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The African Continental Free Trade Area: Economic and Distributional Effects[1]

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Abstract

The African Continental Free Trade Area (AfCFTA) agreement will create the largest single market in the world—encompassing 55 nations, 1.3 billion people and an economic area with a GDP valued at $3.4 trillion. This paper quantifies the long-term economic and distributional implications of the AfCFTA using a global computable general equilibrium model (CGE) and a microsimulation framework. The analysis goes beyond previous studies that have largely focused on tariff and nontariff barriers in goods—by including the effects of services and trade-facilitation measures, as well as distributional impacts on poverty, employment, and wages of female and male workers. Simulation results suggest that the agreement could double intra-regional trade, increase real income in AfCFTA countries by 7 and lift 30 million people in the continent from extreme poverty. In addition, the agreement would increase employment opportunities and wages for unskilled workers and help to close the wage gap between men and women. While on aggregate, distributional outcomes improve, some countries can experience a worsening of the wage gap faced by unskilled, female and young workers indicating the importance of complementary policy reforms.

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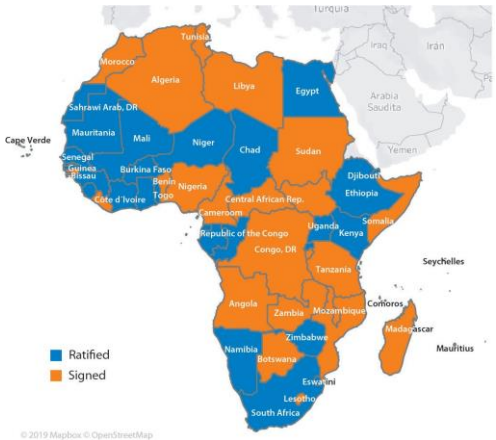
1. INTRODUCTION

On March 21, 2018, at the 10th Extraordinary Summit of the African Union, almost all countries on the African continent signed the African Continental Free Trade Area Agreement (AfCFTA) creating the largest free trade area in the world—connecting 55 countries and 1.3 billion people. The combined GDP of AfCFTA economies is valued at $3.4 trillion. The agreement officially entered into force on May 30, 2019 after ratification of the agreement by 22 countries (see Figure 1 below). AfCFTA aims at addressing the long-standing economic fragmentation of Africa. Existing trade barriers remain high across the continent. While statutory tariffs have been reduced below 5 percent for roughly half of the countries, they remain high for sensitive sectors. There are many other barriers that are restricting continental economic integration—non- tariff barriers in services and other sectors, weak and fragmented rules to promote investment and competition, inadequate institutions such as customs management to facilitate trade.

Figure 1: AfCFTA member countries, by status of ratification



Source: Authors' estimates.
Note: As of October 29, 2019. The map was constructed with available layers in Tableau® version 10.5. As a result, the map above does not represent the official position of the World Bank or its Board of Directors. This visualization was generated exclusively for drafting this report.

African countries account for less than 3 percent of world trade and GDP, but 16.7 percent of population (Figure 2). Poverty reduction remains a critical priority. The signatory countries trade little with each other—less than 8 percent of their exports are directed to other prospective member countries. This share is low even compared to intra-regional trade in Africa, which is around 11 percent, suggesting that there are important constraints to the growth of regional trade. The poverty headcount ratios are high in AfCFTA countries, averaging 32.2 percent, ranging from Madagascar with 77.8 percent of the population living below the poverty line ($1.90 a day) to Algeria and Mauritius, with 0.5 percent.[2]

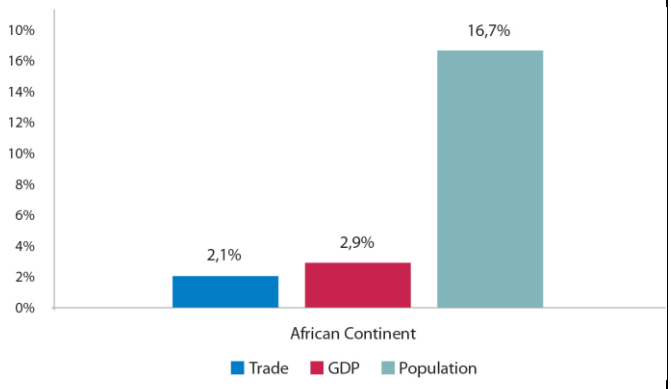
This study assesses the potential economic implications of AfCFTA, quantifying the impacts using a computable general equilibrium model (CGE) calibrated to the most recent database produced by the Global Trade Analysis Project (GTAP). The GTAP database is supplemented by additional data that quantifies some of the other aforementioned barriers to trade, that, if part of the integration package, could support the elimination of tariffs in boosting trade integration and accelerating growth. To date, macroeconomic studies on the economic implications of Africa's regional integration have mainly focused on tariff and non-tariff barriers (NTBs) in goods. Our study extends the analysis to cover NTBs in services and other sectors and trade facilitation measures. Most importantly, we extend the analysis to investigate the implications of AfCFTA for poverty, income distribution, impacts on unskilled workers, youth, and women.

We designed the forward-looking scenarios by employing the global dynamic CGE model and the global microsimulation framework Global Income Distribution Dynamics (GIDD). This approach allows for the analysis of global development and structural transformation, incorporating the complex interactions of productivity differences at the country, sector, or factor level; shifts in demand as income rises; demographic and skill dynamics in factor markets; and changes in comparative advantage and trade flows from globalization or trade liberalization. The analysis on distributional outcomes of AfCFTA required i) building a new dataset on employment and wages of female and male workers at the industry level across AfCFTA members; ii) building a gender sensitive CGE model; and iii) updating several household surveys to be used in the microsimulations (see Annex G: Data preparation on disaggregated labor volumes and wages).

[2] These statistics do not cover informal or small-scale cross border trade flows, which have been estimated to provide income to 43% of African population (Afrika; and Ajumbo 2012), support poverty reduction and improve food security.

While there are several sub-regional integration agreements in Africa that aim in part at achieving the same set of goals, the impact of AfCFTA is likely to stem from two main features. First, in the policy areas that are already covered by sub- regional agreements, AfCFTA will provide a non-discriminatory reduction in tariffs and a common regulatory framework, thereby reducing fragmentation of the continental market. Second, sub-regional agreements in Africa tend to be relatively shallow covering few of the non-tariff measures that affect trade integration. AfCFTA could make substantial progress in ensuring NTBs are more conducive to continental trade integration. Specifically, in order to assess the implications of AfCFTA, the analysis develops a set of policy scenarios to cover: i) tariff changes differentiating between the timeframe of tariff liberalization of least developed countries (LDCs) and non-LDCs; ii) reduction of NTBs in goods and services; iii) improvements in trade facilitation.

Figure 2: Trade, GDP and Population in the African Continent as a share of global total (percent)



Source: World Development Indicators

The study presents background information on the content of AfCFTA and the data used for the quantification exercise. It then presents the key findings of the macroeconomic simulations and the analysis of the distributional impacts of the agreement.

2. THE CONTENT OF AFCFTA AND AFRICAN-SUB REGIONAL TRADE AGREEMENTS

At its launch, the Framework Agreement establishing the African Continental Free Trade Area (AfCFTA) was signed by 44 countries at a Summit of the African Union (AU) held in Kigali, Rwanda, on March 21st, 2018. AfCFTA was proposed in 2012[3] and hopes were that an agreement would be reached in 2017. The first phase comprised negotiation of three Protocols for: (i) Trade in Goods;[4] (ii) Trade in Services;[5] and (iii) Rules and Procedures for Settlement of Disputes.

The Agreement requires members to progressively remove tariffs on at least 97 percent of tariff lines that account for 90 percent of intra-African imports.[6] Average tariffs are 6.1 percent, but with a high variation across countries and sectors. Intra- African trade is highly concentrated, with 1 percent of tariff lines accounting for 74 percent of imports in the average African country. Thus, some of the most onerous and protectionist tariffs may be maintained even if countries liberalize most tariff lines. Trade in select sensitive sectors is expected to be liberalized over a longer period, and other goods are likely to remain excluded from liberalization.[7]

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[3] African Union Assembly Decision Assembly/AU/Dec. 394(XVIII) as part of the Action Plan on Boosting Intra- Africa Trade in Africa (BIAT).

[4] The overarching aims of the agreement with respect to goods are: i) Progressive elimination of tariffs; ii) Progressive elimination of non-tariff barriers; iii) Enhancing the efficiency of customs, trade facilitation, and transit; iv) Cooperation on Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary (SPS) measures; v) Development and promotion of regional and continental value chains; vi) Socio-economic development, diversification and industrialization across Africa

[5] The overarching aims of the agreement with respect to services are: i) Enhance competitiveness of services; ii) Promote sustainable development; iii) Foster investment; iv) Accelerate efforts on industrial development to promote the development of regional value chains; v) Progressively liberalize trade in services

[6] A special dispensation for 7 LDCs has also been tabled, providing for a reduced level of ambition on tariff liberalization. Djibouti, Ethiopia, Madagascar, Malawi, Sudan, Zambia, and Zimbabwe will be expected to meet a reduced level of ambition of 85 percent of tariffs at entry into force of AfCFTA, with a 15-year period to reach 90 percent.

[7] AfCFTA could use the lessons from the most recent World Bank's analysis of trade policy and barriers in CEMAC. World Bank (2018) finds that trade within CEMAC remains limited despite a significant regional integration effort.

The AfCFTA annex on rules of origin is yet to be finalized. Rules of origin describe the transformation a product must undergo in the region, such as the share of value added, to enjoy preferential market access. They are used to prevent goods from non-member countries entering through a low-tariff country and being transshipped duty free to another member country. Rules of origin that are too restrictive can negate the preferential market access intended by the free trade agreement and prevent global supply chains from functioning. South Africa and Nigeria expressed concerns that too lenient or mismanaged rules of origin will provoke a flood of extra-regional products coming in with low levels of value addition.

Services negotiations began in June 2018, and countries have identified five priority sectors, namely financial services, transport, telecom/IT, professional services, and tourism. The benefits of services liberalization extend far beyond the service sectors themselves; they affect all other economic activities that use services as inputs. A second phase of negotiations will focus on investment, competition, and intellectual property rights, with a potential of deepening AfCFTA. Research finds that deep trade agreements boost trade, foreign investment, and participation into global value chains (Mattoo, Mulabdic, and Ruta 2017; Mulabdic, Osnago, and Ruta 2017; Laget et al. 2018). Yet, these areas also involve complex negotiations.

An important question is how AfCFTA will complement existing African sub- regional preferential trade agreements (PTAs). This study provides an analysis of the content of AfCFTA based on the legal text of the agreement and compares it with the policy areas covered in existing African PTAs.[8] The analysis indicates that AfCFTA could promote regional economic integration in Africa in two ways. First, in the policy areas that are already covered by sub-regional PTAs, AfCFTA will offer a common regulatory framework, thereby reducing market fragmentation created by different sets of rules. Second, African sub-regional trade agreements tend to be shallow. AfCFTA will be an opportunity to regulate policy areas important for economic integration that are often regulated in trade agreements but have so far not been covered in most African PTAs.

For this study, we focus on the following African sub-regional PTAs, which are in force and have been notified to the World Trade Organization (WTO) as of September 2019: The Common Market for East and South Africa (COMESA); the East African Community (EAC); the Economic Community of West African States (ECOWAS); the South African Development Community (SADC); the South African Customs Union (SACU); West African Economic and Monetary Union (WAEMU); and the Economic and Monetary Community of Central Africa (CEMAC).[9] The detailed references to the legal text of the agreements are in Annex A: Deep commitments in African RECs – legal texts.

Understanding the detailed content of trade agreements beyond tariffs is essential to appreciate their potential effects. Modern-day PTAs are not just more common instruments of trade policy liberalization, countries participating in PTAs have deepened and expanded their scope.[10] The average PTA in the 1950s covered eight policy areas. In recent years the number went up to 17. "Deep" trade agreements matter for economic development. The rules embedded in these agreements contribute to determine how economies function and, hence, grow. For example, trade and investment regimes determine the extent of economic integration, competition rules affect economic efficiency, intellectual property rights protections matter for innovation.

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[8] The analysis of the sub-regional PTAs draws on the World Bank database on the content of trade agreements (Hofmann, Osnago, and Ruta 2017) which is based on the review of policy areas covered in the PTAs' main legal instrument or founding treaty. The analysis of AfCFTA is based on the text of the agreement signed in March 2018 establishing the continental free trade area.

[9] Not included in this study are four Regional Economic Communities (RECs) that are recognized by AfCFTA Agreement but are not trade agreements that have been notified to the WTO: The Arab Maghreb Union (UMA); the Community of Sahel-Saharan States (CEN-SAD); the Economic Community of Central African States (ECCAS); and the Intergovernmental Authority on Development (IGAD). SACU, WAEMU, and CEMAC are not acknowledged as RECs in AfCFTA Agreement (Art.1(t)) but fall within the ambit of Article 19(2) of AfCFTA Treaty.

[10] Preferential trade agreements have always been a feature of the world trading system, but their prominence has changed in recent years. The number of PTAs has increased from 50 in the early 1990s to roughly 300 in 2019. All WTO members are currently party of one, and often several, PTAs.

The inclusion of new policy areas in PTAs is not random. As shown in Mattoo, Mulabdic, and Ruta (2017), trade agreements covering few policy areas generally focus on traditional trade policy areas, such as tariff liberalization or customs. Agreements with broader coverage tend to include trade-related regulatory issues, such as technical barriers to trade, or subsidies. Finally, agreements with large numbers of provisions often include policy areas that are not directly related to trade, such as labor, environment, and migration issues.[11] In this analysis of the content of AfCFTA and the African sub-regional PTAs, we focus on the 20 policy areas most commonly included in trade agreements in force and notified to the WTO.

Table 1: Overview of policy areas covered in sub-regional African PTAs compared to AfCFTA

	East African Community (EAC)	Common Market for East and South Africa (COMESA)	South African Development Community (SADC)	Economic Community of West African States (ECOWAS)	West African Economic and Monetary Union (WAEMU)	South African Customs Union (SACU)	Economic and Monetary Community of Central Africa (CEMAC)	African Continental Free Trade Agreement (AfCFTA)
Tariffs on manufacturing goods	✓	✓	✓	✓	✓	✓	✓	✓
Tariffs on agricultural goods	✓	✓	✓	✓	✓	✓	✓	✓
Export taxes	✗	✓	✓	✗	✓	✗	✓	✓
Customs	✓	✓	✓	✓	✗	✓	✗	✓
Competition policy	✓	✓	✓	✗	✓	✓	✓	✓
State aid	✓	✓	✓	✗	✗	✗	✓	✗
Anti-dumping	✗	✓	✓	✓	✗	✗	✓	✓
Countervailing measures	✗	✓	✓	✗	✗	✗	✗	✓
STE	✗	✗	✗	✗	✗	✗	✗	✓
TBT	✓	✓	✓	✗	✗	✓	✓	✓
GATS	✓	✓	✓	✓	✓	✗	✓	✓
SPS	✓	✓	✓	✗	✗	✓	✓	✓
Movement of capital	✓	✓	✗	✓	✓	✗	✓	✓
Public Procurement	✓	✗	✗	✗	✗	✗	✗	✗
IPR	✓	✗	✗	✗	✗	✗	✗	✓
Investment	✓	✓	✓	✗	✗	✗	✗	✓
Environmental laws	✓	✓	✗	✓	✗	✗	✓	✗
Labor market regulation	✓	✓	✗	✗	✗	✗	✗	✗

Note: Explanation: 1 = policy area covered; 0=policy area not covered

TRIPS = Trade-Related Aspects of Intellectual Property Rights; STE = State Trading Enterprises;TBT = Technical Barriers to Trade; GATS = General Agreement on Trade in Services; SPS = Sanitary and Phytosanitary Measures; IPR = Intellectual Property Rights;TRIMS = Trade-Related Investment Measures

Source: Based on (Hofmann, Osnago, and Ruta 2017).

There are two policy areas that have not (except for a few occasions) been covered in the African sub-regional PTAs, but are included in AfCFTA. One is intellectual property rights, which is only covered in one sub-regional African PTA.[12] Moreover, while none of the sub-regional African PTAs covers the area of state-trading enterprises (STE). AfCFTA includes this policy area.

[11] A study of EU and US trade agreements identifies a total of 52 potential policy areas covered in PTAs (Horn, Mavroidis, and Sapir 2010).

[12] EAC

Finally, while AfCFTA is deeper than any of the existing sub-regional PTAs, there are some policy areas that are included in individual sub-regional PTAs but not in AfCFTA. Examples of these areas are state aid (i.e. subsidies),[13] environmental laws,[14] labor market regulations,[15] and public procurement.[16] The lack of inclusion of these policy areas in AfCFTA does not prevent countries to aim for common regulations at a later stage and does not affect the commitments taken by countries in the context of the sub-regional PTAs.

An important issue is how inconsistencies or conflict between different jurisdictions, sub-regional or regional will be addressed. As a general comment, Art.19 of AfCFTA Treaty refers to "conflict and inconsistency with Regional Agreements". Art.19(1) establishes that, unless otherwise provided, AfCFTA prevails in case of inconsistencies. At the same time, Art.19(2) refers to the case of "higher levels of regional integration" than those established in AfCFTA, such as for example in "regional economic communities, regional trading arrangements and custom unions". In the latter situation, and as a general rule, States Parties maintain such higher levels among themselves. It remains to be seen how this will be implemented in practice.

3. LITERATURE REVIEW

Our results are broadly in line with the existing literature on the quantitative impacts of AfCFTA. All studies conducted so far have focused on the evaluation of implications of tariff and NTM reduction as well as trade facilitation measures on African welfare. The studies are reviewed in Annex G. The Table 1 below summarizes the key findings of CGE and structural trade models in terms of economic growth and trade implications of AfCFTA. Despite the fact that all previous CGE studies apply comparative static simulations and are based on older data sets (GTAP version 9 or earlier) and often more aggressive trade liberalization scenarios (full tariff liberalization, full elimination of NTBs), our results are broadly aligned. Consistently, the biggest gains are expected from the reduction of NTBs and trade facilitation with significant increases in intra-African trade between 50-132 percent and GDP gains between 1-4 percent.

[13] EAC, COMESA, SADC, CEMAC
[14] EAC, COMESA, ECOWAS, CEMAC
[15] EAC, COMESA
[16] EAC

Table 2: Summary of key findings from the literature

	Scenarios	GDP	Intra African Trade	Total Exports	Total Imports
Removal of tariffs on intra-AfCFTA trade					
African Economic Outlook 2019	Removal of all tariffs on intra-AfCFTA trade	0.10% (US$ 2.8b)	14.60% (US$10.1b)	1.00% (US$5.8b)	0.90% (US$5.8b)
Deepening Regional Integration in Africa (Meve and Karingi, 2012)	Removal of al tariffs on intra-AfCFTA trade by 2017 + CET	0.20%	52.30%	4.00%	
The Continental Free Trade Area - A GTAP assessment (Jensen and Sandrey, 2015)	Removal of all tariffs on intra-AfCFTA trade	0.70%	4.30%	3.11%	
ACFTA: Challenges and Opportunities (Saygili, et al., 2017)	Removal of all tariffs on intra-AfCFTA trade	0.97% 32.80%	2.50%	1.80%	
The African Continental Free Trade Agreement: Welfare Gains Estimates from a General Equilibrium Model (2019)	Removal of all import tariffs	0.037% - 0.053%* *EV			
The African Continental Free Trade Area: Economic and Distributional Effects	Gradual removal of 97% of tariffs on intra-AfCFTA trade	0.13% (US$12b)	21.76% (US$131b)	1.78% (US$35b)	2.31% (US$41b)
Removal of tariffs and NTBs on intra-AfCFTA trade					
African Economic Outlook 2019	Removal of all tariffs on intra-AfCFTA trade Removal of NTBs	1.25% (US$37b)	107.20% (US$74.3b)	44.30% (US$107.2b)	33.80% (US$214.1b)
The Continental Free Trade Area - A GTAP assessment (Jensen and Sandrey, 2015)	Removal of all tariffs 1.60% on intra-AfCFTA trade 50% reduction in NTBs		7.26%	6.28%	
The African Continental Free Trade Agreement: Welfare Gains Estimates from a General Equilibrium Model (2019)	Removal of all tariffs and 35% NTB reduction	7.60% - 1.89% - 2.11%* *EV	8.40%		
The African Continental Free Trade Area: Economic and Distributional Effects	Gradual removal of 97% of tariffs on intra-AfCFTA trade	2.24%	51.85%	18.84%	19.58%
Removal of tariffs and NTBs on intra-AfCFTA trade, implementation of TFA					
African Economic Outlook 2019	Removal of all tariffs on intra-AfCFTA trade Removal of NTBs Implementation of the TFA	3.50% (US$100b)	132.70% (US$92b)	51.10% (US$295.6b)	46.20% (US$292.8)
The African Continental Free Trade Area: Economic and Distributional Effects	Gradual removal of 97% of tariffs on intra-AfCFTA trade 50% reduction in NTBs Implementation of the TFA	4.20% (US$413b)	92.07% (US$556)	28.64% (US$560b)	40.61% (US$714b)

Source: Authors' estimates

4. DATA AND METHODOLOGY

Data

The core data is sourced from the GTAP database (Aguiar et al. 2019). It provides a snapshot of the global economy in 2014—including domestic inter-industry flows and bilateral trade flows. The full database has 141 regions, of which 121 are individual countries, and 65 sectors. For the purposes of this study, the 141 regions are aggregated into 37 regions including all 32 regions in Africa that are part of the database, of which 24 are individual countries with the remaining countries aggregated into five regional components. The 65 sectors are aggregated into 21. The GTAP data is based on official trade flows, but the magnitude of small-scale cross border trade is estimated to be substantial in Africa (Box 1) leading to underestimation of the actual trade flows.

The core data is supplemented with additional information. GTAP's tariff rates are replaced with the most recent estimates, as measured by the World Bank. In addition, the study incorporates estimates of NTBs. The NTBs for goods are sourced from World Bank's World Integrated Trade Solution (WTIS) database and documented in Kee et al. (2009). These are aggregated to the model's regional and sector aggregation using trade weights. Estimates for the missing countries/regions are given by the simple average of the available estimates. The NTBs for services are sourced from Jafari and Tarr (2015). These are provided for 11 services that are mapped to an aggregation of GTAP services. These three sources of data are incorporated into the 2014 reference year using a procedure that aims to preserve as much as possible the original structure of the aggregated GTAP database.

Global dynamic computable general equilibrium model

The quantitative estimates of the impacts of AfCFTA rely on the Envisage computable general equilibrium model. It is a recursive dynamic model, calibrated to the GTAP database and has been at the World Bank for a number of studies[17]. The baseline, or reference simulation, runs from 2014 through 2035. The simulation is calibrated to the UN population projection (2015 Revision), combined with a long-term socio-economic scenario developed by the Integrated Assessment Modeling (IAM) community—the so-called socio-economic pathways (SSPs). There are five such pathways describing different possible storylines of the evolution of global GDP. SSP2 was selected for this study, the so-called 'Middle of the Road Scenario'.

Distributional impacts of AfCFTA

The poverty and distributional impacts of AfCFTA depend on the changes in relative prices across and within countries. To capture the full—between and within country—distributional change, one needs a framework that captures both effects at the macro level (country averages) and the evolution of factor markets at the micro level (dispersion). To account for both effects, this paper uses the GIDD microsimulation framework in combination with the Envisage global CGE model.[18] Both tools have been developed at the World Bank and are described in detail by Bourguignon, Bussolo, and Pereira da Silva (2008); Bussolo, De Hoyos, and Medvedev (2010); and van der Mensbrugghe (2013). The next sub-sections briefly describe the GIDD features.

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[17] In the context of Belt and Road Initiative (Maliszewska and van der Mensbrugge, 2019) or Comprehensive and Progressive Trans-Pacific Partnership (Maliszewska, Olekseyuk and Osorio-Rodarte, 2018) and others.

[18] The origin of dynamic microsimulation can be traced back to the 1950s seminal work of Orcutt (1957), whose contributions aimed at overcoming the limitations of models available at that time. Orcutt observed that those earlier models could be used to predict the aggregate impact but could not describe the distributional impact of policy reforms nor the effects on inequality of long-term trends, such as demographic change. Data availability and modeling have significantly advanced since then, yet dynamic microsimulations remain the main tool to study distributional change and to provide the unique perspective of projecting samples of population forward in time.

Box 1: The Importance of Small-Scale Cross-Border[19]

While deeper regional integration is one of the key trade policy objectives for countries in Africa, a large part of intra-African trade currently goes unrecorded. This is because cross-border transactions often take place at a small scale and such consignments are not captured by standard statistical recording of trade through customs declarations. Because the number of small shipments can be very large, the total unrecorded volume and value of trade can be substantial. Hence, official trade statistics are incomplete and possibly misleading. Indeed, the poor quality of official trade statistics is seen as one reason why recorded regional trade in Africa remains surprisingly low (Golub, 2015). As one example, the Petite-Barriere border crossing between Rwanda and the Democratic Republic of Congo (DRC) in Goma is one of the busiest borders in Africa with more than 40,000 small-scale traders crossing on a normal day. In turn, policy makers lack a holistic and complete understanding of the magnitude of, and impediments to, intra-regional trade that is required to design effective trade and investment policies.

These unrecorded cross-border transactions are sometimes casually referred to as "informal trade" or "illegal trade". However, while many small-scale traders may not be registered as formal business owners, this informal status does not imply that they are intentionally trying to circumvent existing laws, applicable taxes, or relevant procedures (Brenton and Soprano, 2018). Moreover, some individuals might conduct both formal and informal activities, they might pay one tax and not another, or complete one formality and not another (WCO, 2015). Previous research has shown that small-scale traders and the producers and consumers they connect fall into the bottom third of the population by household income. Thus, small-scale cross-border trade (SSCBT), is directly relevant for poverty reduction (Brenton et al., 2013). In addition, SSCBT also makes a notable contribution to regional food security by linking markets across borders. A large proportion of small-scale operators at border crossings tend to be female. Women assume a variety of roles in small-scale trade as border traders, transporters, processors, or vendors. In many cases, they face more severe impediments to trade than their male colleagues in the form of higher trade costs and more pervasive corruption, more limited access to price and market information, and more frequent harassment and abuse (Brenton et al., 2013; Aboudou et al., 2017).

