Regional Economic Integration (REI) and global value chains (GVCs). An Empirical Analysis of the Southern African Development Community (SADC) customs union (CU) using a computable general equilibrium (CGE) model.

Abstract:

This research addresses a significant gap in the economic literature on GVCs, particularly in the context of developing countries and the SADC. Despite growing interest in GVCs, few studies have examined the broad range of determinants of GVCs in developing countries. There is no research that has quantitatively assess SADC's participation and its integration in GVCs and providing evidence-based policy recommendations using a CGE model. Thus, the main objective of this study is to evaluate how the proposed SADC Customs Union affects SADC countries' participation in GVCs, focusing on backward and forward participation in agri-food sectors, using a CGE model. The agri-food sectors were selected since the region is well known for its agricultural production, and the SADC Industrial Roadmap in 2018 identified these sectors as having the potential to promote regional and global value chains, which need to be supported. The region plays a significant role in upstream activities, particularly in the agriculture sector, which has implications for both regional and global value chain dynamics. Using Global Trade Analysis Project (GTAP) database in its multi-regional input output (MRIO) form together with the GTAP-Value Added (VA) module, a revised version of the GTAP model, the study employs ex-ante analysis with three counterfactual simulation scenarios: common external tariffs excluding sensitive products, unemployment closure, and increasing Armington elasticities by 20%. The study presents the results through a structured approach: the effects of the CU on backward and forward participation is evaluated first, followed by the effects of other scenarios (unemployment closure, and Armington elasticity adjustments) – at country, global, regional and sector level. The results show significant variability in benefits across SADC countries, with South Africa, Zimbabwe, and Tanzania experiencing more substantial gains than Malawi and Botswana. Drivers of these results include differences in initial protection levels, economic size, level of GDP, the composition of trade (especially agri-food), and sectoral participation intensity. The findings also show that while the new policy promotes regional integration and enhances backward participation, forward integration remains less affected. Furthermore, the results show that the policy

primarily influences regional rather than global value chains, with the most significant changes observed in agri-food sectors, especially animal products, vegetables, fruits, sugar, and beverages that will become more competitive in global markets. The findings also underscore the importance of addressing disparities, fostering inclusivity, and providing targeted support to smaller economies such as Malawi to ensure a more equitable distribution of benefits. Policy implications also highlight the need for careful tariff calibration, infrastructure investment, and economic diversification to maximize the potential benefits of the SADC CU, thereby enhancing SADC's position in both regional and global value chains.

Key words: Southern African Development Community (SADC), Global Value Chains (GVC), Customs Union (CU), Computational General Equilibrium (CGE), Regional Economic Integration (REI).

1. Introduction

Over the last two decades, many regional trade agreements (RTAs) have been signed between two or more countries to promote regional or intra-regional trade flows. As a result, more than half of global trade is taking place under these regional or preferential trade agreements (Hoekman & Schiff, 2002). The World Trade Organization[1] (WTO) has noted that as of June 2021, 349 RTAs were in force. In Africa, the signing of these trade agreements has been on the rise since the 1980s and they were engineered by what is commonly known as "Regional Economic Communities" (RECs). These RECs were the roadmap to the establishment of the African Economic Community formed by the Abuja Treaty in 1991. However, although there are 14 regional economic communities in Africa, to date the African Union's (AU) Abuja Treaty only recognizes eight of them[2].

The Southern African Development Community (SADC) is one of the RECs recognized by the AU. It was first adopted in 1980 as the Southern African Development Coordination Conference (SADCC) with nine member states (Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe; SADC, 2002). In 1992, the SADCC then became the SADC (Southern African Development Community) and was ratified

[1] https://www.wto.org/english/tratop_e/region_e/region_e.htm

[2] These are the Southern African Development Community (SADC), the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC), the Economic Community of Central African States (ECCAS), the Economic Community of West African States (ECOWAS), the Community of Sahel-Saharan States (CEN-SAD), the Arab Maghreb Union (AMU), and the Inter-Governmental Authority on Development (IGAD). Almost all these trade agreements have already been signed, implemented/ launched, or are preparing to launch their customs union.

by fifteen member states[3]. The SADC's main objectives range from economic to political ones which aim "to promote economic cooperation and integration among member states and to strengthen regional solidarity, peace and security"(SADC,2010). Its integration activities aim to enhance regional cooperation and trade liberalization among member states to facilitate trade within the region. These activities focus on trade, including the removal of tariffs and non-tariff barriers and promoting trade efficiency and other trade-related aspects such as trade and investment, trade and competition policy, trade and labour migration, trade and finance, and trade and procurement policy (SADC,2011).

As its roadmap in 2000, the region implemented a trade protocol to establish a Free Trade Agreement (FTA) within eight years of its day of ratification (SADC, 2002). The member states had agreed to reduce the tariffs leading to the attainment of the SADC Free Trade Agreement in 2008 (SADC,2008). In 2007, the trade ministers then went on to establish the SADC customs union through an agreement to further deepen regional integration. This customs union promotes free trade among member countries and common external tariff (CET) to be applied to goods imported from the states which are outside the union. According to the SADC (2011),

> *This adoption of a customs union and an agreed CET resulted in the harmonization of product description and categorization through the adoption of a Common Tariff Nomenclature (CTN), and the uniform application of customs duties on imports from third countries through an agreed CET. A four-band CTN based on the World Customs Organization's (WCO) Harmonized and Coding System (HS) will be adopted as the standard customs nomenclature for SADC.*

The four bands are listed as capital goods, raw materials, intermediate goods and finished goods (SADC, 2011). The assumed SADC CET structure is as follows: zero percent for capital goods, zero percent for raw materials, ten percent for intermediate products and twenty-five percent for finished goods.

The SADC customs union could not be established in 2010 as per the original plan but was postponed to 2012 and then to 2015 due to complications, in particular the fact that some of the member states were signatories to other customs unions in the region. In 2018, the SADC member countries decided that the SADC customs unions would be the next to be launched

[3]These are Angola, Botswana, Democratic Republic of Congo (DRC), Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Seychelles, South Africa, Namibia, Tanzania, Zambia, and Zimbabwe. Comoros joined SADC in 2017 to become a 16th member.

after the COMESA-EAC-SADC Tripartite Free Trade Agreement (TFTA) and the African Continental Free Trade Agreement (AfCFTA) (SADC industrial strategy, 2018).

At present, SADC countries like other developing economies are still lagging in global value chain participation and their border protection policies could be the potential reason for this. Hence, it is within this background that the researcher seeks to assess the possible effects of the proposed CET on the GVCs of the SADC countries.

Thus, even though there are apparent benefits in participating in global value chains, there is still a gap in the existing economic literature, especially in analysis of the African region (Montalbano et al, 2017, OECD 2020). Few studies have been conducted on the broad basket of possible determinants of global value chains in developing countries. However, as Montalbano et al (2017) noted, trade can also be determined by bilateral preferences while trade policy can also be at the level of industries or even products. Hence, as per the researcher's knowledge, there is at present no research that quantitatively assesses or rather evaluates the participation and integration of SADC in global value chain participation or that formulates any evidence-based policy recommendations on how to increase this participation using a computable general equilibrium model (CGE) framework. Hence, this current research is essential in understanding the region's amount of contribution to trade flows in terms of value-added.

The research therefore evaluates the effects of SADC policy changes on GVCs by measuring the participation of SADC[4] in agri-food global value chains and specifically its backward and forward participation, using the bilateral gross exports decomposition method. Through this, the research reveals the stages of the production process to classify the involvement of each country's trade flows in value-added. The research also analyses the possible effects of the proposed customs union on SADC countries' agri-food global value chain participation of SADC countries, with a specific focus on backward and forward participation, using a computational general equilibrium model (CGEM). The analysis further evaluates the influence of the CET on the regional and global production networks of the SADC region, its effects on the advantages derived from participating in GVCs and explores the potential policy recommendations and strategies for enhancing SADC countries' competitiveness and effectiveness in agri-food global value chains, with a focus on sustainable economic growth and maximizing the benefits of global value chain participation.

[4]The analysis is done for SADC as a region and its member countries.

The empirical analysis, therefore, shows whether the common external tariffs have essential effects on global value chain participation, specifically on backward and forward participation. By doing this, the research establishes the extent to which the designed customs union affect the international fragmentation of production and the extent to which this customs union would affect the benefits of global value chain participation. To achieve the intended results, the research designs the following questions: How can we characterize SADC countries' participation in agri-food global value chains, encompassing both backward and forward linkages, through the application of the bilateral gross exports' decomposition method? What are the potential effects of the proposed CET on the participation of SADC countries in the agri-food global value chain, particularly with respect to backward and forward linkages, as assessed using CGEM? And how does the CET impact the SADC region's integration into regional and global production networks, and the associated advantages from participation in GVCs?

The paper is designed as follows: Section 1 – Introduction. This section introduces the study by outlining the significance of the SADC region in regional economic integration, the motivation and objectives of the study. It sets the context for analyzing the potential impacts of implementing a Common External Tariff (CET) policy within the SADC framework.

Section 2 provides an overview of the economic composition of SADC countries. It explores the trade performance of SADC countries, including their export and import profiles, key trading partners, and the role of regional trade in their economic structures. The section also gives trends and dynamics in SADC GVC Participation by examining how SADC countries have integrated into global value chains over time. Thus, it analyses participation patterns, highlighting progress and challenges in leveraging global trade networks for economic development. It concludes by delves into sector-specific insights, focusing on agriculture and food and beverages, comparing backward and forward participation in GVCs, shedding light on how they contribute to regional integration and economic growth.

Section 3 – explores the tariff structure within the SADC region, focusing on existing disparities between the SADC countries, changes brought by proposed CET and the potential implications of adopting a Common External Tariff (CET) for intra-regional trade and GVC participation.

Section 4 reviews the literature on regional trade agreements (RTAs), customs unions, and their relationship with GVC participation. It includes previous empirical studies on SADC trade dynamics and the lessons drawn from other regional trade blocs.

Section 5 outlines the methodology used to measure GVC participation, using indicators derived from the GTAP framework. It also details the CGE modeling used, data sources and the scenarios developed to assess the impact of the CET on SADC's GVC participation.

Section 6 presents the results of the empirical analysis, focusing on how the CET policy impacts SADC's backward and forward linkages in GVCs. It examines sectoral effects, particularly in agriculture and food and beverages, and discusses implications for regional development.

Section 7 presents key findings that countries with stronger integration into regional value chains, such as South Africa, are likely to benefit the most from the customs union, while smaller economies may face challenges. The introduction of the customs union leads to an increase in country and agrifood backward participation across all scenarios, with countries like South Africa experiencing particularly significant growth. This increase is driven by greater market integration, which allows firms to specialize and access intermediate goods more efficiently. Forward participation also grows, as countries will export more intermediate goods to other regions, benefiting from enhanced production capabilities. However, while backward participation will generally improve across the region, some countries and other agrifood sectors will struggle to increase forward participation due to their limited capacity for downstream production. The section also emphasizes the importance of carefully managing tariff adjustments, promoting equity among member states, and investing in technology and infrastructure to ensure that the full benefits of the policy are realized.

2. Economic Structure of the SADC region

The economies of SADC countries are at various stages of growth. The state of industry differs widely across the region, with agriculture playing a major role in many member states. Agriculture employs more than half of the population, followed by the mining sector which employs almost 5% of the population while contributing to 60% of foreign exchange earnings and 10% of the region's gross domestic product. Food production is also crucial to the region since it accounts for 6% of the regional gross domestic product (SADC, 2018). However, the region has an average unemployment rate of 12%, with South Africa (28.7%), Angola (7.7%), Lesotho (24.6%), Eswatini (23.4%) and Botswana (17.7%) having the highest unemployment rates in the region. On the other hand, countries such as Madagascar (1.9%), Seychelles and Namibia (20.4%), Mozambique (3.4%) and Zimbabwe (5,7%) have the lowest unemployment rates (World Bank, 2020). The remaining countries' unemployment rates average 9%.

With this brief background, Table 2.1 illustrates heterogeneity among the sizes of the member economies, starting from Seychelles (the smallest) with 860 square kilometres to DRC (the largest) with 2,267,050 square kilometres. Thus, this land area plays a significant role in determining the countries' potential for various activities, including resource mobilization, infrastructure development and economic growth. Therefore, countries that have extensive land masses accounting for more than one million square kilometres (km^2), such as Angola, South Africa and DRC present more opportunities for agriculture, natural resource exploitation and tourism development than other SADC countries.

Table 2.1 also presents the gross domestic product per capita, average population growth and the economic classification of each country. Thus, as of 2019, SADC had an average GDP per capita of $1,995 (World Bank 2021). This GDP per capita serves as a measure of the economic well-being and standard of living in a country. Indeed, in 2021, Angola exhibited a GDP per capita of $1953.5, positioning it within the lower middle-income bracket. This figure suggests that, on average, Angolans have a relatively modest income compared to citizens in higher income nations. On the other hand, countries such as Botswana and Seychelles demonstrated higher GDP per capita figures, with $6805.2 and $14653.3 respectively. These figures reflect a more prosperous economic landscape and potentially higher living standards in these nations. Thus, from a SADC perspective, these figures signify the regions' standard of living (SADC report, 2015).

Furthermore, the average total population growth rates for 2021 provide insights into the pace of population expansion or contraction in a country. It is worth noting that most of the listed SADC countries experienced positive growth rates, indicating overall increases in population. Angola had a growth rate of 3.5%, signifying robust population growth. Similarly, countries such as Comoros and Madagascar had growth rates of 2.0 % and 2.8% respectively (World Bank, 2021). Thus, these positive figures reflect potential demographic changes and potential challenges in terms of resource allocation and infrastructure development.

Economic classification also provides insights into the income levels and economic development stages of each country. Thus, the countries in question are divided into different categories, including lower middle income, upper middle income, and high income. For instance, Eswatini and Lesotho fall into the lower middle- income category, indicating ongoing

efforts to improve their economic conditions. In contrast, Mauritius and Seychelles[5] have achieved higher income levels, signifying relatively developed economies. Indeed, these classifications offer insights into the progress made by each SADC country and their position in the global economic landscape. Lastly, it should also be noted that the region has six land locked countries, namely, Botswana, Malawi, Swaziland, Lesotho, Zambia and Zimbabwe, signifying a geographical characteristic that can have significant implications for their economic development and access to global markets.

Table 2.1 Economic structure of SADC countries

Country	GDP Per Capita (2021)	Average Total PPn growth rates (%) (2021)	Land area (km2)	Economic classification
Angola	$ 1953.5	3,5%	1,246,700	Lower middle Income
Botswana	$ 6805.2	1.9%	566,730	Upper middle-income
Comoros	$ 1577.5	2,0%	1,861	Lower-middle-income
DRC	$ 577.2	3,2%	2,267,050	Lower income
Eswatini	$ 3978.4	0.7%	17200	Lower middle income
Lesotho	$1094.1	0,6%	30,360	Lower middle income
Madagascar	$ 500.5	2,8%	581,795	Low income
Malawi	$634.8	2,7%	94,280	Low income
Mauritius	$9106.2	0,3%	2,030	Higher income
Mozambique	$491.8	2,8%	786,380	Low income
Namibia	$4865.6	1,6%	823,290	Upper middle income
Seychelles	$14653.3	1.0%	460	High income
South Africa	$7055.0	1,1%	1,213,090	Upper middle income
Tanzania	$1099.3	2,9%	885,800	Lower middle income
Zambia	$ 1137.3	3.2%	743,390	Lower middle income
Zimbabwe	$ 1773.9	1,4%	386,850	Lower middle income

Source: Author's elaboration using World Development Indicators[6]

With respect to the composition of value added in the region, the contribution of each sector[7] to value added, differs in each country. Indeed, in Botswana, the extraction sector contributes significantly to its value added, accounting for 38% of the total. This suggests the presence of valuable natural resources and highlights the importance of the mining industry in driving economic growth in the country. Additionally, the significant contribution of 27% by other services indicates the diversification of the economy beyond traditional sectors. On the other

[5]These are very small countries in the region which may mean that small countries trade more than the high-income countries and hence quickly receive an economic boost.

[6]https://datatopics.worldbank.org/world-development-indicators/.

[7] These sectors were taken as they are aggregated in the GTAP sector (before sector disaggregation) to show their influence on the value added of each country in the SADC region.

hand, the contribution of grains and crops is relatively low at 1%, followed by processed food at 2%, signifying that these sectors are less significant in the country's economy.

In the case of Madagascar, grains, crops, extraction and other services play a prominent role in the country's value added, contributing 20%, 20% and 21% respectively. This underscores the agricultural prowess of this country and the crucial role of services in supporting economic activities. However, sectors such as textiles and heavy manufacturing have a relatively smaller contribution, signifying that they play a less significant role in the overall GDP of the country. Similarly, in Malawi, grain and crops, along with other Services, have a higher contribution to its value added, accounting for 21% and 24% respectively. On the other hand, heavy manufacturing and light manufacturing sectors contribute less, at 2% and 1% respectively. Indeed, these figures reinforce the observation that Africa's economies are more reliant on agriculture and food processing than manufacturing. Hence, this reflects the region's resource endowments, historical factors and the importance of meeting domestic food demands. However, these figures also reflect the need to bring diversification and development to other sectors, such as manufacturing, promote overall economic growth and reduce dependence on agriculture.

Furthermore, in countries such as Mozambique, Tanzania, Zambia and RSACU[8], other services and grains and crops make significant contributions to their value added. The trend is the same for South Africa and Namibia, where other services (44%) and (41%) play a major role in their value added. On the contrary, the contribution of grains and crops to the value added in South Africa and SCA, is relatively lower, accounting for only 1%. The extraction also shows substantial percentages in RSACU (14%) and Namibia 11% exceeding the regional average of 5% for the rest of Africa. Lastly, food production also contributes an average of 5% in many countries. The charts below illustrate the contribution of each sector to the value added of each country in the SADC region, and the percentages represent the level of contribution of each sector to the overall value added of the SADC countries.

[8] Lesotho and Eswatini have been aggregated as one region, RSACU in the GTAP database; hence, it is impossible to separate them.

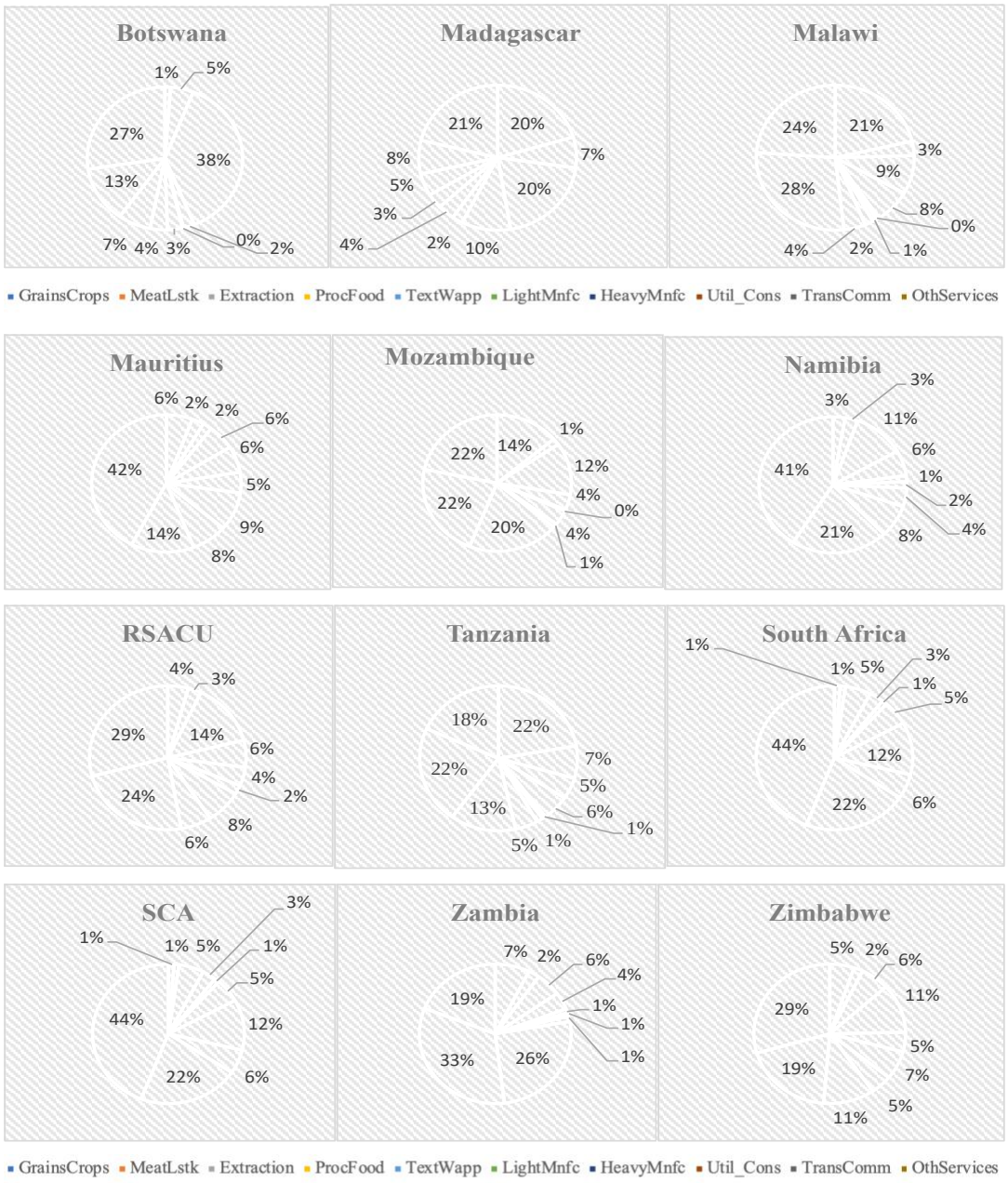


Figure2.1 Composition of value added in SADC countries in 2014.

Source: GTAP database v10

The value added exported by all sectors directly or indirectly can be traced back to the value-added factors of production that participate in their production. Accordingly, Figure 3.3 computes the contribution of the factors of production in six selected SADC countries: Botswana, Malawi, Tanzania, South Africa, RSACU and Zimbabwe. These countries were selected according to their overall GDPs - two countries (South Africa and Tanzania) with high

GDPs, another two (Botswana and Zimbabwe) with middle GDPs, and two more with lower GDPs (Malawi and RSACU). Accordingly, in terms of sectoral composition, a comparison between countries reveals notable variations. Capital emerges as a key factor in all sectors of each country, whereas skilled labour plays a prominent role in producing sectors such as textiles, clothing, and light and heavy manufacturing. Conversely, unskilled labour holds higher shares in sectors such as transport, communication, and other services across all countries.

Land on the other hand, demonstrates greater importance in agriculture production, particularly in the production of grains, crops, and meat. Significantly, when comparing countries, it becomes evident that Malawi and Botswana exhibit higher shares of skilled labour in agriculture and food production compared to other countries. For a visual representation of these comparisons, see Figure 2.2.

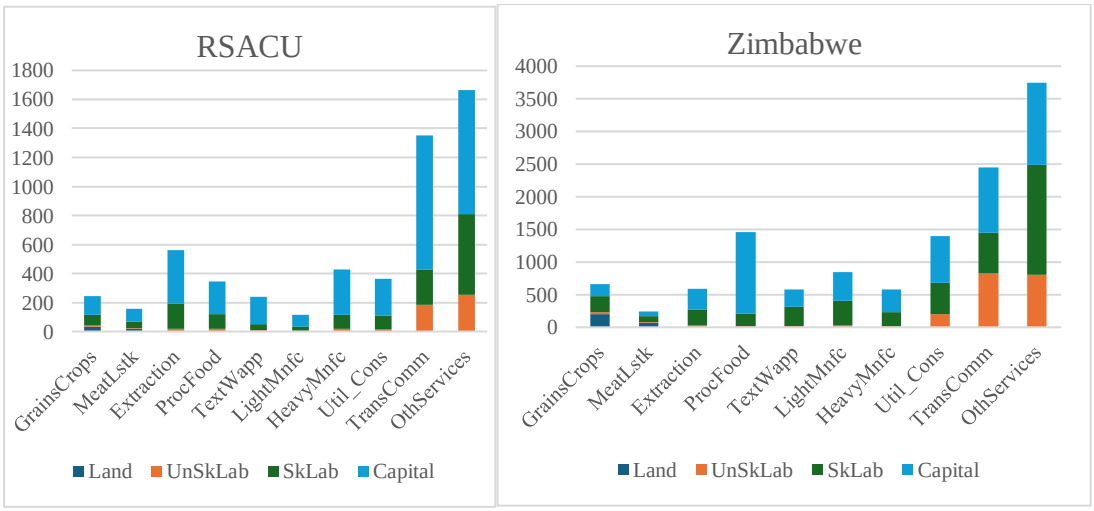


Figure 2.2 Factors of production and value added in millions of USD.

Source: GTAP Database v10

Notes: The vertical axis of the graphs represents the level of each factor of production in millions of USD and the horizontal axis shows all sectors as they are aggregated in the GTAP database.

2.1 SADC countries' trading status.

Analysis of the trading status at country level (Figure 2.3) indicates that most countries actively participate in intra-regional trade within the SADC region. Indeed, this involvement has been facilitated by the SADC Free Trade Area that has removed the tariffs for member countries hence promoting intra-trade among the member countries (SADC report, 2018). Accordingly, Namibia (50%), RSACU (51%) and Mozambique (36%) have higher percentages of exports to the SADC region whereas Mauritius (50%), Madagascar (43%) and Malawi (39%) have higher exports destined to the EU_28. Nevertheless, besides regional intra-trade, most of the SADC countries, except RSACU and Namibia, do more trade with the EU_28 and East Asia. This is linked to the preferential trade agreements (Economic Partnership Agreement) between SADC countries and the EU_28 that promote trade and economic cooperation between these two regions (SADC, 2018).

Additionally, the recognizable trade between SADC countries and East Asia has been necessitated by the new bilateral trade agreements between the SADC or Africa in general, with the Asian countries to promote trade between them, for example the China-South African Free Trade Agreement (FTA), which facilitated trade and enhance economic cooperation between these countries (SADC report, 2015). Indeed, Angola (46%), Zambia (44%), Zimbabwe (26%) and Mozambique (23%) are the countries that trade more with East Asia. Accordingly, Zimbabwe's statistics are further linked to the "Look East Policy" initiated by

the government to trade with countries from the East after the relationship with Western countries soured. Moreover, the results suggest less trade between the African countries since they rely more on European and Asian markets due to their dominance in raw materials which are then processed by the developed countries. Indeed, the discrepancy in trade openness is determined by the countries' bilateral trade agreements and policy changes, amongst other factors, as noted by Montalbano et al (2018). Figure 2.3 illustrates the export statistics of each SADC country in 2014.

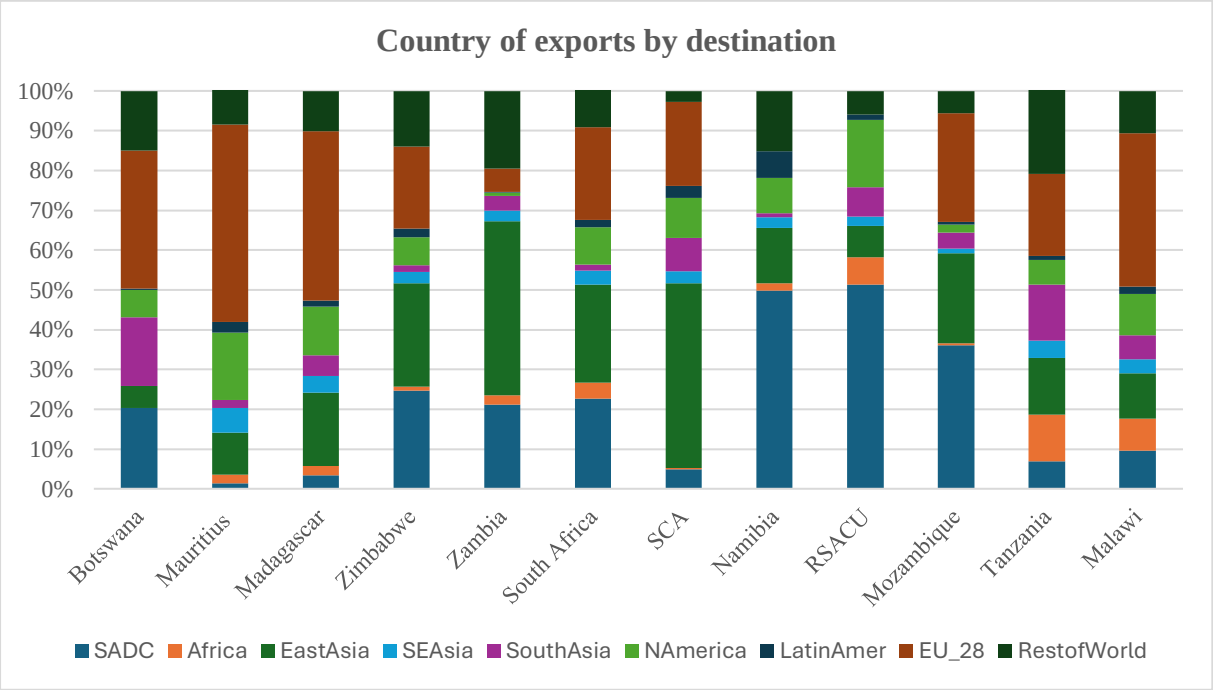


Figure 2.3 Country of exports by destination

Source: GTAP database v10

The import patterns in the SADC region reveals some noteworthy trends. Likewise, most countries in the region tend to import a significant portion of their goods from other SADC member countries, indicating the importance of intra-regional trade. Indeed, RSACU (68%), Zimbabwe (62%), Zambia (58%) and Malawi (46%) are among the countries that have higher import percentages from the SADC region. This showcases the potential for regional cooperation and the benefits of sourcing goods within the SADC market.

Conversely, South-Central Africa (43%), Namibia (41%), Mauritius (31%) and South Africa (30%) import more from the EU_28, highlighting the existing relationships and preferential trade agreements between these countries and the EU (SADC, 2015). Indeed, these agreements have facilitated imports from the EU_28 which often provide goods which are not readily available in the SADC region.

In addition, it should be noted that most SADC countries also import from East Asia, South Asia and North America, as shown in Figure 2.4., indicating the diversification of import sources and the globalization of trade. Additionally, Namibia stands out with a relatively high trade rate with Latin America, suggesting unique trade relationships with countries in that region. Finally, in the same way as export trends, the SADC region imports less from other Africa countries compared to other regions. Indeed, this also highlights the need for enhanced regional economic integration in Africa to promote intra-African trade and reduce reliance on external markets. Figure 2.4 illustrates the imports of SADC countries by origin in 2014.

