International Journal of Economics and Business Administration
Volume XI, Issue 4, 2023

pp. 24-44

Tax and International Trade in the SADC Region: A Panel Gravity Model Approach

Submitted 11/10/23, 1st revision 19/10/23, 2nd revision 21/11/23, accepted 30/11/23

Joalane Rosina Tota[1], Denis Nfor Yuni[2]

Abstract:

Purpose: *The study intends to investigate the effect of taxation on bilateral trade in the Southern African Development Community region. It is motivated by the on-going reviews of tax rates in the frame of the SADC regional integration.*
Design/Approach/Methodology: *This paper further employs the Poisson pseudo maximum likelihood with high dimensional fixed effects (PPMLHDFE) to ascertain the objective, which caters for multilateral resistance and ensures the accuracy and validity of the results for a time spanning from 2012 to 2018.*
Findings: *The results show that during the period of the analysis, import tax for exporting countries significantly increases bilateral trade, while export tax for exporting countries increases bilateral trade, and significantly reduces bilateral trade for importing countries in the region. International trade tax for exporting countries significantly reduces bilateral trade.*
Practical Implications: *Authorities should formulate a more effective and rational approach to taxation, such as increasing their tax net and downward revision tax rates for struggling companies, so that taxes do not become a hindrance, but rather, a pivotal determinant of trade, growth, and development in the region.*
Originality/Value: *This paper is unique because it is the first to examine and understand the impact of taxation (import tax, export tax and international trade tax) on bilateral trade in the SADC region, employing the standard Poisson Pseudo Maximum Likelihood gravity model approach, which accommodates heteroskedasticity and zero trade flows.*

Keywords: *Bilateral trade, export tax, gravity model, import tax, international trade tax, SADC.*

JEL Code: *F1.*

Paper type: *Research article.*

[1]*Ms., National University of Lesotho, makamoras187@gmail.com;*
[2]*Dr., National University of Lesotho.*

1. Introduction

Global and domestic international trade prevail because of variations in the availability of resources and the existence of the comparative advantage principle. Given the growing level of innovation, technology, and globalization, international trade has become a prominent facilitator of economic growth (Sohail *et al.*, 2021). In a fast-changing world, international trade ties between states are imminent and essential (Durguti and Malaj, 2022).

International trade is rich in history and it is accompanied by greater benefits to trading economies as it is associated with a greater share of world production of goods and services, a boom in economic activity, a boost in the level of savings and foreign direct investment, enhancing economic growth as well as the development of nations. It also helps countries accomplish substantial developmental goals, such as poverty reduction, curbing high unemployment rates, food security, fair and equitable inclusive policies, health, and environmental sustainability (Sohail *et al.*, 2021).

Furthermore, trade benefits are bound to vary from nation to nation based on their economic, political, regional, and strategic situation (Durguti and Malaj, 2022). Recently, many countries have enacted and negotiated trade initiatives towards commercial integration for their economic performance and national well-being. SADC (2020) further purports that countries that develop trade with others through liberalization trade policies boost economic growth while elevating their people's quality of life.

Based on this, the analysis of this study is based on the Southern African Development Community (SADC) Free Trade Area member states, where member states consent to eliminating barriers against one another but are free to impose their non-member states external tariffs, to foster economic cooperation among member countries.

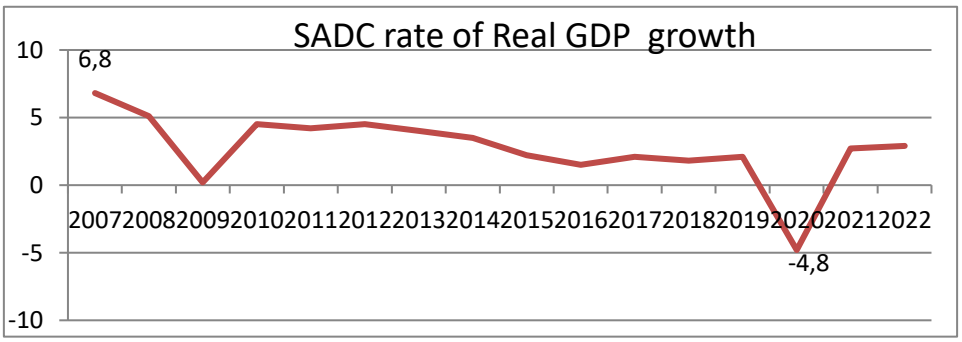
In similar light, several countries tried to develop new types of trade agreements with the assistance of international organizations such as the WTO, the IMF, and the World Bank. These new trade agreements aimed to create new business opportunities for emerging economies after a significant reduction in their trade restriction levels (Durguti and Malaj, 2022).