A range of studies based on surveys at borders attest to the importance of small-sale trade across a range of countries in Africa. For example, Bensassi et al., (2018) analyze data from interviews with 8,883 traders at border crossing points of Benin with Togo and Nigeria. They find that unrecorded imports into Benin are as important as recorded imports, while for exports, the value of unrecorded transactions are more than five times higher than official exports reported in customs statistics. In addition, the statistical offices of Uganda and Rwanda have been monitoring quantitative and qualitative aspects of SSCBT since 2005 and 2010, respectively. These efforts provide for the most rigorous and reliable assessments of the importance of SSCBT. Uganda's approach has been to send enumerators to targeted borders for two weeks per month to capture SSCBT trade flows through observation and then to extrapolate the data for full-month coverage. Rwanda uses enumerators recruited in the border areas who work with electronic tablets and administer a survey throughout the year. In both countries, the observed SSCBT has been substantial. In 2017, almost 16 percent ($550 million) of Uganda's total exports were due to small-scale trade but at the regional level almost 30 percent of Uganda's exports to neighbors were SSCBT. About 60 percent of Uganda's exports to the DRC consists of SSCBT. Similarly, for Rwanda, around 11 percent of total exports is small-scale with this rising to 45 percent for exports to neighbors. More than half of Rwanda's imports from Burundi and a quarter of imports from the DRC are due to small-scale trade.

The magnitude and importance of small-scale trade in Africa suggest that policy reforms such as AfCFTA should address the extensive barriers to such trade. If this occurs the increase in regional trade will be substantially higher than is predicted by using officially recorded trade data

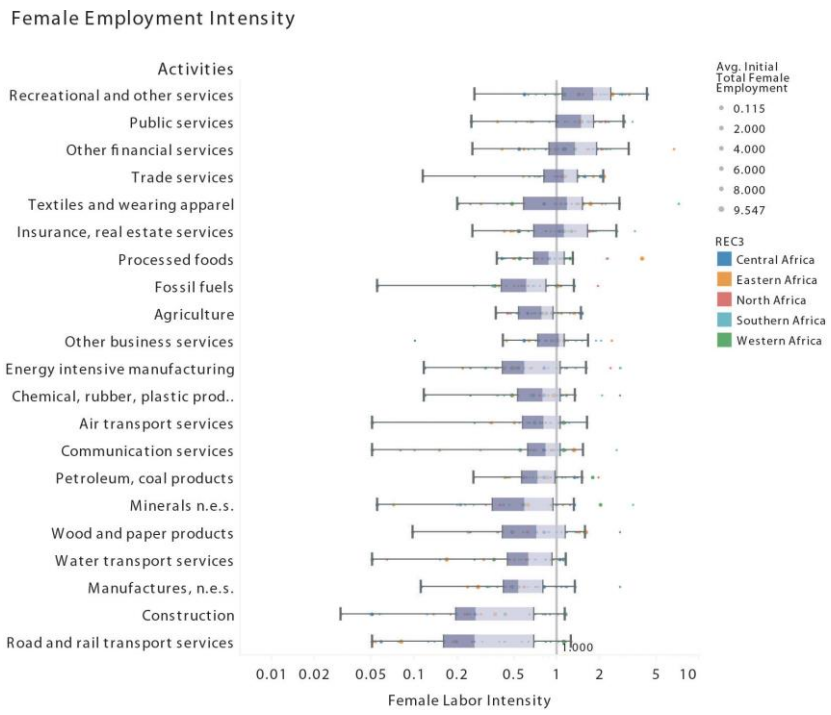
Employment volume and remunerations, gender and skill

Detailed labor statistics by gender and skill are needed to assess the economic impact of AfCFTA beyond its macroeconomic aggregates, deepening the CGE model capacities to account for and draw conclusions about employment and its remunerations for specific segments of the population (e.g., women or the youth). Additional labor market information was incorporated for each country and activity in the GTAP version 10 database. The initial levels of employment as of 2014 with average remunerations (in US$) for four different types of workers that were differentiated based on their gender (male and female) and educational attainment (skill and unskilled) (see

[19] This box is based on Walkenhorst, P (2019) 'Data Collection on Small-Scale Cross-Border Trade: An Overview', forthcoming policy note, World Bank.

Table 3). These statistics were constructed using harmonized nationally-representative household surveys available in the World Bank and the Luxembourg Income Study. Due to the natural inconsistency between macro- and micro-based statistics, adjustments were performed so that total volumes and wages added up to national accounts. This procedure is explained in detailed in Annex G. Figure 3 below summarizes, in a box and whisker plot, the initial distribution of female employment by economic activity for AfCFTA countries. On the horizontal axis, a value in female labor intensity greater than 1 indicates that an economic activity employs a greater proportion of women than the rest of the economy.[20] Across Africa, the economic activities that tend to employ more women are those in services (recreational and other services, insurance, real estate, trade, and financial) and the textiles and wearing apparel sector. In contrast, women tend to be employed the least in construction, mining, and road and rail transport services. While this is true in general, the box and whisker plot show also that there is significant variation of female labor intensity across the African continent.

Figure 3: Female employment intensity in the disaggregated labor database for AfCFTA countries



Source: Authors' estimates
Note: n.e.s. stands for not elsewhere specified

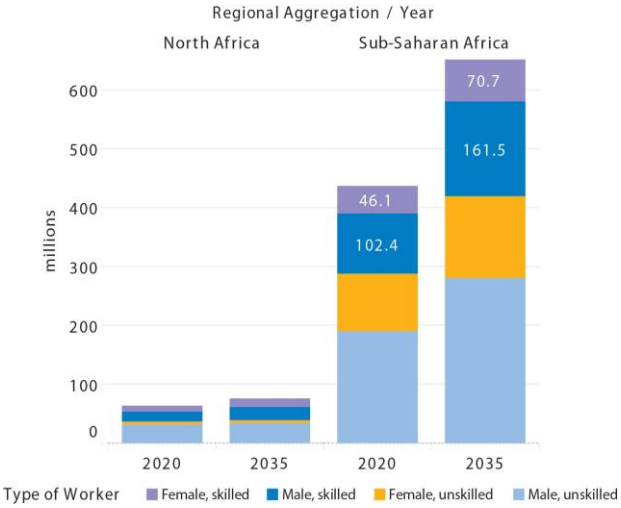
The second set of data that complement the CGE model relate to the expected formation of skills in each country. Projections for the working age population by gender, 5-year age groups, and educational attainment were incorporated into the CGE model. These series are in line with the initial labor volumes, with population totals from the UN World Population Prospects (UN DESA 2019),

[20] Female labor intensity for each country is measured as the share of female employment in an economic activity divided by the share of female employment in the country. This is defined in the formula below for female labor intensity (FLIa) where fa and ma are the female and male labor volumes in activity a, respectively:

$$FLI_a = \frac{\frac{f_a}{(f_a+m_a)}}{\frac{\sum_a f_a}{\sum_a (f_a+m_a)}} \; ; \; \forall_a = \{activities\}$$

assuming constant enrollment ratios for educational progress. The demographic and skill formation implications for AfCFTA countries are summarized in Figure 4 below, which shows the formation of skills in North Africa compared to Sub-Saharan Africa from the start of the implementation of AfCFTA in 2020 until the simulation target year by 2035. By 2035, employment in North Africa is expected to grow from 64.2 to 75.9 million, an annual rate of increase of 1.12 %, very close to the average of the non-AfCFTA countries (not shown in the graph). Sub-Saharan Africa's employment is, in contrast, expected to grow from 437 million to more than 650 million, at an annual increase of 2.7%. In absolute terms, the number of educated (skilled) employment would grow by nearly 92 million, at an annual rate of growth of 2.83 percent.

Figure 4: Projected employment, more than 80 by gender and skill in AfCFTA region



Source: Authors' estimates

Table 3 below summarizes, in relative terms, the information on initial employment figures for the four categories of workers (gender and skill). The information is presented according to the aggregation of activities used in this paper (see Annex D). In 2014, the base year of the simulation, agriculture is the largest employer in Africa by sector with 35,9 percent of total employment, followed by trade and public sector activities. In fact, two out of every three jobs in Africa are in the group formed by a. agriculture; b. wholesale and retail trade, accommodation and food services (trade); and c. education, health, electricity, water, and public sector (public services). At the continental level, the manufacturing sector accounts for 12,6 percent of employment, of which, 42 percent is in food processing.

The participation of women is 36 percent for all the continent, but services tend to employ a larger proportion. For instance, women as a percentage of labor in recreational services is 48.8 percent, in air transport is 42.3 percent, and in public services is 40 percent. Some industries attract fewer women, such as construction (13.8 percent), road and rail transport services, (12.6 percent), or minerals, not elsewhere specified (n.e.s) (26.5 percent). Textile and wearing apparel is above the average, at 33.7 percent, masked by large variations across countries, as discussed above.

At the continental level, skill employment represents 33.8 percent of total employment. Skilled employees are defined as individuals with more than nine years of schooling in low- and lower-middle-income countries and above 12 years of schooling in upper-middle- and high-income countries. The more sophisticated services tend to employ a larger share of skilled workers, such as other financial series (65.2 percent), air transport (57.5 percent), insurance and real state (56.3 percent) with an equally large proportion of skilled employment in public services (64.4 percent). Agriculture and fossil fuels employ a lower proportion of skilled labor, with 16.3 and 24.7 percent, respectively.

Observed wage differentials by gender, namely for females with respect to males, and by skill (for skilled with respect to unskilled), are reported in the last two columns to the right in Table 3. The wages for females are 23.4 percent lower than males, particularly in the sectors of minerals (-47.1 percent), air transport (-45.9 percent), and agriculture (-38.4 percent). In our database, females are reported to earn comparatively higher wages by weighted average in few industries, such as insurance and real estate services (5.6 percent). The skill premia across the continent is 105.7 percent and is higher for the case of construction (160.7 percent), trade services (129.8 percent), and other fossil fuels (95 percent).

Table 3: Employment and Wages in Africa, initial simulation

Activity	Employment (%)			Wage Premium (%)	
	Total	Female	Skilled	Females	Skilled
Agriculture	38,5	30,8	16,3	-38,4	40,2
Fossil fuels	2,2	33,0	24,7	-20,6	95,0
Minerals n.e.s.	0,5	25,8	29,7	-44,1	47,5
Processed foods	6,0	32,8	31,3	-40,2	58,7
Wood and paper products	0,8	25,7	31,8	-31,7	57,1
Textiles and wearing apparel	1,7	33,4	35,6	-27,1	41,2
Energy intensive manufacturing	1,8	27,0	32,0	-42,1	32,5
Petroleum, coal products	0,1	26,3	23,4	-25,3	88,9
Chemical, rubber, plastic products	0,8	27,6	32,7	-39,8	38,3
Manufactures, n.e.s.	1,8	21,3	39,5	-19,0	30,4
Construction	3,8	13,2	39,3	-37,9	160,7
Trade services	15,5	34,2	40,3	-26,7	129,8
Road and rail transport services	2,0	12,5	41,2	-2,0	69,9
Water transport services	0,2	21,6	55,1	-9,2	28,6
Air transport services	0,3	42,0	57,5	-45,9	40,5
Communication services	2,6	27,1	50,3	-14,2	73,8
Other financial services	1,6	35,2	65,2	-3,3	44,4
Insurance, real estate services	0,7	34,4	56,3	5,6	38,0
Other business services	2,9	30,3	46,1	-15,9	75,3
Recreational services	2,3	49,7	31,0	-20,5	42,6
Public services	13,7	40,4	64,4	-11,0	45,7
Africa - Total	100	31,9	33,8	-23,4	105,7

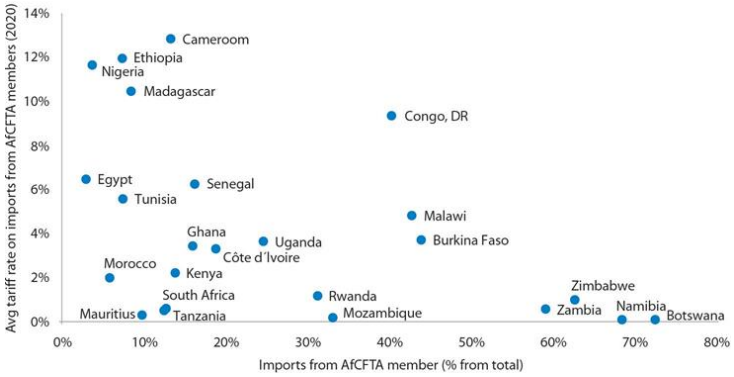
Source: Authors' estimates

Scenario assumptions

AfCFTA scenario relies on three specific instruments:

- Tariffs on intra-continental trade are progressively reduced in line with AfCFTA modalities. Starting in 2020, tariffs on 90 percent of tariff lines will be eliminated over a five-year period (ten-years for the least developed countries, or LDCs). Starting in 2025, tariffs on an additional 7 percent of tariff lines will be eliminated over a five-year period (eight years for LDCs). A maximum of 3 percent of tariff lines that account for no more than 10 percent of intra-African imports can be excluded from liberalization by the end of 2030 (2033 for LDCs).

Figure 5: Share of imports and average tariffs imposed on AfCFTA



Source: Authors' estimates, trade weights based on benchmark trade flows in 2014 GTAP data base.

- NTBs on both goods and services are reduced on a most favored nation (MFN) basis. It is assumed that 50 percent of the NTBs are actionable within the context of AfCFTA—with a cap of 50 percentage points. These are implemented as ad valorem tariff equivalents. We assume that reduction of NTBs also benefits African exporters on non-AfCFTA markets with an additional reduction of NTBs by 20 percent.
- AfCFTA will also be accompanied by measures that facilitate trade, such as implementation of the Trade Facilitation Agreement (TFA). The estimates of the size of these trade barriers comes from a new study by de Melo and Sorgho (2019). These are halved, though capped at 10 percentage points.

Tariffs

For most countries, intra-regional imports are relatively small, accounting for less than 20 percent of total imports, while for countries with higher share of intra-regional imports, the applied average tariffs on intra-regional imports are low. This is because, according to statutory tariff rates, most intra-regional trade in these countries is conducted under zero or very low preferential tariffs as part of sub-regional trade agreements like SACU and SADC.

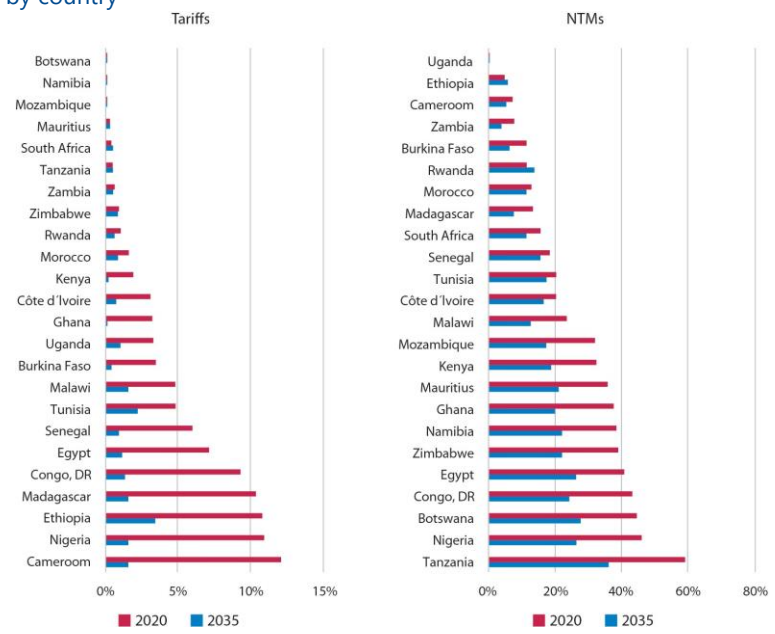
We simulate tariff reductions following the trade liberalization modalities adopted under AfCFTA. Starting in 2020, tariffs on 90 percent of tariff lines (non-sensitive products) will be eliminated over a five-year period (ten years for the least developed countries, or LDCs). Starting in 2025, tariffs on an additional 7 percent of tariff lines (sensitive products) will be eliminated over a five-year period (eight years for LDCs). Three percent of tariff lines that account for no more than 10 percent of intra-African imports can be excluded from liberalization by the end of 2030 (2033 for LDCs). The tariff reductions for both sensitive and non-sensitive products are implemented as equal (linear) cuts over their respective liberalization periods.

The classification of tariff lines into one of the three products categories (non- sensitive, sensitive, excluded) was done to minimize tariff revenue losses. Tariff lines were ranked in descending order by tariff revenues generated from African imports. The bottom 90 percent of tariff lines were classified as non-sensitive products, the next 7 percent of tariff lines as sensitive products, and the remaining three percent as excluded products. However, we revise the list of excluded products to include only the tariff lines with the largest tariff revenues up to a cumulative intra-regional import share of 10 percent and re-classify the remaining tariff lines as sensitive products. Because tariff revenues are more concentrated than imports, this results in exclusion lists with fewer than 1 percent of tariff lines for most countries.

The lists of excluded products selected according to our methodology belong to a wide selection of sectors. No sector clearly dominates the sensitive lists in all countries although most of the products come from the manufacturing sector: machinery (10%), auto (10%), apparel (9%), chemicals (8%), and iron and steel (6%). Agricultural products – especially prepared food and beverages (14%) and fruits and vegetables (9%) – account for about a quarter of products in the sensitive lists. It is important to highlight that this breakdown only considers the number of tariff lines included in excluded lists but not the share of imports that they represent.

As a result of AfCFTA, the largest liberalization is expected in countries with high initial barriers such as Cameroon, Egypt, Ethiopia, Madagascar, and Nigeria (Figures 6 and 7). Import tariffs do not decline compared to the rest of the world. Average intra-African (trade weighted) tariffs decline from 5.2 percent to 1.4 percent with the highest declines in manufacturing from 7 percent to 2 percent, and agriculture declining from 5 to 2 percent (Figure 8).

Figure 6 and Figure 7: Trade weighted tariffs and NTBs imposed on AfCFTA imports, by country



Source: Authors' estimates

Non-tariff measures

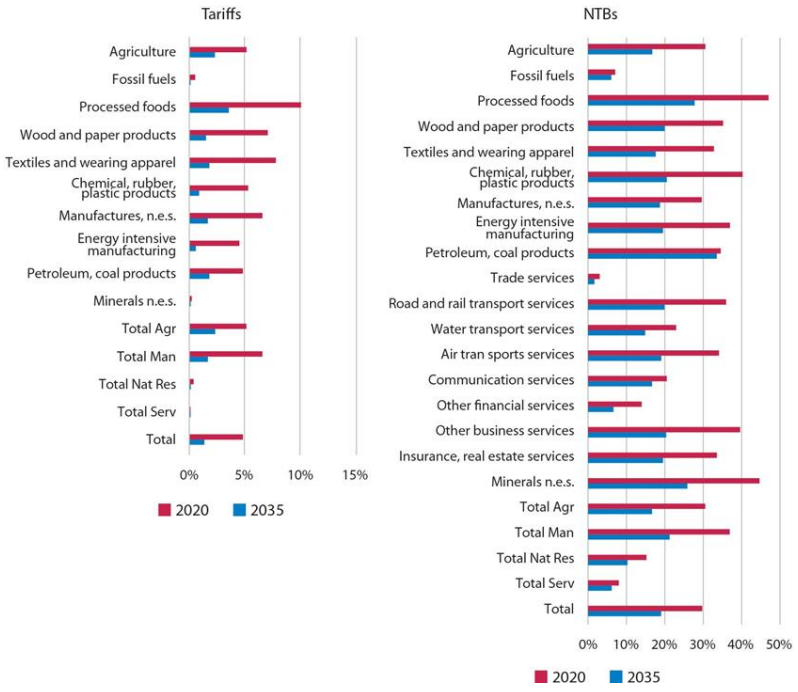
The NTB estimates for goods are sourced from WITS based on the methodology developed by Kee, Nicita, and Olarreaga (2009). The original data at the HS6 level were first aggregated to the 57-sector GTAP level using trade weights (see Annex F). At the continental level the average trade weight tariffs are at about 5 percent, with the highest tariffs imposed in processed foods, textiles and wearing apparel, and manufacturing products n.e.s. (Figure 8). The average trade weighted NTBs for goods and services amount to 30 percent, with the highest levels in manufacturing (37 percent), followed by agriculture (30 percent), natural resources (15 percent) and services (8 percent) (Figure 9). The initial barriers to trade in services are much higher (see Annex F), but we are working with trade weighted averages, which reduces their value quite dramatically. The aggregate numbers again mask great heterogeneity of the starting value of NTBs by sectors with some countries registering the NTBs as high as 104 percent in insurance and real estate services in the Democratic Republic of Congo to 2 percent for the same sector in Mozambique.

AfCFTA will likely reduce trade costs associated with NTBs, as it creates a common set of rules for participating countries in areas such as competition, technical barriers to trade, sanitary and phytosanitary standards, among others (Section 2). To translate reforms in these areas into trade-cost reductions is a difficult task. For the purpose of this study, it is assumed that under AfCFTA scenario, 50 percent of the NTBs are actionable with a cap of 50 percentage points.[21] This assumption is in line with previous studies on AfCFTA and on other deep agreements such as the Trans- Pacific Partnership study of Petri and Plummer (2016) where only a fraction of NTBs are actual barriers that could be actionable (i.e., politically feasible in a trade agreement), the rest is assumed to be beyond the reach of politically viable trade policies. The NTBs are implemented as ad valorem tariff equivalents. Under this assumption, there is a sharp drop in NTB ad valorem rates. For intra-African trade, the drop is 11.0 percentage points on average, with declines of 13.5 and 15.5 respectively on agriculture and manufacturing, but a relatively smaller impact on services—only 2.0 percentage points.

[21] Future work will carefully assess the content of AfCFTA agreement relative to existing sub-regional African RTAs to quantify the exact reduction in trade costs associated to NTMs.

The NTB changes are assumed to apply MFN, i.e. they apply as well to imports from non-African countries.[22] The declines in the NTB rates are substantial compared to the rest of the world, with an average decline of 13 percentage points—17 in agriculture, 14 in manufacturing, and a relatively sizeable 8 in services. We assume that reduction of trade costs associated with NTBs also benefits African exporters on non-AfCFTA markets through domestic measures that reduce the cost of compliance with foreign standards and regulations with an additional reduction of trade costs associated with NTBs by 20 percent.

Figure 8 and Figure 9: Trade weighted tariffs and NTBs imposed on AfCFTA imports, by sector



Source: Authors' estimates

Trade facilitation

By bringing greater attention and policy oversight to trade within Africa, AfCFTA provides an opportunity to improve trade facilitation more widely in the continent at borders and along corridors between Africa countries. The TFA provides the framework and access to knowledge to guide such improvements, and AfCTFA provides the political momentum and additional commitment mechanism, to support broad implementation. While in certain aspects such as local transit, AfCFTA commitments could go beyond TFA commitments, the TFA could provide stronger mechanisms for implementation of AfCFTA as the benefits from TFA implementation increase with neighboring countries implementing the TFA, as well and reducing the trade costs along all borders. To estimate the upper bound of gains, we assume that all countries implement the TFA fully as part of AfCFTA process. We use the estimates of de Melo and Sorgho (2019) that apply a model that predicts observed time in customs as a function of basic structural variables (GDP, Logistics Performance Index, and Infrastructure Quality Index); policy variables (World Governance Indicators); and the trade facilitation variables captured by the trade facilitation indicator (row L).[23]

[22] The nature of the NTMs would decide the extent to which they can be changed bilaterally or not. These scenarios take the maximal position, i.e. the measures are impacted irrespective of the source of the imports.

[23] Row L is a weighted average of the following components: i) information availability; ii) involvement of the trade community; iii) advance rulings; iv) appeal procedures; v) fees and charges; vi) formalities involving documents; vii) formalities involving automation; viii) formalities involving procedures; ix) internal border agency cooperation; x) external border agency cooperation; xi) governance and impartiality.

De Melo and Sorgho (2019) show, after controlling for the structural and policy variables, that a higher trade facilitation indicator score reduces the probability of a longer time in customs. The overall differences in reductions in costs reflect disparities in trade facilitation indicator values and in time in customs for imports. The model provides estimates of the reduction of time in customs as a result of full implementation of the TFA. Those reductions in time in customs are then translated into ad valorem equivalents of barriers using the methodology of Hummels and Schaur (2012), who estimated that one extra day in customs is equivalent to a 1.3 percent extra tariff at destination based on maritime trade flows to the US.

For simulating the gains from implementing the TFA, we apply the econometric estimates of the ad valorem equivalents (AVEs) of time lost in customs reported in Table 4. In the TFA scenario each African landlocked country takes the average value of the top two landlocked countries in the developing world, and each African non-landlocked country takes the average value of the non-landlocked countries in the developing world.

Table 4: Trade facilitation implementation and iceberg trade cost

	Reduction of time in customs due to TFA implementation (%)	Reduction in iceberg trade cost (%)
Nigeria	31.8	10
DR Congo	23.7	10
Cameroon	17.9	10
Egypt	16.7	10
Tanzania	16.6	10
Zimbabwe	15.3	10
Ethiopia	11.1	10
Kenya	10.9	10
Côte d'Ivoire	8.5	8.5
Uganda	5.7	5.7
Burkina Faso	4.5	4.5
Ghana	4.3	4.3
Zambia	4.2	4.2
Mauritius	2.6	2.6
Botswana	2.6	2.6
Namibia	2.6	2.6
South Africa	2.6	2.6
Madagascar	2.1	2.1
Rwanda	2	2
Tunisia	2	2
Morocco	1.6	1.6
Senegal	0.3	0.3
Mozambique	0	0

Source: Authors' estimates

African importers see a roughly 7 percentage point decline in the iceberg[24] cost of importing with minor variations across sectors and source regions. African exporters see roughly the same improvement in their iceberg cost of exporting—similarly on an MFN basis. The biggest expected gains from the implementation of the TFA are expected in countries like Cameroon, Egypt, DRC, Nigeria, and Tanzania with a decline of trade cost of 10 percentage points.

