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The effects of a US-China trade war on Sub-Saharan Africa: Pro-active domestic policies make the difference

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Abstract

This study simulates the impact of the change in trade policy between the US and China on the trade volume and economic prosperity of Sub-Saharan Africa (SSA). To do that, we employ a Computable General Equilibrium (CGE) model based on the Global Trade Analysis Project (GTAP) with different scenarios focusing on increases in tariffs. The results show that the tariff increases negatively affect the US and China in terms of trade volume and economic growth, while it leads to trade diversion and creation for the SSA. This offers valuable opportunities in improving exports and economic growth, particularly for Ethiopia, Kenya, and Nigeria. On the sectorial level, the findings imply that agriculture, food, and oil and gas sectors are positively affected in terms of export volume, while mineral, metal and service sectors are negatively impacted by the trade war.

Keywords: CGE; GTAP; Sub-Saharan Africa; Trade policy; Trade war

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1. Introduction

Over the last five years, there have been several trade policy-related events with an emphasis for more protectionist policies. The most serious one is the US's tariff increase on imports from China. The huge and unsustainable bilateral trade deficit, related to some extent to undervalued Chinese Renminbi (RMB), seems to be the reason that pushed the US to implement tariff increases against China (Xia et al., 2019). There are also other factors such as China's systematic stealing of US intellectual property and bringing back some manufacturing to the US (Salvatore, 2020) with the strategy of "putting America first".

In January 2018, the US imposed new tariffs on solar panels and washing machines imported from China. In March 2018, it imposed a tariff of 10 % and 25 % on aluminum and steel, respectively (Bekkers, 2019; Carvalho et al., 2019). In April 2018, China retaliated by putting tariffs on 128 goods imported from the US, including agricultural goods worth USD 2.4 billion. The US government reacted to this action by releasing a list of 1300 Chinese goods (mainly from technology and pharmaceutical industries) worth USD 50 billion, that were taxed 25 % (Capie et al., 2020; Zhang, 2020). The Chinese government released another list of 106 goods, including cars, airplanes, and other products. The tariff war continued up to a stage where the tax imposed on Chinese goods reached USD 505 billion, affecting almost all Chinese exports (Chi & Qiao, 2019). Despite signing the Phase-One trade agreement with China in January 2020 and the Biden administration taking office in January 2021, the trade war is still ongoing, affecting the world economy (Capie et al., 2020; Palmer, 2023).

Trade policies play a vital role in shaping international trade and the world economy. Goldberg and Pavcnik (2016) claim that trade policies have effects on trade volume, industry, corporate performance, labor market, and the long-run economic growth. Countries come up with different trade policies to protect their domestic market, improve trade balance, and stimulate economic growth. The ongoing trade war between the US and China since 2018 is a good example to understand the remarkable impacts of trade policies on the global economy. Teimouri and Raeissadat (2019) argue that the trade war between the US and China is quite different from others since their cumulative GDP and population constitute over 40 % and 30 % of the world, respectively.

Both the US and China are important trade partners of Sub-Saharan Africa (SSA). These economic and trade relationships are materialized through different agreements such as the African Growth and Opportunity Act (AGOA) and the Forum on China-Africa Cooperation (FOCAC). According to World Integrated Trade Solution (WITS) data for 2019, the SSA exports to China and the US reach to USD 25.9 billion and USD 12.4 billion, respectively, in other terms 10.8 % and 5.1 % of the SSA total exports. The SSA imports from China and the US are worth USD 45.5 billion and USD 16.4 billion, respectively, reaching to 17.9 % and 6.4 % of total imports. The SSA mainly exports raw materials such as oil, minerals like gold and diamonds, and agricultural products like cocoa beans. Thus, a change in trade policy between these two countries may have implications on the SSA countries.

Although there are numerous studies on the impact of the trade war between the US and China on different countries, there are only few papers on Africa that reveal mixed results. Nyongesa (2019) uses descriptive statistics to analyze whether trade war has impacts on Chinese imports of energy and raw materials from Africa. He concludes that the trade war slightly stimulated Chinese interest in African resources. Using the first-year data of the trade war, Ndzendze (2020) finds that in comparison with other regions like Latin America, Asia, and the Caribbean, African countries experienced a declining pattern when it comes to agricultural

products in 2018 and 2019. Using the data from 1970 to 2017, Olayungbo (2019) employs a global vector autoregression (GVAR) model to forecast the possible effects of the trade war on the selected oil-exporting African countries. His findings show that the foreign output shock had a positive long-run effect for Gabon, Egypt, Angola, and Algeria, and negative long-run effect in Tunisia and Nigeria.

To the best of our knowledge, this is the first study that evaluates the impact of the change in trade policy between the US and China in the context of the SSA region. We use a CGE model based on GTAP to simulate the impact of tariff changes implemented since 2018 on the trade volume and economic growth of the SSA countries. We use the latest data from the GTAP 10 database. To minimize computational dimensions, we aggregate 141 regions/countries into 10 including Nigeria, South Africa, Kenya, Ethiopia, Tanzania, Ghana, Rest of SSA, Rest of the World, the US, and China, and the sectors into eight, i.e., food, agriculture, mineral, metal, oil and gas, industry, service, and others. We use the standard GTAP model for calibration to obtain our benchmark equilibrium which is then compared to counterfactual equilibrium after introducing the tariff shocks.

