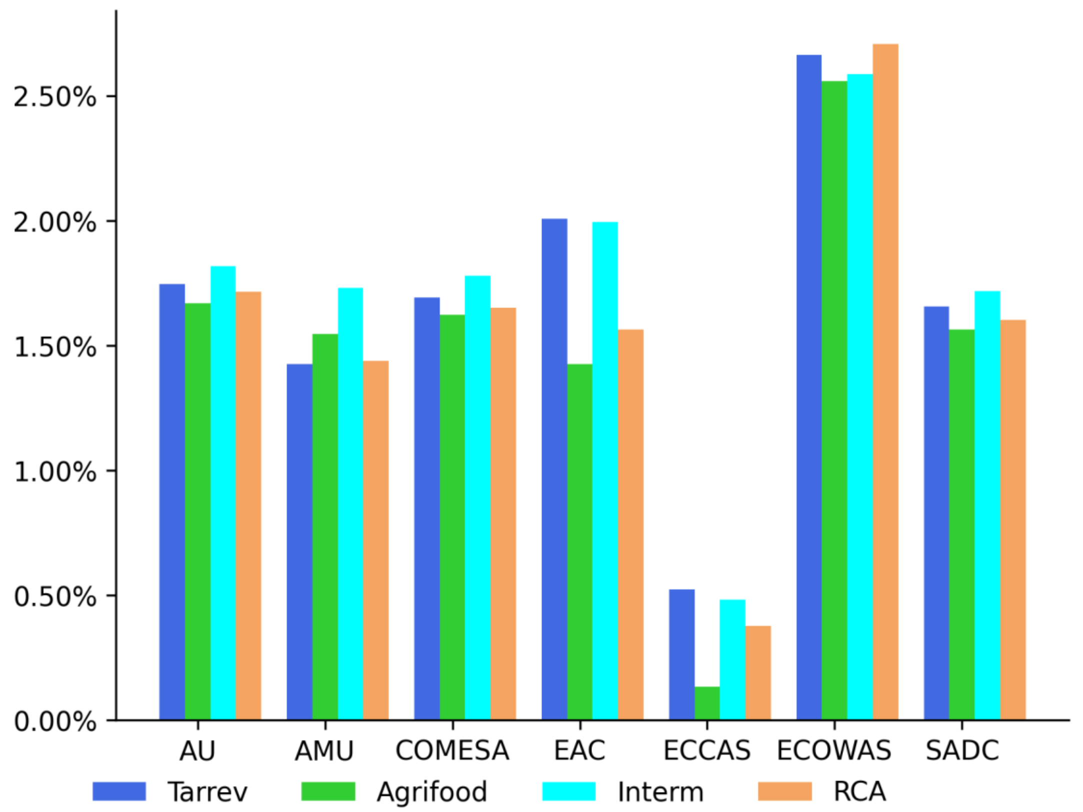

Figure 72. Changes in per capita disposable income by tariff reduction strategy and REC (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

Food consumption per capita is a more direct indicator of changes in food security, and our analysis shows that the AfCFTA has positive effects on it in all the regions. Figure 73 displays the results, which show an aggregate increase of 0.85 %, ranging between 0.50 % and 1.7 % at the REC level. Figure 74 shows the variation between the tariff reduction scenarios. ECCAS is the only region that increases its food consumption markedly when the liberalisation of agri-food industries is uniformly adopted. Nevertheless, the same strategy leads ECCAS to a worse disposable income situation (Figure 72). Both results on tariff cut strategies, for disposable incomes and food consumption, indicate that the uniform strategies do not have uniformly positive outcomes for all the parties. Therefore, they are not likely to be implemented.

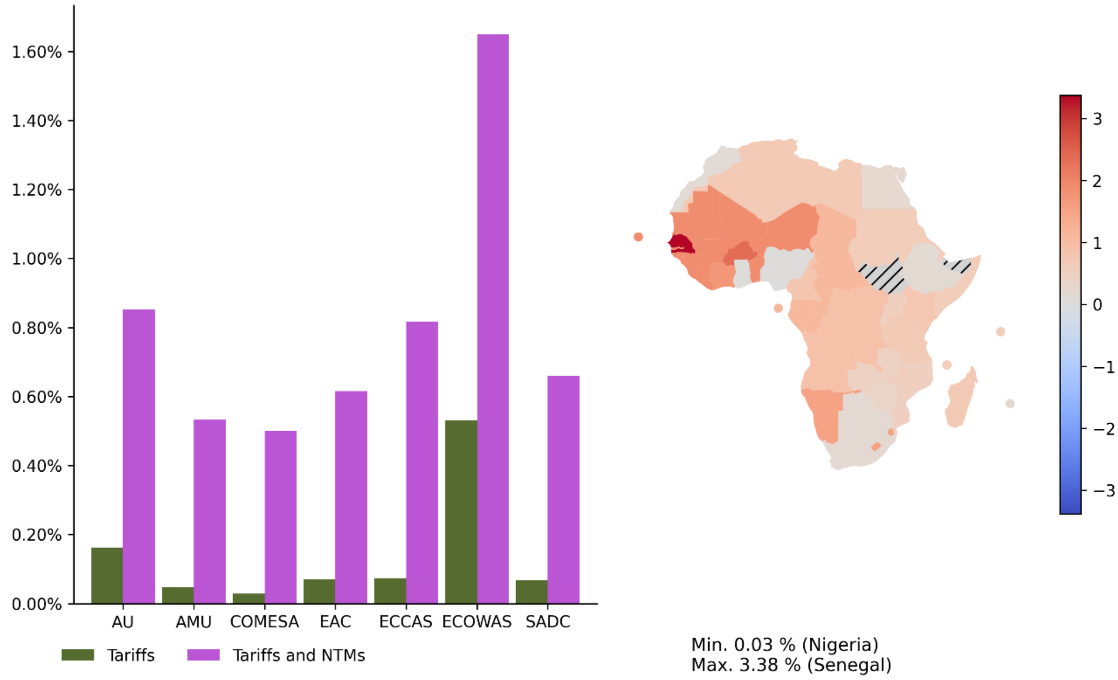

Figure 73. Changes in food consumption per capita by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

