Potential economic and environmental impacts of the African Continental Free Trade Area (AfCFTA)*

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Abstract

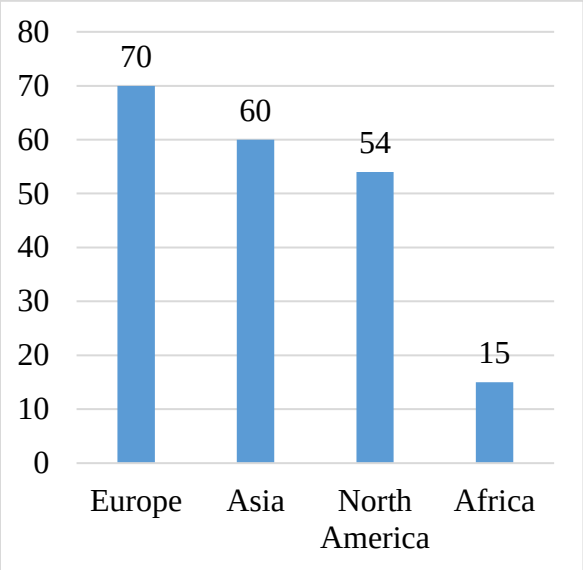
The launch of the African Continental Free Trade Agreement (AfCFTA) is motivated by the need to reverse the lower share of intra-African trade and proportion of African trade with the rest of the world. While the economic impacts of the AfCFTA have attracted significant attention in the literature, empirical evidence on its environmental effects is scanty. Hence, this study attempts to investigate the economic and environmental impacts of the AfCFTA using the PEP-1-w multi-region world CGE model calibrated against the GTAP 7 database. The preliminary results are based only on the economic impacts. Overall, the results shows that the implementation of the AfCFTA will lead to welfare improvement in Africa, but these welfare improvements do not cut across all countries proportionally. Also, the agreement results in trade diversion as trading within African countries increase at the expense of trading with the rest of the world. Based on these results and forthcoming results on the environmental aspects, appropriate policy recommendations will be suggested.

1.0 Introduction

The African Continental Free Trade Agreement (AfCFTA) is aimed at boosting intra-African trade and promoting regional development. Regional trade on the continent is low compared to other regions of the world. According to the United Nations Economic Commission for Africa (UNECA, (2018), average intra-African trade is 15%, compared to 70% for Europe, 60% for Asia, and 54% for North America (Figure 1). Also, Africa's share of global trade at 2.1% is lower than the continent's share of global GDP at 2.9% (Figure 2). The need to boost intra-African trade and regional integration as a basis for achieving structural transformation, poverty reduction and long-term sustainable development is the motivation for the AfCFTA.

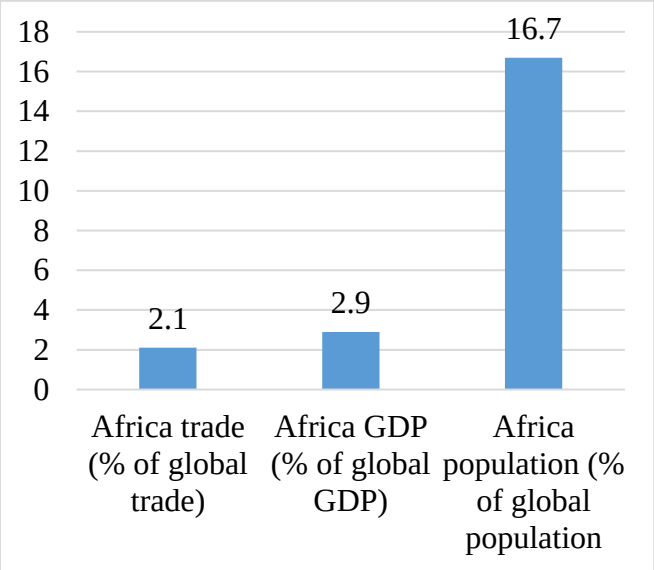
* This version of the report only look at the economic impacts of the AfCFTA. Further work is ongoing on the modeling to incorporate the environmental module.

Figure 1: Average intra-regional trade (%)



Source: UNECA (2018)

Figure 2: African trade, GDP and population (%)



World Bank (2020)

A major thrust of the AfCFTA is the removal of tariffs from about 90% of goods, enhancing free flow of goods and services across the continent. The agreement is the largest free trade area in the world in terms of the number of participating countries, and estimates from the UNECA showed that the agreement will boost intra-African trade by 52% by 2022 compared to the 2010 levels. Hence, the agreement is in response to the very low intra-African trade compared to other regional blocs), and the need to boost intra-continental trade as a means for enhancing social economic development in the continent.

