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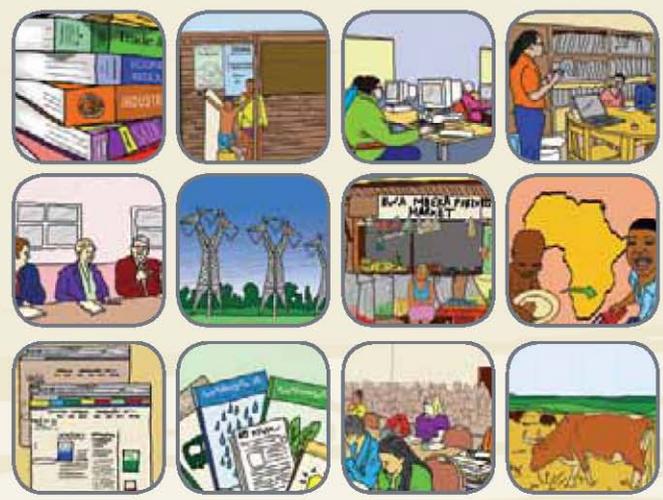
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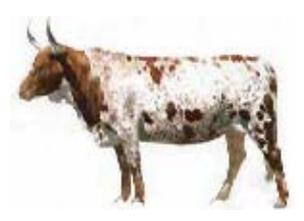


Services Sector Development and Impact on Poverty Thematic Working Group

Trade Effects of Regional Economic Integration in Africa: The Case of SADC

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indigenous growth

TRADE EFFECTS OF REGIONAL ECONOMIC INTEGRATION IN AFRICA: *The Case of SADC (Evidence from Gravity Modeling Using Disaggregated Data)*

Final version



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Executive summary

Empirical studies on regional economic integration process in Africa exhibit sluggish progress and there by limited level of intra trade. The existing literatures in Africa, particularly in Southern African regional integration bloc, SADC have neglected effects of regional economic integration dealing with disaggregated data. This study analyzes trade creation and diversion effects of the Southern African Development Community (SADC) using disaggregated data from 2000 to 2007. The investigation estimates an augmented gravity model using panel data and random effect estimator methods. The results show that the intra -SADC trade is growing in fuel and minerals, and heavy manufacturing sectors while it displays a declining trend in agricultural and light manufacturing sectors. This implies that SADC has displaced trade with the rest of the world in both fuel and minerals, and heavy manufacturing sectors. SADC has served to boost trade significantly among its members rather than with the rest of the world. Countries participating in SADC have moved toward a lower degree of relative openness in these sectors trade with the rest of the world. However, the increasing trend of extra-SADC trade bias over the sample period in both agricultural commodities and light manufacturing sectors means that there has been a negative trade diversion effect. In other words, the value of trade between members and non-members has been increasing for the two sectors. These results seem to suggest that SADC countries retained their openness and outward orientation despite they signed the trade protocol for enhancing intra-SADC trade in agricultural and light manufacturing sectors.

Keywords: *agricultural sector, fuel and minerals, heavy and light manufacturing sectors, SADC, Southern African Development Community, regional economic integration effect , trade creation and trade diversion effects.*

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Introduction

1.1 Background

Regional integration in Sub-Saharan Africa is not a recent phenomenon. At least two unions, the Southern African Custom Union and the East African Community have existed since 1910 and 1919 respectively. Regional integration arrangements initially became fashionable in the 1960s, following the formation of the European Economic Community in 1957 and the European Free Trade Area in 1960. These were pursued by a large number of regional integration agreements in the developing world as well.

In Africa, at the first two post- colonial meetings in April 1958 and in June 1960, African leaders adopted regionalism as one panacea for the economic constraints imposed by the smallness and fragmentation of national markets. Nevertheless, history has shown that the ISI policies not only failed in individual countries but also in the regional integration groupings. Such arrangements launched to fallout of fashion in the 1970s, in part because the first experiences were not successful (William et al, 1997).

However, in the late 1980s and early 1990s, regional integration has again become an attractive policy option, in both the developed and developing world. In this regard, since the end of cold war and with the emergency of powerful trading blocs, there has been a renewed interest in Africa concerning the need to create strong regional economic integration (REI) mechanisms to promote economic growth (Baldwin, 1997).

According to ECA(2006), even though the African Union only recognizes eight RECs, the continent currently has fourteen inter-governmental organizations (IGOs), working on regional integration issues, with numerous treaties and protocols governing relations among them, and between them and the member states. Among these regional schemes, Southern African Development Community (SADC) is a regional bloc working for the southern African sub region of the continent .Hence, this study confines to this regional scheme. Next, it summarizes the historical and present status of the region under the study.

Genesis of Southern African Development Community (SADC)

Originally known as the Southern African Development Co-ordination Conference (SADCC), the organization was formed in Lusaka, Zambia on 1 April 1980, following the adoption of the Lusaka Declaration. SADCC's original strategy was to concentrate on promoting co-operation in the area of infrastructure. In practice, its primary activities were the co-ordination of members' development initiatives and assistance in raising funds for these projects.

SADCC only had limited success in economic co-operation and development endeavor. In 1989, at the SADCC Heads of State meeting in Harare, it was decided to formalize the organization by giving it legal status that would replace the existing memorandum of agreement. Four years of consultation followed, the Declaration and Treaty of the SADC was eventually signed by Heads of State and Government in Windhoek, Namibia in 1992.

These are prerequisites for development with the change of name, the emphasis changed from 'development co-ordination' to 'development integration'. The true vision of SADC is in essence full economic integration of the Southern Africa region and trade liberalization. However, it has been claimed that the old SADCC always portrayed itself as an economic body; the organization had more political and ideological inclinations than economic concerns.

Initially established as a regional organization between nine member countries with the aim to "facilitate flexible coordination on those aspects of national development plans which have potential regional impact", the Southern African Development Community (SADC) as of today has 15 member countries: Angola, Botswana, The Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Madagascar, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. South Africa and Mauritius joined the bloc in 1994 and 1995 respectively.

Recently, SADC has focused on macroeconomic stability and convergence in member countries in order to achieve the formation of a common market over the medium term. In this regard, SADC has announced a plan in March 2004. The goals include establishment of a SADC customs union and implementation of a common external tariff by 2010, a common market pact

by 2012, and establishment of a SADC central bank and preparation for a single SADC currency by 2016.

1.2 Statement of the Problem

The relevance of regional integration is very persistent issue in Africa, specifically in view of political and economic backwardness. Africa is confronted with deep rooted level of poverty, minimal share of world trade, and low pace of development in human capital and infrastructure as well as faces with excess of challenges from external pressures.

Ensuring that regional economic integration succeeds in Africa is vital, not only because of the prospective and challenges mentioned above, but also because the policies that are required to ensure its fruitfulness are the same as those needed if Africa is to benefit from the process of globalization and integration in to the world economy .Owing to these facts, regional integration in Africa is needed, hoping that it will help in enhancing economic development and growth in the continent. However, in practice, the effectiveness of regional integration in Africa is an empirical issue, specifically progress of trade flows among member of any trading bloc in the continent.

There are plenty of empirical studies regarding the effects of regional economic integration on trade flows. Various researchers employ different methodology to analyze the effects of regional economic integration and the results out of these studies are mixed. Although early empirical studies used cross- sectional data to estimate gravity models (Aitkin, 1973 and Berstrand, 1985), most researchers nowadays use panel data (Matyas, 1997; Wall, 2000 and Glick and Rose, 2001). One reason is that the extra time series observations result in more accurate estimates. However, these studies fail to employ disaggregated data for analyzing the effects of regional economic integration on trade. This indicates a limitation of model's dependence upon aggregated data as opposed to disaggregated data which can help in analyzing the effects of trade agreements on specific tradable commodity and helps member countries to identify sectors which are advantageous in joining the trading bloc. In addition, aggregate data masks commodity –level heterogeneity, which may also bias the estimate.

Specifically, to the best of our knowledge, the possibility of looking using panel data approach at sectoral level is hardly practiced in Africa. As elaborated earlier, this leads to a biased estimation and hence incorrect inferences. Clausing (2001) and Romalis (2005) eliminate some of these problems by using commodity level data to analyze the effects of the Canada –United States Free Trade Agreement (CUSFTA) and North America Free Trade Agreements (NAFTA) respectively.

Despite a number of empirical contributions in recent years, the effects of regional economic integration on trade in the region under the study at disaggregated data level have not been investigated rigorously. This void motivates our study, which focuses on the Southern African Development Community (SADC) and its effects on trade using disaggregated data. To assess the effects of SADC on trade flows of member nations, this study relies on a gravity model and disaggregated data .The study analyzes the effects of SADC on trade in four sectors, namely, agricultural commodities, fuel and minerals, heavy manufacturing and light manufacturing products. An augmented gravity model of panel data approach is used to determine the extent of intra regional trade bias and potential trade diversion effects for each sector separately.

1.3 Research Objective

The main objective of this study is to investigate the effects of Regional Trade Agreements on bilateral trade. The study focuses on the trade aspect of regional economic integration.

Specific Objectives

The specific objectives of this study are to:

- i. Examine trade creation, trade diversion effects of regional economic integration at sectoral level.

- ii. Assess the level of intra-trade and extra-trade in the region using disaggregated level of data.

The remainder of this study is segmented into five chapters as follows. Chapter two takes the review of literature on this topic, and pays attention to both traditional and modern theory of regional economic integration as well as the effects of regional integration .It also assesses existing empirical findings on effects of regional economic integration to support the analytical

methods used in this study. Chapter three examines an over view of economic, political and institutional aspects of SADC member states. Looking at an overview of experiences on regional integration progress in Africa is also part of this section. This is followed by empirical methodology in chapter four. In this regard, this study looks at model specification, description of the data and variables used for the analysis of the model used for this study. Chapter five presents the estimation results and discussion part of this study. Finally, Chapter six gives conclusion and policy implication.

2. REVIEW OF THE LITERATURE

2.1 Definition

The term ‘integration’, literally means to bring parts of an object in to a complete whole, while in economic terms, it would indicate, in narrowest sense, the coordination of economic activities within a nation for the purpose of improving the development of that particular nation (Mutharika, 1972). Mutharika further renders the term a wider meaning, and indicates that it implies the process of integration of various economies in a given area or region into a single unit for the purpose of regional economic development. In a more precise way, economic integration occurs when two or more nations carry out policies that result in greater mutual economic interdependence. It follows that if such countries emanate from a single region or regional economic integration activities and/or process, these activities or process will be termed ‘regional economic integration’.