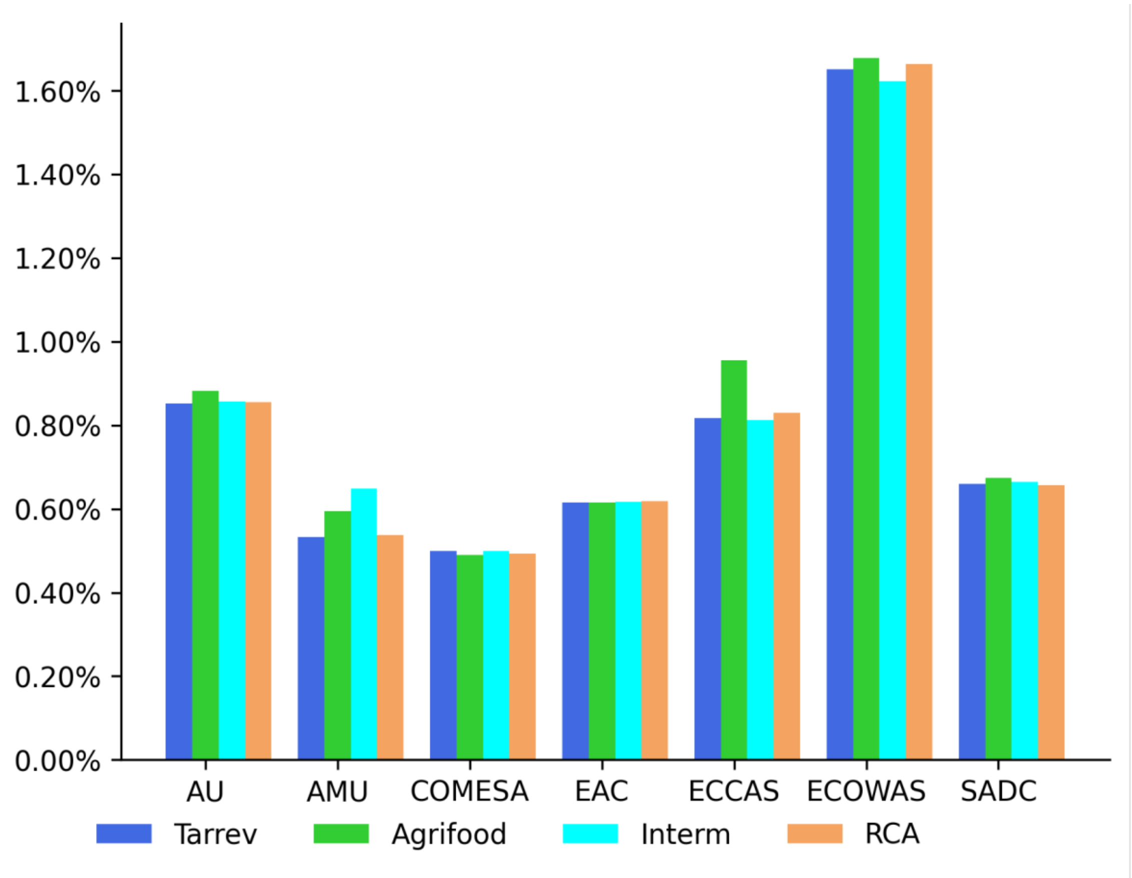

Figure 74. Changes in food consumption per capita by tariff reduction strategy and REC (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

Our results also show that the food price index increases in most of the regions (Figure 75). The overall increase is 0.31 %. However, there is some regional variation (e.g. in ECCAS and SADC, the prices decrease by 0.2 %). Cereal prices increase more on aggregate, 0.95 % (Figure 76). The changes range between 0.52 % and 2.0 % at the REC level. Figure 77 depicts the changes in the ratio of real wages with respect to cereal prices. The results are positive in overall (0.34 % in the AU level) and therefore the purchasing power for food improves in overall and in majority of regions. However, there are nine regions, where the effect is negative. The three with the largest reductions are Rwanda (- 0.58 %), Namibia (- 0.27 %) and Zambia (- 0.16 %). Thus, despite the increase in disposable income and food consumption, some regions experience negative effects for their low-income populations because of increased food prices.

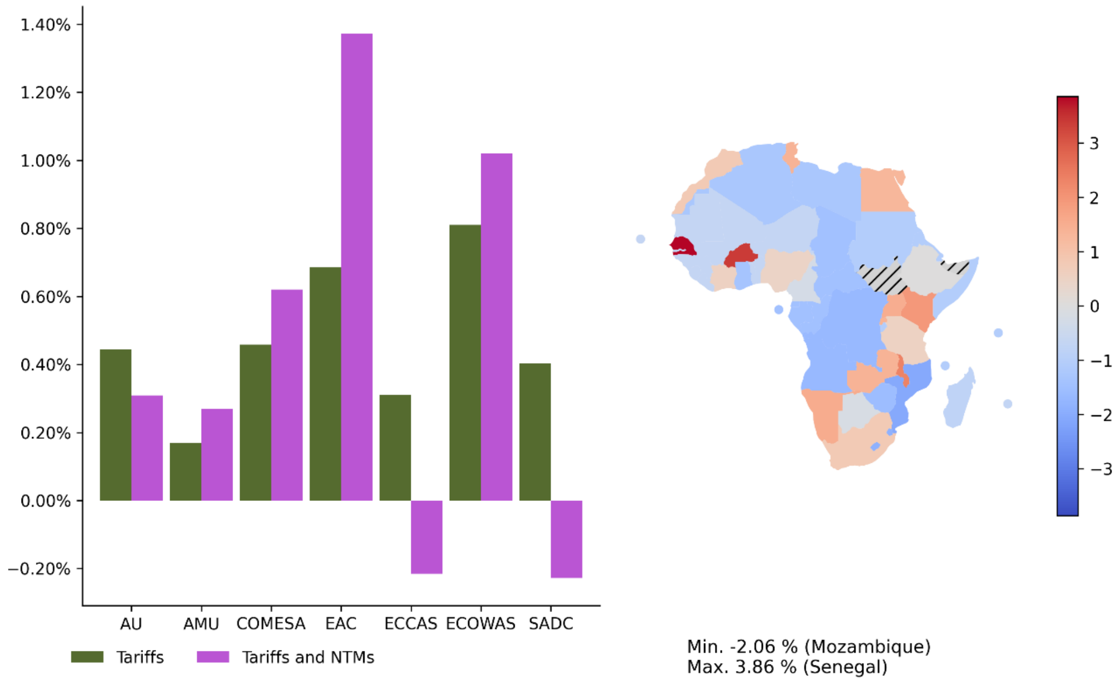

Figure 75. Changes in food price index by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

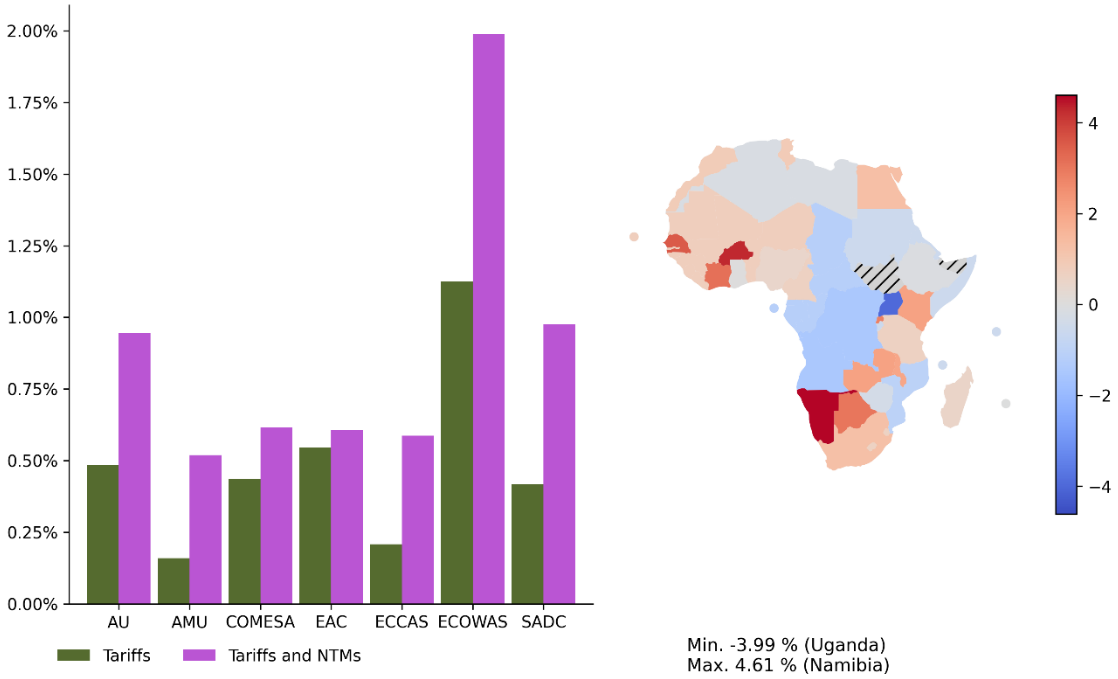

Figure 76. Changes in cereal prices by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