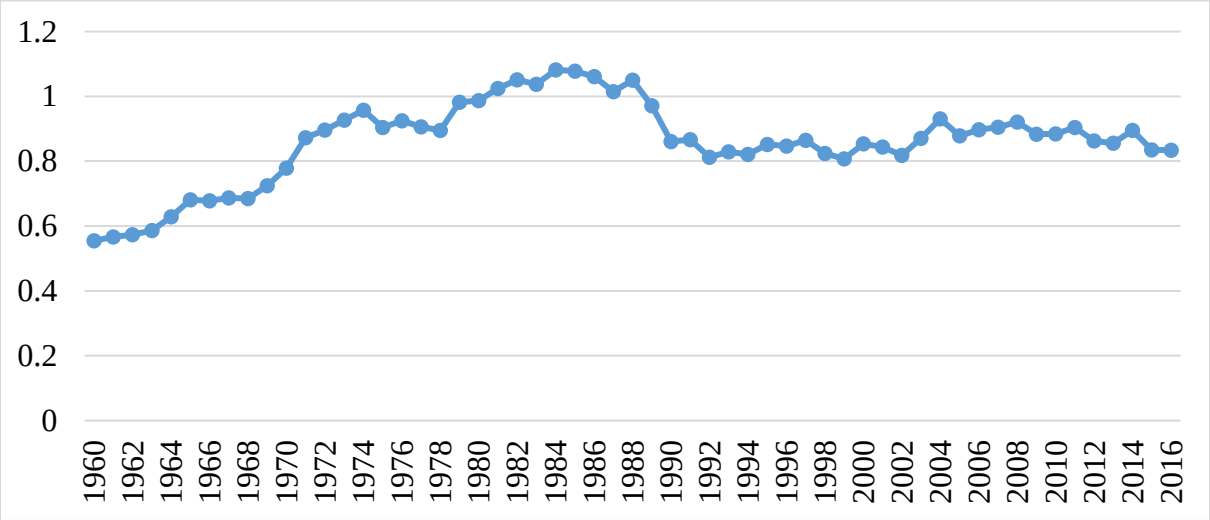
The AfCFTA has a strong link to the Sustainable Development Goals (SDGs). Specifically, it corresponds to Goal 17 of the SDGs, which advocates for strengthening global partnership for sustainable development. It seeks to encourage regional cooperation and development among nations. Also, the AfCFTA is in support of Goal 9, which is about building resilient infrastructure, promoting inclusive and sustainable industrialisation and fostering innovation. These are also in line with the African Union Agenda 2063.

However, despite the potential impacts of the agreement in boosting intra-African trade and regional development, several issues such as SMEs protection, human rights, labour practices and workers' rights, gender considerations and inclusivity, and environmental impacts (Chutto, 2019; UNECA and Friedrich Ebert Stiftung, 2017), among others, have been raised with respect to the AfCFTA in particular and trade liberalisation in general. Goal 13 of the SDGs advocates for urgent

actions to tackle climate change and its impacts. The expected change in resource allocation and production and trading pattern may influence the continent's ability to meet its climate change targets. As noted by the IMF (2019), Africa's exports to the rest of the world are basically unprocessed primary commodities and solid minerals (average of 75% during 2007-2017), while intra-African exports are largely manufacturing commodities (40%). This suggests that promoting intra-African trade may enhance trading in manufacturing commodities, which is capable of engendering regional industrialization and structural transformation, with its attendant environmental implications.

Environmental issues, particularly the impacts of climate change, has become more pronounced in the continent. According to the Boko, et al. (2007), Africa is one of the most vulnerable regions to the impacts of climate change. Currently, the continent contributes less than 5% of global CO_2 emissions, but the level of emissions have trended upward in recent years (see figure 3). Efforts to promote economic growth and development, through trade and industrialization, may increase CO_2 emissions in the continent, particularly if there are no commensurate efforts to change the energy mix towards renewables. Gertler (2012) had posited that most of the growth in energy demand and the associated emissions, over the next 25-30 years, will come from developing countries. Therefore, in consideration of the potential impacts of the AfCFTA on industrialization and structural transformation in Africa, it is essential to balance the economic and environmental aspects of the AFCFTA.

Figure 3: Trend of CO_2 emissions in sub-Saharan Africa (metric ton per capita), 1960-2016



Source: World Development Indicators (World Bank)

This is the main focus of this study. This study attempts to investigate the potential economic and environmental impacts of the AfCFTA using a computable general equilibrium (CGE) model. There are existing studies on the impacts of the AfCFTA in the literature. However, most of these studies only focused on economic impacts (Table 1). A review of these studies showed that the AfCFTA will boost intra-African trade, GDP and economic welfare among participating countries, with variations across countries.

Table 1: Economic impacts of the AfCFTA: Summary of the key findings from the literature (%)

	Scenario	GDP	GDP, African trade	Total exports	Total imports
Removal of tariffs on intra-AfCFTA trade					
ADB (2019)	Removal of all tariffs on intra-AfCFTA trade	0.10 (US$2.8 billion)	14.60 (US$10.1 billion)	1.00 (US$5.8 billion)	0.90 (US$5.8 billion)
Mevel and Karingi (2012)	Removal of all tariffs on intra-AfCFTA trade by 2017 + CET	0.20	52.30	4.00	
Jensen and Sandrey (2015)	Removal of all tariffs on intra-AfCFTA trade	0.70	4.30	3.11	
Saygili, Peters, and Knebel (2018)	Removal of all tariffs on intra-AfCFTA trade	0.97	32.80	2.50	1.80
Abrego et al. (2019)	Removal of all import tariffs	0.037–0.053[a]			
World Bank	Gradual removal of 97% of tariffs on intra-AfCFTA trade	0.13 (US$12 billion)	21.76 (US$131 billion)	1.78 (US$35 billion)	2.31 (US$41 billion)
Removal of tariffs and NTBs on intra-AfCFTA trade					
ABD (2019)	Removal of all tariffs on intra-AfCFTA trade, removal of NTBs	1.25 (US$37 billion)	107.20 (US$74.3 billion)	44.30 (US$107.2 billion)	33.80 (US$214.1 billion)
Jensen and Sandrey (2015)	Removal of all tariffs on intra-AfCFTA trade; 50% reduction in NTBs	1.60	7.26	6.28	
Abrego et al. (2019)	Removal of all tariffs; 35% reduction in NTBs	7.60–1.89–2.11[a]	8.40		
World Bank	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 and implementation of TFA					
ADB (2019)	Removal of all tariffs on intra-AfCFTA trade; removal of NTBs; implementation of TFA	3.50 (US$100 billion)	132.70 (US$92 billion)	51.10 (US$295.6 billion)	46.20 (US$292.8 billion)