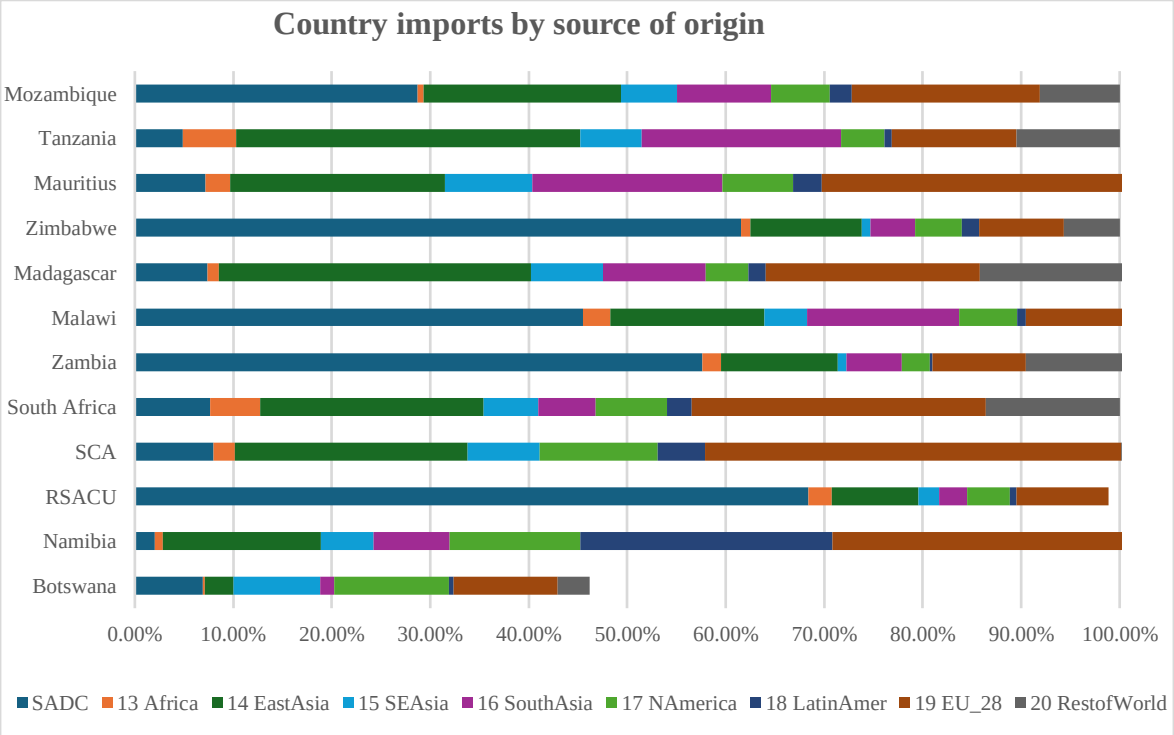


Figure 2.4 Country imports by source of origin

Source: GTAP Database v10

Additionally, the results show that all SADC countries export heavy manufacturing sector products more than any other sector at the sectoral level (N.B.: the percentages shown here show the percentage of exports of each sector in each country). Indeed, Mozambique (61%) exports heavy manufacturing products more than any other country in the SADC region, followed by Tanzania (56%), Zimbabwe (53%) and Zambia (47%), and the rest of the countries export less than 45% of heavy manufacturing sector products. Apart from the heavy industry sector, only Botswana exports in the extraction sector more than any other country, but all other countries export more light manufacturing goods than extraction. Accordingly, Namibia (25%) exports more in the light manufacturing sector than other countries, followed by South Africa

(22%) and Tanzania (19%), while Zimbabwe (13%) and Botswana (14%) export less. Figure 2.5 and 2.6 below illustrates this more clearly.

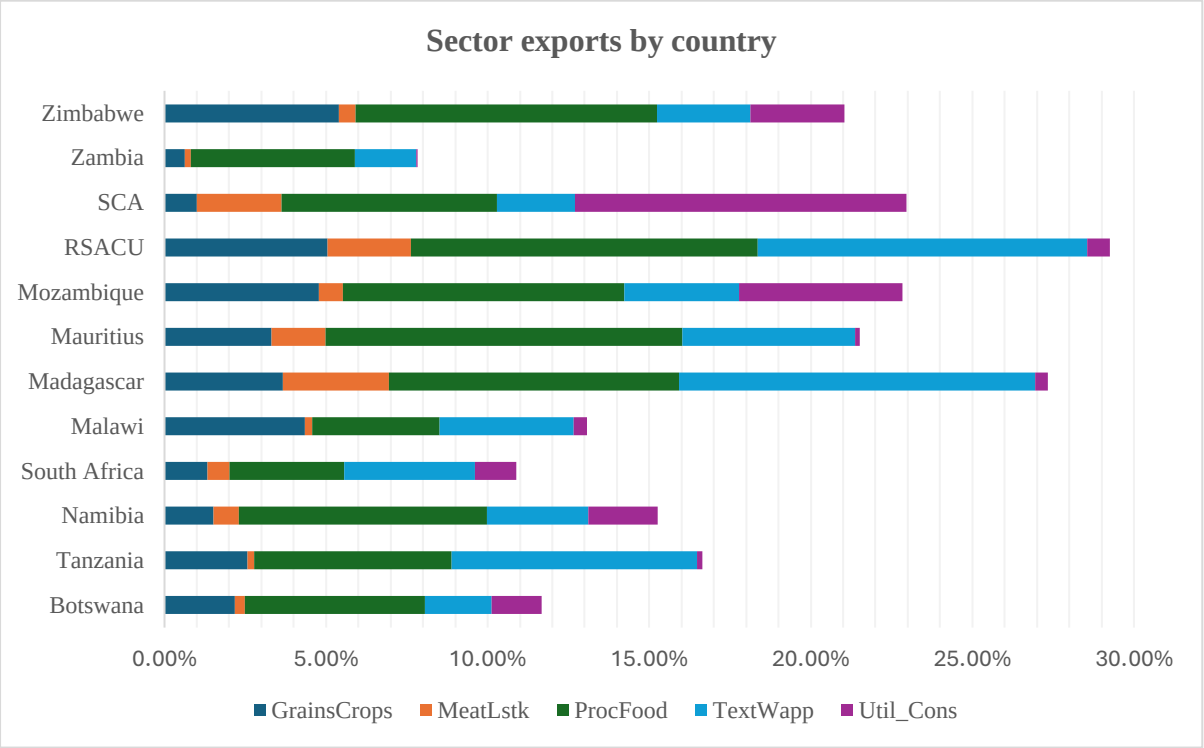


Figure 2.5 Sector exports by country in the SADC region.

Source: GTAP database v10

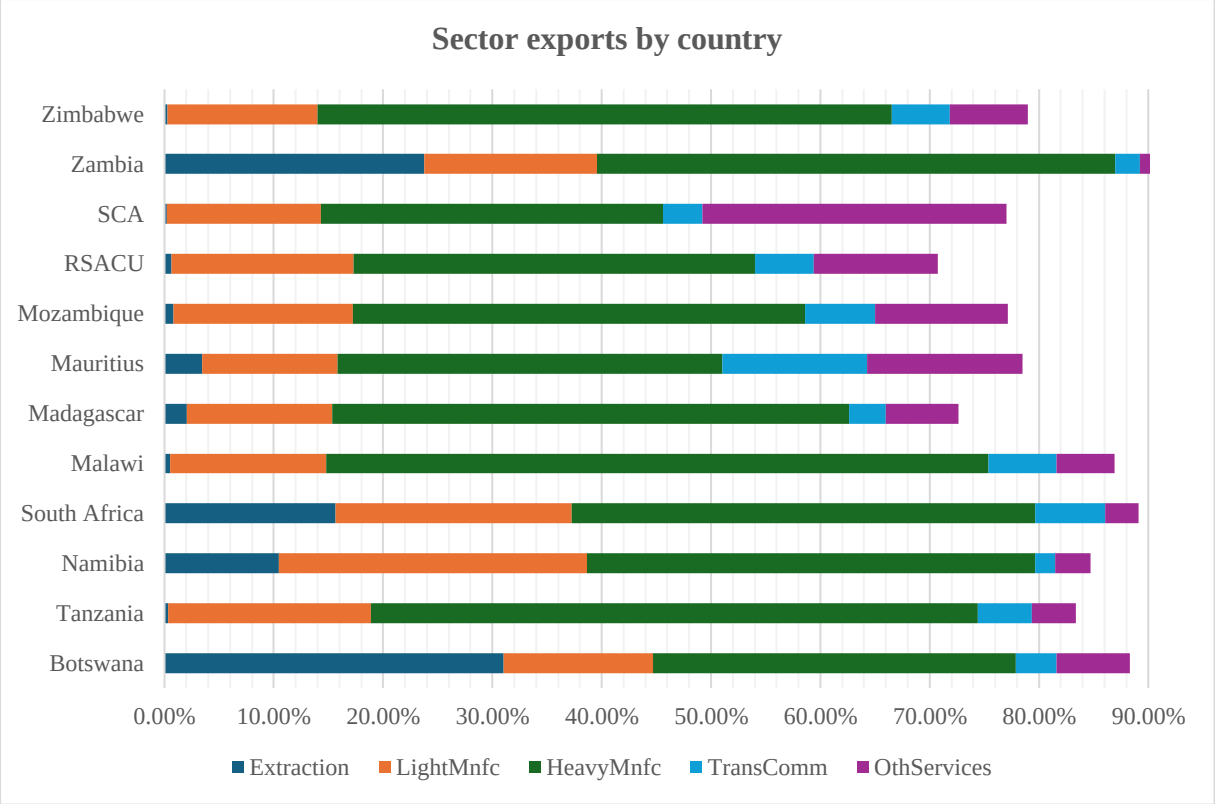


Figure 2.6 Sector exports by country in the SADC region.

Source: GTAP database v10

As for imports, Figure 2.7 shows that some countries import heavy manufacturing sector products more than any other sector and any other country. For example, countries such as Madagascar (78%), Malawi (63%), Tanzania (60%), Zimbabwe (56%) and Mozambique (52%) import heavy manufacturing sector products more than any other sector and any other country. (N.B.: the percentages show the level of imports of the mentioned sector for each country). Countries such as Zambia (54%) and South Africa (53%) import extraction sector products more than any other sector and any other country. On the contrary, Namibia (58%) imports more light manufacturing sector products than any other sector and country. Finally, RSACU imports other services (47%) more than any other sector and country. Grain crops, meat, processed food, and text warp sectors are the least imported sectors in all countries. Figures 2.7 and 2.8 illustrate this.

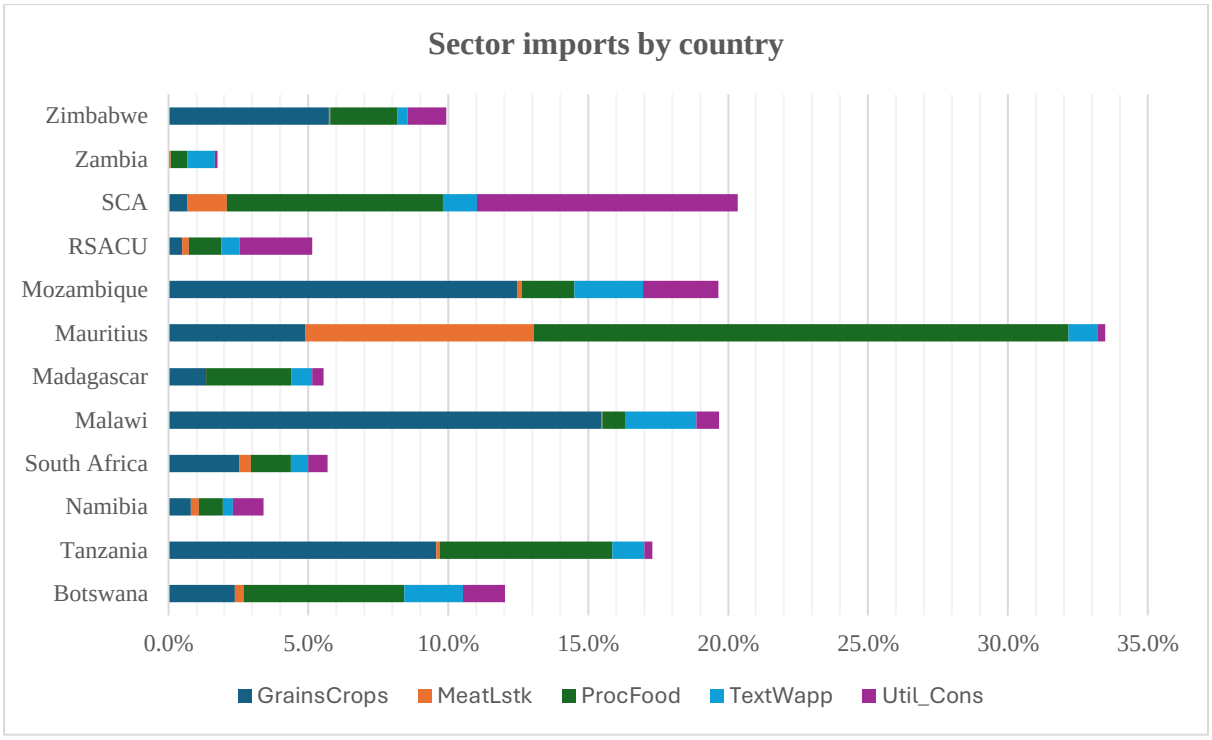


Figure 2.7. Sector imports by country.

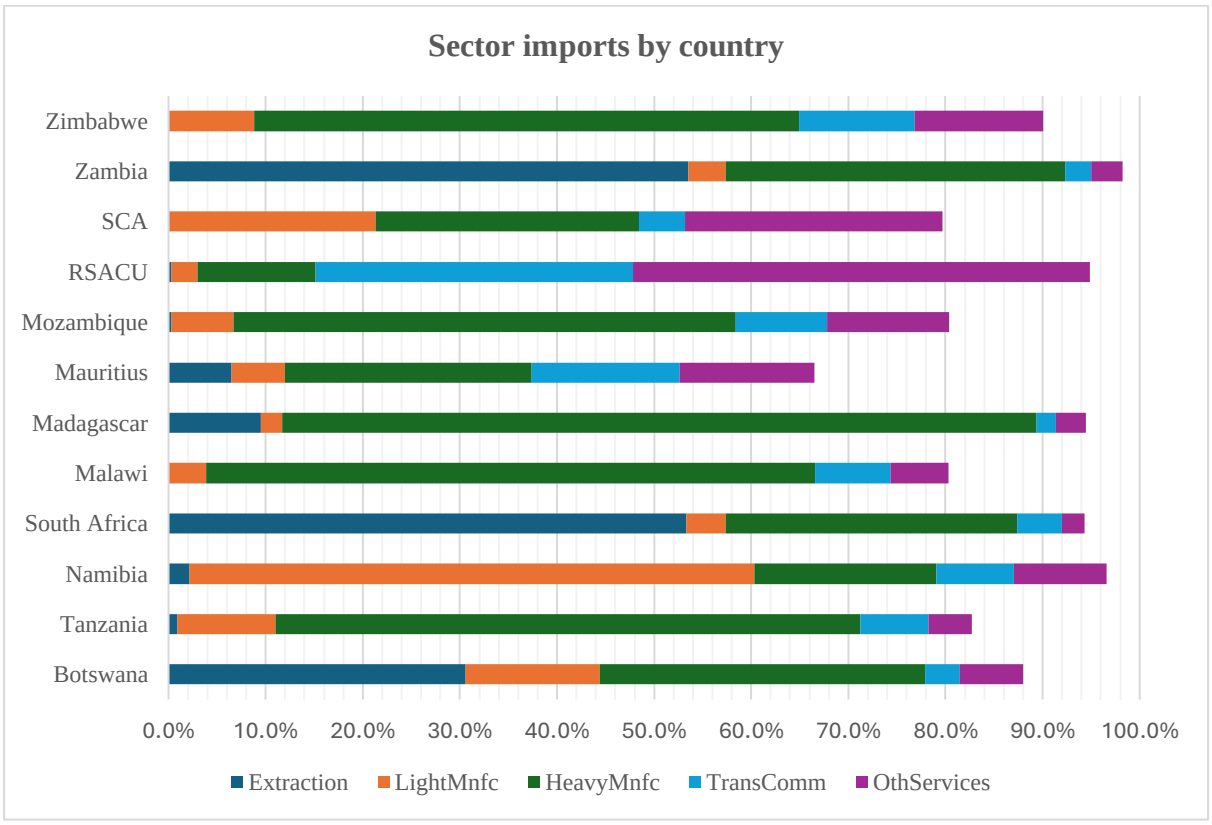


Figure 2.8 Sector imports by country.

Source: GTAP database v10

The agriculture and food and beverage sectors were selected to explore sectors' exports by destination due to their importance in this research study. An exploration of these sectors' imports by source will also be presented. To begin with, Figure 2.9 shows that for agriculture, all the countries export more to the SADC region with Botswana (97%), RSACU (96%), Zambia (96%) and Zimbabwe (81%) having higher exports to the region than other countries. This means that intra-trade is high in the region. Apart from trading within the region (SADC), it shows that Tanzania (36%) and Malawi (30%) export more to the rest of the world, with Mozambique (30%) and SCA (28%) exporting more to Southeast Asia and Madagascar (40%) exporting more to East Asia. EU_28 is also among the high trading partners of the SADC countries.

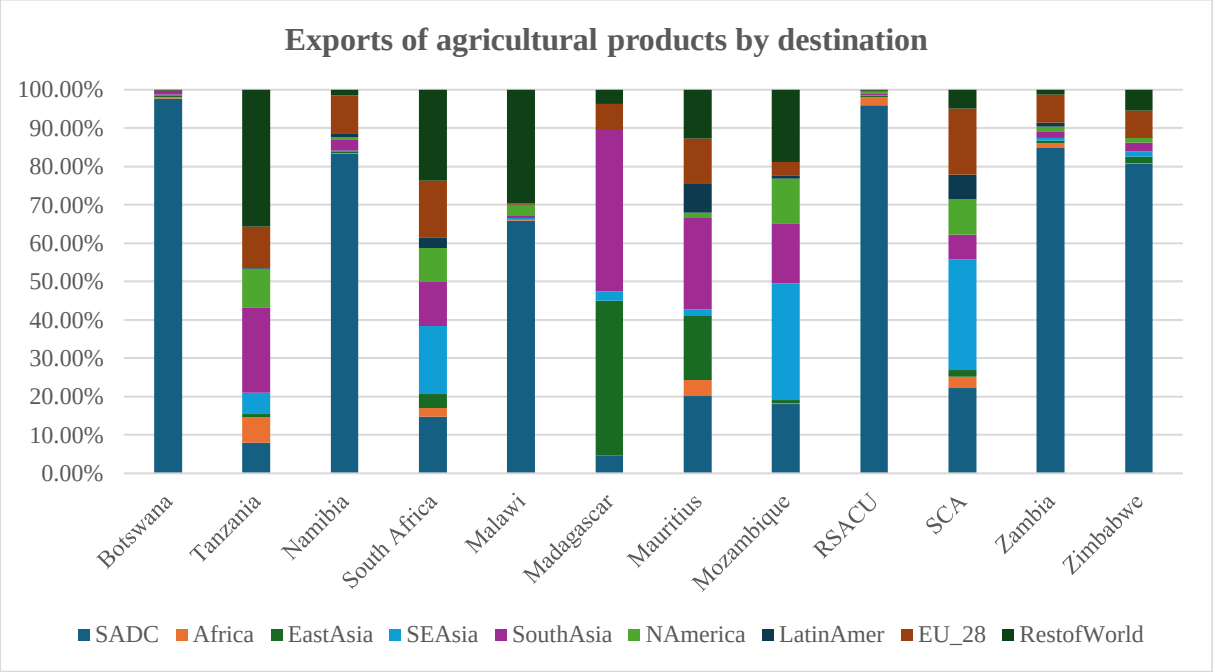


Figure 2.9 Exports of agricultural products[9] by destination.

Source: GTAP database v10

For food and beverages, Figure 2.10 shows the same results as the agricultural sector: more exports are destined for the SADC region. However, with regard to other regions, Tanzania (50%) and Madagascar (35%) export more to SEAsia whereas Mauritius (37%), South Africa

[9]These products include paddy rice, wheat, cereal grains, vegetables, fruits and nuts, oil seeds, sugar cane, plant and fibre, crops nec, animal products, wool, silkworm and cattle, sheep and goats.

(37%), Zambia (29%) and Madagascar (23%) export more to the EU_28. On the other hand, Zimbabwe (18%) exports more to North America. Figure 2.10 illustrates this.

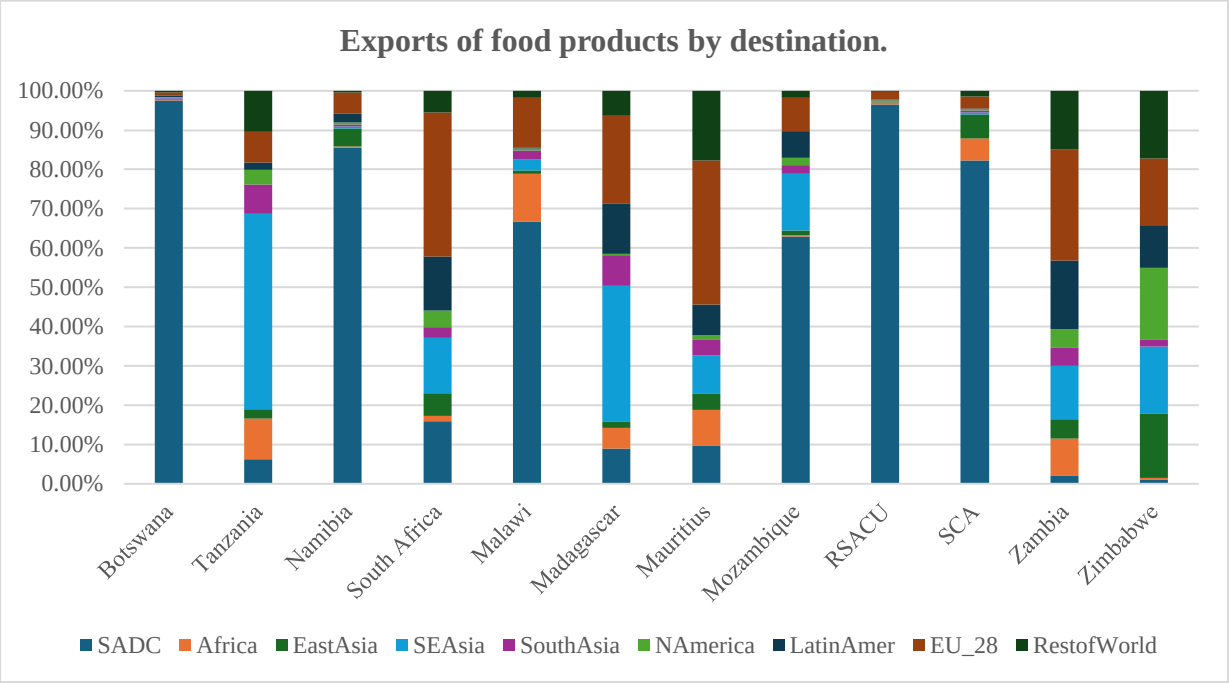


Figure 2.10 Food and Beverages exports[10] by destination.

Source: GTAP database v10

With regard to imports in the agricultural sector, the results are similar to exports. SADC countries trade more among themselves; however, with regard to extra-trade (outside the SADC region), countries such as Mozambique (30%) and SCA (28%) import more from SEAsia. On the other hand, Namibia (31%) and Malawi (36%) import more from the rest of the world whereas Madagascar (43%) and Mauritius (30%) import more from South Asia. Figure 2.11 illustrates this.

[10] These products are meat, vegetable, oil and fats, dairy produce, raw milk, processed rice, sugar, meat products, food products, beverages and tobacco.

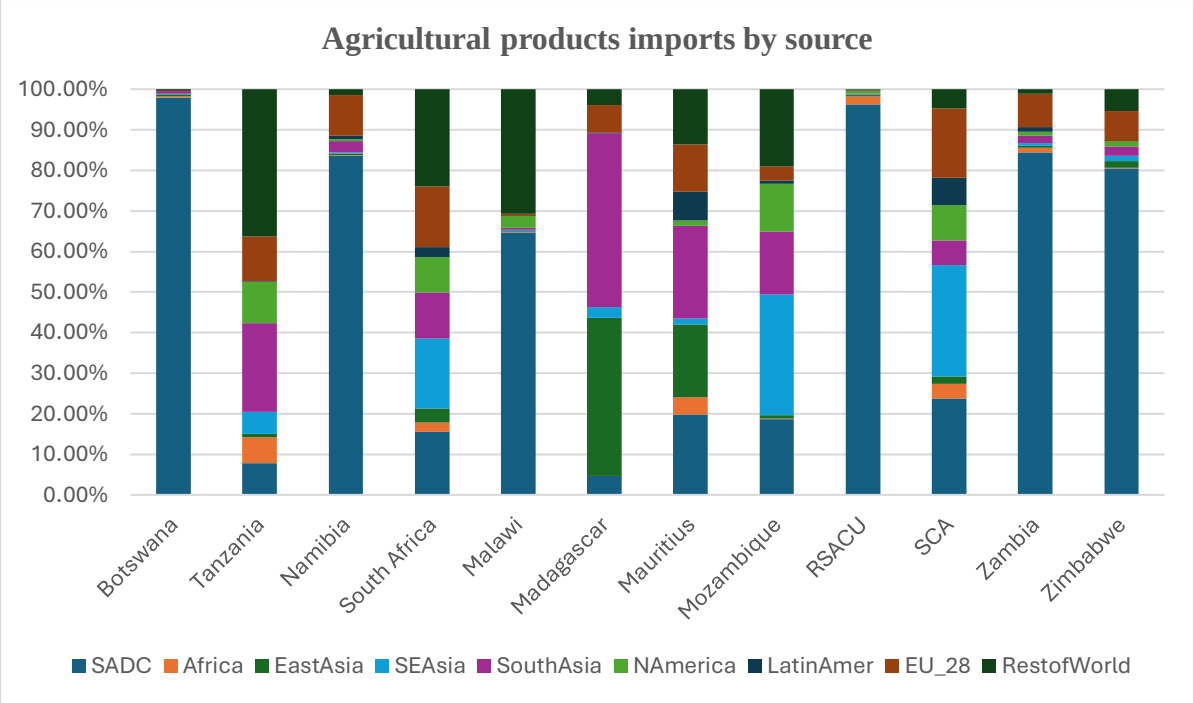


Figure 2.11 Agricultural products imports by source.

Source: GTAP database v10

The trend is the same for the food and beverages sector; more intra-trade with SADC countries, then in addition to this intra-trade, different countries have different partners that they import more from. For instance, Tanzania (49%) and Madagascar (34%) import more of their agricultural products from SEAsia. On the other hand, SCA (35%), South Africa (37%) and Mauritius (37%) import more from the EU_28. Figure 2.12 illustrates this.

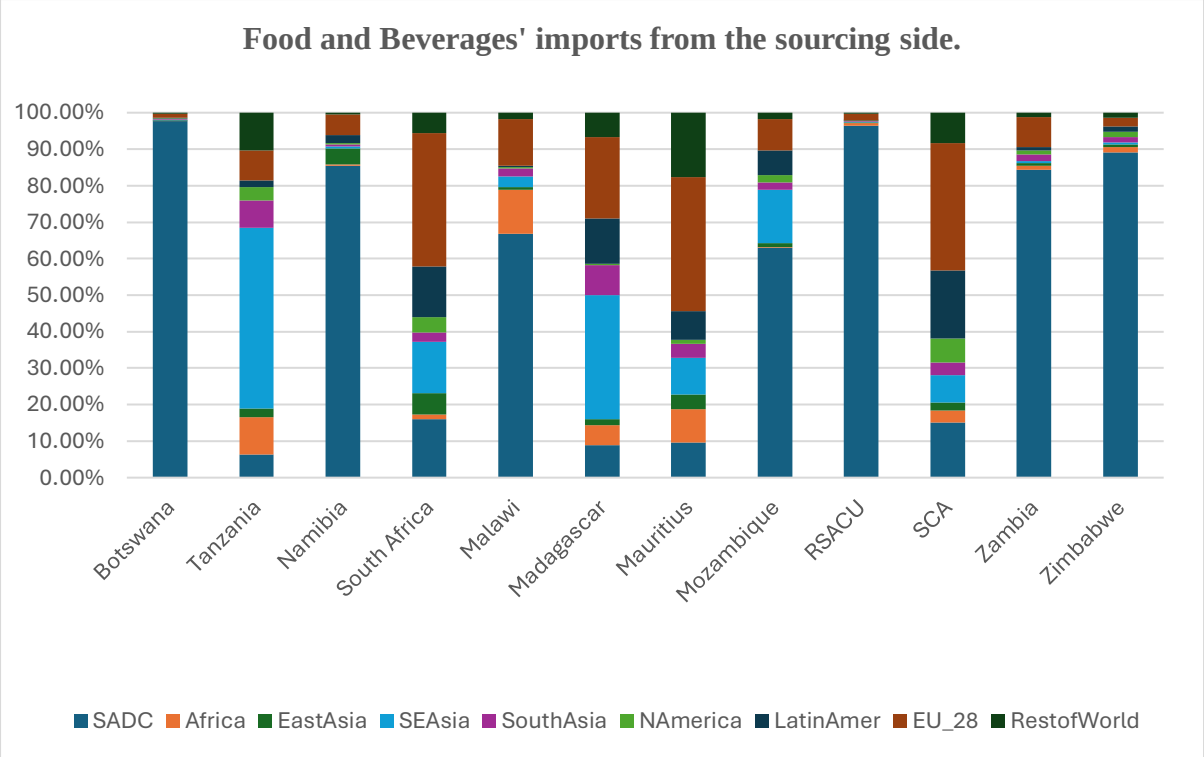


Figure 2.12 imports by sector

Source: GTAP database v10

2.2 Trends and Dynamics in SADC GVC Participation (1990–2015).

Figure 2.13 shows the participation in GVCs of each of the 15 SADC countries[11] between 1990 and 2015. Following Borin and Mancini (2019), the reported figures are measured as ratio of a country's exports that is attributed to multi-stage production. This is calculated as the sum of foreign value-added used in a country's own exports and the value-added supplied to other country's exports taken as ratio of gross exports. Indeed, the figures articulate for an increase in GVC participation of most SADC member countries[12]. Zimbabwe has the highest percentage

[11]SADC has 16 countries; however, Comoros was left out due to data challenges.

[12] On GVC participation indicators, its empirical analysis has brought forth a significant issue regarding the extent of a country and sector's involvement in international production networks. Traditional indicators such as market shares, bilateral trade balances, and sectoral specialization indices were once sufficient for understanding a country's position in global markets and its change over time. However, with the growing fragmentation of production, these indicators have proven inadequate in capturing the intricate dynamics of GVCs.

In response to the limitations of traditional measures, various measures for assessing GVC participation have been developed. For instance, indicators such as the share of imported inputs in gross output, total inputs or exports have been proposed. However, these measures fail to provide an accurate characterization of a country's level of involvement in GVCs (see, for example, Hummels et al., 2001; Haltimeier, 2015). This is due to their inability to differentiate between the use of imported intermediates in a country's exports and their use in domestic production (Aslam et al., 2017). Therefore, these measures do not capture the full extent of a country's integration into GVCs.

The concept of "vertical specialization" introduced by Hummels et al. (2001) is widely recognized as one of the early and commonly used measures to assess a country's participation in different stages of global production chains. This vertical specialization has been defined as follows:

$$VS_s = \frac{\sum_{r\neq s}^{G} V_r B_{rs} E_{s*}}{U_N E_{s*}}, \textbf{ (1).}$$

point increase from 26% in 1990 to 72% in 2015, while Madagascar and Tanzania have the lowest percentage point increases, going from 25% to 33% and 25% to 47%, respectively.

However, it is important to note that this measure focuses primarily on backward linkages, specifically the import content of a country's exports. Therefore, it provides a partial view of a country's involvement in GVCs. To address this limitation, the authors suggest considering the exports of intermediate products that undergo further processing and re-exportation, leading to the development of the VS1 measure. This expanded measure takes into account the additional dimension of intermediate products exports, providing a more comprehensive perspective on a country's participation in GVCs. Thus, this measure has been computed as:

$$\mathrm{V}SI_S = \frac{\sum_{r\#s}^{G} V_s B_{sr} E_{r*}}{U_N E_{s*}} \textbf{ (2).}$$

In the wake of the influential study by Hummels et al. (2001), several measures have been proposed to assess a country's level of integration within international production networks. KWW (2010) introduced a widely used indicator of GVC participation in the field literature by utilizing the trade in value-added components of their decomposition. Their approach involves analysing the foreign value-added component (FVA) component and the "indirect domestic value-added" (DVX) component. Accordingly, FVA serves as a measure of backward participation since it quantifies the imported intermediate inputs used in generating output for export. On the other hand, DVX captures the contribution of the domestic sector to the exports of other countries, reflecting the level of involvement in GVC for industries positioned relatively upstream. Therefore, DVX is regarded as an indicator for forward participation.

