International Trade Effects of Regional Economic Integration in Africa: The Case of the Southern African Development Community (SADC)

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Abstract

Empirical studies on regional economic integration process in Africa exhibit sluggish progress, and there by limited level of intra-trade. The existing literature in Africa, particularly in the Southern African regional integration bloc, has neglected the 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. The investigation estimates an augmented gravity model using panel data and random effect estimator methods applying instrumental variables where needed. The results show that intra-SADC trade is growing in the fuel and minerals and the heavy manufacturing sectors while it displays a declining trend in the agricultural and light manufacturing sectors. This implies that SADC has displaced trade with the rest of the world in both fuel and minerals and the 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 with the rest of the world in these sectors of trade. However, the increasing trend of extra-SADC trade bias over the sample period in both the agricultural commodities and light manufacturing sectors means that there has been a negative trade diversion effect which implies that the value of trade between members and non-members has been increasing (and not falling as would be the case with trade diversion) for the two sectors. These results seem to suggest that SADC countries retained their openness and outward orientation despite signing the trade protocol for enhancing intra-SADC trade.

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

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. The investigation estimates an augmented gravity model using panel data and random effect estimator methods applying instrumental variables where needed. 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 which implies the value of trade between members and non-members has been increasing (and not falling as would be the case with trade diversion) 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.

The relevance of regional integration is a very persistent issue in Africa, specifically in view of political and economic backwardness. Africa is confronted with a deep-rooted level of poverty, a minimal share of world trade, and a low pace of development in human capital and infrastructure as well as being faced with an 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 polices 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 into the world economy. However, in practice, the effectiveness of regional integration in Africa is an empirical issue specifically related to the progress of trade that flows among members of any trading bloc on the continent.

There are plenty of empirical studies regarding the effects of regional economic integration on trade flows. Various researchers have employed different methodology to analyze the effects of regional economic integration, and the results from these studies are mixed. Although early empirical studies used cross-sectional data to estimate gravity models (Aitkin, 1973; Berstrand, 1985), most researchers nowadays use panel data (Matyas, 1997; Wall, 2000; 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 a model's dependence upon aggregated data as opposed to disaggregated data, which can help in analyzing the effects of trade agreements on specific tradable commodities, and helps member countries identify sectors, which are advantageous in joining the trading bloc. In addition, aggregate data masks commodity, or level heterogeneity, which may also bias the estimate.

Specifically, to the best of our knowledge, the possibility of doing an examination using a panel data approach at the sectoral level is rarely practiced in Africa. As elaborated earlier, this leads to a biased estimation and hence incorrect inferences. Clausing (2001) and Romalis (2005) eliminated some of these problems by using commodity level data to analyze the effects of the Canada–United States Free Trade Agreement (CUSFTA) and the 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 study at the disaggregated data level have not been investigated rigorously. This void motivates this study uses disaggregated data to focus on the Southern African Development Community (SADC) and its effects on trade. 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.

Review of the Literature

Effects of Regional Economic Integration

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

Theoretical Framework on the Effects of Regional Economic Integration. Entry into a regional integration scheme can have both static effects, which are a result of resource allocation in response to changing relative prices, and dynamic effects, which come from changes in efficiency, ability to exploit economies of scale, and in the level of investment and growth.

Static Effects. The static impact refers to changes that 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, a 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 production. Nevertheless, besides the trade creation and trade diversion effects, the static effects of regional integration can involve other impacts. Thus, this study is going to look at these static effects by classifying them into traditional (trade creation and diversion) and non-traditional static effects in a broader sense. On top of these traditional static effects, Cline (1978) provided additional non-traditional static effects from regional trade integration, which are as follows: the labor opportunity effect,[27] the economies of scale effect,[28] and the foreign exchange saving effect.[29]

Further studies also discovered 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 assumed perfect competition and constant returns to scale, and

[27] This occurs when an increase of output, made possible by regional trade integration, allows for the employment of extra labor at a wage below the minimum wage rate.
[28] This occurs when firms become able to produce at their capacity as a result of the increase of the market size made possible by more demand of the product.
[29] This occurs when a group of countries forms a regional trade agreement (RTA), and they increase imports from within the union and reduce the level of imports from outside the union, thus saving foreign exchange.

identified 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 output, scale and variety effects.