World Bank	Gradual removal of 97% of tariffs on intra-AfCFTA trade; 50% reduction in NTBs; implementation of TFA	4.20 (US$413 billion)	92.07 (US$556 billion)	28.64 (US$560 billion)	40.61 (US$714 billion)

World Bank (2020)

Note: AfCFTA = African Continental Free Trade Area; CET = common external tariff; GDP = gross domestic product; NTB = non-tariff barrier; TFA = trade facilitation agreement.

a = equivalent variation

While there have been growing body of literature on the economic impacts of the AfCFTA, there is no known study on the environmental impacts of the agreement. However, review of the literature on the environmental impacts of trade liberalisation found mixed effects (Kirkpatrick and Serban Scrieciu, 2007) and varying methodological approaches (OECD, 2000). This study advances the AfCFTA literature by focusing on both the economic and environmental impacts, as opposed only the economic effects. It is also different from the existing literature on the environmental impacts of trade liberalization. Most of the existing studies focused either on specific sectors or studied the linear effects of trade on the environment (Tariku, 2015; Cherniwchan, 2017; Kolcava, Nguyen and Bernauer, 2019) using econometric analysis. The failure to capture intersectoral effects has inspired the use of CGE modeling in studying the environmental effects of trade liberalization (Strutt and Anderson, 2000; Li, 2005). However, the current CGE literature are largely single country analysis. Given the global impacts of climate and environmental issues, a world CGE model may be more appropriate to evaluate the environmental impacts of trade liberalization in general, and the AfCFTA in particular. This is the gap this study seeks to fill. This study, therefore, investigates the potential economic and environmental impacts of the AfCFTA using a multi-region world CGE model.

2.0 Methodology and Data

This study uses a static multi-region world CGE model to analyse the economic and environmental impacts of the AfCFTA. CGE models are used to investigate the impacts of public policy. It has been widely used to explore the impacts of trade liberalization in general (de Melo, 1988; Piermartini and The, 2005), and the AfCFTA in particular. For this study, the PEP-w-1 model, developed by Lemelin, et al. (2013), is used. The PEP-w-1 model is a multi-region, single period world model version of the PEP-1-1 model (developed by Decaluwe, et al. 2013). The equations in the model follow the neo-classical economic theory, and assumes that consumers and producers

are rational, and seek to maximise utility given a budget constraints and minimise production costs respectively.

The PEP model separates capital and labour into several categories, and takes into account a broader set of tax instruments. In the model, output is composed of intermediate consumption and value added in fixed proportion. Value added is a composite of the production factors (which include land, labour and capital) via a CES function. Commodities produced in each sector of the economy are either sold in the domestic market or exported to the rest of the world, and this relationship is depicted by a constant elasticity of transformation (CET) function. The relative prices of domestic sales and exports provide signal for producers in this respect. Similarly, commodities consumed in the domestic market comprises of both imported and domestically produced commodities, which are assumed to be imperfect substitutes (Sisso, Sawadogo and Natama, 2016). This is indicated using the Armington assumption with a CES function between imported and domestic commodities (Armington, 1969).

The CGE model is calibrated to the GTAP 7 database. The GTAP 7 database provides an overview of the global economy in 2004, including bilateral trade flows, transportation and protection linkages and flows between domestic industries. The main database include 134 countries/regions, 57 sectors and 5 factors. All African countries are to be included in the study, but because of numerical instabilities, the model cannot solve. Hence, I only included a few African countries, and aggregate the remaining African countries as "Rest of Africa". Hence, for the purpose of this study, the database is aggregated to only 21 regions, 16 sectors and 5 factors (see Annex) using the methodology provided by Robichaud (2015). To further precisely determine whether the AfCFTA leads to a trade creation or diversion effect, another aggregation of the regions was made, where all non-African countries are aggregated as the rest of the world (ROW). Therefore, all references to the ROW in the results section refers to all non-African countries.

Based on the data available in the GTAP 7 database, a synopsis of initial intra-Africa trade flows and tariffs is provided in Table 2 and 3. Table 2 shows the average import duties and export taxes that exist between African countries. With varying import duties and export taxes before the implementation of the AfCFTA, the agreement will lead to trade diversion among African countries. Most countries that currently enjoy free trade with others will have that advantage eroded, and may have to compete with other AfCFTA member states.

Table 2: Bilateral average import duties and export taxes (%)