This study contributes to literature in two folds. First, it is the first study that involves the SSA regions/countries in evaluating the impact of the recent tariff changes between the US and China. Second, it employs a CGE-GTAP model that gives both the direct and indirect impacts of policy scenarios. Additionally, the GTAP database uses a large coverage of input-output data that provides the interrelations between factors of production, sectors, companies, countries, and regions.

Our findings indicate that changes in trade policy between the US and China create opportunities for the SSA countries. The results show that their GDP increases up to 0.04% on average, and both their exports and imports augment up to 0.02 and 0.05 on average, respectively, in different scenarios. Ethiopia and Kenya are the countries that record the largest increases in GDP, income, and expenditures, followed by Tanzania, Ghana, Rest of SSA, Nigeria, and South Africa, respectively. On the sectorial level, the results imply that agriculture, food, and oil and gas sectors are positively affected by the trade war in terms of export volume. South Africa, Tanzania, and Ethiopia are the most benefiting countries in agriculture and food sectors, while Nigeria and Ghana see their exports rising in oil and gas sector.

The rest of the paper is organized as follows. Section 2 discusses the findings of early papers on the trade war between the US and China. Section 3 presents the CGE model, GTAP database, and simulation scenarios. Section 4 discusses our findings. Section 5 concludes with some policy implications for the SSA countries.

2. Literature review

Changes in trade policy between the US and China affect other regions and the global economy through its spillover effects (Nicita, 2019). Andrews et al. (2018) claim that the trade war significantly affects countries that supply raw materials to the US and China. In 2020, the US and China signed the Phase-One trade agreement to slow down the trade war and reduce tariffs. However, the direction of the trade is still uncertain as argued by Brown (2021). Polatay (2020) claims that the tariff agreement is ineffective since China did not purchase the products that amounted to USD 200 billion from the US to minimize the US trade deficit as a part of the agreement. According to Salvatore (2020), the 25 % tariff imposed on Chinese products worth USD 370 billion continues even after the Phase-One trade deal.

As seen in Table 1, there are several studies conducted to estimate the impact of the trade war between the US and China on these countries' trade volume, economic growth, and welfare

Table 1
Selected studies on the effects of the trade war between the US and China.
Source: Authors' Literature Compilation.

Author(s)	Model/Methods	Tariff Scenario	Findings
Li et al. (2020)	Canonical GTAP model	Scenario 1: Steel-aluminum tariff increases by the US and retaliatory tariffs from China, the EU, India, and Turkey.	The welfare of the US and China drops by 0.2 % and 1.7 %, respectively. Additionally, trade war leads to welfare gain in the form of trade diversion for trade partners.
		Scenario 2: March 2020 tariff increases in scenario 1 and additional tariff increases between the US and China, including USD 50 billion round, USD 200 billion/60 billion round, and the first wave of the USD 300/75 billion round tariff increases (reduced by half).	
		Scenario 3: Full cumulative tariff increases in scenarios 1 and 2, and scheduled tariff increases on USD 250 billion Chinese products from 25 % to 30 %, and the full first wave and the second wave of the USD 300/75 billion round tariffs.	
Carvalho et al. (2019)	GTAP model	Scenario 1: It corresponds to the unilateral imposition of US tariffs on: (a) US additional 25 % import duty on steel from China, India, Russia, the EU, and other countries, (b) Additional 10 % US import tariff on aluminum from China, India, Russia, the EU, and other countries, (c) An additional 25 % charge on Chinese products listed by the US.	The welfare of the US and China decreases by 0.9 % and 1.6 %, respectively, due to the trade war.
		Scenario 2: Chinese retaliation with the imposition of additional 25 % tariff on the US products.	
Itakura (2020)	Dynamic GTAP model (GDyn)	Scenario 1: Raising import tariffs in 2018 and in 2019.	Trade war reduces almost all sectorial imports and output. It also reduces the GDP of China and the US by 1.4 % and 1.3 %, respectively, due to lower productivity.

(*continued on next page*)

Table 1 (*continued*)