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 tariffs.[30] 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. These are competition effect, investment effect, economies of scale, capital formation effect and structural effect. 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 sustained.[31] 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.

Welfare Effects. Across the globe, there is a fierce debate about the merits of regional trading agreements (RTA). 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. In addition, the empirical works fail to provide firm conclusions on even the most basic issues regarding preferential trading agreements: whether trade creation outweighs trade diversion (Clausing, 2001**).**

Empirical Findings on Regional Economic Integration. For analytic purposes, it is useful to classify the researchers' findings on the topic according to the type of methodology they employ 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 the aggregate or sectoral level.

CGE Model. There are a large number of ex-ante Computable General Equilibrium (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) applied CGE analysis in order to better evaluate the likely outcome of a Free Trade Area of the Americas (FTAA) agreement, and they

[30] 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).

[31] Every dynamic effect is a consequence of the increase in effective size following integration, and will have potentially positive effects on growth.

found that that imports increased in all regions of the world as a result of the FTAA. This outcome was robust to variation in the trade elasticities.

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 this study is concerned with here.[32] Krueger (1999) also mentioned that CGE studies have been prospective rather than retrospective. In a CGE model, the sectoral aggregation also does not permit analysis of specific markets. As with McKitrick (1998), policy information is usually outdated, and baseline scenarios are far from facts and based on the older data. CGE methods are also very data demanding and tend not to be applied with high levels of data disaggregation (Milner and Sledziewska, 2005). Therefore, the validity of the results of CGE studies is questionable in some cases. While CGE models are useful for speculating what the effects of a particular agreement might be, they are without 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 patterns, for example, Anderson and Norheim, 1993; Yeats, 1998; Dell'Aquila et al., 1999). These studies used different indicators to measure the regional concentration of trade. A descriptive approach implicitly assumes that the share of trade happens with the partner nation that 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.[33] Furthermore, a descriptive approach misses the ability to analyze trade creation and trade diversion effects and, hence, the welfare implications of RTAs (Jayasinghe & 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) constructed a counterfactual of how trade would have changed in the absence of European integration by calculating pre-integration income elasticities that were assumed to continue post-integration. Some, including Frankel and Wei, 1995; Frankel and Kahler, 1993; Frankel, 1997; Krueger, 1999; Aitkin, 1973; Aitkin and Obutelewicz, 1976; and Willmore, 1976, applied the gravity model to assess the impact of preferential arrangements on trade flows.[34] Schwanen (1997) found that trade growth with the United States was much faster in liberalized sectors.

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

[32] Analyzing trade creation and trade diversion effects of regional trading arrangements on trade patterns at sectoral level

[33] 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, cannot be detected.

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

suggested that the FTA-related reduction in Canadian tariffs led to increases in imports from the United States and to reductions in inter-provincial trade.

Regional dummy variables, inter and extra, have been used in gravity models using ex-post approaches to try to capture separate trade creations and diversion effects. It was also the case that gravity modeling was invariably used to model total trade flows or at least broad aggregates of trade.[35]

Clausing (2001) employed data at the commodity level, and the results indicated that CUSFTA had substantial trade creation effects with little evidence of trade diversion. Further, he argued that unlike the approaches of many previous studies of preferential trading agreements that have relied on aggregate data, disaggregate data was 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.[36]

Similarly, Jayasinghe and Sarker (2004) estimated an extended gravity model using pooled cross–sectional, time–series regression, and generalized least squares methods. As a result, they found that a share of intra-regional trade is growing within NAFTA, and that NAFTA has displaced trade with the rest of world. Using panel data econometric model analysis applied to highly disaggregated trade data, Milner and Sledziewska (2005) came out with the results that showed the European Agreement had transitory, but significant, trade diverting effects for Poland's imports. The trade diversion substantially dominated the trade creation.

