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# Agricultural Trade Flows among Developing Countries: Do Regional Preferential Trade Agreements make a Difference?

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### Introduction

The Southern African Development Community (SADC) was established in 1980 out of the region's felt need for an integrated body to promote regional integration, economic growth and improvement of social welfare.[1] The SADC comprises 14 member states, a total land area of 9.1 million square kilometres, and a population of approximately 200 million people (World Bank, 2001). In 2000, SADC's total and per capita GDP was estimated at US$ 182 billion and US$1,761, respectively. Therefore, the region presents considerable potential for trade.

In 1996, SADC member states adopted a trade protocol, whose implementation commenced in September 2000, to provide a logical framework for reform measures aimed at liberalising intra-SADC trade and implementing a mechanism for a phased removal of tariff and non-tariff barriers.[2] Zambia ratified the SADC Trade Protocol (SADC-TP), which oblige the member states to offer duty free access to imports from the region. The SADC-TP aims at securing expanded regional markets by way of (1) exploiting economies of scale, (2) providing attractive opportunities for foreign and domestic investments, (3) improving value-adding processes, (4) stimulating efficient operation of commodity and service markets, and (5) expanding exports and incomes.

However, implementation of the agreed trade policies among member states has remained erratic, particularly in the area of agricultural trade. Intra-SADC agricultural

[1] The SADC member states are Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Namibia, Republic of South Africa, Swaziland, Seychelles, Zambia, and Zimbabwe. Other East and Southern African regional bodies, which share most of the same member states and common stands on issues of regional investment and trade with SADC, include Common Market for East and Southern Africa (COMESA), Southern African Customs Union (SACU), East African Cooperation (EAC), Indian Ocean Commission (IOC) and the Common Monetary Area (CMA)

[2] Non-tariff barriers (NTBs) include licenses, permits, quotas, prohibitions and confinements, export subsidies and other support measures.

exports and imports have been characterized by disputes and safeguard measures, sometimes resulting in the banning of commodities perceived to be a threat to locally produced goods by some member states. The least developed SADC member states are particularly concerned that trade liberalisation will increase the exposure of their local products to imports entering the countries at preferential terms or with actual export subsidies and other such advantages. These intra-SADC trade impediments are compounded by variations in production and marketing costs, which disadvantage the less developed member states. Owing to its landlocked location, Zambia arguably has one of the most expensive production and marketing systems in the region (ZNFU, 2001).

Although the existence of barriers to intra-SADC agricultural trade is beyond dispute, there is a dearth of knowledge as to the extent to which they influence the volume of trade and the performance of the SADC-TP. This study uses the gravity model and 11 years of country-level annual panel data to study Zambia's intra-SADC agricultural trade flows, before and during the SADC-TP, and to determine the significance of non-tariff barriers on trade. The study also tests the effectiveness of the SADC-TP at reducing such barriers.

The study contributes to the literature in two major respects. First, it is the first to use a relatively long panel to study regional trade while controlling for trading-pair heterogeneity and structural change due to the SADC-TP. Second, the paper represents the first attempt to measure and quantify the impact of the SADC-TP on trade flows by a member state.

**Theoretical framework**

The gravity model has been used to study bilateral trade patterns since the times of Tinbergen (1962) and Pöyhönen (1963), often with impressive accuracy. The model has

been especially useful in estimating and accounting for the 'home or border bias', which would not be captured by models that assume frictionless trade. Home bias, or border bias, is a measure of the degree to which markets are segmented by international borders.

However, until recently, the gravity model lacked justifiable theoretical foundations. Early attempts to theoretically justify and derive the model did so on the basis of the probability model of transactions (Savage and Deutsch 1960; Leamer and Stern 1970) and Armington-based models of product differentiation (Anderson 1979; and Bergstrand 1985). It was only in the mid-1990s that explicit connection with the Heckscher-Ohlin and other standard trade models was made. It turns out that the gravity model is a reduced form of a broad class of some underlying structural relationships (Deardorff 1995).