Author(s)	Model/Methods	Tariff Scenario	Findings
		Scenario 2: Deterring foreign investment. In addition to Scenario 1, the trade war is assumed to deter foreign investment in the US and China. Scenario 3: Lowering productivity. In addition to Scenario 2, the trade war is assumed to worsen productivity in the US and China.	
Balistreri et al. (2018)	GTAP model	The escalated tariff rates as proposed for January 1, 2018.	Trade war causes China and the US to experience a welfare loss of 1.7 % and 1 %, respectively. Other countries gain due to trade diversion effect.
Bellora and Fontagné (2020)	MIRAGE-e, GTAP database	Scenario 1: Trade value and protection: Most impacted bilateral flows Scenario 2: Sanctions on automobiles and retaliations Scenario 3: Phasing out of industrial tariffs between the EU and the US.	The US and China can experience a loss of 0.4 % and 0.6 % of the GDP, respectively.
Devarajan et al. (2018)	Static GLOBE CGE model, GTAP Database	Scenario 1: Join the trade war and retaliate against increases in the US tariffs, Scenario 2: Do nothing, Scenario 3: Pursue trade agreements with non-US regions, Scenario 4: Pursue trade agreements with non-US regions/countries and unilaterally liberalize tariffs on imports from the US.	The Chinese and US GDPs go down by 0.1% and 0.3%, respectively.
Guo et al. (2018)	A multiple-country and multiple-sector model OECD Inter-Country Input-Output Database (ICIO)	Scenario 1: Unilateral US tariffs with balanced trade Scenario 2: US-China retaliatory tariff war with balanced trade Scenario 3: US-China retaliatory tariff war with ongoing trade imbalance, respectively.	Trade war decreases imports and exports of the US and China. Further, the welfare of China and the US decreases by 1.7 % and 0.2 %, respectively, while the welfare of the Asian countries increases. There is also a trade diversion effect on other countries i.e., Mexico, Canada, the EU, and South Korea.

(*continued on next page*)

Table 1 (*continued*)

Author(s)	Model/Methods	Tariff Scenario	Findings
Mahadevan and Nugroho (2019)	Dynamic CGE model, GTAP Database	Scenario 1: The RCEP concludes in 2019. Scenario 2: The US-China trade war in 2018. Scenario 3: It combines Simulation 1 + Simulation 2. Scenario 4: The conclusion of the RCEP without India.	There is a trade diversion to the RCEP member countries due to trade war.
Rosyadi and Widodo (2018)	GTAP model	Scenario 1: Full trade protection scenario 45 %	The trade war shrinks bilateral trade between the US and China and may increase trade with third partners due to trade diversion effect.
		Scenario 2: Manufacturing trade protection scenario 45 %	

but also on other countries' economic performance. Most of them employ CGE modeling based on the GTAP database. For instance, Rosyadi and Widodo (2018) show the trade war decreases the US-China bilateral trade while Guo et al. (2018) indicate that the US and Chinese total exports and imports go down. Itakura (2020) finds that the trade war reduces almost all sectorial trade volume and output. It also lowers the GDP of China and the US by 1.4 % and 1.3 %, respectively. Devarajan et al. (2018) also show that the GDP of China and the US goes down by 0.1 % and 0.3 %, respectively, while Bellora and Fontagné (2020) find that the US and China experience a loss of 0.4 % and 0.6 % of their respective GDP. As both countries record GDP losses due to the trade war, they also face decreases in their welfare. For example, Guo et al. (2018) and Li et al. (2020) find that the welfare of the US and China drops by 0.2 % and 1.7 %, respectively. Carvalho et al. (2019) indicate that the welfare of the US and China decreases by 0.9 % and 1.6 %, respectively, while Balistreri et al. (2018) show that China and the US experience a welfare loss of 1.7 % and 1 %, respectively.

On the other hand, as the bilateral trade between the US and China decreases, there appears a trade diversion effect for other trade partners (Balistreri et al., 2018; Li et al., 2020; Rosyadi & Widodo, 2018). Guo et al. (2018) underline that trade diversion effect is more important for some Asian countries such as South Korea, as well as for Mexico, Canada, and the European Union (EU). Mahadevan and Nugroho (2019) find a significant trade diversion toward the Regional Comprehensive Economic Partnership (RCEP) member countries.

What about the SSA countries knowing that China and the US are important trade partners. This is what we analyze in this paper. As we underlined above, there are only three papers on the impact of this trade war on Africa. Ndzendze (2020) asserts that the trade war is a threat to Africa, while Nyongesa (2019) claims that it is an opportunity. Olayungbo (2019) concludes that the trade war is a double-edged sword.

3. Model, GTAP database, and simulation scenarios

This study employs a standard GTAP model which is an input-output, multi-sector, multi-regional CGE model. We integrate the model with the latest data from the GTAP 10 database that covers 65 sectors, 20 regions, and 141 countries. The database represents 92 % of the global population and 98 % of the global GDP. GTAP database includes input-output tables for each

region/country and aggregate bilateral trade data from the United Nations, World Bank, International Monetary Fund, and Food and Agricultural Organization. The trade protection data is a 6-digit harmonized system level which is aggregated in trade weight obtained from the MacMap database and COMTRADE. In the analysis, we aggregate 65 sectors into eight, i.e., food, agriculture, mineral, metal, oil and gas, industry, service, and others. We aggregate 20 regions and 141 countries into 10, i.e., the US, China, Nigeria, South Africa, Kenya, Ethiopia, Tanzania, Ghana, Rest of SSA, and the Rest of the World. The sectorial and regional aggregations are based on the trade volume that the SSA countries have with the US and China as well as SSA countries with higher GDP.