REGIONS	ROW	ROA	Nigeria	SADC	Mozambique	Zambia	Zimbabwe	Botswana	Namibia	South Africa
Import tariff (%)										
ROW	2.22	8.82	8.27	6.01	6.17	5.97	13.71	2.91	3.81	5.87
ROA	1.07	5.91	10.80	2.61	6.80	4.67	1.49	2.49	0.47	0.48
Nigeria	1.60	2.80		4.85	6.75	13.95	19.33	6.18	1.43	0.04
SADC	3.70	9.70	6.87	1.84	6.68	1.77	0.38	0.09	0.01	0.02
Mozambique	1.78	38.58	0.29	4.09		2.14	10.69	0.02	0.05	0.00
Zambia	2.34	12.36	3.71	0.84	8.23			0.09	0.11	0.00
Zimbabwe	6.71	12.16	8.98	1.35	0.68			0.05	0.01	0.03
Botswana	0.10	4.62	0.15	4.65	7.21	3.19	6.35			
Namibia	2.05	12.19	6.88	1.21	14.56	3.90	21.77			
South Africa	2.40	11.88	8.18	4.70	6.41	7.75	16.36			
Export taxes (%)										
ROW	1.11	0.86	0.69	1.66	2.67	0.97	1.01	0.49	0.62	0.98
ROA	0.43	1.63	2.97	3.31	1.85	1.34	2.66	0.87	2.06	1.15
Nigeria	0.01	0.06		0.07	-0.41	-0.16	-0.20	-0.10	-0.41	0.00
SADC	1.94	4.89	5.99	4.12	8.03	7.55	2.68	0.74	5.29	3.30
Mozambique	0.41	1.64	0.54	4.68		4.06	0.24	0.31	0.69	0.30
Zambia	0.38	1.70	2.04	1.17	1.21		0.87	0.67	0.66	1.34
Zimbabwe	0.62	-0.14	0.16	0.41	2.05	0.95		1.01	0.20	0.74
Botswana										
Namibia	2.17	2.21	4.01	1.30	0.20	2.61	0.78	1.34		1.79
South Africa	1.10	3.65	7.02	3.52	2.31	3.16	4.77		5.47	

Source: Extracted from GTAP 7 database

Also, the share of bilateral trade as a percentage of total trade is presented in Table 3. From the table, African countries trade more with the rest of the world than with fellow African nations. On average, about 78% of African trade is with the rest of the world. The only countries with less than 50% trade with the rest of the world is Zimbabwe, which is partly as a result of global sanctions. Within African countries, the level of intra-African trade varies. For example, Mozambique, Zimbabwe, Namibia and Zambia trade more with South Africa than any other African countries, and there economies are significantly tied to that of South Africa. Hence, by opening up free trade

in the continent, other countries may compete with these countries for the South African market, reducing their comparative advantage.

Table 3: Bilateral trade as a share of total trade (%)

	ROW	ROA	Nigeria	SADC	Mozambique	Zambia	Zimbabwe	Botswana	Namibia	South Africa
ROW	97.35	1.72	0.26	0.09	0.02	0.01	0.01	0.01	0.01	0.53
ROA	92.97	4.93	0.45	0.19	0.01	0.09	0.01	0.00	0.01	1.34
Nigeria	94.82	3.58	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.59
SADC	86.58	4.88	0.55	2.07	0.48	0.38	1.61	0.03	0.08	3.33
Mozambique	59.91	1.02	0.02	1.50	0.00	0.28	7.07	0.06	0.01	30.14
Zambia	73.56	8.97	0.02	2.16	0.03	0.00	2.68	0.26	0.13	12.19
Zimbabwe	44.14	3.20	0.07	2.61	13.80	3.19	0.00	1.40	0.61	30.99
Botswana	83.31	0.26	0.05	0.06	0.01	0.16	6.60	0.00	0.13	9.41
Namibia	75.60	9.35	0.28	0.22	0.80	0.39	0.12	0.42	0.00	12.82
South Africa	80.23	4.78	0.90	1.73	1.44	1.74	1.52	3.85	3.81	0.00

Source: Extracted from GTAP 7 database

It is important to note that this study only focused on the (total) removal of tariff from all commodities (goods and services) within the AfCFTA, and does not consider non-tariff measures in goods and services and trade facilitation measures.

3.0 Results

The paper simulates the potential economic and environmental impacts of the AfCFTA. This section presents the highlights of the key economic and environmental indicators. A summary of the key results are presented in this section. Table 4 presents the results of the impacts of the AfCFTA on sectoral output in the selected countries. The production of agricultural crops decline in Botswana and Mozambique by 0.04%, and 1.85%, but increase in Namibia, Nigeria, South Africa, Zambia, Zimbabwe and rest of Africa by 0.21%, 0.02%, 0.12%, 0.53%, 2.38% and 0.06% respectively. Similarly, Nigeria and Zimbabwe experience an increase in the output of energy and other minerals and metal products sector by 0.00% and 3.48%. The other countries in the study witness a decline in the output of this sector. These results suggest that the AfCFTA will cause changes in sectoral production across the continent, following expected re-allocation of resources occasioned by the agreement.

Table 4: Impacts on sectoral output

	Botswana	Mozambique	Namibia	Nigeria	Rest of Africa	South Africa	Zambia	Zimbabwe
Agriculture crops	-0.04	-1.85	0.21	0.02	0.06	0.12	0.53	2.38
Energy and other minerals and metal products	-0.07	-2.47	-0.47	0.00	-0.01	-0.69	-1.05	3.48
Processed foods, beverages and tobacco	0.25	-2.44	1.41	0.32	0.15	1.03	1.94	1.13
Textile and leather products	4.53	-15.71	-0.02	-1.17	0.35	0.17	2.05	-0.93
Wood and paper products	0.57	-9.90	7.15	-0.57	0.01	0.30	0.12	-1.59
Petrochemical, coal, rubber and plastic products	-0.14	-12.03	-2.09	0.31	0.58	1.35	1.90	-1.40
Motor vehicles and parts	9.82	-11.62	7.05	-0.12	0.38	0.55	-11.32	-5.62
Other manufactures	-0.14	190.91	-2.70	-0.11	-0.03	-0.22	-0.31	-33.16
Utilities	0.08	-3.49	-0.69	0.19	0.14	0.27	-0.07	1.44
Construction	-0.10	-4.58	-0.80	-0.06	-0.57	-0.42	-2.49	-11.96
Trade	0.08	9.11	0.06	-0.10	0.03	0.15	0.05	1.70
Transportation	-0.57	-0.39	0.43	0.52	0.10	-0.25	0.36	9.88
Communication	-0.14	-0.28	0.16	0.04	-0.02	0.00	0.38	3.08
Financial services and insurance	-0.20	-1.19	0.25	0.07	-0.01	-0.06	0.11	0.64
Other services	-0.13	-2.29	-0.04	-0.10	-0.06	0.02	0.98	1.16
Public administration, defense, health and education	-0.08	-1.07	-0.02	0.11	0.01	-0.01	0.04	-0.08