5. MACROECONOMIC IMPACTS OF AFCFTA

AfCFTA benefits member countries by lowering costs for consumers and producers, reducing administrative red tape, and lowering compliance costs. The reduction of tariffs leads to lower prices of imported goods for consumers, as well as for producers using intermediate inputs. The non-tariff barriers represent the cost of burdensome administrative procedures and of satisfying various technical requirements. The sanitary and phytosanitary standards or technical standards are in place to protect consumer welfare and safety, but differences in regulations and standards across countries lead to compliance costs and sometimes are used as barriers to trade. The deep commitments under AfCFTA are expected to reduce these costs. Similar to tariffs, the NTB reductions benefit consumers of final (household) and intermediate goods (firms). Trade cost reductions brought about by trade facilitation measures are captured as iceberg trade costs. With implementation of trade facilitation reforms, such as border infrastructure improvements and reduction of cost of administrative procedures, the price of exports and imports declines and transporting a unit of exports or imports requires less trade and transportation services. Overall, with lower trade costs, the price of a unit of imports is less expensive and increases the competitiveness of local

[24] The assumption of iceberg trade costs implies that a fraction of the good is lost in transport due to transport costs as originally proposed in Paul Samuelson (Samuelson, 1954).

production (using imported inputs) either sold on the domestic market or exported. As a result, production shifts to the most competitive sectors, leading to productivity gains and expansion of trade and faster economic growth in AfCFTA region. The trade cost reductions also apply to trade with non-AfCFTA countries, leading to somewhat faster growth in trade with non-AfCFTA countries too.

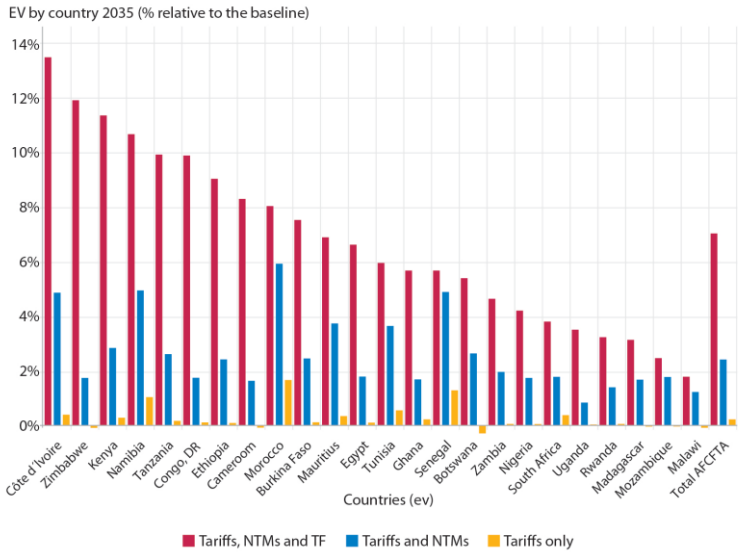
Better market access to regional markets allows countries to benefit from faster growth of exports, while reduction of own barriers coupled with reduction of barriers in regional markets leads to lower prices of imports. The differences in gains across countries are linked to the initial level of tariffs, NTBs and border costs and their reductions under AfCFTA as well as to the initial level of intra-African trade. The overall welfare implications are also linked to the sectors of comparative advantage, if sectors benefiting under AfCFTA have higher productivity than those that would be expanding in the baseline scenario, the reallocation of production leads to faster economy-wide productivity gains and income growth.

The results of this study assume full implementation of AfCFTA and should be interpreted with caution. Partial reforms would lead to smaller macroeconomic effects. On the other hand, the framework does not capture the dynamic gains from trade. We would expect AfCFTA members to enjoy faster productivity gains by taking advantage of the economies of scale in larger market, as well as attract foreign direct investment. We come back to this issue in Section 8.

Real income implications

The real income (equivalent variation[25]) gains from tariff liberalization alone are small at the continental level at 0.22 percent. However, selected countries including Namibia, Morocco, and Senegal, benefit substantially from improved market access in other AfCFTA markets and see their welfare increase over 1 percent. The relatively small gains associated to tariff liberalization are explained by the high non-tariff barriers and trade facilitation bottlenecks that constrain trade in Africa. Removing only one constraint is a necessary but not sufficient condition for real income gains to materialize. Indeed, the gains from tariff liberalization and reduction in NTBs (with the increase market access in non-African markets), would lead to a gain of 2.4 percent in 2035 for the continent, but several countries such as Cote d'Ivoire, Morocco, Namibia, and Senegal see their real income increase over 5 percent. Under full implementation of AfCFTA scenario, the continental welfare increases by an additional 4.6 percentage points implying that there are substantial gains to be had in trade facilitation.[26]

Figure 10: Equivalent variation, percentage relative to the baseline for 2035



Source: Authors' estimates

Note: Equivalent variation is the expenditure to attain utility in year t in any given simulation using base year prices.

Under AfCFTA scenario, the real income would increase by 7 percent by 2035 relative to the baseline for the Africa region, a sizeable gain.[27] In monetary terms, the gains

[25] Equivalent variation is the expenditure to attain utility in year t in any given simulation using base year prices.

[26] It should be noted that the TFA simulations do not include specific measures to improve trade facilitation. Some measures may have relatively low cost, but others may require investments in software, other logistical support, infrastructure, etc. These costs could reduce the net gains from improvements in trade facilitation— depending in part on the source of financing.

[27] Real income is measured by equivalent variation: the expenditure to attain utility in year t in any given simulation using base year prices. It is similar in magnitude to real private consumption.

represent around US$445 billion in 2035 (at 2014 prices and exchange rates). Though the continent is by far the largest gainer in aggregate, the rest of the world sees an increase of US$76 billion by 2035, which translates into a gain of 0.1 percent relative to the baseline scenario.

The gains are unevenly distributed across the region (Figure 10). At the very high end are Côte d'Ivoire and Zimbabwe with gains of 14 percent, followed by Kenya, Namibia, and Tanzania at above 10 percent. At the lower end are a few countries clustered around a gain of 2 percent including Madagascar, Malawi, and Mozambique. The gains are very closely related with the initial level of trade barriers and trade costs, countries that are already relatively open tend to benefit less from own liberalization but tend to benefit more from improved market access in other markets. Countries that are heavily protected might see a larger reallocation of output across sectors due to increased import competition but are also likely to benefit more from lower imported input prices.

Trade implications

Trade growth is very substantial for the continent. The volume of total exports increases by almost 29 percent by 2035 (relative to the baseline). Intra-continental exports increase by over 81 percent, while exports to non-African countries increase by 19 percent. Despite these changes, intra-continental trade would remain around 20 percent of total trade for the continent in 2035. The fastest growth of intra-AFCFTA exports to AfCFTA partners is expected to benefit Morocco, Egypt, Cameroon, Ghana, and Tunisia, with exports doubling or tripling with respect to the baseline. The smallest export expansions are expected in Mozambique, Democratic Republic of Congo and Zambia (10-30 percent). Under AfCFTA scenario, manufacturing exports gain the most, 62 percent overall with intra-African trade increasing by 110 percent and exports to the rest of the world rising by 46 percent. There are smaller gains in agriculture, 49 and 10 percent with respect to intra- and extra-African trade, respectively. The gains in services trade are more modest—about 4 percent overall and 14 percent within Africa. In monetary terms, intra-continental trade grows from US$294 billion in 2035 in the baseline scenario to US$532 billion after implementation of AfCFTA in 2035. By 2035 under AfCFTA, the biggest increase of the value of exports to the regional partners is expected to benefit, in order of value, Egypt, Morocco, South Africa, Nigeria, Kenya, and Côte d'Ivoire (between US$48 and US$11 billion). Similarly, to the welfare gains, the smallest export expansions are expected in the economies that are already relatively open such as Madagascar, Malawi, Mauritius, and Rwanda, with export increases of less than US$1 billion.

Table 5: Percentage deviations from baseline of equivalent variation (EV), exports, and imports for 2035

	EV (%)			Exports (%)			Imports (%)		
	Tariffs only	Tariffs and NTMs	Tariffs, NTMs and TF	Tariffs only	Tariffs and NTMs	Tariffs, NTMs and TF	Tariffs only	Tariffs and NTMs	Tariffs, NTMs and TF
Egypt	0.1%	1.8%	6.7%	3.1%	30.1%	51.5%	3.1%	24.0%	56.2%
Morocco	1.7%	6.0%	8.1%	3.1%	28.0%	32.6%	4.6%	29.2%	37.0%
Tunisia	0.6%	3.7%	5.9%	1.7%	27.4%	31.1%	2.4%	25.9%	33.8%
Burkina Faso	0.1%	2.5%	7.5%	1.6%	7.9%	13.9%	1.7%	10.8%	29.2%
Cameroon	-0.1%	1.6%	8.3%	7.2%	23.0%	45.9%	7.4%	22.2%	61.5%
Côte d'Ivoire	0.4%	4.9%	13.5%	1.6%	23.5%	40.4%	2.3%	30.3%	68.9%
Ghana	0.2%	1.7%	5.7%	1.1%	14.3%	18.7%	1.1%	13.3%	25.6%
Nigeria	0.0%	1.7%	4.2%	1.0%	15.2%	26.0%	1.1%	19.8%	44.9%
Senegal	1.3%	4.9%	5.5%	4.0%	30.2%	31.7%	4.6%	26.8%	29.8%
DR Congo	0.1%	1.7%	9.9%	1.8%	12.2%	21.0%	4.3%	30.2%	71.7%
Ethiopia	0.1%	2.4%	9.0%	3.6%	17.4%	30.6%	4.1%	17.2%	48.4%
Kenya	0.3%	2.8%	11.4%	0.8%	23.7%	36.0%	1.0%	19.2%	49.4%
Madagascar	0.0%	1.7%	3.1%	2.0%	13.4%	19.2%	2.2%	14.3%	23.6%
Malawi	-0.1%	1.2%	1.8%	1.1%	12.1%	12.5%	0.8%	10.9%	13.4%
Mauritius	0.3%	3.8%	6.9%	0.7%	27.0%	32.9%	0.8%	22.5%	31.7%
Mozambique	0.0%	1.8%	2.5%	-0.2%	16.6%	17.1%	-0.2%	14.2%	15.9%
Rwanda	0.0%	1.4%	3.2%	0.4%	6.4%	9.3%	0.3%	6.3%	14.2%
Tanzania	0.2%	2.6%	9.9%	0.4%	21.1%	32.4%	0.6%	19.8%	52.1%
Uganda	0.0%	0.8%	3.5%	0.8%	4.6%	10.4%	0.8%	6.6%	24.5%
Zambia	0.1%	2.0%	4.7%	0.1%	5.6%	7.9%	0.3%	9.9%	19.6%
Zimbabwe	-0.1%	1.7%	12.0%	0.0%	25.0%	47.4%	-0.2%	19.6%	57.3%
Botswana	-0.3%	2.6%	5.4%	-0.1%	10.6%	13.5%	-0.5%	12.2%	18.9%
Namibia	1.0%	5.0%	10.7%	1.2%	28.5%	33.3%	1.6%	21.9%	31.3%
South Africa	0.4%	1.8%	3.8%	1.4%	12.5%	17.6%	2.0%	14.9%	24.7%

Source: Authors' estimates

Note: Equivalent variation is the expenditure to attain utility in year t in any given simulation using base year prices

Under AfCFTA scenario, manufacturing exports gain the most, 62 percent overall with intra-African trade increasing by 110 percent and exports to the rest of the world rising by 46 percent. There are smaller gains in agriculture, 49 percent and 10 percent with respect to intra- and extra-African trade, respectively. The gains in services trade are relatively slight—some 4 percent overall and 14 percent within Africa. Note that base year trade shares and volumes are relatively slight in services.

In volume terms, manufacturing exports dominate the export picture for Africa. Of the US$2.5 trillion in exports projected in 2035 for Africa, US$823 billion are manufactures, US$690 billion are natural resources, US$191 billion are agriculture and the remaining US$256 billion are in services. Of the total growth in exports of US$560 billion, manufactured export increase represents some US$506 billion—an increase of US$220 billion within Africa and US$286 billion with the rest of the world.

Overall, the destination of African exports rises from 15 percent in 2035 in the baseline, to over 21 percent in AfCFTA scenario. For manufactures, the relevant increase is from 24 percent to almost 32 percent. Exports to AfCFTA members expand with very little trade diversion, as the decline of exports to non-AfCFTA regions is negligible and concentrated in a few services sectors and minerals (Figure 13). As compared to the baseline, by 2035 exports of minerals to the European Union and China are smaller under AfCFTA.

The biggest expansion of exports to regional partners is recorded in manufactures n.e.s, followed by energy intensive manufacturing, chemical, rubber, plastic products, and processed food products. Among services, the biggest expansion to regional partners is expected in health and education services, air and road and rail transport services, and other business services, but the volume of exports growth is much smaller than in the case of agriculture and manufacturing. The same sectors would also be expected to expand their exports to non-

AfCFTA partners with significant gains in exports of several manufacturing sectors and agricultural products.

The volume of total imports is also very substantial, increasing by 41 percent relative to the baseline for the year 2035. For intra-continental, imports coming from inside the region expand by 102 percent, while imports coming from outside the region increase by 25 percent. In value terms, there is an increase of imports of US$310 billion in the baseline scenario, comparing to AfCFTA scenario where that increase reaches the US$627 billion of imports. In terms of shares of intra-continental trade, it goes from 18 percent in the baseline to 25 percent with AfCFTA, since the share from the rest of the world had a small reduction from 82 percent in the baseline to 75 percent with AfCFTA, which is still very substantial.

For the baseline scenario, intra-continental imports increase from 12 percent in 2020 to 18 percent in 2035 (Table 8). In the scenario where AfCFTA is implemented, this increase to 25 percent in 2035, 7 percent more than with the baseline scenario. By 2035, and under AfCFTA, the countries that benefit the most from the higher increases of imports are Côte d'Ivoire, the Democratic Republic of Congo, Egypt, Ghana, Kenya, Nigeria, South Africa, and Tanzania where imports increase from a range between US$32 billion and US$10 billion.The smaller imports expansions are expected in economies such as Malawi, Rwanda and Mauritius with imports increases of less than $1 billion.

Under AfCFTA there is also an expansion of total imports from non-AfCFTA members, with no trade diversion (Figure 14). The sector showing the highest expansion of imports is manufactures, n.e.s. Among AfCFTA regions, North Africa experiences the highest growth, whereas for non-AfCFTA members, the imports increase mainly from China and the European Union.The sectors of chemical, rubber, plastic products, processed foods, and textiles also see their imports expanding, with North and West Africa having an important role in that expansion. Among services sectors, imports increase fastest in other business services, with the highest increase of imports coming from the European Union. The expansion of trade in services is muted due to the initial low levels of trade in services.

Table 6: Impacts of AfCFTA on trade of member countries (in percent and in US$ billion 2014) – deviations from the baseline in 2035

	AfCFTA				Non-AfCFTA				World			
	Export		Import		Export		Import		Export		Import	
	%	BS	%	BS	%	BS	%	BS	%	BS	%	BS
Agriculture	49	12	72	19	10	17	62	20	15	29	66	39
Fossil fuel	8	3	8	3	2	13	7	2	2	15	8	5
Processed foods	91	29	118	40	45	25	44	31	62	55	67	71
Wood and paper products	98	8	125	12	68	8	31	8	80	17	54	20
Textiles and wearing apparel	195	22	240	29	47	39	43	31	64	62	70	60
Chemical, rubber, plastic products	88	36	114	50	99	51	26	40	94	87	45	89
Manufactures, n.e.s.	177	97	213	121	69	67	25	121	108	164	44	242
Energy intensive manucaturing	75	24	99	34	32	94	28	26	36	118	48	60
Petroleum, coal products	12	2	12	2	4	1	7	9	7	4	7	11
Construction	19	0	42	0	19	1	10	2	19	1	11	3
Trade services	9	0	25	0	-8	-2	32	11	-8	-2	32	11
Road and rail trasport services	35	1	55	1	11	5	46	11	12	5	47	12
Water transport services	25	0	44	0	33	2	17	1	32	2	18	1
Air transports services	33	1	53	1	29	7	30	8	29	7	31	9
Communication services	11	0	29	0	-13	-4	42	6	-12	-4	41	6
Other financial services	13	0	32	0	-5	0	38	5	-4	0	38	5
Other business services	22	0	41	1	16	4	39	39	17	4	39	39
Recreational and other services	3	0	18	0	-7	-2	19	4	-7	-2	19	5
Public services	9	1	17	3	-10	-4	26	13	-5	-3	24	16
Insurance, real estate services	35	0	56	0	11	1	46	7	12	1	46	7
Minerals n.e.s.	6	1	6	1	-2	-1	11	1	-1	-1	8	2
Total agriculture	49	12	72	19	10	17	62	20	15	29	66	39
Total manufacturing	110	220	137	288	46	286	26	267	62	506	44	554
Total natural resources	8	4	8	4	2	11	8	3	2	15	8	7
Total services	14	3	26	6	3	7	33	107	4	10	32	113
Total	**81**	**239**	**102**	**317**	**19**	**321**	**27**	**397**	**29**	**560**	**41**	**714**

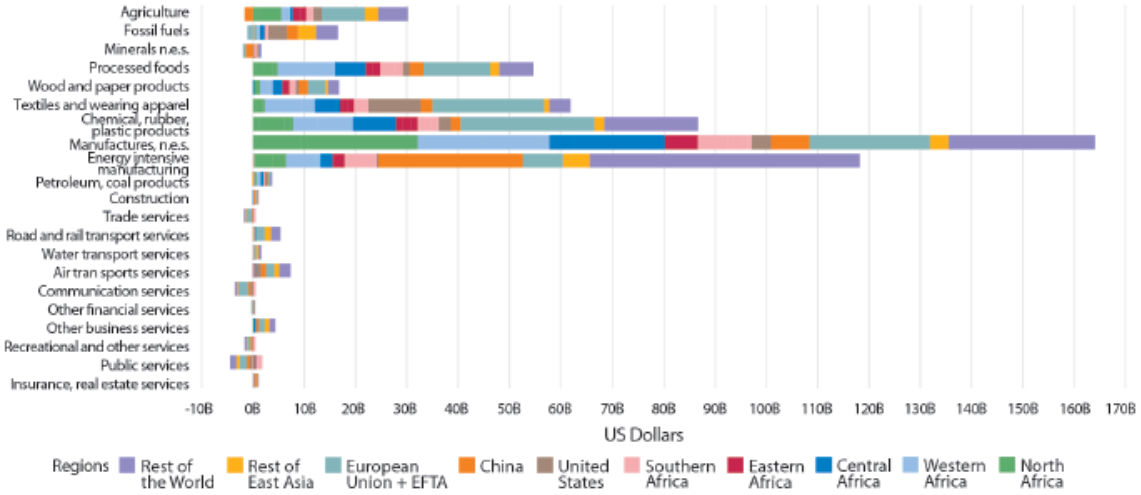
Source: Author's estimates

Table 7: Exports under the baseline scenario and AfCFTA.

	Share of intra-AfCFTA exports in total exports			Intra-AfCFTA exports (percentage deviations from the baseline)		
	Baseline		AfCFTA	AfCFTA	Tariff liberalization	Tariffs and NTBs
	2020	2035	2035	2035	2035	2035
Total Africa	12%	15%	21%	81%	22%	52%
Morocco	7%	9%	26%	278%	144%	245%
Egypt	8%	10%	22%	237%	55%	129%
Cameroon	11%	14%	19%	100%	29%	55%
Ghana	9%	10%	16%	94%	32%	64%
Tunisia	11%	13%	19%	91%	45%	79%
Nigeria	8%	10%	15%	83%	13%	38%
Tanzania	18%	20%	27%	77%	13%	46%
Côte d'Ivoire	26%	31%	37%	66%	9%	36%
Kenya	30%	35%	43%	66%	6%	36%
Senegal	36%	41%	50%	63%	20%	58%
Mauritius	12%	17%	20%	62%	18%	48%
Zimbabwe	23%	26%	28%	59%	2%	29%
Namibia	33%	32%	39%	59%	20%	51%
Ethiopia	20%	17%	21%	59%	12%	34%
Burkina Faso	15%	19%	25%	53%	4%	29%
South Africa	25%	30%	37%	44%	15%	33%
Rwanda	17%	26%	33%	38%	4%	19%
Uganda	24%	23%	28%	38%	4%	17%
Botswana	18%	21%	26%	37%	1%	27%
Malawi	21%	24%	29%	34%	5%	23%
Madagascar	7%	9%	10%	33%	9%	21%
Zambia	22%	26%	30%	26%	6%	14%
Congo, DR	15%	8%	9%	21%	5%	15%
Mozambique	33%	28%	27%	14%	3%	7%

Source: Authors' estimates

Figure 11: Total exports from Africa, deviation from the baseline for 2035



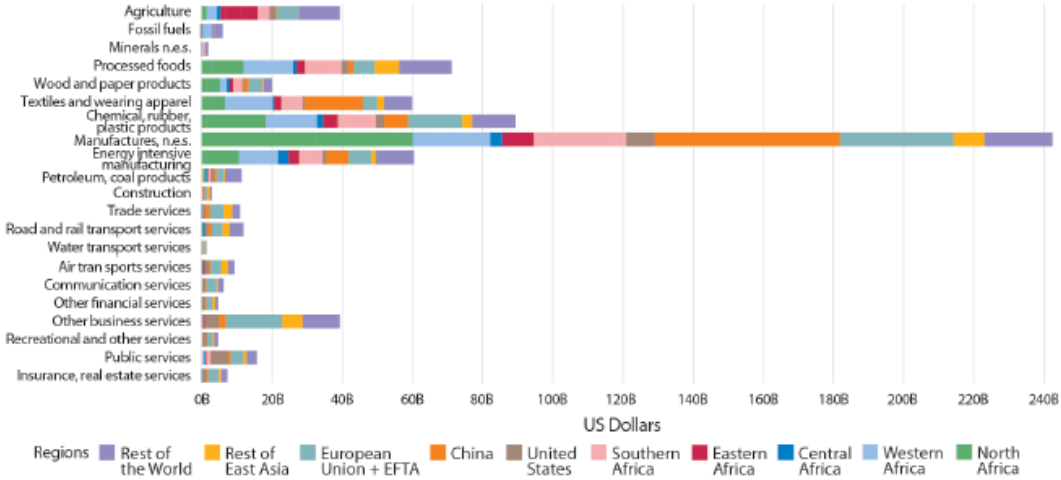
Source: Author s' estimates

Table 8: Imports under the baseline scenario and AfCFTA

	Share of intra-AfCFTA imports in total imports			Intra-AfCFTA imports (percentage deviations from the baseline)		
	Baseline		AfCFTA	AfCFTA	Tariff liberalization	Tariffs and NTBs
	2020	2035	2035	2035	2035	2035
Total Africa	12%	18%	25%	102%	22%	52%
Egypt	3%	6%	14%	293%	94%	188%
Ethiopia	8%	12%	25%	221%	84%	105%
Cameroon	14%	20%	35%	188%	68%	97%
Nigeria	4%	5%	9%	157%	38%	75%
Madagascar	8%	10%	18%	131%	56%	88%
Congo, DR	40%	47%	57%	106%	18%	50%
Tunisia	7%	11%	16%	103%	22%	58%
Tanzania	13%	21%	28%	103%	-1%	32%
Côte d'Ivoire	20%	27%	32%	101%	12%	42%
Kenya	14%	20%	25%	89%	5%	29%
Morocco	6%	9%	12%	79%	7%	39%
Ghana	17%	28%	40%	79%	8%	32%
Senegal	17%	24%	32%	78%	27%	59%
Uganda	26%	38%	48%	57%	5%	16%
Zimbabwe	63%	67%	66%	56%	-1%	17%
Burkina Faso	45%	59%	69%	50%	7%	21%
Mauritius	10%	13%	15%	43%	-1%	21%
Rwanda	31%	39%	46%	35%	1%	11%
Namibia	68%	69%	71%	34%	1%	22%
South Africa	13%	19%	20%	32%	2%	16%
Mozambique	32%	33%	36%	25%	-2%	15%
Zambia	59%	63%	65%	25%	0%	10%
Malawi	44%	53%	58%	24%	5%	15%
Botswana	71%	72%	72%	19%	-1%	11%

Source: Authors' estimates

Figure 12: Total imports from Africa, deviation from the baseline for 2035



Source: Authors' estimates

Output implications

AfCFTA is expected to boost regional output by US$211 billion by 2035 (Figure 13). The impacts on output are highly variegated across sectors. In broad terms output goes up most in natural resources and services (1.7 percent) and manufacturing (1.2 percent), while agriculture declines (0.5 percent) relative to the baseline in 2035. In terms of volume of output, most of the gains will be realized by the services sector (US$147 billion) with smaller gains in manufacturing (US$56 billion) and natural resources (US$17 billion), with a small decline registered in

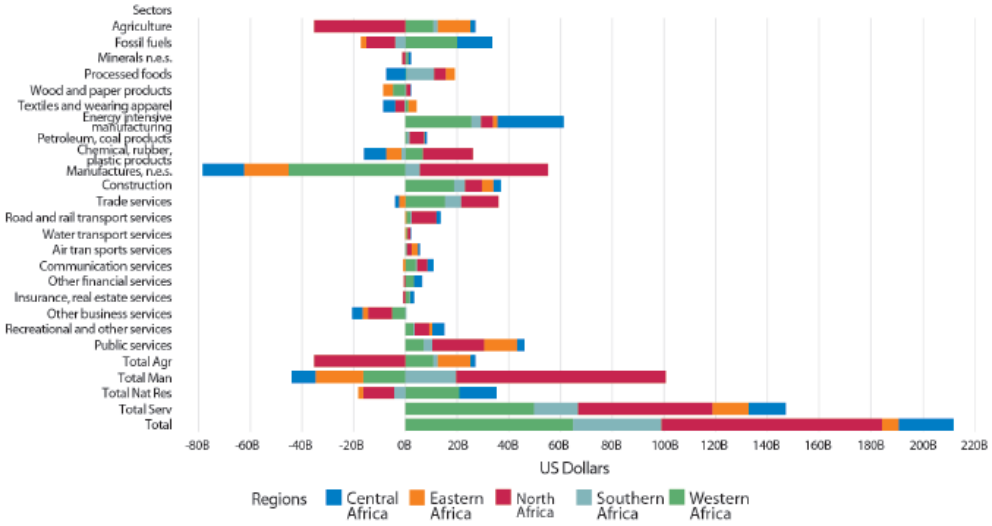
agriculture (US$8 billion) as compared to the baseline in 2035. As compared to the baseline in 2035, agriculture is growing faster in all parts of Africa except for North Africa, which under AfCFTA is shifting toward manufacturing n.e.s., chemicals, rubber and plastics, as well as trade services and transport, as well as recreation services. East African economies as an aggregate seem to specialize more in agricultural products and services with productive factors shifting away from selected manufacturing sectors to take advantage of more profitable opportunities in the growing sectors. Natural resources trade will grow in Central and West Africa under AfCFTA, while they decline in other regions as compared to the baseline. Services expand across all regions driven by increasing demand as incomes in Africa rise.