In conducting a tariff policy simulation, it is necessary to examine possible or actual scenarios that may have effects on the economy, sectors, companies, and consumers. The changes in tariff policy affect the relative prices of inputs and final goods and services due to close integration with trade partners. The simulation focuses on the trade volume (imports and exports), trade balance, and economic growth (GDP). The model allows making comparative analyses related to changes in the factors of production and inter-sectorial production. Microeconomic theory lays the foundation of the behavioral equations that the GTAP model captures (Hertel, 1997). The model includes accounting relationship equations that ensure the consistency between macroeconomic theory and behavioral equations. Accounting relationship equations create balance and consistency in terms of expenditures and revenues among government, producers, consumers, and the rest of the world (Ahmed, 2010).

As summarized in Table 2, different tariffs are applied on different categories of products by the US and China from 2018 ongoing. This starts with the US imposing a 25 % tariff on USD 50 billion worth of Chinese exports in June and August 2018. This tariff mainly targeted the "Made in China 2025" products. The Chinese government hit back with the same 25 % tariff on the same products (Zhang, 2020). In September 2018, the US increased tariffs by 10 % on products worth USD 200 billion. The Chinese government responded with an increase of 5–10 % of the products worth USD 60 billion. The 10 % tariff on USD 200 billion worth of products was later increased to 25 %. Similar measures were taken by the Chinese government by imposing a

Table 2
Tariff scenarios between the US, China, and other trading partners.

Tariff description	Imposing country	Targeted country	Import tariff (Ad valorem)
Current tariff	China	US	19.3 %
Current tariff	US	China	20.7 %
List of Chinese products worth USD 50 billion	US	China	25 %
List of US products worth USD 50 billion	China	US	25 %
Iron and steel	US	China, the EU, India, and others	25 %
Aluminum	US	China, the EU, India, and others	10 %
Chinese products worth USD 200 billion	US	China	10 % later 25 %
List of China for US products worth USD 60 billion	China	US	5–10 %, later 25 %

5–25 % tariff on products worth USD 60 billion. According to Brown (2021), even after the Phase-One trade agreement between the US and China in 2020, the applied tariffs are six times higher as compared to the tariff before the trade war. This accounts for a tariff of 20.7 % on Chinese products exported to the US, while the average tariff imposed by China on the US imported products is 19.3 %. Thus, the following tariff scenarios are used to simulate the impact of the tariff changes between the US and China on SSA's economic performance[4]:

(i) 10 % tariff on Chinese products from the US, and retaliatory measures from China;
(ii) 25 % tariff on Chinese products from the US, and retaliatory measures from China;
(iii) 20.7 % tariff on Chinese products from the US and 19.3 % tariff on US products from China.

To do the simulation, we use Run GTAP and GTAPAgg2 which are part of the General Equilibrium Modeling Package Software (GEMPACK). GTAPAgg2 focuses on country/region and sectorial aggregation, while RunGTAP calibrates the simulation of the results. In this study, we use tariffs (*tms*), expressed in percentages (10 %, 25 %, 19.3 %/20.7 %), as a shock variable to simulate the impacts of the trade war. The shock links the tariff on the imports of sector *i* in country *s* which is imposed on the exports from country *r*. The changes in tariff *tms* change the prices of the imported products given by country *r* to region *s* which is *pms* (*i r s*). Thus, *tms* and the cost, insurance, and freight, *pcif* make *pms* as shown in Eq. (1).[5]

$$tms(i, r, s) + pcif(i, r, s) = pms(i, r, s) \tag{1}$$

There are two direct outcomes due to changes in the prices of domestic products for the imports of sector *i*. First, the impact on the total prices of imports of sector *i*, which affects the prices of imported products *pim (i,s)*. The participation of each region in the imports of sector *i* (MSHRS) creates *pim* as shown in Eq. (2).

$$\sum^{r} \mathrm{MSHRS(i, r, s)}x \quad pms(i, r, s)pim(i, r, s) = pim(i, s) \tag{2}$$

Another impact is the change in imports of the region/country that are affected by the changes in tariff. If there is a reduction in imports in the regions that are subject to the tariff, it creates an opportunity for the regions that are not affected by the tariff known as *qxs (i,r,s)*. *qxs* is the product of total imports of sector *i* in country *s*, the elasticity of the substitution between domestic and imported products *i* in country *s*, called *esubm*, and the difference between *pms (i,r,s)* and *pms (i,s)*.

$$qim(i, s) - esubm(i)x \quad (pms(i, r, s) - pim(i, s)) = qxs(i, r, s) \tag{3}$$

As a result, there will be a change in production in the region which is caused by the demand directed toward domestic production. Thus, the effect of *tms*, i.e., tariff shock, is observed in the

[4] These are the actual tariff policy scenarios that took place from the beginning of the trade war in 2018. However, in practice these scenarios do not involve all the sectors but have been generalized in a sectorial aggregation of this study. This is among the weaknesses of the CGE model. Massiani (2022) recommended that there should be a sufficiently detailed and adequate sectorial decomposition that is also specific to a certain mega event like the trade war between the US and China.