Empirical Findings on Regional Economic Integration in Africa

Alemayehu and Haile (2002), in their study for COMESA, showed 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 had insignificant effects on the flow of bilateral trade. Khorana et al. (2007), using a partial equilibrium model, assessed the implications of the transitional measures for products sensitive from the Ugandan perspective. They discussed whether the regional trading arrangements conferred any real benefits on the stakeholders, and suggested alternative approaches that may increase the benefits for Uganda from trade liberalization within the customs union.

Specifically, Maasdorp (1999), in his study of regional trade and food security in SADC, concluded that trade in the region can contribute substantially to provide improved food security. Besides, he noted that there was a considerable scope for greater intra-regional trade in grains and other food products, and for a greater cross-border investment in agriculture and the agro-industry. By modeling South Africa and the rest of southern Africa, Lewis et al. (1999) also concluded that: (i) trade creation dominates trade diversion for the region under all FTA arrangements; (ii) the rest

[35] 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).

[36] 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.

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. To address the potential of increasing intra-SADC trade, Chauvin and Gaulier (2002) used three complementary approaches.[37] Keck and Piermartini (2005) applied the general equilibrium model with 15 regions and 9 sectors to simulate the impact of EPAs for countries of SADC. Their simulation results showed that EPAs with the EU were welfare-enhancing for SADC overall, which led also to substantive increases in real GDP.

Brief Overview of SADC's Economic Structure and Characteristics

Economic Indicators of SADC Member Nations

From the beginning, the southern African region was comprised of heterogeneous countries both in terms of economic and political dimensions. Put differently, there were significant gaps of development. In 2007, this included six countries with a GDP per capita below or equal to US $660 (DRC, Lesotho, Malawi, Mozambique, Tanzania, and Zimbabwe), and eight other countries with an income per capita of US $900 to $8,600 (Botswana, Swaziland, Namibia, Mauritius, Seychelles, Zambia, South Africa, and Angola). If one excludes South Africa from the region, the average per capita income in 2007 was US $2,735 in SADC.

SADC Trade Level

Despite impressive growth in total exports between 2000 and 2007, intra-SADC trade remained weaker.[38] An examination of trade between countries also revealed that more than two thirds of the total trade was with South Africa. However, SADC's growth of extra-regional trade was more than with fellow members. Since SADC had commenced its implementation of the trade protocol, it experienced huge increases in exports. However, most of these exports were destined to markets outside the region itself and Africa on the whole. European countries were the major trading partners of the SADC members. Following European countries, Asia and the USA served as second and third, respectively, as significant export destinations of SADC members.

[37] The first two refer to trade indices: export diversification indices revealed comparative advantages and trade complementarily indices and the last one is based on gravity model.

[38] 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 outside Africa.