Aggregate numbers mask a lot of heterogeneity of outcomes across countries. Out of 24 economies represented in the simulations, the relative importance of agriculture increases in 14 countries, natural resources in 12 countries, manufacturing in 6 countries and services in 13 countries. Even while manufacturing's share of output decreases for the majority of countries, the volume of manufacturing will continue to increase under AfCFTA. In fact, in 15 of 24 countries the value of output of manufacturing is higher under AfCFTA in 2035 than under the baseline scenario and output of several manufacturing sectors expands, just at a slower pace compared to other sectors. Similarly, in the case of agriculture, the volume of output under AfCFTA by 2035 is higher than under the baseline in 15 out of 24 countries, while in the case of services the volume is higher under AfCFTA in 21 countries partially reflecting positive income elasticity of services.

A number of factors explain the impact on output. In the standard Armington framework, a decline in import prices, which in our simulations vary highly across sectors, leads to increased spending on imports compared to domestic production. In the absence of exports, this leads to an absolute decline in production. Exports nonetheless do increase— driven by real exchange rate depreciation, a reduction in production costs (from the lower cost of imported intermediates), the assumed improvement in trade facilitation for African exporters, and the improvement in market access in Africa and the rest of the world. The key question is whether the import driven expenditure switching from domestic consumption is greater than the increase in exports. This will depend on four additional factors. First, what is the import exposure of the sector, i.e., the level of imports relative to domestic absorption. If the import share is relatively low, the impact on domestic markets will be attenuated. The second factor is the ease of substitution between imports and domestic goods. The third factor is the export exposure of domestic production. The final factor is the ex-ante decrease in the price of imports, i.e., the sum of the change in import tariffs, NTM AVE and the import component of the TFA. In a two-sector economy, the sector with the highest decline in import tariffs would see a relatively larger impact on domestic production, i.e., there would be more expenditure switching. Resources would then flow to the sector that is subject to the smallest decline in import prices. On average, agriculture and manufacturing see an ex-ante import price decline of 28 percent and 24 percent respectively, and services only 16 percent (and even less for natural resources). This implies that all else equal, one would expect to see a reallocation of production toward services away from agriculture and manufacturing, which we observe in broad terms.

There are significant variations across sectors. If one takes the case of agriculture, the import exposure overall is relatively low (only 6 percent) and the import price shock is 28 percent. At the same time, domestic output is mostly oriented toward the domestic market. This is a situation where one sees that the expenditure switching is a more important factor than export expansion and resources flow to other sectors. The energy intensive sector is an interesting counter example. The import intensity is high at nearly 40 percent and the import price shock is also relatively high at 27 percent, yet output expands substantially—some 9.5 percent. However, exports in the baseline are already a high percentage of domestic output and thus the export expansion is a more import factor than domestic expenditure switching. Manufacturing n.e.s. is another sector where we observe output declines. It is also highly exposed—some 50 percent, but with a relatively low export base. Among services, other business services are the only services to see a decline in output. But they are one of the most exposed services with an import share of 22 percent in the baseline, and also one that receives the largest import price shock (some 28 percent). Thus, the expenditure switching plays a large role in this service sector.

Figure 13: Output, difference relative to the baseline in 2035 (billion 2014 USD)



Source: Authors' estimates

Government revenue implications[28]

AfCFTA's short-term impact on tax revenues is small for most countries. Tariff revenues would decline by less than 1.5 percent for most countries except for the Democratic Republic of Congo (3.4 percent), Gambia (2.7 percent), Republic of Congo (2.1 percent), and Zambia (1.6 percent). Total tax revenues would seldom decline by more than 0.3 percent except for Djibouti (0.5 percent), Republic of Congo (0.6 percent), Gambia (0.9 percent), and the Democratic Republic of Congo (0.9 percent). Two factors help explain these small revenue impacts: (i) imports from African countries account for a small share of tariff revenues for most countries (less than 10 percent on average); (ii) most tariff revenues can be shielded from liberalization with exclusion lists because these revenues are highly concentrated in a few tariff lines (1 percent of tariff lines account for more than three-quarters of intra-African tariff revenues in almost all African countries). These results are consistent with other studies that show that, even under full liberalization, the number of countries that will experience significant tariff revenue losses is small and that exclusion lists have the potential to significantly reduce such losses (UNECA (2017), African Development Bank (2019), Laborde et al. (2019).

In the medium term, the overall impact on import tariff revenue is expected to be positive in the AfCFTA scenario at the regional level. Although tariffs decline, the increase in the volume of imports leads to higher tariff revenue collection with an increase of 3 percent at the continental level compared to the baseline in 2035. Faster economic growth leading to higher level of economic activity are likely to increase the total revenue from other taxes as well.

In the scenario where only tariffs are reduced, the fiscal revenue from import taxes declines by almost 10 percent at the continental level. Again, aggregate results mask a big heterogeneity of impacts across countries. In fact, in our simulations 10 out of 24 countries might see a decline of tax revenues from imports in AfCFTA scenario as compared to the baseline in 2035, including Burkina Faso, Cameroon, Democratic Republic of Congo, Ethiopia, Ghana, Madagascar, Malawi, Rwanda, Uganda, and Zambia. However, overall government revenues are very difficult to predict as our model is not best suited to follow other taxes when analyzing scenarios up to 2035, so these results should be treated with caution and further research is needed in this area.

[28] Arenas and Vnukova (2019) (see Annex B) estimate the short-term impact of AfCFTA's tariff liberalization on imports and tax revenues using a partial equilibrium model.

6. DISTRIBUTIONAL IMPACTS OF AFCFTA ON EMPLOYMENT, WOMEN, AND POVERTY

Effects on poverty

The latest estimate from the World Bank (World Bank 2018b) indicates that in the African continent 415 million people live in extreme poverty (57 percent of the world total) and 60 percent of the people reside in countries in fragility.[29] Progress in development goals, including poverty reduction, is heterogenous across the continent. At the broad regional level, for instance, the level of extreme poverty in Northern Africa is less than 3 percent while that of Sub-Saharan Africa is 41.1 percent. These regional estimates mask strong discrepancies between countries. In Northern Africa, the extreme poverty headcount ratio in Djibouti is 19.3 percent while the same ratio for Algeria or Egypt is below 0.4 percent. In Sub-Saharan Africa, incidences of extreme poverty are the lowest in Mauritius (0.4 percent), Seychelles (0.9 percent) and Gabon (3.9 percent) while the highest are in Burundi (74.8 percent), Madagascar (77.5 percent) and the Central African Republic (77.7 percent).

By 2035 and under baseline conditions, the headcount ratio of extreme poverty in Africa is projected to decline to 10.9 percent. Contemplating a continuation of current demographic and economic trends, and in line with poverty projections from World Bank (2018b), the world remains off target to eradicate extreme poverty by 2030. In the baseline scenario and throughout Africa, the headcount ratio of extreme poverty is expected to decline from 34.7 percent in 2015 to 15.5 by 2030 and 10.9 percent by 2035[30] [31]. Throughout this period, Sub-Saharan Africa would observe a decline in extreme poverty from the most recent estimate of 41.1 percent to 13.1 percent, while most countries in Northern Africa[32] are expected to eradicate extreme poverty by 2035.

More than half of Africa's population is likely to live on more than PPP$5.50 a day by 2035. Under baseline projections, the proportion of people that live above moderate poverty, here defined above an international threshold of PPP$5.50/a day[33], is expected to increase from 21.9 percent in 2015 to nearly half to the population by 2035[34], which is equivalent to a net increase of half a billion people. In our baseline projections, this expansion is reflected in a higher demand for basic public services such as education, health, electricity, and water.

AfCFTA can lift an additional 30 million from extreme poverty. As shown in the left- panel of Figure 14, by 2035 the full implementation of AfCFTA can lift from extreme poverty 30 million people or 1.5 percent of the continent's population. Western Africa would observe a decline of 12 million due to AfCFTA, while Central and Eastern Africa would observe declines of 9.3 and 4.8 million, respectively. At the country level, the largest gains in poverty reduction due to AfCFTA would occur in countries with high initial poverty rates such as Guinea-Bissau (10.2 percentage points), Togo (7.2 percentage points), Mali (7.6 percentage points) Sierra Leone (7.2 percentage points), Liberia (5.7 percentage points), Niger (5.4 percentage points), and the Central African Republic (5.1

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[29] The harmonized list of countries in fragile situation can be found here: https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations

[30] Poverty estimates were obtained by linking results of a CGE model with a simple global microeconomic model. The initial global distribution of per capita consumption/income was constructed with household-based data. Country-specific growth rates in real per capita household consumption from the macro CGE are fully transmitted to households assuming distribution-neutrality. To calculate the number of poor, the total population in each country is adjusted using World Bank population projections.

[31] There are 163 countries represented in the microeconomic model with 146 harmonized, nationally- representative household surveys obtained from the World Bank's Global Micro Database (GMD). Additional per capita consumption/income distributions for 17 countries were obtained from the PovcalNet website.

[32] With the except of Djibouti and Libya (no data).

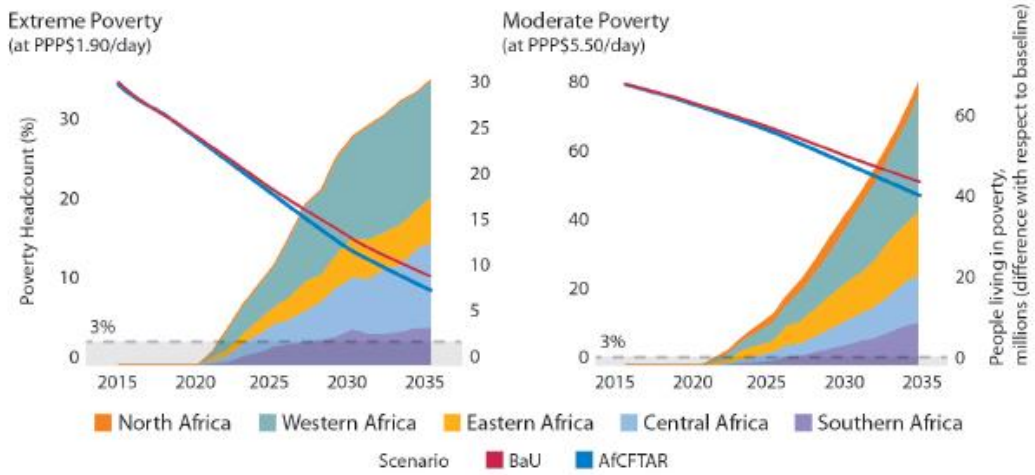
[33] The World Bank now reports international poverty lines that are more closely related with national poverty standards. These poverty lines are set t at $1.90, $3.20, and Purchasing Poverty Parity $5.50, for low-, lower- middle, and upper-middle income countries, respectively

[34] In comparison the World Bank estimated that in 2015 53.69 percent of the population in developing countries lived with less than PPP$5.50 a day – or 3,369 million.

percentage points).

As a result of the Agreement, 67.9 million in the continent can be lifted from poverty (at PPP$5.50/day) by 2035. The right-panel shows the effect of AfCFTA on moderate poverty at PPP$5.50/day. Partly due to the large size of the population but also influenced by the large boost in household consumption expected from trade openness, about half of the people lifted from moderate poverty will be located in six countries, Ethiopia (8.2 million), Nigeria (7 million), Tanzania (6.3 million), Democratic Republic of Congo (4.8 million), Kenya (4.4 million) and Niger (4.2 million).

Figure 14: Evolution of moderate poverty under baseline and AfCFTA implementation



Source: Authors' estimates

Note: Central Africa = Angola, Central African Republic, Cameroon, Congo, Dem. Rep., Congo, Rep., Gabon, Equatorial Guinea, Rwanda, São Tomé and Principe, and Chad; Eastern Africa = Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Sudan, Somalia, South Sudan, and Uganda; Northern Africa = Algeria, Egypt, Arab Rep., Libya, Morocco, and Tunisia; Southern Africa = Botswana, Lesotho, Madagascar, Mozambique, Mauritius, Malawi, Namibia, Eswatini, Seychelles, Tanzania, South Africa, Zambia, and Zimbabwe; Western Africa = Benin, Burkina Faso, Côte d'Ivoire, Cabo Verde, Ghana, Guinea, Gambia, The Guinea- Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal ,Sierra Leone, and Togo

Effects on employment

Our analysis focuses on workers switching jobs. In standard CGE models, the unemployment is fixed at the benchmark level and the number of jobs grows only in line with the growth of the working age population over time and remains exogenous under different scenarios (we relax this assumption in sensitivity analysis).[35] This means that the analysis does not capture the effects of AfCFTA on job creation, but rather its impact on job reallocation as employment shifts from sectors of comparative disadvantage to sectors of comparative advantage. Our analysis therefore focuses on workers switching jobs or on labor displacement, not on new jobs being created. Under baseline conditions and at the continental level, the distribution of employment by activity changes accordingly to expected demographic and urbanization trends.

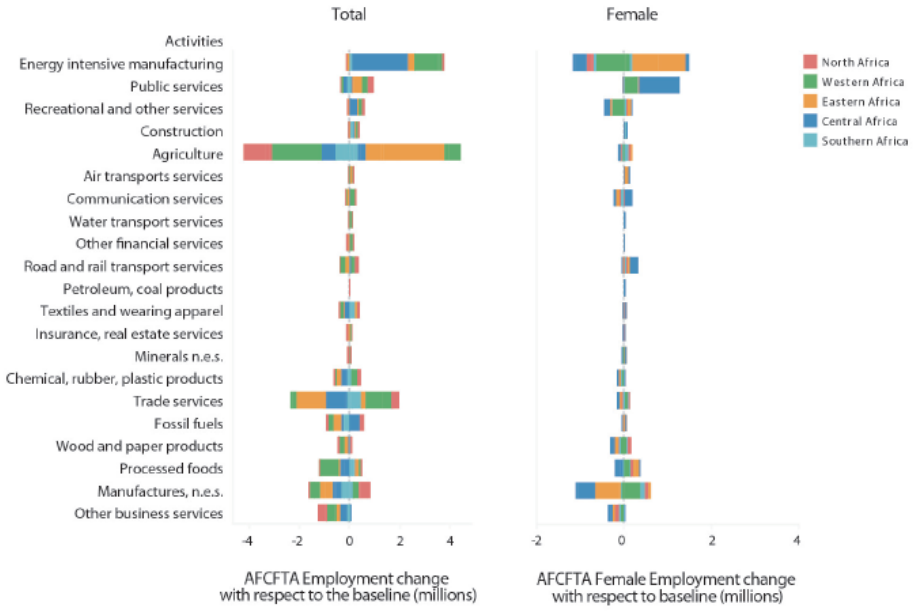
Under baseline conditions, agriculture and wholesale and retail trade would provide half of employment in the continent. Agriculture's importance as a source of employment is expected to decline to 29.7 percent of total employment in Africa, down from 35.9 percent in 2020. This decline is in line with historical trends around the world and for the African continent. The retail and wholesale trade sector's participation in total employment is expected to increase from 16.9 in 2020 to 20 percent by 2035.

[35] There are still some minor differences in total employment only attributable to convergence issues.

Under baseline conditions, agriculture would account for one quarter of employment in the continent, with marked differences between countries. In Northern Africa, the percentage of people employed in agriculture would be lower than in other regions, at 10.7percent. In Egypt, agriculture is expected to employ 12.4 percent of the workforce by 2035, and in Morocco 11.6 percent, but smaller proportions are projected in Tunisia (7.8 percent) and the rest of Northern Africa (6.1 percent). In Eastern Africa, the proportion of employment in agriculture is projected at 47.8 percent, driven by the large shares in Kenya (60.9 percent), Ethiopia (60.7 percent), and Uganda (52.1 percent), compared with lower shares in the countries that rest of Eastern Africa (with 11.4 percent of employment in agriculture by 2035). In Southern Africa, with an employment projection in agriculture of 29.8 percent, the largest agriculture employment share is projected in Madagascar (53.1 percent) and Tanzania (50.4 percent), and the lowest in Botswana (4.9 percent) and South Africa (1.7 percent). Meanwhile, Western Africa's agricultural employment is projected at 26.7 percent by 2035, while that of the Central Africa region at 20.9 percent, with more homogenous conditions between countries.

Under baseline conditions, the wholesale and retail trade sector would be the second most important employer in the continent. Across the continent, the wholesale and retail trade sector is expected to reach 21.1 percent of employment, but this proportion is expected to be larger in some countries, such as Nigeria (with a 41 percent employment share for trade employment). In Northern, Eastern, Central, and Southern Africa, trade employment share is on average 18 percent. After trade, the most important sectors for employment are related with public services (education, health, electricity, water, and public administration) with 15.2 percent in the continent, followed by other business services (3.2 percent), recreational services (2.5 percent), and communication services (2.2 percent).

Figure 15: AfCFTA employment change with respect to baseline, total and female (millions)



Source: Authors' estimates

AfCFTA would support the structural transformation of employment in Africa. As seen in Figure 15 and as a result of the Agreement, the continent would see a net increase in the volume of workers in energy intensive manufacturing (i.e. steel, aluminum, with an increase of 2.4 million), trade services (0.13 million), public services (4.6 million), and recreational services (0.28 million) .These effects are not distributed equally across countries and a more careful examination of the results at the country level reveals differentiated impacts across countries. For example, agricultural employment, as percentage of total employment, is increasing in 15 countries[36] and declining in 14, which reflects the large sectoral redistribution of agricultural output across the continent as seen in Figure 15.

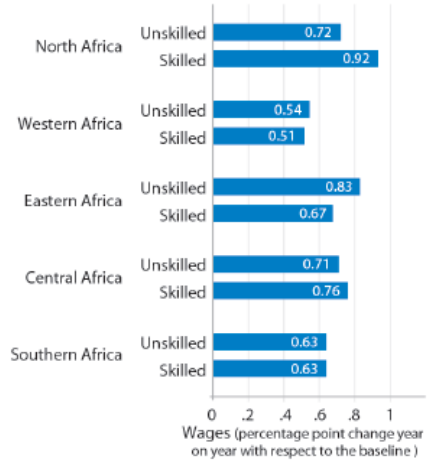
Sectoral reallocation of labor within countries is driven by the intensity of labor used and reduction of trade costs under AfCFTA. The effect on segments of the population is driven as well by their propensity to be

[36] There are still some minor differences in total employment only attributable to convergence issues

employed in certain industries, particularly for the case of women. Across the African continent, the sector that tends to employ a larger proportion of women is recreational and other services.[37] While at the continental level recreational and other services are not affected in terms of total employment, nuanced differences emerge when looking at the regional level. For instance, as a result of AfCFTA, Central Africa would observe combined gains of 287,000 jobs in recreational and other services. Again, within Central Africa, Cameroon and Central African Republic would observe gains, while there would be a decline in Rwanda. Figure 15 shows in the right panel results for women at the continental level. Major gains in employment are expected in the agricultural sector (0.3 million), which is, overall, close to gender-neutrality in employment across Africa (refer to Figure 3).

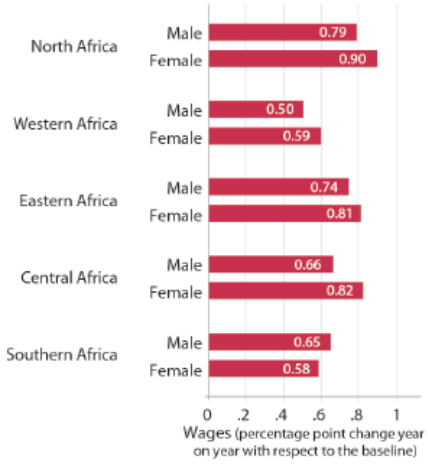
In general terms, wages for unskilled labor would grow at a faster rate than average in Western, Eastern, and Southern Africa. Figure 16 and Figure 17 summarize the effect on wages after full implementation of AfCFTA at the regional level .Effects on relative wages are driven by the changes in the composition of output induced by the policy reforms. In Western, Eastern, and Southern Africa, AfCFTA is expected to reduce the skill wage premia as labor remunerations for unskilled labor would grow at a faster rate than those of skilled labor (initial gender and skill premia are reported in Table 3). In Eastern Africa, wages for unskilled labor would grow 0.16 percentage points higher (year-on-year) than wages for skilled workers. In Western Africa, wages for unskilled would grow 0.03 percentage points higher than those of skilled workers, while unskilled wages would grow 0.02 percentage points would grow the same percentage points than those of the skilled in Southern Africa. Skill premia is expected to increase in Northern Africa amid the increase in demand of skilled workers in manufactures and sophisticated services due to AfCFTA (processed foods and manufactures n.e.s.).Wages for skilled workers would grow 0.2 percentage points (year-on-year) higher than those of unskilled workers.

Figure 16: AfCFTA's effect on wages, by skill



Source: Authors' estimates

Figure 17: AfCFTA's effect on wages, by gender



Source: Authors' estimates

As a result of an expansion of output in female-labor intensive industries, female wages would grow faster in all regions except for Southern Africa. With respect to baseline conditions, female wages would grow faster than males' in Northern (0.11 percentage points), Western (0.09 percentage points), Eastern (0.07 percentage points), and Central Africa (0.17 percentage points) amid an increase of female employment in agriculture and some key service sectors which tend to employ larger shares of women (see Figure 15).Wages for female workers would grow at a slower pace than males' in Southern Africa, 0.07 percentage points. While these results consider that male and female workers are imperfect substitutes, they also assume frictionless mobility of workers between sectors and fixed labor force participation rates. As a result of output expansion in key female-labor intensive industries, female wages would grow faster than males' in 19 countries[38]. Overall, these results are upper-bound estimates that serve to highlight the role of complementary policy reforms to support labor mobility and promote equality of opportunities in the labor market, especially for female workers.

[37] See Annex D for a full description of the sectors

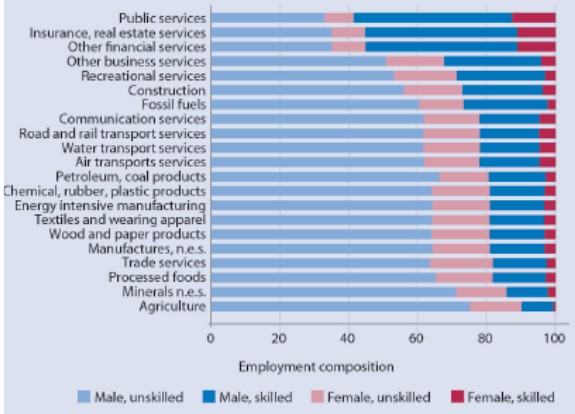
[38] Democratic Republic of Congo, Rwanda, Rest of Central Africa, Kenya, Uganda, Rest of Eastern Africa, Egypt, Morocco, Rest of North Africa, Mozambique, Mauritius, Tanzania, South Africa, Zambia, Zimbabwe, Rest of South Africa, Cote d'Ivoire, Ghana, and Nigeria.

Box 2: Wages and employment under AfCFTA for the case of Cote d'Ivoire

This box explains the effect that reductions in trade restrictions create on employment and wages. Cote d'Ivoire is showcased due to the relatively large reductions in trade barriers and highest expected welfare gains, although a similar analysis can be done for all countries in the simulation.

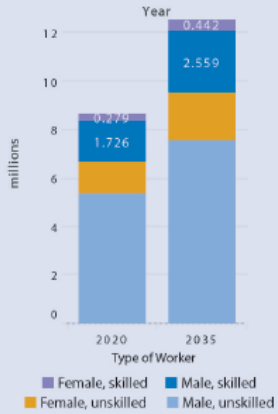
The final effect on wages is driven by a series of factors, the most important being the following: a) the relative size of the reduction in trade barriers by economic activity; b) the initial composition of labor in each economic activity and c)the future supply of labor by gender and skill, not only in absolute terms in the country of interest, but also in relative terms to the rest of its trading partners. A global CGE model is uniquely capable to address these dynamic changes simultaneously in a consistent economic framework. Overall, changes in trade restrictiveness will increase the demand of certain varieties of products and increase the demand of the factors of production used to produce them.

Figure 18: Cote d'Ivoire: labor composition by skill and gender, AfCFTA in 2035 (% of total in the activity



Source: Authors' estimates

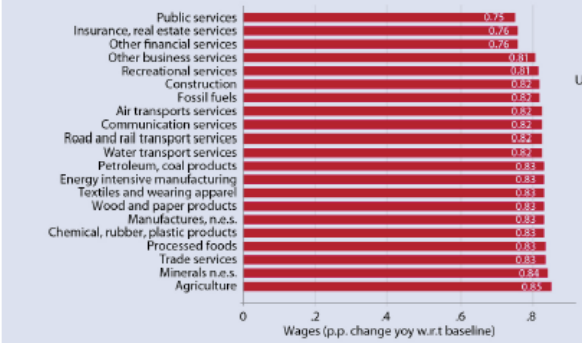
Figure 19: Cote d'Ivoire: labor volumes by skill and gender



Source: Authors' estimates

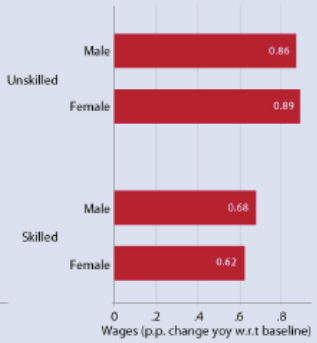
With respect to point a, Cote d'Ivoire is one of the countries that faces some of the highest trade restrictions in the continent, but over the simulation period (2020-2035), it will also experience one of the largest reductions in tariffs and non-tariff barriers, seeing a reduction from 8 to 4 percent in tariffs and from 40 to 24 percent in NTBs (see Figure 6 and Figure 7). Textiles and wearing apparel are the sector that will experience the largest reduction in tariffs (from 10 to 3 percent), followed by energy intensive manufacturing (from 5 to almost zero percent tariffs), and manufactures n.e.s. (from 4 to 0.13 percent); agriculture would experience a net decline of 4 percentage points in tariffs, from 24 to 20 percent. In the case of NTBs, the sectors that benefit the most are chemical, rubber, plastic products (with a decline in restrictions of 23 percentage points), energy intensive manufacturing (-21 percentage points), and other business services (-19 percentage points). Related with point b and c, Figure 18 shows the final composition of employment under AfCFTA (by 2035) according to gender, skill, and economic activity. Growth in the supply of labor by skill and gender is obtained from demographic projections (UN DESA 2019), assuming constant labor force participation rates, it follows that males would account for nearly 80 percent of employment across all industries (Figure 19). Nevertheless, the final composition of skills varies significantly across industries.