The gravity model asserts that trade between any two countries is directly related to the two countries' incomes (or GDP) and inversely related to the distance between them, where the latter proxies transportation costs. Often, the model also includes foreign direct investment (FDI), a proxy for foreighn investment policy in the trading countries (Poonyth et al., 2002), and the countries surface areas. Built on Newton's "Law of Universal Gravitation", the model usually depicts a multiplicative functional form:

$$y_{ijt} = \exp(\beta_0 + \boldsymbol{\delta}'\mathbf{z}) x_1^{\beta_1} x_2^{\beta_2} ... x_K^{\beta_K} \mu_{ijt} \qquad (1)$$

where $y_{ijt}$ is the value of exports from country *i* to country *j* in period *t*, $\forall\, i = 1,2,...,n$, $j = 1,2,...,m$, and $t = 1,2,...,T$; $\{x_1, x_2, ..., x_K\} = \mathbf{x}$ is a vector of *K* standard gravity model explanatory variables; **z** is a vector of dummy variables representing geographical, political and trade policy status or position of the trading countries; $\mu$ is an error term; and $\{\beta_0, \beta_1, \beta_2, ..., \beta_k\} = \boldsymbol{\beta}$ and $\boldsymbol{\delta}$ are vectors of parameters to be estimated.

The contents of vector **z** vary depending on the specific geographical, political and trade policy circumstances of the countries under study. Zambia is a signatory to several other regional trade agreements, including the Common Market for East and Southern Africa (COMESA), and the Cross-Border Initiative (CBI). Dummy variables for these and other initiatives such as the Common Monetary Area (CMA) would capture the effect of belonging to common trade agreements. They are all expected to be directly related to the volume of trade.

Eligibility for the trade benefits of the African Growth and Opportunity Act (AGOA) is likely to affect trade among African countries. By reinforcing African reform efforts, providing improved access to U.S. technical expertise, credit, and markets, and establishing a high-level dialogue on trade and investment, AGOA is expected to substantially expand preferential access for imports from eligible Sub-Saharan African countries. While these trade reform effects may imply freer trade and, hence, higher importation of Zambia's exports (for an export model) and higher exports to Zambia (for an import model), improved access to U.S. markets may strengthen Zambia's trading links with the US at the expense of Zambia's trade with her regional partners. The coefficient is, thus, expected to reflect the net effect Zambia's participation in AGOA.

**0.1. The empirical model**

A number of specification issues need to be addressed when implementing Equation (1). First, standard regression parameterization is inadequate to deal with all the trading-pair heterogeneity. Wall (2000) demonstrated, using US-Canada trade data, that huge biases could be introduced if such unobserved effects are ignored. Panel data help to deal with this problem by permitting specification of a trading-pair specific effect. Assuming this effect is time invariant, Equation (1) can be reformulated as:

$$y_{ijt} = \exp\left(\beta_0 + c_{ij} + \boldsymbol{\delta}'\mathbf{z}\right) x_1^{\beta_1} x_2^{\beta_2} ... x_K^{\beta_K} \mu_{ijt} \quad (2)$$

where $c_{ij}$ is the trading-pair effect between countries *i* and *j*.

For estimation purposes, the multiplicative function in (2) is linearized by a logarithmic transformation:

$$\ln y_{ijt} = \beta_0 + c_{ij} + \boldsymbol{\delta}'\mathbf{z} + \sum_k^K \beta_k \ln x_k + \varepsilon_{ijt} \quad (3)$$

where $\varepsilon_{ijt} = \ln \mu_{ijt}$ is the error term, and $\{x_1, x_2, ..., x_K\} = \mathbf{x}$ is as a vector of continuous gravity variables.

Because we are modelling trade between Zambia and each of the other 13 SADC member countries, there is only one exporting country (Zambia) and 13 importing countries in an export model ($n$=1; $m$=13) and only one importing country (Zambia) and 13 exporting countries in an import model ($n$=13; $m$=1). Thus, strictly speaking for our purposes, *i* and *j* can be dropped when modelling exports and imports, respectively. To avoid losing observations whenever $y_{ijt} = 0$, a one was added to it prior to the logarithmic transformation. Seychelles was excluded from the analysis because trade in either direction was zero during much of the reference period. Also, because South Africa was by far Zambia's largest trading partner and because of its dominance in the region in general, Equation (3) was estimated both with and without South Africa.

***Estimation***

With only a few exceptions (Porojan 2000; and Laaser and Schrader 2002), most empirical studies using the gravity model have estimated either (not both of) the export or import side of trade, with imports taking the larger proportion (Baldwin 1994; Porojan 2000). Because Zambia is traditionally a net importer and an emerging exporter of agricultural commodities, we estimate both export and import models.