Source: Author's computation

The goal of the AfCFTA is to increase intra-African trade. Table 5 presents the results of the impacts of the AfCFTA on bilateral trade, focusing mostly on trade within Africa and with the rest of the world. From the results, trade flows between African countries and the rest of the world mostly reduce. Trade flows from the rest of the world to Africa decline by 0.73% (RoA), 1.07% (Nigeria), 0.78% (SADC), 5.81% (Zambia), 23.39% (Zimbabwe), and 0.73% (Namibia). Similarly, trade flows from Africa to the rest of the world decline by 0.20% (RoA), 0.04% (Nigeria), 1.01% (SADC), 5.51% (Mozambique), 1.56% (Zambia), 0.09% (Botswana), 3.01% (Namibia), and 2.14% (South Africa).

The bilateral trade flows among African countries is mixed. In some cases, the trade flows increase. For example, trade flow from South Africa to all African countries increase, except to Botswana. Also, trade flows from other African countries to South Africa also increase, except for

Mozambique. Hence, these results imply that while the AfCFTA has the capacity to improve aggregate intra-African trade, bilateral trade flows among the AfCFTA members may increase or decrease, depending on the current level of trade between the countries and changes in production level caused by the agreement. Besides, the increase in intra-African trade will be at the detriment of trading with the rest of the world, resulting in trade diversion.

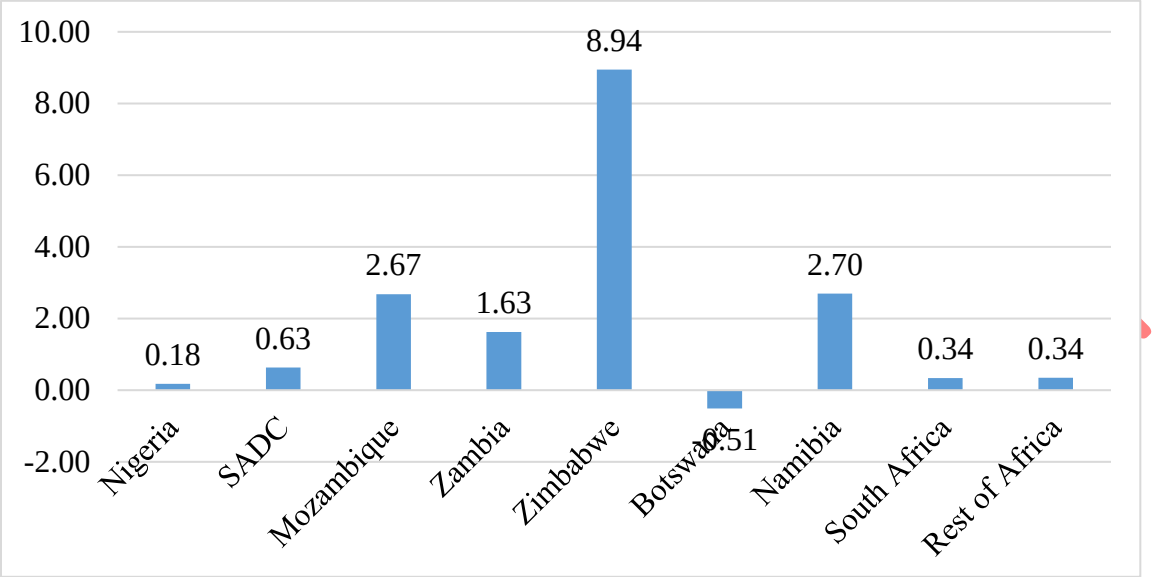
Table 5: Impacts of AfCFTA on bilateral trade (%)

	RoW	RoA	Nigeria	SADC	Mozambique	Zambia	Zimbabwe	Botswana	Namibia	South Africa
RoW	0.01	-0.73	-1.07	-0.78	0.93	-5.81	-23.39	0.86	-0.73	1.11
RoA	-0.20	14.67	23.84	10.41	18.76	5.91	-11.87	6.07	4.94	4.16
Nigeria	-0.04	5.33		7.18	12.15	16.29	-13.78	14.88	-0.12	0.66
SADC	-1.01	30.71	23.59	10.11	40.66	11.93	-21.15	1.09	-1.01	7.69
Mozambique	-5.51	64.29	-8.57	4.45		-7.17	95.38	-3.94	-5.79	-3.72
Zambia	-1.56	26.39	3.41	0.22	20.46		-6.39	-1.20	0.80	1.56
Zimbabwe	2.70	28.06	19.62	3.98	12.13	-1.39		3.40	2.63	6.13
Botswana	-0.09	7.40	-0.59	9.21	14.54	0.58	1.39		-2.24	1.46
Namibia	-3.01	25.59	20.48	-0.23	26.29	4.30	37.30	-0.71		1.60
South Africa	-2.14	31.25	28.05	13.26	15.63	11.87	7.51	-1.05	5.03	

Source: Author's computation

Figure 4 shows the welfare (real household consumption) effects of the AfCFTA. From the analysis, the implementation of the AfCFTA will result in aggregate welfare improvement for the continent, but this welfare effects vary across countries and regions. There will be negative but negligible (0.002%) welfare loss for the ROW. Within the continent, while the welfare effect in Zimbabwe, Mozambique, Nigeria and the rest of Africa will be 8.94%, 2.67%, 0.18% and 0.34% respectively, the AfCFTA will lead to a reduction in welfare in Botswana by 0.512%. The uneven distribution of the potential economic benefits and welfare warrants a compensation mechanism to assist countries that experience welfare losses as a result of the agreement.