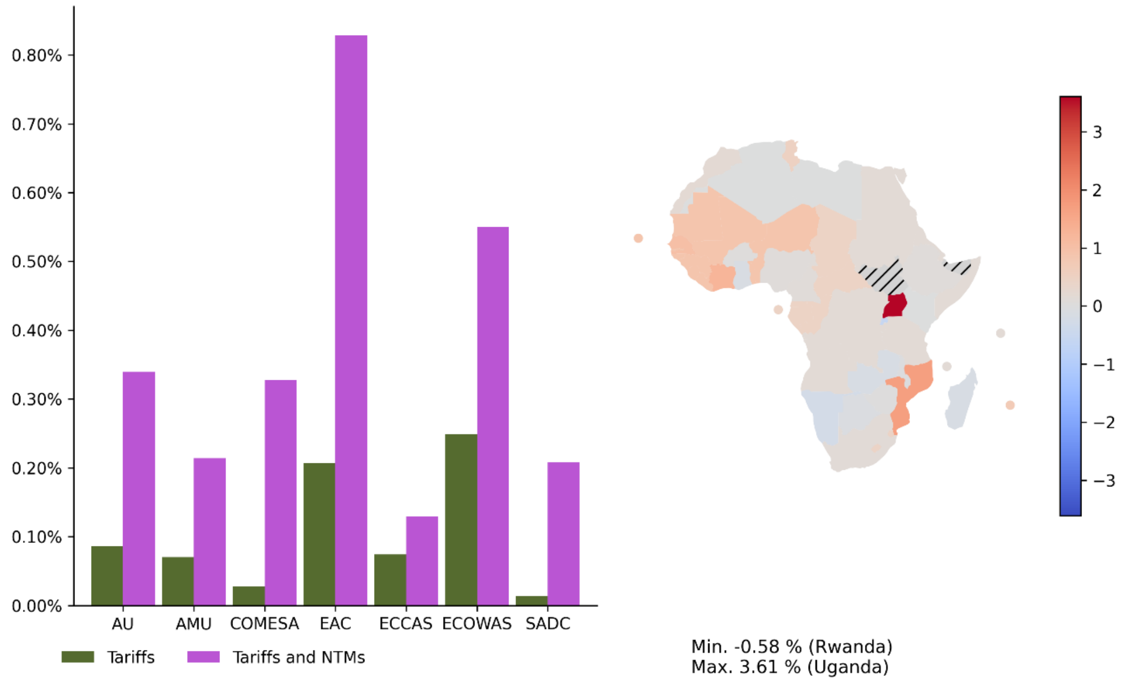

Figure 77. Changes in ratio of real wages to cereal prices by shock decomposition and REC (2035, uniform tariff revenue maximisation)

Source: Authors' calculation from MAGNET results.

Figure 78 and Figure 79 depict the food and cereal price changes for different tariff cut scenarios. They show that the uniform liberalisation of agri-food industries yields lower food prices throughout Africa. The overall food prices decrease by 0.03 % with that strategy, in which the tariff revenue maximisation yields a 0.31 % increase. The differences are similar, but not as pronounced, for cereal prices. Therefore, the uniform liberalisation of agri-food industries has a mixed and ambiguous outcome for food security: it decreases disposable income, which on average decreases food purchases, but it also decreases food prices, which makes food more affordable for lower-income households. Figure 80 shows the changes in the ratio of real wages to cereal prices. The differences are in general small, but the Interm scenario has both the highest overall effect and smallest negative effects in the regions where they occur. Seven regions have negative effects with Interm, whereas in the Tarrev scenario there was nine (individual region effects shown in Figure 81). However, the regions that have negative outcomes are not the same in each scenario. Therefore, considering non-uniform scenarios could help to find outcomes that avoid the negative outcomes for even larger set of regions.

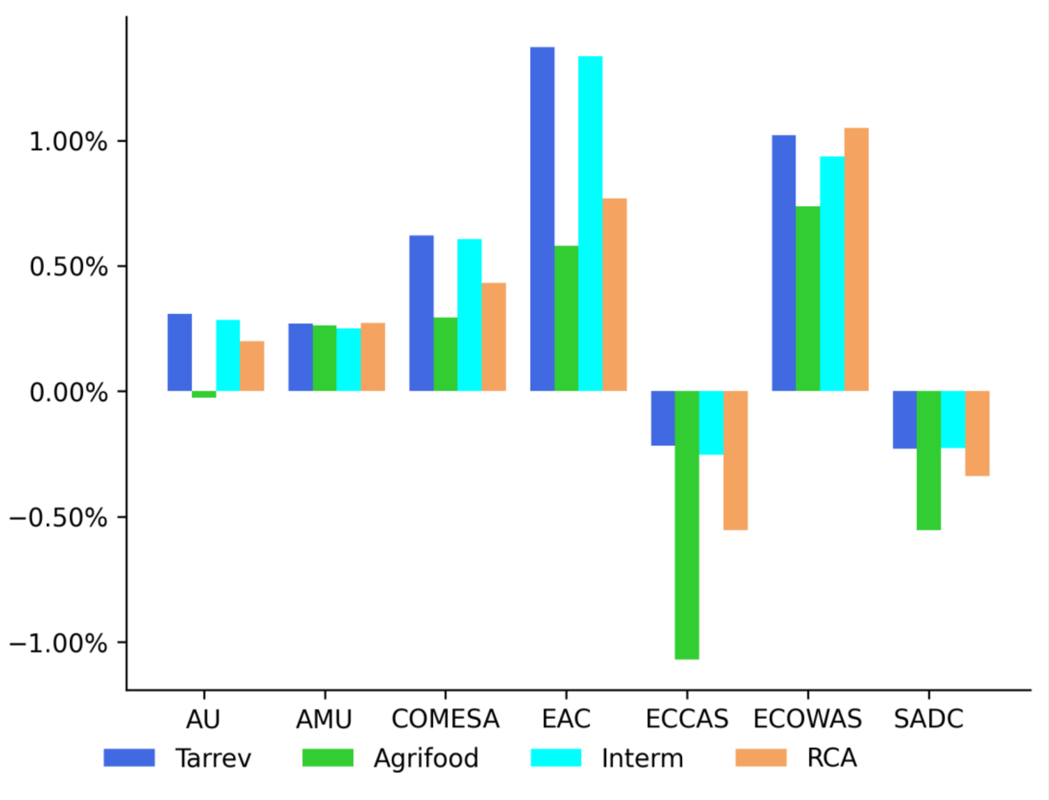

Figure 78. Changes in overall food prices by tariff reduction strategy and REC (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

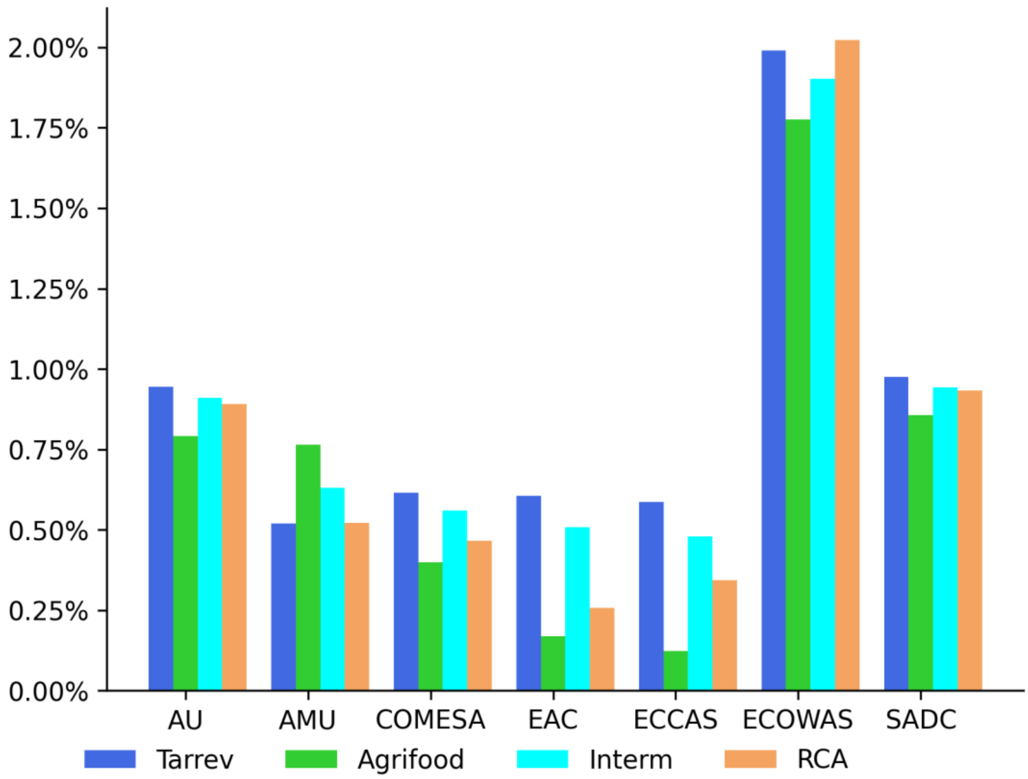

Figure 79. Changes in cereal prices by tariff reduction strategy and REC (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