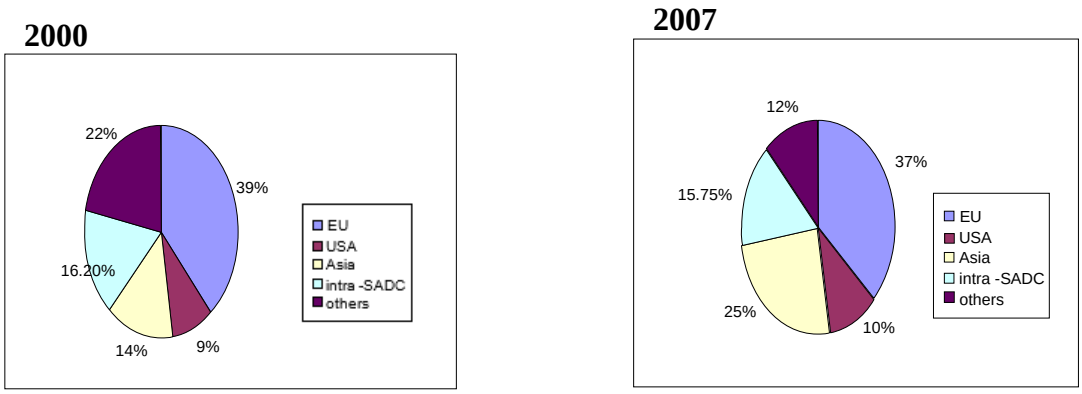

Figure 1: Export Share Trends of SADC by Destination in 2000 and 2007.
Source: Own Computation from COMTRADE DATA CD-ROM

Share of Exports by SADC Member States

As Figure 2 displays, in both years, South Africa contributed the highest share in total intra-SADC trade. Zimbabwe and Namibia held the second and third positions in total trade that took place within the region in 2007.

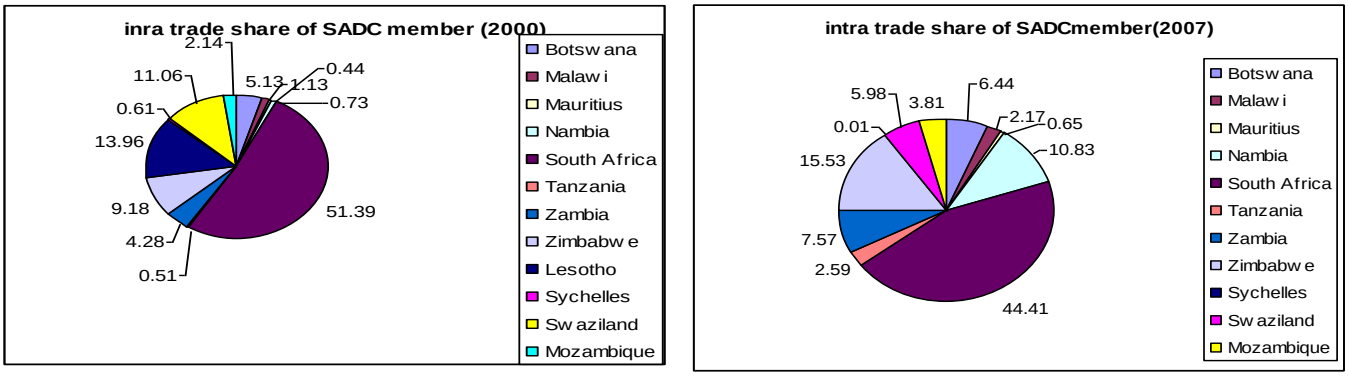

Figure2: Share of Intra- Export value in SADC Trade by Members (in US dollar)
Source: Own Computation from COMTRADE DATA CD-ROM

It was also evident that intra-trade among SADC members had declined in the agricultural and light manufacturing sectors in 2007 as compared to the base year 2000. However, trade shares increased in fuel and minerals and the heavy manufacturing sectors for the same period.

Table 1

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

Source: Own Computation from COMTRADE DATA CD-ROM

According to Table 1, South Africa, followed by Botswana and Zambia, accounted for 70% of the total exports of SADC for the year 2007.

Empirical Methodology and Model Specification for Estimation

The existing literature on the methodology of assessing the effects of how regional economic integration on trade flows among nations can be broadly classified into three categories. Empirical studies have employed a range of techniques to investigate the effects of RTAs. Namely, computable general equilibrium (CGE) models which employ economy wide, multi sectoral analyze the welfare impacts of RTAs, and a descriptive approach that is also applied in the literature analyzes the impacts of RTAs can be mentioned. However, these two approaches have various limitations as explained in the literature section. Hence, as an alternative, recent econometric studies have incorporated the effects of RTAs into the model specification and into estimate models using pre-RTA and post-RTA data. The impact of RTAs on the trade flow is captured through the use of regional dummy variables. This is known as the gravity model approach, which explains bilateral trade flow between trading partners over time. The gravity model has become an attractive technique for assessing the effects of RTAs.