[5] All the equations are available in RunGTAP software. The equations can be viewed by GEMPACK related softwares (TABmate, ViewHAR and AnalyzeGE).

Table 3
The impact of the tariff changes on GDP (decomposed), exports, imports, and trade balance (% change) – Scenario 1. Source: Authors' calculations.

Scenario 1	US	China	Nigeria	South Africa	Kenya	Ethiopia	Tanzania	Ghana	Rest of SSA	Rest of the World	Total
Household	-0.017	-0.040	0.014	0.013	0.018	0.022	0.016	0.015	0.015	0.019	0.004
Investment	-0.051	-0.055	0.025	0.032	0.021	0.025	0.025	0.029	0.027	0.035	-0.001
Government	-0.018	-0.043	0.014	0.013	0.022	0.021	0.029	0.014	0.014	0.019	0.005
Exports	-0.132	-0.109	0.010	0.006	0.000	0.016	0.000	0.008	0.008	0.012	-0.016
International Margins	-0.021	-0.020	0.000	0.000	0.000	0.000	-0.204	0.000	0.000	-0.019	-0.019
Imports	-0.156	-0.162	0.022	0.018	0.019	0.024	0.020	0.017	0.017	0.024	-0.016
Land	-0.121	0.037	0.015	0.000	0.066	0.047	0.000	0.000	0.012	0.011	0.009
Capital	-0.023	-0.047	0.013	0.012	0.020	0.017	0.014	0.010	0.014	0.018	0.003
Natural Resources	0.039	-0.005	0.007	0.000	0.000	0.000	0.000	0.000	0.009	-0.004	0.001
Labor	-0.023	-0.046	0.015	0.012	0.018	0.020	0.016	0.013	0.014	0.019	-0.002
Indirect Taxes	0.072	-0.007	0.024	0.019	0.046	0.022	0.017	0.019	0.019	0.020	0.023
Total GDP	-0.016	-0.039	0.014	0.013	0.020	0.020	0.017	0.016	0.014	0.018	0.003
Exports	-0.130	-0.107	0.009	0.006	0.011	0.015	0.000	0.008	0.008	0.011	-0.016
Imports	-0.156	-0.162	0.022	0.018	0.019	0.024	0.020	0.017	0.017	0.024	-0.016
Trade Balance	0.024	0.054	-0.013	-0.012	-0.019	-0.008	-0.020	-0.009	-0.009	-1.012	0.000

endogenous variables, i.e., *pim, qds, qxs, qo,* and *pms*. The changes in the values of these variables are compared to the baseline equilibrium.[6]

$$SHRDM(i,s)x \quad qds(i,s) + SHRST(i,s)xqst + \sum^{s} SHRXMD(i,r,s)xqxs(i,r,s) = qo(s) \tag{4}$$

4. Findings and discussions

4.1. The impact of the tariff changes on export, import, and trade balance by country

Tables 3–5 present the simulation results for exports, imports, trade balance, and GDP (decomposed). We observe that Chinese total exports and imports decrease due to tariff changes in all scenarios. Chinese exports go down by 0.107 %, 0.267 %, and 0.212 %, while Chinese imports reduce by 0.162 %, 0.405 %, and 0.323 %, respectively in scenarios 1, 2, and 3. Our results also show that the US records a decline in total exports and imports: exports fall by 0.130 %, 0.326 %, and 0.260 %, while imports decline by 0.156 %, 0.390 %, and 0.312 %, respectively in scenarios 1–3. These results indicate that the US trade balance slightly improved following the tariff changes. Our findings are in line with the findings of prior studies (i.e., Guo et al., 2018).

[6] SHRXMD is the share of export sales of product *i* provided by country *r* to region *s*, SHRDM is the share of domestic sales of sector *i* in the country *s*, SHRST is the share of sales of *i* to global transportation services in *s*, qxs are the exports of *i* from country *r* to region *s* (% change), qo is the output of sector *i* in country *s* (% change), qds is the domestic sales of *i* in region *s*, and qst is the sales of sector *i* to international transport sector.

Table 4
The impact of the tariff changes on GDP (decomposed), exports, imports, and trade balance (% change) – Scenario 2. Source: Authors' calculations.