However, developing and least-developed nations continue to face significant tariff and non-tariff restrictions on trade, despite the growth of trade and interference of these international organizations, giving rise to governments resorting to tax policies to shield their domestic products, enhance competitiveness and trade openness (Longoni *et al.*, 2009). Taxation's impact on international trade has been uncertain. CIT, as Holzner (2021) discovered, diminish exports and imports.

As evidenced by SADC indicators in Figure 1, SADC regions' average real GDP growth rate has been declining dramatically since 2007 from 6.8 percent to 2.1 percent in 2019, contracting to a further 4.8 percent in 2020. In 2009, the region's average growth was 0.2 percent due to the global financial crisis which put a strain on global fiscal activities in many economies globally, reducing household incomes, wealth, and consumption, hence economic growth.

A contraction of 4.8 percent in the region, in 2020 was likely due to the COVID-19 protective alleviation measures such as the global restrictions which disrupted and held back economic activity, weakening prospects in the country's main trading partners, as well as low external demand which badly impacted the mining and manufacturing industries (UNESCO, 2021).

Figure 1. *Annual average real GDP growth rate, SADC region*



Source: *SADC selected indicators.*

To proceed, markets are competitive and their prices are unstable, responding to variations and fluctuations in demand and supply. Hence, the need to improve performance in bilateral trade has informed the redesign of the recent trade policy.

However, there exists no empirical study showing the extent to which the last tax reform was effective. It is on this premise that this research contributes to the existing stock of literature in 2 ways; first, the study investigates the effect of different taxes on bilateral trade in the SADC region. The different taxes stem from different policy interests and vary with countries.

For its analysis empirically, the study investigates the effects of these taxes on bilateral trade with the aid of a gravity model which gives us more inside into the intra-trade system in SADC. Lastly, the study employs a relatively recent model – the gravity model using the Poisson Pseudo Maximum Likelihood approach that caters for heterogeneity and zero trade values which have been the major limitation of this model in the past.

According to the researcher's knowledge, the research analysis on the impact of taxation on bilateral trade in the SADC region is deficient in the literature as most studies are focused on trade policies and international trade in individual countries, while a few are focused on developed economies.

This study, therefore, adds to the little research on underdeveloped countries by looking at the Southern African Development Community (SADC) region. SADC member countries possess a substantial potential for economic growth and development, so, understanding taxation, as well as its impact on bilateral trade, in general, will help policymakers to implement robust policies that will help in achieving ambient objectives to fight high poverty in the region, to guarantee peace, stability, and sustainability.

The paper is structured logically, starting with the introduction, followed by a literature review, then methodology, and a discussion of the results, completed with the conclusions and implications for policymaking.

2. Literature Review

There are numerous arguments from previous literature that a greater tax burden weakens productivity in the economy and trade performance, resulting in a decline in exports in the longer term. Beck and Chaves (2013) examined the different macroeconomic impacts of various taxes on trade competitiveness in OECD countries by employing a gravity model using panel data from 25 OECD countries. He further examined the influence of average effective rates of taxation on expenditure, earnings from labour, and investment earnings on trade openness. Beck and Chaves's (2013) findings conceded previous debates that indeed; high tax burdens negatively impact exports.

Moreover, Khair-Uz-Zaman *et al.* (2011) explored the potential of bilateral trade between Pakistan and Turkey, employing a gravity model technique derived from Newton's Law of Gravitation. Both regression and correlation analyses were performed on secondary time series data from 1998 to 2008. Correlation analysis evidenced that trade between the two countries correlates strongly to GDP and income per capita, albeit uncorrelated to distance. Both of their methods promoted the concept of trade between Pakistan and Turkey, which can provide economic success to both countries.

Agbeyegbe *et al.* (2006) examined the linkage between free trade facilitation and income from taxation, as well as the interaction between fluctuations in exchange rates, the rate of inflation, and earnings from taxes, using a panel of 22 Sub-Saharan African nations, from 1980 to 1996. Trade liberalization has been proxied using two different indicators, international trade as a percentage of GDP and the ratio of import tariffs to imports value. The authors performed a Generalized Method of Moment regression. Evidence proved that the relation between trade opening and tax

revenue is susceptible to the approach used to approximate trade liberalization, but that in general, trade liberalization is not closely interrelated with aggregate tax revenue, and however, it corresponds to higher income tax revenue by one measure.

Alinaghi and Reed, (2021), Khumbuzile and Khobai, (2018) and Macek, (2014) similarly studied the impact of individual types of levies on GDP growth. Alinaghi and Reed (2021) conducted a systematic review of the effect of taxes on economic development in OECD nations.