There are two basic frameworks for generalizing Equation (3) – fixed effects (FE) and random effects (RE) (Greene 2000). Under the FE framework $c_{ij}$ is taken as a trading-pair specific constant term whereas the RE framework specifies $c_{ij}$ as a group specific disturbance. The simplest RE model assumes that $\varepsilon_{ijt}$ and $c_{ij}$ are uncorrelated and that each has mean zero and constant variance, leading to a compound symmetric block diagonal covariance matrix, where the block for each $ij$ trading pair, $\mathbf{\Omega}$, can be expressed as: [3]

$$\mathbf{\Omega} = \sigma_{\varepsilon}^2 \mathbf{I}_T + \sigma_c^2 \mathbf{i}_T \mathbf{i}_T^{/}, \tag{4}$$

where $\sigma_{\varepsilon}^2$ and $\sigma_c^2$ are variance components corresponding to $\varepsilon_{ijt}$ and $c_{ij}$, respectively.

Under these conditions, the RE estimator is efficient provided the unobserved effects are not correlated with the explanatory variables, i.e. $\text{Cov}(\mathbf{x}_{ijt}, c_{ij}) = 0$ but is inconsistent if significant correlation exists. The FE estimator, on the other hand, is consistent whether $\text{Cov}(\mathbf{x}_{ijt}, c_{ij}) = 0$ or not. Therefore, the choice of which framework to use hinges on whether there is significant correlation between $c_{ij}$ and $\mathbf{x}$. Most empirical studies have used the Hausman test to choose between the RE and FE models (Hausman, 1978), which compares the parameter estimates of the consistent FE model against those from the more efficient RE model under the null.

However, the traditional hausman test is inappropriate if (4) does not hold. In our case, a likelihood ratio test could not reject panel-level heteroskedasticity (significant at 1 percent level) in all models while Wooldridge's test for autocorrelation in panel data (Drukker 2003) could not reject serial correlation in the export models (significant at 5 percent). Cross-sectional dependence was also significant in the import models as

[3] Readers who are interested in more details about alternative covariance structures are referred to Littell et al. (1996).

indicated by Pesaran's test (Pesaran 2004). Thus, the assumptions implied in (4) were strongly rejected.

Thus, we used a more general, panel-robust auxiliary regression approach to discriminate between the RE and FE estimators (Wooldridge 2002; Cameron and Trivedi 2005). This test rejected the FE estimator in all the models considered. We, thus, estimated all our models using the cluster-corrected RE estimator, where the cluster was the trading pair. Cluster-correction was necessary to ensure that the estimates were heteroskedasticity and autocorrelation consistent.

If the SADC-TP had been effective in achieving its objectives, it is expected to have led to improvement in trade flows. We use a Chow test to test for structural change between the pre-SADC-TP period (1996-2000) and the SADC-TP period (2001-2006). Predicted values from the estimated models, which represent potential trade, were used to estimate HBRs. By definition,

$$HBR = \frac{\text{Potential trade}}{\text{Actual trade}}. \qquad (5)$$

HBRs were estimated for the entire study period as well as for the periods before and during the SADC-TP. If $HBR = 1$, then actual is equal to potential trade, given the economic and political circumstances faced by the trading partners (as stipulated in the gravity equation). If, however, $HBR < 1$ then the actual volume of trade is above potential whereas $HBR > 1$ implies that trade falls below potential. The disaggregated HBR estimates were used to assess whether and to what extent trade flows improved during the SADC-TP. An unequal-variance t test was used to test for the significance of the differences between the two periods.

***Data and data sources***

The data used in this study were assembled from various sources. Estimates of the value of Zambia's agricultural trade volumes and GDP were obtained from Central Statistical Office's External Trade Statistics (CSO, 2007) and Internal Statistics (CSO, 2007), respectively. Estimates of trading partners' GDP and population were obtained from SADC Reviews Annual Report (SADC 2002), United Nations (UN) Population Division (UN 2006), and the World Banks's GDP and FDI database (World Bank 2007).

Data on FDI were obtained from the UNCTAD database, World Investment Report (2006), FAO Statistical Yearbook (FAO 2007), and International Direct Investment Statistical Yearbook (2007). Data on exchange rates were obtained from International Monetary Fund (IMF) International Financial Statistics while the Fund's World Economic Outlook database (IMF 2007) was the source for consumer price indices (CPIs).