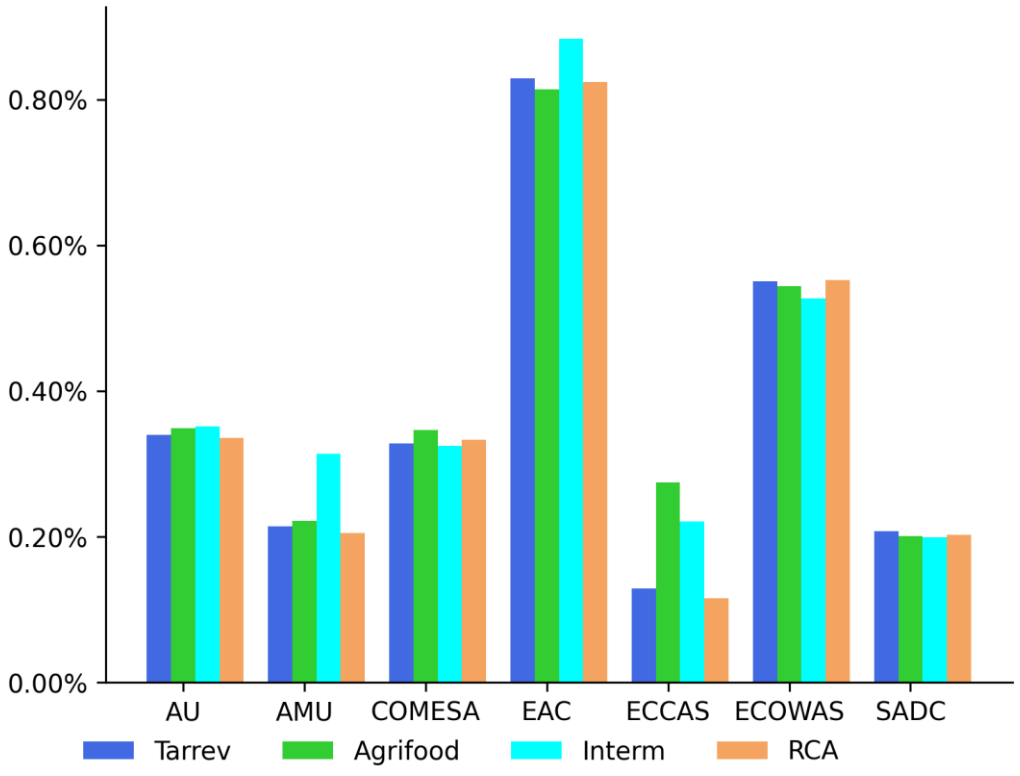

Figure 80. Changes in the ratio of real wages to cereal prices by tariff reduction strategy and REC (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

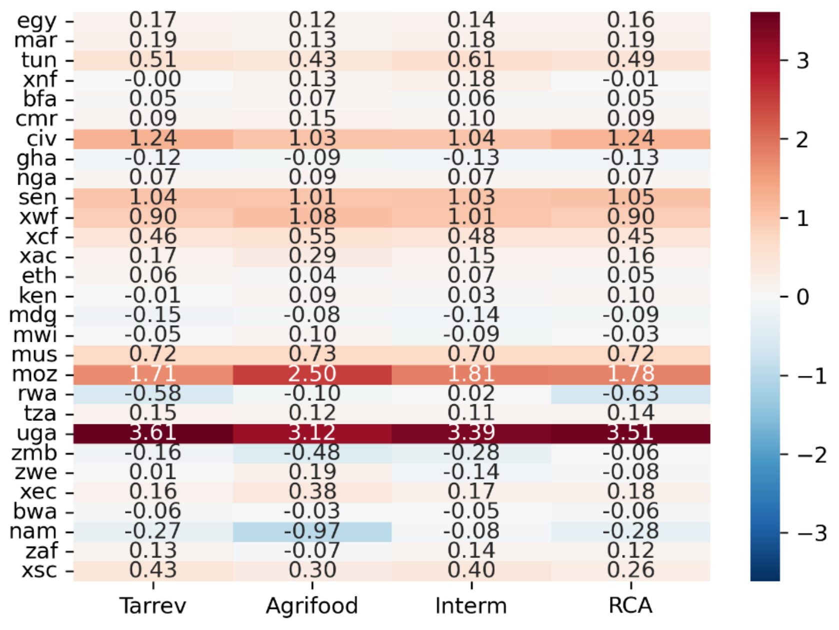

Figure 81. Changes in the ratio of real wages to cereal prices by tariff reduction strategy and region (2035, mixed NTM composition)
Source: Authors' calculation from MAGNET results.

6.4. Tariff revenues and public sector balances

Tariff revenues decrease as a result of the AfCFTA, as expected. Our results indicate that the reduction is 8.2 % at the AU level, and the range of reduction at the REC level is 4.4–13.3 % (Figure 82). However, the net effect on public expenditures is still positive for a large majority of the regions, with the increase in public expenditures being 0.30 % and the range within the RECs being 0.10–0.44 % (Figure 83). Thus, for the most part the increased economic activity can compensate for the loss in tariff revenues. Our results also show that a much smaller share of public revenue will come from the tariff revenues, a 1.0-percentage-point reduction at the AU level, whereas the range between the RECs is 0.44–2.0 percentage points (Figure 84).

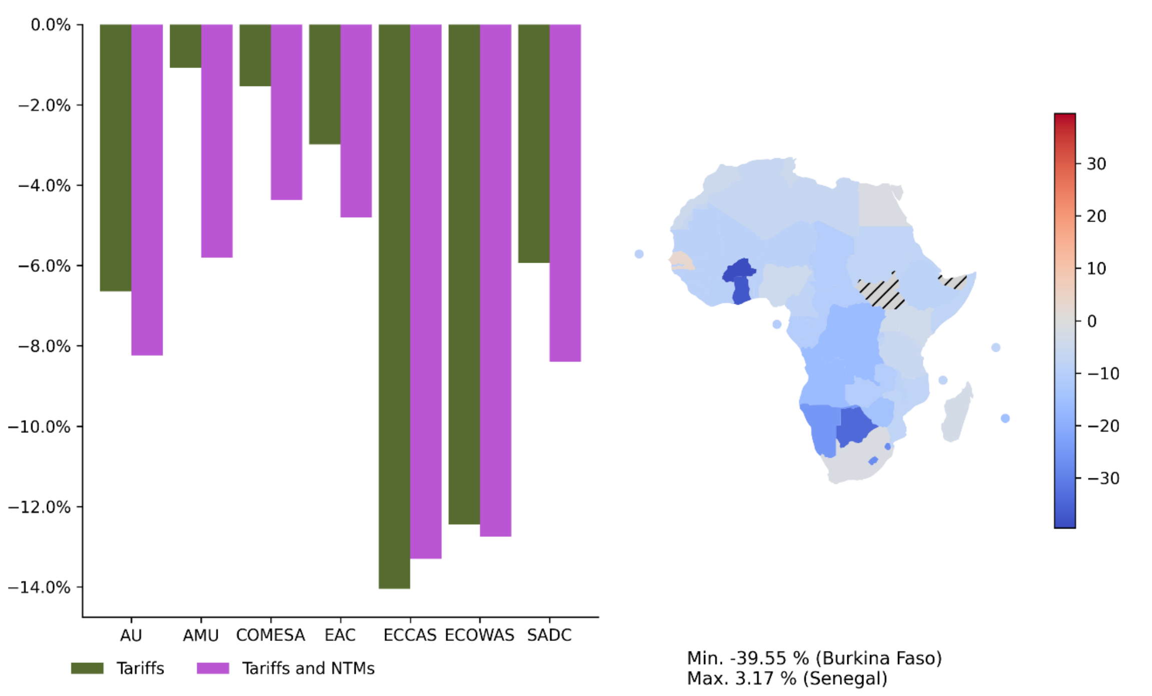

Figure 82. Changes in tariff revenues by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