Hence, by expressing both measures as a proportion of total exports, the formula for calculating total GVC participation is as follows:

$$\text{GVC participation} = \frac{FVA + DVX}{Gross\ Exports.} \textbf{ (3).}$$

A higher ratio indicates a stronger level of engagement for a specific country or sector in GVCs. However, Borini and Mancini (2017) have seen that the same value added produced within a particular country can be recorded multiple times in the exports of other countries. This phenomenon, referred to as double counting in exports originated abroad by KWW, creates a discrepancy between the numerator in equation (2). As a result, $\mathrm{V}S_a$ + $\mathrm{V}SI_a$ cannot be regarded as a precise measure of the share of a country's exports associated with GVC.

Wang et al. (2016) has also introduced two distinct indicators. The first indicator, called GVCv, focuses on forward production linkages and assesses the breakdown of total value added within a sector. The second indicator, known as GVCy, is backward oriented and examines the decomposition of final production by sector. In both cases, the value-added component associated with GVCs is identified by adopting the same underlying logic of GVC exports. These indicators offer a comprehensive perspective on the extent of GVC participation at both sectoral and country levels. However, according to Borin and Mancini (2017), to accurately assess the overall level of engagement of a country or specific sector in GVC, it is insufficient to rely solely on trade flows. This is because, in certain countries, the exporting sectors may be deeply integrated into GVCs, but they may represent only a small portion of the overall economic activity. Also, when considering sectoral participation in GVCs, it is essential to acknowledge that certain industries may indirectly contribute to production networks despite their limited export activities. For instance, services often serve as inputs to manufacturing sectors that directly engage in GVCs. Therefore, a comprehensive analysis of sectoral involvement in GVCs should take into account these indirect linkages and recognize the broader scope of participation beyond just export activities.

Indeed, several studies have attempted to measure a country's forward participation in GVCs by examining the export components that are subsequently re-exported by the immediate importer (Rahman and Zhao, 2013; and Ahmed et al, 2017). However, these studies rely on KWW's decomposition of gross exports which, as noted before, does not accurately allocate a country's exports between the portion that is directly absorbed by importers and the portion that is re-exported internationally. Consequently, the measures of GVC participation derived from this methodology are considered to be imprecise. Accordingly, Borin and Mancini (2015;2019), therefore developed bilateral decomposition (see Borin and Mancini, 2019), to address the challenges in the existing literature to fully compute all characteristics/ features of backward and forward participation indicators of GVCs. Indeed, Nenci (2020) indicated that they have provided correct definitions for some components that KWW has incorrectly specified: i) the domestic value added that is either directly or indirectly absorbed by the importing nation's final demand; ii) the international value added that is directly and indirectly absorbed by the importing country's final demand.

Hence, in line with the adopted decomposition of gross exports, to give trends of SADC GVC participation over time, this section follows Borin and Mancini (2019) in order to calculate GVC participation indicators and the overall GVC. The backward component corresponds to the VS index and the forward component corresponds to the VS1, as suggested by Hummels et al. (2001).

The formulas are as follows:

$$GVC\ backward_{sr} = \frac{V_s (1-A_{ss})^{-1} \sum_{j\#s}^{G} A_{sj} B_{js} E_{sr} + \sum_{t\#s}^{G} V_t B_{ts} E_{sr}}{U_N E_{sr}} \text{ (4).}$$

$$\text{where as } GVC\ forward_{sr} = \frac{Vs\,(1-A_{ss})^{-1}\ A_{sr}(1-A_{rr})^{-1}(\sum_{j\#r}^{G} Y_{rj} + \sum_{j\#r}^{G} A_{rj}\ \sum_{k}^{G}\sum_{l\#s}^{G} B_{jk} Y_{kl})}{U_N E_{sr}} \textbf{ (5).}$$

and the overall GVC participation is computed as: *GVC overall participation* = $GVC\ backward_{sr}$ **(VS_{sr})** + $GVC\ forward_{sr}$ **($VS1_{sr}$).**

Indeed, these increases in GVC participation are attributed to increased investment in infrastructure, improved access to technology, and the development of a skilled workforce. These factors improved the competitiveness of SADC countries, making them more attractive to investors seeking to enter the growing African market (SADC Industrial Report, 2018).

Furthermore, growth of the African market has also played a significant role in driving the increase in participation in GVCs. The expanding middle class in African countries has created a growing demand for consumer goods which has led to increased investment in manufacturing and other sectors (Ncube et al 2011; Ncube et al, 2015). Indeed, this has created opportunities for SADC countries to participate in GVCs, particularly in industries such as textiles, agriculture and mining. However, despite the overall increase in GVC participation, some countries such as Madagascar and Malawi still have relatively low levels of participation. These linked to their limited access to technology, poor infrastructure and lack of skilled workers (since they are the poorest in the region) make it difficult for them to compete in the global market.

Also, developed economies in the region with better infrastructure and technology have had more opportunities to integrate into GVCs, whereas less developed countries have had fewer opportunities. This explains why countries such as Mauritius that has export diversification that ranges from sugar to textiles and clothing, and relatively developed countries such as Lesotho, Botswana and South Africa, had high participation rates in both 1990 and 2015, while countries such as Madagascar, Malawi and Mozambique had relatively low participation rates in both years.

Government policies, trade agreements and the presence of natural resources also have an impact on participation rates at the country level. Indeed, DRC's participation rate saw a significant increase by 2015, made necessary by a combination of government policies aimed at attracting foreign investment and the country's abundant natural resources (IMF,2016). However, continuous political instability and conflict in DRC tend to affect the maximum potential of the country's participation in GVCs since it scares investors away.

Overall, the heterogeneity of the global value chain participation rate amongst the countries is also impacted by each country's macro-economic policies (as they influence trade and investment conditions, exchange rates, infrastructure development and human capital development) and individual trade agreements (since each country has its unique macro-economic behaviour). Thus, Figure 2.13 compares the GVCs of SADC countries between 1990 and 2015.

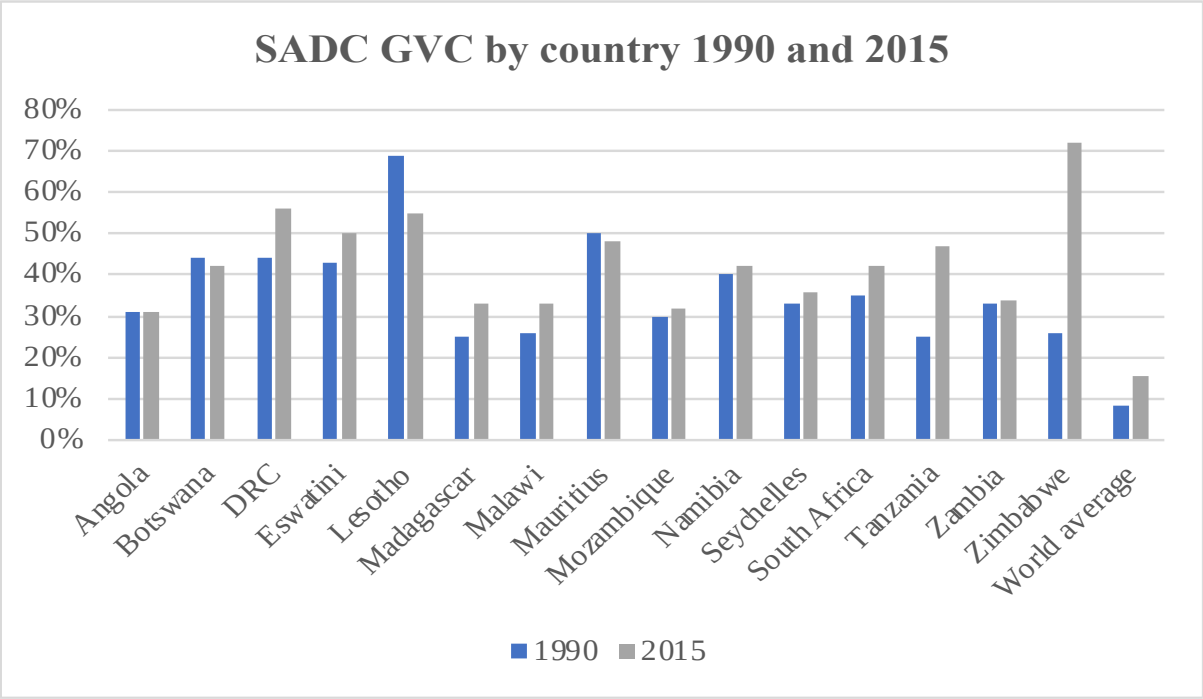


Figure 7.13 GVC participation by SADC country.

Source: Author's calculation using the UNCTAD-EORA Database.

Notes: The GVC participation measure was calculated using the UNCTAD-EORA database. These reported figures are the quantity of a region's exports which are the segment of the multi-stage trade procedure. The exports of the region include intra-region exports. This has been calculated as the total of the FVA incorporated in a nation's exports and the DVX supplied to other nations' exports is considered as a ratio to gross exports.

Regarding backward integration, Figure 2.14 indicates significant changes in SADC countries' reliance on foreign inputs. Mauritius had a very high backward participation rate of 87% in 1990, indicating heavy reliance on foreign inputs but this dropped sharply to 31% in 2015, suggesting that the country has been able to reduce its reliance on foreign inputs (and produce more goods and services domestically) in the production of its exports. Additionally, this indicated a shift away from assembly-based manufacturing to a more capital-intensive activities such as financial services and tourism which was driven by government policies aimed at diversifying the economy and moving up the value chain. In contrast, Tanzania saw a significant increase in its backward participation from 6% in 1990 to 27% in 2015, indicating greater reliance on foreign inputs in the production of its exports.

The variation of changes among the backward participation of SADC countries is also caused by changes in the availability and cost of domestic and foreign inputs. In most of the member countries, domestic inputs tend to be more expensive and less available, and most of the firms

turn to foreign inputs to maintain production levels which has also been supported by the reduction or elimination of tariffs in specific goods by most of the SADC countries, making it easier for the firms to import foreign inputs. However, other countries saw a decrease in their participation rates due to a decline in the production of key sectors in their economies. For example, Seychelles' backward participation rate decreased from 14% in 1990 to 11% in 2015 due to a decline in the country's fishing industry which was a major contributor to the country's economy. Lesotho on the other hand, decreased its participation from 52% in 1990 to 36% in 2015 due to a decline in the country's textile industry[13] which was once a major contributor to the country's economy.

Other countries experienced a low level or decrease in their participation due to their reliance on the sectors that do not add much value addition in the production process. For example, Angola's participation rate decreased from 5% in 1990 to 4% in 2015 due to the country's heavy reliance on the export of crude oil which accounts for over 90% of its exporting earnings. Hence, since crude oil is largely extracted and exported without much value-addition, its foreign value-added rate is low. Conversely, other countries' participation increased significantly over time, due to an increase in their export-oriented tobacco, textile and apparel industry (e.g. Malawi and Eswatini).

In addition, the increase in backward participation rates in other countries has also been linked to the rise of GVCs and the fragmentation of production across borders. As countries specialize in certain stages of the production process and trade in intermediate goods, the backward participation rates of their exports increase. This is because a higher proportion of the value added in the final product is derived from imported inputs.

Overall, low percentage rates for several countries indicate that countries are not yet fully integrated into GVCs and are still facing challenges in upgrading their industries and improving their quality of exports. This low level in percentages can also be caused by individual countries' policy choices. For example, in Mauritius and Zimbabwe, they have implemented some policies that incentivize the production of certain goods and services domestically instead of importing them (SADC, 2015,18). Indeed, such policies could limit backward participation since they discourage the use of imported intermediate goods.

[13]In 1990 the country had a high participation rate due to the clothing industry which relied heavily on imports of textile inputs and exports of finished garments. However, this has decreased due to increased competition from other garment-producing countries in the region and globally.

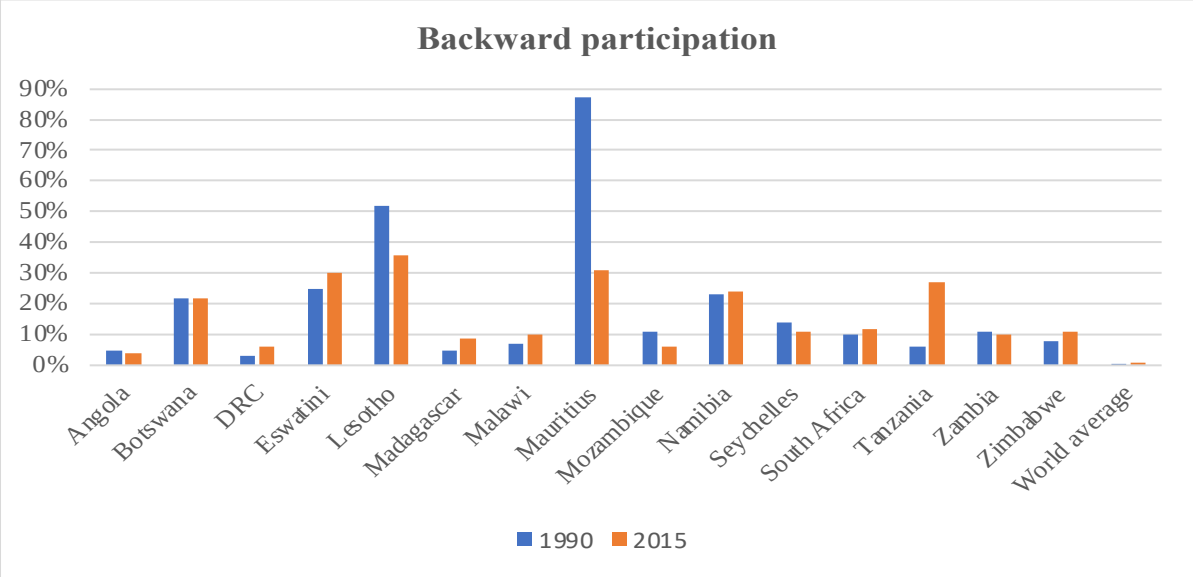


Figure 2.14 SADC countries' backward participation between 1990 and 2015.

Source: Author's calculation using UNCTAD-EORA Database.

Notes: Here the foreign value added is compiled using the EORA 26 sector version of the UNCTAD-EORA GVC database. The stated numbers are the ratio of the FVA used in the region's own exports to gross exports. Exports of a region include intra-region exports.

With regard to the forward participation indicator, Figure 15 indicates that Angola, Botswana, Mozambique, Zambia and Zimbabwe had participation rates that were relatively stable or increased slightly between 1990 and 2015, suggesting that these countries have been able to increase/maintain their own production and promotion of value-added activities in support of their exports. These countries expansion has been attributed to increase in oil, diamond, copper, tea and sugar sectors' exports. Hence the increase in domestic value added is attributed to the development local supply chains.

On the other hand, Seychelles' significant growth is attributed to the country's expansion in the tourism sector which has boosted the demand for domestically produced goods and services. Meanwhile Tanzania's decline rate signifies that the country has become more dependent on imported inputs to support its export activities.

Furthermore, the involvement of SADC countries in forward participation is not spared from the global production networks and value chains status. Indeed, many of these networks are organized in such a way that developing countries are tasked with supplying raw materials and semi-finished products, while developed countries perform the final stages of production (Antràs, 2015; Baldwin, 2016). Consequently, the participation of SADC countries primarily occurs in the early stages of production, mainly involving the export of natural resources. This explains their higher levels of forward participation compared to backward participation,

indicating a greater involvement in upstream production rather than downstream production. Figure 2.15 shows the forward participation of SADC countries between 1990 and 2015.

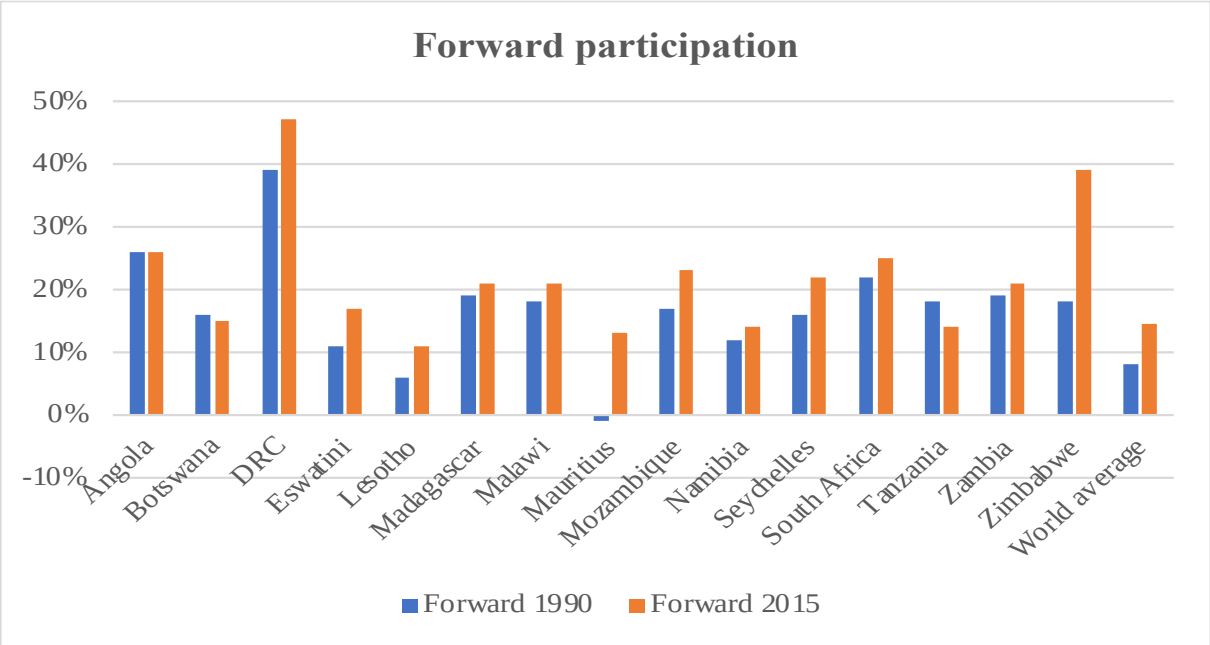


Figure 7.15 SADC countries' forward participation in 1990 and 2015.

Source: Author's calculation using the UNCTAD-EORA Database.

2.2.1 A comparison by sector - Agriculture and Food and Beverages sectors[14]

The interest in these two sectors is explained by the fact that Africa is well-known for its agricultural production and that it employs around 60-80% of its population in this sector (Sow, 2017). Moreover, the SADC industrial strategic roadmap (2018) has classified these sectors as one of the six main value chain clusters that have to be promoted due to their potential to deepen regional and global value chain participation of the region. This indeed motivates us understand how SADC performs in GVCs under these two sectors by comparing it with other RECs. The results, as shown in this subsection, indicate that all the communities participate in the global value chain through the agriculture sector more than food and beverages. The sum across the sectors therefore equals the value of total GVC participation reported in Figure 2.16.

[14] The EORA database has been classified into 26 sectors according to the International Standard Industrial Classification of Economic Activities (ISIC). Agriculture and food and beverages are selected from these sectors. GVC participation measures used in previous section are also used in these sectors as well.

Indeed, the figures reveal an increase in GVC shares for agriculture and food and beverages among SADC countries between 1990 and 2015, indicating greater integration into GVCs. However, growth rates vary across countries. For instance, countries such as Eswatini, Lesotho, and Tanzania have experienced significant growth in their agriculture and food GVC shares, while others like Angola and Zimbabwe show more mixed trends. The shift in consumer preferences toward healthier, value-added foods (Sonja, J et al., 2020) has driven the increased production of higher-value agricultural products, such as fruit, vegetables, dairy, and specialty crops. This demand has contributed to the growth of agriculture and food and beverages in SADC's GVC participation.

In 2015, countries like Angola, Eswatini, DRC, and Malawi derived a substantial portion of their exports from agriculture, while Seychelles and Tanzania had a higher share in food, signifying a stronger presence in the food sector within their GVCs. Furthermore, by comparing the sector GVC to the total GVCs, for several countries, the share of agriculture GVC was relatively high compared to the total GVC exports. This indicate that agriculture played a significant role in their GVC participation.

The trends also reveal variations between the agriculture and food and beverages sectors. Countries such as Botswana, Lesotho, and Seychelles have seen a greater increase in GVC shares for food and beverages compared to agriculture, indicating a specialization in processed and value-added food products. In contrast, countries like Madagascar and Mozambique have experienced relatively stable GVC shares in both sectors. Overall, the food sector's GVC share was lower than agriculture in most countries, except for Botswana, Lesotho, Malawi, Mauritius, and Tanzania, highlighting its significance in these economies.

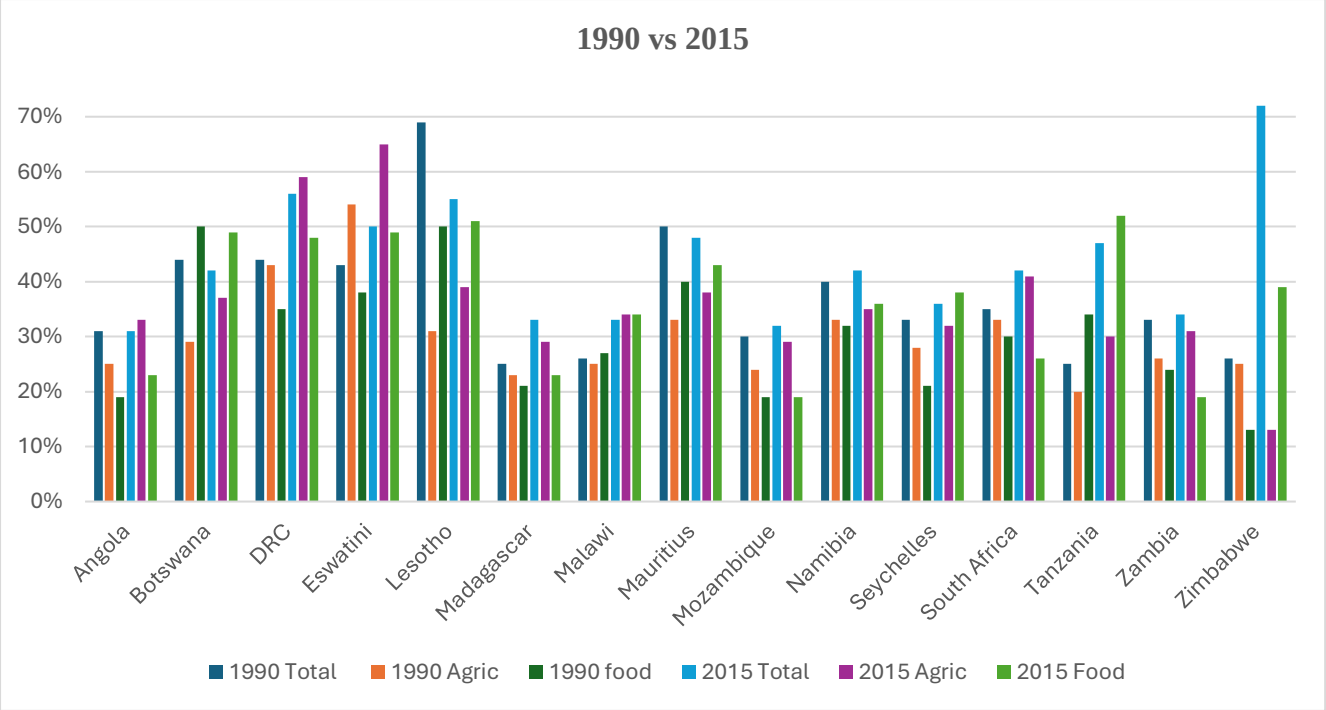


Figure 7.16 Agri-food GVC participation at the country level.

Source: Author's calculation using the UNCTAD-EORA database.

Comparing SADC GVC participation to regional value chain (RVC) participation (Figure 2.17) reveals some disparities. Countries such as Botswana, Namibia, and Angola show a stronger inclination toward RVCs, while many other SADC nations have a more significant presence in GVCs, reflecting their active engagement in global markets. These trends highlight the dynamic value chain strategies among SADC countries, with some consolidating their positions in global markets, while others shift their regional focus. Many SADC countries prioritize GVC participation, aligning with export-oriented strategies that emphasize access to global markets, foreign investment, and economies of scale. By partnering with multinational corporations and attracting FDI, they gain access to advanced technologies and skills, allowing them to engage in higher value-added activities within GVCs.

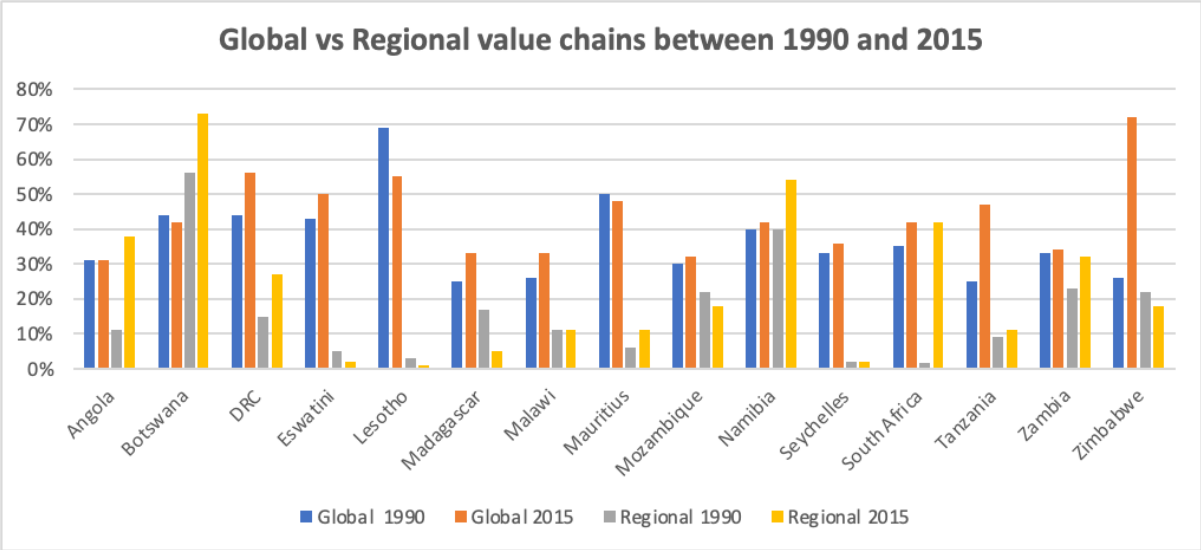


Figure 7.17 SADC countries' regional and global value chains between 1990 and 2015.

Source: author's calculation using the UNCTAD-EORAdatabase.

3. SADC tariff structure.

An analysis of average applied tariff rates reveals significant variations among member countries. These tariffs play a pivotal role in the formulation of trade policies and agreements within the region. Indeed, these disparities reflect differences in economic structures, developmental aspirations and priorities among the member states.

On average, the SADC region maintains an applied tariff rate of approximately 9%. However, a closer examination at the country level demonstrates considerable divergence from this regional average. Notably, Comoros stands out with the highest average applied tariff rate at 12.47%, followed closely by Tanzania at 12.15%. Zambia and Zimbabwe exhibit tariff rates of 10.8% and 9.60%, respectively. In the contrary, Mauritius emerges as an outlier with the region's lowest average applied tariff of 1.30%.

The majority of the SADC member countries maintain average applied tariff rates falling within the range of 7% to 9%. Thy include Malawi, Lesotho, Angola, Botswana, South Africa, Mozambique, Namibia and Seychelles, among others. Indeed, these disparities in applied tariffs reflect broader challenges and opportunities faced by the SADC region. High tariffs may be an indicative of protectionist measures while low tariffs might signify an openness to international trade.

Furthermore, this diversity in applied tariff rates across SADC member countries underscores the importance of considering these variations in the formulation and evaluation of scenarios for the proposed SADC Customs union while prioritizing equitable growth, shared values and

collective development. Indeed, the impact of such a union is expected to vary significantly among member states due to these disparities in tariff rates. Figure 3.1 graphically illustrates the average applied tariffs of SADC member countries, highlighting the extent of this variation.

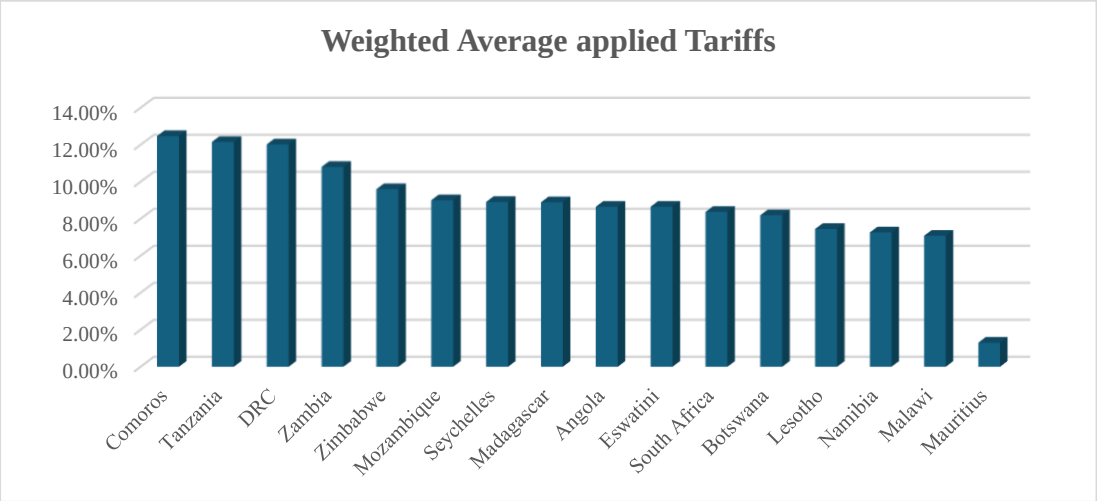


Figure 7.1Weighted Average applied Tariffs.

Source: MacMap database

As for the tariff structure across various product categories (raw materials, capital goods, intermediate goods, and final goods) the figures reveal differing adjustments among SADC countries under the proposed Customs Union tariff framework. Countries such as Comoros and Zimbabwe will experience the most significant tariff reductions on raw materials and capital goods, which will reduce the cost of imports for industries dependent on these inputs. These changes aim to promote competitiveness in manufacturing and support the supply of essential industrial inputs.

In contrast, the tariff adjustments for intermediate goods show slight increases or decreases across various countries, reflecting their varying levels of dependence on imports. For countries like Madagascar, where intermediate goods imports constitute a significant portion of trade, the tariff increases may elevate production costs. However, countries such as Namibia, with relatively higher self-sufficiency in intermediate goods, may face less pronounced effects.

The final goods category sees the most substantial tariff hikes, particularly in Madagascar and Mauritius, where the increased rates could protect domestic markets and foster local production. This protectionist measure may reduce imports and incentivize the growth of local industries that produce finished products, supporting economic self-sufficiency.

These tariff adjustments, as part of the SADC Customs Union's broader strategy, reflect the region's goal to strike a balance between integration into global markets and protecting domestic industries. By reducing barriers for industrial inputs and increasing protection for

final goods, the new policy could shape trade and economic system that promote local production while encouraging countries to participate in the global economy.