Road distances between Lusaka and capital cities of all mainland SADC member states were obtained from Zambia's Roads Department of the Ministry of Works and Supply. For Seychelles and Mauritius, which are islands in the Indian Ocean, the distances were computed using an algorithm available at www.indo.com/cgi-bin/dist on an as-the-bird-flies basis. Surface area of each member state in square kilometres and the map of Africa were obtained from the SADC member states website: http://www.sadc.int/english/memberstates.html.

Data on membership status of SADC member states to regional trade organizations (CBI, CMA and COMESA) and AGOA eligibility were obtained from the organizations' respective websites. Finally, the authors' recollection and consultations with other knowledgeable key informants were used to determine for each SADC

member state whether she was going through political instability and if she had had a civil war on her soil.

**Results**

Table 1 presents regression results for exports and imports, with and without South Africa. Overall, all the four models fitted the data very well, each accounting for at least 55 percent of the variation in trade flows. Most of the postulated variables had the correct signs and were highly significant. Zambia's exports and imports were directly and significantly related to the trading partners' total and per capita GDP, the level of FDI received by Zambia and the trading partner's membership to CBI, CMA and AGOA; and inversely related to the distance separating the two countries.

Coming from a double-log functional form, all the parameter estimates for the continuous variables were themselves elasticities. For example, a one percent increase in a trading partner's per capita GDP was associated with a 1.3 percent and 3.6 percent increase in Zambia's exports and imports, respectively. Overall, trade was most elastic to the distance between Zambia and her trading partners; a 1 percent increase in distance was associated with a 5.7 and 9.3 percent reduction in the volumes of exports and imports, respectively.

The effects of the trading partners' political environment appear largely contrary to expectations. Countries with political instability, for example, traded more with Zambia than their politically stable counterparts. However, a closer look at those countries suggests that there were other, trade-enhancing attributes whose combined effects crowded out the effects of instability. In our classification, the countries that experienced political instability during the reference period include Angola, DRC, Mozambique and Zimbabwe. All these share their borders with and are, thus, closer to

Zambia than most other countries. As already stated, distance to the trading partner was a very important, trade-dampening factor. Also, historically, the last three countries have been Zambia's important trading partners. DRC, for example, is second only to South Africa. Similar results were evident with respect to the war dummy variable, where imports were higher among countries that had experienced war (Angola, DRC and Mozambique).

Membership to CBI, CMA and AGOA had unambiguously positive effects on trade. While CBI and CMA member countries were significantly more likely to export to Zambia, AGOA influenced both imports and exports. The AGOA initiative includes commodities such as textiles, which are traditionally not considered agricultural products. The resultant softening of market access restrictions for these products may have led to resource reallocation among SADC member states and substitution of part of the quota for agricultural products in the US market.

Contrary to expectations, the dummy variable for COMESA was consistently negative and even significant for imports. On average, Zambia imported 4.5 percent more from non-COMESA countries than it did from COMESA members. One may argue that this could be because South Africa, Zambia's leading source of agricultural imports, was not a member of COMESA. South Africa also is the largest economy in the region (has the highest GDP) and has one of the highest per capita GDP, both of which were highly significant. However, even when South Africa was excluded from the analysis, the COMESA dummy was still negative and significant for imports, implying that the combined effect of other non-COMESA countries was equally substantial. In general, contrary to our expectations, the estimated trade relationships were robust to the removal of South Africa from the sample (Table 1).

*Impact of the SADC-TP on trade flows*

To test for structural change due to the SADC-TP, the dummy variable separating the two periods, *dsadctp*, was interacted with all the other variables and included in the model together with the interaction terms, after which they were tested for joint significance using a Wald test. In all the models, the assertion that the coefficients were statistically the same in the two periods was soundly rejected at 1 percent level (Table 2). Also, although the major results were largely robust, there were cases where the interaction terms implied a complete adjustment in the slope coefficients. For example, COMESA member countries had 3.1 percent less exports before 2001 and 0.2 percent more exports during 2001-2006 than their non-COMESA counterparts.