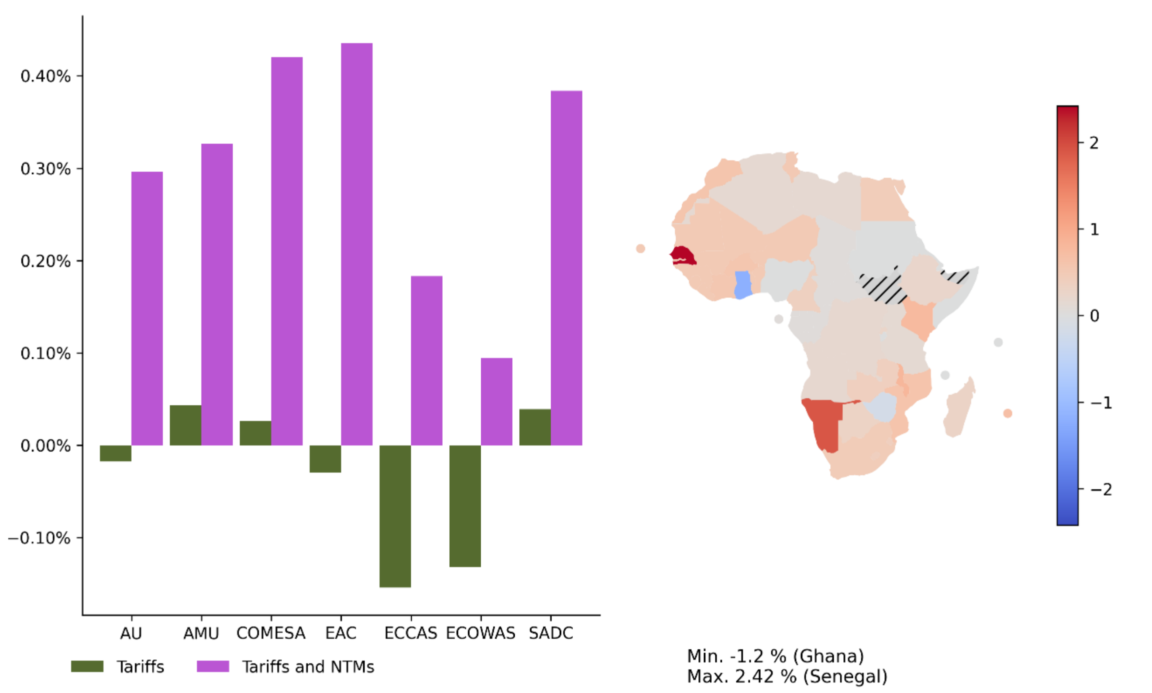

Figure 83. Changes in public expenditure by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

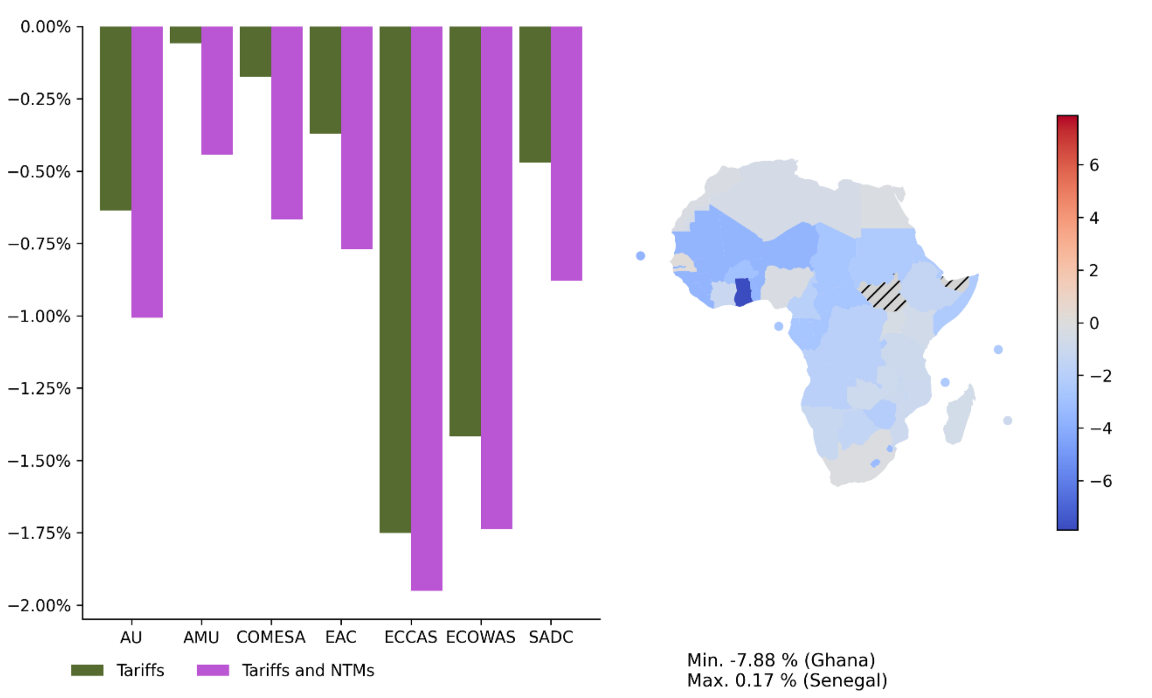

Figure 84. Changes in tariff revenues as a proportion of the public expenditure by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

6.5. Environmental indicators

The main effects that AfCFTA has on agricultural land and water uses are derived from the regional shifts in food production that were summarised in Section 6.3.1. Figure 85 depicts the land use changes: there is a small, 0.07 %, increase overall, ranging between – 0.36 % and 0.26 % at the REC level. ECCAS has the highest decrease, and SADC increases its agricultural land use the most. The changes are more significant for water use that shows a small reduction to the increase that happens in the baseline (Figure 86). The change is – 1.1 % at the AU level, and – 3.0 % in ECOWAS whose growth is the strongest on the baseline. Effectively, the AfCFTA directs agricultural production to regions that are less dependent on irrigation, and thus contributes to small water savings in the continental level.