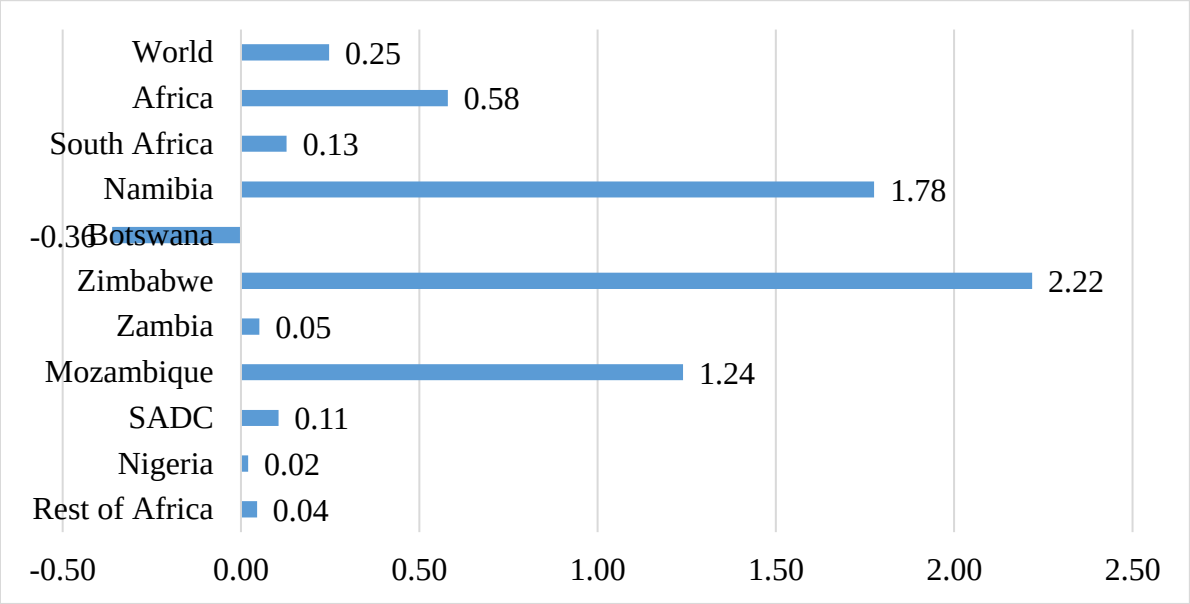
Figure 4: Welfare (Real household consumption)



Source: Author's computation

The implementation of the AfCFTA will also have mixed effects on the real GDP of different countries and regions (Figure 5). For example, the average real GDP of the ROW will decline marginally by 0.003%. The real GDP growth rates of African economies are not uniform among all countries. For example, while some countries experience positive real GDP growth as a result of the AfCFTA, Botswana's economy will shrink by 0.36%. Even among the economies that experience positive GDP growth, the growth rates will differ significantly. While Zimbabwe and Namibia will experience real GDP growth of 2.22% and 1.78%, Nigeria and Zambia will only grow by a modest 0.02% and 0.05% respectively.