Regional integration ,or more crudely ‘regionalism’ is “any policy designed to reduce trade barriers between a subset of countries regardless of whether those countries are actually contiguous or even close to each other” (Winter ,1996) . Integration aims at abolishing discrimination between local and foreign goods, services and factors. (Salvatore, 1997:97)

Economists have defined the term ‘economic integration’ in various ways over period. Economic integration is a process of eliminating restrictions on international trade, payments and factor mobility (Carbaugh, 2004). Economic integration thus results in the uniting of two or more national economies in regional trading agreements .According to Biswaro (2003), regional economic integration involves the process of trade, economic and financial convergence of integrating states.

The economic integration literature clearly distinguishes between regional economic integration and regional economic cooperation. Regional economic cooperation is seen more as an ad hoc and temporary scheme, which is mainly based on contractual agreements with regard to projects of mutual interest between member states. Such projects could involve two or more countries in

the region. On the other hand, regional economic integration involves agreements that are more permanent.

The classical trade- oriented economic integration sees regionally coordinated development of infrastructure as an issue of cooperation rather than integration. Balassa (1961) point out that economic cooperation denotes the suppression of discriminatory practices is usually embodied in trade agreements, and like Carbaugh (2004), he agrees that economic integration implies an elimination of trade restrictions. In addition, other economists argue that there can not be integration with out cooperation. However, it is clear from these descriptions that both these concepts are means to an end, and not ends in themselves. According to Mutharika (1972), the process of economic integration can be at various stages in its development, embrace some aspects of economic cooperation efforts which are fully supported by this study.

Biswaro (2003) points that regional integration is characterized by the establishment of joint institutional mechanisms and a degree of shared sovereignty .Although this may be true in theory, the practicality of it is very difficult, particularly in Africa, as it involves ceding a percentage of the country's power to take decisions. This is confirmed by Biswaro (2003), when he argues that existing regional integration schemes in Africa function in a governmental rather than a supranational mode, and the actual sharing of sovereignty is minimal.

The term 'economic integration' also has other applications which do not require member countries to be from the same region or neighbors. In other words, the generic form of the term can also refer to establishing and developing ties between countries that may or may not be geographically linked.

2.1 Effects of Regional Economic Integration

This section analyzes the theory on effects of regional economic integration .It further reviews the existing empirical findings on this topic, in order to grasp some practical insights in this regard.

2.1.1 Theoretical Framework on Effects of Regional Economic Integration

Entry in to a regional integration scheme can have both static effects , which is as a result of resource allocation in response to changing relative prices ,and dynamic effects ,come from a changes in efficiency ,ability to exploit economies of scale ,and in level of investment and growth.

Much of theoretical literatures belong to the static effects of trade integration, specifically in the context of a customs union. The current study also biases more towards reviewing the static effects of regional integration effects. However, dynamic effects are more significant given that the changes they constitute are cumulative rather than simply once and for all adjustments (Hine, 1994).Again, although these dynamic factors are identified as potentially importance, there is no consensus as to a single adequate model to treat the issues. Despite the fact that dynamic effects are more difficult to model, recent theoretical developments enable us to distinguish some of the key issues. But, now we confine to the static, resource allocation effects. Next, we devote in presenting dynamic effects briefly.

Static Effects

Liberal economic theoretical framework is relied on the assumption that ‘productive efficiency’ is enhanced if states undertake economic production in areas where they have relative advantage to others, thus rationalizing costs and prices. In general, economic theories view existence of tariffs and quotas as hostile to free flow of goods within a region. Realizing this fact and unwilling to adopt complete free trade liberalization for various reasons , states form various regional schemes as the ‘second best’ trade policy to minimize distortions in trade flows and enjoy the fruits out of it. As it is mentioned at the out set of this subsection, these regional economic integration schemes result in both static and dynamic effects.

The static impact refers to changes occurred in the equilibrium market price and quantity before and after the creation of the economic bloc. This can be a trade creation or a trade diversion. For a given product, trade creation appears when high cost production is substituted by low cost production because of regional integration while economic diversion occurs when low cost

production is substituted by high cost of production. Nevertheless, besides to trade creation and trade diversion effects, the static effects of regional integration can involve other impacts. Thus, we are going to look at these static effects by classifying in to traditional (trade creation and diversion) and non- traditional static effects in broader sense.

Viner takes into account only trade-creation and trade-diversion effects, which are considered by Cline (1978) as traditional static gains. On top of these traditional static effects, Cline (1978) provides additional non-traditional static effects from regional trade integration, which are as follows: Labour opportunity effect¹, economies of scale effect² and foreign exchange saving effect³

Further studies also discover more static gains from regional trade integration, depending on the models used. Following the classification of Baldwin and Venables (1995) and that of Lloyd and Maclaren (2004), the models assuming perfect competition and constant returns to scale identify that trade volume, trade cost and terms of trade as beneficial effects of regional trade integration. However, models assuming imperfect competition and increasing returns to scale identified benefits from regional trade integration in the form of out put, scale and variety effect.

Welfare Effects

Across the globe, there is a fierce debate about the merits of regional trading agreements. While some herald such agreements as stepping stones towards worldwide free trade, others fear that these initiatives will be stumbling blocks, acting primarily to divert trade from other countries to those countries receiving preferential treatment. Although these issues are essential for the future of the world's trading relationships, a number of obstacles prevent economists from reaching any consensus on the effects of preferential trading agreements.

The second-best nature of tariff liberalizations under preferential trading arrangements makes it very difficult to assess a priori whether the welfare effects from a preferential trading

¹ This occurs when an increase of output made possible by regional trade integration allows for the employment of extra labour at a wage below the minimum wage rate.

² which occurs when firms become able to produce at their capacity, as a result of the increase of the market size made possible by the integration

³ when a group of countries forms an RTA, they increase imports from within the union and reduce the level of imports from outside the union, thus save foreign exchange

arrangement will be positive, even for the members of the arrangement. In addition, the empirical works fail to provide firm conclusions on even the most basic issue regarding preferential trading agreements: whether trade creation outweighs trade diversion (Clausing, 2001).

Dynamic Effects

The effects considered in the above subsection are purely static responses of producers and consumers in more general models to changes in relative prices owing to changing patterns of tariffs⁴. Besides these effects, however, there are also a variety of potential dynamic effects. These may be felt more gradually but will be longer lasting and in some cases continued.

First, there is the competition effect, brought about by freeing imports from partner countries. Second, there is the investment effect, which appears when there are new foreign and domestic investments that have not occurred in the absence of regional trade integration. Third, the larger market provides greater possibilities for the exploitation of economies of scale. Fourth, there is an effect on capital formation, possibly through various channels: reduction on barriers to diffusion, technological transfer, externalities from export growth, rising marginal product of capital and so on. Fifth, the union members acting as a group may be more able to influence the terms of trade they face. Lastly, there is the structural transformation effect, which is a shift from traditional primary-products export to new industrial-products export.

In contrast to the static effect of regional trade integration, the dynamic effects are presumed to continue to generate annual benefits, even after the withdrawal of a country from the union. For instance, a rising in the growth rate made possible by integration will have continued effects provided that it is sustained⁵. They likely constitute stronger arguments for regional integration than the static arguments based on resource allocation arguments addressed above. More precisely, dynamic effects, if present, are likely to dominate static effects.

⁴ The associated welfare changes are once and for all effects which in principle have their impact shortly after the integration scheme is introduced. They constitute a once-off outward shift in the production possibility frontier attainable by the country, given its resources (Cline, 1978).

⁵ Every dynamic effect is consequences of the increase in effective size following integration and will have potentially positive effects on growth.

2.1.2 Empirical Findings on Regional economic integration

The above section presents a brief overview of the theory on regional trade integration, which helps to understand how regional trading agreements work and through which mechanisms they provide benefits to member countries. At this subsection, the focus is switched to reviewing of the existing empirical evidences on the effects of regional economic integration.

Thus, for analytic purposes, it is useful to classify the researchers' findings on the topic according to the type of methodology they approach to examine the impacts of forming regional economic integration on trade flows , viz descriptive approach, simulation approach(Computable General Equilibrium),or econometric approach(gravity model and others) as well as the nature of data they employ , namely cross section, time series , panel based on aggregate or sectoral level. Next, empirical works of selected researchers on the topic are reviewed in line with the above classifications.

CGE Model

The simulation approach uses a static Computable General Equilibrium (CGE) model or a dynamic inter –temporal general equilibrium model. The model specifies economic structures and behaviors of agents in detail and, using the frame work, simulate the economic effects of existing or proposed regional blocs. Simulation based on the general equilibrium models usually finds substantial potential gains from trade liberalization between members of RTA.

There are a large number of ex ante CGE studies of trade agreements that examine what effects can be expected from preferential trading arrangements (for instance , Brown et al , 1992; Brown and Stern ,1989a; Haaland and Norman, 1992). More recently, Hertel et al (2006) applies CGE analysis in order to better evaluate the likely outcome of a Free Trade Area of the Americas (FTAA) and they find that that imports increase in all regions of the world as a result of the FTAA, and this outcome is robust to variation in the trade elasticities. Moreover, they conclude that there is great potential for combining econometric work with CGE-based policy analysis in order to produce a richer set of results that are likely to prove more satisfying to the sophisticated policy maker.

One weakness or imperfection of CGE studies is that their results are very sensitive to the assumptions, parameters, and data used in the model, and have to be interpreted accordingly. Besides, they do not allow an investigation of the questions we are concerned with here⁶.

Krueger (1999) also mention that CGE studies have been prospective rather than retrospective. In CGE model, the sectoral aggregation also does not permit analysis of specific markets. As of Mckitrick (1998), policy information is usually outdated, and base line scenarios are far from facts and based on the older data. CGE methods are also very data demanding and tending not to be applied with high levels of data disaggregation (Milner and Sledziewska, 2005:7). Therefore, the validity of the results of CGE studies is questionable in some case. While CGE models are useful for speculating what effects of a particular agreement might be? But with out firm evidence.