Figure 20: Cote d'Ivoire: AfCFTA effect on wages by industry, annual percentage point deviations w.r.t. baseline



Source: Authors' estimates

Figure 19: Cote d'Ivoire: Wages by skill and gender, (p. p. change yoy, w.r.t. baseline)



Source: Authors' estimates

Agriculture, among the industries that employ the largest proportions of males, is also the one with the highest intensity of unskilled labor. Figure 20 and Figure 21 show AfCFTA's effect on wages as annual percentage point deviations from baseline wage growth by industry and by type of worker, respectively. Due to AfCFTA full implementation, wages of unskilled workers would grow 0.87 percentage points higher than baseline. For the case of skilled workers, wages are deviating less from baseline (although from a higher base). Wages for skilled males would grow 0.68 p.p. higher than baseline, while wages for skilled women would do it at a lower rate of 0.62 percentage points.

7. Sensitivity analysis

The results of this analysis are sensitive to the key assumptions on the reduction of nontariff barriers (NTBs) in goods and services, as well as trade facilitation. In the central scenario for the African Continental Free Trade Agreement (AfCFTA), it is assumed that NTBs are reduced at the multilateral level. It is often argued that changes in NTBs benefit countries outside of the trade agreements to the same degree as the integrating countries. Indeed, some barriers are simply measures that do not discriminate across trading partners, and this view has been adopted in previous studies. In this analysis, however, two additional scenarios are considered:

- Scenario 1: (1) full liberalization of 97 percent of tariff lines as in the central AfCFTA scenario; (2) 50 percent reduction of NTBs in trade with all partners, with a cap of 50 percentage points; and (3) trade facilitation that reduces the costs of imports from all partners by half, although capped at 10 percentage points. This scenario removes reduction of NTBs that also benefit African exporters in AfCFTA and non-AfCFTA markets.

- Scenario 2: (1) full liberalization of 97 percent of tariff lines as in the central AfCFTA scenario; (2) 50 percent reduction of NTBs in trade with AfCFTA partners, with a cap of 50 percentage points; and (3) trade facilitation that reduces the costs of imports from AfCFTA partners by half, although capped at 10 percentage points. Scenarios 1 and 2 are similar, but, in addition, all NTBs and trade facilitation measures reduce the trade cost only within the continent and not with respect to non-AfCFTA partners.

Under Scenario 1, the continental welfare gains amount to about 5 percent. The countries that benefit the most under this scenario include the same countries that benefit the most under the central scenario, but overall gains are smaller because the costs of exporting remain unchanged.

Scenario 2 represents the lower bound of estimate of gains. With no reduction of trade costs with the non-AfCFTA partners, the continent would only experience the welfare gains of 1.2 percent with biggest winners among countries that trade the most within the continent such as Morocco, Namibia, and Senegal.

Table 10: Real income gains under different scenarios (% deviations with respect to baseline in 2035)

	AfCFTA	Scenario 1	Scenario 2
Total Africa	7%	5%	1%
Cote d'Ivoire	13%	8%	4%
Zimbabwe	11%	6%	3%
Kenya	11%	6%	3%
Tanzania	10%	6%	2%
Namibia	10%	6%	6%
Congo, DR	9%	7%	2%
Cameroon	9%	5%	1%
Ethiopia	9%	4%	1%
Morocco	8%	5%	7%
Burkina Faso	7%	5%	3%
Egypt	7%	5%	0%
Mauritius	6%	3%	2%
Ghana	6%	4%	0%
Botswana	6%	3%	1%
Tunisia	6%	3%	3%
Senegal	6%	4%	6%
Zambia	5%	2%	2%
Nigeria	4%	4%	0%
South Africa	4%	2%	2%
Uganda	3%	2%	1%
Madagascar	3%	2%	0%
Rwanda	3%	2%	0%
Mozambique	2%	0%	-1%
Malawi	2%	1%	1%

Source: Authors' estimates

8. CAVEATS

A number of caveats accompanies the quantitative results. Reasons for an underestimation of the overall gains include: (1) The baseline scenario has a relatively static assumption on trade preferences over time, including many 'zero' flows in intra-continental bilateral trade in the reference year that remain zero throughout. Given the growth path, one might assume a growing preference for imports irrespective of price movements. The gains could be considerably larger with more open economies and with informal trade flows taken into consideration (Box 1). (2) Producers and consumers do benefit from lower prices, but also from an increase in product varieties. This so-called love-of-variety effect can have important impacts on consumer welfare. For producers, as well, imports of key intermediate and capital goods can come embedded with technology that could lead to an increase in productivity, all else equal. (3) Rising exports can be associated with two additional impacts. First, exports in and of themselves may lead to rising productivity as exporters need to meet the quality and regulatory requirements of global markets. In addition, evidence suggests that rising exports tend to benefit higher productivity firms and this structural shift could lead to an increasing share of higher productivity firms relative to lower productivity firms that are producing for the domestic market. In addition to this structural shift, exporting firms may benefit from scale economies which would be an additional boost to these firms. (4) The model assumes constant returns to scale and perfect competition, thus there are no pro-competitive impacts of lowering trade barriers, nor potentially pro-productivity impacts as more productive export-oriented firms gain market share. Most importantly, (5) improving market conditions, competitiveness, and business sentiment would induce foreign direct investment in Africa thus leading to higher

investment and accelerating the import of higher technology intermediate and capital goods and improved management practices.

On the other hand, the reasons that the estimates may be over-estimating the gains from trade include: (1) the fact that the study ignores the potential costs of lowering the non- tariff barriers and the trade facilitation measures; (2) the transitional costs associated with trade- related structural change such as employment shifts and potentially stranded assets, such as capital.

Limitations associated with the use of microdata and the reconciliation with macroeconomic statistics should be considered. Nationally representative household surveys are incorporated in our modeling framework to provide information related with the contribution of labor to value added into the CGE model, disaggregated by sector and type of worker. To incorporate this information, which is not available in national accounts statistics[39], requires a reconciliation of macro and micro data sources. This reconciliation must deal with the fact that (a) aggregates obtained from microeconomic data do not add up to the aggregate statistics in national statistics; and that (b) microeconomic data might not provide accurate information about very some small sectors[40]. Annex G provides further details on the construction of the micro-based statistics and the validation process. Overall, microdata used in this study is not meant to provide, especially to the general public, timely and accurate labor statistics; rather, they are meant to be provide a detail representation of relative labor conditions that exist between and within countries within the context of general-equilibrium modeling.

[39] Most countries in Africa now have the technical capacity to gather and document national accounts statistics, and these statistics – along with ancillary data from central banks, customs authorities and other agencies – usually provide a fair, if not always accurate and timely, macro picture for the economy.

[40] For instance, a small sampling size in the survey design might not be able capture enough observations for very small sectors or groups of people, which can lead to unreliable statistics. Another consideration is that household surveys is bounded to recover information about individuals within its sampling framework, excluding the homeless or individuals living in refugee camps. Lastly, an emerging restriction is non-response, which affects in a greater proportion the wealthier segments of the population.

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Annex A: Deep commitment in African RECs – legal texts

References to the Legal Text of the Agreements of AfCFTA and the African Sub-Regional RTAs

East African Community (EAC)

• EAC Treaty – Treaty for the Establishment of the East African Community; http://rtais.wto.org/rtadocs/94/TOA/English/EAC%20TREATY.pdf
• Protocol on the Establishment of the EAC Common Market; http://eacj.org/wpcontent/uploads/2012/08/Common-Market-Protocol.pdf

EAC Treaty:

• Chapter 11 – reference to Protocol
• Chapter 12 – cooperation in investment
• Chapter 13 – TBT
• Chapter 14 – movement of capital (Art.86)
• Chapter 15 – services
• Chapter 18 – SPS
• Chapter 19 – environment
• Art.75 – customs

Protocol on the Establishment of the EAC Common Market:

• Part C – free movement of goods
• Part F – services
• Part G – free movement of capital
• Art.29 – investment
• Arts.33, 34, 36 – competition
• Art.35 – public procurement
• Art.40 – environment
• Art.43 – IPR
• Art.34 – subsidies = state aid
• Part D – labour

Common Market for East and South Africa (COMESA)

• COMESA Treaty (1994); https://www.comesacompetition.org/wp-content/uploads/2016/03/COMESA_Treaty.pdf

COMESA Treaty:

• Chapter 6 – customs (Art.58, among others). See also chapter 7.
• Chapter 6 – trade liberalization (goods)
• Art.51 – AD
• Art.52 – state aid
• Arts.52.2, 52.4, 53 and 54.2
• Art.55 – competition
• Art.81 – movement of capital
• Chapter 15 – TBT
• Chapter 16 – environment
• Chapter 26 – investment
• Art.86 – export duties
• Chapter 6 – includes trade in services = GATS. See also chapter 11.
• Art.132 – SPS
• Chapter 28 – labor. See also Art.143.1(b)

South African Development Community (SADC)

• SADC Treaty (1992); https://www.wipo.int/edocs/lexdocs/treaties/en/sadc/trt_sadc.pdf
• Protocol on Trade (August 1996); https://wipolex.wipo.int/en/text/203430

Protocol on Trade:

• Part 2 – Trade in goods

• Art.5 – export taxes
• Part 3 – customs (Art.13)
• Art.16 – SPS
• Art.17 – TBT
• Art.18 – AD
• Art.19 – subsidies and CVM
• Part 5 – investment
• Art.23 – GATS
• Art.24 – IPR
• Art.25 – competition

Economic Community of West African States (ECOWAS)

• ECOWAS Treaty; https://www.ecowas.int/wp-content/uploads/2015/01/Revised-treaty.pdf

ECOWAS Treaty:

• Chapter VI – environment
• Art.35 – trade liberalisation
• Arts.36, 46 – customs
• Art.42 – dumping
• Art.53 – movement of capital
• References to services trade throughout the Treaty – GATS

West African Economic and Monetary Union (WAEMU)

• Treaty WAEMU; http://www.uemoa.int/fr/system/files/fichier_article/traitreviseuemoa.pdf

Treaty WAEMU:

• Arts.76, 77: trade in goods.
• Arts. 88-90 – competition
• Art.77 – export taxes
• Various references to services trade throughout the agreement – GATS
• Arts.76, 79 – movement of capital

South African Customs Union (SACU)

• SACU Agreement; http://sacu.int/docs/agreements/2017/SACU-Agreement.pdf

SACU Agreement:

• Part 5 – trade liberalization
• Art.23 – customs
• Art.28 – TBT
• Art.30 – SPS
• Arts.40 and 41 – competition

Economic and Monetary Community of Central Africa (CEMAC)

• CEMAC Treaty; http://rtais.wto.org/UI/CRShowRTAIDCard.aspx?rtaid=95

CEMAC Treaty

• Art.13 – trade liberalization
• Arts.23-25 – competition
• Section V – environment
• Art.14(o) – export taxes
• Arts.13 and 23 – state aid
• Art.19 – AD
• Art.17 – TBT and SPS
• Various references to services – GATS
• Art.28 – movement of capital

African Continental Free Trade Agreement (AfCFTA)

• AfCFTA Treaty; https://au.int/sites/default/files/treaties/36437-treaty-consolidated_text_on_cfta_-_en.pdf

AfCFTA Treaty

• Art.6 – goods, services, investment, IPR, competition
• See Protocol on trade in goods for trade liberalization.
• Protocol Trade in Goods
o Art 10 – export duties
o Arts.14, 15 – customs
o Art.17 – AD and CVM
o Art.21 – TBT
o Art.22 – SPS
o Art.25 – STE
• Protocol on Trade in Services – GATS
o Arts.11, 12 – competition
o Art.13 – payments, transfers (movement of capital)
o Art.2.4 – carve out for public procurement ("Procurement by governmental agencies purchased for governmental purposes and not with a view to commercial re-sale are excluded from the scope of this Protocol")

Annex B: Short-Term Revenue Implications of Tariff Liberalization under the African Continental Free Trade Area (AfCFTA)[41]

Methodology and Data

The Tariff Reform Impact Simulation Tool (TRIST) simulates the short-term impact of tariff reforms on imports and tax revenues based on a partial equilibrium model. TRIST treats demand for each product in isolation from other products and does not consider inter and intrasectoral linkages. TRIST is used to analyze short-term impacts of trade reforms on imports and tax revenues, and it is not designed to assess economy wide impacts over the medium and long term. The model also does not model new trade flows through the extensive margin. The response to tariff changes is modeled in two steps in TRIST. First, in the case of AfCFTA, imports from member countries substitute imports from the rest of the world as they become relatively cheaper following the elimination of tariffs on intra-regional goods. Second, demand for imports of affected products will increase because they are cheaper after the tariff liberalization. The import responses in each step are driven by the exporter substitution elasticity, which is assumed constant among products, and the product-specific import demand elasticities, respectively. TRIST uses data on imports and collected amounts for customs duties and other taxes charged on imports (e.g. VAT, sales tax, excise) at the tariff line and country of origin level. This data is compiled from import transactions by national customs agencies and provides exact values for tax revenues and effective tariff rates applied on imports. This data will be referred to as "customs data" and provides the most accurate estimates of the impacts of tariff changes on imports and tax revenues. However, TRIST can also use data compiled using import values and statutory tariff and tax rates obtained from national tariff schedules ("statutory data"). Because the latter does not account for non-preferential tariff exemptions and assumes a perfect utilization rate for preferential trade agreements, significant differences in estimated impacts might arise between simulations using statutory and customs data. A database based on import values and statutory tariffs was constructed for 48 African countries for which data was available and will be used to simulate impacts in section 4.[42] Additionally, data collected by national customs offices will be used to obtain estimates on revenues and imports impacts for eleven countries in section 3.

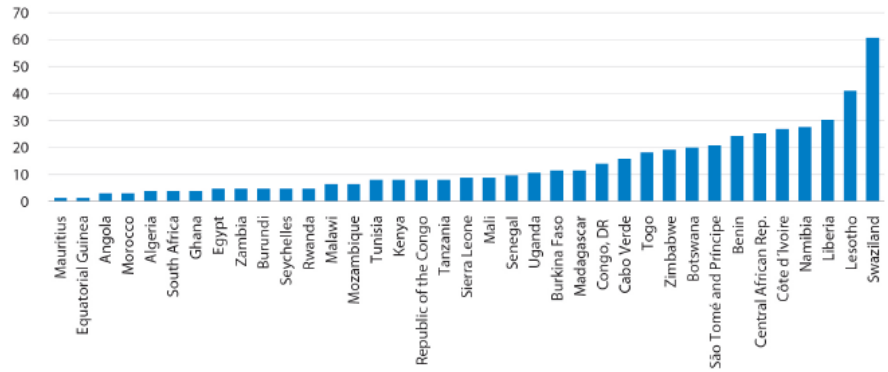
Descriptive Statistics

Tariffs are not the only, and usually not the most important, source of revenues from imports. Figure B 1 shows that the importance of taxes on international trade (exports and imports) as a

[41] Based on Arenas and Vnukova (2019)
[42] No statutory data is available for Equatorial Guinea, Eritrea, Libya, Somalia, South Sudan, Sudan.

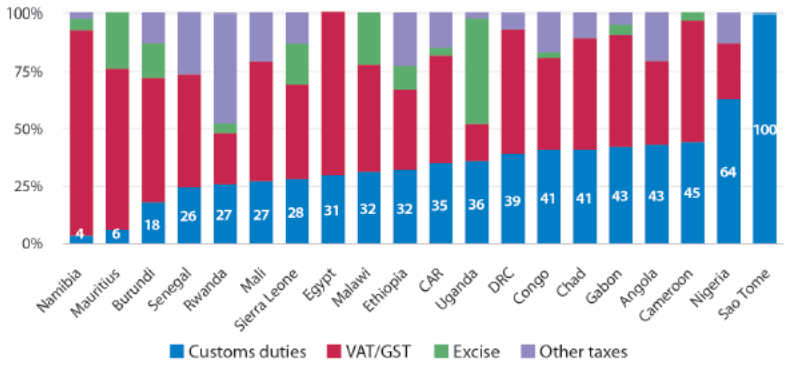
percentage of government revenues is below twenty percent for about two thirds of countries for which data is available. Figure B 2 shows that custom duties are not the most important source of import tax revenue for most countries for which we have customs data except Nigeria and Sao Tome and Principe: the combination of Excise and VAT usually accounts for half to three quarters of tax revenues collected from imports. In general, taxes on international trade are not the most important sources of revenues for most governments in Africa.

Figure B1: Taxes on international trade as percentage of government revenues



Source: IMF (2018)

Figure B2: Share of total tax revenues from imports



Source: Authors' calculations based on customs data and Sanaa Consulting (2018).

Collected tariff rates deviate significantly from statutory tariff rates for most countries for which data is available (Table B 3). These differences might arise due to two reasons. First, the statutory rates assume that imports granted preferential treatment under trade agreements make full utilization of those preferences. However, in cases in which preference utilization is not complete, the statutory rate will be lower than the paid tariff rate reflected in the customs data. Second, the statutory data assumes that imports from non-FTA origins pay MFN tariffs - which neglects the presence of non-preferential tariff exemptions granted under national schemes that are widespread in Africa (special economic zones, investment attraction packages, industrialization plans, etc). In countries in which these exemptions are important, the statutory rate will be higher than the effectively paid rate calculated using customs data.

Table B1: Statutory and collected tariff rates

	Statutory tariff rate	Collected tariff rate	Collected to statutory ratio
Chad	15.5	15.5	1.00
Cameroon	12.9	10.8	0.84
Senegal	7.2	5.9	0.82
Mauritius	0.9	0.7	0.78
Central African Republic	14.4	10.1	0.70
Angola	8.0	5.5	0.69
Gabon	12.9	8.0	0.62
Ethiopia	10	6.1	0.61
Congo, Democratic Rep.	7.4	4.1	0.55
Burundi	12.3	6.7	0.54
Congo, Rep.	12.7	5.7	0.45
Rwanda	12.1	5.3	0.44
Sao Tome and Principe	8.7	2.9	0.33

Source: Authors' calculations based on customs data and Sanaa Consulting (2018).

Simulation results using customs data

Despite fears about fiscal losses from AfCFTA, the initial short-term tax revenue losses will be small (below one percent for most countries) and distributed over a decade. Average annual tariff revenue losses are estimated below one percent change for most countries (Table B 5) except for Burundi (1.1 percent), Malawi (2 percent), and Mali (3.3 percent). However, due to the liberalization timeline, most of the revenue impact will materialize only after the fifth year when sensitive products are liberalized. The fiscal effect of AfCFTA will be small because intra-regional trade and its share of tariff revenue is low in most countries.

Table B2: Tariff revenue changes under AfCFTA (average annual percent change)

	AfCFTA liberalization	Full liberalization
Burundi	-1.13%	-2.01%
Egypt	0.00%	-0.02%
Ethiopia	-0.27%	-0.40%
Malawi	-2.01%	-2.27%
Mali	-3.31%	-3.53%
Mauritius	-0.01%	-0.55%
Namibia	-0.04%	-0.09%
Nigeria	-0.31%	-0.47%
Senegal	-0.09%	-0.21%
Sierra Leone	-0.52%	-0.68%
Uganda	-0.23%	-0.30%

Source: Authors' calculations based on customs data.

Tariff revenue losses are estimated to be even smaller as a share of government revenues. AfCFTA will result in annual revenue losses that do not exceed 0.06 percent of total government revenues, on average, during the liberalization period with the exemption of Mali (0.5 percent).

Table B3: Tax revenue changes under AfCFTA liberalization scenario

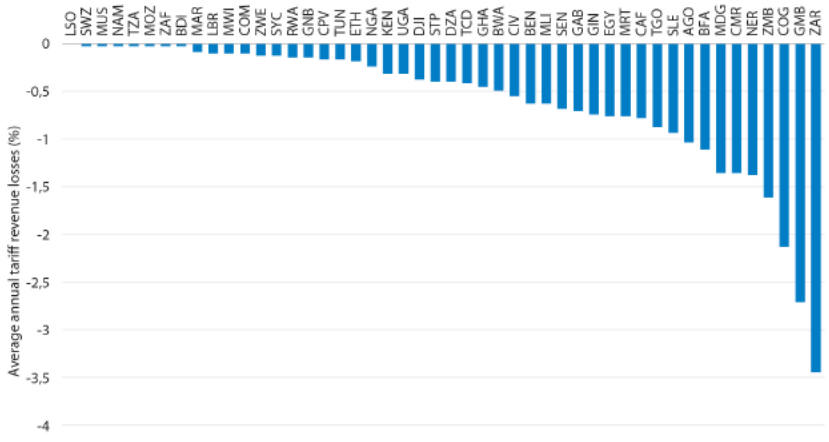
	Tariff revenue loss (% tariff revenue)	Tariff revenue loss (% total government revenue)
Burundi	-1.13%	-0.028%
Egypt	0.00%	0.000%
Ethiopia	-0.27%	-0.001%
Malawi	-2.01%	-0.060%
Mali	-3.31%	-0.493%
Mauritius	-0.01%	0.000%
Namibia	-0.04%	0.000%
Nigeria	-0.31%	-0.034%
Senegal	-0.09%	0.003%
Sierra Leone	-0.52%	-0.045%
Uganda	-0.23%	-0.038%

Source: Authors' calculations based on customs data and IMF Article IV reports and IMF Government Finance Statistics (GFS), using the latest year available: Burundi (2013), Ethiopia (2013), Malawi (2017), Mali (2016), Mauritius (2017), Sierra Leone (2014), Uganda (2016).

Simulation results using statutory data

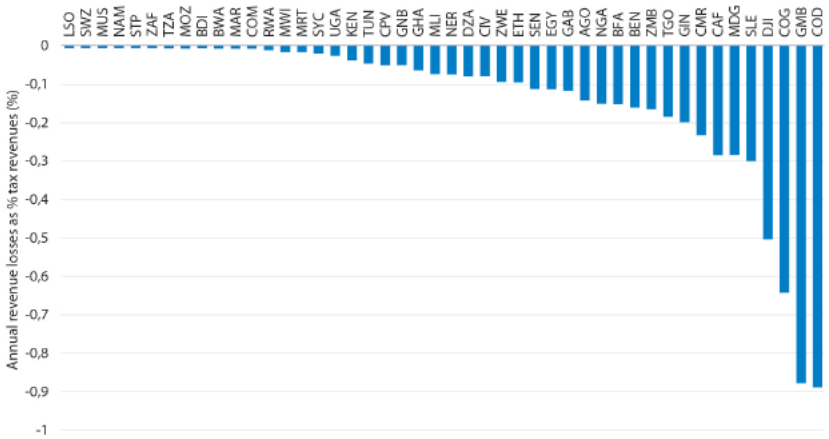
Tariff revenue losses will remain below 1.5 percent for most countries, or below 0.3 percent of total tax revenues, with a few exceptions. Average annual tariff revenues losses will remain below 1.5 percent for most countries, except for DRC (3.4 percent), Gambia (2.7 percent), Republic of Congo (2.1 percent), and Zambia (1.6 percent change). However, due to the liberalization timeline, most of the revenue impact will materialize only after the fifth year when sensitive products are liberalized (see Table B 5 for a yearly breakdown of tariff revenue impacts). However, even in countries experiencing the largest tariff revenue losses, lost revenues as a percentage of total government revenues is rarely expected to rise above 0.3 percent annual change. These results are consistent with other partial-equilibrium estimations. UNECA 2017a. that show that the number of countries with high tariff revenue losses is reduced, even under full liberalization.

Figure B3: Average annual change in tariff revenues (average annual percent change)



Source: Authors' calculations based on statutory data.

Figure B4: Average annual change in tax revenues (percent of tax revenue)



Source: Authors' calculations based on statutory data.
Note: countries for which total government revenue data was available in IMF GFS.

Comparison of results using customs and statutory data

Differences in the estimated tariff revenue effects vary across countries using customs data versus statutory data. Table B 4 shows the differences in tariff revenue losses estimated using customs and statutory data. For some countries such as Egypt, Senegal, Sierra Leone, and Uganda, the percentage estimates using statutory data are higher than the estimates using the actual customs data, while for the remaining countries the customs data estimates are lower. For instance, in Egypt, statutory data estimates of tariff revenues are significantly higher (more negative) in comparison to the actual customs data (-0.8 percent versus -0.001 percent). Likewise, Senegal's tariff revenue losses using statutory data are seven times higher than the estimates using customs data (-0.7 percent versus -0.1 percent). Among the remaining countries presented in Table B 4, the revenue losses estimated with customs data are higher than those estimated with statutory data ranging from forty times higher (Burundi) to only 1.3 times higher (Nigeria). Despite the differences in results, the average tariff revenue impact of AfCFTA are small irrespective of the data used with most countries in Table B 4 experiencing losses below 1 percent according to customs data and all countries experiencing losses below 1 percent according to statutory data.

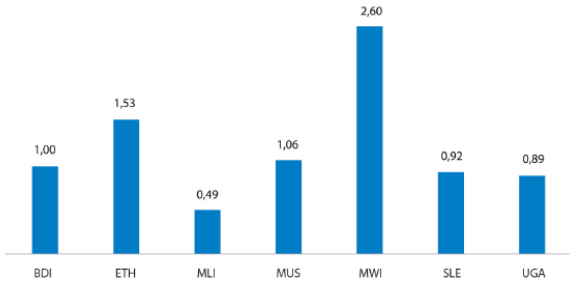
Table B4: Import and tariff revenue impacts estimated with customs and statutory data

	Tariff revenues	
	Customs data	Statutory data
Burundi	-1.10%	-0.03%
Egypt	-0.001%	-0.76%
Ethiopia	-0.30%	-0.18%
Malawi	-2.00%	-0.11%
Mali	-3.30%	-0.62%
Mauritius	-0.01%	0.00%
Namibia	-0.04%	-0.01%
Nigeria	-0.30%	-0.24%
Senegal	-0.10%	-0.68%
Sierra Leone	-0.50%	-0.93%
Uganda	-0.20%	-0.32%

Source: Authors' calculations based on customs and statutory data.