Theoretical Justification of the Gravity Model in Analyzing Trade

As was mentioned earlier, the Newtonian physics notion[39] is the first justification of the gravity model. The second rationale, that the gravity equation can be analyzed in the light of a

[39] 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."

partial equilibrium model of export supply and import demand, was provided by Linneman (1966). Relying on some simplifying assumptions, the gravity equation proves to be a reduced form of this model.[40] Nonetheless, Bergstrand (1985) and others indicated that this partial equilibrium model cannot explain the multiplicative form of the equation, and also leaves some of its parameters unidentified mainly because of the exclusion of the price variable. With the simplest form of the equation, of course, Linneman's justification for exclusion of prices is consistent.

Anderson (1979) provided the first theoretical explanation for the gravity equation based upon the properties of the expenditure systems.[41] Since Anderson's synthesis, Bergstrand (1985, 1989), Helpman and Krugman (1985), and Deardorff (1998) have also contributed to improvements of the theoretical foundation of the gravity model. In these studies, the gravity equation was derived theoretically as a reduced form from a general equilibrium model of international trade of final goods. The micro-foundation approach also claimed that the crucial assumption of perfect product substitutability of the 'conventional' gravity model is unrealistic as evidenced 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 and Krugman (1985), and others agreed with this view. Hence, this new legitimacy, or theoretical foundation in applying the gravity model for assessing international trade flows, motivated this study's reliance on an extended gravity model for the purpose of analyzing the trade effects of SADC.

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 specifications for the gravity model.

In the context of international trade, the basic formulation of the gravity model equation is as follows:

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

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:

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

where notation is defined as follows:

[40] ***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.

[41] 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).

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

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

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

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

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

U_{ijt} =log normal error term

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

ln = the natural logarithm operator

Trade theories based upon imperfect competition and the Hecksher-Ohlin models justify the inclusion of the core variables: basically, income and distance. However, most researchers incorporate additional variables to control differences in geographic factors, historical ties, exchange rate risk, and even overall trade policy for the fact that trade that flows between nations can be affected by factors besides 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 were added for each RTA under critical examination. Furthermore, in order to avoid capture by these dummy variables and the impact of other influences on trade, other dummy variables were added to control the common language and common border. Thus, the augmented gravity model incorporated other variables, and thus, by introducing these variables in to equation (21), the basic formulation of the model could be extended as follows:

$$\ln X_{ijt} = \ln \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln GDPPC_{it} + \beta_4 \ln GDPPC_{jt} + \beta_5 \ln GDPPCDIFF_{ijt} + \beta_6 \ln D_{ij} + + \beta_7 \ln IF_{it} +$$

$$\beta_8 \ln IF_{jt} + \beta_9 \ln TR_{it} + \beta_{10} \ln TR_{jt} + \beta_{11} CL_{ij} + \beta_{12} Border_{ij} + \beta_{13} SADCT_{ij} + + \beta_{14} SADCX_{ij} + \ln U_{ijt} \quad \textbf{….. (6)}$$

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 countris i and j at time t

Border = common border between countries i and j

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

The GDP per capita income was incorporated rather than population in equation (6).[42]

[42] Because population is appropriate when aggregate export data is used 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 are included in the gravity model. Second, there are mixed results on the estimated impact of each variable on bilateral trade.

Introducing regional dummy variables helped to estimate the trade effects of the SADC regional bloc using equation (6), which is the interest of this study. Therefore, following Coulibaly (2004), two dummy variables SADCTij and SADCXij, were introduced to capture intra-bloc and extra-export effects 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 a member of SADC and the importing country j belongs to the ROW [zero otherwise] (capturing bloc exports to the ROW).