Descriptive Approach

A descriptive approach is also another methodology pursued in the literature to examine the effects of regional economic integration on trade patters (for example, Anderson and Norheim, 1993; Yeats, 1998; dell'Aquila et al, 1999). These studies use different indicators to measure the regional concentration of trade. A descriptive approach implicitly assumes that the share of trade happening with the partner nation would not have changed in the absence of the agreement. This method depends on a static frame work and the results are dependent on the level of aggregation⁷. Further more, a descriptive approach misses the ability to analyze trade creation and trade diversion effects and, hence, the welfare implications of RTAs (Jayasinghe and Sarker, 2004).

Gravity Model

Developing an accurate counterfactual of Ex post studies of how much trade would have increased in the absence of a given free trade agreement or customs union has proved difficult. For instance, Balassa (1967, 1975) constructs a counterfactual of how trade would have changed

⁶ Analyzing trade creation and trade diversion effects of regional trading arrangements on trade patterns at sectoral level.

⁷ As a result, changes in terms of trade as a result of changes in the relative trade importance of members and outsiders, as well as declines in the volume of trade for a particular commodity comprised in the broader class, can not be detected.

in the absence of European integration by calculating pre-integration income elasticities that were assumed to continue post-integration.

It was later exhibited, however, that income elasticities vary substantially pre- and post-integration, making these results sensitive to the sample period. Some (including Frankel and Wei, 1995; Frankel and Kahler, 1993; Frankel, 1997; Krueger, 1999; Aitkin, 1973; Aitkin and Obutelewicz, 1976; Willmore, 1976) apply gravity model to assess the impact of preferential arrangements on trade flows⁸. Schwanen (1997) undertakes a comprehensive study of changes in Canadian trade patterns, considering the effects of both CUSFTA and NAFTA between 1989 and 1995. He compares trade in sectors that have been liberalized by these agreements to trade in other sectors, finding that trade growth with the United States was much faster in liberalized sectors.

Helliwell et al (1998) use two types of evidence in their approach to assess the impact of the FTA on inter provincial trade. First, they develop a gravity model to explain inter provincial and province-state trade flows. Then, they analyze new industry-level data to estimate the extent to which tariff changes in Canada and the United States help explain inter-industry differences in the growth of inter provincial trade.

At the aggregate level, their results show that the FTA increased north-south trade relative to east west trade. After adjusting for appropriate factors, the gravity model suggests that in 1996, inter provincial trade would have been 13 percent higher than it actually was if the 1988 trade structure had remained unchanged. However, since the FTA also affected the provinces general economic growth, it is hard to calculate the FTA's net effect on the overall 15 percent increase in inter provincial trade between 1988 and 1996.

The disaggregated results of Helliwell et al (1998) suggest that the FTA-related reduction in Canadian tariffs led to increases in imports from the United States and to reductions in inter provincial trade. On the other hand, reductions in U.S. tariffs led to increases in exports to the United States and to increases in inter provincial trade. Overall, the authors calculate that FTA-

⁸ This model has the advantage of including several variables that are affecting trade flows, such as income changes and exchange rate variables.

induced tariff cuts led to reductions in inter provincial trade by about 7 percent, only about half of the total reduction previously calculated with aggregate data.

Regional dummy variables (inter and extra) have been used in gravity models (using ex-post approaches) to try to capture separate trade creation and diversion effects. The estimated coefficients on the dummy variables may capture a range of policy and other (including misspecification) effects rather than the regional trade policy effect under investigation. It is also the case that gravity modeling is invariably used to model total trade flows or at least broad aggregates of trade⁹.

However, the existing empirical literatures on the topic exhibit that most of the researchers' findings are based on aggregated data level. Nonetheless, there is firm argument that estimation relied on aggregated data could mask changes that may be occurring at disaggregated level. In addition, the use of more disaggregated data allows one to exploit the variation in the extent of tariff liberalization under the agreement without utilizing such variable. It is difficult to identify the effects of tariff liberalization on different sectors. Thus, sectoral variation could make a difference in the welfare outcome.

Realizing this deficiency in the existing literature on the topic, using a simple supply and demand framework specification analysis, Clausing (2001) employ data at the commodity level and the results indicate that CUSFTA had substantial trade creation effects, with little evidence of trade diversion. Further, he argues that unlike the approaches of many previous studies of preferential trading agreements that have relied on aggregate data, disaggregate data are used to analyze how actual tariff changes affect trade flows. Without utilizing the variation in the extent of liberalization across goods, it would be far more difficult to distinguish the effects of an agreement from other influences affecting trade flows. Here, the current study agrees with the above notions.¹⁰

⁹ In which case it does not allow the investigator to comment on trade creation and diversion effects at the disaggregate level. (Milner and Sledziewska, 2005).

¹⁰ Because assessing the impacts of forming regional trading blocs on trade flows based on aggregate data level may bias the estimation and results in incorrect inference.

Similarly, Jayasinghe and Sarker (2004) conduct a study that analyze trade creation and trade diversion effects the North America Free Trade Agreement (NAFTA) on trade of six selected agri food products from 1985 to 2000. Their investigation estimates an extended gravity model using pooled cross –sectional time –series regression and generalized least squares methods .As a result, they find that share of intra regional trade is growing with in NAFTA and that NAFTA has displaced trade with the rest of world . Using panel data econometric models analysis applied to highly disaggregated trade data, Milner and Sledziowska (2005) come out with the result that shows the European Agreement had transitory but significant trade diverting effects for Poland’s import; the trade diversion substantially dominating the trade creation.

The panel gravity model for trade has often been estimated with out taking account of the effects of past trade and income on current trade flows. However, there are numerous economic reasons that show trade is dynamic process¹¹. As a remedy for the observed weakness of static panel gravity model, Bun and Klassen (2002) apply a dynamic panel model by extending the static model with lagged regressors incorporating lags of trade and income. Consequently, using a panel of 221 annual bilateral OECD trade flows over 48 years, they explore that the dynamics are significant and note that static models are misspecified.

In African context, there are huge empirical works that analyze the impacts of regional integration. Among these, Alemayehu and Haile (2002), on their study for COMESA, show that bilateral trade flows among the regional groupings could be explained by standard variables as demonstrated by the results of the conventional gravity model, while regional groupings have had insignificant effect on the flow of bilateral trade. Further, they suggest that the performance of regional blocs is mainly constrained by problems of variation in initial condition, compensation issues, real political commitment, overlapping membership, policy harmonization and poor private sector participation.

Khorana et al (2007), using a partial equilibrium model, assess the implications of the transitional measures for products sensitive from the Ugandan perspective. The simulation results question

¹¹ Most of the literatures on gravity model based on panel are static, which means that they merely permit for contemporaneous effects of repressors on trade flows.

the underlying rationale for these arrangements. They also discuss whether the regional trading arrangements confer any real benefits on the stakeholders and suggest alternative approaches that may increase the benefits for Uganda from trade liberalization within the customs union .At this juncture, in depth analysis of specific regional bloc would be worthwhile because the existing empirical findings on the effects of regional economic integration on partner nations' trade flows may vary from one region to other regions even with in Africa .

2.1.3 Empirical Findings on SADC

There are plenty of studies that assess the effects of regional integration for SADC on trade pattern. Among these, we are going to review some of the basic ones. Maasdorp (1999), on his study of 'regional trade and food security in SADC', concludes that trade in the region can contribute substantially to provide improved food security. Besides, he notes that there is considerable scope for greater intra-regional trade in grain and other food products, and for greater cross- border investment in agriculture and agro-industry.

Using a multi-region model constructed to focus on the determination of sectoral and geographic trade patterns, Lewis et al (1999) model South Africa and the rest of southern African to evaluate how alternative SADC regional trade strategies can influence trade pattern in the region and how the EU deal affects the region's economies. Consequently, they conclude that: (i) trade creation dominates trade diversion for the region under all FTA arrangements; (ii) the rest of southern Africa benefits from an FTA between the EU and South Africa; (iii) the rest of southern Africa gains more from zero-tariff access to EU markets than from a partial (50 percent) reduction in global tariffs; and (iv) the South African economy is not large enough to serve as a growth pole for the region. Access to EU markets provides substantially bigger gains for the rest of southern Africa than access to South African markets.

To address the potential of increasing intra SADC trade, Chauvin and Gaulier (2002) use three complementary approaches¹². Given that SADC countries have concentrated and identical

¹² The first two refer to trade indices: export diversification indices, revealed comparative advantages and trade complementarity indices and the last one is based on gravity model.

comparative advantages, their static analysis show that the chance for further trade within SADC is limited. However, some results and ongoing researches show that development of intra industry trade might have trade creation effects in the region.

Cheng and Wall (2005), using the gravity model to estimate international trade flows, allow for country-pair heterogeneity. Their results suggest that standard gravity estimates of the effects of integration can differ a great deal from what is obtained when heterogeneity is accounted for.

Keck and Piermartini (2005) apply general equilibrium model (15 regions, 9 sectors) to simulate the impact of EPAs for countries of SADC. Their simulation results show that EPAs with the EU are welfare-enhancing for SADC overall, leading also to substantive increases in real GDP. For most countries further gains may arise from intra-SADC liberalization. The possibility of the EU entering a FTA with other countries, such as Mercosur, reduces estimated gains, but they still remain largely positive. Similarly, estimated gains need to be revised downwards if agriculture liberalization is not as far reaching as a reduction of import barriers for manufactures.

Further more, they note that at the sectoral level, the largest expansions in SADC economies take place in the animal agriculture and processed food sectors, while manufacturing becomes comparatively less attractive following EU-SADC liberalization. Interestingly, multilateral liberalization would instead promote some of the manufacturing sectors (textile and clothing and light manufacturing). Their results also show the need for the SACU tariff pooling formula to be adjusted to reflect new import patterns as tariffs are removed.

3. BRIEF OVERVIEW OF SADC ECONOMIC, POLITICAL AND INSTITUTIONAL STRUCTURE

In this chapter, this study seeks to provide an overview of economic, political and institutional aspects of SADC member states. Here, it pays attention in assessing of intra-trade structure and trade protocol of the region.

3.1 Economic Indicators of SADC Member Nations

From the beginning, the southern African region comprises heterogeneous countries both in terms of economic and political dimensions. Put it differently, there is significant gaps of development.