We examine three reasons that might explain the differences in results obtained using customs and statutory data: (i) different import values; (ii) import origin composition; (iii) applied tariff rates. First, total import values might be different between both datasets. Estimated impacts would then be overestimated in the database with the largest values. Second, the share of imports originating from AfCFTA countries may be different in both datasets. If one dataset significantly overestimates (underestimates) the percentage of imports from AfCFTA countries then, all else equal, the impact on imports from removing tariffs on AfCFTA countries will be larger (smaller). Third, the tariff rates applied on AfCFTA countries may differ between the databases. In this case, eliminating tariffs on AfCFTA countries using the database with the larger (smaller) applied tariffs would result in larger (smaller) impacts on imports, assuming that elasticities remain the same.

Figure B5: Ratio of statutory to customs import values

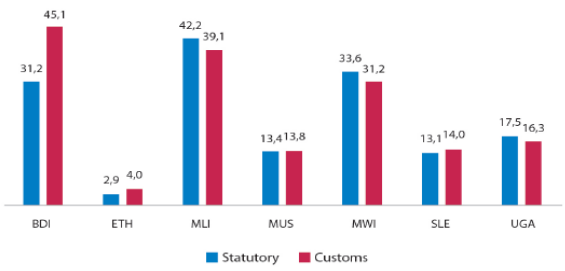


Source: Authors' calculations based on customs and statutory data.

Difference in import values are significant for Ethiopia, Mali, and Malawi. Differences between statutory and customs total import values are generally less than ten percentage points for most countries in our sample (Figure B 5). However, even though differences in Ethiopia are large, the value recorded in the customs database matches the official import value reported by the statistical agency while the value from COMTRADE exceeds it by close to 50 percent.

Differences in the percentage of imports originating from AfCFTA are small except for Burundi. Figure B 6 shows the share of total imports accounted by AfCFTA countries calculated using customs and statutory data. The differences are smaller than 3 percentage points for all countries except for Burundi which shows an AfCFTA share of imports that is 14 percentage points higher (45 percent vs 31 percent) in the customs than in the statutory database.

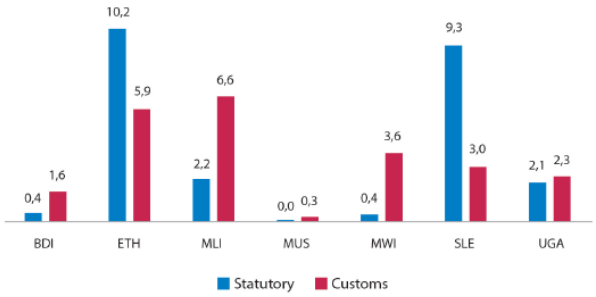
Figure B6: Imports from AfCFTA countries (% total)



Source: Authors' calculations based on customs and statutory data.

Differences in tariff rates applied on AfCFTA imports are significant in most countries except for Uganda and Mauritius (Figure B 7). These differences might arise due to two reasons. First, the statutory data assumes, by construction, that imports granted preferential treatment under current trade agreements make full utilization of those preferences. In cases in which preference utilization is not a hundred percent, the statutory rate will be higher than the effectively paid tariff rate which is reflected in the customs data. Second, the statutory data assumes imports not affected by preferential rates pay MFN tariffs - which neglects the presence of non-preferential tariff exemptions granted under national schemes that are widespread in Africa (special economic zones, investment

Figure B7: Effective tariff rates for AfCFTA countries (weighted average)



Source: Authors' calculations based on customs and statutory data.

attraction packages, industrialization plans, etc). In countries in which these exemptions are important, the statutory rate will be higher than the effectively paid rate in the customs data.

Conclusions

The results from our simulations show that the short-term impact of AfCFTA on imports and tax revenues is small for most countries. Import increases are expected to remain below 0.5 percent. Tariff revenue losses will remain below one percent for roughly two thirds of countries. Even in countries experiencing the largest tariff revenue losses, the decline in terms of total government revenues is rarely expected to rise above 0.3 percent. Our results are consistent with other studies that show that, even under full liberalization, the number of countries that will experience significant tariff revenue losses is small and that exclusion lists have the potential to significantly reduce such losses (UNECA 2017a and African Development Bank 2019). Our results also show that there could be significant differences in estimates using customs and statutory data, although both sets of data point to lower impacts overall. We found that collected tariff rates deviate significantly from statutory tariff rates for most countries for
which data is available and that we are not able to predict the direction or magnitude of the difference with the available data. An effort should be made to collect customs data for most African countries to corroborate the results from the statutory simulations.

Table B5: Simulation results based on statutory data (% tariff revenues)

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
AGO	-0.046	-0.046	-0.046	-0.046	-0.046	-2.00	-2.00	-2.00	-2.00	-2.00
BDI	0.000	0.000	0.000	0.000	0.000	-0.05	-0.05	-0.05	-0.05	-0.05
BEN	-0.003	-0.003	-0.003	-0.003	-0.003	-1.23	-1.23	-1.23	-1.23	-1.23
BFA	-0.014	-0.014	-0.014	-0.014	-0.014	-2.20	-2.20	-2.20	-2.20	-2.20
BWA	0.000	0.000	0.000	0.000	0.000	-0.99	-0.99	-0.99	-0.99	-0.99
CAF	0.000	0.000	0.000	0.000	0.000	-1.54	-1.54	-1.54	-1.54	-1.54
CIV	-0.013	-0.013	-0.013	-0.013	-0.013	-1.09	-1.09	-1.09	-1.09	-1.09
CMR	-0.006	-0.006	-0.006	-0.006	-0.006	-2.69	-2.69	-2.69	-2.69	-2.69
COG	-0.006	-0.006	-0.006	-0.006	-0.006	-4.25	-4.25	-4.25	-4.25	-4.25
COM	0.000	0.000	0.000	0.000	0.000	-0.22	-0.22	-0.22	-0.22	-0.22
CPV	0.000	0.000	0.000	0.000	0.000	-0.31	-0.31	-0.31	-0.31	-0.31
DJI	0.000	0.000	0.000	0.000	0.000	-0.73	-0.73	-0.73	-0.73	-0.73
DZA	-0.007	-0.007	-0.007	-0.007	-0.007	-0.79	-0.79	-0.79	-0.79	-0.79
EGY	0.000	0.000	0.000	0.000	0.000	-1.51	-1.51	-1.51	-1.51	-1.51
ETH	-0.002	-0.002	-0.002	-0.002	-0.002	-0.36	-0.36	-0.36	-0.36	-0.36
GAB	-0.006	-0.006	-0.006	-0.006	-0.006	-1.38	-1.38	-1.38	-1.38	-1.38
GHA	-0.036	-0.036	-0.036	-0.036	-0.036	-0.85	-0.85	-0.85	-0.85	-0.85
GIN	-0.003	-0.003	-0.003	-0.003	-0.003	-1.48	-1.48	-1.48	-1.48	-1.48
GMB	0.000	0.000	0.000	0.000	0.000	-5.40	-5.40	-5.40	-5.40	-5.40
GNB	0.000	0.000	0.000	0.000	0.000	-0.30	-0.30	-0.30	-0.30	-0.30
KEN	-0.009	-0.009	-0.009	-0.009	-0.009	-0.61	-0.61	-0.61	-0.61	-0.61
LBR	0.000	0.000	0.000	0.000	0.000	-0.21	-0.21	-0.21	-0.21	-0.21
LSO	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
MAR	0.000	0.000	0.000	0.000	0.000	-0.16	-0.16	-0.16	-0.16	-0.16
MDG	-0.027	-0.027	-0.027	-0.027	-0.027	-2.67	-2.67	-2.67	-2.67	-2.67
MLI	-0.019	-0.019	-0.019	-0.019	-0.019	-1.22	-1.22	-1.22	-1.22	-1.22
MOZ	0.000	0.000	0.000	0.000	0.000	-0.03	-0.03	-0.03	-0.03	-0.03
MRT	-0.002	-0.002	-0.002	-0.002	-0.002	-1.52	-1.52	-1.52	-1.52	-1.52
MUS	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
MWI	0.000	0.000	0.000	0.000	0.000	-0.21	-0.21	-0.21	-0.21	-0.21
NAM	0.000	0.000	0.000	0.000	0.000	-0.01	-0.01	-0.01	-0.01	-0.01
NER	-0.005	-0.005	-0.005	-0.005	-0.005	-2.74	-2.74	-2.74	-2.74	-2.74
NGA	-0.010	-0.010	-0.010	-0.010	-0.010	-0.46	-0.46	-0.46	-0.46	-0.46
RWA	-0.005	-0.005	-0.005	-0.005	-0.005	-0.28	-0.28	-0.28	-0.28	-0.28
SEN	-0.006	-0.006	-0.006	-0.006	-0.006	-1.36	-1.36	-1.36	-1.36	-1.36
SLE	-0.002	-0.002	-0.002	-0.002	-0.002	-1.86	-1.86	-1.86	-1.86	-1.86
STP	-0.004	-0.004	-0.004	-0.004	-0.004	-0.76	-0.76	-0.76	-0.76	-0.76
SWZ	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
SYC	0.000	0.000	0.000	0.000	0.000	-0.26	-0.26	-0.26	-0.26	-0.26
TCD	0.000	0.000	0.000	0.000	0.000	-0.82	-0.82	-0.82	-0.82	-0.82
TGO	-0.001	-0.001	-0.001	-0.001	-0.001	-1.76	-1.76	-1.76	-1.76	-1.76
TUN	0.000	0.000	0.000	0.000	0.000	-0.33	-0.33	-0.33	-0.33	-0.33
TZA	0.000	0.000	0.000	0.000	0.000	-0.02	-0.02	-0.02	-0.02	-0.02
UGA	-0.012	-0.012	-0.012	-0.012	-0.012	-0.63	-0.63	-0.63	-0.63	-0.63
ZAF	0.000	0.000	0.000	0.000	0.000	-0.05	-0.05	-0.05	-0.05	-0.05
ZAR	-0.294	-0.294	-0.294	-0.294	-0.294	-6.58	-6.58	-6.58	-6.58	-6.58
ZMB	0.000	0.000	0.000	0.000	0.000	-3.20	-3.20	-3.20	-3.20	-3.20
ZWE	0.000	0.000	0.000	0.000	0.000	-0.24	-0.24	-0.24	-0.24	-0.24

DZA=Algeria; AGO=Angola; BEN=Benin; BWA=Botswana; BFA=Burkina Faso; BDI=Burundi; CMR=Cameroon; CPV=Cape Verde; CAF=Central African Republic; TCD=Chad; COM=Comoros; ZAR=Congo, Dem. Rep.; COG=Congo, Rep.; CIV=Cote d'Ivoire; DJI=Djibouti; EGY=Egypt; ETH=Ethiopia; GAB=Gabon; GMB=Gambia; GHA=Ghana; GIN=Guinea; GNB=Guinea-Bissau; KEN=Kenya; LSO=Lesotho; LBR=Liberia; MDG=Madagascar; MWI=Malawi; MLI=Mali; MRT=Mauritania; MUS=Mauritius; MAR=Morocco; MOZ=Mozambique; NAM=Namibia; NER=Niger; NGA=Nigeria; RWA=Rwanda; STP=Sao Tome and Principe; SEN=Senegal; SYC=Seychelles; SLE=Sierra Leone; ZAF=South Africa; SWZ=Eswatini; TZA=Tanzania; TGO=Togo; TUN=Tunisia; UGA=Uganda; ZMB=Zambia; ZWE=Zimbabwe.

Annex C: Statutory tariff data availability by countries

Table C1: Availability of tariff data, by country

ISO3	Country Name	Imports	Tariff	ISO3	Country Name	Imports	Tariff
AGO	Angola	2015	2016	MUS	Mauritius	2017	2016
BDI	Burundi	2017	2016	MWI	Malawi	2015	2016
BEN	Benin	2016	2016	NAM	Namibia	2017	2016
BFA	Burkina Faso	2016	2016	NER	Niger	2016	2016
BWA	Botswana	2017	2016	NGA	Nigeria	2017	2016
CAF	Central African Republic	2016	2016	RWA	Rwanda	2016	2016
CIV	Cote d'Ivoire	2015	2016	SDN	Sudan	N.A.	N.A.
CMR	Cameroon	2017	2014				
COG	Congo, Rep.	2017	2015				
COM	Comoros	2017	2015				
CPV	Cape Verde	2017	2015				
DJI	Djibouti	2017	2014				
DZA	Algeria	2017	2016				
EGY	Egypt, Arab Rep.	2017	2016				
ERI	Eritrea	N.A.	N.A.				
ETH	Ethiopia	2015	2015				
GAB	Gabon	2017	2016				
GHA	Ghana	2017	2016				
GIN	Guinea	2015	2012				
GMB	Gambia, The	2016	2013				
GNB	Guinea-Bissau	2017	2014				
GNQ	Equatorial Guinea	N.A.	N.A.				
KEN	Kenya	2017	2016				
LBR	Liberia	2017	2014				
LBY	Libya	N.A.	N.A.				
LSO	Lesotho	2017	2016				
MAR	Morocco	2016	2016				
MDG	Madagascar	2017	2016				
MLI	Mali	2017	2016				
MOZ	Mozambique	2016	2016				
MRT	Mauritania	2017	2015				

Source: Arenas and Vnukova (2019)

Annex D: Summary description of the Envisage model

The description of the ENVISAGE Model follows the circular flow of an economy paradigm. Firms purchase input factors (for example labor and capital) to produce goods and services. Households receive factor income and in turn demand goods and services produced by firms. And, equality of supply and demand determine equilibrium prices for factors, goods and services. The model is solved as a sequence of comparative static equilibria where the factors of production are exogenous for each time period and linked between time periods with accumulation expressions. Production is implemented as a series of nested constant-elasticity-of-substitution (CES) functions aiming to capture the substitutability across all inputs. Three production archetypes are implemented. The first is for crops that reflects intensification of inputs versus land intensification. The second is for livestock that reflects range-fed versus ranch-fed production. The final, also referred to as the default, revolves largely around capital/labor substitutability. Some production activities highlight specific inputs (for example agricultural chemicals in crops and feed in livestock) and all activities include energy and its components as part of the cost minimization paradigm. Production is also identified by vintage—divided into *Old* and *New*—with typically lower substitution possibilities associated with *Old* capital.

Each production activity is allowed to produce more than one commodity—for example the ethanol sector can produce ethanol and distiller's dried grains with solubles (DDGS). And commodities can be formed by the output of one or more activities (for example electricity). ENVISAGE therefore uses a different classification of activities and commodities.[43] One of the features of the model is that it integrates the new GTAP power data base that disaggregates GTAP's electricity sector ('ely') into 11 different power sources plus electricity transmission and distribution. Though the database has both the supply and demand side for all 11 power sources, the aggregation facility permits the aggregation of electricity demand into a single commodity and the 'make' matrix specification combines the output from the different power activities into a single electricity commodity.

Income accrues from payments to factors of production and is allocated to households (after taxes). The government sector accrues all net tax payments and purchases goods and services. The model incorporates multiple utility functions for determining household demand. There is a set of three household demand functions linked to the ubiquitous linear expenditure system (LES): the standard LES, the extended LES (ELES) that incorporates household saving into the utility function, and 'an implicitly directly additive demand system' (AIDADS), that allows for non-linear Engel curves in the LES framework.[44] The fourth option uses the constant differences in elasticity (CDE) utility function that is used in the core GTAP model (Hertel 1997 and Corong et al. 2017). The ELES incorporates the decision to save in a top-level utility function. The other demand systems assume savings is an exogenous proportion of disposable income in the default closure. The consumer utility function determines consumer demand bundles that are subsequently converted to produced goods using a consumer demand 'make' or transition matrix. Investment is savings driven and equal to domestic saving adjusted by net capital flows. Trade is modeled using the so-called Armington specification that posits that demand for goods are differentiated by region of origin. The model allows for domestic/import sourcing at the aggregate level (after aggregating domestic absorption across all agents), or at the agent level. In the standard specification, a second Armington nest allocates aggregate import demand across all exporting regions using a representative agent specification. Note that a newer, though minimally tested version, allows for sourcing imports by agent—also known as the MRIO specification. Exports are modeled in an analogous fashion using a nested constant-elasticity of-transformation (CET) specification. The domestic supply of each commodity is supplied to the domestic market and an aggregate export bundle using a top-level CET function. The latter is allocated across regions of destination using a second-level CET function.[45] Each

[43] Production activities are indexed with *a* and commodities are indexed with *i*.

[44] Users can also specify implementing a Cobb-Douglas (CD) utility function, which can be considered part of the LES framework.

[45] The model allows for perfect transformation, which is the standard specification in the GTAP model.

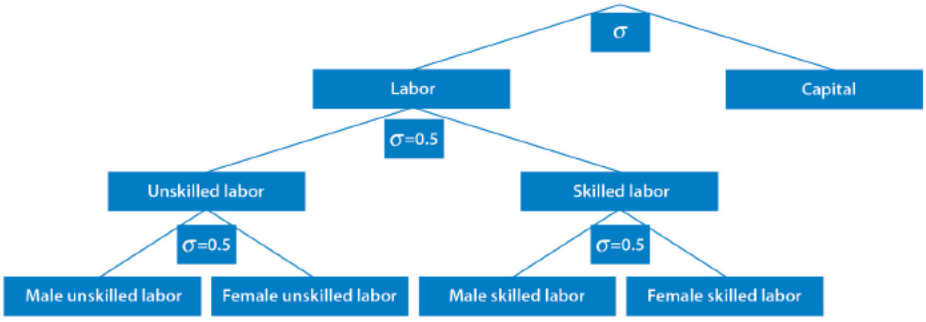
bilateral trade node is associated with four prices: 1) the producer price; 2) the export border price, also referred to as the free-on-board (FOB) price; 3) the import border price, also referred to as the cost, insurance and freight (CIF) price; and 4) the end-user price that includes all applicable trade taxes. The wedge between the producer price and the FOB price is represented by the export tax (or subsidy if negative) and the wedge between the CIF and end-user prices represents the import tariff (and perhaps other import related distortions). The wedge between the CIF and FOB prices represents the international trade and transport margin. These margins represent the use of real resources that are supplied by each region. The global international trade and transport sector purchases these services from each region so as to minimize the aggregate cost.

The model has two fundamental markets for goods and services. Domestically produced goods sold on the domestic market, and domestically produced goods sold by region of destination. All other goods and services are composite bundles of these goods. Two market equilibrium conditions are needed to clear these two markets.[46]

The model incorporates five types of production factors: 1) labor (of which there can be up to five types); 2) capital; 3) land; 4) a sector specific natural resource (such as fossil fuel energy reserves); and 5) water. The labor market is allowed to be segmented (though not required), typically agriculture vs. non-agriculture. The model allows for regime switching between full and partial wage flexibility. In this gender-sensitive version of the model, labor bundle is composed of four labor types—skilled and unskilled labor, each broken out by gender.

At a first stage, the aggregate labor bundle is composed of skilled and unskilled labor. In the default parameterization, the substitution elasticity is 0.5. Each skill bundle, unskilled and skilled, is composed of labor by gender—male and female. The default substitution elasticity is 0.5 across gender. This implies that all four labor types are equally substitutable in the default configuration.

Figure D1: Structure of value added in the production fun



Source: Authors' calculations based on customs and statutory data.

Capital is allocated across sectors so as to equalize rates of returns. If all sectors are expanding, Old capital is assumed to receive the economy-wide rate of return. In contracting sectors, Old capital is sold on secondary markets using an upward sloping supply curve. This implies that capital is only partially mobile across sectors. Aggregate land and water supply are specified using supply curves. Though there are several options, the preferred supply curve is a logistic function that has an upper bound. Water demand

[46] If there are N commodities and R regions, there will be $R \times N$ market clearing conditions for domestic goods and $R \times N \times R$ market clearing conditions for bilateral trade.

also includes exogenous components for environmental uses and groundwater recharge. Land and water are allocated across activities using a nested CET specification.[47] Natural resources are supplied to each sector using an iso-elastic supply function with the possibility differentiated elasticities depending on market conditions. ENVISAGE incorporates the main greenhouse gases—carbon, methane, nitrous oxides and fluorinated gases, as well as 10 additional non-greenhouse gases[48] that may have impacts on the atmosphere and climate change, but often have significant local impacts, particularly on health. Emissions are generated by consumption of commodities (such as fuels), factor use (for example land in rice production and herds in livestock production) and there are also processed base emissions such as methane from landfills.[49] A number of carbon control regimes are available in the model. Carbon taxes can be imposed exogenously—potentially differentiated across regions. The incidence of the carbon tax allows for partial or full exemption by commodity and end-user. For example, households can be exempted from the carbon tax on natural gas consumption. The model allows for emission caps in a flexible manner—where regions can be segmented into coalitions on a multi-regional or global basis. In addition to the standard cap system, a cap and trade system can be defined where each region within a coalition is assigned an initial emission quota.

Dynamics involves three elements. Labor supply (by skill level) grows at an exogenously determined rate. The aggregate capital supply evolves according to the standard stock/flow motion equation, i.e. the capital stock at the beginning of each period is equal to the previous period's capital stock, less depreciation, plus the previous period's level of investment. The third element is technological change. The standard version of the model assumes labor augmenting technical change—calibrated to given assumptions about GDP growth and inter-sectoral productivity differences. In policy simulations, technology is typically assumed to be fixed at the calibrated levels.

For this particular study, key model specifications include:

- Agent-based Armington specification for import demand, with an aggregate agent allocation of total import demand by source region.
- The value of time in trade is captured by an iceberg parameter—specified for each commodity and bilateral trade node. The iceberg parameter is assumed to be fixed over time in the baseline. The model has a separate iceberg parameter related to imports and exports.
- Diagonal make matrix, i.e. one-to-one correspondence between activities and commodities.
- Constant-differences-in-elasticity (CDE) utility function.
- Logistic aggregate land supply function.
- The capital account is fixed within each time period at reference year levels. This implies that it declines over time as a share of GDP.

[47] Land is only implemented for agricultural activities. Water demand by activity is only present in irrigated crop sectors. Other water demand is based on aggregate demand functions with market clearing but is not part of the cost structure.

[48] Black carbon (BC), carbon monoxide (CO), ammonia (NH3), volatile organic compounds (NMVB and NMVF), nitrogen oxides (NOx), organic carbon (OC), particulate matter (PM10 and PM2.5) and sulfur dioxide (SO2).

[49] The current version of the model does not include carbon emissions from deforestation—an important source of global carbon emissions.

Table D1: Regional dimension

	Region name (code in parenthesis)
1	Egypt (EGY)
2	Morocco (MAR)
3	Tunisia (TUN)
4	Rest of North Africa (XNF)
5	Burkina Faso (BFA)
6	Cameroon (CMR)
7	Côte d'Ivoire (CIV)
8	Ghana (GHA)
9	Nigeria (NGA)
10	Senegal (SEN)
11	Rest of West Africa (XWF)
12	Central Africa (XCF)
13	Congo, DR (COD)
14	Ethiopia (ETH)
15	Kenya (KEN)
16	Madagascar (MDG)
17	Malawi (MWI)
18	Mauritius (MUS)
19	Mozambique (MOZ)
20	Rwanda (RWA)
21	Tanzania (TZA)
22	Uganda (UGA)
23	Zambia (ZMB)
24	Zimbabwe (ZWE)
25	Rest of East Africa (XEC)
26	Botswana (BWA)
27	Namibia (NAM)
28	South Africa (ZAF)
29	Rest of South African Customs Union (XSC)
30	China (CHN)
31	Rest of East Asia (XEA)
32	United States (USA)
33	European Union + EFTA (weu)
34	Rest of the World (row)

Table D2: Sector dimension

	Sector name (code in parenthesis)
1	Agriculture (AGR)
2	Fossil fuels (FFL)
3	Minerals n.e.s. (OXT)
4	Processed foods (PFD)
5	Wood and paper products (WPP)
6	Textiles and wearing apparel (TWP)
7	Energy intensive manufacturing (KE5)
8	Petroleum, coal products (P_C)
9	Chemical, rubber, plastic products (crp)
10	Manufactures, n.e.s. (XMN)
11	Construction (CNS)
12	Trade services (TRD)
13	Road and rail transport services (OTP)
14	Water transport services (WTP)
15	Air transports services (ATP)
16	Communication services (CMN)
17	Other financial services (OFI)
18	Insurance, real estate services (INS)
19	Other business services (OBS)
20	Recreational and other services (ROS)
21	Public services (XSV)

The model's reference year is 2014 and the model is initialized and calibrated to the GTAP Data Base, Version 10 pre-release 3.[50] The 141 regions in the database have been aggregated to 34 regions, see Table C-3.[51] Similarly, the database's 65 sectors have been aggregated to 28, see Table C-4, with an emphasis on the more traded manufacturing sectors, and the trade and transport services.[52]

The key macro-economic drivers of the baseline are based on a number of existing baselines. Population growth is calibrated to the United Nation's Population Division 2015 projection, the medium variant.[53] Baseline GDP is calibrated to the so-called Shared Socio- Economic Pathway (SSP) 2, or SSP2. The SSPs, of which there are 5, have been developed by the Integrated Assessment Modeling (IAM) Community to

[50] Pre-releases are only made available to GTAP Board members. The public version of Version 10 was posted on July 31, 2019. The database used for this study is a special version of Release 10p3 as it includes the D.R. Congo (COD) as a separate region using an input-output table provided by the World Bank. Angola was aggregated with the Central Africa region. Note that COD has yet to be made available in other versions of the database.

[51] The GTAP concordance is available in Table A-3.

[52] The GTAP concordance is available in Table A-4.

[53] http://www.un.org/en/development/desa/publications/world-population-prospects-2015-revision.html

provide a macroeconomic framework for quantitative analysis of the economics of climate change.[54] Three economic modeling groups have quantified global GDP projections: the Organisation for Economic Co-operation and Development (OECD), the International Institute for Applied Systems Analysis (IIASA), and the Potsdam Institute for Climate Impact Research (PIK). All three teams harmonized to the same demographic projections provided by IIASA's demographic unit. For our purposes, we are using the OECD-based SSP2 projection. SSP2, also referred to as 'middle of the road' scenario, is being treated by many modeling groups as a business as usual scenario.