In the researchers' estimates, SADCTIJ captured the total intra-regional trade bias. The dummy *SADCXIJ* captured the extra-regional export bias where a negative and significant coefficient indicated that member countries had switched to export to members rather than non-members.[43]

Table 2

Data description and Hypotheses for Gravity Model Variables

Name of variable	Expected sign	Measurement	Source	Remarks
GDP	+ve	In US dollars	WDI-CD-R0M (2008)	Growth in economic capacity boosts trade flows
GDP per Capita income	+ve/-ve	In US dollars	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).
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 activities among nations
Regional dummy SADCXIJ SADCTIJ	+ve/-ve +ve/-ve			capture the influence of regional trading agreements on trade flows among nations

[43] This can be trade diversion which results in a member country preferring to export to members rather than non-members.

Data Description and Sampling Procedure

The majority of empirical literature on the gravity model used total bilateral trade flows as dependent variable. However, Cernat (2001) suggested that the use of bilateral export flows for a given pair of countries with total bilateral trade cannot distinguish between the impacts of RTA formation on exports from non-members to RTA members and impacts on exports from the RTA member to the non-members. For the present study, bilateral export flow (proxy for total bilateral trade) was used as the dependent variable. This study covers a total of 30 countries. The countries were chosen on the basis of importance of trading partnerships with SADC members and availability of the required data. Eight countries of SADC (out of fourteen countries): Botswana, Malawi, Mauritius, Namibia, South Africa, Tanzania, Zambia and Zimbabwe were incorporated in the sample as reporter countries. However, all members of SADC were included as the partner countries in the sample taken for this study to examine the level of intra-regional trade.[44]

Estimation Results and Analysis

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 was constructed.[45]

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 problems among the explanatory variables. See details for random versus fixed effect tests in Appendix B, Table B2, endogeneity of explanatory variables in Appendix B, Table B1, and Random Effect Estimator Vs Instrumental Variables in Appendix B, Table B3. All estimates have also been checked for heteroscedasticity.

Analysis of Results

Our workhorse gravity model equation (6) has been estimated using a random effect estimation technique and by applying instrumental variables where it is justifiable with panel data for the aforementioned reasons. It has been estimated by taking all variables separately for every sector considered in this study. As Table 3 exhibits, when the agricultural commodities export value was the dependent variable, except for common language, all variables were found to be significant.[46] Similarly, in regression results with fuel and mineral export value as the dependent

[44] From the EU, ten countries were taken because they serve as major trading partners of SADC. These are UK, Germany, France, Italy, Netherlands, Austria, Portugal, Belgium, Luxembourg and Spain. Next to the EU, Asian countries are the second most important trading partner for the region. As a result, five countries were chosen from Asian countries: India, China, Japan, Hong Kong and Indonesia. The USA is also included in the sample since it takes the third position of SADC's export destinations.

[45] This study uses export values as the dependent variable for the aforementioned reasons. Furthermore, total export value was disaggregated in four sectors.

[46] While GDP per capita income coefficient for both trading partners was negative and significant, implying that 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 the importing country's contribute to the economies of scale of the domestic industry.

variable, we found that all variables included in the regression were significant, but GDP and the GDP per capita income for importing countries were only slightly significant.

Table 3
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* (3.18)	-.32** (-2.24)	-.09 (-0.95)	.15** (1.99)
logDIJ	-2.38* (-9.96)	-.67** (-2.23)	-1.38* (-6.71)	-2.33* (-10.19)
logIFIT	1.01* (11.36)	1.23 * (5.79)	1.25* (11.53)	2.09* (23.05)
logIFJT	.21*** (1.79)	.36** (2.07)	.59* (5.0)	-.09 (-0.69)
logTRIT	.21* (4.45)	-.96* (-4.67)	-.06* (-6.10)	.42 (-7.62)
logTRJT	-1.15 (1.24)	-2.57* (-3.16)	-2.02 (-0.30)	-2.10** (2.38)
CLIJ	.13 (0.72)	-.83** (-2.51)	.56* (2.84)	.86* (4.52)
BORDERIJ	1.80* (7.07)	2.10* (5.53)	2.35* (8.54)	2.11* (8.10)
cons	3.57 (1.03)	-3.65* (-0.60)	-18.35 (-4.72)	-1.70 (-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 mineral export value, Hmanu = heavy manufacturing export value, and Lmanu = light manufacturing export value. The numbers in Parentheses are t-values and *, **and *** show at the 1%, 5% and 10 % significance level respectively. All variables except dummy variables are in logs.