Table1: GDP per capita of SADC Members for the year 2000 and 2007(in US Dollars)

country/year	2000	2007	% share as of SADC	
			2000	2007
Botswana	3,745.75	7,932.89	15.35	19.13
Lesotho	313.816	663.863	1.28	1.60
South Africa	2,440.23	5,915.71	10.00	14.26
Swaziland	1,191.11	2,837.53	4.88	6.84
SACU	7,690.91	17,349.99	31.52	41.83
Angola	805.658	3,756.19	3.30	9.06
DRC	105.091	170.725	0.43	0.41
Malawi	220.821	266.061	0.90	0.64
Mauritius	3,768.66	5,495.64	15.44	13.25
Mozambique	227.977	396.694	0.93	0.96
Namibia	1,595.95	3,671.50	6.54	8.85
Seychelles	8,846.54	8,600.08	36.26	20.73
Tanzania	308.05	428.368	1.26	1.03
Zambia	349.565	938.552	1.43	2.26
Zimbabwe	477.517	402.586	1.96	0.97
SADC	24,396.74	41,476.39	100	100

Source: Own Computation, From World Economic Outlooks, 2008

As table 1 exhibits , six countries, with GDP per capita inferior or equal to USD 660(DRC, Lesotho, Malawi, Mozambique, Tanzania ,Zimbabwe) , eight other countries, with income per capita from USD 900 to 8600 (Botswana, Swaziland , Namibia, Mauritius, Seychelles, Zambia,

South Africa, Angola) . If one excludes South Africa from the region, the average per capita income in 2007 is US\$ 2,735 in SADC.

3.2 Integration plans, Instruments and Intra-Regional Trade of SADC

SADC was supposed to pass through different integration phases using various instruments agreed among the member states .These are dealt in below under the title trade protocol of SADC. Next, it examines the situation of intra- trade in SADC.

3.2.1 Overview of the SADC Trade Protocol

The Southern African Development Community (SADC) Trade Protocol Was signed in August 1996 but only came into effect on September 1, 2000, after protracted negotiation, indicating serious commitment towards regional economic integration. Angola, the Democratic Republic of Congo (DRC) and Seychelles were not yet party to the free trade process¹³. The aim was to liberalize trade flows between members and eventually lead to deeper integration in the region (Kalaba and Tsedu, 2008:1).

The first steps of the implementation of the Trade Protocol started with the trade liberalization process, which was to be completed over eight years. The tariff phase down process came into effect as from September 2000. A free trade area (FTA) will be reached in 2008, where up to 85% of trade flows within SADC will be duty free (SADC Secretariat, 2003). The remaining 15% consisting of sensitive products will be liberalized by 2012. Subsequent to the FTA, SADC envisages establishment of a Customs Union by 2010 and of a Common Market in 2015. A further liberalization of trade in services was to be undertaken, but there was very little progress reported in that area.

The main instrument of trade liberalization is therefore the elimination of customs tariffs and non tariff measures on substantial intra-SADC trade. The intention is also to extend trade liberalization to services. However, services liberalization has not yet been a subject of

¹³ Angola formally acceded to the protocol in March 2003 but is yet to negotiate a tariff liberalization schedule with other member States.

negotiations. More energy had to be devoted to protracted negotiations on the liberalization of trade in goods, especially on rules of origin for sensitive products (Kalenga, 2004:30-31).

The reduction of tariffs is being carried out based on four categories. Category A requires immediate reduction of duty to zero at the beginning of the implementation period, by 2000. These commodities already attracted low or zero tariffs. The second category B deals with goods that constitute significant sources of customs revenue and whose tariffs are to be removed over 8 years, by 2008. Categories A and B should account for 85% of intra-SADC trade ¹⁴.

Category C deals with sensitive products whose tariffs are to be eliminated between 2008 and 2012. Category C is limited to a maximum of 15% of each Member's intra-SADC merchandise trade. Category E is goods that can be exempted from preferential treatment under Articles 9 and 10 of the Trade Protocol such as firearms and munitions, comprising of a small fraction of intra-SADC trade.

The Trade Protocol provides for the elimination of all existing non-tariff barriers (NTBs) and refraining from introducing new ones. However, in practice it does appear that non-tariff measures are widespread, increasing and are a real obstacle to intra-regional trade expansion. Some SADC members' states continue to introduce non-tariff measures such as a periodic ban on imports, imposition of additional import levies and other forms of import controls, often as protectionist devices. This undermines the credibility of the Trade Protocol and makes it irrelevant in the eyes of traders, investors and consumers at large (Kalenga, 2004:29).

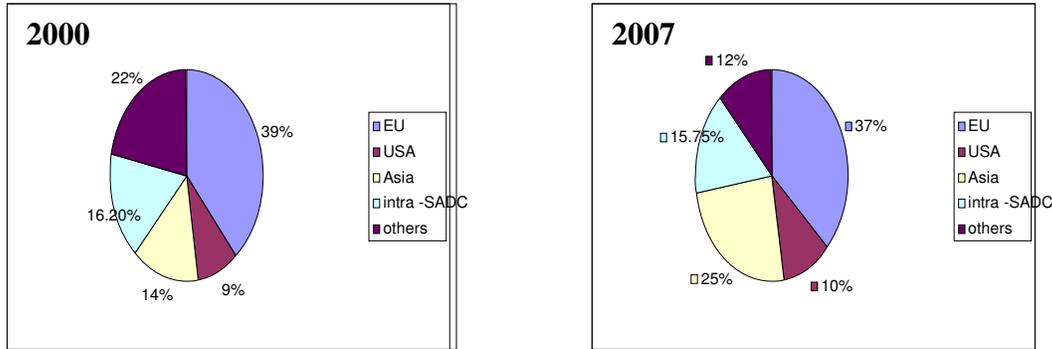
3.2.2 SADC Trade Level

Despite impressive growth in total exports between 2000 and 2007, intra-SADC trade remains weaker¹⁵. Trade between countries also reveals that more than two thirds of total trade is with South Africa. However, SADC's growth of extra-regional trade was more than with fellow members.

¹⁴ By 2008 SADC can be regarded as a free trade area not in line with Article 24 of the General Agreement on Tariffs and Trade (GATT). This needs that "completely all trade" should be duty free.

¹⁵ A comparison of SADC with other regional blocs shows that intra-regional trade provides the necessary impetus for deeper integration and regional progress. However, SADC is relatively lagging behind most regions out side Africa.

Figure 2: Export Share Trends of SADC by Destination in 2000 and 2007



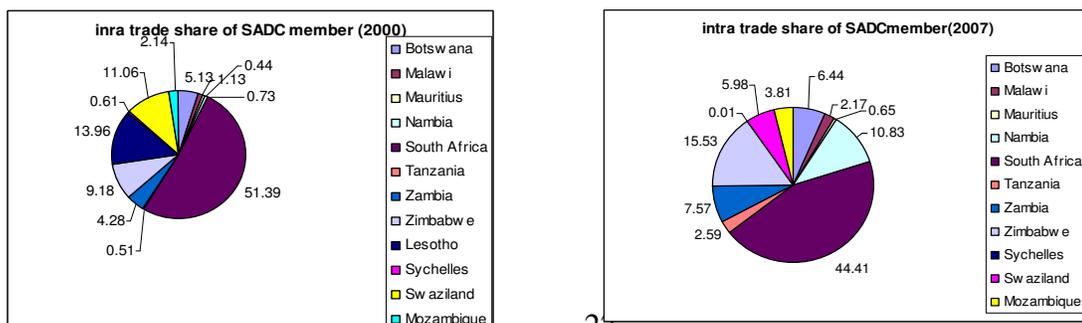
Source: Own Computation from COMTRADE DATA CD-ROM

Since SADC has commenced its implementation of the trade protocol, it experiences huge increases in exports. However, most of these exports are destined to markets outside the region itself and Africa as whole. European countries are the major trading partner of the SADC members. Following European countries, Asia and USA serve as second and third significant export destination of SADC members respectively. SADC’s trade with other than member Africa countries is very minimal. Therefore, SADC lost market shares of its own export growth, and therefore missing out on opportunities to take advantage of its own integration initiative (Kalaba and Tsedu, 2008:10).

3.2.3 Share of Exports by SADC member states

As figure 3 displays, in both years, South Africa contributes the highest share in total intra-SADC trade. Zimbabwe and Namibia represent the second and third position in total trade takes place within the region respectively in 2007.

Figure3: Share of Intra- Export value in SADC Members (in US dollars)



Source: Own Computation from COMTRADE DATA CD-ROM

According to the table 4, South Africa accounts for 70% of the total exports of SADC. Next to South Africa, Botswana and Zambia represent the second and third rank in the total exports of the region consecutively for the year 2007.

Table4: Share of Total Export value in SADC Trade by Members (in US dollar)

country/year	2000	2007	As % of SADC-World	
			2000	2007
Botswana	2762610944	5072523185	7.36	5.64
Malawi	379292364	868559184	1.01	0.97
Mauritius	1489961728	2054081555	3.97	2.28
Namibia	1326732160	4040273925	3.54	4.49
South Africa	26297951898	64026608364	70.10	71.15
Tanzania	655797120	2139346909	1.75	2.38
Zambia	892362022	4618619360	2.38	5.13
Zimbabwe	1924962432	3310184142	5.13	3.68
Seychelles	193679154	360146563	0.51	0.40
Swaziland	890750016	1082299753	2.37	1.20
Mozambique	363962000	2412078629	0.97	2.68
SADC-World	37514227630	89984721569	100	100

Source: Own Computation from COMTRADE DATA CD-ROM

Table 5 clearly indicates that intra trade among SADC members has declined in agricultural and light manufacturing sectors in 2007 as compare to the base year 2000. However, it has boosted up in fuel and minerals, and heavy manufacturing sectors for the same period.

Table5: Total Export value of SADC Members by sector for the year 2000 and 2007(in US dollars)

Year	2000				2007			
	Agricultural com	min and fuel	Heavy manu	Light manu	agricultural	min and fuel	Hmanu	Lmanu
Botswana	29130353524	2244966	2323756660	118291000000	1328443909	12629859	3257372162	450857170
Malawi	342711441	649530	9332912	26598481	776210253	332400	29968576	62044286
Mauritius	285854712	121901	148515636	1055124098	665766961	2937684	224339794	1154407063
Nambia	526000551	27467644	562425776	177140664	1599748283	16604562	1646829178	702371657
South Africa	4861048120	2664190589	9541647570	5670564577	11337169558	6759014901	30447150725	15040571327
Tanzania	434964456	674289	90802588	15706779	1127630368	14797666	279673412	160992670
Zambia	152040304	9395826	701935551	23116106	702368719	23283781	3724674371	139627318
Zimbabwe	1263771498	21838136	464549356	168451300	1372100390	21283828	853816658	925477988
Intra-SADC trade	36996744606	2726582881	13842966049	125427997018	18909438441	6850884681	40463824876	18636349479

Source: own computation from COMTRADE CD-ROM DATA BASE.