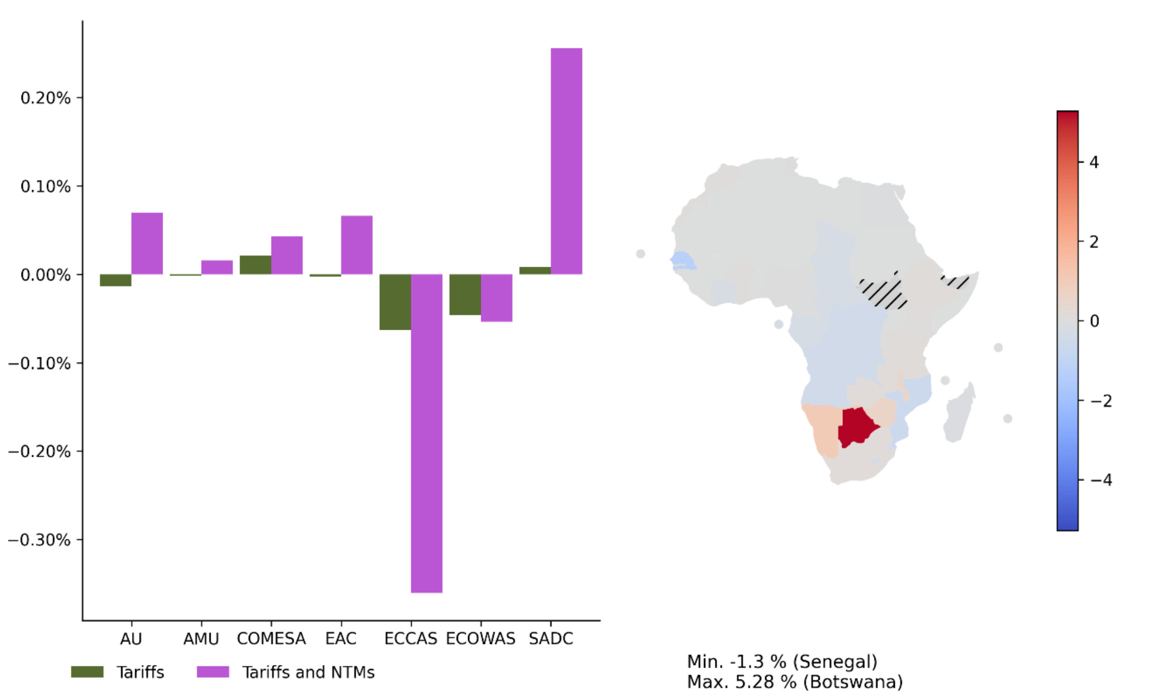

Figure 85. Changes in agricultural land use by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

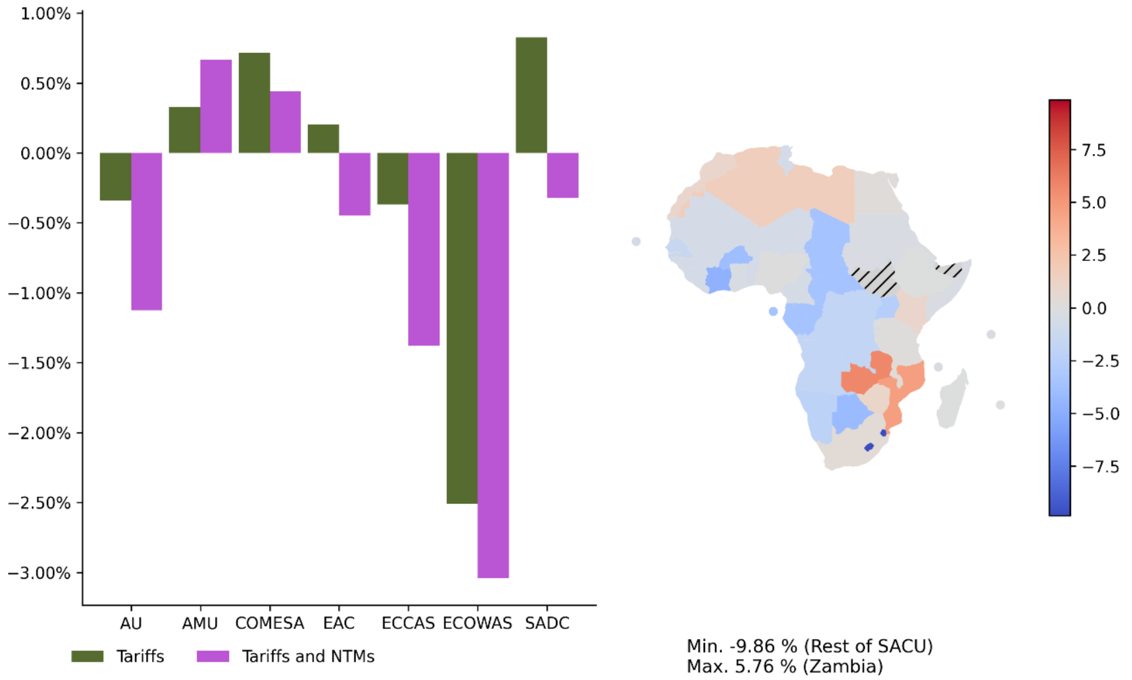

Figure 86. Changes in agricultural water use by shock decomposition and REC (2035, uniform tariff revenue maximisation)
Source: Authors' calculation from MAGNET results.

7. Conclusions and policy recommendations

7.1. Methods and key results

This report presents the effects of the implementation of the AfCFTA. The quantitative assessment was performed using the global multisector model MAGNET. MAGNET is a CGE model and analyses the economy-wide impacts of the trade policy changes involving all sectors of the regional blocs. The model reveals the impacts of these policies on bilateral trade flows and assesses the impacts of the AfCFTA on agri-food prices, supply, and demand at continental, regional and, in specific cases, country levels. The model also provides insights into food security, environmental and social indicators.

As the final tariff liberalisation offers from the AU member states detailing the exact tariff lines and rate cuts are not available yet, four hypothetical yet realistic tariff line scenarios were constructed utilising the information on the modalities of liberalisation of trade in goods agreed in the AfCFTA negotiations to date. The principal assumption was that governments will select tariff lines for exclusion and delay from liberalisation such that tariff revenue is maximised, subject to the agreed modalities. In addition, governments might follow a primary strategy that involves complete liberalisation of a defined product group before applying the tariff revenue maximisation approach to the remaining tariff lines. The four tariff liberalisation scenarios that were constructed are:

(a) tariff revenue maximisation only (Tarrev),

(b) improving food access by liberalising agri-food products (Agrifood),

(c) promoting industrialisation by liberalising intermediate input products (Interm),

(d) increasing healthy competition by liberalising industries with revealed comparative advantage within the AU (RCA).

The agreement will also enable a 50 % reduction in the costs of NTMs on merchandise and services for all trade between AU member states, and a reduction in the costs of NTMs for all trade between AU and non-AU countries owing to the harmonisation of rules and regulations and a corresponding reduction in costs of compliance with foreign rules and regulations. The costs of NTMs for trade between AU and non-AU countries were assumed to decrease by 25 %.

This report, despite not being the first to analyse the impacts of the AfCFTA, fills a gap regarding the effects of the agreement on the continental, regional and national agricultural and food sectors, and its impact on key food security indicators such as food availability (production and trade) and affordability (incomes and price). Including effects produced by both tariff and non-tariff liberalisation, the report aims to provide a realistic representation of the possible outcomes of the agreement from the macro level to the sector level.

The results, which are consistent with existing literature, show the positive impact of the AfCFTA on African economies and on the continental agri-food sectors. The policy simulations show that the AfCFTA is likely to strengthen the positive economic development of the African continent, while intracontinental trade is likely to undergo a strong positive shift. GDPs are predicted to grow moderately; however, welfare gains are more significant given both a reduction in general prices and an increase in household income.

Tariff revenues are an important part of public finances for African countries; however, despite their importance, they are predicted to decrease on our baseline. The loss of tariff revenues should not be a concern for African governments as the model shows that it should be more than covered by an increase in tax revenues from other sources thanks to the increased economic activity and the net effect on public expenditures. Therefore, this is expected to be positive for most of the regions.

Food security indicators of food availability, on one hand, are predicted to improve as a result of better access to food commodities in all the modelled regions. Food consumption and disposable incomes are also predicted to improve. Food prices, on the other hand, show more varied changes among the regions. The issue of increasing prices could undermine food security for lower-income groups and should be one of the main concerns of governments after the liberalisation period. Indeed, the study has indicated several regions where food prices will increase faster than the wages of the low-income groups.