Scenario 2	US	China	Nigeria	South Africa	Kenya	Ethiopia	Tanzania	Ghana	Rest of SSA	Rest of the World	Total
Household	-0.044	-0.099	0.036	0.033	0.048	0.052	0.041	0.038	0.037	0.047	0.010
Investment	-0.127	-0.137	0.062	0.077	0.063	0.065	0.056	0.078	0.067	0.089	-0.002
Government	-0.044	-0.107	0.035	0.033	0.056	0.062	0.044	0.043	0.037	0.048	0.013
Exports	-0.331	-0.271	0.023	0.014	0.012	0.031	0.000	0.015	0.020	0.030	-0.041
International Margins	-0.048	-0.047	0.000	0.000	0.000	0.000	-0.204	0.000	-0.051	-0.047	-0.047
Imports	-0.390	-0.405	0.056	0.045	0.052	0.071	0.048	0.045	0.043	0.060	-0.041
Land	-0.303	0.093	0.038	0.000	0.066	0.094	0.058	0.105	0.049	0.027	0.022
Capital	-0.057	-0.118	0.032	0.030	0.046	0.046	0.034	0.031	0.034	0.046	0.008
Natural Resources	0.096	-0.011	0.018	0.000	0.000	0.000	0.000	0.000	0.024	-0.009	0.003
Labor	-0.058	-0.115	0.038	0.031	0.048	0.049	0.039	0.036	0.035	0.047	-0.004
Indirect Taxes	0.179	-0.016	0.057	0.047	0.093	0.065	0.052	0.056	0.049	0.050	0.056
Total GDP	-0.040	-0.096	0.035	0.032	0.047	0.050	0.040	0.036	0.035	0.046	0.008
Exports	-0.326	-0.267	0.023	0.014	0.011	0.015	0.000	0.015	0.019	0.027	-0.041
Imports	-0.390	-0.405	0.056	0.045	0.052	0.071	0.048	0.045	0.043	0.060	-0.041
Trade Balance	0.059	0.134	-0.033	0.031	-0.040	-0.040	-0.048	-0.030	-0.023	0.030	0.000

Table 5
The impact of the tariff changes on GDP (decomposed), exports, imports, and trade balance (% change) – Scenario 3. Source: Authors' calculations.

Scenario 3	US	China	Nigeria	South Africa	Kenya	Ethiopia	Tanzania	Ghana	Rest of SSA	Rest of the world	Total
Household	-0.039	-0.075	0.029	0.027	0.038	0.043	0.035	0.031	0.030	0.038	0.008
Investment	-0.105	-0.105	0.050	0.063	0.049	0.050	0.050	0.068	0.055	0.072	-0.001
Government	-0.039	-0.081	0.028	0.027	0.045	0.041	0.044	0.029	0.029	0.038	0.011
Exports	-0.264	-0.215	0.018	0.012	0.012	0.016	0.000	0.015	0.016	0.024	-0.032
International Margins	-0.039	-0.037	0.000	0.000	0.000	0.000	-0.204	0.000	-0.051	-0.037	-0.037
Imports	-0.312	-0.323	0.045	0.036	0.043	0.055	0.034	0.034	0.035	0.048	-0.032
Land	-0.247	0.079	0.031	0.000	0.066	0.047	0.058	0.000	0.037	0.023	0.018
Capital	-0.049	-0.090	0.026	0.025	0.036	0.038	0.027	0.021	0.027	0.037	0.007
Natural Resources	0.081	-0.009	0.014	0.000	0.000	0.000	0.000	0.000	0.018	-0.007	0.003
Labor	-0.050	-0.088	0.030	0.025	0.037	0.041	0.031	0.027	0.028	0.038	-0.003
Indirect Taxes	0.062	0.001	0.024	0.019	0.046	0.043	0.017	0.019	0.019	0.020	0.023
Total GDP	-0.036	-0.073	0.028	0.026	0.037	0.041	0.033	0.028	0.029	0.037	0.006
Exports	-0.260	-0.212	0.017	0.012	0.011	0.015	0.000	0.015	0.016	0.022	-0.032
Imports	-0.312	-0.323	0.045	0.036	0.043	0.055	0.034	0.034	0.035	0.048	-0.032
Trade Balance	0.048	0.107	-0.026	-0.024	-0.031	-0.040	-0.034	-0.019	-0.019	-0.024	0.000

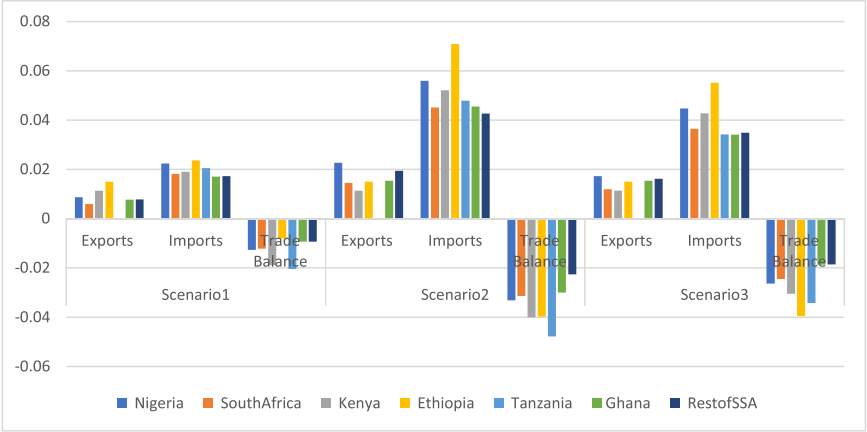

Fig. 1. The impact of the tariff changes on the exports, imports, and trade balance of the SSA countries (% change).