4. EMPIRICAL METHODOLOGY and MODEL SPECIFICATION FOR ESTIMATION

The existing literatures on the methodology of assessing the effects of regional economic integration on trade flows among nations can be broadly classified in three categories. Empirical studies have employed a range of techniques to investigate the effects of RTAs. There are large bodies of empirical literatures that employ economy wide, multi sectoral computable general equilibrium (CGE) models to analyze the welfare impacts of RTAs. Although the CGE models have been influential in analyzing the welfare effects, their empirical limitations have been

highlighted. First, the CGE studies have been prospective rather than retrospective (Krueger, 1999). Second, the sectoral aggregation does not allow analysis of specific markets. Policy information is often outdated, and baseline scenarios are unrealistic and based on older data (McKittrick, 1998).

Third, it relies on fundamental assumptions of perfect competition and constant elasticity of substitution (CES) technology and a system of demand and supply ensuring market clearing mechanism(see for instance Alemayehu,2002) which are not realistic. Moreover, it lacks details on sectors (using high levels of sectoral aggregation), particularly for the poorest countries. Hence, the results of CGE studies are sometimes questionable. (Jayasinghe and Sarker, 2004: 5).

A descriptive approach is also applied in the literature to analyze the impacts of RTAs .These studies employ various indicators to measure the regional concentration of trade. The descriptive approach indirectly assumes that the share of trade occurring with partner countries would not have changed in the absence of the agreement. This method depends on a static framework and the results are dependent on the level of aggregation. Consequently, changes in the terms of trade due to changes in the relative trade importance of members and outsiders, as well as declines in the volume of trade for a single commodity included in the broader class, cannot be detected .In addition, the descriptive approach lacks the ability to analyze trade creation and diversion effects and, hence, the welfare implications of RTAs.

As an alternative, recent econometric studies have incorporated the effects of RTAs into the model specification and estimate models using pre-RTA and post-RTA data. The impact of RTAs on trade flows is captured through the use of regional dummy variables. This is known as the

gravity model approach, which explains bilateral trade flows between trading partners over time. The gravity model has become an attractive technique for assessing the effects of RTAs.

The following section attempts to cover model specification part of the current study, starting from the theoretical background of gravity model to its application in the SADC trade flow determinants. It also devotes to describe the data nature and variable employed to estimate the specified model for this study.

4.1 The Gravity Model

The gravity model is a popular formulation for statistical analyses of bilateral flows between different geographical entities. In the following, an overview of the evolution and use of this equation are provided. Originally, in 1687, Newton proposed the “Law of Universal Gravitation.” This inspiration of gravity model which comes from physics states that the force of gravity between two objects is proportional to the product of the masses of the two objects divided by the square of the distance between them, it is given by:

$$F_{ij} = G \cdot \frac{M_i \cdot M_j}{D_{ij}^2}, \dots\dots\dots (1)$$

Where notation is defined as follows;

- F_{ij} is the attractive force.
- M_i and M_j are the masses.
- D_{ij} is the distance between the two objects.
- G is a gravitational constant depending on the units of measurement for mass and force.

Since then, it has been applied to a whole range of what we might call “social interactions” including migration, tourism, and foreign direct investment.

However, economists discovered the gravity model to apply in international trade when Tinbergen (1962) and Poyhonen (1963) proposed that roughly the same functional form could be

applied to international trade flows. Consequently, a large number of empirical works applied gravity model to inspect the trade creation and trade diversion effects of the RTAs. According to this model, flows of export between two countries are explained by their economic sizes (GDP or GNP), population and direct geographical distances between the countries. Based upon Newton's Law of Gravitation; the gravity model predicts that the flow of people, ideas or commodities between two locations is positively related to their size and negatively related to the distance. In its original form, they specified the following gravity model equation:

$$trade_{ij} = A \frac{(GDP_i \cdot GDP_j)^{b_1}}{distance_{ij}^{b_2}}, \dots\dots\dots (2)$$

Where notation is defined as follows;

trade_{ij} is the value of bilateral trade between country *i* and *j*, GDP_i and GDP_j are country *i* and *j*'s respective national incomes, distance_{ij} is a measure of the bilateral distance between the two countries and *A* is a constant of proportionality.

The multiplicative nature of the gravity equation means that we can take natural logs and obtain a linear relationship between log trade flows and the logged economy sizes and distances. Taking logarithms of the gravity model equation (2), we get the estimable equation:

$$\log(trade_{ij}) = A + b_1 \log(GDP_i \cdot GDP_j) - b_2 \log(distance_{ij}) + \epsilon_{ij} \dots\dots\dots (3)$$

Where *A*, *b*₁ and *b*₂ are coefficients to be estimated. The error term ϵ_{ij} captures any other shocks and chance events that may affect bilateral trade between the two countries.

Equation (3) is the core gravity model equation where bilateral trade is predicted to be a positive function of income and a negative function of distance. While the core gravity equation has been used in the empirical literature since the econometric studies of trade flows by Tinbergen (1962) and Pöyhönen (1963). The application of the gravity model has long been controversial because it often lacks a coherent theoretical foundation. Estimated results of empirical gravity equations suffer omitted variable bias due to the lack of a strong theoretical foundation. As a result, the estimates cannot be validly used to draw comparative-static inference about the impacts of barriers on trade flows. The theoretical justification behind the core gravity model has been a gradual process.

4.1.1 Theoretical Justification of the Gravity Model in Analyzing Trade

As it is mentioned earlier, the Newtonian physics notion is the first justification of the gravity model. The second rationale for the gravity equation can be analyzed in the light of a partial equilibrium model of export supply and import demand provided by Linneman (1966). Relying on some simplifying assumptions, the gravity equation proves to be a reduced form of this model.¹⁶ Nonetheless, Bergstrand (1985) and others indicate that this partial equilibrium model could not explain the multiplicative form of the equation and also left some of its parameters unidentified mainly because of exclusion of price variable. With the simplest form of the equation, of course, Linneman's justification for exclusion of prices is consistent.

Anderson (1979) provides the first theoretical explanation for the gravity equation based upon the properties of expenditure systems.¹⁷ Since Anderson's synthesis, Bergstrand (1985, 1989), Helpman and Krugman (1985), and Deardorff (1998) also contribute to improvements of the theoretical foundation of the gravity model. In these studies, the gravity equation is derived theoretically as a reduced form from a general equilibrium model of international trade in final goods. As a result, the theoretical underpinnings of the gravity model have become apparent, well understood, and hence widely accepted in recent years. This shortcoming has also been solved by the studies of Anderson and Wincoop, 2003 and Feenstra, 2002.

The micro-foundations approach also claims that the crucial assumption of perfect product substitutability of the 'conventional' gravity model is unrealistic as evidence in recent times has shown that trade flows are differentiated by place of origin. Exclusion of price variables leads to misspecification of the gravity model. Anderson (1979), Bergstrand (1985, 1989), Helpman & Krugman (1985) and so on agree with this view. Their studies show that price variables, besides

¹⁶ **The Trade Flow Model:** The potential supply of any country to the world market is linked systematically to (i) the size of a country's national or domestic product (simply as a scale factor), and (ii) the size of a country's population.

¹⁷ Both **the Pure Expenditure System Model** (The simplest possible gravity-type model stems from a rearrangement of a Cobb-Douglas expenditure system implying that identical expenditure shares and gravity equation income elasticities of unity.) and **the Trade-Share-Expenditure System Model** (While a gravity equation is produced by such a framework, the real variables of interest are the non-income-dependent expenditure shares.

to the conventional gravity equation variables, are also statistically significant in explaining trade flows among participating countries.

Hence, the above analyses indicate that there is theoretical foundation in applying gravity model on international trade flows. Again, this new legitimacy for assessing international trade flows motivates our reliance on an extended gravity model in this study to analyze the trade effects of SADC. Next, we will see the application of gravity model in SADC trade flows' determinants.

4.1.2 Gravity Model for the Present Study

The gravity model of bilateral trade hypothesizes that the flows of trade between two countries is proportional to their gross domestic product (GDP) and negatively related to trade barriers between them. Empirical works have provided a number of alternative specification for the gravity model. In the context of international trade, the basic formulation of the gravity model equation is as follows:

$$X_{ijt} = \beta_0 Y_{it}^{\beta_1} Y_{jt}^{\beta_2} N_{it}^{\beta_3} N_{jt}^{\beta_4} D_{ij}^{\beta_5} U_{ijt} \dots\dots\dots (4)$$

For estimation purposes, the basic gravity model is most often used in its log-linear form. Hence, this is equivalently written using natural logarithms as:

$$\ln X_{ijt} = \ln \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln N_{it} + \beta_4 \ln N_{jt} + \beta_5 \ln D_{ij} + \ln U_{ijt} \dots\dots\dots (5)$$

Where notation is defined as follows;

X_{ijt} = total bilateral trade between country i to country j in year t;

Y_{it} = GDP of country i in year t

Y_{jt} = GDP of country j in year t;

N_{it} = population of country i in year t;

N_{jt} = population of country j in year t;

D_{ijt} = distance between two country i and j

U_{ijt} =log normal error term

ln = the natural logarithm operator

Trade theories based upon imperfect competition and the Hecksher-Ohlin models justify the inclusion of the core variables: income and distance merely. However, most researchers incorporate additional variables to control for differences in geographic factors, historical ties, exchange rate risk, and even overall trade policy for the fact that trade flows between nations can be affected by factors besides to the core variables (GDP, population, distance). Hence, it is common to expand the basic gravity model by adding other variables, which are thought to explain the impact of various policy issues on trade flows.