The reported results show the crucial importance of the NTMs on the final outcomes of the agreement. It is important to emphasise again that ‘reduction’ in the context of NTMs does not mean a lowering of the NTMs per se (e.g. food standards), but instead it means harmonisation, a reduction in differences in NTMs between countries. Firstly, scenarios including only import tariff reductions show a minimal impact on the continental agri-food sectors, reinforcing the idea that NTMs are increasingly the key factors for a successful free trade agreement. Secondly, the results show a high sensitivity to the extent of the NTM reduction. More specifically, the extent of the reduction in NTMs on goods imported by the AU member states and goods exported outside the AU has substantial influence on the results of crucial food security variables, such as AU imports and production. This is also more relevant for agri-food products, for which NTMs tend to be higher than for other sectors. Increasing harmonisation with partners outside the continent is also predicted to cause an increase in imports and increased competition with domestic production. This result shows that policies accompanying the adoption of the AfCFTA to increase agri-food productivity will be crucial measures to encourage domestic production and intracontinental trade. Estimating intra-Africa NTMs and quantifying the extent of their reduction as a result of the AfCFTA is a challenging task, given the absence of empirical evidence around this issue. In addition, quantifying how much non-members of a trade agreement (third countries) could benefit from NTM harmonisation (reduction), if it decreases the cost associated with export to the newly integrated market, is extremely difficult, and often neglected, but crucial in generating results. Given the large uncertainty around NTMs, the scenarios including NTM reduction should be considered as an optimistic view about the extent to which the AfCFTA will lower NTMs, both intra-African and with respect to third countries. The potentially large trade effect triggered in this scenario represents a best-case scenario for NTM liberalisation, whereas the scenario without NTM reduction could be seen as the worst-case one. These results call for a more detailed analysis of the NTM issue within the AfCFTA and a quantitative analysis of the relationship between the reduction in NTMs within the continent and the cost associated with importing from and exporting to outside of the AU. Liberalised trade helps countries to exploit their comparative advantages. African countries can move their resources from food production to other activities, and food production might become more regionally concentrated.

Looking at the four liberalisation scenarios considered, the one promoting trade in agri-food products results in the lowest food prices and the largest increases in per capita food consumption, but also results in a slight reduction in the income gains as compared with the other scenarios. When the prices are compared to the development of wages of the low-income groups, we find that the most beneficial outcome is achieved by promoting industrialization as that yields the highest increase in the real wages to food prices ratio, and avoids the worst outcomes in the negatively affected regions. In other words, promoting low food prices doesn't have as positive effects on real incomes as promoting industrialization has. The difference shown in our results is probably a conservative estimate as it does not fully account for the ensuing dynamic effects. From a GDP perspective, the agri-food promotion liberalisation scenario results in the highest GDP gains in EAC, ECOWAS and SADC, whereas a scenario promoting trade in intermediate products lead to better outcomes for COMESA and UMA. ECCAS is predicted to have a slightly greater gain when the liberalisation is coordinated around country-specific products with a revealed comparative advantage.

7.2. Policy recommendations

The study shows that, although food consumption increases on average throughout Africa, changes in food prices could make low-income earners more vulnerable to food security risks in some regions. There are regions where the prices of basic food items increase more than the wages on low-income groups. Therefore, governments in these regions are advised to take measures to protect the vulnerable groups. In particular, establishing food safety nets, and providing adequate income transfers, should be high on these governments' agendas.

The study has also shown that the decisions on tariff offers can already mitigate the worst food security outcomes as the uniform adoption of promoting industrialization yields both the highest overall improvement of food security in vulnerable groups, it also avoids the worst outcomes in regions that will encounter negative consequences. Promoting low food prices in particular is not as beneficial as regards food security, since it does not increase the incomes of the African households as much as aiming for a more rapid industrialization and improvement of general value added of production do. However, as the results vary by region, the recommendation should be considered within the local context.

On the other hand, the study shows that most African economies, after the adoption of the AfCFTA, might become less dependent on agriculture while increasing the value added shares in their output and that trade in processed foods increases more than trade in primary agricultural products. These results indicate that governments, to further boost the regional integration and positive effects on agri-food value chain, should support a more vibrant food industry sector. The study further reveals that reduction in non-tariff measures has a larger positive impact than reduction in tariffs. This result means that governments should focus efforts in ensuring reduction (or total removal) of measures that hinder or limit the flow of goods across borders. Governments should invest in efforts that facilitate cross-border trade, and eliminate unnecessary red tape that hinders the integration of the African economies. Reduction of non-tariff measures along with trade facilitation are the key areas where the AU member states should focus to make the AfCFTA a success. However, the non-tariff measures in reality are more varied than our study can account for. As regards food security, the harmonization of food related measures such as sanitary- and phytosanitary measures require a particular scrutiny and consideration of food security aspects to yield an optimal outcome also for the vulnerable groups.

The study reveals that although trade liberalization results in lower tariff revenue in 2035 compared to no liberalization, the general economic activity stimulated by the AfCFTA will compensate the shortfall through increased revenues from other tax classes. Therefore, governments should not worry about initial tariff revenue reductions, but aim at facilitating the companies in adapting to a more open international trade and strengthening the trading partnerships within Africa and beyond.

7.3. Further research

As discussed in the section of the report describing the caveats to the approach used (Section 3.4), additional future research would be necessary to cope with some of the limitations of the current modelling approach.

Firstly, once the final AfCFTA tariff access offer is decided, the model should assess with more precision the results of the definitive market access offer instead of relying on hypothetical scenarios.

Secondly, given the structure of the database underlying the MAGNET model, the impacts of the agreement cannot be evaluated in detail either for all countries (some of them are not available within the latest GTAP version as individual countries) or at sectorial level (the commodity disaggregation is set by the structure of the GTAP database). To overcome these limitations, a linkage between the MAGNET model, a single-country CGE model and a farm-level model developed and maintained in house by the JRC is under development. These linkages should enable the results produced by the global CGE MAGNET model to be used in country-level models to produce a refined analysis, including more detailed sectorial results and impacts on a wider range of agents (e.g. urban and rural households in various regions of the countries, and farmers).

Future research should also benefit from an improved modelling approach in allocating the NTM reductions between import and export costs. Despite all these uncertainties around the analysis of the NTM reduction, the results highlight that there is a potentially large gain for the AU from an ambitious commitment to lower NTMs.

An additional stream of research should focus on the impact of a higher level of integration among African countries, including free mobility of people and/or capital.

Finally, further model enhancements should be developed to include a more refined analysis of social (nutrition, employment, migration) and environmental (emissions, resource use, footprints) indicators affected by the trade agreement and the possible interactions and impacts on food security between Africa integration and climate change issues.

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Abbreviations and definitions

AfCFTA	African Continental Free Trade Area
AMU	Arab Maghreb Union
AU	African Union
AVE	*ad valorem* equivalent
CEMAC	Central African Economic and Monetary Community
CGE	computable general equilibrium
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
ECCAS	Economic Community of Central African States
ECI	export concentration index
ECOWAS	Economic Community of West African States
EDI	export diversification index
EU	European Union
G7	Group of seven particularly vulnerable AU Member States
GDP	gross domestic product
GTAP	Global Trade Analysis Project
HS	Harmonized System (of tariff nomenclature)
HS4	Harmonized System (of tariff nomenclature; four-digit level)
HS6	Harmonized System (of tariff nomenclature; six-digit level)
HS8	Harmonized System (of tariff nomenclature; eight-digit level)
IMF	International Monetary Fund
JRC	Joint Research Centre
LDC	least-developed country
MAcMap	Market Access Map
MAGNET	Modular Applied GeNeral Equilibrium Tool
MFN	most-favoured nation
NTM	non-tariff measure
REC	Regional Economic Community
SACU	Southern African Customs Union
SADC	Southern African Development Community
SPS	sanitary and phytosanitary
SSP	Shared Socioeconomic Pathway
TBT	technical barrier to trade