Given that structural change was significant, we estimate the home bias ratios using the models that accounted for it (Table 2). Table 3 summarizes HBRs for the full sample as well as for the sub-samples before and during SADC-TP for both exports (columns 1-3) and imports (colums 4-6). The results indicate that Zambia's intra-SADC agricultural trade was largely below potential with HBRs consistently above unity for most countries. There were relatively more countries with less-than-unity HBRs in the import relationships – Botswana, Mauritius, Mozambique, and Tanzania.

The impact of the SADC-TP on trade flows was mixed. While improving significantly in relation to Malawi and South Africa, Zambia's exports to Angola and Botswana increasingly fell below potential during the SADC-TP period compared to the pre-SADC-TP period. Similarly, imports from Mauritius and Mozambique improved from being below potential during the period prior to the protocol to being significantly above potential during the SADC-TP period whereas the converse was true with respect

to Tanzania. For all other countries the differences in bias ratios were not statistically significant.

The trend was largely the same when the HBRs were derived from the models that did not include South Africa although a little more optimistic for some countries (e.g. Angola and Botswana for exports; Swaziland and Tanzania for imports) and less so for others (e.g. Mauritius) (Table 4). There were still improvements in exports to Malawi due to the SADC-TP although it was a lot smaller and less significant.

**Summary and conclusions**

This study used the gravity model and 11 year data on Zambia and 12 major intra-SADC trading partners to estimate the agricultural trade relationships and home bias ratios (HBRs). HBRs from the gravity models indicate the extent to which trade (exports or imports) fell below or above potential due to friction within the trade environment brought about by controls and other non-tariff barriers. As South Africa was by far the largest trading partner, all the analyses were repeated with and without South Africa.

The results indicate that trade flows between Zambia and other SADC member states follows the usual forces suggested by the gravity model. Exports and imports were positively and significantly related to the size and purchasing power of the trading partners, foreign direct investment received by Zambia, and the trading partner's membership to the preferential trade arrangements; and inversely related to the distance between the trading partners. However, the results also showed that Zambia's trade flows were larger with countries that were experiencing political instability or had had war on their soil. The COMESA dummy variable was also negative and significant in the import models.

A Chow test confirmed the existence and significance of a structural change in the trade relationships before and during the SADC-TP. Thus, the home bias ratios were

based on versions of the gravity models that allowed for different intercept and slope coefficients between the two periods. Although a few differences emerged when South Africa was excluded from the analysis, the general results were largely robust to this adjustment.

During the study period (1996-2006), Zambia on average exported below potential to almost all the SADC trading partners while importing above potential from at least four countries. Improvements in export flows between the period prior to the SADC-TP (1996-2000) and the period when the protocol was in force (2001-2006) were observed with respect to DRC, Malawi, Mozambique, Namibia, and South Africa but were significant only for Malawi and South Africa. Export flows to Angola and Botswana worsened between the two periods (significant at 5 percent). On the other hand, import flows improved from most countries but only those from Mauritius and Mozambique did so significantly.

The fact that Zambia had unexploited potential in agricultural exports identifies two possible factors. Either Zambia's agricultural production sector was not able to respond to the export opportunities and/or there existed impediments, policy or otherwise, to frictionless trade. While free trade is argued to be beneficial to the parties involved, this is possible only in an environment of perfect competition. However, although some success was scored through regional integration efforts, many countries still practiced protectionist policies. Furthermore, the success of free trade needs to be supported by responsive infrastructure and institutions in and between the trading partner states.

While variations in factor costs are argued to justify trade, most poor countries in the region have comparative disadvantages in most commodities, which in theory would justify one-way trade. In 2001, the Zambia National Farmers Union estimated the cost of producing one tonne of maize to have been US$142 in Zambia, compared to US$110 and

US$80 in Zimbabwe and South Africa, respectively (ZNFU 2001). The average cost of transporting produce from the farmer to the market was estimated at US$ 15.25/Tonne in Zambia, compared to Zimbabwe's US$ 6.5/tonne and South Africa's US$4/tonne.

In conclusion, the study has uncovered evidence of friction in Zambia's intra-SADC trade flows, which was greatest for exports. While it is important to look to the implementation of the preferential trade agreements as a region, we cannot underplay the need to improve efficiency levels in the production and marketing sectors of most member countries.