In the case of gravity equations used to estimate the impact of regional trade arrangements, dummy variables are added for each RTA under critical examination. Furthermore, in order to avoid capturing by these dummy variables the impact of other influences on trade, other dummy variables are added to control for common language and common border. Thus, the augmented gravity model incorporates other variables and thus by introducing these variables in to equation (21), the basic formulation of the model can be extended as follows:

$$\ln X_{ijt} = \ln \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln GDPPC_{it} + \beta_4 \ln GDPPC_{jt} + \beta_5 \ln GDPPCDIFF_{ijt} + \beta_6 \ln D_{ij} + \beta_7 \ln IF_{it} + \beta_8 \ln IF_{jt} + \beta_9 \ln TR_{it} + \beta_{10} \ln TR_{jt} + \beta_{11} CL_{ij} + \beta_{12} Border_{ij} + \beta_{13} SADCT_{ij} + \beta_{14} SADCX_{ij} + \ln U_{ijt} \quad (6)$$

Where,

$IF_{i(j)}$ = infrastructural level of trading nations at time t

CL = common language between country i and j;

IM_{it} = import to GDP ratio of country i at time t which measures openness

IM_{jt} = import to GDP ratio of country j at time t which measures openness

$GDPPC_{it}$ = GDP per capita income of exporting countries at time t.

$GDPPC_{jt}$ = GDP per capita income of importing countries at time t

$GDPCDIFF_{ijt}$ = the per capita GDP difference between country i and j at time t

Border = common border between country i and j

SADC = regional dummy, takes the value one when a certain condition is satisfied, zero otherwise.

We incorporate GDP per capita income rather than population in equation (22).¹⁸

Hypotheses for Gravity Model Variables

Name of variable	Expected sign	Measurement in	Source	Remarks
GDP	+ve	In US dollar	WDI-CD-R0M(2008)	Growth in economic capacity boosts trade flows
GDP per Capita income	+ve/-ve	In US dollar	WDI-CD-R0M(2008)	Because of Economies of scale effect and absorption effect
GDP per Capita income difference	+ve/-ve	In US dollar	WDI-CD-R0M(2008)	Because of HO – Theory and Linder hypothesis
Distance	-ve	In kilometers	Indo.com/distance	seen as a restriction or friction to trade
Infrastructure index	+ve		WDI-CD-R0M(2008)	This index is computed using 4 variables from WDI database (2008). ¹⁹
Trade –GDP ratio	+ve	In US dollar	WDI-CD-R0M(2008)	Proxy indicator of openness
Common language and border	+ve		World Fact Book(2008)	sharing common language and border is assumed to facilitate trade

¹⁸ Because population is appropriate when aggregate export data is used while for specific export product, GDP per capita income is preferable. Although not exhaustive, our list includes most other variables used in the literature. Nonetheless, there is no agreement on which variables beyond the core factors to include in the gravity model. Second, there are mixed results on the estimated impact of each variable to bilateral trade.

¹⁹ The number of kilometer of roads, of paved roads, of railways, and the number of telephone sets/lines per capita of country i (j) at time t. The first three variables are divided by the land area to obtain a density. Thus, each variable obtained is normalized to have a same mean equal to one. An arithmetic average is then calculated over the four variables, for each country and each year, without taking into account the missing values

				activities among nations
Regional dummy SADCXIJ SADCTIJ	+ve/-ve +ve/-ve			capture the influence of regional trading agreements on trade flows among nations

Introducing regional dummy variables helps to estimate the trade effects of SADC regional bloc using equation (6), which is the interest of the then study.

Therefore, following Coulibaly (2004), two dummy variables $SADCT_{ij}$ and $SADCX_{ij}$, are introduced to capture intra-bloc and extra export effect of the SADC as a whole in the following way:

$SADCT = 1$ if both partner belongs to SADC, [other wise 0] (capturing intra bloc trade)

$SADCX = 1$ if the exporting country i is member of SADC and the importing country j belongs to the ROW [zero otherwise] (capturing bloc exports to the ROW).

In our estimates “ $SADCT_{ij}$ ” captures the total intra-regional trade bias. The dummy “ $SADCX_{ij}$ ” captures the extra-regional export bias where a negative and significant coefficient indicates that member countries have switched to export to members rather than non-members. This can be interpreted as trade diversion which results in a member country preferring to export to members rather than non-members.

4.2 Data Description

Majority of the empirical literature on gravity model use total bilateral trade flows as dependent variable. However, Cernat (2001) suggests that the use of bilateral export flows arguing that for a given pair of countries, with total bilateral trade one cannot distinguish between the impacts of RTA formation on exports from non-member to RTA members from that on exports from the RTA member to the non-member. For the present study, bilateral export flow (proxy for total bilateral trade) is used as dependent variable.

Again, since this study employs disaggregated data, export values are categorized in to four sectors: agricultural commodities, fuels and mining, heavy manufacturing and light

manufacturing sectors (for details, see appendix II). Data on the countries added in the sample for the current study before 1999 are not available. Thus, this scarcity of data for most of countries in the sample as reporter forces this study to use data ranges from the period 2000 to 2007 (8 years only). Moreover, the year 2000 coincides with the beginning of the implementation of trade protocol of SADC trade agreements which was signed in 1996 and helps to assess the post implementation effects of trade agreements on SADC's trade flows. All observations are also annual values.

Sampling Procedure

Our study covers a total of 30 countries. The countries are chosen on the basis of importance of trading partnership with SADC members and availability of required data. Eight countries of SADC (out of fourteen countries): Botswana, Malawi, Mauritius, Namibia, South Africa, Tanzania, Zambia and Zimbabwe are incorporated in the sample as reporter countries. We could not include Angola, Democratic republic of Congo and Lesotho as these countries have no data for most of the years of our sample period. Seychelles, Swaziland and Mozambique are not also part of the sample members for the reason that the sample countries represent more than three – fourth out of total trade flows in the SADC while these countries have insignificant share in the region's total trade flows.

How ever, all members of SADC are included as the partner countries in the sample taken for this study to examine level of intra regional trade. From EU, ten countries are taken because it serves as a major trading partner of SADC. These are UK, Germany, France, Italy, Netherlands, Austria, Portugal, and Belgium, Luxembourg and Spain. Next to EU, Asian countries are the second important trading partner for the region. As a result, five countries are chosen from Asian countries: India, China, Japan, Hong Kong and Indonesia. USA is also included in the sample since it takes the third position of SADC's export destination.

When we come to the dependent variable data description (export value), this study uses COMTRADE data base, developed by the United Nations Statistics Division(SITC-Revision3).In the current task, export values are classified under four sectors based on Keck and Piermartini

(2005) sectoral aggregation (for details, see appendix III). Missing of data for some countries, sectors and years in international trade statistics is a common phenomenon.²⁰

5. ESTIMATION RESULTS AND DISCUSSION

5.1 Econometric Method

Various ways of estimations are employed for panel data gravity model specification: an ordinary-least squares (OLS) estimation, fixed effect estimation, random-effects estimation, feasible generalized least-squares (FGLS) panel estimation, and Tobit estimation. The use of different panel data methods, such as random or fixed (within) effect estimators, allows for various assumptions regarding trade flows to be analyzed and tested.

The Within equation treats the bilateral specific effects as fixed, thereby giving unbiased parameter estimates for time-varying variables. However, since the regional dummies are defined over the whole period of the RTA, these variables would only vary when there are changes in membership during the period. So, the fixed-effects model does not allow the estimation of the effects of RTA with fixed membership. Another problem with the fixed-effects model is that, since the within-method ignores the cross-sectional nature of the data, the interpretation of the regional dummies coefficients does not exactly answer the question of this paper, namely what are the effects of SADC regional integration scheme on region's trade flow ?

As an alternative to the fixed effect specification, the coefficients for the time-invariant variables could be estimated by using a random effect (RE-) technique, which assumes that explanatory variables are uncorrelated with random effects. Additional reasons for choosing random effects method against fixed effect relies on hausman test results which demonstrate that random effect is preferred to fixed effect(details are given in appendix I in table10). Further more, the interest

²⁰ Countries which do not declare their exports in each sector to their partners or which do not export to their partners are identified in the same way, i.e. with a missing value. Hence, our data are not censored at zero. Except in fuel and minerals sector, the actual number of observations in the rest three sectors represents more than two- third of potential number.

of this study is to assess the effects of regional integration on SADC's trade flows which is one aspect of trade policy analysis where as for structural analysis purpose, fixed effect is preferable. Hence, modeling the bilateral effects as random variables is more appropriate. In the absence of correlation between the explanatory variables and the specific bilateral effects, the Generalized Least Squares (GLS) estimation provides consistent estimates of the coefficients.

However, variables like GDPs or infrastructure may be correlated with bilateral specific effects. Even, "the regional dummy variables may be endogenous by being correlated with unobservable (omitted) variables that are correlated also with the decision to trade" (Baier and Bergstrand, 2002). The Hausman test (1978), based on differences between Within and GLS estimators, assures that GLS estimator is biased and then some explanatory variables are endogenous. The usual way to deal with this issue is to consider instrumental variables estimation proposed by Hausman and Taylor (1981).²¹

5.2 Discussion

Before proceeding to the discussion of empirical results, it should be noted that the current empirical analysis differs in some important respects from many gravity models found in the literature. The first stems from the way bilateral trade data is constructed.²² The dependent variable is total merchandise export value for each sector alluded above, in log-linear form, between pair of 8 SADC members as reporting countries and other 16 non member countries , and all SADC members as partner countries.

So, estimation and tests are carried out for each sector separately and thereby apply separate analysis for the estimation results of four sectors. First, analysis for the selected tests will be provided. Then, discussion for regression results of equation (6) for each sector will be followed.

²¹ The Hausman and Taylor estimator is based upon an instrumental variable estimator which uses both the between and within variation of the strictly exogenous variables as instruments. The definition of the explanatory variables as exogenous or endogenous is a testable hypothesis.

²² this study uses export values as dependent variable for the aforementioned reasons. Furthermore, total export value is disaggregated in four sectors.

5.2.1 Tests

Different tests have been conducted to choose the appropriate estimation method for the specified panel gravity model of equation (6) and for detecting endogeneity problem among the explanatory variables. Here, the tests are separately done for each sector listed above.

I. Random effect Vs Fixed effect

As mentioned earlier, our all four sectors gravity models suggest [see in the appendix I random versus fixed effect test in Table 10] that, based on the Hausman tests, random effect model of Panel estimation is the appropriate strategy to be adopted. So the results of random effect technique would be discussed here for the said four sectors model.²³

II. Endogeneity of explanatory variables

As table (9) in appendix I is evident, the gravity model equation (6) results for all sectors reveal that when any one explanatory variable become dependent variable in equation (6) over the remaining regressors, there are R^2 values in each sector above the overall R^2 of the full model. According to Klien's rule of thumb (Klien, 1962), this condition indicates the existence of multicollinearity problem among the variables.²⁴

Random Effect Estimator Vs Instrumental Variables

²³ In this model, the intercept term in random effect method is considered to be random variable, instead of fixed country specific variable, and the slope coefficients are considered to be the same for all countries.