Labor force growth is being generated by the GIDD projections (Annex E). The projections are available by broad age group (we use the 15-64 age cohort for labor force), gender and education (primary, secondary and tertiary). Growth of skilled labor is equated with the growth of specific education categories. For low- and lower-middle income countries, skilled workers are equated with secondary and tertiary levels. For upper-middle and high-income countries, skilled workers are equated with tertiary levels only. The baseline scenario tracks the per capita income growth of countries and implements a switch in the definition of skilled workers if a country graduates from lower-middle income to upper-middle income (using the 2014 World Bank income thresholds).[55]

We target real GDP growth by calibrating labor productivity in the baseline. We allow for sector differences in labor productivity growth, with a (fixed) higher rate in agriculture and manufacturing, relative to services. Other factors that impact calibrated labor productivity include an exogenous improvement in energy efficiency, agricultural yields, and international trade and transport margins.

The baseline also incorporates the following list of exogenous assumptions:

- The income parameter of the CDE is adjusted between periods based on an estimated economic relation between the income parameter and aggregate per capita consumption. The parametrization of the relationship is based on a least-squares estimate using the base year GTAP database. One key purpose is to reduce the share of food expenditures as incomes rise.
- Capital accumulation is based on the standard capital motion equation: Kt=(1-8)Kt-1+It-1, thus the capital stock trends depend on investment/savings decisions. In the baseline, household savings are adjusted in order to target future trends in the investment to GDP ratio—with the basic idea that these trends should more or less line up with steady state returns to capital.

The focus of the paper is on AfCFTA, though we will briefly outline the contours of the baseline:[56]

- World population is expected to rise from 7.3 billion in 2014 to 8.8 billion in 2035, an increase of around 1.5 billion, and about 1 percent per annum on average.
- Population growth in Africa accounts for 45percent of the increase, with an increase in population of 700 million, some 61percent from the 2014 base of 1.1 billion, or a blistering annual growth rate of 2.3percent compared to 0.6percent in the rest of the world. Africa's share of global population increases from 16percent to 21percent.
- Global GDP will rise from $82 $2014 trillion in 2014 to $158 $2014 trillion in 2035—an average annual increase of 3.2 percent.
- The growth of GDP in Africa is a relatively rapid 5.8 percent per annum between 2014 and 2035, somewhat tempered by high population growth. Nonetheless, Africa sees its share in global output increase from 3.7 percent to 6.2percent (at constant $2014 prices and market exchange rates).
- Average per capita income in Africa rises from $2,600 to $5,300 between 2014 and 2035, growing at an annual clip of 3.4percent. World average income rises from $11,300 to $19,700 over the same period—a growth rate of 2.2percent per annum.

[54] A Special Issue of Global Environmental Change provides significant background material on the SSPs and their development. See in particular Dellink et al. 2017 for a discussion of the OECD-based macroeconomic drivers.

[55] The respective thresholds for 2014 are $1,045, $4,125 and $12,736.

[56] Additional details and tables are available from the authors.

- African incomes exhibit some convergence to the world average with the parity index rising from 23percent to 30percent.

Table D3: GTAP regional concordance

	Region name	GTAP concordance
1	Egypt (EGY)	Egypt (EGY)
2	Morocco (MAR)	Morocco (MAR)
3	Tunisia (TUN)	Tunisia (TUN)
4	Rest of North Africa (XNF)	Rest of North Africa (XNF)
5	Burkina Faso (BFA)	Burkina Faso (BFA)
6	Cameroon (CMR)	Cameroon (CMR)
7	Côte d'Ivoire (CIV)	Côte d'Ivoire (CIV)
8	Ghana (GHA)	Ghana (GHA)
9	Nigeria (NGA)	Nigeria (NGA)
10	Senegal (SEN)	Senegal (SEN)
11	Rest of Westn Africa (XWF)	Benin (BEN), Guinea (GIN), Togo (TGO), Rest of Westn Africa (XWF)
12	Central Africa (XCF)	Central Africa (XCF)
13	Congo, DR (COD)	Congo, DR (COD)
14	Ethiopia (ETH)	Ethiopia (ETH)
15	Kenya (KEN)	Kenya (KEN)
15	Madagascar (MDG)	Madagascar (MDG)
17	Malawi (MWI)	Malawi (MWI)
18	Mauritius (MUS)	Mauritius (MUS)
19	Mozambique (MOZ)	Mozambique (MOZ)
20	Rwanda (RWA)	Rwanda (RWA)
21	Tanzania (TZA)	Tanzania (TZA)
22	Uganda (UGA)	Uganda (UGA)
23	Zambia (ZMB)	Zambia (ZMB)
24	Zimbabwe (ZWE)	Zimbabwe (ZWE)
25	Rest of East Africa (XEC)	Rest of East Africa (XEC)
26	Botswana (BWA)	Botswana (BWA)
27	Namibia (NAM)	Namibia (NAM)
28	South Africa (ZAF)	South Africa (ZAF)
29	Rest of South African Customs Union (XSC)	Rest of South African Customs Union (XSC)
30	China (CHN)	China (CHN)
31	Rest of East Asia (XEA)	Hong Kong SAR, China (HKG), Japan (JPN), Korea (KOR), Mongolia (MNG), Taiwan, China (TWN), Rest of East Asia (XEA), Brunei Darussalam (BRN), Cambodia (KHM), Indonesia (IDN), Laos (LAO), Malaysia (MYS), Philippines (PHL), Singapore (SGP), Thailand (THA), Viet Nam (VNM), Rest of Southeast Asia (XSE)
32	United States (USA)	United States of America (USA)
33	European Union + EFTA (weu)	Austria (AUT), Belgium (BEL), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), Ireland (IRL), Italy (ITA), Latvia (LVA), Lithuania (LTU), Luxembourg (LUX), Malta (MLT), Netherlands (NLD), Poland (POL), Portugal (PRT), Slovakia (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), United Kingdom (GBR), Switzerland (CHE), Norway (NOR), Rest of EFTA (XEF), Bulgaria (BGR), Croatia (HRV), Romania (ROU).
34	Rest of the World (row)	Australia (AUS), New Zealand (NZL), Rest of Oceania (XOC), Bangladesh (BGD), India (IND), Nepal (NPL), Pakistan (PAK), Sri Lanka (LKA), Rest of South Asia (XSA), Canada (CAN), Mexico (MEX), Rest of North America (XNA), Argentina (ARG), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Ecuador (ECU), Paraguay (PRY), Peru (PER), Uruguay (URY), Venezuela (VEN), Rest of South America (XSM), Costa Rica (CRI), Guatemala (GTM), Honduras (HND), Nicaragua (NIC), Panama (PAN), El Salvador (SLV), Rest of Central America (XCA), Dominican Republic (DOM), Jamaica (JAM), Puerto Rico (PRI), Trinidad and Tobago (TTO), Rest of Caribbean (XCB), Albania (ALB), Belarus (BLR), Russian Federation (RUS), Ukraine (UKR), Rest of East Europe (XEE), Rest of Europe (XER), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Tajikistan (TJK), Rest of Former Soviet Union (XSU), Armenia (ARM), Azerbaijan (AZE), Georgia (GEO), Bahrain (BHR), Iran (IRN), Israel (ISR), Jordan (JOR), Kuwait (KWT), Oman (OMN), Qatar (QAT), Saudi Arabia (SAU), Turkey (TUR), United Arab Emirates (ARE), Rest of Westn Asia (XWS), Rest of the World (XTW)

Table D4: GTAP sector concordance

	Sector name	GTAP concordance
1	Agriculture (AGR)	Paddy rice (PDR), Wheat (WHT), Cereal grains nec (GRO), Vegetables, fruit, nuts (V_F), Oil seeds (OSD), Sugar cane, sugar beet (C_B), Plant-based fibers (PFB), Crops nec (OCR), Bovine cattle, sheep and goats, horses (CTL), Animal products nec (OAP), Raw milk (RMK), Wool, silk-worm cocoons (WOL), Forestry (FRS)
2	Fossil fuels (FFL)	Coal (COA), Oil (OIL), Gas (GAS), Gas manufacture, distribution (GDT)
3	Minerals n.e.s. (OXT)	Other Extraction (formerly omn Minerals nec) (OXT)
4	Processed foods (PFD)	Fishing (FSH), Bovine meat products (CMT), Meat products nec (OMT), Vegetable oils and fats (VOL), Dairy products (MIL), Processed rice (PCR), Sugar (SGR), Food products nec (OFD), Beverages and tobacco products (B_T)
5	Wood and paper products (WPP)	Wood products (LUM), Paper products, publishing (PPP)
6	Textiles and wearing apparel (TWP)	Textiles (TEX), Wearing apparel (WAP), Leather products (LEA)
7	Energy intensive manufacturing (KE5)	Mineral products nec (NMM), Ferrous metals (I_S), Metals nec (NFM)
8	Petroleum, coal products (P_C)	Petroleum, coal products (P_C)
9	Chemical, rubber, plastic products (crp)	Chemical products (CHM), Basic pharmaceutical products (BPH), Rubber and plastic products (RPP)
10	Manufactures, n.e.s. (XMN)	Metal products (FMP), Computer, electronic and optical products (ELE), Electrical equipment (EEQ), Machinery and equipment nec (OME), Motor vehicles and parts (MVH), Transport equipment nec (OTN), Manufactures nec (OMF)
11	Construction (CNS)	Construction (CNS)
12	Trade services (TRD)	Trade (TRD), Accommodation, Food and service activities (AFS) Warehousing and support activities (WHS)
13	Road and rail transport services (OTP)	Transport nec (OTP)
14	Water transport services (WTP)	Water transport (WTP)
15	Air transports services (ATP)	Air transport (ATP)
16	Communication services (CMN)	Communication (CMN)
17	Other financial services (OFI)	Financial services nec (OFI)
18	Insurance, real estate services (INS)	Insurance (formerly isr) (INS)
19	Other business services (OBS)	Real estate activities (RSA), Business services nec (OBS)
21	Public services (XSV)	Electricity (ELY), Water (WTR), Public Administration and defense (OSG), Education (EDU), Human health and social work activities (HHT), Dwellings (DWE)

Annex E: Summary description of the GIDD model

In the microsimulation model, the ultimate focus of analysis is the evolution of the distribution of the welfare in different scenarios. Starting from the base year t, the income or expenditure ($Y_{i,t}$)[57] of each individual living in a household can be modeled as a function of: (i) its own characteristics and the household members' characteristics or assets (endowments) ($\boldsymbol{X}$), (ii) the market reward for those characteristics ( ), and (iii) the intensity in how those endowments are used as captured by a set of parameters defining labor force participation and occupation status ($L|\lambda$) ; and, finally, (iv) unobservable components (ε):

$$Y_{i,t}=f(\boldsymbol{X}_{i,t},\boldsymbol{\beta}_t,(L_{i,t}|\lambda_t),\boldsymbol{\varepsilon}_{i,t}) \qquad (1)$$

The income distribution D for a population of N individuals (or households) in the base year t can be represented by a vector$\{Y_{1,t}...Y_{i,t}...Y_{N,t}\}$, where each $Y_{i,t}$ can be defined as in (1) in terms of endowments, prices, labor status and unobservables:

$$D_t=\{Y_{1,t}\dots Y_{N,t}\}=\{f(\boldsymbol{X}_{i,t},\boldsymbol{\beta}_t,(L_{i,t}|\lambda_t),\boldsymbol{\varepsilon}_{i,t})\dots f(\boldsymbol{X}_{N,t},\boldsymbol{\beta}_t,(L_{N,t}|\lambda_t),\boldsymbol{\varepsilon}_{N,t})\} \qquad (2)$$

How does this distribution change dynamically, for example from year t to year $t+k$? This framework allows distinguishing two sources that affect the dynamic change of distribution D, both of which are relevant for the assessment of the distributive impact of AfCFTA.

The first source consists of the changes in either the parameters β or λ, namely the market rewards to the characteristics (or assets) $\boldsymbol{X}$ and parameters affecting occupational decisions. This means, for example, that inequality for distribution D can go down if the skill premia $\beta_{skill}/\ \beta_{unskill}$ is reduced; or if a change in labor demand in sectors with higher wages (a change in λ) affects the decision to move to these sectors for some individuals working in sectors with lower wages. The second source of dynamic shift is represented by changes in the distribution of individual and household characteristics ($\boldsymbol{X}$). Alterations of the structure of the population in terms of age and education by gender, and changes in the size and composition of households, will all affect the distribution of income of that population.[58] Both sources of distributional change matter to the impact of AfCFTA. Defining the contrasting values of endowments, prices, and labor status to build the two Ds can be quite challenging, especially when done for many countries. To do so, let's begin with a distribution of earning from labor by sector and skill [ys,e] in the macro data, define a set of wage gaps as follows:

$$g_{s,e}=\frac{y_{g,s,e}}{y_{f,1,1}}-1 \qquad (3)$$

and a similar set of wage gaps for the macroeconomic counterfactual scenario:

$$\hat{g}_{s,e}=\frac{\hat{y}_{x,s,e}}{\hat{y}_{f,1,1}}-1 \qquad (4)$$

---

[57] We use household consumption expenditure wherever available and income when consumption expenditure is not available (e.g., in many countries in Latin America and the Caribbean, LAC).The variables consumption and income are used interchangeably given the qualification. Clearly income dispersion will tend to be higher than consumption dispersion within countries; and having a uniform welfare variable for all countries would be better. However, this limitation affects all comparable studies of global income distribution (see for example World Bank Group (2016) or Lakner and Milanovic (2013).

[58] These two sources of dynamic change are not independent one from the other and, in the real world, they are simultaneously determined. The problem of estimating and running a fully simultaneous microsimulation framework are discussed in more detail in François Bourguignon and Bussolo (2013).

where $y_{f,1,1}$ is the average earnings from labor of female unskilled workers in agriculture and $y_{f,1,1}$ *and* $y_{x,s,e}$ are their predicted values from the CGE model in the counterfactual scenario. All right-hand side values in equation 3 are known data in the CGE model benchmark dataset, and all right-hand side values in equation 4 are known values in the CGE model simulations.

The micro data will have also a set of wage premia which, in general, will differ from the CGE data. Analogous to equations 3 and 4, define:

$$g'_{s,e} = \frac{y'_{x,s,e}}{y'_{f,1,1}} - 1 \qquad (5)$$

$$\hat{g}'_{s,e} = \frac{\hat{y}'_{x,s,e}}{\hat{y}'_{f,1,1}} - 1 \qquad (6)$$

where $\boldsymbol{g}'_{s,e}$ are the wage premia based on averages by skill group and sector in the household data; $y'_{s,e}$ are the average earnings of labor in sector *s* and skill group *e* and gender *x* based on the household data; $y'_{f,1,1}$ are the average earnings of female unskilled labor in agriculture based on the household data; and the g' are the predicted values at the household level as a result of the policy change. All right-hand side values of equation 5 are known from the initial household data. In order to calculate $g'_{x,s,e}$, we define:

$$\hat{g}'_{x,s,e} = g'_{x,s,e} \frac{\hat{g}'_{x,s,e}}{g_{x,s,e}} \qquad (7)$$

We may calculate the left-hand side of equation 7, since the three values on the righthand side are known from equations 3, 4, and 5. Equation 7 implies that even if initial wages differ between the CGE and micro models, the percentage change in the wage gaps will be consistent across the two models. By passing on percentage changes in wage premia by type of worker, instead of percentage changes in wages, the possibility of wage gaps moving in opposite directions in the macro and in the household data is eliminated. Within each group of workers, distributional changes occur; but, on average, for any group of workers, the relative wages for each type of worker is constrained to be consistent with the corresponding growth rates from the CGE model.

Given the known values in equations 3-7, and defining average wages for female unskilled labor in agriculture as numeraire in the GIDD, so that $y'_{f,1,1} = y'_{f,1,1}$, it is possible to calculate the percentage changes in average wage income of in sector *s,* skill level *e* and gender *x* that are consistent with wage gaps expressed in Equation 7:

$$\hat{y}'_{g,s,e} / y'_{g,s,e} \qquad (8)$$

Note that Equation 8 only operates on labor income. In order to adjust the micro data such that the weighted average percentage change in the per capita income/consumption across all households matches the change in real consumption per capita in the CGE model, a subsequent adjustment is carried out. Define Y as real per capita income calculated from the CGE model in the benchmark and *Y* as its predicted value in the CGE model simulation. Define $y'_h = \Sigma_{i \varepsilon h} y'_{i,h} / n_h$ as the per capita income of household *h* in the benchmark equilibrium, where $y'_{i,h}$ is the income of the ith member of household *h*, and n is equal to the size of household *h*. similarly, define $\hat{y}'_h = \Sigma_{i \varepsilon h} y'_{i,h} / n_h$ where $y'_{i,h}$ and $y'_{i,h}$ are the unadjusted and adjusted values, respectively, of the income of the *ith* member of household *h* in the counterfactual of the micro-model; the role of . Then define Y' as the weighted average value of real per capita income across all households, i.e.,

$$\Sigma'_h V_h \, y'_h = Y' \qquad (9)$$

where v_h is the weight of household h in aggregate income in the benchmark. Correspondingly

$$\Sigma_h \omega_h \lambda \hat{\gamma}'_h = \hat{Y}' \qquad (10)$$

is the weighted average per capita income value in the policy simulation. Note that $\Sigma_h u_h=1$, $\Sigma_h \omega_h =1$ and is a scalar. Equations 9 and 10 allow for different household weights since the weights of the households will typically change over time. So that the percentage change in the aggregate value of household income is consistent with the CGE model, we constrain $\hat{Y}'$ by equation 11:

$$\hat{Y}' = Y' \frac{Y'}{Y} \qquad (11)$$

We implement this constraint in a distribution neutral way. That is, we adjust all household income in the counterfactual by a scalar such that per capita household income equals $\lambda\hat{\gamma}'_h$: as a result, λ can be defined by:

$$\lambda \sum_h \omega_h \hat{\gamma}_h = Y' \frac{Y'}{Y} \qquad (12)$$

Despite the fact that the GIDD ignores other forms of income, such as capital income, this transformation guarantees consistency between the weighted average household income assessment and the CGE model assessment. For households that receive labor income, which is the main focus of our work, the assumption should be reasonably accurate. There is more of a margin of error for wealthier households. But for these households, it is skilled labor rather than unskilled labor that tends to be more important and Bussolo et al., (2010) have noted a tendency for skilled wage and returns to capital to be correlated.
Finally, macroeconomic estimates of changes in agricultural and non-agricultural prices are distributed across heterogeneous households using the following method. Let us define the initial per capita monetary income of household h, γ'_h, and the purchasing power of household h, γ^r_h, as the ratio of its monetary income divided by a household-specific price index capturing the household's consumption patterns in terms of food and non-food expenditure:

$$\gamma^r_h = \frac{\gamma'_h}{P_h} = \frac{\gamma'_h}{\alpha_h P_f + (1-\alpha_h) P_{nf}} \qquad (13)$$

where P_f and P_{nf} are food and non-food price indices and $_h$ is the proportion of household's h budget spent on food.
The α_h parameter in the denominator of the right-hand side of Equation 13 can be estimated with household data using the following specification:

$$\alpha_h = \beta_0 + \beta_1 \ln(\gamma'_h) + e_h \qquad (14)$$

where eh is a vector of household-specific errors that are assumed to be distributed with $E(e_h) = 0$ and $V(e_h) = \sigma^2$. Assuming that estimated parameters $_0$ and $_1$ remain constant, the new budget share spent on food for household h, $\alpha' h$, at the counterfactual per capita income, $\lambda\hat{\gamma}'_h$, can obtained from:

$$\hat{a}'_h = \hat{\beta}_0 + \hat{\beta}_1 \ln(\lambda\hat{\gamma}'_h) + \hat{e}_h \qquad (15)$$

The changes in real per capita incomes brought about by a change in relative prices of food versus non-food can be approximated by the following linear expression:

$$\hat{\gamma}^r_h = \frac{\lambda\hat{\gamma}'_h}{\hat{a}'_h P'_f + (1-\hat{a}'_h) P'_{nf}} \qquad (16)$$

where $\hat{y}_h$ in Equation 16 is the real per capita income adjusted for changes in relative prices of food versus non-food. $\hat{y}_h$ is the counterfactual measure of real per capita income of household *h* for the analysis of poverty and shared prosperity.

Annex F: Data sources

Introduction

The key data source is the GTAP database. For this study, we used a modified version of V10 pre-release 3.[59] The key modification compared to the official Board release is the inclusion of the D. R. Congo as a separate country in the database using an input-output table provided by the World Bank. Angola was moved to the Central Africa regional aggregate. Three modifications to the standard GTAP database were introduced as changes to the reference data. These modifications were implemented using the 'Altertax' procedure.[60] This procedure is intended to introduce modifications to the GTAP database that minimizes the distortions from the original database. The three modifications are:

1. Introduction of observed statutory tariffs on traded goods and services by the countries in Africa. These were provided by the World Bank.
2. Incorporation of estimates of the quantification of non-tariff measures (NTBs) on traded goods based on estimates from Kee, Nicita, and Olarreaga (2009).
3. Incorporation of estimates of the quantification of barriers to services trade based on estimates from Jafari and Tarr (2017).

New estimates of statutory tariffs

A database with import values from UN-COMTRADE and statutory tariffs from TRAINS was constructed for 48 African countries for which data was available and used for the simulations[61]. The most recent statutory data available for each country was used for this database and is listed in Annex C: Statutory tariff data availability by countries and Annex B: Short-Term Revenue Implications of Tariff Liberalization under the African Continental Free Trade Area (AfCFTA).

The classification of tariff lines into one of the three products categories (non-sensitive, sensitive, excluded) was done to minimize tariff revenue losses. For this purpose, we ranked tariff lines for each country in descending order in terms of tariff revenues generated from AfCFTA imports. Then, we classify the bottom ninety percent of tariff lines as non-sensitive products, the next 7 percent of tariff lines as sensitive products, and the remaining 3 percent as excluded products. However, due to limits agreed on excluded products, we revise the list of excluded products to include only the tariff lines with the largest tariff revenues up to a cumulative intra-regional import share of 10 percent and re-classify the remaining tariff lines as sensitive products. Because tariff revenues are more concentrated than imports, this results in exclusion lists with fewer than ten percent of tariff lines for all countries.

Quantification of non-tariff measures in goods

The NTBs estimates for goods are sourced from WITS based on the methodology developed by Kee, Nicita, and Olarreaga (2009). The original data covers 78 developing and developed countries and goods at the HS6 level. In a first step, these estimates are converted to the 57-sector categories of the GTAP database.[62] The aggregated NTM database is in a CSV format (AVE_GTAP_Data.csv) with three fields: country ISO code, GTAP sector code, and the value of the NTM estimates. Note that the country coverage in Africa in this database is limited: Burkina Faso (BFA), Côte d'Ivoire (CIV), Cameroon (CMR), Algeria (DZA), Egypt (EGY),

[59] GTAP pre-releases are only available to GTAP Consortium members.

[60] Malcolm 1998.

[61] No recent data was available for six countries: Equatorial Guinea, Eritrea, Libya, Somalia, South Sudan, and Sudan.

[62] Thanks to Jean-Marc Solleder for the aggregation. Note that the pre-release 3 and final release of Version 10 of the GTAP database have 65 sectors. The 57-sector estimates were converted to the new 65-sector scheme assuming uniformity across the new sub-groups. An improvement would consist in re-aggregating the HS6 level estimates to the new 65-sector GTAP classification.

Ethiopia (ETH), Gabon (GAB), Ghana (GHA), Kenya (KEN), Morocco (MAR), Madagascar (MDG), Mali (MLI), Mauritius (MUS), Malawi (MWI), Nigeria (NGA), Rwanda (RWA), Sudan (SDN), Senegal (SEN), Tunisia (TUN), Tanzania (TZA), Uganda (UGA), South Africa (ZAF) and Zambia (ZMB). We discuss below how missing countries and sectors were treated. These AVE's are aggregated to the model level using GTAP's trade weights defined as aggregate imports (across source regions) at border prices (i.e. VCIF).[63] The gap filling for the goods AVE is relatively straightforward. The average AVE over the countries with Kee, Nicita, and Olarreaga (2009) estimates is calculated—both the trade weighted average and the simple average. After merging with the services NTBs, described below, the AVEs are converted to have the correct labels, saved in a GDX file and are used as inputs to the Altertax procedure. The latter defaults to using the unweighted, i.e. the simple average of the AVEs.[64]

Quantification of non-tariff measures in services

Estimates of services trade barriers are sourced from Jafari and Tarr (2017). The services covered in Jafari and Tarr only loosely line up with the GTAP services classification. Table B-1 shows the services classification in their study and the estimates of the services trade barriers for selected regions. The Jafari and Tarr data were obtained as 11 separate Excel files (with macros)—one for each of their sectors. The data was collated into a single database in an Excel file (the 'Data' worksheet in 'ServicesAVE.xlsx') with the country names replaced by their corresponding ISO code. The country coverage for Africa includes: Algeria (DZA), Botswana (BWA), Burundi (BDI), Côte d'Ivoire (CIV), Cameroon (CMR), D.R. Congo (COD), Egypt (EGY), Ethiopia (ETH), Ghana (GHA), Kenya (KEN), Lesotho (LSO), Madagascar (MDG), Malawi (MWI), Mali (MLI), Mauritius (MUS), Morocco (MAR), Mozambique (MOZ), Namibia (NAM), Nigeria (NGA), Rwanda (RWA), Senegal (SEN), South Africa (ZAF), Tanzania (TZA), Tunisia (TUN), Uganda (UGA), Zambia (ZMB) and Zimbabwe (ZWE). Table B-1 displays the simple averages for each of the 11 service sectors for two African regions and for the remaining non-African aggregate regions.

A second step mapped the modeled countries/regions to the data from Jafari and Tarr or one of the aggregate regions in table C 5. The missing data included 'Rest of North Africa' (XNF) that was mapped to NAF from the table above, and Benin, Burkina Faso, Guinea, Togo, 'Rest of West Africa', 'Rest of Central Africa' (XCF), 'Rest of South-Central Africa' (XAC), 'Rest of East Africa'

Table F1: AVEs in Services

	N. Africa (NAF)	SSA	Rest of E. Asia	Westn Europe	Rest of the world
Accounting	54	31	43	28	32
Legal	60	45	63	28	41
Air	55	23	46	16	38
Rail	59	59	57	18	50
Road	36	31	45	24	33
Banking	17	15	17	2	16
Insurance	29	31	26	11	26
Fixedline	13	546	134	4	75
Mobile	1	3	1	1	1
Retail	5	2	4	1	3
Maritime	67	12	40	7	30

Source: Table 2.4 from Jafari and Tarr (2017).