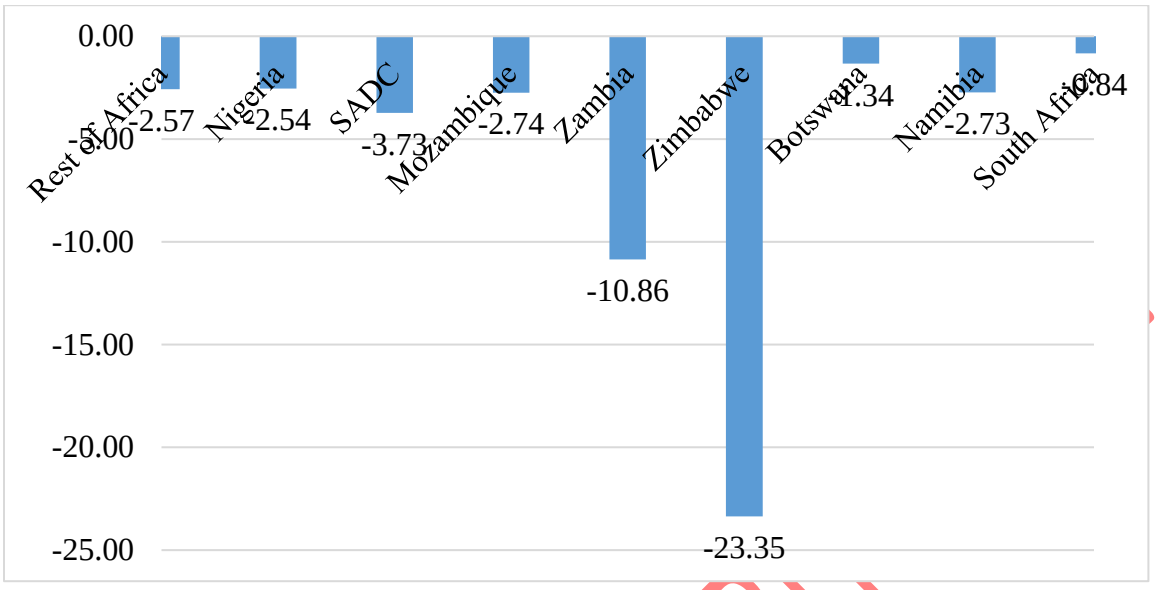
Figure 5: Real GDP at market price



Author's computation

One of the controversial aspects of the AfCFTA is the potential loss of import and export tax revenue and the effects on government finances. This effect is described in Figure 6, and describes the impacts of the AfCFTA on total government revenue. As expected, aggregate government revenue will reduce. This is because import duties and export taxes constitute a significant proportion of total government revenue. But the degree of the effects on government revenue varies from one country to another, depending on the initial share of import and export taxes in overall government revenue. According to Figure 3, Zimbabwe will experience the biggest decline in government revenue by 23.35%, followed by Zambia at 10.86%. Government revenue in Nigeria, South Africa, Botswana and "Rest of Africa" will reduce by 2.54%, 0.84%, 1.34% and 2.57% respectively. The varying degree of revenue losses among African countries may undermine commitment to the AfCFTA if adequate measures are not put in place to support countries with significant revenue losses.

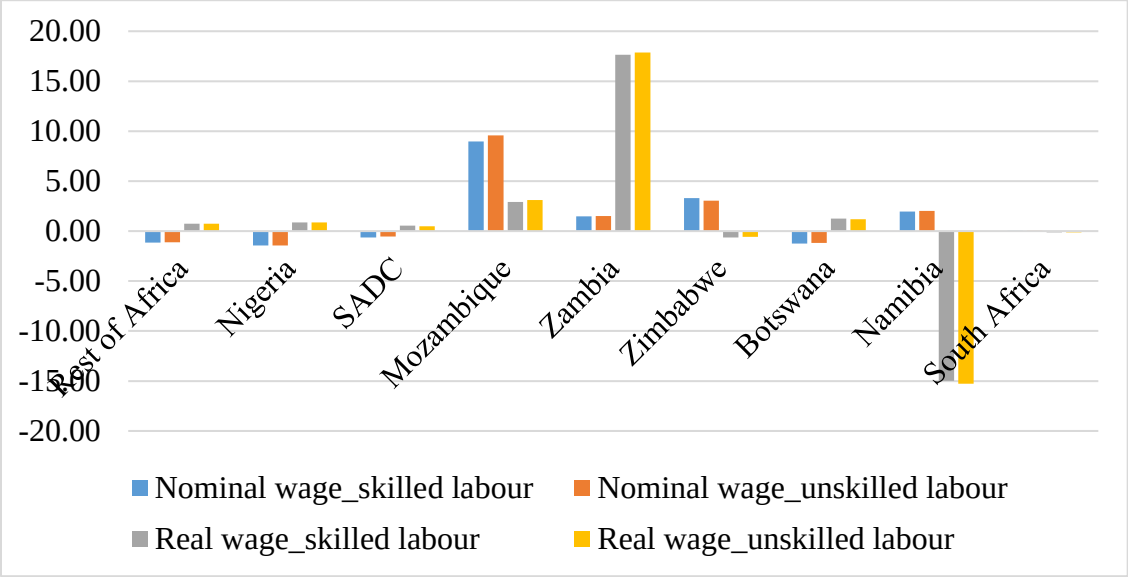
Figure 6: Total government revenue



Source: Author's computation

The ratification of the AfCFTA raised eyebrows among labour and workers unions across Africa. Specifically, the Nigerian Labour Congress (NLC) initially opposed the ratification of the agreement, arguing that it will dampen wages and lead to suppression of workers' rights. Hence, this study presents the impacts of the AfCFTA on real wages (Figure 7). For individual countries under review in this study, the AfCFTA have very similar effects on skilled and unskilled labour. Nominal wages for skilled labour in Nigeria, Botswana, SADC region, and ROA will decline by 1.45%, 1.25%, 0.63% and 1.14% respectively. Nominal wages for unskilled labour will also decline by almost similar proportion. On the other hand, nominal wages for skilled and unskilled labour in the other countries will increase. However, when the changes in price is considered, the real wages for skilled and unskilled labour will increase in all the countries except Zimbabwe and Namibia. Real wages for skilled labour in Zimbabwe and Namibia will decline by 0.62% and 14.98% while real wages for unskilled labour will decline by 0.57% and 15.26% respectively. These results suggest that the AfCFTA will have disproportionate effects on real wages. Hence, there should be a compensating mechanism to support the erosion of real wages to ensure that the benefits of the agreement is inclusive and "leave no one behind".

Figure 7: Nominal and real wages



Author's computation

5.0 Conclusion and Recommendation

This study attempts to examine the potential economic and environmental impacts of the AfCFTA using a multi-region world CGE model calibrated on GTAP 7 database. The current version of the paper only looks at the economic aspects of the analysis, and further modeling is ongoing with respect to the environmental module.

The preliminary results shows that while the AfCFTA will benefit the African continent (on average) in terms of welfare gains, these gains are spread disproportionally, and some countries may experience welfare losses. Also, the implementation of the agreement will lead to loss of government revenue. The labour market impacts are also not proportionally spread across the continent as real wages will increase in some countries and decrease in others.