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**Table 1. Gravity model parameter estimates for Zambia's intra-SADC agricultural exports and imports, 1996-2006**

| Variable | Variable description | All trading partners | | Excluding RSA | |
|---|---|---|---|---|---|
| | | Export | Import | Export | Import |
| | | (1) | (2) | (3) | (4) |
| Constant | Intercept | -42.443 ** | -5.390 | -47.766 ** | -13.095 |
| | | (18.095) | (18.372) | (19.756) | (19.580) |
| lgdp | Log of trading partner's GDP (USD) | 0.936 *** | 1.036 *** | 0.908 *** | 0.693 ** |
| | | (0.169) | (0.200) | (0.325) | (0.337) |
| lgdpc | Log of trading partner's per capita GDP (USD) | 1.345 *** | 3.608 *** | 1.252 * | 2.899 *** |
| | | (0.521) | (0.625) | (0.713) | (0.905) |
| lzmgdp | Log of Zambia's GDP (USD) | 0.788 | -0.363 | 1.026 | 0.163 |
| | | (0.678) | (0.704) | (0.779) | (0.802) |
| lzmgdpc | Log of Zambia's per capita GDP (USD) | -0.157 | -0.055 | -0.184 | -0.097 |
| | | (0.182) | (0.275) | (0.184) | (0.260) |
| ldistance | Log of distance to capital of trading partner (km) | -5.715 *** | -9.294 *** | -5.471 *** | -7.718 *** |
| | | (1.202) | (1.167) | (1.928) | (1.721) |
| lfdi | Log of FDI received by trading partner (USD) | 0.072 | 0.008 | 0.035 | 0.029 |
| | | (0.174) | (0.262) | (0.170) | (0.282) |
| lzmfdi | Log of Zambia's FDI (USD) | 1.657 *** | 0.925 ** | 1.685 *** | 0.925 ** |
| | | (0.311) | (0.370) | (0.325) | (0.378) |
| political | Political instability dummy | 9.443 *** | 16.163 *** | 9.206 *** | 14.923 *** |
| | | (1.677) | (2.227) | (1.946) | (2.208) |
| comesa | COMESA dummy,1=partner is a member | -0.760 | -4.508 *** | -0.659 | -3.632 *** |
| | | (0.802) | (0.825) | (1.055) | (0.981) |
| cbi | CBI dummy, 1=partner is a member | 1.523 | 10.622 *** | 1.466 | 10.117 *** |
| | | (1.158) | (1.153) | (1.178) | (1.176) |
| cma | CMA dummy, 1=partner is a member | 2.356 *** | 6.956 *** | 1.998 | 4.615 ** |
| | | (0.816) | (0.883) | (2.075) | (1.862) |
| agoa | AGOA dummy, 1=partner is a member | 13.257 *** | 18.7 *** | 13.07 *** | 16.874 *** |
| | | (2.335) | (2.855) | (2.984) | (2.724) |
| war | War dummy, 1=partner has had civil war on its soil | -0.461 | 5.194 *** | -0.620 | 3.86 * |
| | | (1.730) | (1.640) | (2.081) | (2.134) |
| Number of observations | | 132 | 132 | 121 | 121 |
| Number of countries | | 12 | 12 | 11 | 11 |
| Goodness of fit Wald Chi-sq | | 17,189 *** | 7,037 *** | 12,919 *** | 5,047 *** |
| R-squared | | 0.581 | 0.690 | 0.548 | 0.666 |
| Idiosyncratic error variance | | 9.988 | 7.400 | 10.870 | 7.889 |

Robust standard errors in parentheses
Level of significance: *=10 percent **=5 percent ***=1 percent

**Table 1. Gravity model parameter estimates for Zambia's intra-SADC trade, allowing for structural change due to SADC-TP, 1996-2006**