Unlike the regression results table of agricultural commodities export value sector model, the GDP per capita income difference was found to be negative and significant endorsing Linder's

(1961) hypothesis that similar countries trade more with each other than dissimilar countries do.[47] Again, when heavy manufacturing export value is on the left side of the regression equation (6), all core variables of the gravity model, the GDP for exporting, as well as importing and distance are consecutively significant with the anticipated positive and negative sign. Furthermore, with the light manufacturing export value as the dependent variable, it is shown that the GDP of exporting and importing countries, the GDP per capita income, and the infrastructural level index of exporting countries and distance were found to be significant with the expected sign.[48]

Analysis for Regional Dummy Variables Results in All Sectors. When we come to the variable interest of this study, the results in Table (7) below display that the regional dummies effects vary from sector to sector. Referring to this regression result table, the intra-trade dummy coefficient for the fuel and minerals sector as well as the heavy manufacturing sector model fits with the expected positive sign and was found significant. The results suggest that the positive sign of the intra–SADC dummy is associated with intra-bloc export creation for the two sectors mentioned above. If two countries are 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 the fuel and minerals and the heavy manufacturing sectors, respectively (see Table 5). Nevertheless, the extra–SADC dummy coefficient for these sectors demonstrates a negative sign implying that extra–SADC trade diversion in the fuel and minerals and heavy manufacturing sectors is registered for the given sample year of study. One possible justification for extra-trade diversion effects in the fuel and minerals and heavy manufacturing sectors might be the exclusion of Angola from the sample of this study, which represents a significant share and destining its market in fuels and minerals outside Africa. This may underestimate the trade flow of fuel and minerals to nonmember partners.

For the positive intra- and negative extra–SADC trade in the heavy manufacturing sector, one possible reason might be that manufactured goods from the SADC countries not only faced high import barriers in the developed countries, but also were not competitive. This is equivalent to saying that the SADC countries prefer to trade within the region because they realize their lack of competitiveness in trading heavy manufacturing products in the global market. On top of this, as incomes rise in southern African countries, consumers demand a 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 highly valued products to take advantage of opportunities in such markets which are exhibited in SADC's fuel and minerals, and heavy manufacturing sectors.

[47] This Linder hypothesis emphasis shows income similarity as the driver of trade instead of income differences.

[48] Like in the agricultural commodities export value regression result, per capita GDP differential was shown to be significant and had a positive sign, which again supports the H – O hypothesis in the light manufacturing export value model.

Table 4

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: 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 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 levels, respectively.

However, the intra-regional dummy for the agricultural commodities exported and light manufacturing sectors is unexpectedly negative which implies 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 differently, there was intra-SADC export trade diversion in the agricultural and light manufacturing sectors. With regard to the extra trade dummy, Table 4 reveals a positive sign for the two sectors indicating that SADC‘s trade outside of the region has grown at the expense of declining trade within the region itself, which is interpreted as SADC’s openness (extra-SADC export trade creation) in agricultural commodities and light manufacturing exports.

Table 5

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: As the dependent variable is in logarithm form, the percentage effect of the dummy variables is calculated by subtracting one from the exponent of the regression dummy coefficient shown in table 4 and then multiplying the result by 100.i.e. [{exp (coefficient)}-1]*100.

One possible reason for the negative intra-SADC trade exhibited in the agricultural sector might be the importance of the agricultural sector in SADC economies. The agricultural sector plays a vital role in the economies of southern African countries, not only as a producer of food but also as the largest employer of its population. Naturally, member states 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. Moreover, 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. Additionally, most of the members of SADC are small economies and rely on similar comparative advantages such as an

agricultural dominant economy. Hence, it is not surprising to see the negative of intra–SADC trade in this sector.