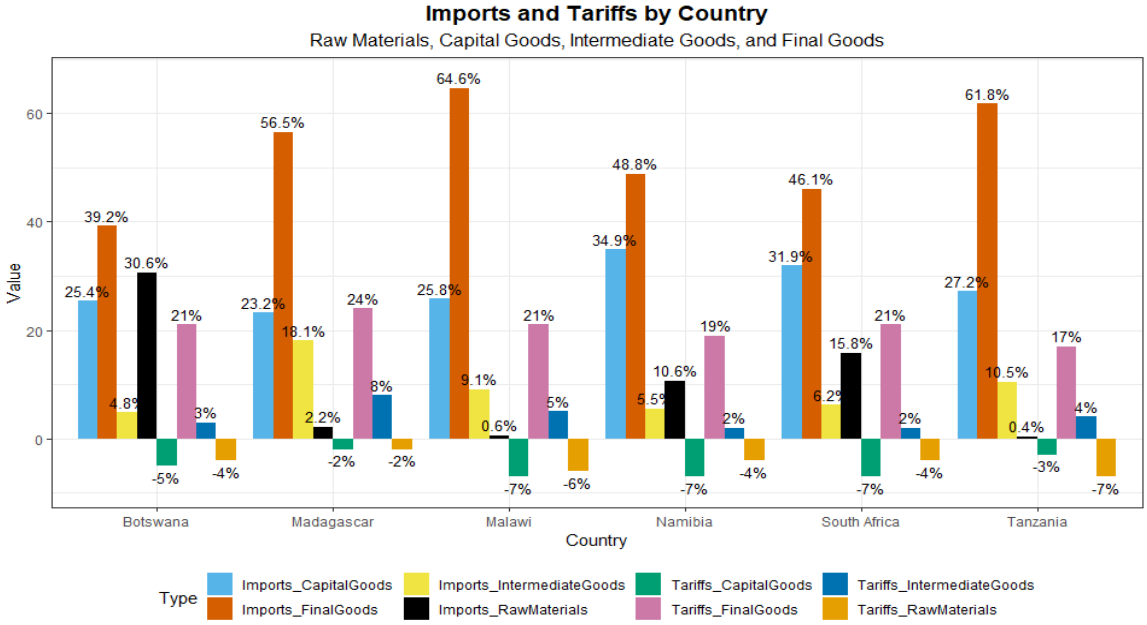


Figure 7.2 Total imports values and rate of tariff changes in percentages.

Author's calculation.

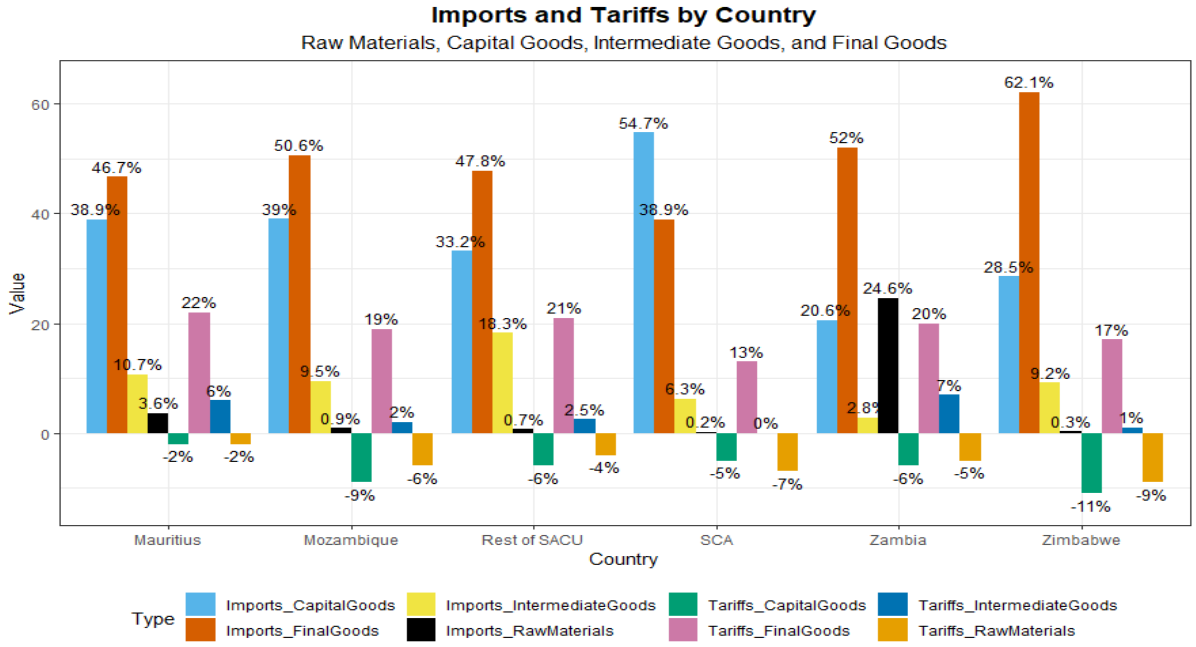


Figure 7.3 Total imports values and rate of tariff changes in percentages.

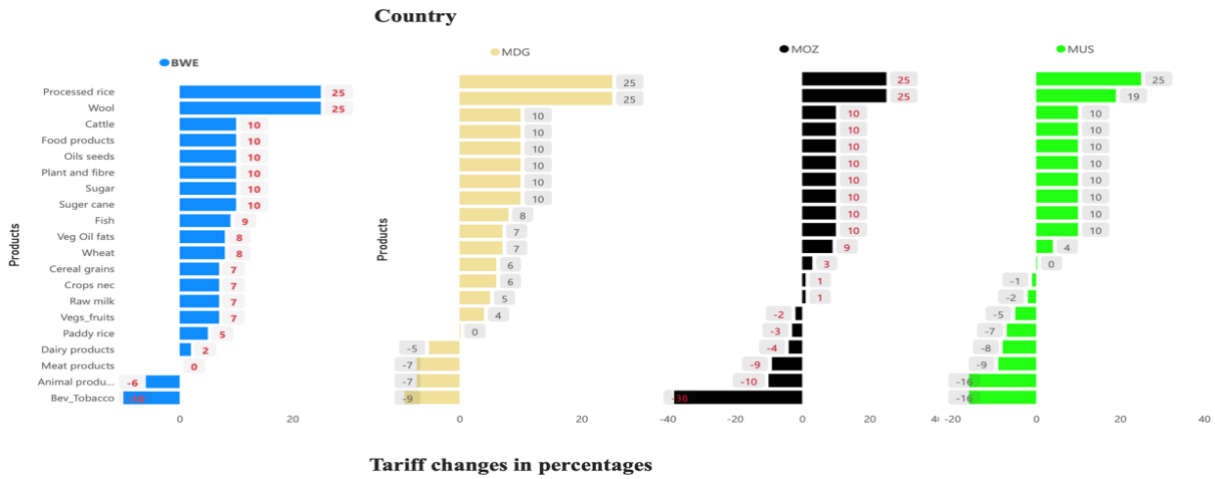
Author's calculation.

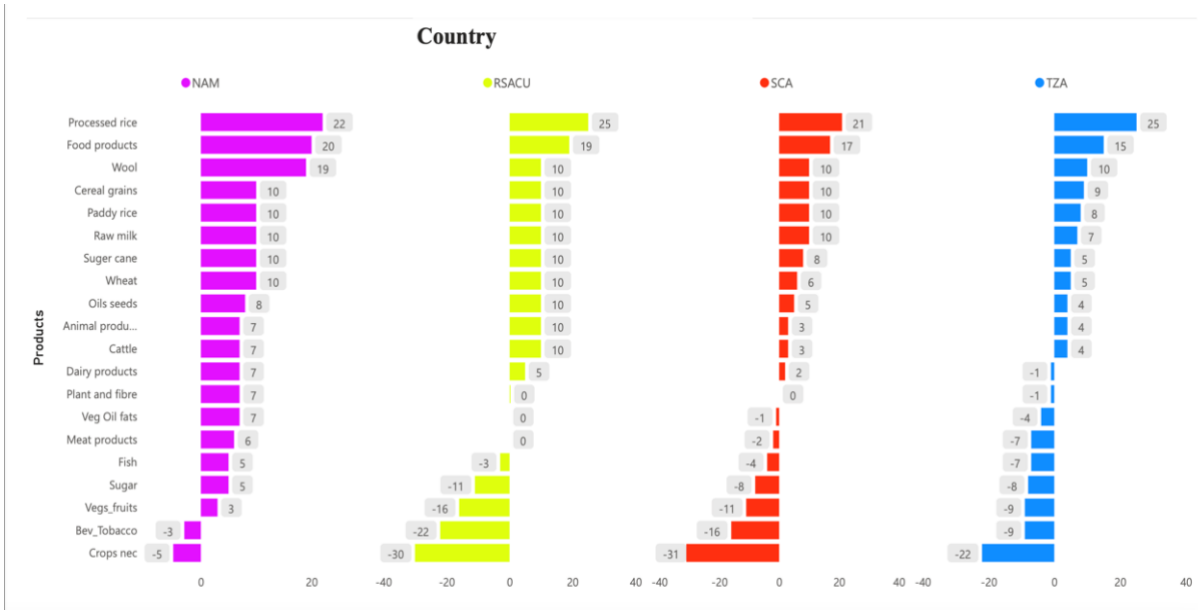
Indeed, to make a comparison, the initial tariffs were compiled using the MacMap database (version, v.2), a detailed tariff database that gives a "consistent ad-valorem equivalent measure of ad-valorem tariffs, specific tariffs, tariff rate quotas on a bilateral basis, accounting for all preferential agreements for 2007 for 190 nations and 240 exporters for more than 5000 product lines at the six-digit level of the 1996 Harmonized System" (Bout et.al. 2008). The process involved in analysing the tariff structure by category was conducted by mapping the official Nomenclature (CTN) to the HS6 1996 classification which is utilized in the 2007 Macmap-H6 V2 database. However, it was seen that there was no direct mapping in these specific product categories in the MacMap database. To overcome this limitation, the researcher opted to group the products based on the Broad Economic Categories (BEC) classification. Subsequently, weighted averages were calculated for each country within these grouped categories. By employing this approach, the researcher was able to derive meaningful insights and analyse the changes in tariff rates across different product categories for the SADC region.

Figures 3.4 presents the sector-level[15] tariff changes brought about by the implementation of the SADC Customs Union. Positive figures in the table indicate an increase in tariff rates, whereas negative figures represent a reduction in tariffs. Examining the sectors individually, provides various patterns. For instance, tariffs for paddy rice and wheat increased across all countries with Namibia, Malawi, Madagascar, Mauritius, Mozambique, RSACU and Zimbabwe experiencing the highest increase. Indeed, this also indicate a shift towards protectionism in these sectors leading to safeguarding domestic industries, promoting local industry and reducing reliance on imports. However, they could also limit market access for foreign goods, potentially leading to higher prices for consumers and reduced competitiveness.

On the other hand, tariff changes for cereal grains, vegetable and fruits, oil seeds, cattle, sheep and goats, animal products, raw milk, wool, fish, meat products, vegetables, oil and fats, dairy products, processed rice, food products, and beverages and tobacco were mixed, with some countries seeing increases and other facing reductions. Thus, the negative changes e.g. in Mozambique suggest a move towards liberalization and increased openness to international trade, leading to enhanced market integration and more cross border investments.

[15]This part presents only changes of tariffs in agri-food sectors.


Country
BWE
MDG
MOZ
MUS
Products
Processed rice
Wool
Cattle
Food products
Oils seeds
Plant and fibre
Sugar
Suger cane
Fish
Veg Oil fats
Wheat
Cereal grains
Crops nec
Raw milk
Vegs_fruits
Paddy rice
Dairy products
Meat products
Animal produ...
Bev_Tobacco
Tariff changes in percentages


Country
NAM
RSACU
SCA
TZA
Products
Processed rice
Food products
Wool
Cereal grains
Paddy rice
Raw milk
Suger cane
Wheat
Oils seeds
Animal produ...
Cattle
Dairy products
Plant and fibre
Veg Oil fats
Meat products
Fish
Sugar
Vegs_fruits
Bev_Tobacco
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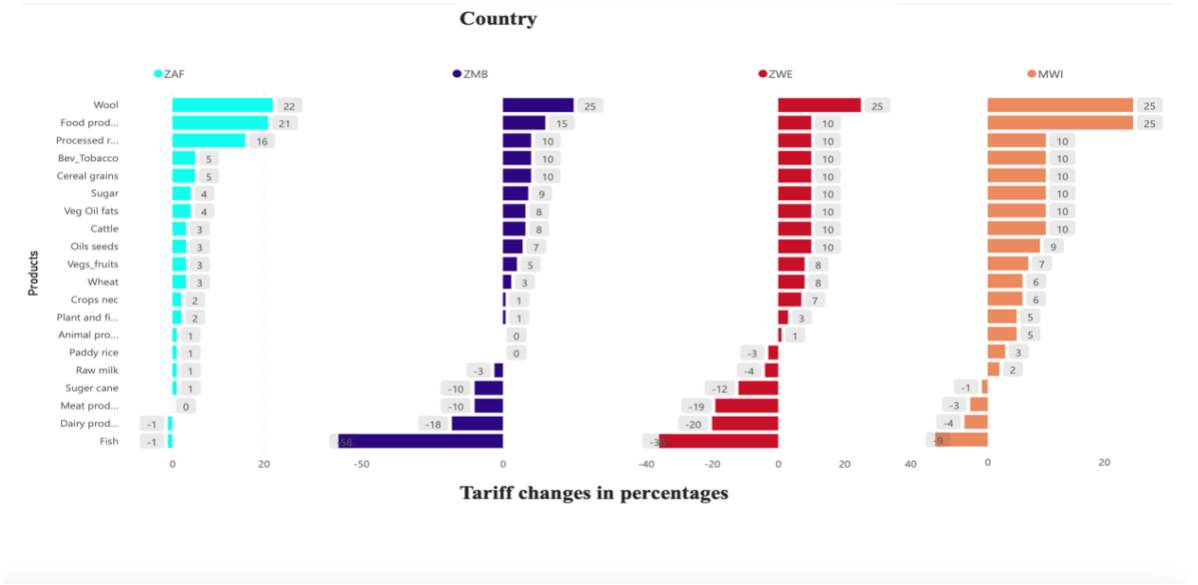
Country
ZAF
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Products
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Cereal grains
Sugar
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Oils seeds
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Animal pro...
Paddy rice
Raw milk
Suger cane
Meat prod...
Dairy prod...
Fish
Tariff changes in percentages

Notes: BWE=Botswana, MDG= Madagascar, MOZ= Mozambique, MUS= Mauritius, NAM= Namibia, TZA= Tanzania, ZAF= South Africa, ZMB= Zambia, ZWE= Zimbabwe and MWI= Malawi.

Figure 7.4 percentage changes in *tariff rates (percentage changes)* due to *CET.*

Source: Author's calculation

4. The related literature

This part discusses global value chains, regional trade agreements and the previous research on global value chains (GVCs). This subsection, therefore, starts by discussing the definitions and concepts of GVCs and their drivers as well as their relation to trade policy. It then discusses the concepts of regional trade agreements, their proliferation, and their role in enhancing global value chains. The literature concludes by showing the empirical evidence of the two main features of the research.

The concept of global value chains has been derived from the "value chain" context of analysis which highlights the companies' activities ranging from the start of production of goods to its final consumption (demand). These commodities and services are done by single or joint industries or countries. Even though Hirschman (1958) introduced the concept of backward and forward linkages, Porter (1985) then introduced the concept of the value chain. Initially, the concept focused on the industrial sector only, but in the early 1990s it developed further to include international trade characterized by more world trade integration. This resulted in the value chains being internationally segmented (Gereffi & Fernandez-Stark,2011). Therefore, through it, the countries saw an opportunity to intensify their comparative advantages.

From this, the policy environment and technological advancements have enhanced the term "global value chains" to explain the vivid trends of value chains across the globe since goods and services are now produced in different locations (De Backer and Miroudot, 2012); Antràs, 2020, Koopman et al, 2014, Baldwin, 2015, Blanchard, 2016 etc). Many scholars have since started to estimate the importance of participating in these (global) value chains and their results show that participation signifies income growth, employment rate and social welfare. For instance, UNCTAD (2013 and 2016) states that high participation in GVCs leads to domestic value-added which directly impacts GDP and employment whilst enhancing productive capacity through developed skills and infrastructure[16].

[16]The extent of the country's participation in global value chains measured by dissociating the value-added embodied in products based on sources of origin and final destinations. Under this method, literature has defined the foreign value added (FVA) and the indirect domestic value-added (DVX). (Lenzen, Moran, Kanemoto & Geschke, 2013) and the summation of the two shows total global value chain participation.

Additionally, the analysts note that even though the global value chains have both positive and negative results in developing economies, they enhance economic development, knowledge movement, job creation and the intensity of competitiveness (Sturgeon and Memedovic, 2010; Humphrey and Schmitz, 2002; Pahl and Timmer, 2019; Montalbano and Nenci, 2020 and World Bank, 2020).

Indeed, this research follows a general definition of GVCs[17] given by the Centre for Global Value Chains - at Duke University: "A global value chain describes the full range of activities undertaken to bring a product or service from its conception to its end use and how these activities are distributed over geographic space and across international borders" (DFAIT, 2011).

Even though many concepts can be used to explain the global value chains, Amador and (2014) noted that theoretically there are two key unrelated theories (fragmentation theory and the new trade theory) that can be used to explain GVC participation. The first theory - the fragmentation theory - focuses on the location of the production processes (Arndt & Kierzkowski, 2001; Cabral 2014; Jones & Kierzkowski, 1990). This has become a fundamental theory that is generally used by economists to establish the determinants of global value chains. The main concept of this theory is that the manufacturing process is fragmented into many pieces and set in various nations. Amador and Cabral (2014) note the importance of this fragmentation if: (1) "there is production cost saving in fragmented production blocks, whereby the firm can benefit from differences in location (lower labour and production costs) between the original position and a new position, (2) the incurred service link costs involved in connecting remotely located production blocks are lower and (3) the cost of network setups is smaller". Koopman and Wang (2014), on the other hand, note that the fragmentation theory posits that countries participate in GVCs based on their comparative advantage in specific stages of the production process. They emphasize that this theory helps explain how countries specialize in specific tasks or industries within the production network. For example, countries with abundant low-cost labour may specialize in labour-intensive production stages while those with advanced technology may focus on high value-added activities.

Empirical evidence has supported the fragmentation theory. Indeed, studies have examined specific industries, such as the electronics industry, to understand the patterns of fragmentation. For example, they (e.g., Miroudot and Sauvage, 2010) have explored how the production of

[17]Generally, literature labels GVC in different terms: "vertical specialisation", "outsourcing", "offshoring", "internationalisation of production", "global supply chains", "global production networks", "multi-stage production", "international fragmentation of production", etc, this research follows this literature and uses these terms to refer to GVCs.

electronic goods is spread across various countries, with each country specializing in specific tasks or stages of the production process. Thus, the analysis has also revealed the impact of fragmentation on trade flows and competitiveness, highlighting the connection between fragmented production and economic performance. Indeed, this has provided insights into the mechanisms and consequences of fragmentation within GVCs.

Scholars such as Antras and Chor (2022) illustrate how firm-level dynamics and trade frictions affect GVC participation, shedding light on the micro-foundation of fragmentation theory. Further to this, by consolidating and analysing research findings from various studies, Antraś (2020) in their article provide a comprehensive overview of how fragmentation theory contributes to our understanding of global value chains. Their work reinforces the significance of fragmentation theory as a tool for analysing the complexities of GVCs, trade patterns, and economic development, contributing to the advancement of international economics and trade policy research.

Baldwin (2015) has explored the intersection between fragmentation theory and the impact of information technology on globalization. Baldwin argues that information technology has been a driving force behind the convergence of fragmented production processes, enabling firms to coordinate and integrate activities across borders more efficiently. He highlights the role of advancements in communication and data sharing technologies in facilitating global value chains. Koopman and Wang (2012) have further highlighted that the fragmentation theory has motivated new approaches to measure a country's involvement in GVCs. They also discuss the development of various metrics, such as the "value-added trade" approach, which better captures the actual contribution of each country to the final product, accounting for the use of intermediate inputs for other countries.

Furthermore, Koopman and Wang (2014) highlight the connection between fragmentation theory and the concept of firm heterogeneity. They explain that GVC participation is often driven by a firm's decision to leverage its specific capabilities and efficiencies at various stages of production. Thus, more productive and efficient firms tend to be more involved in GVCs since they can benefit from accessing global markets and collaborating with other firms across borders. Antràs (2015) has further emphasized the role of the fragmentation theory in shaping trade structure and contractual arrangements between the firms that are engaged in global value chains.

Johnson (2018) has also contributed to the understanding of fragmentation theory in the context of GVCs. For example, he explores the link between fragmentation and industry-level competitiveness. Timmer's work provides empirical evidence and analytical frameworks that

help elucidate the relationship between production fragmentation and the competitiveness of industries within GVCs. He examines how different stages of production contribute to overall industry competitiveness and highlights the importance of upgrading capabilities to enhance the competitiveness of global markets.

The new trade theory, on the other hand, which was initially proposed by Melitz (2003) and further developed by Helpman, Melitz, and Yeaple (2004) centres on "product differentiation, monopolistic competition and firm heterogeneity". This theory provides insights into a firm's decisions regarding GVC integration and global trade relationships. Helpman et al (2004) note the difference between firms, especially by considering their efficiency[18]and fixed and variable costs which highlight an impetus to participate in global trade. Hence, only a few highly efficient firms can make enough profit to cover necessary trade costs for global operations.

Indeed, in line with the new trade theory, Melitz (2003) and Helpman et al (2004) show the effect of intra-sector firm heterogeneity on the decisions of a firm on how to service markets. Grossman and Helpman (2002), Antràs (2003) and Antràs (2020) underscore the choice between procuring intermediate products via vertical integration and procuring them from independent suppliers (outsourcing). Furthermore, Antràs (2020) articulates that heterogeneous producers of final products select contrasting organizational forms of intermediate product procurement that vary with regard to ownership structure and location.

Empirical research within the new trade theory has focused on understanding the determinants of firms' participation in GVCs and the implications for their competitiveness. Also, in the case of new trade theory, studies have examined firm-level data to assess the factors that influence firms' decisions to engage in GVCs such as productivity level, firm size, and the use of technology. For example, Alfaro et.al (2019) who highlight that firms with higher productivity are better equipped to withstand the effects of minimum wage increases and more likely to remain in the market, suggest that productivity plays a significant role in firms' competitiveness and sustainability. Thus, the findings suggest that firms with higher productivity and greater efficiency are more likely to participate in GVCs since they can capitalize on their comparative advantages to access global markets. Furthermore, countries with firms possessing higher productivity and efficiency tend to specialize in industries with a higher value-added content, contributing to their participation in GVCs. However, Sebastian (2012), reveal that firms with higher productivity levels tend to occupy central positions in the

[18]Firm size is also a crucial factor of the notion of efficiency. Small and medium-sized enterprises face resource constraints to a higher extent than large firms. Accordingly, the probability that small and medium firms will join GVCs as exporters or suppliers is lower than larger firms.

global trade network, indicating that their competitiveness plays a crucial role in their integration into GVCs.

Furthermore, Pol Antràs has also made a notable contribution to the new trade theory. He delves into the role of incomplete contracts and property rights in shaping the international organization of production within GVCs. Antràs suggests that the choice between vertical integration and outsourcing in influenced by contractual considerations and property rights, providing insights into the organizational forms of intermediate product procurement. On the other hand, Gereffi (2018), while focusing on the relationship between GVCs and economic development, argues that GVCs have redefined the contours of 21st century capitalism, reshaping industries and impacting global economic dynamics. He highlights the importance of understanding GVCs to design effective development strategies, emphasizing the need for countries to position themselves in global production networks to enhance their economic performance.

On the other side, GVCs have become increasingly complex and ubiquitous in today's interconnected world economy. Thus, understanding the driving forces behind GVCs is crucial for policy makers and businesses alike. Scholars such as Hillberry (2011) and Antràs (2020), as in the case of international trade, acknowledge the challenges in identifying separate drivers that impact the international fragmentation of production. However, an emerging consensus recognizes certain critical factors that underpin the evolution of GVCs which are often interlinked. Thus, a reduction in transport costs, information and communication costs, technological improvement, and a reduction in economic barriers to trade and capital flows are nowadays widely regarded as the crucial drivers[19] of global value chains. This is illustrated in the diagram below:

[19]Nevertheless, Amador and Cabral (2014) affirmed that the lack of data availability has affected the empirical evaluation of these key drivers.

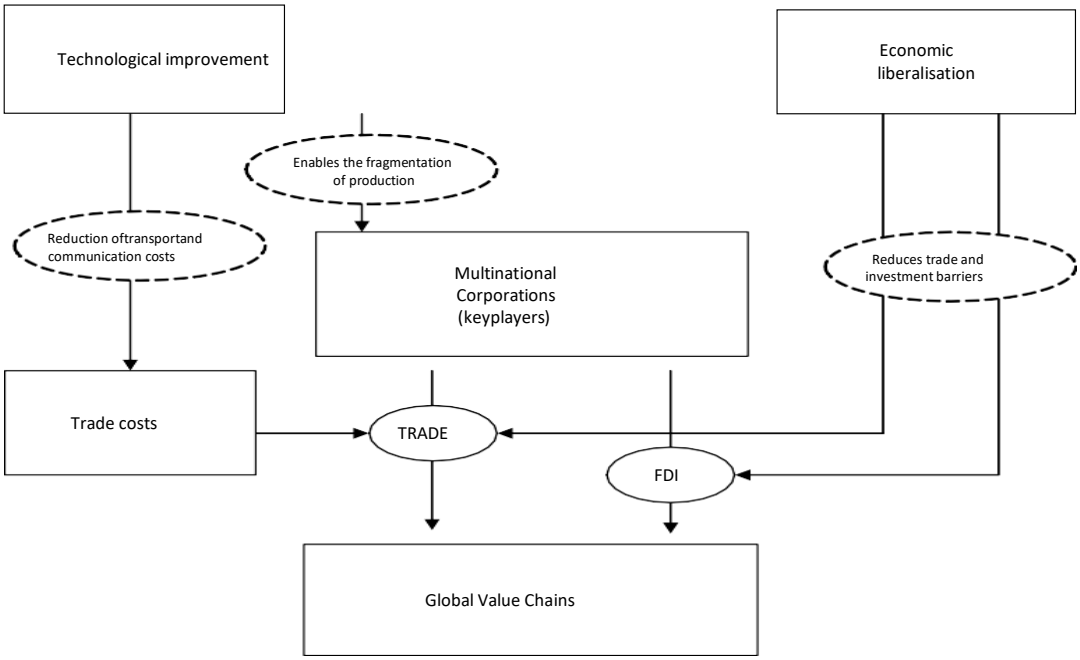

Figure 4.1 Schematic illustration of main drivers of GVCs.

Source: Amador and Cabral (2014).

Some scholars have an optimistic view that these illustrated factors (which have primal effects) promote the evolution of the global value chains and illustrate the main channels of influence of the several factors behind the development of GVCs[20]. For instance, Antràs (2020), Baldwin (2014), Blanchard et al (2016) and Cadestin et al (2016) note that the lowering of international trade costs together with tariff rates, transportation and trade costs and the time spent exchanging goods and reducing the managerial costs of offshoring are key factors that drive this process. Baldwin (2013) has added that trade-offs between specialization gains and coordination costs are also likely to affect the development of global supply chains.

Indeed, transportation costs have long been recognized as a crucial determinant of GVCs. Thus, recent studies, including Arvis et al. (2017) have further examined the relationship between transport infrastructure, logistics efficiency and GVC integration. Enhanced transport connectivity, facilitated by efficient ports, roads, and shipping networks, has been shown to positively influence a country's participation in GVCs. Not only does this enable the seamless movements of goods and intermediate inputs across borders, but it also enhances the overall efficiency of production processes within GVCs. Indeed, policy makers have increasingly focused on infrastructure development to capitalize on the opportunities offered by GVCs.

[20]Classical structure effects may also explain the development of GVCs but are not of interest here.

Similarly, advances in information and communication technologies (ICT) have revolutionized GVC dynamics. Adarov (2021) shows how ICT fosters efficient communication, coordination and information-sharing among firms operating in different countries. Seamless communication channels and real time data exchange allow companies to manage dispersed production activities more effectively. As a result, business can respond swiftly to changes in demand, optimize inventory levels, and streamline supply chain operations. Furthermore, the digitalization of trade documentation and customs procedures reduces administrative bottlenecks, further facilitating cross-border transaction.

Additionally, Blinder (2006) has highlighted that the available technology, especially in transportation, information and communications, largely determines what can be traded internationally and what cannot. He and Antràs (2020) have further added that technological improvements and trade liberalization lead to a lowering of costs of services which are also important in the development of global value chains. Hence, technological progress is important in the coordination of dispersed production activities and the management of highly complex GVCs because since these costs are relatively more important in internationally fragmented activities, potential savings arising from technological progress act as a driver of GVCs. Trade in services, such as research and development, design and marketing, often complement manufacturing activities with value chains.

As technological progress remains at the core of GVC evolution, recent works (e.g., Rehnberg and Ponte; 2016) have also explored the impact of emerging technologies, such as artificial intelligence, 5G, and the Internet of things, on the design and coordination of GVCs. Thus, these technologies drive GVCs in the sense that they allow greater automation, data analysis, and connectivity, revolutionizing production processes and supply chain management. Hence, technological advancement not only drives efficiency gains but also creates new opportunities for product customization and innovation. Additionally, technologies like such as block chain hold show promise for enhancing transparency and traceability in GVCs and, addressing concerns related to product quality and labour standards.

Baldwin (2012; 2016) on the other hand, highlights the importance of a reduction in economic and political barriers to trade in general and global value chains in particular. He notes the regionalization of the supply chain trade that is supported by a combination of deep preferential trade agreements, bilateral investments treaties (BITs) and unilateral reforms (that reduce economic barriers) by developing countries mostly accomplished outside the World Trade

Organisation[21] (WTO) (Baldwin, 2011). These WTO members, however, have also signed a comprehensive trade agreement known as the "Bali package" which promotes the lowering of global trade barriers. This package involves an effort to simplify the procedures for doing business across borders, including an agreement on trade facilitation, and also aims to improve market access for least-developed countries.

Furthermore, Zhao (2021) and Gereffi et al (2019) recognizes the complex interplay between FDI, intra-firm trade and GVC expansion. However, Cabral (2014), noted that while FDI and intra firm trade are not direct drivers of GVCs, they are the result of GVC expansion, and this reflects the role of multinational corporations in shaping these variables. Multinational companies often establish affiliates in different countries to access resources, markets and specialized skills, leading to increased intra-firm trade. The interaction of various factors, such as market access, regulatory environment and supply chain efficiency, influences FDI flows and intra-firm trade patterns, further influencing GVC dynamics.

In conclusion, the drivers of GVCs are multifaceted and interconnected. Empirical evidence from recent research underscores the crucial role of transportation and communication costs, technological progress, and the reduction of economic barriers in shaping GVCs. Additionally, the complex interplay of FDI and intra-firm trade with other driving force further enhances our understanding of GVC development. Thus, a comprehensive understanding of these drivers is essential for navigating the ever-evolving landscape of international trade and maximising the benefits of participation in GVCs.

4.1 Regional Trade Agreements[22] (RTAs) and global value chains

In this research, the broad definition of RTAs given by Amadheo (2021, p.1) is used: "trade agreements occur when two or more nations agree on the terms of trade between them. They determine the tariffs and duties that countries impose on imports and exports". These trade agreements, in addition to their traditional focus on tariffs, have now deepened to include investment and competition policy (Mattoo et al 2020 and Baldwin et al, 2020). Compared with bilateral and multilateral agreements, these regional trade agreements have increasingly grown around the world while bilateral and multilateral trade negotiations had made unprecedented progress since the 1990s (Cabral, 2014). Hence,

[21]Since its multilateral trading system, its principles are based on the existence of localised production within nations and not on internationally fragmented production systems (Baldwin,2011).

[22]This research treats the terms "regional trade agreements", "deep trade agreements" and "preferential trade agreements" as having the same meaning following Baldwin who identifies all these groups of agreements as regional trade agreements.

as Maggi and Ossa (2020) noted, the rise of protectionism in some regions and challenges in multilateral trading system have also contributed to increases in RTAs since it has led countries to explore alternative avenues for trade cooperation, including deepening regional economic integration through deep trade agreements.

GVCs and trade agreements are two sides of the same coin in that the directions of the most favourable trade agreements are determined not only by the volume and intensity of international trade, but also by the GVC structure of countries. Indeed, Bekkers et al. (2016) note that the structure of GVCs and the distribution of gains from trade can influence the incentives for countries to participate in RTAs and engage in multilateral trade negotiations. Thus, according to Fontagnè et al (2018), the degree of integration within GVCs, in turn, affects the extent to which firms and industries benefit from trade agreements. On the one hand, GVCs as an internationally dispersed production system have changed the pattern of international trade and cross-border investment for goods. Thus, intermediate goods traded in parts and components have increased almost eight times in GVCs between 1990 and 2018.