²⁴ According to test table 9 for multicollinearity in appendix I, equation (22) of this study considers the variables of GDP, GDP per capita, trade to GDP ratio and infrastructural level index as most endogenous explanatory variables. Almost similar variables are obtained in all sectors' model as endogenous variables. As Matyas (1997, 1998) suggests, they are instrumented with their one year lag. Consequently, results are improved to some extent.

The Hausman test for the appropriateness of using instrumental variable reveals a $\chi^2(14) = 23.89$ for agricultural sector model and $\chi^2(14) = 28.41$ in light manufacturing sector model, which are significant at 10 % and 5% respectively. Hence, this test rejects the null hypothesis according to which there would be no correlation between the bilateral specific effects and the explanatory variables. The GLS estimator is thus biased, and the use of the instrumental variable method is justified for agricultural commodities and light manufacturing sectors model. However, χ^2 's value for fuels and minerals , and heavy manufacturing sector is insignificant implying that employing instrumental variable is inappropriate or using it does not improve the model's efficiency (see table 11 in appendix I).All estimates are checked for heteroskedasticity.

5.2.2 Analysis of Results

Our workhorse gravity model equation (6) has been estimated using random effect estimation technique and by applying instrumental variable where it is justifiable with panel data for the aforementioned reasons.

Table 6: Regression results of all four sectors together
(log of export value of each sector as dependent variable)

Variable/Coefficients	agri	Fuel& min	Hmanu	Lmanu
logYIT	.98* (12.83)	1.23* (8.01)	1.27* (12.82)	.80* (10.16)
logYJT	.70* (8.75)	.23*** (1.82)	1.08* (12.91)	.87* (10.31)
logGDPPCIT	-.52* (-5.99)	.78* (3.76)	.14 (1.14)	.67* (7.64)
logGDPPCJT	-.37* (-3.59)	.34*** (1.73)	-.11 (-0.89)	-.04 (-0.35)
logGDPPCDI	.24*	-.32**	-.09	.15**

	(3.18)	(-2.24)	(-0.95)	(1.99)
logDIJ	-2.38*	-.67**	-1.38*	-2.33*
	(-9.96)	(-2.23)	(-6.71)	(-10.19)
logIFIT	1.01*	1.23 *	1.25*	2.09*
	(11.36)	(5.79)	(11.53)	(23.05)
logIFJT	.21***	.36**	.59*	-.09
	(1.79)	(2.07)	(5.01)	(-0.69)
logTRIT	.21*	-.96*	-.06*	.42
	(4.45)	(-4.67)	(-6.10)	(-7.62)
logTRJT	-1.15	-2.57*	-2.02	-2.10**
	(1.24)	(-3.16)	(-0.30)	(2.38)
CLIJ	.13	-.83**	.56*	.86*
	(0.72)	(-2.51)	(2.84)	(4.52)
BORDERIJ	1.80*	2.10*	2.35*	2.11*
	(7.07)	(5.53)	(8.54)	(8.10)
cons	3.57	-3.65*	-18.35	-1.70
	(1.03)	(-0.60)	(-4.72)	(-0.42)
Number of obs	1594	610	1542	1568
Over all R ²	0.39	0.51	0.44	0.52

Note: agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.

The numbers in Parentheses are t-value and *, **and *** show at 1%, 5% and 10 % significance level respectively. All variables except dummy variables are in logs.

Equation (6) is estimated taking all variables for every sector considered in this study separately. When agricultural commodities export value is dependent variable, except common language, all variables are found to be significant. The coefficients for GDP and infrastructural level index for both exporting and importing countries are in line with the predicted theory (positive sign).

GDP per capita income coefficient for both trading partners is negative and significant. The estimation results on table (6) for GDP per capita income of both exporting and importing

countries show that GDP per capita income has negative impact on bilateral export flows of agricultural commodities. In other words, increasing per capita income in the exporting country results in the rise of the absorption capacity of the domestic market while increasing per capita income in importing countries contribute to the economies of scale of the domestic industry. However, the GDP per capita income difference is positive which supports the HO-theory; countries with different factor endowments trade more each other than that of with similar endowments.

Regression results with fuel and minerals export value as dependent variable which is shown on table (6) exhibit that all variables included in the regression are significant but GDP and GDP per capita incomes for importing countries are slightly significant. Regarding to their coefficients' sign, the core variables of gravity model such as GDP for both exporting and importing is found with the expected positive sign. We also find the traditional negative sign on distance. GDP per capita income for both origin and destination countries is positive indicating economies of scale effect for exporting and absorption effect for importing countries.

Unlike to the regression result table of agricultural commodities export value sector model, GDP per capita income difference is found negative and significant endorsing Linder hypothesis (similar countries trade more each other than dissimilar countries do).²⁵

Again, when heavy manufacturing export value is on the left side of regression equation (6), all core variable of gravity model, GDP for exporting as well as importing and distance are significant with anticipated positive and negative sign consecutively. For both origin and destination nations, GDP per capita income is insignificant for both exporting and importing nations. The coefficient of per capita GDP differential between SADC members and country j is also found to be insignificant.

Infrastructural level of both trading partners is obtained in line with theory, positive sign and significant. The trade-GDP ratio which is a proxy for openness of countries bearing a negative sign is found significant for exporting countries while it is not different from zero for importing

²⁵ This Linder hypothesis emphasizes show that income similarity as the driver of trade instead of income differences.

countries. What is more, common language and border are obtained significant with expected positive sign.

At the end , as table 6 regression results with light manufacturing export value as dependent variable show that GDP of exporting and importing countries , GDP per capita income and infrastructural level index of exporting countries and distance are found to be significant with expected sign. GDP per capita income and infrastructural level index of importing countries coefficients are found to be not different from zero. Like in agricultural commodities export value regression result, per capita GDP differential is obtained to be significant and has positive sign which again supports the H – O hypothesis in the light manufacturing export value model. Common language and border are as expected with positive sign and significant.

Regional Dummy Variables Results in All Sectors

When we come to the variable interest of this study, the results in table (7) below display regional dummies effects vary from sector to sector. Referring to this regression result table, intra trade dummy coefficient for fuel and minerals as well as heavy manufacturing sectors model fits with the expected positive sign and found significant.

Table7: Regression Results of Regional Trade Agreement Dummy Variables (2000-2007)

Variable/coefficients	agri	Fuel& min	Hmanu	Lmanu
SADCTIJ	-3.51*(3.61)	4.49 *(5.13)	2.21* (-4.15)	-1.95***(-1.94)
SADCXIJ	3.51*(3.61)	-4.49*(5.13)	-2.21*(4.15)	1.95***(1.94)

- Note: agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.
- SADCTIJ takes the value unity when both countries are current members of the bloc. A positive coefficient indicates trade creation.
- The regional dummy, SADCXIJ takes a value of unity if only if the exporting country is a current member of the bloc and the importing countries are part of the ROW. A positive coefficient indicates an open bloc, while a negative coefficient suggests trade diversion.
- The numbers in Parentheses are t-value and *, **and *** show at 1%, 5% and 10 % significance level respectively.

The results suggest that the positive sign of intra – SADC dummy is associated with intra-bloc export creation for the two sectors mentioned above. If two countries are the members of SADC, an export flow between them is 8812% [$\exp\{ (4.49)-1\} =88.12$] and 811 % [$\exp\{ (2.21)-1\}=8.11$] more than two otherwise similar countries for fuel and mineral sector , and heavy manufacturing sectors respectively (see table 8). Nevertheless, the extra –SADC dummy coefficient for these sectors demonstrates negative sign implying that extra –SADC trade diversion in fuel and minerals, and heavy manufacturing sectors is registered for the given sample year of study. In other words, intra-trade export increases at the costs of reduction in extra-regional export. One possible justification for extra- trade diversion effects in fuels and minerals, and heavy manufacturing sectors might be the exclusion of Angola from sample of this study where representing a significant share and destining its market out side Africa in fuels and minerals .This may underestimate the trade flow of fuels and minerals to nonmember partners.

For positive intra and negative extra –SADC trade in heavy manufacturing sector, one possible reason might be manufactured goods from SADC countries not only faced high import barriers in the developed countries, but also were not competitive. This is equivalent to say that SADC countries prefer to trade with in the region realizing their uncompetitive ness in heavy manufacturing products in the global market. On top of this, as incomes rise in southern African countries, consumers demand greater choice in the variety of products and increasingly sophisticated products. In the absence of capacity for local production, increased demand for imports of such products provides an opportunity for South African exporters of processed and high value products to take advantage of opportunities in such markets which are exhibited in SADC’s fuels and minerals, and heavy manufacturing sectors.

However, the intra-regional dummy for agricultural commodities export and light manufacturing sectors is unexpectedly negative implying that countries located within these regions do trade less with each other over and above the levels predicted by the basic explanatory variables for the given sample years of this study. Put it differently, there was intra-SADC export trade diversion in agricultural and light manufacturing sectors.

Table 8: Calculated percentage change equivalents in the respective estimated intra and extra dummy coefficients of SADC (2000-2007)

Variable/coefficients	agri	Fuel& min	Hmanu	Lmanu
SADCTIJ	-95	8812	811	-86
SADCXIJ	3244	-98	-89	603

- Note agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.
- As the dependent variable is in logarithm form , the percentage effect of dummy variables is calculated by subtracting one from the exponent of the regression dummy coefficient shown in table 7 and then multiplying the result by 100.i.e. $[\exp(\text{coefficient})-1]*100$.

With regard to extra trade dummy, table (7) reveals a positive sign for the two sectors indicating that SADC's trade out side of the region has grown at the expense of declining trade with in the region it self which is interpreted as SADC's openness (extra-SADC export trade creation) in agricultural commodities and light manufacturing exports. One possible reason for the negative intra SADC trade exhibited in agricultural sector might be the importance of agricultural sector in SADC economies. Agricultural sector plays a vital role in the economies of Southern African countries, not only as a producer of food but also the largest employer of its population. Naturally, member states will seek to protect their sensitive sectors. International experience has indicated that the agricultural sector is the most likely to give rise to major negotiating difficulties. In short, the absence of extra trade diversion might be owing to the fact that many of the SADC members examined have not been able to fully implement the intra-RTA tariff elimination schedules proposed in 1996. Most of the members of the SADC are small economy

and rely on similar comparative advantage such as agricultural dominant economy. As of Alemayehu (2009), this signifies little or no chance to exchange with in the region. Hence, it is not surprising to see the negative of intra –SADC trade in this sector.