It was interesting to observe that the 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 was not a bilateral trade agreement between the countries, compared to the country pairs with bilateral trade ties. The estimates in Table 5 suggest that during the 2000-2007 periods, members of SADC traded with the rest of the world in the agricultural and light manufacturing sectors by 32.44 and 6.03 more than they traded within the region, respectively. The extent of intra-bloc export creation in SADC member countries was much higher in fuel and minerals than in that of heavy manufacturing products. With regard to the extent of extra–SADC export trade creation, it was larger in agricultural commodities and lesser in light manufacturing products. The lowest level of intra–SADC trade was exhibited in the agricultural sector while the highest level was recorded in the fuel and minerals sector. The reverse was registered for the extra-SADC trade level.

Conclusion and Policy Implication

Conclusion

This paper has attempted to investigate the effects of a 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.

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 that they vary from sector to sector. Turning to the variable interest of this study, the regression results for the regional dummy display a different sign and magnitude on SADC's export trade across the sectors considered under the study. This implies that this study's results for some sectors deviate from the previous empirical findings for the same region. In general, the formation of the SADC regional scheme enhances intra-regional trade in the fuel and minerals and heavy manufacturing sectors, where as it reduces trade within the region in the agricultural commodities and light manufacturing sectors. SADC's trade with the ROW has increased in the agricultural commodities and light manufacturing sectors, but has failed to increase extra trade in the fuel and minerals and heavy manufacturing sectors owing to a regional integration effect. In a nutshell, intra-SADC export trade creation has occurred in the fuel and minerals and the heavy manufacturing sectors where as SADC maintains openness in agricultural commodities and light manufacturing product exports which exhibits extra-SADC export trade creation in these sectors. In conclusion, as the study's findings confirm effects of regional economic integration using disaggregated data does really matter as expected.

Policy Implication

An increase of trade among SADC countries will imply either an openness of the 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 facilitate the implementation of trade protocol, and achievement of its final goals at the scheduled time.

It is also anticipated that with a reduction in tariff barriers and non-tariff barriers within the region, there will be a rise in intra-regional trade in the SADC region. Elimination of trade barriers and structural rigidities originating from adverse political relationships could also lead to a substantial increase in intra-SADC trade. Regional national policy makers can also approach the boosting of intra-trade in Africa by designing sectoral trade related agreement policies, which again fasten regional economic integration to the highest level on the continent.

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Appendices

Appendix A: 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 n.e.c.; raw milk; wool, silkworm cocoons; cattle etc.; meat; meat products, Sugar cane and beets, paddy rice; wheat; cereal grains n.e.c.; oil seeds; crops n.e.c.; vegetables, fruit, nuts, food products, i.e. vegetable oils and fats; dairy products; processed rice; food products n.e.c.; sugar; beverages and tobacco products
Fuel and minerals	Fuels and minerals, i.e. coal; oil; gas; minerals n.e.c.;
Heavy manufacturing	Heavy manufactures and metals, i.e. chemical, rubber and plastic products; paper products and publishing; wood products; petroleum, coal products; mineral products n.e.c.; metals; ferrous metals; metals n.e.c.; metal products
Light manufacturing	Light manufactures, i.e. motor vehicles and parts; transport equipment n.e.c.; electronic equipment; machinery and equipment n.e.c.; forestry; fishing; manufacture n.e.c.

Source: COMTRADE CD-ROM DATA BASE

Appendix B: Test Tables

Table B1

Multicollinearity Test

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 R^2's are from random effect regression results.

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

Table B2

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)

* Where H_0: random effect estimator is consistent

H_1: fixed effect estimator is consistent

* High (low) Hausman test prefers fixed (random) effect.

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

Table B3

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%and10%	Significant at 5%
Decision	For H_1	For H_0	For H_0	For H_1

* 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. Models II and III prefer the random effect estimator.