In SSA, the results indicate that the export volume increases following the trade war in all scenarios. The most favorable scenario is the second one for all countries. Thus, there is a trade creation for the SSA countries except for Tanzania whose exports did not change. Nigeria performs better than other SSA countries since its exports increase by 0.009 %, 0.023 %, and 0.017 % in scenarios 1, 2, and 3, respectively. As for imports, we observe that Ethiopia, Kenya, and Nigeria are leading countries since they record larger percentage increases in their import volume. Although increases in import volume of the SSA countries may increase consumer welfare, the trade war slightly deteriorates their trade balance as seen in Fig. 1.

The sectorial results for the exports and imports in Fig. 2 differ in the SSA countries. The findings show that the trade war creates an opportunity for some sectors while other sectors are not affected. The mineral and metal sector in South Africa and the service sector in Ethiopia and Kenya incur negative effects in exports and imports due to the changes in tariff policy. The negative effects in the mineral and metal sectors in South Africa are obvious because South Africa was among the countries that were directly targeted by the US tariffs policy in the steel and aluminum sector when the trade war started. Moreover, Kenya records a decline in exports in service and agriculture sectors. On the other hand, Nigeria and Ghana are among the top producers of oil and gas in the SSA region. Hence, they both enjoy benefits following the trade war. Furthermore, South Africa incurs positive effects in the food and agriculture sectors in terms of export and import. The tariff policy affects more the West and South African countries compared to East African countries as most of their sectorial exports and imports are nearly same before and after the tariff war.

4.2. The impact of the tariff changes on GDP

The results show that the US experiences a slight decrease in GDP: 0.02 %, 0.04 %, and 0.04 % for scenarios 1, 2, and 3, respectively. On the other hand, the GDP of China is also negatively affected: – 0.04 %, – 0.09 %, and – 0.07 % for scenarios 1, 2, and 3, respectively. These results are in line with the findings of Bellora and Fontagné (2020), Furceri et al. (2020), and Panagariya (2018) as the tariff policy decreases the US and Chinese GDPs.