[63] The read-in 57-sector country-level estimates are stored in the parameter 'AVEC0'. This gets converted to the 65-sector level and stored as 'AVEC'. The country-level estimates are converted to the GTAP region level estimates (at the 65-sector level) and stored in 'AVER'. The final step aggregates the GTAP-level regions and sectors to the model's regions and sectors using trade weights, which producers the parameter 'AVE'. Note that there is no regional aggregation involved here since there is largely a one-to-one mapping between the countrylevel AVE estimates and the country-coverage in GTAP, i.e. none of the countries in the Lee et al. (2009) estimates is part of a GTAP regional aggregation. There are three exceptions. The 'XEF' region is composed of Island (from the Lee et al. estimates), the 'XWS' is composed of Lebanon and the 'XNF' region is composed of Algeria.

[64] The parameter 'AVE' is converted to the parameter 'AVE0' and 'AVE_WGT0'. Both use 'AVE' for all countries in the original Kee et al. (2009) database for goods and the services AVE. For the missing countries/regions, the simple and weighted averages are merged. The labels of these parameters are then converted and stored in a GDX file for Altertax.

(XEC) and 'Rest of SACU' were all mapped to the SSA column in the table above. All other countries were mapped to their corresponding data in the AVE estimates of Jafari and Tarr. This step is essentially done in the 'ServicesAVE.xlsx' spreadsheet and the resulting table (with the range name of 'SRVAVE' in the 'Agg' worksheet) is read by the GAMS aggregation routine for additional processing.

A third step maps the Jafari and Tarr sectors to the corresponding service sectors used in the model. Table B-2 shows the mapping and the weights. For example, the AVE in the model's 'other business services' (OBS) is mapped to the accounting and legal services—each with a weight of 0.5.

Quantification of trade facilitation measures

Following the signing of the TFA in December 2013, the OECD produced a series of 11 trade facilitation indicators (identified from A to K) for monitoring the TFA targets. Data for these indicators are available for 43 African countries. Each indicator takes a value between 0 (no implementation) and 2 (full implementation). We use the estimates of de Melo and Sorgho (2019) that apply a model that predicts observed time in customs as a function of basic structural variables (GDP, Logistics Performance Index, and Infrastructure Quality Index); policy variables (World Governance Indicators); and the trade facilitation variables captured by the trade facilitation indicator (row L). Row L is a weighted average of the following components: i) information availability; ii) involvement of the trade community; iii) advance rulings; iv) appeal procedures; v) fees and charges; vi) formalities involving documents; vii) formalities involving automation; viii) formalities involving procedures; ix) internal border agency co-operation; x) external border agency co-operation; and xi) governance and impartiality.

The model shows, after controlling for the structural and policy variables, that a higher trade facilitation indicator score reduces the probability of a longer time in customs. The overall differences in reductions in costs reflect disparities in trade facilitation indicator values and in time in customs for imports. The model provides estimates of the reduction of time in customs as a result of full implementation of the TFA. Those reductions in time in customs are then translated into ad valorem equivalents of barriers using the methodology of Hummels and Shaur (2013) who estimated that one extra day in customs is equivalent to a 1.3 percent extra tariff at destination based on maritime trade flows to the US.

Table F2: Mapping of Jafari and Tarr service sectors with model's service sectors

Jafari and Tarr	Model	Weight
Accounting	obs	0.5
Legal	obs	0.5
Air	atp	1.0
Rail	otp	0.5
Road	otp	0.5
Banking	ofi	1.0
Insurance	isr	1.0
Fixedline	cmn	0.1
Mobile	cmn	0.9
Retail	trd	1.0
Maritime	wtp	1.0

For simulating the gains from implementing the TFA, we apply the econometric estimates of the AVEs of time lost in customs reported in table X for each REC. The estimates are for the individual countries used to build up the averages at the REC level reported in table Y. As noted in table Y, we have estimates 47 African countries. We have AVE estimates for 21 countries in the model. For the aggregate regions, we apply the average for the corresponding group they belong to: XNF is mapped to the Algerian estimate; XAC is mapped to the estimate for Angola; XEC is mapped to the average estimate for Burundi, Comoros, and Sudan; XCF is mapped to the average estimate for Chad, Congo and Gabon, XWF is mapped to the average estimate for Liberia, Mali, Niger and Sierra Leone. For the missing estimates, we have mapped Côte d'Ivoire and Guinea to the estimate for the XWF region; Mauritius, Botswana, Namibia and rest of SACU (XSC) have been mapped to the estimate for South Africa. In the simulations, we assume that improvements apply for imports that are likely to be via 20' (or 40') containers. This means we exclude import from mining, fossil fuels and refined oil.

Annex G: Data preparation on disaggregated labor volumes and wages

The CGE model requires internationally comparable statistics on labor remunerations and employment volumes disaggregated by workers' skill level and gender. This section covers the technical aspects behind the construction of disaggregated labor value-added statistics for each country and economic activity in the GTAP 10 database. Additionally, the section provides an overall perspective on the dataset's underlying advantages and its caveats.

Disaggregated data on labor remunerations and employment volumes was generated using harmonized household surveys obtained from the World Bank's International Income Distribution Database (I2D2)[65] and labor statistics obtained from the Luxembourg Income Study (LIS) Database, supplemented with disaggregated earnings and employment distribution provided by the International Labor Organization (ILO) and other national employment statistics compiled by the World Bank. Figure D.1 below shows the general structure of data processing. Our disaggregated labor database is consistent with the GTAP 10 database (pre-release mentioned in Annex D) for the base year 2014. It contains disaggregated labor volumes and remunerations for 4 types of based on gender and two skill levels[66]. The database includes data for each of the 141 GTAP 10 regions and its 65 economic activities.[67]

To the best of our knowledge, internationally comparable disaggregated statistics on wages and employment are only available at 1-digit ISIC level[68]. Thus, to disaggregate further require mining each survey's meta-data[69] to gather information about national industry and occupation classifications. The construction process starts by collecting initial labor and monthly wage statistics based on 92 nationally-representative pre-harmonized household surveys. The complete list of surveys can be found in Table D1 below. The exploited variables included: 1. individual and household characteristics; demographic information (age, gender); level of education or years of schooling; labor force and employment status; industry and occupation original codes; (self- reported) wages in LCUs and unit of last payment. With this information at hand, industry and occupation variables were then re-harmonized to the highest level possible using ISIC (Rev 4) and ISCO (08) codes, respectively. Lastly, all industry codes were transferred from ISIC Rev 4 to the broader 65-sector GTAP 10 activity codes.

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[65] I2D2 is a unique database compiled by the World Bank that as of now it includes more than 1,600 nationally representative household surveys for 140 countries. Despite the obvious limitations of such a large harmonization effort (i.e. compatibility issues due to different survey designs, conversion of local-into-international currencies, etc.) the I2D2 dataset is the largest available source of micro-level individual employment characteristics. A detailed description of the source can be found in Gindling and Newhouse (2014).

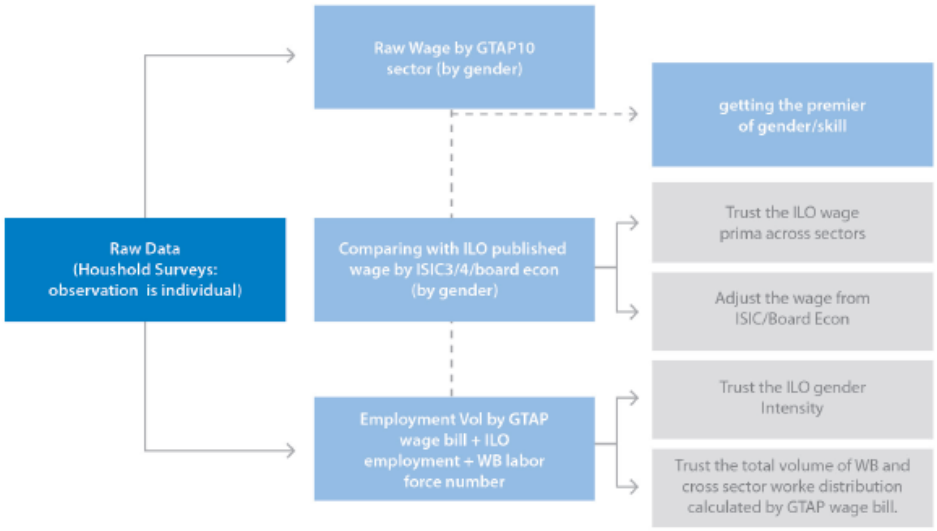
[66] We use 9+ years of schooling to define "skilled worker" in low and lower-middle income countries. For upper middle and high-income countries, a threshold of 13 and more years of schooling was used. Income levels are based on World Bank official classification of countries based on GDP per capita PPP$ (Atlas Method).

[67] Complete details of the GTAP 10 database can be found here: https://www.gtap.agecon.purdue.edu/databases/v10/index.aspx

[68] 21 sectors in ISIC Rev 4 and 17 sectors in ISIC Rev 3.1

[69] While this process involved the examination of quality of survey data, most efforts were devoted to gathering meta-data about national classification systems. In most cases, countries based their national systems on international standards but adjusted their classifications to their own necessities. Concordance tables and an international mapping, in the form of meta-data were hence created for this project and are available upon request. The resulting meta-data sheet contains information for 78 I2D2 and 15 LIS household surveys that represent more than 70% of World GDP and 80% of its population.

Figure G1: Procedure for Wage and Employment Volume



Source: Authors' own elaboration

Household surveys' sampling guarantee that they are nationally representative and that they will replicate, at some sub-national level of disaggregation, features such as gender/age composition or the employment distribution across broad economic activities. Nevertheless, the accuracy of statistics based on survey data are bounded by its sampling design.[70] Even though each worker in the household survey is mapped to a specific GTAP activity, the sampling nature of each survey cannot guarantee that all disaggregated sectors are fully represented. Another important caveat of household survey data is related with some level of inaccuracy, especially with variables that are difficult to recall as wages for the self-employed.

These problems were solved using by validation through external data. The overall strategy was to use the relative wages by skill and gender for each of the 65 GTAP economic activities (obtained from household surveys) making sure that the sum of wages is aligned with ILO's aggregated sectors (21 sectors in ISIC Rev 4 1-digit level) and that employment and labor value added corresponded with national statistics and GTAP, respectively. The databases that were used for external validation included a) ILO employment and monthly earnings data;[71] b) national data on employment (compiled by the World Bank) and c) GTAP version 10 capital and labor value-added. The final database contains the share of value-added of labor for each type of worker, activity and region. Since it represents labor remunerations multiplied by employment volumes, it's straightforward to calculate labor volumes simply dividing the wage bill by average wages.

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[70] There are other problems related with the use of survey instruments. In recent years, decreasing response rates and data errors have challenged the usefulness of some surveys and resulted in lower quality data. For instance, respondents in more affluent groups tend to give inaccurate information about their personal finances, especially in wages (Meyer, Mok, and Sullivan 2015).

[71] The ILO database systems compile the largest set of labor-specific statistics with global coverage. It includes data for 149 countries "Mean nominal monthly earnings of employees by sex and economic activity". ILO published 3 tables than can be disaggregated by gender including "Mean nominal monthly earnings of employees by sex and economic activity", "Employees by sex and economic activity (Thousands)" and "Employment distribution by economic activity (by sex)". While some of this information is gender disaggregated specific tabulation with cleaned and reasonable data for every year (and wage in local currency and USD). However, some regions or years are not available for the full data or only harmonized to board economic activities.

Table G2: Household surveys used for the construction of wage bill data

Country Name	Country Code	Survey Aronym	Year
East Asia & Pacific			
Australia	AUS	HILDA	2015
Cambodia	KHM	CLFCLS	2012
Cambodia	KHM	CLFCLS	2012
China	CHN	CGSS	2013
Fiji	FJI	HIES	2008
Indonesia	IDN	SAKERNAS	2009
Mongolia	MNG	LFS	2013
Philippines	PHL	LFS	2014
Solomon Islands	SLB	HIES	2005
Thailand	THA	HSES	2011
Timor-Leste	TMP	LFS	2010
Vietnam	VNM	LFS	2010
Europe & Central Asia			
Austria	AUT	SILC	2013
Azerbaijan	AZE	AMSSW	2015
Belarus	BLR	LFS	2016
Czech Republic	CZE	SILC	2013
Denmark	DNK	Law_Model	2013
Estonia	EST	HBS	2004
Finland	FIN	IDS_SILC	2013
Georgia	GEO	HIS	2013
Germany	DEU	GSOEP	2014
Greece	GRC	SILC	2013
Hungary	HUN	HNS	2008
Kosovo	KSV	LFS	2014
Lithuania	LTU	HBS	2008
Luxembourg	LUX	PSELLIII_SIL	2013
Moldova	MDA	LFS	2015
Montenegro	MNE	LFS	2011
Poland	POL	HBS	2011
Russian Federation	RUS	RMLS	2016
Slovak Republic	SVK	SILC	2013
Slovenia	SVN	HBS	2004
Switzerland	CHE	SILC	2013
Tajikistan	TJK	JMSC	2013
Turkey	TUR	HLFS	2015
United Kingdom	GBR	SILC	2013
Latin America & Caribbean			
Argentina	ARG	EPHC_2	2014
Bolivia	BOL	EH	2015
Brazil	BRA	PNAD	2015
Chile	CHL	CASEN	2015
Colombia	COL	GEIH	2014
Costa Rica	CRI	ENAHO	2012
Dominican Republic	DOM	ENFT	2015
Ecuador	ECU	ENEMDU	2015
El Salvador	SLV	EHPM	2014
Haiti	HTI	EEEI	2007
Honduras	HND	EPHPM	2014
Mexico	MEX	ENIGH	2010
Nicaragua	NIC	EMNV	2014
Peru	PER	ENAHO	2015
Uruguay	URY	ECH	2015
Middle East & North Africa			
Djibouti	DJI	EDESIC	2015
Egypt	EGY	ELMPS	2005
Iraq	IRQ	HSES	2012
Jordan	JOR	LFS	2016
Lebanon	LBN	LBN	2011
Morocco	MAR	ENSLE	2009
Tunisia	TUN	HBS	2010
South Asia			
Afghanistan	AFG	ALCS	2013
Bangladesh	BGD	HIES	2010
Bhutan	BTN	BLSS	2017
India	IND	NSS_SCH10	2011
Maldives	MDV	HIES	2009
Nepal	NPL	LSS	2010
Pakistan	PAK	LFS	2014
Sri Lanka	LKA	HIES	2016

Source: Authors' own elaboration

Table G3: Household surveys used for the construction of wage bill data (cont)

Country Name	WB Country Code	Survey Acronym	Year
Angola	AGO	CENSUS	2014
Botswana	BWA	BCWIS	2009
Ethiopia	ETH	UEUS	2016
Gambia	GMB	IHS	2015
Kenya	KEN	IHBS	2005
Lesotho	LSO	HBS	2010
Malawi	MWI	LES	2013
Mali	MLI	EPAM	2010
Mauritius	MUS	HBS	2012
Mozambique	MOZ	IOF	2014
Namibia	NAM	LFS	2014
Niger	NER	ECVMA	2014
Rwanda	RWA	EICV	2013
Sao Tome and Princip	STP	IOF	2010
Seychelles	SYC	HBS	2006
Sierra Leona	SLE	LFS	2016
Somalia	SOM	HFS	2016
South Africa	ZAF	QLFS_Q1	2017
Sudan	SDN	NBHS	2009
Eswatini	SWZ	HIES	2000
Uganda	UGA	UNHS	2016
Zambia	ZMB	LCMS	2015
Zimbabwe	ZWE	LFS	2011
North America			
United States	USA	CPS	2018

Source: Authors' own elaboration

Annex H: Literature Review on the Impacts of AfCFTA

The existing literature on the quantitative impacts of AfCFTA has been mainly focused on the evaluation of implications of tariff and NTM reduction as well as trade facilitation measures on African welfare. CGE modeling using the GTAP as database is broadly used in the studies to evaluate the impact of the shocks of tariff reductions, with some studies using TASTE (Tariff Analytical and Simulation Tool for Economists) for the specific tariff lines cuts. Chauvin, Ramos, and Porto (2016) apply MIRAGE-e CGE to study the impacts of tariffs, NTM and trade cost reductions. The authors also apply microsimulations to evaluate the effects of price and wages changes on welfare of households in 6 SSA countries. Vanzetti, Peters, and Knebel (2018) apply a standard GTAP model.

To measure the quantitative impacts of the CFTA, Vanzetti, Peters, and Knebel (2018), applied three shocks to the model. The first is a full elimination of tariffs, the second includes the tariff elimination with exemptions for 5% of sensitive products and the last one focus on the impact of NTB reduction, without any tariff reduction. Chauvin, Ramos, and Porto (2016) in turn, opted for a more incremental approach, with all simulations in the first stage of the study running until the year 2027. They first proceed to eliminate all tariffs on agricultural goods, and then in all manufactured goods. The third shock consist in adding a 50% reduction of NTBs. And lastly, they apply a 30% reduction on transaction costs in all goods. The results of the studies show that by eliminating all the applied tariffs, the continent would register an increase of trade up to $3.6 billion per annum. The demand for labor, for both skilled and unskilled, is foreseen to experience a sharp increase, especially in countries such as South Africa, Kenya and Nigeria. However, these results show to be asymmetric throughout the continent with South Africa, Nigeria and Angola being the main winners. In some countries, there may even be a reduction of welfare, in the medium and long run, as it appears to be the case for Burkina Faso, Malawi, Mozambique and Rwanda when agricultural tariffs are eliminated (Chauvin, Ramos, and Porto, 2016). In the scenario witch exemption of 5% in sensitive products, the effect is a reduction in the gains for trade by more than 60%. Abrego et al. (2019) demonstrate that the size of the potential gains in allocative efficiency that may be obtained from AfCFTA is deeply dependent of the degree of openness, initial level of trade barriers, and of the strength of initial intra-African trade ties of each county. The study also shows how the continent can have biggest benefits by reducing the NTBs, together with lowering tariffs. The increase in welfare in this scenario will be of 2.1 percent comparing to the baseline, with all countries enjoying welfare increases, and 9 of them with gains of over 5 percent or more.

The microsimulations applied by Chauvin, Ramos, and Porto (2016), point to the heterogeneity of the impacts on welfare. In some countries such Burkina Faso, the benefits will help more the poor, where in Cameroon and Nigeria the rich will gain more. Maleheaded households will have better gains in Nigeria, in contrast with Burkina Faso, Cote d'Ivoire and Ethiopia, where female headed households will be the biggest winners. Rural households will benefit more in Cote d'Ivoire, where urban households will earn more in Cameroon, Ethiopia and Madagascar.

Besides the gains, already mentioned and observed in the existing, but still small, literature, of increases in intra-Africa trade, in demand for labor and welfare, especially if there is a reduction in the NTBs, Africa will also have other benefits derived from AfCFTA. By increasing the intra-Africa trade relatively to trade with the rest of world, intra-Africa trade often becomes more resilient to global price shocks. African countries will also trade, between each other, a more diverse set of goods and products, since trade with non-regional partners tends to be very concentrated and focused on primary commodities. Lastly, a deeper regional integration effort like AfCFTA also creates the opportunity for further reduction of barriers to trade and it has the potential to generate economies of scale. (Ahmed et al. 2018). CGE simulations by the African Development Bank (2019) reinforce the conclusions in the rest of the literature and complement it by adding further simulations that implement Trade Facilitation Agreement. Their additive set of scenarios show that the biggest gains for most of the regions materialize when there is removal of tariffs and nontariff barriers, together with the Trade Facilitation Agreement on an MFN basis and a 50 percent reduction in tariffs and nontariff barriers to other developing countries. This scenario reveals an increase of market access in other developing countries and raises total African exports by 57

percent, which translates in gains of 4.5 percent of Africa's GDP over the baseline, or an additional $31 billion, equivalent to the total gain of $134 billion. The region of Central Africa reaps the most benefits, followed by Northern, Western and Eastern Africa.

The results from the literature shows that under liberalization scenarios where there was a reduction of the NTBs and improvement of trade facilitation conditions, there was a much more substantial increase of trade and welfare than in scenarios where there were only tariff reductions. For instance, one quarter of the costs associated with SPS measures and TBT can be reduced and traditional barriers, such as quotas, can be fully eliminated, without losses for any country. A gain up to $20 billion can be obtained by reducing the trade distortion effect of the NTBs, with the biggest winners being South Africa, Kenya, and Egypt (Vanzetti, Peters, and Knebel, 2018).

Annex I: Recent World Bank research on regional integration in Africa

Recent research at the World Bank has shown that the African continent would benefit from deeper regional integration and offers useful background analysis for the proposed study. This annex provides a brief summary.

Intra-regional Trade and Trade Policy

AfCFTA could benefit from the lessons from the most recent World Bank's analysis of trade policy and barriers in CEMAC. World Bank (2018) finds that trade within CEMAC remains limited despite significant regional integration efforts. Firstly, despite a common external tariff (CET), there is significant divergence from CET at national levels. Secondly, CEMAC's average CET (18.1 percent) is higher when compared internationally and with other regions e.g. CET of ECOWAS (12.4 percent). The authors recommend converging to a tariff schedule with only 4 instead of 5 bands, eliminating the top tariff of 30 percent, which would simplify the tariff regime, lower the average level of tariff protection, and reduce import prices. Thirdly, there are significant non-tariff measures and members' non-compliance with CEMAC transit agreements that prevent intra-regional trade, particularly agricultural trade. Fourth, for regional integration to succeed, the broad political will for integration has to be consistent. World Bank (2018) suggests deepening the common market by: harmonizing customs exemptions; removing remaining non-tariff barriers; facilitating trade along trade corridors; implementing the CEMAC transit and customs regime; and setting and implementing regional standards for border agencies.

In relation to resource-rich countries in Sub-Saharan Africa (SSA), Izvorski, Coulibaly, and Doumbia (2018) find that while SSA has established numerous integration arrangements, spillovers from the resource-rich countries to their neighbors have been negligible, including from Angola, Nigeria, and South Africa—the region's largest resource-rich middle-income countries (MICs). The essential pillar for rejuvenating growth in resource-rich SSA includes building up the institutions for regional integration, such as the establishment of AfCFTA. AfCFTA is expected to boost intraregional trade, strengthen the complementarities of production and exports, create employment, and limit the impact of commodity price volatility on the participants. The authors also suggest establishing preferential access for all countries in regional groupings to leading world markets with attractive rules of origin, conditional on their lead in promoting regional integration (Izvorski, Coulibaly, and Doumbia, 2018).

Estimating impact of preferential trade agreements in Africa

The estimated impact of preferential trade agreements (PTAs) is known to be heterogenous for small developing countries, and the following studies evaluate the trade impacts and examine the determinants of these variations and In the example of "African Growth and Opportunity Act (AGOA) extended by the U.S. and "Everything But Arms" (EBA) extended by the EU since 2001, Coulibaly (2018) proposed a rigorous econometric strategy to re-estimate the impact of these two trade agreements during 2001-2015. The author found that West Africa could be exporting 2.5 to 4 times more to the EU and the US if AGOA and EBA were not implemented in a differentiated manner in terms of (i) country eligibility, (ii) product coverage and (iii) rules of origins. The author used the Pseudo-Poisson Maximum Likelihood

(PPML) gravity model estimation to properly account for the heteroscedasticity of bilateral trade flows as well zero trade flows.

Coulibaly and Kassa (2019) assess the impact of the African Growth and Opportunity Act (AGOA) on AGOA eligible countries during the post-AGOA period 2001-2015 using the Synthetic Control Method (SCM), a quasi-experimental approach that estimates the gap between the synthetic counterfactual and the treatment which represents the impact of the treatment after the treatment period. Findings in Coulibaly and Kassa (2019) show that most eligible countries registered gains in exports due to AGOA, although with varied results.

Industry-specific empirical findings

Coulibaly and Kassa (2019) found that most countries registered gains in exports due to AGOA, however, export gains were uneven. Most gains were due to exports of petroleum and other minerals, while other countries had gains in manufacturing and others in industrial goods. When the gains were derived from exports of fuel, they have been uneven. When they were based on non-fuel exports, the gains have been increasing over the years of AGOA eligibility. Importantly, the positive trade impacts were associated with improvements in ICT infrastructure, integrity in the institutions of legal and property rights, ease of labor market regulations and sound macroeconomic environment including stable exchange rates and low inflation. While, undue exposure to either a single market such as the US or few commodities may have also restricted the gains from trade. The lesson for AfCFTA could be that in the long term, the impact of AfCFTA on exports could support the transformation of economies as long as there are measures supporting diversification of exports into non-fuel products such as manufacturing and agro-processing.

According to Coulibaly (2018), the textile provision of AGOA has had a stronger positive impact on Sub-Saharan Africa exports to the US than the general AGOA provision. At shorter time spans, the estimated effect of the textile provision of AGOA is even stronger: 75 percent more export over 2001-2003, 51 percent over 2004-2006, and 88 percent more export over 2012-2015, compared to 14percent more export over 2001-2015. The full set of simulations indicate that ECOWAS exports of non-textile products to the EU or the US could have been on average 2.5 times more than the levels registered, and the exports of textile products could have been 4 times more.

Policy Implications for an effective regional integration in Africa

Coulibaly (2018) concludes that given the estimated trade creation potential for a group of countries committed to deep regional integration, a revision of AGOA or EBA provision to eliminate the differentiated eligibility criteria and rules of origin would make these PTAs a driving force behind the success of regional integration in Sub-Saharan Africa. Therefore, such potential for trade creation in a region coupled with aforementioned revisions could be imperative during the design process of AfCFTA.

The Coulibaly and Kassa (2019) study suggests that PTAs need to be reinforced with a reform-based eligibility criteria. The authors recommend that during the designing process of PTAs, countries should consider incorporating policy commitments along with preferential access across a range of areas to create an enabling environment for private investment and trade that could enhance export capacity. Lessons from AGOA might include efforts to ease supply constraints and support the integration of African economies to global trade by augmenting the quota-tariff-free 'preferential' agreements with additional instruments to strengthen the capacity and competitiveness of firms. Recent initiatives such as Compact with Africa (CwA) with a strong focus on improving the business environment, building infrastructure, and promoting effective regulations and institutions bridge preferential access

with such policy frameworks. Expansion of the quota-tariff-free access to products that most African countries may have comparative advantage in, such as agriculture and relevant manufacturing, may expand the benefits for African firms.