Researchers, policymakers and the general public have shown interest in whether the deepening of trade agreements can boost the participation and integration of partner countries in GVCs. It is also thought that a trade agreement with one or more policy areas can significantly increase the domestic and foreign value-added of intermediates as suppliers link with forward and backward global value chains respectively. Thus, they suggest that in regional and global production processes, policymakers can use traditional agreements to anchor national producers to the global and regional production process (Baldwin and Lopez Gonzalez, 2014; Laget et al, 2020). Additionally, Felbermayr et al., (2017) and Berger et al (2016) noted that comprehensive trade agreements can enhance the participation of domestic firms in international production networks by reducing barriers to trade and investment and creating a predictable business environment. Hufbauer et al., 2013 also noted that deepening RTAs can lead to increased FDI flows as companies seek to establish affiliates in partner countries to access resources, markets and skilled labour.

In regional and global production processes, policy makers utilize RTAs as mechanisms to anchor national producers to the GVCs. The incorporation of provisions related to investments foster a conducive environment for business operations within GVCs (Garcia-Herrero 2022). These agreements help create stable and predictable trade rules, encouraging companies to participate in international production networks and take advantage of economies of scale and comparative advantages (Mattoo et al, 2020). However, the effectiveness of RTAs in shaping

GVCs is contingent on various factors beyond the provisions of the agreements. The success of GVC participation depends on the economic, institutional and cultural environment of the partner countries in the RTAs (Coulibaly et al (2022). Thus, trust in an open and cooperative system is essential for sustained GVC engagement. Adequate infrastructure, legal frameworks, and institutional support are critical to ensuring seamless cross border transactions and facilitating the movement of goods and services within GVCs (Wijesinghe et.al; 2022).

Moreover, the ongoing debate surrounding the multilateral trading system, and the rise of trade protectionism may also impact dynamics between RTAs and GVCs. As countries face increasing uncertainty, they may seek to solidify their positions within regional blocs through deeper trade agreements (Kawai et al., 2017). This trend can potentially lead to a more fragmented global trade environment, with varying degrees of integration across different regions. However, OECD (2020) have raised concerns over an effective implementation and enforcement of these trade agreements, particularly non-tariff measures, which can be complex since it involves coordination across different regulatory systems and national institutions. Moreover, the unequal distribution of benefits from GVC participation among countries can lead to varying degrees of enthusiasm for deeper trade agreements. Indeed, Borin and Mancini (2019) articulate that developing countries may face capacity constraints and adjustments costs when fully exploiting the opportunities offered by GVCs, warranting targeted support and capacity-building measures.

Bruhn (2014) has noted that the proliferation of deep trade agreements not only brings opportunities but also risks. On a positive level, these deep trade agreements consider the growing importance of regional and global production networks and encourage further integration by eliminating tariff and non-tariff barriers to trade and investment. Developing countries may benefit from a more stable and reliable trade and investment environment promoted through deep trade agreements (Ibrahim, 2020). Furthermore, Rocha and Ruta (2022) noted that trade agreements offer a pathway to enhance trade, fostering greater integration and advancement within global value chains. This, in turn, enhances economic performance and contributes significantly to overall economic growth and development. On the contrary, the extensive coverage of behind-the-border regulations, affecting far more policy areas than just directly trade-related issues, can tie governments' hands when they are trying to pursue a national development strategy. For example, some deep preferential trade agreements include provisions on dispute settlement mechanisms that grant foreign investors the right to sue states before an international arbitration court and demand significant compensation (Bruhn, 2014).

In addition, the evolution of global value chains and the desire to regulate trade barriers regulations have definitely contributed to the recent proliferation of deep trade agreements (Dingra et al, 2016). In many cases, preferential trade agreement provisions go much further than the multilateral World Trade Organization (WTO) rules. This is because they regulate not only trade between member states but also areas such as investment, industrial standards, competition policy, intellectual property rights, labour standards and environmental protection (Horn et al, 2010; Blanchard, 2017).

These deep trade agreements include many contexts which are relevant to global value chains, and they influence the movement of firms to offshore or outsource a specific task to developing countries (Antràs, 2020; Dhingra, 2018). These contexts, according to Bruhn (2014) and Blanchard (2016), include (i) elimination of tariffs, (ii) services trade, (iii) investments, (iv) standards, (v) public procurement, (vi) competition and (vii) intellectual property rights (UNCTAD, 2013b; Backer, 2013; Hoekman, 2014; Miroudot, 2011, Rocha and Ruta 2022; Eugster et.al, 2022). Baldwin (2013) adds that these regional trade agreements act as a signalling and commitment device that can remedy local institutions' deficiencies. Hence, there is no doubt that these trade agreements have also proliferated the global value chains aspect as well.

The inclusion of such extensive provisions in deep trade agreements reflects recognition of the interconnectedness of international trade and production activities. As global value chains have become more increasingly intricate and vital for economic development, policy makers have sought to address the complexities of cross border transactions and foster an enabling environment for business engaged in GVCs. By encompassing areas outside traditional trade, these trade agreements facilitate deeper integration of economies, supporting the smooth flow of goods, services and investments across borders.

However, it is essential to strike a balance between reaping the benefits of GVC participation and safeguarding national interests and policy flexibility. As GVCs become more prominent, governments must carefully consider the implications of deep trade agreements provisions on their ability to pursue strategic economic goals. Ensuring that these agreements promote sustainable and inclusive economic development while respecting national policy space remains a critical challenge.

In summary, the relationship between RTAs and GVCs is multifaceted, with each one influencing and shaping the other. RTAs have evolved to reflect the changing nature of trade and production in the global economy, seeking to create an environment for firms engaged

in GVCs that is conducive to operating seamlessly across borders. Thus, deepening trade agreements can enhance GVC integration by reducing trade costs, facilitating FDI investment and promoting deeper economic cooperation among partner countries. Since countries navigate the complexities of international trade and economic integration, a coordinated and cooperative approach is essential to harnessing the benefits of RTAs and GVCs for sustainable and inclusive development. Furthermore, the proliferation of deep trade agreements has been influenced by the evolving nature of global value chains and the need to regulate an array of trade-related and non-trade-related aspects. These agreements serve as a vital mechanism for facilitating deeper economic integration, fostering innovation, and enhancing competitiveness in the global economy (Mattoo et al, 2020). However, policy makers must be mindful of the potential implications of these agreements on national policy autonomy and carefully design provisions that strike a balance between harnessing the benefits of GVCs and preserving their country's policy flexibility and development priorities. A comprehensive understanding of the intricate relationship between deep trade agreements and GVCs is essential for effectively navigating the complexities of modern international trade and shaping a prosperous and sustainable global economic landscape.

As for the purposes of trade agreements (deep provisions for global value chains), the world of global value chains has heightened the modification of traditional trade policy[23] as goods cross borders multiple times and hence even small tariffs add up to significant trade costs. The magnificent effect is reinforced by the tariffs that are applied to gross imports - both to the value-added part and to the direct exporter who is taxed for the parts that she has not produced. Koopman et al. (2010) estimate that such effects are more magnified in developing countries because their tariffs on intermediate imports are higher than those of developed countries[24]. Hence, this state of international fragmentation of production has led to the world's tariffs being re-assessed and the regional trade agreements could not be left out as a tool for this process.

[23]In this respect, scholarly contributions noted that the emergence of GVCs has influenced the nature and determinants of trade patterns between different countries (Ari Van Assche; Byron Ganges 2017). Blanchard et.al (2017), for example, argued that, by removing the distinction between final goods manufactured at home and those that are manufactured abroad, global value chains are simply modifying the contours of trade policy. Therefore, the rising of global value chains has modified (or is modifying) both the economic and political contours of trade protection. Hence, this automatically shows how global value chains are amplifying the effects of tariffs [OECD (2013); Curran & Nadvi, (2015); Gereffi, (2014); Horner & Nadvi, (2018); Baldwin (2019) & Blancard (2019)].

[24]For example, Kowalski, P (2015) and Ibrahim A, Zeidy (2020) noted that some countries in EAC such as the Democratic Republic of Congo, Cameroon, Djibouti, Rwanda and Nigeria would benefit from the trade policy reform (reducing their tariffs) and this would enhance their participation in global value chains.

Tariff barriers have become more expensive and more harmful because they negatively affect the domestic comparative advantage (OECD (2013; 2016). Whether a company is competitive enough to export several products hinges to a larger extent on its ability to source cheap inputs. In final goods, tariffs harm consumers by increasing prices whilst protecting domestic producers. Additionally, OECD (2013) notes that the level of the thickness of a country's border complicates and accumulates high costs for the global sourcing of inputs. Therefore, tariffs are no longer just "beggar your neighbour" but also "beggar thyself" policies (Miroudot, 2013). Hence, IMF (2013), Blanchard (2016) and Fernandes et al (2022) viewed them as being negatively associated with GVC participation. Thus, according to Rocha and Ruta (2022), by reducing these tariffs and improving market access, these agreements can lead to increased trade volumes and greater integration within GVCs. Indeed, de Melo et al (2020) and Cadot et al (2012) highlight that African countries that have strategically reformed their trade policies to accommodate GVCs principles have experienced positive outcomes in terms of supply chain integration and GVC participation.

As per the above scholarly views, GVCs can now be seen as a "new argument for trade liberalization" (OECD, 2013). Scholars such as Blanchard (2016), Cadestin et al (2016) and Baldwin (2019) note that the removal of these tariffs is the starting point in the world of global value chains since they are overly burdensome to the products which cross borders multiple times. Hence, Blanchard et al (2017) and the World Bank (2019a) encouraged governments to pay more attention to this since global value chains are transfiguring the consequences of tariffs and other border barriers[25]. Ibrahim (2020) specifically mentioned that the importance of the removal of these tariff barriers by African countries lies in reaping the benefits of the global value chains. Additionally, Blanchard (2010) noted the importance of easing the customs procedures (since they may be blocking or delaying the processing of goods at borders) especially if the production stages are scattered over different countries to enjoy its benefits.

There are several examples in Africa of strategizing policies that include global value chains concepts and these include the Southern African Customs Union (SACU) region which has re-strategized trade policy to support regional and global value chains by deepening regional value

[25]These may include the behind border policies whereby governments may face credibility problems for behind-the-border measures in the context of GVCs and the costs created by coordination externalities (such as heterogeneous regulations) may be higher in the presence of cross-border production. These spillovers and credibility concerns generate the demand for deeper forms of integration **(**Hoffman, Osnago and Ruta, 2017). Blanchard et.al (2017) estimated that trade agreements have stimulated the creation of GVCs by internalizing cross-border policy externalities, lowering trade costs, and providing deeper common disciplines that facilitate the operation of economic activities spanning multiple borders.

chain integration; broadening the SACU's regional scope through the Tripartite Free Trade Agreement (TFTA) encompassing other African regions (e.g. COMESA and EAC) and extending and deepening preferential agreements through the Economic Partnership Agreement (EPA) with the EU. SACU's average applied tariffs[26] were reduced from 27.5 % to 8.2% and most of its tariff lines are now duty-free (WTO, 2023).

There is also the East African Community (EAC) which since 2018 has begun negotiations to review its Common External Tariff (CET) to promote and upgrade its value chain positioning (Jaimelo de Melo and Twum 2020). One of their discussions is about the adoption of a longer tariff band structure to "facilitate the production processes with strong forward and backward linkages, in particular, products of strategic regional interest" (EAC, 2018). The EAC has then implemented a regional customs management system to streamline trade procedures and reduce trade costs.

The Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union (UEMOA) have developed a comprehensive trade policy framework to improve the region's supply chain network (Engel and Jouanjean, 2013). The process has further advanced in UEMOA where they established the surveillance mechanism for macroeconomic convergence, a customs union and the abolition of tariffs or quotas on intraregional trade in domestic products. This confirms the IMF's (2013) idea of the role of international fragmentation of production in limiting the use of tariffs and other protection measures on parts and components. Hence, the move by these trade agreements undoubtedly contributes to the dropping of applied tariffs which, according to Baldwin and Lopez-Gonzalez (2014), can be interpreted as unilateral or bilateral efforts to facilitate integration into global value chains.[27]

Furthermore, African countries are recognizing the importance of promoting regional value chain integration as a steppingstone towards broader global integration. For example, COMESA is actively pursuing initiatives to reduce trade barriers including tariffs, and enhance connectivity and infrastructure (COMESA, 2022). Such efforts are seen as instrumental in facilitating the movements of goods, services and people across borders, creating larger

[26]Effective protection has been significantly reduced on most intermediate products except for clothing & textiles, automotive, and leather.

[27]It is also important to note that non-tariff barriers are also harmful to global value chains participations. UNCTAD (2013d) noted that trade gains from border procedures are higher than those from tariff reductions. Behind-the-border policies can also have a significant impact on GVC participation. UNCTAD (2013a) estimated that an improvement in government effectiveness in low-income countries to the level of that in middle-income countries would increase exports of intermediates by almost 50%. To give an example, the enforcement of contracts and intellectual property rights plays a crucial role, especially when products are characterized by a large share of research and development (R&D) or intellectual property involved in their content (Dean 2013, Blanchard 2016; Hoffman, Osnago and Ruta, 2017).

markets and fostering regional value chains. Furthermore, the Tripartite Free Trade Agreement (TFAT) is another significant initiative that aims to promote regional and global value chains in Africa. The TFTA encompasses various African regions including EAC, COMESSA and SADC. By facilitating trade and reducing barriers to regional integration, the TFTA aims to enhance cross border economic activities and promote the development of regional value chains (African Union, 2015). The agreement creates a larger market for participating countries which can lead to increased economies of scale, enhanced productivity and improved competitiveness in the global market.

Furthermore, in addition to regional trade agreements and policy reforms, it is also important to note that African countries are also exploring sector-specific strategies to capitalize on the potential of global value chains. The African Continental Free Trade (AfCFTA), which came into effect in January 2021, is a significant milestone in this regard. AfCFTA aims to create a single market for goods and services across the continent, promoting intra-African trade and fostering industrial development (African Union, 2019). By eliminating tariffs on 90% of goods traded in Africa, AfCFTA seeks to enhance regional value chain integration and attract investments into key sectors, contributing to job creation and economic diversification (Andrew and Hippolyte, 2021).

Empirically, Jaimelo de Melo et al. (2020) and Engel and Jouanjean (2013) have examined the experiences of African countries that strategically reformed their trade policies to accommodate value chain principles. Their studies provide valuable case studies of regional trade agreements in Africa, demonstrating the positive outcomes in terms of supply chain integration and GVC participation. These examples underscore the effectiveness of deep trade agreements in promoting regional and global value chain integration in developing regions.

Therefore, the importance of global value chains implies that tariff barriers to trade matter a great deal especially when integrating developing countries into value chains. Baldwin (2012) notes that “protectionism is a distraction as far as developing nations are concerned”. One way of addressing tariff issues underpinning global value chain trade is the signing of trade agreements (Fernandes et al, 2022). These trade agreements, as noted by Salvatici (2020) and Antras (2020), are potentially reshaping the geography of production due to the productivity gains associated with the reduced prices of imported inputs.

4.2 The customs union

A customs union is defined as an agreement between neighbouring countries to remove trade barriers, reduce customs duty and eliminate quotas. They differ from free trade agreements in

that they impose a common external tariff on non-member countries (meaning that goods from non-member countries have to pay a duty fee but once they enter the union, they can freely trade without any further added tariffs). Their main purpose is to promote free trade among member states, reduce the administrative and financial encumbrance of trade barriers, and promote economic cooperation between member countries (Krugman, 1991). Thus, customs union have been a subject of interest for trade economists and policy makers due to their potential to foster economic integration among member countries.

Indeed, one of the significant advantages of a customs union is the creation of a larger and more integrated market for member countries which can lead to economies of scale, increased competition and enhanced efficiency (Balassa, 1962). By eliminating internal tariffs, customs union also encourage intra-regional trade and investment which can boost economic growth and development (Baier et al., 2017). Grobbelaar and Meyer (2017) added that these efforts to remove trade barriers through customs union are particularly significant in the context of global value chains where timely and cost-effective movement of goods and inputs is essential for competitiveness.

However, the literature also explores the potential challenges and drawbacks of customs unions. For instance, the establishment of a common external tariff can limit member countries' flexibility in pursuing independent trade policies and responding to external shocks (Egger et al., 2008; Staiger and Sykes, 2017). Additionally, the distribution of benefits and costs within customs union may not be equitable among member countries, leading to potential conflicts and disputes (Bagwell and Staiger, 2002).

By creating a larger and more integrated market, customs union can attract foreign direct investment and promote the relocation of production activities to member countries, leading to deeper integration within GVCs (Fontagnè and Freudenberg, 2018; Mattoo et al., 2017). However, Zongwe and Masumbe, (2021) and Okubo et al, (2019) highlight that the effectiveness of customs union in promoting GVC participation depends on various factors such as the level of integration among member countries, the existence of non-tariff barriers, and the overall trade and investment environment. Additionally, Zongwe and Masumbe (2021) indicate that the impact of customs unions on GVC participation may differ depending on the structure and composition of GVCs within the region.

There are indeed different theoretical frames on the customs union. Viner (1950), the father of customs union literature, points out that even though regional trade agreements eliminate or reduce tariffs, they do not necessarily bring positive results to its members. For a clearer

understanding of this ambiguity, he established the trade creation[28]-trade diversion[29] concept[30]. He and his predecessors referred to regional trade agreements that promote trade creation as being beneficial[31] while those that promote trade diversion were unfavourable[32]. However, other scholars, for example Bhagwati (1999), were not convinced by these concepts and developed alternative approaches including the trade volume of trade approach where the impacts of trade are summarized by considering both the effects on terms of trade (prices) and trade volumes.

Spyropoulos (1999) argues that the process of creating a customs union gives rise to two distinct effects that influence the determination of the optimal external tariff for the union. Firstly, there is the "tariff reduction effect" which occurs when countries enter into customs union and commit to reduce or eliminate tariffs on trade within the union. This commitment is aimed at promoting a higher degree of economic integration among the member countries, streamlining trade flows and fostering cooperation. Indeed, by removing barriers to intra-union trade, the tariff reduction effect seeks to boost economic efficiency and create a more seamless trading environment for the participating nation. Secondly, there is the "effect that enhances the increase of tariffs". This phenomenon arises due to the customs union's impact on trade with non-member countries. When the members of the customs union import the same product from outside the union, they collectively negotiate as a single entity with non-member

[28]Trade creation refers to the growth in trade between countries that are part of a trading bloc's establishment or enlargement. The formation or expansion of the trading bloc leads to the elimination of trade barriers which in turn, enables countries to specialize in areas where they have a comparative advantage. As a result, prices tend to decrease, and this fosters an expansion of trade among the member countries. In other words, trade creation results in a shift of consumption from a high-cost producer to a low-cost producer, leading to an expansion of trade.

[29] Trade diversion occurs when the establishment of a trading bloc leads to a reduction in trade with low -cost trading bloc members. In other words, the formation of the trading bloc causes a shift in trade patterns away from more efficient and cheaper non-member trading partners towards less efficient and relatively costlier member countries within the bloc.

[30]However, Guillaume et.al (2021, pg. 1) argued that "his view is mostly inspired by a world of trade in final goods where consumers shop for the lowest prices, inclusive of tariffs, for their purchases. However, it misses a key feature of today's production process: with GVCs, trade agreements also facilitate firms' access to lower-priced inputs, which in turn impacts their competitiveness both at home and in other markets".

[31] Beneficial in the sense that it reduces trade barriers and fosters increased trade among its member countries, typically resulting in enhanced economic efficiency and benefits.

[32] Unfavourable in the sense that it signifies that the agreement leads member nations to favour less efficient internal trade partners at the expense of more efficient global ones.

countries. This joint bargaining power can lead to higher external tariffs on those specific products since the customs union seeks to protect its internal market and create advantage for its member countries. The interplay between these two effects can create a delicate balancing act when determining the optimal external tariff for the customs union.

Furthermore, Abrego and Riezman (2003) argued that when a customs union is established, it leads to significant improvements in trade flows (increase in trade– imports and exports) among its member states. Their simulations indicate that transitioning from free trade to a customs union result in a substantial increase in the trade volume for member countries, with a rise of nearly 90%. In addition, the formation of the customs union causes a reduction in trade between member countries and the rest of the world. This effect is a natural consequence of the customs union's commitment to reducing internal trade barriers and promoting trade within the union. As a result, member countries tend to engage more in trade with each other, leading to a decrease in trade with non-member countries. Furthermore, Abrego and Riezman (2003) reveal that there are several positive outcomes for the member countries. Thus, the establishment of the customs union enhances the welfare of the member nations and positively impact the terms of trade[33] for its countries with the rest of the world.

Additionally, Kemp and WAN's (1976, p1) theorem holds significant implications for an analysis of customs unions and their potential welfare effects. The theorem establishes the existence of Pareto-improving customs unions wherein each member country can experience welfare gains without inflicting losses on any other member. However, the realization of these welfare gains is contingent upon the behaviour and responses of non-member countries. Therefore, even though the theorem provides theoretical supports for the idea that a customs union, if properly designed, can unilaterally guarantee welfare improvements for all its participating members, the actual outcomes hinge on the interplay of economic and political factors with non-member nations.

Even though Krugman (1991) expressed concerns regarding the potential harmfulness of the common external tariffs to the member countries of a customs union, he also acknowledged that a customs union could be beneficial if it adjusted its tariffs optimally. On the other hand, Richardson (1995), presented a different perspective. He indicated that a customs union cannot always guarantee mutual gains for all its member countries. Thus, these differing viewpoints among different scholars highlight the complexities involved in evaluating the impacts of

[33]This means that the collective bargaining power of the customs union members in trade negotiations with non-member countries allows them to secure more favourable terms of trade for their exports and imports.

customs union on member countries. Hence, while an optimally managed customs union could bring advantages, such as reduced trade barriers within the region and improved economic integration, there may still be challenges in ensuring that all members experience mutual gains. Indeed, factors such as the distribution of benefits among member countries, the external trade environment and the varying economic conditions of individual nations can influence the overall outcomes of the customs union. As a result, the debate surrounding customs union' effectiveness and their impact on member countries continue to be an important area of research and analysis especially in international economics.

From an empirical point of view, Lawal et al (2021), by analysing three customs unions - the East African Community (EAC), the Southern African Customs Union (SACU) and the Economic Community of West African States (ECOWAS) - from 2000 to 2015, estimated that the regional trade agreements are not significant drivers of the economic upgrading of their members in global value chains. However, their research also highlights an interesting finding regarding one-period lagged GVC backward participation. They indicate that the level of involvement and integration of member countries in GVCs in the previous period (lagged one period) has a significant impact on their economic upgrading. Thus, the preceding participation in GVCs positively influence economic upgrading and value-added activities of the countries in a subsequent period.

By estimating the impact of COMESA free trade areas and customs unions on the economies of member countries, Karingi et al (2002), also observed that even though the free trade agreements brought economic benefits to the member countries, customs unions emerged as the more favourable option. Specifically, the customs union signatories experience positive impacts on real income and poverty reduction. They also noted that the effects of the customs unions depend on whether the average rate of the tariff which is already in place is above or below the Common External Rate. If the average of the existing tariff rate is high, it means that the opportunities for creating a customs union are high too. Hence, customs unions create an opportunity for non-member countries to export to the COMESA region. Additionally, Dimaranan and Mevel (2008) estimated that customs unions would result in an overall expansion of trade in the region. However, it would also hurt some members in terms of lost tax revenue and significant terms of trade losses.

Summarily, different theories suggest that customs unions somehow provide benefits to member countries including welfare gains, improvement of trade volumes and terms of trade or trade. The literature also highlights the importance of customs union in promoting global value chains and regional economic integration. However, while customs unions offer various

advantages to member countries, some scholars have also articulated the negativity of the customs unions to its signatories (Richardson, 1995; Kurgman, 1991; Lawal, 2021) related to trade diversion, trade facilitation and ensuring equitable distribution of benefits among member countries. Thus, policy makers in African customs unions and beyond continue to grapple with these complexities as they strive to harness the potential of customs union for sustainable and inclusive economic development.

4.3. Previous research- empirical evidence

Although literature that analyses Africa trade agreements is very limited, the available literature shows that different scholars analyse economic effects of trade agreements similar to the SADC trade agreement and use various models and techniques that vary from gravity to non-gravity models including CGE modelling. Indeed, Balaki and Mamba (2022) indicated that some studies have assessed the effects of deep trade agreements on GVCs using the gravity framework. Thus, Peridy and Abedini (2014) conducted a comprehensive analysis of the Greater Arab Free trade Area (GAFTA) among fourteen Arab countries by utilizing a new gravity model combined with supply-demand export equations in an environment of imperfect competition. To address the issue of endogeneity, the researchers applied instrumental Generalised Methods of Moments (GMM) panel estimation. They concluded that GAFTA countries could potentially benefit from deeper regional trade integration since the existing benefits of GAFTA were limited.

Boffa et al. (2018) evaluated the impact of deep trade agreements on GVCs using the standard gravity model framework. By using ordinary least squares (OLS) and Poisson Pseudo Maximum Likelihood (PPML) techniques, they found that trade agreements had more positive effects on GVCs than shallow regional trade agreements and bilateral investments treaties. Zhang et al. (2021) also used gravity model to assess the effects of FTA on member states' GVCs for the period between 2000–2004, and they found that deep FTAs positively affect both the total trade and the member states' foreign value added. Their results also demonstrate that the varying levels of economic development and the specific design and features of the FTAs can lead to diverse outcomes for different countries engaged in these agreements. Lastly, Laget et al (2020) examined the impact of deep preferential trade agreements (PTAs) on GVCs. They revealed a fascinating heterogeneity effect, indicating that the influence of deep PTAs on GVCs differed substantially across countries and their respective trade networks. This finding highlighted the complexity of the relationship between deep PTAs and the GVCs, with potential implications for international trade patterns and economic integration.

Other works have explored frameworks other than the gravity model. Indeed, Karingi et.al (2002) used the GTAP model (together with the GTAP 5 database) to conduct a comprehensive analysis to assess the potential implications of a COMESA FTA and a COMESSA customs union. The researchers observed a positive economic gain for all regions under the scenario of free trade. As for the customs union's scenario, with regards to welfare outcomes, the researchers observed that all member countries would experience increased real incomes. With their results, the scholars recommended that COMESA should be moved from the FTA to the customs union since it increase the real income of all member countries. Additionally, Jonathan et al (2009) using the MIRAGE model which relies on the GTAP database for multisectoral, multiregional data indicated that the established COMESA customs union is expected to have a mixed effect on its member countries. Some nations may experience adverse impacts in terms of reduced tariff revenue and real income losses, while others may benefit from the union.

Furthermore, Ceong et al (2013) used the MIRAGE model to assess the possible effects of the AfCFTA on agriculture. Their main results indicate that while at global level, the agreement would enhance the total exports of African countries including agriculture and food exports, it would also positively affect real income, wages and employment creation. Mhonyera and Meyer (2023) have also quantitatively evaluated the potential welfare and trade effects of the AfCFTA on sectors in Nigeria and South Africa, by combining the decision support model (DSM) with the GTAP CGE model which exhibit sustained export potential within the AfCFTA member states. By considering two scenarios of AfCFTA membership, the simulation outcomes indicate positive welfare gains for both Nigeria and South Africa originating from the GTAP sectors identified as having sustainable export opportunities among the AfCFTA member nations. The results also confirm that the trade deal is projected to be net-trade-creating, resulting in a net trade of USD 2.15 billion at global level.

In addition, other scholars have used partial equilibrium models to analyse the impacts of RTA on individual countries. For example, Roningen and de Rosa (2003) analysed the impacts of several membership options under the EU-EPA negotiations for Zambia. Their results suggested that Zambia was better off as a member of COMESA FTA than SADC FTA. Conversely, Kaluwa et al. (2005) employed a partial equilibrium model to evaluate the effects of different COMESA common external tariff (CET) specifications on Malawi. The researchers pointed out that adopting a 0 percent CET rate for intermediate goods, instead of a10 percent rate, would be more advantageous for Malawi. This is particularly significant considering Malawi's trade relations with South Africa. Indeed, this evidence highlights the

diverse empirical methodologies[34] used to examine the impact of regional trade agreements. Although the individual research outcomes exhibit some degree of variation, a prevailing consensus can be observed. The overall results indicate some potential benefits that come from the FTA and customs union for the regions.

Furthermore, with regard to RTAs and GVCs, early attempts to empirically identify the effects of regional trade agreements have struggled to draw clear conclusions due to methodological challenges such as reverse causality, unobserved heterogeneity, multilateral resistance, and zeros in the matrix of bilateral trade flows. Bergstrand and Baier (2007) and Egger et al (2011) have however contributed to the empirical literature by mitigating these problems and going further to identify causal effects. They have found that regional trade agreements had a significant and positive impact on members' trade flows.

However, RTAs have mostly been treated as a "black box" for estimating their effect on trade and it was common to use a dummy variable, taking the value one if an agreement existed between a country pair and zero otherwise. This strategy was improved by defining the type of trade agreement according to a set of broad categories, e.g., free trade agreement, customs union, etc. Recent literature on global value chain trade has considered the heterogeneity of regional trade agreements to a certain extent. For example, Orefice and Rocha (2014) estimated an increase in production network trade of almost 12 % points when considering the depth of the trade agreement. They also estimated that the average impact of preferential trade agreements has gained relevance overtime which could be linked to the growing importance of global value chains. In addition, Orefice and Rocha (2014), using a database on the content of trade agreements created by the WTO, showed that production network trade is significantly increased by these trade agreements.

Noguera (2012) and Johnson (2014) estimated a gravity equation for bilateral value-added trade flows. They found that preferential trade agreements increase bilateral gross trade flows more than value-added trade flows. This is quite intuitive since the elimination of trade costs encourages multiple border crossings and thus makes trade with intermediates more attractive. Multiple border crossings, however, are counted only once in the value-added measure and therefore value-added trade is less affected. Quantitatively, adopting a trade agreement increases gross trade by 23%andtrade-invalueaddedby15%within the subsequent five years (Noguera,2012). They also estimated that a preferential trade agreement increases both exchanges of goods and value chain creation in the domestic economy as reflected in their

[34]For the rationale behind the selection of the methodology used in the current research, please refer to section 5.

results which show a 15% growth in value-added trade flows. Lastly, Osnago et al (2016) used the value-added decomposition of gross exports to show that deeper trade agreements increase foreign value-added in exports. They also showed that the positive impacts of the agreements on trade in parts and components are driven by trade between asymmetric partners.

De Melo and Twum (2020), using methodology developed by Borin and Mancini (2015, 2019), compared the regional (and non-regional) value chains in different regional communities. They showed that EAC and COMESA have improved their global value chain participation (share of imported intermediates in gross exports), due to a reduction in trade costs and policy-imposed trade barriers. Of the EAC members, Rwanda and Tanzania have shown the greatest increase in overall participation in GVCs whereas Kenya and Uganda have remained below average as shown in Figure 4.1.

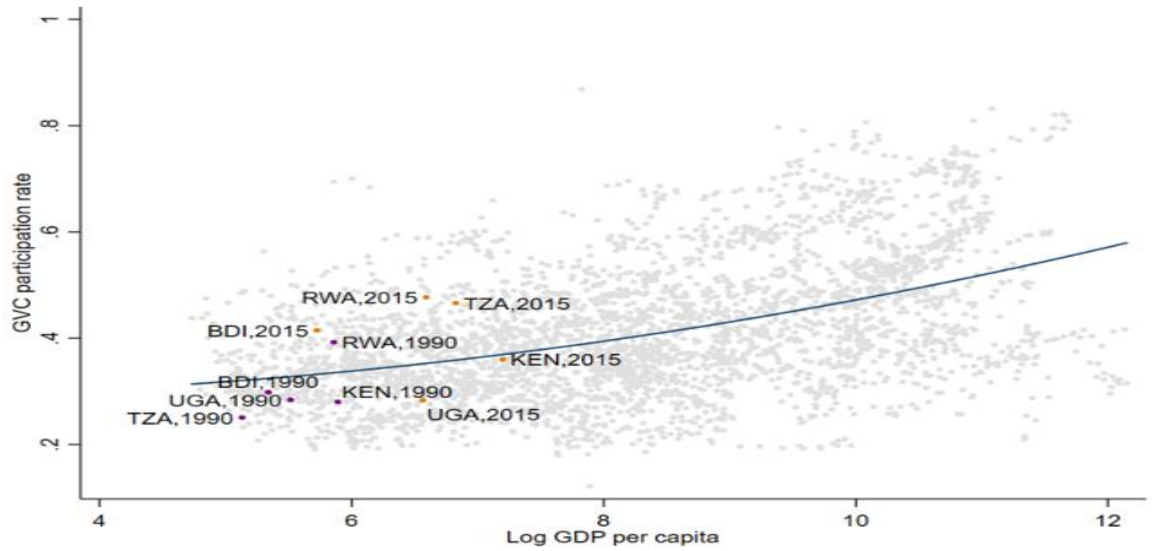

Figure 4.1 The increase of GVC participation in EAC countries.