Based on this preliminary results, it can be concluded that the AfCFTA will benefit African in terms of welfare gains, but these gains are not proportionally distributed. Hence, complimentary policies should be implemented to support countries that experience economic and welfare losses as a result of the agreement.

References

Armington, P. (1969). A theory of demand for products distinguished by place of production. *IMF Staff Papers No. 16,* 159-178, International Monetary Fund, Washington, DC.

Boko, M., Niang, I. Nyong, A. Vogel, C., Githeko, A., Medany, M., Osman-Elasha, B., Tabo, R. and Yanda, P. (2007). Africa. Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, 433-467.

Cherniwchan, J. (2017). Trae liberalisation and the environment: Evidence from the NAFTA and the U.S. manufacturing. *Journal of International Economics, 105,* 130-149.

Chutto, R. (2019). The African Continental Free Trade Area: Will it promote fair trade, economic development and decent work? Industriall Global Union. Available at http://www.industriall-union.org/report-the-african-continental-free-trade-area-will-it-promote-fair-trade-economic-development-and

Decaluwé, B., Lemelin, A., Robichaud, V., and H. Maisonnave (2013). PEP-1-1: The PEP standard computable general equilibrium single-country - Static CGE model, Version 2.1". Partnership for Economic Policy (PEP), Nairobi, Kenya.

De Melo, J. (1988). Computable general equilibrium models for trade policy analysis in developing countries: A survey. *Journal of Policy Modeling, 10(4),* 469-503.

IMF (2019). Sub-Saharan Africa: Recovery amid elevated uncertainty. Regional Economic Outlook, World Economic and Financial Surveys (April). International Monetary Fund, Washington, DC.

Kirkpatrick, C. and Serban Scrieciu, S. (2007). Is trade liberalisation bad for the environment? A review of the economic evidence. *Journal of Environmental Planning and Management, 51*(4), 497-510.

Kolcava, D., Nguyen Q. and Bernauer, T. (2019). Does trade liberalisation lead to environmental burden shifting in the global economy? *Ecological Economics, 163*, 98-112.

Lemelin, A., Robichaud, V., Decaluwe, B. and Maisonnave, H. (2013). PWP-w-1: The PEP Standard multi-region, single period world CGE model. Partnership for Economic Policy, Nairobi, Kenya.

Li, J. C. (2005). Is there a trade-off between trade liberalisation and environmental quality? A CGE assessment on Thailand. *The Journal of Environment & Development, 14*(2), 252-277.

OECD (2000). Assessing the environmental effects of trade liberalisation agreements: Methodologies. OECD Publishing, Organisation for Economic Cooperation and Development, Paris, France.

Piermartini, R. and The, R. (2005). Demystifying modelling methods for trade policy. WTO Discussion Paper No. 10, World Trade Organisation, Geneva, Switzerland.

Robichaud, V. (2015). How to create input files for DATA_AGG.gms. Partnership for Economic Policy (PEP), Nairobi, Kenya.

Sisso, D. C., Sawadogo, B. and Natama, H. M. (2016). Decline in gold prices, tax receipts and employment: Which adaptation strategy for Burkina Faso. *PEP Working Paper No. 2016-28*, Partnership for Economic Policy, Nairobi.

Strutt, A. and Anderson, K. (2020). Will trade liberalisation harm the environment? The case of Indonesia to 2020. *Environmental and Resource Economics, 17*, 203-232.

Tariku, L. (2015). The impact of trade liberalisation on air pollution: In case of Ethiopia. *New Media and Mass communication, 40*, 43-55.

UNECA (2018, May 18). Continental Free Trade Area deal set to boost intra-African trade, says Ambassador Quartey. Communication Section, United Nations Economic Commission for Africa, Addis Ababa, Ethiopia.

UNECA and Friedrich Ebert Stiftung (2017). The Continental Free Trade Area (CFTA) in Africa: A human rights perspective. Friedrich-Ebert-Stiftung, Geneva, Office, Switzerland.

Wolfram, C., Shelef, O. and Gertler, P. (2012). How will energy demand develop in the developing world? *Journal of Economic Perspectives, 26*(1), 119-138.

World Bank (2020). The African Continental Free Trade Area: Economic and distributional effects. The World Bank Group, Washington, DC.

Annex

Code and abbreviation of sectors

Sectors	agrc	Agriculture
	omin	Energy and other minerals and metal products
	pfood	Processed food and beverages and tobacco
	text	Textile and leather products
	wpp	Wood and paper products
	petch	Petroleum, coal, chemical, rubber and plastic products
	mvh	Motor vehicles and parts
	oman	Other manufactures
	util	Utilities
	cns	Construction
	trd	Trade
	transp	Transportation
	cmn	Communication
	fina	Financial services and insurance
	oserv	Other services
	osg	Public administration, defense, health and education
Factors	slab	Skilled labour
	ulab	Unskilled labour
	cap	Capital
	land	Land
	natr	Natural resources
Regions	row	Rest of the World
	chn	China
	roasia	Rest of Asia
	jpn	Japan
	kor	Korea
	ind	India
	usa	United States of America
	refta	Rest of EU Free Trade Area
	deu	Germany
	nld	Netherland
	gbr	United Kingdom
	mena	Middle East
	roa	Rest of Africa
	nga	Nigeria
	sadc	SADC
	moz	Mozambique
	zmb	Zambia
	zwe	Zimbabwe
	bwa	Botswana
	nam	Namibia
	zaf	South Africa

Source: Aggregation from GTAP database