| | All trading partners | | Excluding RSA | |
|---|---|---|---|---|
| Variable | Export | Import | Export | Import |
| | (1) | (2) | (3) | (4) |
| constant | -85.816 | -114.758 | -115.237 | -120.622 |
| | (73.742) | (108.969) | (71.028) | (113.973) |
| lgdp | 1.666 *** | 1.339 *** | 2.755 *** | 1.163 *** |
| | (0.476) | (0.245) | (0.740) | (0.439) |
| lgdpc | 1.889 | 4.619 *** | 3.712 | 4.347 *** |
| | (1.367) | (0.810) | (2.720) | (1.444) |
| lzmgdp | 0.754 | 5.043 | 1.524 | 5.265 |
| | (2.196) | (4.406) | (2.315) | (4.803) |
| lzmgdpc | -1.302 | 0.433 | -1.429 | 0.453 |
| | (1.278) | (0.617) | (1.239) | (0.573) |
| lfdi | 0.305 | -0.565 | 0.144 | -0.532 |
| | (0.392) | (0.426) | (0.409) | (0.435) |
| lzmfdi | 2.831 ** | 0.999 | 2.602 | 1.201 |
| | (1.260) | (0.608) | (1.619) | (0.793) |
| ldistance | -8.819 *** | -10.578 *** | -12.526 *** | -10.068 *** |
| | (2.302) | (1.274) | (4.804) | (2.643) |
| political | 13.354 *** | 12.184 *** | 15.797 *** | 11.874 *** |
| | (2.526) | (1.675) | (3.598) | (2.490) |
| comesa | -3.130 *** | -3.538 *** | -5.481 *** | -3.188 *** |
| | (0.936) | (0.614) | (1.594) | (1.066) |
| cbi | 6.271 *** | 8.413 *** | 8.081 *** | 8.105 *** |
| | (1.861) | (1.009) | (1.917) | (1.211) |
| cma | 3.086 | 8.047 *** | 9.135 | 7.085 ** |
| | (2.116) | (0.938) | (6.214) | (3.395) |
| agoa | 29.949 *** | 12.825 *** | 35.868 *** | 12.114 *** |
| | (7.427) | (3.857) | (5.930) | (3.991) |
| war | 0.421 | 9.956 *** | 3.918 | 9.430 *** |
| | (4.559) | (2.594) | (7.374) | (3.650) |
| dsadctp[a] | 72.963 | 160.203 | 90.572 | 152.505 |
| | (78.004) | (106.771) | (83.798) | (108.276) |
| dsadctp x lgdp | -1.041 * | -0.750 * | -2.602 *** | -1.055 *** |
| | (0.561) | (0.384) | (0.719) | (0.330) |
| sadlgdpc | -1.413 | 0.184 | -4.439 | -0.773 |
| | (1.455) | (0.536) | (2.837) | (1.057) |
| sadlgdpc x lzmgdp | -0.743 | -5.805 | -0.746 | -5.175 |
| | (2.583) | (4.803) | (2.915) | (4.987) |
| sadlgdpc x lzmgdpc | 1.313 | 0.465 | 1.252 | 0.252 |
| | (1.255) | (0.435) | (1.247) | (0.409) |

## Table 2 Continued

| | All trading partners | | Excluding RSA | |
|---|---|---|---|---|
| Variable | Export | Import | Export | Import |
| | (1) | (2) | (3) | (4) |
| sadlgdpc x lfdi | -0.523 | 0.258 | -0.358 | 0.253 |
| | (0.495) | (0.563) | (0.472) | (0.547) |
| sadlgdpc x lzmfdi | -1.630 | -1.268 ** | -1.470 | -1.554 ** |
| | (1.219) | (0.579) | (1.624) | (0.721) |
| sadlgdpc x ldistance | 6.496 ** | -0.373 | 12.879 ** | 1.814 |
| | (2.633) | (1.419) | (5.028) | (2.535) |
| sadlgdpc x political | -7.666 ** | 7.834 ** | -12.289 *** | 5.957 |
| | (3.010) | (3.897) | (3.753) | (4.376) |
| sadlgdpc x comesa | 3.373 *** | -3.156 ** | 7.186 *** | -2.008 |
| | (1.203) | (1.402) | (1.806) | (1.558) |
| sadlgdpc x cbi | -7.420 *** | 4.262 *** | -10.056 *** | 3.738 ** |
| | (2.231) | (1.540) | (2.109) | (1.669) |
| sadlgdpc x cma | -1.872 | 0.325 | -11.763 * | -2.573 |
| | (2.756) | (1.241) | (6.438) | (2.639) |
| sadlgdpc x agoa | -23.510 *** | 6.597 | -31.614 *** | 5.123 |
| | (7.316) | (4.825) | (5.600) | (5.264) |
| sadlgdpc x war | -3.718 | -3.334 | -9.300 | -4.953 ** |
| | (4.491) | (2.398) | (7.581) | (2.525) |
| Number of observations | 132 | 132 | 121 | 121 |
| Number of countries | 12 | 12 | 11 | 11 |
| R-squared | 0.718 | 0.754 | 0.717 | 0.738 |
| Joint test for structural change[b] | 54.630 *** | $2.7 \times 10^5$ *** | 212.000 *** | 601.140 *** |