Source: de Melo and Twum, (2020).

Notes: Points above the line represent an increase in GVC participation.

Rwanda's entry in the customs union saw firms facing lower tariffs on intermediate inputs and this resulted in an increase in exports (between 5 and 10%) for exporting firms (Frazer, 2012). Osnago, Rocha, and Ruta (2016) found that the depth of third-country agreements increases the impact of preferential trade agreements on GVCs. Greenville et al (2019a) estimated the same. Additionally, Osnago, Rocha and Ruta (2016) stipulated that deep preferential trade agreements stimulate the creation of GVCs by providing common disciplines that allow cross-border policy spillovers to be internalized and address credibility problems. However, countries

already involved in GVCs are more likely to sign deep preferential trade agreements because cross-border production creates a demand for deep provisions.

These scholars also estimated the relationship between regional trade agreements and GVCs using an instrumental variable approach to measure the depth of agreements between different countries and the results of the analysis confirmed its relevance in enhancing global value chain trade. Their other results, using the gravity regression and the decomposition of gross exports into value-added components for 13 manufacturing sectors WIOD for 1995-2011, showed that deep preferential trade agreements have a higher effect on GVC-intensive sectors.

Using the structural gravity model at an aggregate and sectoral level to assess the relationship between cross-border production linkages and the depth of trade agreements, Laget et al (2018) showed that deep trade agreements increase the domestic value-added content of exports mainly through the global value chains and they improve forward linkages, particularly for more complex GVCs (GVCs for which exported intermediates cross borders multiple times). From these results, trade agreements may help the nations/firms to integrate into high-value-added industries. Therefore, the reshaping of international trade policy may have a significant impact on the future of production linkages.

Using a gravity model to examine the effect of deep trade agreements (RTAs) on GVCs in the ECOWAS region over the period of 1996 – 2018, Balaki and Mamba (2022) showed that deepening RTAs significantly increases backward linkages in GVCs, while it has a mixed effects on total DVA, reducing it, but only at the 10% significance level. However, their results did not show any significant effect on forward linkages. These results therefore show that deep regional trade agreements have an impact on GVC participation especially in the African region.

In summation, these results show that deep trade agreements positively affect global production networks. These documented simulations confirm the multiple crossing of goods and services and that protective measures against any country have knock-on effects on all its trading partners in the value chain. Lastly, global value chains also amplify the costs of trade policy uncertainty since firms are more reluctant to make further investments in new or existing relationships with their foreign suppliers.

5. Empirical modelling and data

The global ICIO table, which harmonizes national input-output tables for different regions and links trade flows directly from producers in each region to importing companies and consumers in all other regions, was required to measure the GVC participation of the SADC region in

section 2 to allow time series analysis. The exercises were done specifically by using the UNCTAD EORA database (Lenzen et al, 2013)[35]. Here, the researcher follows the GTAP value-added module based on the computable general equilibrium (CGE) model to perform the ex-ante analysis of the impact of the proposed SADC Customs Union on the agri-food value chains. In addition, this CGE considers inter-country inter-sectoral linkages.

This study uses the GTAP Data Base, version 10, which is a standard of coherent data on consumption, production and trade (Aguiar et al, 2019). This GTAP Data Base is a fully recorded global database that provides all-inclusive and balanced data on production, bilateral trade, transport, and trade policies, covering 121 countries, signifying 98% of the world's GDP, 92% of the world's population and 20 aggregate regions for 65 commodities. Its consistency, full global analysis and provision for sectoral detail have been credited to its comprehensive use to perform CGE economic analysis. The advantage of using this database for trade in value-added evaluation is based on the fact that the reconciled data comes from various sources and is stored in a single consistent database which has a wide range of sectoral and regional coverage (Aguiar et al,2019).

The main shortfall of this database in terms of GVC analysis is that it does not account for how imported intermediate products are used which is usually catered for using the BEC database as shown in literature by the previous researchers (e.g., Salvatici, 2020) who undertook the research which is very close to the current one. Its framework, therefore, does not allow industry-to-industry trade which is usually required to form the construction of the ICIO data to be tracked nor permits the harmonization of input-output tables for multiple regions and provision of the connection of trade flows straight from the producers in each region to importing industries and purchasers in all other regions. To cover the said challenge, this study uses the MRIO version of this database to explore the GVC participation in agri-food sectors. Indeed, the main difference between this GTAP MRIO model and the standard GTAP model lies in the level of regional detail and the representation of interregional trade flows.

In the standard GTAP model, regions are treated as aggregates and the interregional trade is captured through bilateral flows between these aggregates. It provides a macro-level perspective on trade and allows for analysis of global economic impacts. However, it lacks the ability to capture the intricacies of trade relationships on a more detailed regional level[36]. The

[35] An only database that can provide a time series analysis of African GVC participation.

[36]The standard GTAP also lacks detailed information on import sourcing unlike other MRIO tables published by different institutions. In the GTAP model, trade flows in the input-output tables are aggregated at the border, without providing specific data on the source of imports. To address this limitation, researchers such as Walmsley et al. (2013) have developed a methodology to derive MRIO detail from the GTAP data using import proportionality assumption. However, compiling MRIO tables from GTAP data can be challenging for individual researchers due to the extensive

GTAP MRIO model, on the other hand, incorporates multi-regional input-output tables that provide a more granular representation of economic activities and interregional trade flows. It allows for the analysis of trade patterns, supply chains and interdependencies between regions in a more detailed manner. Indeed, this enables researchers to examine the regional impacts of policy changes or shocks more accurately.

This GTAP MRIO[37] database is an extension of the GTAP database. It is also constructed from IO tables of various countries complemented by a trade database containing bilateral trade flows by end users such as firms, consumers and investors. The database also distinguishes bilateral trade and tariff flow by agents or end users. In this MRIO framework, trade occurs when the "producers in source region***s*** export a commodity, classified by end-use, to corresponding agents (producers, investors and consumers) in importing region ***d"*** (Carico et al, 2020). This GTAP MRIO database is constructed by incorporating the United Nations Statistics Division's (UNSD) Harmonized System (HS) to Broad Economic Categories (BEC)[38] to System of National Accounts (SNA) and GTAP centre HS to GTAP concordances into MacMap. GTAP commodities are then aggregated, the trade and tariff data distinguished by end-users in MacMap, and this information used to disaggregate their associated flows in the standard GTAP database. Constrained optimization procedures are then employed to ensure that the GTAP-MRIO trade and tariff flows when summed over end-users aggregate back to the standard GTAP database (Carico et al, 2020).

This GTAP MRIO database is different from the EORA database[39] which was used in the previous section, in the sense that the EORA database provides time series MRIO tables from

amount of data and statistical work involved (Zhiwang, 2017). Furthermore, constructing reliable global MRIOs poses another challenge since it requires data to be reconciled from multiple disparate sources and rigorous manual data checking must be conducted to ensure the highest level of quality and reliability. Thus, Gesche and Hadjikakou (2017) emphasize the need for meticulous data verification to achieve accurate and trustworthy global MRIOs.

[37] Despite the advantages of the GTAP MRIO model, there are some remaining limitations. First, data availability and consistency across regions can be a challenge since multi-regional input-output data may not be available for all the regions or may have different levels of detail. Second, the computational requirements for running the GTAP MRIO model can be higher due to increased complexity and data volume. Additionally, the GTAP MRIO model still relies on certain assumptions and simplifications, such as the assumption of constant technical coefficients in regions, which may introduce some level of approximation in the analysis.

[38] BEC is able to identify the heterogeneity by sources based on 6-digit HS trade data, hence the GTAP MRIO construction uses its classification to separate the trade of final and intermediate goods.

[39]EORA keeps data in its original format whereas GTAP reorganizes tables, for example, into 65 sectors (GTAP 10). When the data is missing, these MRIOs make assumptions differently. GTAP models many regions/countries into the Rest of the World (RoW) regionwhereas EORA attempts to construct production structures for every country's economy refuting the need for the RoW region (Montalbano et al, 2018). Another element where there is missing data that needs to be constructed is in the off-diagonal trade matrices. GTAP uses a fairly blunt proportional assumption to turn a vector of import data by source into a matrix where use is the second dimension. On the other hand, EORA adopts a different approach. It records all data on intermediate and final imports as constraints within its model. Instead of relying on a proportional assumption, EORA models the off-diagonal matrices (representing intersectoral flows) as a solution in the matrix optimization process. This means that EORA's approach is more sophisticated and allows for a more detailed, accurate representation of the interdependencies between sectors and the use of imports (Owen, 2015).

1990 to 2015 covering 189 countries and 26 sectors (Lenzen et.al, 2013). EORA also includes the longest time series coverage amongst the existing MRIO tables. This database was, therefore (as mentioned before) useful for exploring the continuous series of the SADC member countries' participation in global value chains from 1990 to 2015. However, to perform ex-ante analysis, CGE modelling, which works with the GTAP database, is more suitable.

Hence, in this exercise, which is more concerned with value added, as noted earlier on, the research uses the GTAP VA (value-added) model (an extension of the GTAP model) by Antimiami et al. (2018). The GTAP VA module is used with the GTAP MRIO database to explore the possible effects of the SADC CU on agri-food global value chain participation. The model will be used to perform a comparative analysis to estimate the trade-in value added generated after the simulation of the SADC Customs Union scenarios and those that are initially computed from the model's database to see the effect of the policy changes.

This GTAP VA model enables the use of the "source-based approach" which shows the value added by its country of origin. Furthermore, even though this research does not use different elasticities, it is important to note that this GTAP VA model also allows the elasticities of substitution to differ depending on whether goods are imported as inputs or final goods. In addition to capturing value-added contributions, the GTAP VA model incorporates two distinct pathways that highlight the relationship between trade, domestic value added, and global value chains. The first pathway focuses on direct involvement in trade and GVCs where domestic value added is combined with raw products. The resulting exports can then be classified as either intermediate goods or final goods, illustrating the country's participation in GVCs through trade activities.

The second pathway, known as the processing pathway, emphasizes the downstream processing activities undertaken by sectors in a country that export goods. In this pathway, the link between domestic value added, trade and GVC is established through the value-added process conducted in the exporting country. This aspect of the model recognizes the importance of value addition and processing activities in shaping trade patterns and GVC integration (Greenville et al, 2019).

This model can therefore retrieve domestic export value-added components across borders, helps with the computation of the forward and backward linkages of trade, and supports the tracing of value added from the country/sector of origin to the country/sector of trade. Thus, it

is useful when highlighting the downstream/upstream positions of different industries (Antimiani et al., 2018).

5.1. GVC participation indicators in the GTAP VA module framework.

The model deconstructs gross trade flows to allocate the value added generated in the production goods back to the countries where the income is generated. This information allows for the breakdown of export values at the sector level into domestic value-added (DVA) generated by producing/exporting sector and the indirect value added embedded in other domestic sectors' exports or other countries' exports. Similarly, it captures the foreign value added (FVA) generated by other countries producing the imported inputs used in exports.

Specifically, the researcher used the following indicators related to value-added exports:

i) Multilateral domestic value-added[40] (DVAM). This is defined as domestic value-added in intermediate goods and services exported to a partner country that re-exports it to the final market, embodied in other commodities or services. The DVAM, often known as the "triangular" production chain, as noted by Johnson and Noguera (2012), is a measurement of a country's forward linkages in selling GVCs. At sector level, the research distinguishes between DVA[41] and DVAM indicators which are adjusted for double counting, meaning that the domestic value-added embodied in an export that has already crossed an international border and been counted as domestic value-added is netted off.

ii) Foreign value added (FVA). The import content of exports is the value of imported intermediate inputs embodied in a country's exports. This is because it reflects linkages up the value chain towards its origin, sometimes referred to as backward linkages in global production networks. The above metrics can be used to assess value chain participation and integration on a regional and global scale.

Research postulates that the degree of integration in international value chains is determined by the import content of exports (foreign value-added on gross exports) and the domestic production employed by the receiving country to manufacture its exports (DVAM). Salvatici

[40] For algebraic definitions, see appendix.

[41] This refers to the value-added that originates in all sectors of the exporting country and is incorporated in the exports of a specific domestic sector. DVA in exports provides an indication of the actual contribution that a particular export makes to an economy's income. The overall domestic value-added component can be divided by making a distinction between two parts: (i) the value that originates within the domestic exporting sector itself (referred to as DVA_dir), and ii) the value that originates in other domestic sectors which provide intermediate inputs to the domestic exporting sector (referred to as DVA_indir) (Antimiami et al, 2018).

(2021) noted that these metrics were primarily invented by Hummels, Ishii and Yi (2001) and have been appropriately extended and redefined to correctly focus on measuring production and trade in value-added flows, as shown in the literature. For example, Daudin, Rifflart and Schweisguth 2011; Johnson and Noguera, 2012; Koopman, Wang, and Wei, 2014; Wang, Wei, and Zhu, 2013; Borin and Mancini, 2017; Antimiani, Fusacchia, and Salvatici, 2018b, have extended and extended these metrics.

5.2. Aggregation of data

Since the data need to be aggregated to cater for the sectors and regions relevant to the research issue(s), in the GTAP 10 database, sectors are grouped into 65 categories. Here sectors are aggregated into 26 sectors: 11 agricultural sectors, 9 food sectors *(N.B. agriculture and food sectors are in bold since they are disaggregated individually)*, then other important divisions of industries - textiles and clothing, light manufacturing and heavy manufacturing - and other crucial sectors to the region: extraction and transport, communications, utilities and construction, and finally other services (usually services are not directly affected by the tariff changes) as shown in Table 3.3.

Table 5.1 Sector aggregation

Agriculture	• **Paddy rice (pdr)** • **Wheat (what)** • **Cereal grains nec (gro)** • **Vegetables, fruit, nuts (v_f)** • **Oil seeds (osd)** • **Sugar cane, sugar beet (c_b)** • **Plant-based fibres (pfb)** • **Crops nec (ocr)** • **Meat: cattle, sheep, goats, horse (cmt)** • **Animal products nec (oap)** • **Wool, silk-worm cocoons (wol)** • **Cattle, sheep, goats, horses (ctl)**
Food & Beverages	• **Vegetable oils and fats (vol)** • **Dairy products (mil)** • **Raw milk (rmk)** • **Processed rice (pcr)** • **Sugar (sgr)** • **Meat products nec (omt)** • **Food products nec (ofd)**

	•	**Beverages and tobacco products (b_t)**
Fish (Fish)	•	**Fishing (fsh)**
Extraction (Mining and Extraction)	•	Forestry (frs)
	•	Fishing (fsh)
	•	Coal (coa) Oil (oil)
	•	Gas (gas)
	•	Minerals nec (omn)
TextWapp (Textiles and Clothing)	•	Textiles (tex) & Wearing apparel (wap)
LightMnfc (Light Manufacturing)	•	Leather products (lea)
	•	Wood products (lum)
	•	Paper products, publishing (ppp)
	•	Metal products (fmp)
	•	Motor vehicles and parts (mvh)
	•	Transport equipment nec (otn)
	•	Manufactures nec (omf)
HeavyMnfc (Heavy Manufacturing)	•	Petroleum, coal products (p_c)
	•	Chemical, rubber, plastic prods (crp)
	•	Mineral products nec (mmn)
	•	Ferrous metals (i_s)
	•	Metals nec (nfm)
	•	Electronic equipment (ele)
	•	Machinery and equipment nec (ome).
TrnsCmUtiCns (Transport, Communication, Utilities and Construction)	•	Trade (trd)
	•	Transport nec (otp)
	•	Sea transport (wtp) & Air transport (atp)
	•	Communication (cmn)
	•	Electricity (ely)
	•	Gas manufacture, distribution (gdt)
	•	Water (wtr)
	•	Construction (cns)

OthServices (Other Services).	•	Financial services nec (ofi)
	•	Dwellings (dwe) & Insurance (isr)
	•	Business services nec (obs)
	•	Recreation and other services (ros)
	•	PubAdmin/Defence/Health/Educat (osg).

For regional aggregation, six selected SADC countries are maintained as single regions: Botswana, Malawi, Tanzania, South Africa, Zimbabwe and the RSACU. The rest of the SADC countries are aggregated into a single region - Namibia, Mozambique, Madagascar, Zambia, Mauritius, Democratic Republic of Congo and South-Central Africa. Seychelles is omitted since it does not have its region in the GTAP. These countries have been selected according to their total GDPs. South Africa (51,41%) and Tanzania (9,21%) have high GDPs in the region, Zimbabwe (3,14%) and Botswana (2,68%) have middle GDPs, and Malawi (1,18%) and RSACU[42] (0,52%), have lower GDPs. *N.B. other countries such as Angola, Comoros and Seychelles are not singled out or individually represented in the GTAP database.*

All the other African countries are aggregated into the rest of Africa, then other regions are aggregated as – EU_28, East Asia, South Asia, Latin America, North America, South America, and the rest of the world (see Table 3.4). (N.B. even though countries such as China, the USA and Japan are big enough to be singled out, it was deemed unnecessary since the study aims to see the impact of SADC CET on its members' participation in global value chains).

Table 5.2: Regional data aggregation scheme

SADC Countries	**South Africa (zaf), Tanzania (tza), Zimbabwe (zwe), Botswana (bwa), Malawi (mwi), RSACU (Lesotho & Eswatini) & RSADC (Madagascar(mdg), Mauritius(mus), Mozambique (moz), Zambia (zmb), South Central Africa (xac), Namibia (nam).**
Rest of Africa (ROA)	Egypt (egy), Morocco (mar), Tunisia (tun), Rest of North Africa (xnf), Benin (ben), Burkina Faso (bfa), Cameroon (cmr), Cote d'Ivoire (civ), Ghana (gha), Guinea (gin), Nigeria (nga), Senegal (sen), Togo (tgo), Rest of Western Africa (xwf), Central Africa (xcf), Ethiopia (eth), Kenya (ken), Rwanda (rwa), Uganda (uga) & Rest of Eastern Africa (xec).

[42]RSACU are two countries aggregated as one region/country in the GTAP database; hence they cannot be separated.

EU_28	Austria (aut), Belgium (bel), Bulgaria (bgr), Croatia (hrv), 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), Romania (rou), Slovakia (svk), Slovenia (svn), Spain (esp), Sweden (swe) & United Kingdom (gbr).
Latin America	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) & Caribbean (xcb).
North America	Canada (can), United States of America (usa), Mexico (mex), Rest of North America (xna),
East Asia	China (chn), Hong Kong (hkg), Japan (jpn), Korea (kor), Mongolia (mng), Taiwan (twn), Rest of East Asia (xea), Brunei Darussalam (brn),
SEAsia	Cambodia (khm), Indonesia (idn), Lao People's Democratic Republ (lao), Malaysia (mys), Philippines (phl), Singapore (sgp), Thailand (tha), Viet Nam (vnm), the Rest of Southeast Asia (xse)
South Asia	Bangladesh (bgd), India (ind), Nepal (npl), Pakistan (pak), Sri Lanka (ika), Rest of South Asia (xsa).
Rest of the World	Australia (aus), New Zealand (nzl), Rest of Oceania (xoc), Switzerland (che), Norway (nor), Rest of EFTA (xef), Albania (alb), Belarus (blr), Russian Federation (rus), Ukraine (ukr), Rest of Eastern 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 Islamic Republic of (irn), Israel (isr), Jordan (jor), Kuwait (kwt), Oman (omn), Qatar (qat), Saudi Arabia (sau), Turkey (tur), United Arab Emirates (are), Rest of Western Asia (xws) & Rest of the World (xtw).

The factors of production are skilled labour, unskilled labour, land, natural resources and capital (see also Table 3.5). For simulation, all labour and capital are set to be fully mobile.

Table 5.3: Factor aggregation

Land	**Sluggish**		**-1,000000**
UnSkLab	Mobile	---	
SkLab	Mobile	---	
Capital	Mobile	---	
NatRes	**Sluggish**		**-0.001000**

5.3. Research scenarios.

The research study chose scenarios that provided information on customs union[43] measures in order to determine their impact on agriculture and food and beverages global value chain participation. The analysis, therefore, explores hypothetical scenarios that provide the best illustration of the effects. Moreover, these scenarios could also provide possible trade policy adjustments which can be explored within the SADC-CU framework. Hence the research designs the following scenarios:

First, let $\boldsymbol{s}$ be the SADC country$\{\boldsymbol{s}Botswana, Tanzania, SA, zimbabwe, e.t.c\}$,

A_s^t implies the initial trade-weighted average tariffs by country $\boldsymbol{s}$, and A_{CET}^t implies the average tariffs that SADC applies under the customs union known as the common external tariff. Hence, it is assumed that each country will choose to move from the initial average tariffs and implement A_{CET}^t.

In the first scenario, the simulation focuses on the implementation of the common external tariff (CET) while excluding the sensitive products. These sensitive products, along with their respective applied tariffs, are listed in Appendix 3B for reference. These sensitive products make up approximately 6% of the total number of products, and their regional weighted average tariffs have been calculated based on the HS6 1996 classification. As part of the simulation, these specific sensitive products are exempted from adopting the common external tariffs and the FTA.

To determine sensitive products, most of the trade agreement frameworks usually allow nations to provide their sensitive products which will be excluded from the liberalized sectors. However, the reasons for the provision of these sectors vary from country to country (benefits from tariff revenues, protection of infant industries, the economic importance of the sector). With this in mind, the SADC Customs Union framework allows for the exclusion of sensitive products. Hence the SADC Trade Protocol - the road map to the creation of the customs union - has grouped the sensitive products for the region under Category C - in this research, these listed regional sensitive products are then used.

The identified sensitive products constitute 2.8% of all agricultural products with the HS6 code and include items such as textiles/garments, clothing/cotton, wheat flour, cereals, dairy

[43] For more on the SADC Customs Union, see section 4.2.

products, and sugar products (Maringwa, 2009). Motor vehicles, sugar and fish are also sensitive products that are grouped individually due to their consideration as sensitive products by many regional affiliates (Maringwa, 2009). To determine the sensitive products for the simulations, the research adopts a framework proposed by Jean, Laborde and Martin (2005, p.10) which takes into account the political economy of the trade policy. An index is calculated based on the differences between initial and final (CET) tariff rates and the volume of imports for each commodity. This method has been used in several studies that examine the possible impacts of the Doha Development Agenda, for example, by Bouët et al (2007).

Even though the GTAP database can be used to find the tariff information at the 2014 reference year aggregated at GTAP region and sector category, the research uses the MacMap HS6 database (latest version, v.2) to explore the regional applied tariffs on sensitive products. This is a detailed tariff database that gives a "consistent ad-valorem equivalent measure of ad-valorem tariffs, specific tariffs, tariff rate quotas on a bilateral basis, accounting for all preferential agreements for 2007 for 190 nations and 240 exporters for more than 5 000 product lines at the six-digit level of the 1996 Harmonized System" (Bout et al, 2008). This is done by first mapping the official Tariff Nomenclature (CTN) quantified at the HS6 1996 classification that is used in the 2007 MacMap-HS6 v.2.

Lastly, the importance of understanding or measuring the effects of these common external tariffs by SADC on the global value chains lies in the fact that these GVCs continuously impact the trade of goods and services (even though services are not included in the analysis). Moreover, trade policy reforms such as creating regional custom unions result in changes in domestic goods production influenced by changes in global and regional value chains. One of these changes is reflected in tariff structures that greatly influence all sectors of domestic economies.

Simulations and variations

1st simulation	All the CE tariffs are shocked (0% raw materials, 0% capital goods, 10% intermediate goods and 25% final goods) excluding the sensitive products. Factors are mobile and fully employed. Gragg's method (by default) is used. The base year is 2014.
2ndsensitive analysis (variation 1)	Different from the first simulation, we consider labour unemployment. Swap qe ("UnSkLab", REG) = pebfactreal [44]("UnSkLab", reg).
3rdsensitive analysis (variation 2)	Augmenting Armington elasticities by 20%[45].

Table 5.3 Simulations and variations

Notes: The variations are used to obtain results for different economic circumstances such as unemployment and tariff reforms.

For simulations, the SADC common external tariffs are implemented as shocks and there are no major alterations of the GTAP framework (e.g., adapting of the closures), except increasing the Armington elasticity since the literature confirms that increasing[46] the Armington

[44]In this analysis "pebfactreal" is used instead of "peb" since it takes the real factor productivity changes into account (unlike "peb" which represents the effective labour endowment". Thus, by using "pebfactreal" the model accounts for changes in labour productivity that can affect unemployment levels. Indeed, the use of "pebfactreal" allows for a more accurate representation of labour market dynamics in the GTAP model. It captures the impact of changes in labour productivity on unemployment, as well as the overall efficiency in labour utilization. This variable considers both the quantity and quality of labour inputs, providing a more comprehensive analysis of labour market outcomes.

[45]The elasticities were augmented for all sectors and for the eight regions indicated in Table 3.4. at the regional level.

[46] A number of scholars in the literature has done this, for example, Strutt A, (2009), in her book "Indonesia in a Reforming World Economy", noted the influence of increasing the Armington elasticities on simulation results, and Ruhr-Universität Bochum (RUB) (2015) in their research work on A Meta-Sensitivity Analysis of the

elasticities before implementing any shock leads to more accurate simulation results in experiments done using the GTAP (Gehlhar, 1997).This is because, when the Armington elasticities are increased, the model becomes more flexible in capturing changes in consumer behaviour and trade patterns. Thus, higher elasticities allow for a greater responsiveness of demand to changes in relative prices between domestic and foreign goods. This in turn, reflects a higher degree of substitution between the two types of goods. Additionally, when shocks are introduced to the model, such as changes in trade policies or economic conditions, the increased elasticities allow a more accurate representation of how consumers adjust their consumption patterns in response. With greater elasticities, consumers are more likely to switch between domestic and foreign goods in the face of changing relative prices, leading to a more realistic simulations of trade flows and market outcomes.

In the analysis, the assumption is made that labour and capital are perfectly mobile, meaning they can easily move between different sectors of the economy without any constraints. This assumption implies that labour and capital can be reallocated based on their relative returns or profitability, allowing for flexibility in their use. On the other hand, land is assumed to have an elasticity of transformation of -1 by default. This means that land is considered relatively fixed in supply and cannot be easily transformed or reallocated across different sectors. Thus, the negative elasticity value indicates that land resources cannot be easily modified or moved, limiting their flexibility in terms of allocation. Similarly, natural resources are assumed to have an elasticity of transformation of -0.001; this implies that there is some limited substitutability across sectors of natural resources, but their supply is still relatively fixed. The small negative elasticity value suggests that natural resources are not easily transformable or substituted and are considered relatively inflexible in their use.

Furthermore, in initial model variations (i and ii), the circumstances of the factor market are not the same. Also, as in African countries (same for all developing countries), there is no full employment (as noted by all the SADC countries), and 'the assumption of the GTAP framework is inappropriate', especially in these nations. Hence, it is crucial to fix the real wage

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Influence of Armington Elasticity Misspecification on Simulation Results with results that indicate that a change in the elasticities has noteworthy quantitative and qualitative effects on the results in more than half of the models. Additionally, Hillberry and Hummels (2013) argue that "the frequently used elasticities in the literature which stem from time series estimations of CES functions are subject to a misspecification in the underlying econometric method and that the elasticities should be much higher".

rate[47]exogenously and endogenize the supply of labour in the analysis. This concept has been previously used when analysing customs unions in Africa, for example, by éé et al (2004) to examine the effects of the creation of the UEMOA Customs Union on regionalism and labour market structure.

6. Results and analysis: effects on regional and global value chain participation.

This research assesses how the SADC common external tariff affects the agricultural and food GVC participation of member countries. Two indicators of GVCs are used: backward participation and forward participation. The first is the value of imported intermediate inputs embodied in a country's exports and the latter is the domestic value-added indirectly used by the importing country to produce its exports. Hypothetically, the customs union agreement may affect global value chains directly since it reduces trade barriers between member states of the agreement and a common external tariff to all non-member countries, and indirectly since it improves the institutions through commitments to reform. Results are presented for regional and global integration, first at country level and then at sector level.

6.1. Backward participation by country

The implementation of the SADC Customs Union fosters a significant increase in the regional backward integration of SADC countries compared with global backward participation in exports. This outcome is attributed to the relative price change resulting from the extent of tariff adjustments. Consequently, the inputs from the SADC countries will become more cost effective compared with those from extra-regional producers. This aligns with the customs union's goal of improving production capabilities, economies of scale, and the cost structures within the SADC countries, thereby increasing their competitiveness. Consequently, countries such as South Africa and those grouped as "RSADC" show higher positive changes in both regional[48] and global value chains than other SADC countries.

Furthermore, these findings indicate that the implementation of a common external tariff deepens regional value chains by encouraging member countries to source intermediate goods

[47]By fixing the real wage rate exogenously, the analysis considers the prevailing wage conditions in these countries which may be influenced by factors such as labour market regulations, institutional factors and socio-economic conditions. This approach acknowledges the fact that the wage rate is an important determinant of labour supply decisions and can have a significant impact on economic outcomes.

[48] Regional backward participation is calculated as inputs/intermediate goods sourced destined in the SADC region and incorporated in their exports.

locally within the region rather than globally. This is facilitated by the free movements of goods within the region which reduces the costs of regional trade and incentivizes exporters to utilize local products. These outcomes are attributed to increased tariffs on imported commodities from outside the region while facilitating the unrestricted movements of goods within the region. Consequently, this implies a reduction in the factors of production among products. Thus, products whose exports are expanding due to decreased trade costs are those embedding relatively more foreign inputs. Therefore, these results align with Blanchard et al. (2016) who highlighted changing tariff rates and trade costs as the key factors driving the global value chains.

Furthermore, the implementation of the policy is expected to have a significant positive impact on regional exports, while also influencing certain extra-regional exports. These findings align with the estimations made by Dimaran and Mevel (2008) who anticipated that the customs union would lead to an overall expansion of trade in the region. Significantly, South Africa's foreign value added in exports destined for Zimbabwe, Botswana and RSACU is estimated to increase by more than 50%, surpassing other countries' share of foreign value-added in exports destined to the region. This underscores the effectiveness of the common external tariffs in directing SADC countries' exports towards regional markets. The policy also demonstrates its positive impact on regional exports by member countries without significantly affecting the foreign value-added in exports destined for the region by other countries. For instance, Malawi's and Botswana's foreign value-added in exports destined to all member countries (except Zimbabwe) remains relatively stable, with marginal variations below 1% (percentage change). Conversely, for extra-regional exports, South Africa and RSADC are expected to experience an increase of approximately 2% in their foreign value-added in exports destined to the EU_28, South Asia and the rest of Africa. These findings affirm the empirical evidence put forth by Bruhn (2014), Osnago et.al (2016) and de Melo (2020), highlighting the positive effects of regional trade agreements on member countries and their valuable contributions to enhancing international production networks.

Additionally, relative to their economic size, larger countries with higher GDPs such as South Africa and RSADC experience more significant positive changes in regional value chains compared to smaller countries such as Malawi. These findings further support the notion that larger economies tend to benefit more from trade policies due to their market dominance. This observation is supported by the fact that the policy would increase South Africa's welfare by over 30% compared with other SADC countries, and this aligns with the findings of Abrego and Riezman in 2003 who highlighted the welfare gains of the customs union. Indeed, in both

absolute and relative terms, South Africa emerges as the country that would benefit the most in terms of the demand for inputs from regional partners and the strengthening of pre-existing trade relationships within the SADC region.