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Annexes

Annex 1. Commodity aggregation in MAGNET simulations

Commodity	MAGNET codification	Commodity subsets ([30]) A	B	C	D	E	F	G	H
Paddy rice	pdr	X		X					
Wheat	wht	X		X					
Cereal grains not elsewhere classified (n.e.c.)	gro	X		X					
Horticulture	hort	X		X					
Oilseeds	osd	X		X					
Sugar (cane and beet)	c_b	X		X					
Plant-based fibres	pfb	X		X					
Crops n.e.c.	ocrops	X		X					
Cattle	ctl	X		X					
Other animal products	oap	X		X					
Raw milk	rmk	X		X					
Wool, silkworm cocoons	wol	X							
Fishing	fish			X	X				
Forestry	for				X				
Coal	coa					X			
Oil	oil					X			
Gas	gas					X			
Other mining extraction	oxt					X			
Cattle meat	cmt		X	X					
Meat products n.e.c.	omt		X	X					
Vegetable oils and fats	vol		X	X					
Dairy products	mil		X	X					
Processed rice	pcr		X	X					
Sugar	sugar		X	X					
Other food products	ofd		X	X					
Beverages and tobacco products	b_t		X	X					
Animal feed	feed		X	X					
Light manufacturing	LightManuf						X		
Lumber	lum						X		
Paper and paper products	ppp						X		
Petroleum and coal products	petro						X		
Manufacture of chemicals and chemical products	chm						X		
Fertilisers	fert						X		
Manufacturing	Manuf						X		
Electricity	ely							X	
Gas distribution	gas_dist							X	
Wholesale and retail trade	trd								X
Transport	Trnsp								X
Food services	foodserv								X
Services	serv								X

([30]) A = primary agricultural commodities, B = processed foods, C = food commodities, D = renewable resources, E = non-renewable resources, F = manufacturing, G = utilities, H = services.

Annex 2. Regional aggregation of the African countries/territories

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

Congo	xcf	xcf			X			
Equatorial Guinea	xcf	xcf			X			
Gabon	xcf	xcf			X			
São Tomé and Príncipe	xcf	xcf			X			
Angola	xac	xac			X		X	
Democratic Republic of the Congo	xac	xac	(X)		X		X	
Ethiopia	eth	eth	X					
Kenya	ken	ken	X	X				
Madagascar	mdg	mdg	X				X	
Malawi	mwi	mwi	X				X	
Mauritius	mus	mus	X				X	
Mozambique	moz	moz					X	
Rwanda	rwa	rwa	X	X	X			
Tanzania	tza	tza		X			X	
Uganda	uga	uga	X	X				
Zambia	zmb	zmb	X				X	
Zimbabwe	zwe	zwe	X				X	
Burundi	xec	xec	X	(X)	(X)			
Comoros	xec	xec	X				(X)	
Djibouti	xec	xec	X					
Eritrea	xec	xec	X					
Mayotte	xec	xec	X					
Seychelles	xec	xec	X				(X)	
Somalia	xec	xec	X					
Sudan	xec	xec	X					
South Sudan ([31])	—	—		(X)				
Botswana	bwa	bwa					X	

[31] South Sudan is not included in the most recent version of the GTAP database and was thus not part of the analysis.

Namibia	nam	nam					X	
South Africa	zaf	zaf					X	
Eswatini	xsc	xsc	(X)				X	
Lesotho	xsc	xsc					X	

NB: The GTAP and MAGNET columns show the GTAP and MAGNET regional aggregations of African countries, respectively. The remaining columns show how the countries are aggregated to the various RECs: COMESA, EAC, ECCAS, ECOWAS, SADC, and UMA. The regional label X means that a country belongs to that REC in reality and in model results. The label (X) means that the country belongs to that REC in reality, but not in the model results. The label O means that the country belongs to the REC in the model results but not in reality. The discrepancies between the real REC memberships and the modelled ones are due to the regional aggregation of the GTAP model. The rest of the world is aggregated in the following seven regions: the EU-27, the United Kingdom, the rest of Europe, North and South America, Asia, the Middle East, and the rest of the world.

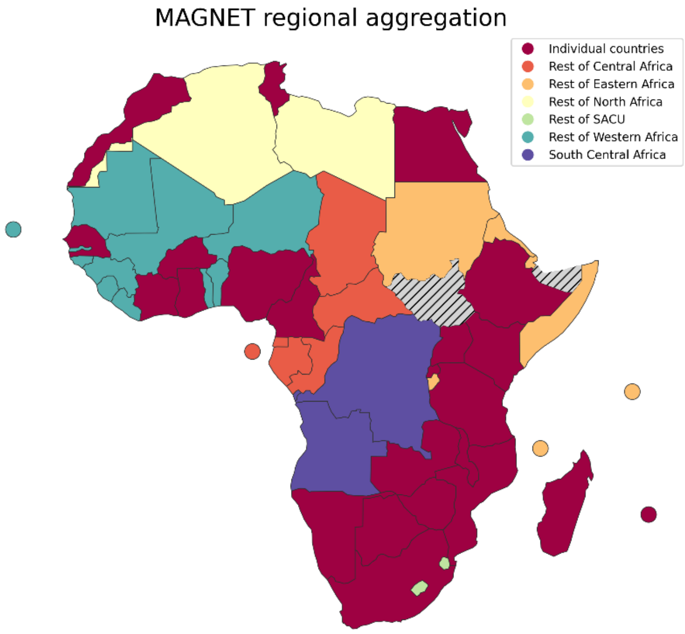

Figure A2.1 Regional aggregations of African countries used in the simulations. The following regions are not visible on the map: Saint Helena (included in Rest of Western Africa) and Mayotte (included in Rest of Eastern Africa).

Annex 3. Yearly GDP growth rates on the baseline by region

Region	2020–2025	2025–2030	2030–2035
Asia	4.65	3.74	2.98
Botswana	3.71	3.14	2.69
Burkina Faso	6.72	6.51	6.23
Cameroon	5.8	5.78	5.49
Côte d'Ivoire	8.91	8.31	7.3
Egypt	5.64	5.26	4.88
Ethiopia	6.32	6.25	6.02
EU	1.55	1.52	1.53
Ghana	6.63	6.09	5.65
Kenya	5.86	5.78	5.5
Madagascar	6.32	6.67	6.6
Malawi	7.01	7.03	6.85
Mauritius	3.94	3.24	2.72
Middle East	3.87	3.54	3.09
Morocco	5.47	5.04	4.6
Mozambique	6.93	6.34	5.87
Namibia	4.52	4.35	3.9
Nigeria	6.47	6.26	5.95
North and South America	2.53	2.16	1.89
Rest of Central Africa	4.69	4.58	4.41
Rest of Eastern Africa	5.71	5.58	5.34
Rest of Europe	2.8	2.57	2.24
Rest of North Africa	4.07	3.4	2.63
Rest of SACU	3.82	4.19	4.3
Rest of the world	3.31	2.8	2.47
Rest of Western Africa	6.92	6.71	6.36
Rwanda	7.01	6.65	6.22
Senegal	5.82	5.73	5.53
South Africa	4	3.49	3.09
South Central Africa	4.35	3.73	3.39
Tanzania	7.34	7.03	6.55
Tunisia	5.36	4.82	4.21
Uganda	7.45	7.26	6.94
United Kingdom	2.05	1.81	1.72
Zambia	7.09	6.94	6.53
Zimbabwe	4.57	5.58	6.15

Annex 4. Web infographic with interactive data visualisations

This report is associated to an interactive infographic published on the European Commission's data portal of agro-economic modelling (DataM website). Find below the link and the related QR code.

https://datam.jrc.ec.europa.eu/datam/mashup/AFCFTA/index.html

Figure A3.1. QR code – AfCFTA interactive infographic
Source: JRC, 2021.

This is the link to the home page of the DataM portal

https://datam.jrc.ec.europa.eu

Figure A3.2. QR code – AfCFTA interactive infographic
Source: JRC, 2021.

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