Cluster-corrected standard errors in parentheses

Level of significance: *=10 percent **=5 percent ***=1 percent

[a] Dummy variable for structural change due to the SADC-TP, 1=2001 or later

[b] $H_0$: dsadctp and all its interactions equal to zero

**Table 1. Home bias ratios for Zambia's intra-SADC agricultural trade before and during the SADC Trade Protocol, 1996-2006**

| | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|
| | | Mean comparisons[a] | | | | Mean comparisons[a] | | |
| Country | Overall | Before SADC-TP | SADC-TP period | | Overall | Before SADC-TP | SADC-TP period | |
| | (1) | (2) | (3) | | (4) | (5) | (6) | |
| | Mean home bias ratios (potential:actual trade) | | | | | | | |
| Angola | 1.15 | 0.12 | 1.85 | ** | 7.11 | 10.41 | 0.50 | |
| Botswana | 1.60 | 0.18 | 2.79 | ** | 0.59 | 1.04 | 0.22 | |
| DRC | 1.99 | 2.65 | 1.44 | | 8.29 | 8.35 | 8.25 | |
| Malawi | 1.82 | 3.11 | 0.74 | * | 5.25 | 6.72 | 4.03 | |
| Mauritius | 0.82 | 0.62 | 0.91 | | 0.91 | 1.76 | 0.20 | * |
| Mozambique | 2.60 | 5.00 | 0.67 | | 0.64 | 1.18 | 0.18 | * |
| Namibia | 3.36 | 5.99 | 1.17 | | 12.28 | 2.78 | 24.16 | * |
| RSA | 1.81 | 3.18 | 0.66 | * | 1.26 | 1.22 | 1.29 | |
| Swaziland | 2.29 | 0.86 | 3.24 | | 1.08 | 1.42 | 0.80 | |
| Tanzania | 1.96 | 0.71 | 2.99 | | 0.86 | 0.15 | 1.32 | ** |
| Zimbabwe | 1.48 | 1.41 | 1.54 | | 2.02 | 1.08 | 2.80 | |

[a] In our study, the period before the Southern African Development Community Trade Protocol (SADC-TP) was 1996-2000 while the SADC-TP period was 2001-2006

Significance level for unequal variance t tests: *=10 percent, **=5 percent, ***=1 percent

**Table 1. Home bias ratios for Zambia's intra-SADC agricultural trade before and during the SADC Trade Protocol, excluding South Africa, 1996-2006**

| | Exports | | | Imports | | |
|---|---|---|---|---|---|---|
| | | Mean comparisons[a] | | | Mean comparisons[a] | |
| Country | Overall | Before SADC-TP | SADC-TP period | Overall | Before SADC-TP | SADC-TP period |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Mean home bias ratios (potential:actual trade) | | | | | |
| Angola | 0.94 | 0.39 | 1.3 | 5.46 | 8.05 | 0.28 |
| Botswana | 0.98 | 0.32 | 1.52 ** | 0.6 | 1.14 | 0.15 |
| DRC | 1.82 | 2.52 | 1.23 | 9.33 | 7.85 | 10.8 |
| Malawi | 1.58 | 2.26 | 1.02 | 4.05 | 6.92 | 1.19 |
| Mauritius | 2.04 | 0.18 | 2.97 | 1.07 | 1.76 | 0.49 * |
| Mozambique | 1.17 | 1.63 | 0.8 | 0.68 | 1.18 | 0.26 * |
| Namibia | 3.55 | 6.46 | 1.12 * | 8.2 | 3.15 | 16.63 |
| Swaziland | 1.79 | 2.48 | 1.32 | 0.89 | 1.51 | 0.38 |
| Tanzania | 1.5 | 1.46 | 1.54 | 0.51 | 0.16 | 0.74 ** |
| Zimbabwe | 1.24 | 1.31 | 1.18 | 1.57 | 1.06 | 1.99 |

[a] In our study, the period before the Southern African Development Community Trade Protocol (SADC-TP) was 1996-2000 while the SADC-TP period was 2001-2006

Significance level for unequal variance t tests: *=10 percent, **=5 percent, ***=1 percent