In light of the positive changes in global backward integration observed in countries such as South Africa, Tanzania, Zimbabwe and RSADC, it is evident that the implementation of the SADC Customs Union has the potential to significantly enhance these countries' ability to access affordable intermediate goods in competitive international markets. This presents an opportunity for these countries to further strengthen their downstream production which has shown gradual growth over the past two decades that has evidenced in section 2. Indeed, these outcomes are linked to changes in tariffs at country level since countries that implement higher tariff increases due to the common external tariffs, such as Malawi, experience negligible changes compared to other SADC countries. Therefore, the impact of the customs union on member countries varies according to whether their existing tariffs are above or below the common external rate.

Undoubtedly, the positive effects of the policy in SADC countries underscore the potential of the customs union to drive economic development, knowledge sharing, and domestic value added, thereby contributing to overall GDP growth, employment opportunities, and enhanced productive capacity. Accordingly, these findings reinforce the views expressed by UNCTAD (2013, 2016) and Sturgeon and Memedovic (2010), Pahl and Timmer (2019) and the World Bank (2020), highlighting the significance of regional trade agreements in promoting positive economic outcomes and sustainable development.

Furthermore, South Africa's foreign value-added in exports is expected to experience a significant increase of approximately 2% (compared with other SADC countries) destined for South Asia, the EU_28 and the rest of Africa, indicating a strengthening of the existing strong trade relations between South Africa and these regions. However, it is important to acknowledge that this increase in foreign value-added shares comes at the expense of Latin America where South Africa's foreign value-added shares in exports are relatively low. With regard to Malawi, despite its previous increase in backward participation that has shown in section 2, the insignificant changes brought about by the new policy (since there is no positive increase in foreign value-added in exports destined to other regions) affect its global progress value chains. Therefore, in line with this change, the policy would not significantly enhance the country's ability to compete in international markets compared with other countries. Thus, even though this tariff barrier protects its domestic markets, it also negatively affects the

country's domestic comparative advantage and increasing prices harms its consumers and exporting firms, as noted by Cadestin et al (2016).

By considering some variations, the results closely resemble Scenario 1 which involves the implementation of the common external tariff, suggesting that the benefits of the customs union are not highly sensitive to the specific assumption made in the simulations. However, recognizable changes are recorded at regional level particularly on agri-food backward participation.

In the scenario where the Armington elasticities are augmented by 20% and the outcomes are compared with and without this augmentation, South Africa and RSACU both register a slight decrease in results at both the regional and global levels. This can be attributed to the increased monopoly power these countries gain on the demand side compared with other SADC countries, allowing for greater control over market demand and pricing dynamics. Indeed, the augmented elasticities reduce their supply response, indicating a lower ability to adapt their production levels to respond to changes in market conditions compared with other regional affiliates. Furthermore, these countries experience heightened terms of trade, resulting in an improvement in their terms of trade compared with other SADC countries.

These effects contribute to the observed decrease in results. However, the results that show significant gains (e.g., in Zimbabwe, Botswana, Tanzania and RSADC- at regional level) align with the research of Engler and Tervala (2018) which demonstrates that augmenting the Armington elasticities from 3 to 8 in the context of the Transatlantic Trade and Investment Partnership (TTIP) results in increased trade gains. Accordingly, augmenting elasticities can potentially enhance benefits derived from trade agreements or partnerships for other member countries. Therefore, these dynamics highlight the intricate interplay between elasticities, monopoly power, supply response, terms of trade and their implications for trade outcomes and economic welfare.

Table 6.1 shows percentage changes in backward participation by SADC countries with different simulation variations.

	Scn 1 (global)	**ScN 1 (regional)**	**Scn 2 *(global)***	**ScN 2 (regional)**	**ScN 3 (global)**	**ScN 3 (regional)**	**Actual values (2014) global**	**Actual values (2014) Regional**
SA	1.37%	73,08%	1,37%	73,07%	1,32%	72,56%	18,06%	3,49%
Tanzania	0.04%	0,79%	0,04%	0,79%	0,04%	1,25%	35,10%	2,85%
Zimbabwe	0.04%	2,51%	0,04%	2,52%	0,04%	2,81%	50,07%	51,95%

Botswana	0.05%	2,26%	0,05%	2,28%	0,05%	2,32%	28,98%	5,20%
Malawi	0.02%	0,38%	0,02%	0,38%	0,02%	0,41%	13,56%	3,63%
RSACU	0.05%	5,50%	0,05%	5,50%	0,04%	4,36%	50,14%	0,72%
RSADC	0.87%	15,49%	0,87%	15,47%	0,87%	16,29%	10,13%	15,12%

Source: Author's simulation using GTAP VA module.

6.2. Forward participation by country

Establishing a common external tariff would have significant implications for the member countries' intra-agreement exchanges. These results reveal a wide variation in the impact of tariff alterations in each country. As noted in the case of backward participation, the heterogeneity in countries' changes is related to the extent of tariff changes (increase or decrease) due to current disparities in import tariffs across the SADC countries. The results suggest the most significant trade gains for South Africa and RSADC where intra-agreement forward participation[49]is estimated to increase by 26% and 47%, respectively, under Scenario1. However, the results show that the increase appears at the expense of global engagement. This suggests that the SADC common external tariff promotes regional integration since the tariffs would be notably higher for extra-regional imports, as noted by Bouët, Odjo and Zaki (2007). The results also highlight the reinforcing effect of the common external tariff on already strong regional relationships[50], particularly evident in the increased shares of South Africa's forward participation in exports to Zimbabwe and Malawi by 2.2% and 2.5%, as well as RSADC's to Zimbabwe and Botswana by 4.8% and 5.20% respectively, compared with other countries (see Appendix, for the bilateral values). This strengthens the regional export 'platform' (since regional forward participation is higher than global forward participation) and supports the integration of SADC countries into high value-added industries.

It is also evident that the new policy brings significant changes in extra-regional trade, particularly benefitting South Africa and the RSADC. These countries will also have a competitive advantage and greater ability to compete in international markets than other SADC countries. The anticipated increase, approximately between 1% and 2%, in South Africa's and RSADC's shares of forward participation in exports destined for the EU_28, North America and East Asia indicates notable changes within the region, surpassing the changes observed in

[49] Regional forward participation is calculated as the domestic value-added in exports originating in the SADC countries and exported to external countries/regions.

[50]Relations that were also enhanced by the SADC Free Trade that was signed in 2001.

other countries. However, these gains come at the expense of exports destined for Latin America. Indeed, these changes are also relative to the economic size of the countries and their current level of forward participation in GVCs. Thus, South Africa's already higher percentages in exports destined for the EU_28, North America and East Asia compared with other SADC members indicate that the common external tariff will enhance its position in these markets, leading to increased trade opportunities and potential economic benefits. Hence, the results underscore the need to consider the existing trade patterns of countries when evaluating the impacts of the common external tariff, while also emphasizing the potential for South Africa to consolidate its position as a leading player in the international marketplace.

Conversely, it is clear that the new policy does not significantly enhance the access of Botswana, Malawi and Zimbabwe to international markets due to the increased competition from other SADC countries which benefits from the common external tariff. Indeed, the lack of substantial changes in their shares of forward participation in exports destined to other regions, with changes below a half percent, further reinforces this notion.

Thus, these findings highlight the challenges faced by these countries in leveraging the common external tariff to expand their export opportunities and establish stronger international trade relationships. This suggests the need for targeted measures and strategies to address the specific barriers and constraints faced by Botswana, Malawi and Zimbabwe in effectively benefitting from the common external tariff. Moreover, the results indicate that changes in forward participation are relatively lower than changes in backward participation. This result is consistent with Antràs and de Gortari (2020) who noted that forward participation, associated with upstream stages of production, is less sensitive to trade costs than backward integration.

On the other hand, it can be seen that the inclusion of variations, in particular considering the impact of unemployment, has no effect on the outcomes at the country level. However, significant changes are evident at sector level, as explained in subsection 6.5.

Thus, the observed percentages in forward participation reflect the potential benefits and opportunities brought about by the new customs union. The positive changes across different simulation variations indicate an increased involvement and contribution of SADC and sectors in production and value creation process with the GVCs. This signifies an improved positioning of the region within the global economy and highlights the potential for enhanced competitiveness. Additionally, the significant increase at regional level, emphasize the strengthened intra-regional linkages and collaboration.

Table 6.2 shows percentage changes in forward participation in SADC countries with different simulation variations.

	ScN 1 *(global)*	ScN1 (regional)	ScN2 *(global)*	SCN2 (regional)	ScN3 (global)	ScN3 (regional)	Actual values (2014) Global	Actual values (2014) Regional
South Africa	1.14%	26,0%	1,14%	26,03%	1,15%	24,45%	25,25%	0,15%
Tanzania	0.08%	2,5%	0,08%	2,53%	0,07%	1,22%	14,25%	0,15%
Zimbabwe	0.04%	4,7%	0,04%	4,72%	0,04%	4,12%	30,56%	3,60%
Botswana	0.17%	12,4%	0,17%	12,41%	0,17%	8,43%	15,13%	0,15%
Malawi	0.02%	0,7%	0,02%	0,71%	0,02%	0,50%	21,18%	0,20%
RSACU	0.05%	6,8%	0,05%	6,79%	0,04%	4,23%	13,73%	0,13%
RSADC	1.56%	46,8%	1,56%	46,80%	1,55%	57,05%	26,08%	2,00%

Source: Author's simulation using GTAP VA module

6.3. Backward participation by sector

This section provides an assessment of the overall effect of the policy on global and regional agri-food backward participation by country and each agri-food sector. The analysis highlights that the effects vary across sectors and countries, primarily influenced by relative changes in prices resulting from the changes in tariffs. The sectors with tariffs below the baseline and increased due to the customs union and those with higher tariff increases are expected to be more significantly affected. Consequently, these sectors may experience a decline in production. Conversely, sectors that witness tariff reductions have the potential to generate efficiency gains, leading to increased income and production in sectors where the country possesses a comparative advantage.

Table 6.3 compares the average changes in total (global) agriculture and food backward participation. The results go hand in hand with those obtained by OECD (Greenville, Kawasaki, Flaig, and Carrico 2019) which highlight the impact of changes in import tariffs on value-added trade flows encompassing both positive and negative effects.

The results illustrate that even though the policy drives the firms to use locally produced products, overall, it also promotes access to foreign inputs for both sectors in several countries. Indeed, in Scenario1, relative to different levels of tariff changes, South Africa, Malawi and RSADC register higher (positive) percentage changes in the food sector than other countries. In addition, South Africa, RSADC, Tanzania and Zimbabwe register higher (positive) percentage changes relative to the agriculture sector. Hence, the policy would make it cheaper for these countries to buy inputs abroad than from local producers.

Thus, SADC countries demonstrate greater involvement in backward participation through the food sector than agriculture since most of the agriculture sectors are used in food production. Hence, these results are in line with those obtained by Nenci (2020). Additionally, since the agri-food sectors make a significant contribution to the value-added of SADC countries, the

indicated changes resulting from the policy are expected to lead to a remarkable increase of more than 5% in value-added for Zimbabwe and RSACU, surpassing the gains experienced by other countries. Consequently, these countries are likely to experience notable growth in their production levels, indicating positive prospects for their economies.

Furthermore, the discrepancies in changes across different scenarios indicate that the impact of the policy varies among SADC countries. However, on average, the results align closely with Scenario 1 when comparing the effects of unemployment closure to the full employment scenario. This indeed confirms that the policy has a positive influence on the countries' outputs, particularly in South Africa and RSADC, where notable positive changes are observed at regional level. In the context of agri-food backward participation (at regional level), South Africa and RSADC (in agriculture), as well as Tanzania and Botswana (in food products), experience a slight decrease in results, highlighting the importance of addressing unemployment and ensuring a skilled workforce.

These variations are attributed to the endowment effect which has a greater impact on the production of these sectors in these countries compared to others. Thus, unemployment closure alters the relative marginal product of skilled versus unskilled labour and the relative quantity of each type of labour, making it apparent that fostering equitable and inclusive labour markets is vital to promoting production and improving real incomes. Consequently, these differences, along with variations in the shares of unskilled labour, lead to significant disparities in labour quantity and marginal product, thereby affecting production and real incomes. However, in the case of South Africa and the RSADC (in food products), the positive effects of the endowment effect, resulting in increased demand for capital and skilled labour, highlight the significance of investing in human capital and creating an enabling environment for sustained economic growth.

Additionally, the modifications in the results due to changes in Armington elasticities are due to the change in demand or use of domestic and imported intermediates in the SADC countries. These changes could also be explained by their terms of trade where higher percentage values are registered in these countries. Thus, improvements in the terms of trade where export prices rise relative to import prices lead to increased purchasing power and potentially greater demand for imported goods, further influencing the balance between domestic and foreign intermediate use. Therefore, the higher percentage values observed in these countries' terms of trade suggest that favourable external conditions such as rising commodity prices or increased global demand for their exports are reinforcing the reliance on imports while also reshaping domestic production strategies.

Indeed, significant changes are also registered at a regional than global level due to the region's close economic ties and integration efforts, which are highly affected by shifts in regional trade patterns, especially in sectors such as agriculture and food beverages. For example, a significant change in the terms of trade for one SADC country can have spillover effects on its neighbours due to shared value chains and trade agreements within the region. Therefore, regional interconnectedness can also magnify the effects of changes in Armington elasticities, making the trade adjustments more pronounced at the SADC level than at the at the global level.

All in all, the positive changes in agriculture and food beverages signify that these countries will be able to purchase more intermediate inputs abroad at low prices and produce at low costs which is beneficial to the firms that export final goods to third countries; hence, their increase in downstream production. Table 5.3 illustrates the average changes in backward participation with various scenarios for SADC countries.

The results also confirm that the new trade policy promotes intra-region (regional) backward participation. These results are in line with those of de Melo and Twum (2020) who confirm the positive impact of EAC and COMESA on regional and global value chains.

This policy would further enhance this participation and overcome the higher AMU value of participation which was higher than this (SADC) region. Hence, in Scenario1, the SADC region will increase its integration in agriculture backwardness by 3% and food by 10%. As food products are almost at the end of production and most agricultural products are used as inputs to produce them, it is not surprising that food backward participation is higher than agriculture. Additionally, since SADC is well known for its higher agriculture production and exportation of agricultural products, the new policy would increase the region’s exportation of these sectors. Also, implementing the new policy would fulfil the objective of the SADC Industrial strategic roadmap initiated in 2018 to promote regional value chains, primarily through agriculture and food products.

Furthermore, RSACU, Malawi, South Africa and the Zimbabwe are expected to increase their sourcing of intermediate inputs within the region to a greater extent than other SADC countries in terms of agriculture backwardness. As indicated in UNCTAD EORA database, these countries have imported intermediate inputs inside the region more than other member countries; hence, the new policy would further enhance this trade pattern. On the other hand, countries such as Botswana, RSACU and Tanzania exhibit less significant changes relative to other member countries, indicating that the policy has a relatively lower impact on their

production levels. This is also explained by the fact that these countries' products become uncompetitive in the region since their exports decrease compared with other countries.

With regard to regional food backward participation[51], the results for Scenario1[52] show that Zimbabwe, South Africa, RSACU and RSADC record more significant changes (over 30%) than other countries[53]. This signifies that the policy would even highly promote these countries' GDP and attracts foreign direct investment in the production of this sector, since it has been shown that these variables correlate. This would also promote technological development and, most importantly, economic growth since GVCs are one of the drivers of economic growth. Thus, higher changes indicated for Zimbabwe, South Africa and RSACU are driven by higher positive changes in sectors such as crops nec, meat, cattle, sheep and goats, meat products, food products, beverages and tobacco. These are key sectors with higher shares of value-added in these countries, as shown in section 2. Hence, this improves the competitiveness of these sectors and their production capacity.

On the contrary, the new policy has a relatively smaller impact on Malawi compared to other countries, signifying the challenge of the country's ability to penetrate the competitive markets that would affect its production and income and enjoy the benefits of effectively participating in GVCs. Compared to other countries, this would also exacerbate the challenges faced by the country in its efforts to increase its participation in downstream production. This could be explained by the fact that the insignificant changes in high-volume sectors of Malawi's imports for exports within the region, especially products like sugar, meat, meat products, processed rice, wool, silk, wheat, are greater than the substantial changes in sectors that show positive growth, such as vegetables, fruits and nuts, crops and nec, vegetable oil and fats, and cattle, sheep, and goats. Thus, these results indicate the importance of addressing the challenges faced by Malawi to facilitate its integration into downstream production activities. By doing so, Malawi can leverage its strengths and seize opportunities to enhance its participation in regional backward participation.

Table 6.2 Changes in backward participation at global level with different simulation variations.

[51]See the appendix for a table with changes in regional backward participation.

[52]As far as Scenario 2(unemployment closure) and Scenario 3 (augmentation of Armington elasticities by 20%) are concerned, the results, as in the global value-chains situation, show that these variations on average lowered the results of Scenario 1and those countries with the most significant changes still remain the same. For the results of these two variations, see Appendix.

[53]These results also show that regionally those countries with better economies (with high GDPs per capita - South Africa and Zimbabwe) than other member countries will also benefit more from the intra-regional policy change.

	Agriculture				Food and Beverages			
Scenarios	**SCN 1**	**SCN 2**	**SCN3**	**ACTUAL VALUES**	**SCN1**	**SCN2**	**SCN3**	**ACTUAL VALUES**
South Africa	3,18%	3,18%	3,30%	15,92%	4,00%	3,99%	4,20%	14,61%
Tanzania	9,35%	9,35%	9,50%	15,04%	21,31%	21,31%	27,60%	43,46%
Zimbabwe	9,88%	9,89%	10,80%	17,73%	33,31%	33,32%	35,80%	58,52%
Botswana	0,32%	0.32%	0,20%	17,47%	2,40%	2.40%	2,00%	40,35%
Malawi	10,20%	10,19%	10,20%	6,78%	50,41%	50,39%	51,40%	19,76%
RSACU	0,99%	0.99%	1,00%	24,65%	12,29%	12,29%	10,70%	39,26%
RSADC	0,70%	0,70%	0,70%	6,57%	3,04%	3,04%	2,80%	22,52%

Source: Author's simulation using GTAP VA module

Moving to backward participation at global level, the results for Scenario1confirm that vegetables, fruits and nuts, food products, sugar, beverages and tobacco, and crops and nec show on average higher positive changes than other products. These results can be interpreted as an increase in downstream production as these products proved to have an increased demand from the global firms which will then use them as inputs for their exports. These results could mean the more important of these sectors in value-addition since they make a significant contribution to the value-added for several SADC countries (as indicated in section 2). Overall, it also reveals that the policy limits access to inputs acquired abroad that are used in the agriculture and food sectors since the policy creates a bias towards the use of domestic inputs. Hence, changes in sectors do not correlate with the changes in tariffs since those with decreased tariffs or increased tariffs but a lower rate compared to other sectors (which remain in the tradeable zone), have more positive changes than other sectors. Therefore, regional trade agreements have a higher effect on GVC-intensive sectors, as Osnago et al. (2016) noted.

Conversely, more positive changes in sectors are registered in South Africa, Zimbabwe and RSADC, while fewer positive changes in sectors are registered in Malawi and Botswana. South Africa and Zimbabwe are big economies compared to Malawi; hence, as previously indicated, these changes could be explained by the fact that the higher impact of the policy change may favour bigger economies rather than smaller economies. This also shows that the markets for the sectors that show positive changes will be less protected and hence have more opportunity to acquire cheap inputs at the international competitive markets, meaning more participation in downstream production.

Also, the discrepancies in changes in sector tariffs may explain this behaviour since, on average, the customs union increases Malawi's sector tariffs more than other countries' sector tariffs, as indicated in earlier on. Hence, highly protected sectors might experience production loss or show no changes in production, prompting the country to reallocate resources to sectors

with a comparative advantage. This would also affect foreign investors interested in investing in the affected sectors, hence the loss of income. Lastly, given that backward participation is calculated as the share of total gross exports, the results confirm Leyaro's results which demonstrated the positive impacts of the EAC Customs Union.[54] on Tanzania's imports and exports (Leyaro et al.,2021).

Table 6.4 shows the percentage changes in total (global) agriculture and food backward participation by sector in SADC countries after implementing the common external tariff trade policy. The new policy drives sectors such as cattle, sheep and goats, raw milk and sugar cane to become uncompetitive in international markets and this comes at the expense of those sectors that register higher positive changes. This also has an impact on the demand for imported intermediate goods sourced abroad used in these sectors since they will increase their demand for domestic inputs (inside the region) used in their production more than other sectors. Hence, these changes depend on the relative changes in import and export prices following the tariff changes. However, this comes as good news in terms of regional integration since these sectors show higher percentages of sourcing inputs inside the region. This increases regional integration since section 2 has shown that the regional members have higher percentage shares of their agri-food imports and exports from the intra-region than the extra-regions.

Table 6.3 Agri-food sectors' changes in backward participation (Scenario 1).

	South Africa	Tanzania	Zimbabwe	Botswana	Malawi	RSACU	RSADC
paddyrice	0,08%	0,45%	0,00%	0,00%	0,00%	0,00%	0,00%
Wheat	1,18%	0,39%	0,00%	0,00%	0,00%	1,71%	0,40%
Cerealgrain	4,77%	2,71%	0,00%	0,00%	0,00%	0,00%	1,89%
Vegfrutsnuts	27,68%	3,74%	6,52%	0,00%	4,44%	0,95%	4,55%
Oil_seeds	0,16%	3,63%	0,00%	0,00%	1,08%	0,00%	0,55%
Sugrcane	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
plant_b_fibr	0,65%	10,08%	7,09%	0,00%	1,39%	0,00%	2,34%
Cropsnec	1,34%	8,91%	6,96%	0,00%	9,58%	0,00%	6,57%
Meat	1,49%	0,62%	0,00%	35,93%	0,00%	1,21%	3,33%
animal_prdct	2,59%	0,00%	2,06%	6,26%	0,00%	0,00%	1,06%
Wool_silkwm	5,62%	0,00%	0,00%	0,00%	0,00%	4,47%	0,30%
Ctle_shp_gts	0,23%	0,41%	0,00%	0,00%	0,00%	0,00%	1,00%
Veg_oil_fats	5,07%	28,80%	0,68%	0,00%	2,37%	0,00%	2,74%
Dairyproduc	2,42%	0,00%	0,00%	0,00%	0,00%	0,00%	0,59%
Rawmilk	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Procrice	2,92%	0,95%	0,00%	0,00%	0,00%	0,00%	0,17%
Sugar	3,67%	0,00%	22,12%	0,00%	6,91%	55,45%	12,84%
Meatprodcts	1,53%	0,00%	0,00%	4,06%	0,00%	0,00%	0,46%

[54]EAC and SADC common external tariffs are identical – 0% on raw materials and capital goods, 10% on intermediate goods, and 25% on final goods.

Foodprodcts	26,22%	16,84%	2,91%	39,04%	1,05%	35,21%	45,73%
Bev_tobacco	12,38%	22,47%	51,67%	14,70%	73,19%	0,99%	15,48%

Source: Author's simulation using GTAP VA module

For unemployment closure and the augmentation of Armington elasticities by 20%, as previously noted, the obtained values closely resemble those of Scenario1. As far Armington elasticities is concerned, this could mean that domestic products are not easily substituted with imported ones, or that external factors like regulations or trade policies limit the elasticity of demand in these products. Table 5.5 shows the changes in scenarios 2 and 3. With these two scenarios, higher positive changes are registered in RSADC in Crops and nec at 35.07%, South Africa in vegetables, fruits and nuts at 27.69% and Zimbabwe in plant and fibre at 7.10%. Hence, these changes are driven by a shifting of factors of production that lead to the demand for higher skilled labour and capital in agricultural production than in other sectors and the substitution effects (between domestic and international products), hence the increase in production and the real GDP.

Table 6.4 Shows changes in agriculture backward participation with different scenarios: 2and 3.

Country	**SA**		**Tanzania**		**Zimbabwe**		**Botswana**		**Malawi**		**RASCU**		**RSADC**	
scenario	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***
Paddy rice	0,09 %	0,09 %	0,45 %	0,51 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00%
Wheat	1,18 %	1,11 %	0,40 %	0,32 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	1,71 %	2,27 %	1,95 %	0,38%
Cerealgrain	4,77 %	4,52 %	2,71 %	2,34 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	1,93 %	1,72%
Veg. fruitnuts	27,68%	28,93%	3,74 %	3,20 %	6,51 %	6,42 %	0,00 %	0,00 %	4,44 %	4,35 %	0,95 %	1,22 %	5,49 %	5,08%
Oil_seeds	0,16 %	0,14 %	3,63 %	3,08 %	0,00 %	0,00 %	0,00 %	0,00 %	1,08 %	1,00 %	0,00 %	0,00 %	3,25 %	0,57%
Sugarcane	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00%
Plant_b_fibr	0,65 %	0,64 %	10,08%	8,72 %	7,10 %	7,39 %	0,00 %	0,00 %	1,39 %	1,37 %	0,00 %	0,00 %	11,69%	2,41%
Cropsnec	1,34 %	1,14 %	8,92 %	7,11 %	6,96 %	7,15 %	0,00 %	0,00 %	9,57 %	9,41 %	0,00 %	0,00 %	35,06%	7,09%
Animal_prod.s	2,59 %	2,58 %	0,00 %	0,00 %	2,06 %	2,03 %	6,24 %	4,80 %	0,00 %	0,00 %	0,00 %	0,00 %	5,19 %	1,09%
Wool_silkwm	5,63 %	5,38 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	4,47 %	5,36 %	5,84 %	0,31%
Ctle_shp_gts	0,23 %	0,20 %	0,41 %	0,35 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	4,55 %	1,02%

Source: Author's simulation using GTAP VA module

As for food products, in both scenarios, higher positive changes are recorded primarily in products such as vegetable oil and fats, sugar, food products, beverages, and tobacco in countries such as South Africa, Tanzania, Botswana, RSADC and the RSACU. The positive changes in these sectors would increase these countries' value-added by +5% on average since they already had higher values compared to other countries before the new policy. Hence, this could mean more engagement in global value chains through these sectors as firms would benefit from the prices and access to the preferred goods they decide to purchase, and this leads to economic growth. Additionally, the introduction of the new policy testifies to the increase of these sectors in GVC participation (as noted in section 2, it increased over time), even though they are not so complex as other manufacturing services such as cars, and this could also increase specialization.

On the contrary, insignificant changes are recorded in products such as raw milk, meat and meat products. This suggests that they contribute less to the countries' GDP which comes at the expense of those sectors that record higher positive changes. Indeed, these changes also do not correlate with the sector tariff changes since those countries with higher sector tariff changes have lower or insignificant changes in backward participation. Table 5.6 illustrates the changes recorded in the food and beverages sectors when Scenarios 2 and 3 are considered. It is important to note that these results are in line with those for Scenario1.

Table 6.5 changes in food backward participation with different simulations: Scenarios 2 and 3.

Country	**SA**		**Tanzania**		**Zimbabwe**		**Botswana**		**Malawi**		**RASCU**		**RSADC**	
Scenarios	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***
Meat	1,49 %	1,31 %	0,63 %	0,50 %	0,00%	0,00 %	35,9 1%	44,0 3%	0,00 %	0,00 %	1,21 %	1,60 %	3,32 %	3,69%
Veg_oil_fats	5,08 %	4,47 %	28,8 0%	22,9 0%	0,68%	0,65 %	0,00 %	0,00 %	2,37 %	2,35 %	0,00 %	0,00 %	2,73 %	2,88%
Dairy produce	2,41 %	1,77 %	0,00 %	0,00 %	0,00%	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,59 %	0,83%
Raw milk	0,00 %	0,00 %	0,00 %	0,00 %	0,00%	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00%
Processed rice	2,92 %	1,98 %	0,95 %	0,87 %	0,00%	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,17 %	0,18%
Sugar	3,67 %	3,80 %	0,00 %	0,00 %	22,10%	21,1 4%	0,00 %	0,00 %	6,91 %	6,78 %	55,5 0%	66,4 1%	12,8 4%	14,50 %
Meat prod.s	1,53 %	1,46 %	0,00 %	0,00 %	0,00%	0,00 %	4,10 %	4,93 %	0,00 %	0,00 %	0,00 %	0,00 %	0,46 %	0,47%
Food prod.s	26,2 1%	19,1 8%	16,8 4%	13,4 1%	2,91%	1,13 %	39,0 9%	16,0 7%	1,05 %	0,76 %	35,1 5%	20,6 2%	45,7 5%	40,32 %

Bev_tobacco	12,38%	21,29%	22,46%	36,68%	51,68%	54,09%	14,66%	30,15%	73,20%	74,00%	0,99%	2,51%	15,50%	17,46%

Source: Author's simulation using GTAP VA module

6.4 Forward participation by sector

Table 6.7 shows the average changes in the global agri-food forward participation of countries after implementing the common external tariffs. The results suggest that Tanzania and Malawi and Zimbabwe will significantly increase the supply of inputs used in the agriculture and food sector by other countries compared with other SADC countries. These results go hand in hand with those of Laget et al. (2018) who confirmed that signing deep trade agreements, on average, increases the domestic value-added in exports through GVCs and improves the forward linkages.

Additionally, the variation of augmenting Armington elasticities by 20% shows some significant changes (though at lower values) in several countries due to an increase in demand for imported intermediate goods substituting domestic inputs that would increase by roughly 7%. However, in Botswana, the variation has no effect as the results did not change. Moreover, if we compare full employment with unemployment closure, though results are not significant compared with the augmented Armington elasticities, some slight changes can be seen in countries such as Zimbabwe and Malawi due to the endowment effects.

The results are different when comparing agriculture to food; other countries have higher positive changes in food than agriculture, e.g., Zimbabwe, Malawi and the RSACU. The fact that these countries have higher percentage values in forward participation in food than agriculture signifies that their domestic value-added in exports has increased more in this sector than in agriculture. It is not surprising since these countries import more agricultural products in the region than other countries and they could be incorporated into their food sectors which they may export as inputs to other countries' production.

Apart from global forward participation, the customs union theory notes that regional trade agreements promote regional integration; this is also confirmed in terms of regional forward participation in SADC. As far as Scenario1is concerned[55], some countries record positive changes in their regional forward participation indicating that SADC countries would increase their exports even in agri-food sectors. Accordingly, South Africa and RSADC have recognized regional agriculture and food forward participation changes than other countries

[55]For the regional results of Scenarios 2 and 3, see Appendix - the results of these two scenarios are not far from those of Scenario 1.

while the majority of the countries show no changes (see table in Appendix). These results enhance the already higher values of these countries' forward participation in the food sector.

On average, in terms of (regional) forward participation, it shows that the policy will increase regional trade integration by 8% for agriculture and 3% for food. This would also enhance the upstream production of the region which could even encourage the region to participate in forward participation more than other regions in Africa. Moreover, adding to the growth of services and intensity of natural resources that enhance the region's forward participation, the results also outline the importance of these two sectors (agriculture and food) in enhancing the region's local value-added and the growth of its economies. Also, by comparing regional agri-food forward changes with backward participation changes, on average, it shows that backward changes (6.5%) are higher than forward ones (5.5%)[56]. This is also coherent with the results showing that forward participation, related to the upstreamness of production, is less sensitive to trade costs than backward integration (Antràs and Gortari, 2020; Salvatici et al., 2021).

As we observe different scenarios, although the results do not deviate significantly from Scenario 1 (as in the case of backward participation), the consideration of unemployment tends to reduce the magnitudes of the changes, particularly in agri-food forward participation at the intra-region trade level (see appendix). Therefore, when comparing full employment to unemployment, some noticeable changes in the results are recorded for intra-region trade in South Africa and RSADC, while in the majority of the countries, no significant changes are evident. Indeed, with regard to intra-region trade, the results confirm what has been observed by Amogne et al. (2021) who note that unemployment closure brings different results from one country/sector to the other due to different endowment effects and economic characteristics.