It is interesting to observe that export value in agricultural commodities and light manufacturing between two countries would increase by 3244% [$\exp \{(3.51)-1\} = 32.44$] and 603% $\exp \{(1.95)-1\} = 6.03$] consecutively if there is no a bilateral trade agreement between the countries compared to the country pairs with bilateral trade tie. The estimates in table 8 suggest that during the 2000-2007 periods, members of SADC traded with the rest of the world in agricultural and light manufacturing sectors by 32.44 and 6.03 more than they trade with in the region respectively.

The second objective of this study is assessing the level of intra -trade and extra- trade level of SADC. The extent of intra-bloc export creation in SADC member countries is much higher in fuel and minerals than that of heavy manufacturing products. With regard to the extent of extra – SADC export trade creation, it is larger in agricultural commodities and lesser in light manufacturing products. The lowest level of intra –SADC trade is exhibited in agricultural sector while the highest level is recorded in fuel and minerals sector. The reverse is registered for extra-SADC trade level.

6. CONCLUSION AND POLICY IMPLICATION

6.1 Conclusion

This paper is attempted to investigate the effects of regional trade agreement for the case of SADC's trade with its major trading partners using an augmented gravity model when disaggregated data is employed. For this purpose, panel data is considered. A particular emphasis is given to the analysis of gross trade creation and trade diversion effects, resulting from the creation of SADC regional bloc across sectors.

The results for other than the regional dummy factors in the gravity model of this study paint a familiar picture of the findings in the gravity model literatures except they vary from sector to sector. Bilateral trade flows are positively related to GDP and negatively related to distance in all sectors. Other variables such as GDP per capita income of exporting countries affects SADC's exports in fuel and minerals and light manufacturing sectors positively but negatively for agricultural sector. However, it is insignificant for heavy manufacturing sector. Except in fuel and minerals sector, GDP per capita income of importing countries is directly related with exports of SADC in the rest sectors but it is not different from zero for both heavy and light manufacturing sectors.

In agricultural and light manufacturing sectors, the GDP per capita income difference supports the HO effect trade theory while it favors the Linder hypothesis effect in fuel and minerals sector. Regarding to infrastructural level index, except in light manufacturing sector model for importing countries, it is found in line with what is hypothesized (positive sign) and significant for both trading partners. However, as compare to importing countries, the magnitude of infrastructural index is larger (almost above unity) in exporting countries for all four sectors.

Common border is found significant and positive sign in all sectors. Trade- GDP ratio, the proxy for openness of the SADC economy affects SADC's export positively in agricultural and light manufacturing sectors and negatively in fuel and minerals, and heavy manufacturing sectors.

Finally, turning to the variable interest of this study, the regression results for regional dummy display different sign and magnitude on SADC's export trade across sectors considered under the study. This implies that this study's results for some sector deviate from the previous empirical findings for the same region. In general, the formation of SADC regional scheme enhances intra regional trade in fuel and mineral, and heavy manufacturing sectors, where as it reduces trade with in the region in agricultural commodities and light manufacturing sectors.

SADC's trade with the ROW has boosted in agricultural commodities and light manufacturing sectors but has failed to increase extra trade in fuel and mineral, and heavy manufacturing sectors owing to regional integration effect. In a nutshell, intra-SADC export trade creation has occurred in fuel and minerals, and heavy manufacturing sectors where as SADC maintains openness in agricultural commodities and light manufacturing products exports exhibiting that extra-SADC

export trade creation in these sectors. In other words, even though the extent varies from sector to sector, extra-SADC trade diversion is exhibited in fuel and minerals, and heavy manufacturing sectors but negative intra trade is registered in agricultural commodities and light manufacturing products. This is interpreted as intra-SADC export trade diversion in agricultural and light manufacturing sectors.

During the sample period of this study, the level of intra and extra trade of SADC vary from sector to sector. Highest intra-SADC trade and extra –SADC trade are registered in fuel and minerals sector, and agricultural sector respectively.

In conclusion, as the study’s findings confirmed, effects of regional economic integration using disaggregated data does really matter as expected.

6.2 Policy Implication

An increase of trade among SADC countries will imply either an openness of Southern African market, a changing of specialization of SADC countries or a reduction of protection on sensitive goods like agricultural commodities. The quality and strength of effective institutions in SADC is also essential in overcoming obstacles for promoting greater trade. This helps to facilitate the implementation of trade protocol and achieve its final goals at the scheduled time.

It is also anticipated that with Reduction in tariff barriers and non-tariff barriers within the region raise intra-regional trade in the SADC region. Elimination of trade barriers and structural rigidities originating from adverse political relationship could also lead to substantial increase in intra-SADC trade.

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APPENDICES

Appendix I: Regression results and test tables

Table9: Multicollinearity test

Dependent Variable	Original R ² =0.43	Original R ² =0.51	Original R ² = 0.44	Original R ² =0.55
Dependent Variable	agri	Fuel& min	Hmanu	Lmanu
logYIT	0.61	0.61	0.61	0.61
logYJT	0.89	0.89	0.89	0.89
logGDPPCIT	0.60	0.60	0.60	0.60
logGDPPCJT	0.85	0.85	0.85	0.85
logGDPPCDI	0.77	0.77	0.77	0.77
logDIJ	0.84	0.84	0.84	0.84
logIFIT	0.36	0.36	0.36	0.36
logIFJT	0.75	0.75	0.75	0.75
logTRIT	0.58	0.58	0.58	0.58
logTRJT	0.86	0.86	0.86	0.86
CLIJ	0.33	0.33	0.33	0.33
BORDERIJ	0.46	0.46	0.46	0.46
SADCTIJ	0.90	0.90	0.90	0.90
SADCXIJ	0.90	0.90	0.90	0.90

Note: agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.

* All R²'s are from random effect regression result.

Implication: the above four sectors' models are not free from multicollinearity problem.

Table 10: Model Selection Test- Fixed vs Random Effect Models

Test type	agri	Fuel& min	Hmanu	Lmanu
Hausman	χ^2 (13)=-27 (p= -27.87)	χ^2 (13)=-30 (p= -30.55)	χ^2 (13)=-5.7 (p= -5.70)	χ^2 (13)=41 (p=0.001)
Significance level	At any level	At any level	At any level	At 1%,5%&10%
Decision	For H ₀	For H ₀	For H ₀	ForH ₁ (againstH ₀)

Note: agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.

* Where H_0 : random effect estimator is consistent

H_1 : fixed effect estimator is consistent

* high (low) hausman test prefer fixed (random) effect .

Conclusion: except light manufacturing sector, all sectors model justified random effect in both tests.

Table11: Hausman test for random effect estimator Vs instrumental variable

Test type	agri	Fuel& min	Hmanu	Lmanu
Hausman	$\chi^2 (14) = 23.89$ (p= 0.0473)	$\chi^2 (14) = 0.94$ (p= 1.0000)	$\chi^2 (14) = 16.38$ (p= 0.2906)	$\chi^2 (14) = 28.41$ (p= 0.0125)
Significance level	Significant at 5% and 10%	Insignificant at any level	Insignificant at 5% and 10%	Significant at 5%
Decision	For H_1	For H_0	For H_0	For H_1

Note: agri=agricultural commodities export value, fuel&min = fuel and minerals export value, Hmanu=heavy manufacturing export value and Lmanu= light manufacturing export value.

* Where, H_0 , random effect estimator is consistent

H_1 : using instrumental variable is appropriate

** **Conclusion:** using instrumental variable is justified for Model I and Model IV. Model II and III prefer random effect estimator.

Table 12: Summary statistics for all sectors together

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
XIJTA	1594	54100000	295000000	3	9850000000
XIJTFM	630	41600000	139000000	1	1540000000
XIJTHM	1542	109000000	915000000	1	32900000000
XIJTLM	1568	47700000	180000000	3	2180000000
Explanatory variables					
YIT	1856	58700000000	115000000000	3560000000	417000000000
YJT	1856	1180000000000	2370000000000	712000000	13800000000000
GDPPCIT	1856	3462.55	3655.864	266.061	12121.37
GDPPCJT	1856	17533.82	17816.2	170.725	103125
GDPPCDIF	1856	16538.85	16796.89	3.005	103125
DIJ	1856	5795.625	4012.949	252	16955

IFIT	1856	.1002521	.1294353	.0245666	.4429103
IFJT	1856	.3601648	.3654684	.0114448	1.390241
TRIT	1856	76.95396	25.67176	19.35008	129.7811
TRJT	1856	59.90903	57.17522	3.987224	244.4658
CLIJ	1856	.5086207	.5000604	0	1
BORDERIJ	1856	.125	.330808	0	1
SADCTIJ	1856	.4482759	.4974514	0	1
SADCXIJ	1856	.4482759	.4974514	0	1

Note: XIJTA=agricultural export value, XIJTFM=fuel and minerals export value, XIJTHM=heavy manufacturing export value and XIJTLM= light manufacturing export value

AppendixII: description and aggregation of sectors based on Keck and Roberta Pier martini (2005)

Traded commodities are divided in the following four sectors (Sector Aggregation)

Agricultural commodities	Animal agriculture, i.e. animal products nec; raw milk; wool, silkworm cocoons; cattle etc.; meat; meat products, Sugar cane and beet, Paddy rice; wheat; cereal grains nec; oil seeds; crops nec; vegetables, fruit, nuts, Food products, i.e. vegetable oils and fats; dairy products; processed rice; food products nec; sugar; beverages and tobacco products
Fuel and minerals	Fuels and minerals, i.e. coal; oil; gas; minerals nec;
Heavy manufacturing	Heavy manufactures and metals, i.e. chemical, rubber and plastic products; paper products and publishing; wood products; petroleum, coal products; mineral products nec; metals; ferrous metals; metals nec; metal products
Light manufacturing	Light manufactures, i.e. motor vehicles and parts; transport equipment nec; electronic equipment; machinery and equipment nec; forestry; fishing; manufactures nec

Source: COMTRADE CD-ROM DATA BASE