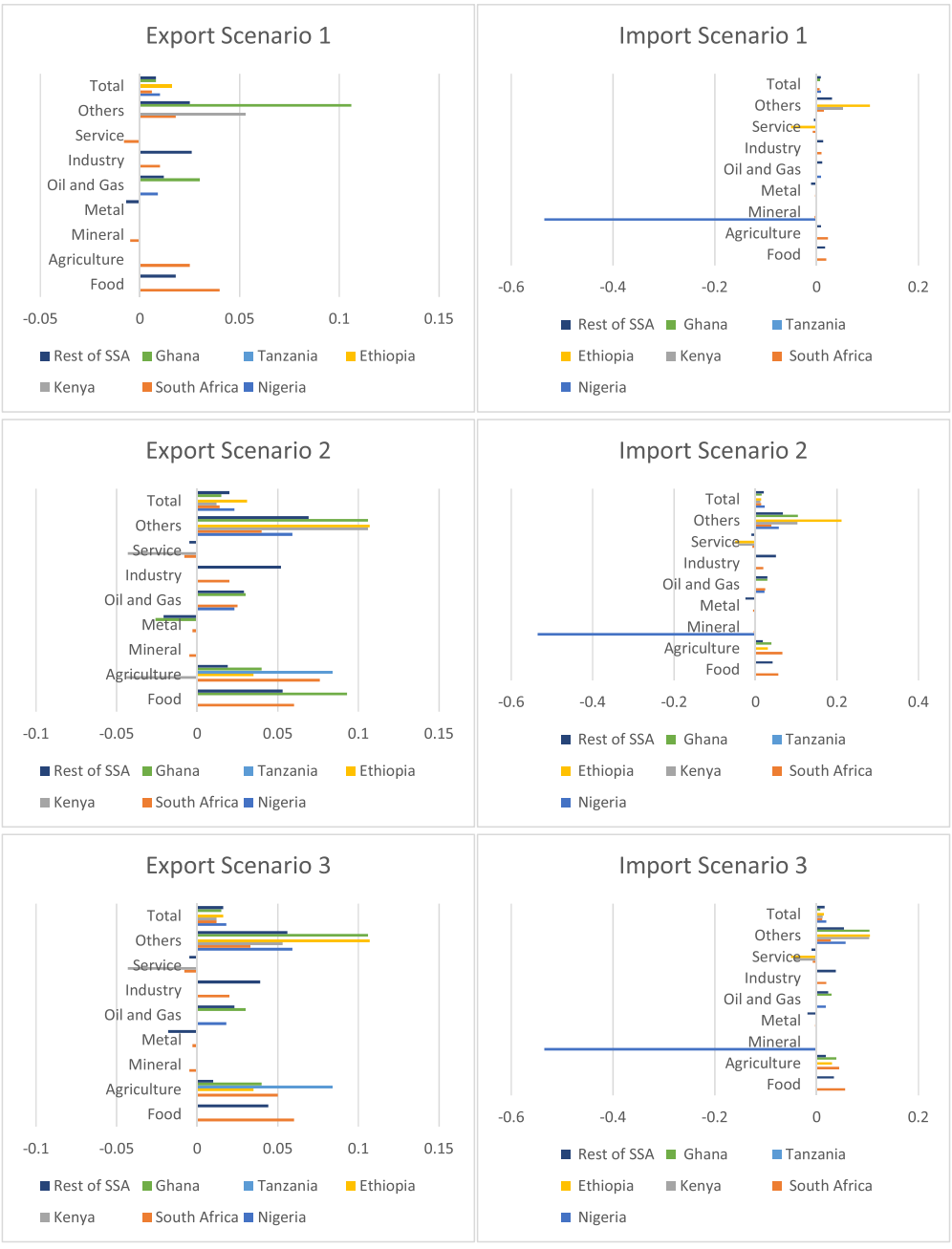

Fig. 2. The impact of the tariff changes on SSA trade by sectors (% change).

In the SSA, the US-China tariff war positively affects the GDP. Ethiopia and Kenya record the largest improvements in their GDPs followed by Tanzania, Ghana, Rest of SSA, Nigeria, and South Africa, respectively in all three scenarios. Moreover, our findings indicate that income earned by labor, capital, and land increases in all scenarios compared to the pre-tariff war period, while income for natural resources remains nearly constant. Ethiopia and Kenya are the countries that experience the largest improvements in terms of income for all factors of production. As the income for all inputs increase, we observe higher private consumer and investment expenditures as well as higher government spendings. Governments also record higher indirect tax revenues in all scenarios.

5. Conclusion and policy implications

This study examined the impact of the trade policy changes between the US and China on the trade volume and economic performance of the SSA countries by employing a CGE model based on the GTAP framework along with three different scenarios. The results show that the tariff war causes a reduction in the trade volume and GDP of both the US and China. Although the US slightly improves its trade balance following higher tariffs on Chinese products, protectionist policies cannot solely solve the trade deficit problem of the US, as also underlined by Salvatore and Campano (2018).

Our findings indicate trade diversion and creation effects towards the SSA, leading to an increase in their import and export volume. The SSA countries also benefit from the tariff changes in terms of increases in GDP, income, and expenditures. Ethiopia and Kenya are the countries that record the largest increases in GDP, income, and expenditures, followed by Tanzania, Ghana, Rest of SSA, Nigeria, and South Africa, respectively. The results imply that the changes in trade policy between the US and China offer some opportunities for the SSA region, particularly for those countries that export raw materials to the US and China. The same argument is valid regarding the effect of the trade war on the economic prosperity of the SSA. Our results suggest that the SSA countries should remain neutral as well as continue with the same relationship they had with both the US and China before the beginning of the trade war. Choosing a side may cause some negative repercussions. However, despite the increase in imports and exports, the SSA countries have larger trade deficits to some extent following the trade war. Tanzania, Kenya, and Ethiopia are the countries which record higher deficits compared to other countries in the region.

The policy of free trade agreements with other trade partners apart from the US and China or trade liberalization among the SSA countries could be a solution for the trade deficit issue that the region has been facing over decades. Moreover, as international trade increases GDP and welfare in the SSA countries, policymakers may focus on policies that facilitate international trade activities. For instance, they may remove barriers, and establish stable political relations with trade partners. The SSA countries may also act as one block and sign regional trade agreements to strengthen their positions in international trade and to reduce economic inequalities among the SSA countries and hence, strengthening the prosperity of the whole region.

On the sectorial level, results indicate that the tariff changes lead to different impacts according to sectors. One may affirm that agriculture, food, and oil and gas sectors are generally positively affected by the trade war in terms of export volume. South Africa, Tanzania, and Ethiopia are the leading countries that could increase their exports in agriculture and food sectors, while Nigeria and Ghana see their exports rising in oil and gas sector. On the other hand, South Africa experiences a decrease in metal, mineral, and service sectors while Kenya

suffers from a decline in its export volume in agriculture and service sectors. As for import volume, we observe a decrease in mineral sector in Tanzania and in service sector in Ethiopia and Ghana.

Even though the tariff war between the US and China offers opportunities to the SSA countries, it has also created some challenges. The trade creation goes with the quality of the exported products, thus there is a need to improve the quality of products that will meet international standards. Otherwise, the benefits that came with the tariff war will not last long. This involves the provision of a well-functioning export and import business environment, from the availability of raw materials, production, infrastructure, and logistic services.

We acknowledge that this study has limitations. We cover only SSA countries to discuss the impact of the trade war between the US and China. Future research may include both SSA and non-SSA countries to generalize the results for Africa. We also aggregate sectors into eight, focusing on the most important ones. Future studies may deepen the analysis by enlarging the sectorial coverage and focusing on specific products. The study employs the CGE-GTAP model which may be considered a black box in nature. Future works may use other models to support our findings. The sectorial results may also be expanded to target the sectors affecting each SSA country without aggregating them. There are also different measures implemented in both countries in terms of trade war, but our study is limited to tariffs. Hence, future studies can include other measures. Finally, the trade war between the US and China is not only limited to foreign trade but also includes the war in territorial terms, technology, and other areas. These can be further explored by future work.

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