Thus, these findings underscore the importance of recognizing the diverse socioeconomic factors at play within each country. Furthermore, they highlight the nuance nature of the relationship between trade and employment. Indeed, unemployment closure shifts the demand for factors of production. Notably, in South Africa and RSADC, unemployment closure would decrease the demand for land, increase the demand for skilled labour, and create more capital supply for production, hence an increase in exports. For RSADC, these changes enhance its exports destined inside the region to be in the same range as those of other member countries. This is because, without the new policy, it has lower values than other member countries, as noted earlier on.

[56] These are the changes in regional backward participation in agri-food sectors. It has been calculated as the shares of foreign value-added in exports originated inside the region.

Therefore, these results emphasize the significance of considering labour market conditions and their potential influence on trade dynamics. Thus, policy makers should consider the specific context of each country and tailor strategies accordingly to mitigate any adverse effects of unemployment on trade outcomes. Lastly, the results also confirm that higher Armington elasticities provide more benefits to some SADC countries at both regional and international level (e.g., in Tanzania, Zimbabwe, RSACU and RSADC), in line with the results obtained by Daniel and Balistreri (2003). They demonstrated that marginal liberalization benefits Colombia with higher (augmented) Armington elasticities, but that it was harmful with lower Armington elasticities.

Table 6.6 Changes in forward participation at global level with different simulations.

	Agriculture				Food and Beverages			
Scenarios	**SCN1**	**SCN 2**	**SCN 3**	**ACTUAL VALUES**	**SCN1**	**SCN 2**	**SCN 3**	**ACTUAL VALUES**
South Africa	1,16%	1.16%	1,14%	26,13%	0,74%	0.74%	0,71%	12,55%
Tanzania	11,88%	11.88%	12,05%	17,53%	3,62%	3.62%	3,66%	13,32%
Zimbabwe	4,87%	4.86%	4,86%	3,02%	16,01%	16,00%	16,55%	14,66%
Botswana	0,24%	0.24%	0,24%	20,70%	0,30%	0,30%	0,30%	10,65%
Malawi	7,62%	7.61%	7,52%	28,02%	9,56%	9.55%	9,71%	15,99%
RSACU	1,32%	1.32%	1,42%	28,93%	2,98%	2.97%	3,28%	13,57%
RSADC	0,86%	0.86%	0,87%	27,52%	0,55%	0.55%	0,57%	16,03%

Source: Author's simulation using GTAP VA module

From the results for total forward participation, we learn that the proposed trade policy has various effects across different sectors and countries. Table 5.8 shows that the new policy has a differentiated impact on the overall forward participation of the 20 agriculture and food sectors in different SADC countries. From Scenario1, significant changes are registered in vegetables, oil and fats, cattle, sheep and goats, animal products, meat, sugar cane, cereal grains, and crops and nec in the majority of the countries. Almost all countries will increase their exports in these sectors which other countries will then use to produce their final goods, hence the increase in upstream production.

The results show that insignificant changes occur in other sectors such as paddy rice, wheat, meat, meat products and processed rice in most of the countries. These insignificant changes come at the expense of those sectors with significant changes, for example, in sectors such as crops and nec, dairy produce, oil and seeds, food products, meat products, vegetables oil and fats, vegetables, fruits and nuts, and beverages and tobacco. Additionally, sector-significant changes are registered mostly in RSADC, Tanzania, and South Africa; the countries that have

higher GDPs per capita in the region (as well as high participation rates in GVCs). Hence, better-positioned countries benefit more from regional trade policies than worse-off countries. This is in line with Bilal and Roza (2007) and Dobeling (2016) who indicated that policy changes may give higher benefits to better (developed) economies (in this case, South Africa and Tanzania) than emerging countries. Economic theory also stipulates that the largest economies have the greatest monopoly power on world markets. This is supported by the fact that these countries' terms of trade would show higher significant changes of more than 5%, values which are higher than other countries. Also, their welfare[57] increases by more than 30 % compared with other countries.

Table 6.7 Changes in global forward participation (Scenario 1).

	South Africa	Tanzania	Zimbabwe	Botswana	Malawi	RSACU	RSADC
paddyrice	0,34%	5,50%	0,00%	0,00%	0,00%	0,00%	0,67%
Wheat	1,82%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Cerealgrain	8,89%	7,40%	0,00%	8,05%	0,00%	0,00%	3,43%
Vegfrutsnuts	28,49%	19,71%	0,76%	16,25%	0,00%	8,56%	11,48%
Oil_seeds	1,18%	9,44%	0,00%	0,00%	12,46%	0,00%	3,58%
Sugrcane	0,73%	0,86%	4,87%	0,00%	0,00%	11,72%	4,66%
plant_b_fibr	1,40%	8,16%	3,99%	0,00%	7,19%	0,00%	6,67%
Cropsnec	3,76%	20,98%	10,30%	0,00%	22,31%	0,00%	23,02%
animal_prdct	5,40%	2,07%	3,01%	7,56%	0,00%	0,00%	3,02%
Wool_silkwm	5,28%	0,00%	0,00%	0,00%	0,00%	5,31%	0,00%
Ctle_shp_gts	3,78%	3,42%	0,00%	13,87%	0,00%	0,00%	4,36%
Meat	0,76%	1,49%	0,00%	0,00%	0,00%	0,00%	0,71%
Veg_oil_fats	2,34%	1,77%	0,00%	0,00%	0,00%	0,00%	1,66%
Dairyproduc	2,44%	0,00%	0,00%	46,49%	0,00%	0,00%	0,33%
Rawmilk	2,21%	0,50%	0,00%	0,00%	0,00%	3,40%	6,80%
Procrice	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Sugar	3,38%	0,00%	4,68%	0,00%	8,02%	52,75%	6,24%
Meatprodcts	0,72%	0,00%	0,00%	0,00%	0,00%	0,00%	0,71%
Foodprodcts	20,32%	5,62%	2,19%	7,78%	0,00%	18,24%	11,62%
Bev_tobacco	6,75%	13,09%	70,21%	0,00%	50,01%	0,00%	11,04%

Source: Author's simulation using GTAP VA module

[57]Since the welfare changes are calculated in terms of equivalent variations, these can be interpreted as money gains.

Here the changes necessitated by Scenarios 2 and 3 are also close to those in Scenario 1. For many products, the changes are, on average, between 1% and 20% for agriculture and food products. These positive changes further support the notion that countries may experience improved production and demand in these sectors which can have positive effects on their agriculture economies. Indeed, some products show significantly more positive changes in Scenario3 than in the other two, suggesting that these products are easier to substitute with foreign alternatives than in other sectors.

Table 6.8 Changes in forward participation in agriculture with different simulations: Scenarios 2 and 3.

Country	**SA**		**Tanzania**		**Zimbabwe**		**Botswana**		**Malawi**		**RASCU**		**RSADC**	
scenario	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***	***Scn 2***	***Scn 3***
Paddy rice	0,35 %	0,37 %	5,50 %	5,70 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,67 %	0,70%
Wheat	1,83 %	1,90 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00%
Cerealgrain	8,88 %	8,99 %	7,40 %	7,30 %	0,00 %	0,00 %	8,05 %	8,70 %	0,00 %	0,00 %	0,00 %	0,00 %	3,43 %	3,43%
Veg. fruitnuts	28,49%	28,86%	19,71%	19,69%	0,76 %	0,73 %	16,28%	17,67%	0,00 %	0,00 %	8,56 %	8,29 %	11,48%	11,22 %
Oil_seeds	1,18 %	1,19 %	9,44 %	9,42 %	0,00 %	0,00 %	0,00 %	0,00 %	12,48%	11,94%	0,00 %	0,00 %	3,58 %	3,47%
Sugarcane	0,73 %	0,74 %	0,86 %	0,83 %	4,87 %	4,71 %	0,00 %	0,00 %	0,00 %	0,00 %	11,73%	13,11%	4,66 %	4,55%
Plant_b_fibr	1,40 %	1,42 %	8,16 %	8,11 %	3,99 %	3,88 %	0,00 %	0,00 %	7,19 %	7,22 %	0,00 %	0,00 %	6,67 %	6,57%
Cropsnec	3,76 %	5,43 %	20,98%	2,07 %	10,30%	2,99 %	0,00 %	8,12 %	22,32%	0,00 %	0,00 %	0,00 %	23,00%	2,98%
Animal_prod.s	5,40 %	5,20 %	2,07 %	0,00 %	3,01 %	0,00 %	7,55 %	0,00 %	0,00 %	0,00 %	0,00 %	5,19 %	3,02 %	0,00%
Wool_silkwm	5,28 %	3,82 %	0,00 %	3,40 %	0,00 %	0,00 %	0,00 %	14,85%	0,00 %	0,00 %	5,32 %	0,00 %	0,00 %	4,27%
Ctle_shp_gts	3,78 %	3,72 %	3,42 %	21,35%	0,00 %	9,97 %	13,88%	0,00 %	0,00 %	22,17%	0,00 %	0,00 %	4,36 %	23,35 %

Source: Author's simulation using GTAP VA module

As for food products, in both scenarios (as in Scenario 1), higher positive changes are recorded primarily in products such as vegetable oil and fats, sugar, raw milk, food products and beverages, and tobacco in countries such as South Africa, Tanzania, Zimbabwe and RSADC. Since Zimbabwe already has higher forward participation than other SADC countries (as noted in section 2), the positive changes in these sectors would further increase its forward

participation to remain higher than other member countries. On the contrary, insignificant changes are recorded in products such as processed rice and dairy produce in most countries. Therefore, these results could also be interpreted as follows: as far as scenario 3 is concerned, the regional disparities in production responses to higher Armington elasticities emphasize the importance of tailored policy interventions. While some sectors, like sugar and beverages, show resilience due to competitive advantages and forward participation in regional trade, others, like dairy and raw milk, are more vulnerable to import competition. The results indicate that countries within the SADC region, particularly RSADC, should prioritize strengthening their agro-processing capabilities and regional trade networks to mitigate the effects of higher substitutability with imported goods. This will ensure more robust participation in the regional value chains and greater resilience to changes in global trade dynamics, thereby safeguarding economic growth and regional integration efforts.

As far as scenario 2 is concerned, sectors like food products, sugar, and vegetable oils and fats show significant positive changes, indicating robust demand and the capacity of these economies to attract more labour under the fixed-wage assumption. However, sectors like processed rice and dairy produce reveal stagnation, suggesting limited labour mobility or demand in those industries. Thus, the regional differences show how economic structures, and sectoral specializations influence employment outcomes when wages are fixed, with some countries better able to absorb unskilled labour across various industries than others. Table 6.10 illustrates the changes recorded in the food and beverages sectors when Scenarios 2and 3 are considered.

Table 6.9 Changes in food sector with different simulations: Scenarios 2and 3.

Country	**SA**		**Tanzania**		**Zimbabwe**		**Botswana**		**Malawi**		**RASCU**		**RSADC**	
Scenarios	Scn 2	Scn 3	Scn 2	Scn 3	Scn 2	Scn 3	Scn 2	Scn 3	Scn 2	Scn 3	Scn 2	Scn 3	Scn 2	Scn 3
Meat	0,76 %	0,76 %	1,49 %	1,48 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	2,11 %	0,74%
Veg_oil_fats	2,35 %	2,36 %	1,77 %	1,72 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	4,23 %	1,62%
Dairy produce	2,45 %	2,40 %	0,00 %	0,00 %	0,00 %	0,00 %	46,4 9%	50,6 5%	0,00 %	0,00 %	0,00 %	0,00 %	0,70 %	0,39%
Raw milk	2,21 %	2,25 %	0,50 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	3,40 %	0,00 %	17,6 1%	6,66%
Processed rice	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00%
Sugar	3,38 %	3,41 %	0,00 %	0,00 %	4,68 %	4,61 %	0,00 %	0,00 %	8,02 %	8,06 %	52,7 6%	58,6 6%	15,4 9%	6,27%
Meat prod.s	0,72 %	0,71 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	0,00 %	2,11 %	0,72%

Food prod.s	20,31%	19,50%	5,62%	5,53%	2,19%	2,07%	7,76%	0,00%	0,00%	0,00%	18,24%	14,74%	29,58%	11,94%
Bev_tobacco	6,75%	6,96%	13,09%	13,38%	70,20%	71,05%	0,00%	0,00%	49,99%	50,61%	0,00%	0,00%	28,17%	11,14%

Source: Author's simulation using GTAP VA module.

7. Conclusion and policy implications

Historically, at international level, agriculture and food are the sectors believed to be produced for domestic consumption or directly exported to the final consumer. These sectors are generally more protected than other sectors (they have high tariffs applied to them compared with other sectors). In the language of global value chains, as Salvatici (2020) noted, these sectors are linked to other economic sectors and are now globally processed in value chains. This participation in the global value chain promotes domestic value-added and economic growth.

Traditional international trade statistics databases no longer give accurate results when analysing global value chains due to magnificent effect and double counting problems since goods and services cross the border several times. This has led to the development of new value-added databases that smoothly analyse value-added chains. These new databases include but are not limited to TiVA, UNCTAD Eora, GTAP, and World input-output (WIOD). They trace where the value-added has originated and where it is finally consumed (Borin and Mancini, 2019, Salvatici 2021). Each of these databases has its advantages and disadvantages. For example, the EORA database, used to provide some stylized facts on SADC GVC participation is the only database that provides continuous time series for almost all African countries between 1990 and 2015. This is the reason why it is useful in terms of time series analysis. Conversely, the GTAP database works well with CGE modeling, and is useful for performing ex-ante analysis – a major aspect of the current research.

Indeed, this research adds to the existing broad literature by analysing the effects of the proposed SADC common external tariff, specifically on agriculture and food and beverages global value chain participation (backward and forward GVC participation). A CGE model has been used together with the MRIO to perform ex-ante analysis. These MRIO tables measure production at bilateral and sectoral levels while showing the effects of the changes in tariffs on the fragmentation of production and the participation of the global value chains. This experiment offers an understanding of the nexus between customs unions and global value chain participation. Data were obtained from the GTAP in its MRIO version. The researcher

established an ICIO table from this database to calculate disaggregated global value chain participation indicators for 20 agri-food sectors in six SADC countries. This database covers a wide range of countries, including SADC countries.

To obtain the desired results, the researcher used a revised version of the GTAP model, the GTAP-VA module, to explore the range of scenarios (shock of the new policy and some variations) where the proposed policy was simulated. The counterfactual scenarios provided new insights into the impact of the newly framed trade policy on value-added flows at industry, national and global levels.

Indeed, the results demonstrate that the customs union creates a single market among SADC member countries by eliminating tariffs and other barriers to trade among them. Thus, the results show that the introduction of the customs union leads to an increase in backward participation in all scenarios, with the largest increases observed in Scenario 3. One of the main drivers of the results is the increase in market size that occurs when SADC countries integrate their markets through the customs union which will also likely intensify competitiveness. This larger market provides firms with greater opportunities to specialize in production processes and benefit from economies of scale. As a result, there is an increased demand for intermediate inputs from other countries in the region which leads to higher levels of backward participation.

Significantly, the specific results for each country depend on a variety of factors such as the level of development of each country's economy, the structure of its production processes, and the composition of its exports. Thus, countries that are more integrated into regional value chains prior to the introduction of the customs union such as South Africa experience larger increases in backward participation than countries that are less integrated. South Africa and other countries grouped as RSADC, which are also expected to experience higher positive changes in global backward integration, should therefore capitalize on their progress by actively seeking opportunities to acquire cost-effective intermediate goods from competitive international markets. Their higher levels of backward participation compared with other SADC countries indicate the potential for further expansion of downstream production.

SADC countries should recognize the influence of tariff changes at national level since higher tariff increases due to the common external rate, as seen in countries such as Malawi, can have a more pronounced negative impact on the economy. Therefore, member countries should carefully manage tariff adjustments in order to align with the new tariff rates. Indeed, prudent decision-making regarding tariffs is essential to maximizing the benefits of the customs union.

Therefore, based on the empirical findings, it is advisable to prioritize policies that address the economic disparities between larger and smaller countries within the SADC region.

Indeed, the analysis clearly demonstrates that developed economies such as South Africa, Botswana and RSADC benefit significantly from the proposed policy, indicating the need for measures that promote greater equity among member states. Special attention should be given to smaller countries such as RSACU to ensure their fair share of the positive changes in regional and global value chains. By taking this into consideration and reducing the potential disadvantages faced by smaller economies, the SADC region can achieve a more balanced distribution of the benefits from the new policies while fostering economic growth. Thus, policy makers can work towards creating a more equitable and mutually beneficial regional trade environment.

Additionally, the positive impacts of the SADC Customs Union extend beyond economic development, but also contribute to knowledge transfer, domestic value-addition, and subsequently impact crucial factors such as GDP, employment and productive capacity. Thus, these findings underline the significance of strategic policies in fostering regional integration, international production networks and promoting sustainable economic growth, aligning with the perspectives shared by UNCTAD (2013; 2016), Sturgeon and Memedoci (2019), Pahl and Timmer (2019) and the World Bank (2020).

Furthermore, the increase in forward participation among SADC countries resulting in the customs union stipulates an increase in their upstream production, potentially enhancing their market competitiveness and participation in GVCs, while finding themselves in a difficult position to break into downstream production. However, they can take advantage of this and increase their market competitiveness while increasing their participation in GVCs. This is an argument that aligns with the principles of comparative advantage where countries specialize in industries where they have inherent strengths. Therefore, as in the case of backward participation, supportive policies that address the potential inequality of benefits arising from the implementation of the customs union, while promoting a more inclusive and balanced distribution of benefits and comparative advantages among member countries, are crucial.

The results also highlight the importance of considering variations such as unemployment closure and augmentation of the Armington elasticities when assessing the impact of regional integration policies. These variations reveal that different countries experience varying effects due to their unique endowment effects, particularly in agri-food sectors at regional level. Therefore, policy makers should take into account these differences and design interventions that address the specific challenges faced by individual countries.

Furthermore, To maximize the potential benefits of deeper integration into agri-food GVCs, member states should prioritize improving labour mobility across borders. This can be achieved through the mutual recognition of qualifications and the establishment of robust regional mobility frameworks. In addition, targeted investments in upskilling agricultural workers are essential to ensure they can transition into more value-added roles along the production chain. Such strategic interventions would not only facilitate better alignment with the demands of modern agri-food value chains but also enhance the region's competitiveness and inclusivity in GVC participation.

By comparing the effects of the policy on regional and global value chains, the results also indicate that the proposed policy positively promotes regional integration more than global integration in both backward and forward participation, suggesting that implementing a common external tariff and promoting value chains can enhance intra-regional trade and sourcing of intermediate goods within the region. Indeed, by increasing tariffs for imported commodities from outside the region, the policy encourages the use of locally sourced inputs, fostering economic cooperation and reducing dependence on global markets. These findings are in line with Blanchard et al. (2016) who noted that changing tariff rates and trade costs are key factors that drive the global value chains. Thus, policymakers could also encourage the local sourcing of intermediate goods by providing incentives to domestic producers, promoting technology transfer and knowledge sharing among member countries, and facilitating access to finance and investment for local producers. This could also help strengthen regional value chains and boost local production and employment.

However, the policy may also result in a decrease in GVC participation with specific trading partners outside the region as noted by South Africa and Latin America and therefore have implications for the geographic reorientation of SADC's GVC participation (this also has implications for SADC's strategic positioning in GVCs). This highlights the trade-offs and complexities involved in designing trade policies that affect GVC participation and the need for careful consideration of the specific context and dynamics of the region. Therefore, the research suggests that a careful calibration of the tariff rates is needed to balance the potential gains from increased regional value chains participation within the SADC region with the potential losses from reduced GVC participation with external partners. The findings stress the importance of considering heterogeneity in the production structures and trade patterns of SADC countries when implementing the CET policy.

Furthermore, the implementation of the SADC Customs Union and its impact on agri-food GVC can be seen as a positive step towards regional and global integration, and economic development. Indeed, the findings from an analysis of these sectors, further confirm the positive effects of the new policy. Thus, countries that benefit most from the agriculture sector in the global market such as South Africa, Tanzania, Zimbabwe and Malawi countries have an opportunity to enhance economic growth and create more jobs through increased participation in GVCs.

The positive changes in sectors such as vegetables, fruits and nuts, animal products, food products and beverages and tobacco indicate that the policy has the potential to drive greater domestic value-added, promote competitiveness, and contribute to overall economic improvement through these products. Indeed, by capitalizing on their strengths in the agri-food sector, they can increase income levels, stimulate technological advancement, and strengthen their overall GDP. On the other hand, the lower benefits in the majority of sectors observed in Botswana and RSACU countries, highlight challenges they face in terms of competitiveness in international markets. This suggests the need for targeted efforts to enhance their agricultural productivity, promote innovation, and improve market access to fully leverage the opportunities provided by the customs union. Thus, by implementing supportive policies, their participation in GVC can be enhanced while reaping the benefits of market integration. However, since the results also emphasize the importance of regional cooperation and coordination in promoting agri-food value chains, policy interventions should also focus on supporting sectors with significant potential for value addition and promoting trade facilitation measures to foster an environment that is conducive to regional integration and sustainable growth.

Furthermore, the policy's enhancement of regional value chains aligns with the objectives of the SADC's 2018 Industrial Roadmap which aims to promote regional value chains, particularly in the agriculture and food sectors. However, it is important to note that since the benefits of the policy could not be uniformly distributed in terms of backward and forward participation, this can lead to different perspectives among countries regarding the impact on GVC participation and associated benefits. Nevertheless, the promotion of regional value-chains holds promise for addressing challenges such as trade deficits in food products that are commonly experienced in the SADC region. By fostering higher levels of intra-regional trade, the region can enhance food security and uplift the livelihood of its population, given the region's heavy reliance on agriculture and the food sector. Thus, SADC countries should capitalize on the opportunities presented by policy implementation which include prioritizing

investment in agriculture and promoting agriculture innovation. Therefore, by leveraging the potential of regional value chains, the SADC region can achieve greater self-sufficiency and economic prosperity.

Accordingly, the implications of the newly proposed policy align with the findings from previous research on customs unions in other regions. For example, research on the ECOWAS Customs Union by Oluwaseun Ojo and Adeola Adenikinju (2020) as well as the Gulf Cooperation Council Customs Union on intra-regional trade and economic development by Abdullah Al-Mulhim (2017) have demonstrated positive impacts on intra-regional trade, investment and value chain integration. Gianfranco et al. (2014) also found that the Andean Community Customs Union facilitated regional value chain integration.

To fully harness the benefits of the proposed policy, investment in technology and infrastructure development is crucial. Thus, improved infrastructure will reduce trade costs within the region and attract more investors. Furthermore, even though the policy offers substantial benefits, it also presents complex challenges and implications that require nuanced policy design and diplomatic finesse. By recognizing and addressing the specific needs of member countries and fostering regional cooperation, the SADC region can harness the full potential of this trade policy for the mutual benefit of all stakeholders. Lastly, since the analysis used an ex-ante approach, policymakers should continuously monitor and evaluate the actual impacts of the policy after its implementation to assess its effectiveness and make necessary adjustments. This could involve regular data collection and analysis, stakeholder consultations and impact assessments to inform evidence-based policy decisions.

Lastly, the research opens up several avenues for further research. Future research could explore the dynamics of GVC participation and regional value chain development in the context of technological innovation and global production networks. Understanding how technological changes affect SADC countries' competitiveness in GVCs can inform policies for fostering technological upgrades and innovation. Additionally, research could examine non-tariff measures, such as trade facilitation and customs procedures, and investigate the long-term effects of CET policies on SADC's trade and production patterns. Exploring the role of institutions and governance in shaping GVC participation can provide broader insights into enabling conditions for regional integration. Furthermore, examining the policy's implications for employment, income distribution, and industrial upgrading would offer a comprehensive assessment of its welfare effects.

8. Appendix.

8.1 Formal derivation of GVC participation indicators based on GTAP VA module.

Let *i* and *j*, ranging from 1 to N, represent the indices for sectors, while s and r, ranging from 1 to C, represent the indices of the countries. We define VSH as diagonal matrix, denoted as VSH, which contains the sectoral value-added shares (i.e., the proportion of value-added to total output) along the main diagonal (Antimiami et al, 2018). The value-added comprises the remuneration of primary factors of production, such as capital and labour, as well as the income generated from the output and trade-related taxes. Additionally, we define A as a technical coefficient matrix with dimensions NCxNC, and L as the global Leontief inverse (multiplier) matrix, which provides the total requirement of output, both directly and indirectly, needed globally to produce 1 unit of consumption, consequently, the value added in trade (TVA) can be precisely defined as follows:

$$\boldsymbol{TVA_{ij}^{tsr} = \widehat{VSH_i^t} L_{ij}^{ts} * VXE_j^{sr}}$$

thus, the value-added multiplier matrix, denoted as $\boldsymbol{\widehat{VSH_i^t} L_{ij}^{ts}}$, quantifies the contributions of value-added from the entire output required directly or indirectly to produce 1 unit of output (Antimiami et al, 2018). The coefficients $\boldsymbol{VXE_j^{sr}}$ represents bilateral exports assessed at market prices, excluding any potential intra-regional trade flows that do not apply to the differentiation between domestic value-added (DVA) and foreign value-added (FVA). Therefore, $\boldsymbol{TVA_{ij}^{tsr}}$ signifies the value-added originating in sector *i* of country *t* and embedded within country *s'* exports in *j* to *r*.

a) Multilateral DVA (DVAM).

$$\boldsymbol{DVA\_mlt_j^{sr} = \sum_i \sum_{t\#s,r} \widehat{VSH_j^s} L_{jt}^{st} * VXE_j^{sr} - DCM_j^{sr}},$$

in which the term "DCM" refers to double counting, which addresses the issue of value-added being repeatedly counted in the trade process. This phenomenon occurs when country *s'* value added is first exported to country *r* as part of intermediates, which are then utilized by country *r* to reexport to country *s*. Subsequently, in country *s*, this value added is once again exported to country *t*, where it undergoes further processing before being exported yet again to country *r*. As a results, this process leads to the repetition of value added in trade calculations.

b) Foreign value added (FVA).

$$\boldsymbol{FVA_j^{sr} = \sum_i \sum_{t\#s} \widehat{VSH_i^t} L_{ij}^{ts} * VXE_j^{sr}}.$$

8.2 Changes in GVC participation destined to different regions at the bilateral level.

i) Changes in shares of foreign value-added in exports destined to various regions/countries- first scenario.

Table 6.11 Changes in shares of foreign value-added in exports destined to extra-SADC regions.

	Rest of Africa	EastAsia	SEAsia	SouthAsia	NAmerica	LatinAmerica	EU_28	ROW
SouthAfrica	1,50%	1,50%	0,60%	1,80%	0,60%	0,40%	1,50%	0,70%
Tanzania	0,20%	0,00%	0,00%	0,10%	0,00%	0,00%	0,00%	0,10%
Zimbabwe	0,00%	0,10%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Botswana	0,00%	0,00%	0,00%	0,10%	0,00%	0,00%	0,10%	0,00%
Malawi	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
RSACU	0,10%	0,00%	0,00%	0,10%	0,00%	0,00%	0,00%	0,00%
RSADC	0,20%	1,70%	0,30%	1,30%	0,40%	0,40%	1,10%	0,30%

Source: Author's simulation using GTAP VA module

Table 6.12 Changes in shares of foreign value-added in exports destined to SADC regions.

	SouthAfrica	Tanzania	Zimbabwe	Botswana	Malawi	RSACU	RSADC
SouthAfrica	0,00%	5,70%	60,90%	75,70%	34,70%	82,20%	25,10%
Tanzania	0,10%	0,00%	0,10%	0,00%	1,40%	0,00%	0,40%
Zimbabwe	0,70%	0,10%	0,00%	0,30%	1,60%	0,00%	0,60%
Botswana	0,70%	0,00%	1,30%	0,00%	0,10%	0,10%	0,40%
Malawi	0,10%	0,10%	0,70%	0,00%	0,00%	0,00%	0,10%
RSACU	2,40%	0,70%	0,70%	0,00%	1,20%	0,00%	0,20%
RSADC	6,10%	1,10%	7,00%	8,70%	6,60%	2,00%	0,00%

Source: Author's simulation using GTAP VA module

Table 6.13 Changes in shares of forward participation in exports destined to extra-SADC regions.

	RestofAfrica	EastAsia	SEAsia	SouthAsia	NAmerica	LatinAmerica	EU_28	ROW
SouthAfrica	1,00%	1,10%	1,10%	1,00%	1,10%	0,90%	1,30%	1,40%
Tanzania	0,10%	0,10%	0,10%	0,10%	0,10%	0,10%	0,10%	0,10%

Zimbabwe	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
Botswana	0,10%	0,20%	0,10%	0,20%	0,10%	0,10%	0,20%	0,20%
Malawi	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
RSACU	0,00%	0,10%	0,00%	0,00%	0,00%	0,00%	0,00%	0,10%
RSADC	1,40%	1,30%	1,80%	1,30%	1,60%	1,40%	1,50%	2,00%

Source: Author's simulation using GTAP VA module

Table 6.14 Changes in shares of forward participation in exports destined to SADC regions.

	SouthAfrica	**Tanzania**	**Zimbabwe**	**Botswana**	**Malawi**	**RSACU**	**RSADC**
South Africa	0,00%	1,40%	2,20%	0,90%	2,50%	0,40%	1,20%
Tanzania	0,10%	0,00%	0,10%	0,10%	0,10%	0,10%	0,10%
Zimbabwe	0,00%	0,10%	0,00%	0,50%	0,30%	0,50%	0,20%
Botswana	0,20%	0,20%	0,80%	0,00%	0,70%	0,90%	0,40%
Malawi	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
RSACU	0,00%	0,10%	0,60%	0,70%	0,40%	0,00%	0,30%
RSADC	1,30%	1,80%	4,80%	5,20%	3,40%	5,30%	0,00%

Source: Author's simulation using GTAP VA module

8.2 Changes in SADC intra-regional backwards and forward participation.

a) *Table 6.15 Changes in SADC intra-regional agri-food backward participation.*

	Agriculture				**Food and Beverages**			
Scenarios	SCN 1	SCN2	SCN3	ACTUAL VALUES	SCN1	SCN 2	SCN3	ACTUAL VALUES
South Africa	1,93%	1,62%	0,41%	1,93%	9,33%	9,73%	0,00%	3,48%
Tanzania	0,65%	0,65%	0,00%	0,33%	22,0%	3,20%	0,00%	2,22%
Zimbabwe	3,69%	3,69%	0,00%	15,40%	12,81%	12,81%	0,00%	74,82%
Botswana	1,87%	1,87%	0,02%	2,31%	7.59%	7,58%	0,01%	2,90%
Malawi	2,10%	2,10%	0,00%	0,73%	4,43%	4,43%	0,00%	4,23%
RSACU	4,06%	4,06%	0,00%	0,43%	14,90%	14,89%	0,00%	0,72%
RSADC	1,34%	1,30%	0,48%	7,87%	9,95%	10,00%	1,77%	18,0%

Source: Author's simulation using GTAP VA module

b) *Table 5.16 Changes in SADC intra-regional agri-food forward participation.*

	Agriculture				**Food and Beverages**			
Scenarios	SCN1	SCN2	SCN3	ACTUAL VALUES	SCN1	SCN2	SCN3	ACTUAL VALUES

South Africa	0,40%	0,37%	0,52%	0,15%	0,00%	0,38%	0,00%	0,13%
Tanzania	0,00%	0,00%	0,00%	0,14%	0,00%	0,00%	0,00%	0,16%
Zimbabwe	0,00%	0,00%	0,00%	0,83%	6,58%	6,58%	6,60%	0,22%
Botswana	0,00%	0,00%	0,00%	0,23%	0,00%	0,00%	0,00%	0,11%
Malawi	0,00%	0,03%	0,00%	0,23%	0,00%	0,01%	0,00%	0,23%
RSACU	0,00%	0,00%	0,00%	0,27%	0,00%	2,11%	4,27%	0,13%
RSADC	0,32%	0,25%	0,00%	0,26%	1,21%	0,00%	4,27%	0,27%

Source: Author's simulation using GTAP VA module.

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