Macek (2015) assessed the influence of specific forms of taxes on economic development using a model-based approach on OECD nations from 2000 to 2011, while Khumbuzile and Khobai (2018) for the time frame spanning 1981 to 2016, used the ARDL technique to evaluate the influence of revenue taxation on GDP growth in South Africa. The empirical results revealed that the vast majority of tax systems were extremely important and related to a country's economic growth.

In a 2013 study, Solleder determined the trade-related consequences of taxes on exports relying on the estimation of a log-linearized traditional gravity approach, employing a Panel Export Taxes (PET) dataset encompassing 20 exporting nations and 169 importing counterpart nations from 2000 to 2011. Solleder (2013)'s findings on the other hand suggested that the financial strain of export taxes is borne by both exporters and importers and that export taxes contribute to an increase in global prices.

The contribution made by this research will be to broaden the deficient empirical literature between taxation and bilateral trade using the most recent data available for the SADC nations included in the analysis, by employing another version of the gravity model - the standard Poisson Pseudo Maximum Likelihood gravity model approach, which accommodates heteroskedasticity and zero trade flows.

This information may not be gotten from a time series or traditional panel studies but is essential in informing countries on the effect of their tax policies on international trade within SADC.

3. Data and Methodology

3.1 Data Description

The study uses a stacked time series with a balanced panel of 13 SADC countries, and employs a gravity model of international trade, with a quantitative approach method relying on secondary data for the time frame spanning from 2012 to 2018. These countries are Angola, Botswana, Kingdom of Lesotho, Republic of Madagascar, Malawi, Mauritius, Republic of Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia, and Zimbabwe.

The dependent variables together with the independent variables included in the study are bilateral trade (dependent variable), import tax, export tax, international trade tax, GDP per capita, lending rates, investment, inflation, corruption control, political instability and voice and accountability.

Table 1 summarizes the statistics for all of the variables used in this investigation. The mean score for net exports for the SADC region is 121.26 million dollars.

Table 1. *Summary statistics of variables in the analysis or research study*

Variable	N	Mean	Std. D.	Min	Max
Bilateral Trade (Net exports)	546	121.26	515.78	0.00	4677.58
Import tax for exporting countries	546	11.512	9.748	1.388	47.718
Import tax for importing countries	546	19.844	86.604	1.388	2015
Export tax for exporting countries	546	0.085	0.229	0.00	1.123
Export tax for importing countries	546	0.031	0.125	0.00	1.123
International trade tax for exporting countries	546	9.963	8.852	1.10	36.311
International trade tax for importing countries	546	11.714	10.2	1.10	36.311
Log of GDP per capita for exporting countries	546	3.355	0.495	2.499	4.228
Log of GDP per capita for importing countries	546	3.344	0.534	2.499	4.228
Log of distance	546	3.286	0.244	2.599	3.701
Log of investment for exporting countries	546	9.146	2.032	2.653	10.892
Log of investment for importing countries	546	8.349	2.668	2.653	10.892
Lending rates for exporting countries	546	15.053	11.368	6.50	60
Lending rates for importing countries	546	20.409	16.608	6.50	60
Inflation for exporting countries	546	6.101	5.245	-2.41	28.28
Inflation for importing countries	546	8.448	7.395	-1.02	30.69
Corruption control for exporters	546	-0.339	0.66	-1.42	1.182
Corruption control for importers	546	-0.254	0.756	-1.468	1.182
Political stability for exporting countries	546	0.008	0.584	-1.094	1.104
Political stability for importing countries	546	0.123	0.622	-1.094	1.104
Voice and accountability for exporting countries	546	-0.114	0.624	-1.47	0.94
Voice and accountability for importing countries	546	-0.06	0.597	-1.177	0.94

Source: *Authors' calculations using WGI, WDI, DOTS, and CEPII data*.

Table 1, column 1 contains the names of the variables used in the empirical analysis. The mean value of the variables represents the central tendency. When the mean value is high, it shows that there is more power in central tendency (McHugh and Hudson-Barr, 2003; Sohail *et al.*, 2021).

The standard deviation, or SD, for each of the variables, indicates how far the estimates deviate from the average value of the variable. It is significant and reliable statistical data (Sohail *et al.*, 2021). When the standard deviation value is smaller, it shows that the estimates are closer to their mean values and less volatile, while a

large value of the standard deviation shows that the estimates are far from their mean values and more volatile.

From the results, we see that investment spending averaged only 9 percent for exporting countries while it averaged 8 percent for importing countries in a year throughout the research period in the area. The minimum spending on investment is about 2.7 percent in Seychelles and the highest spending on investment of about 10.9 percent in South Africa.

The inflation rate averaged approximately 6.1 percent for exporting countries and 8.4 percent for importing countries. Zimbabwe had a negative and the smallest inflation rate of -2.41 percent in 2015 while Angola had the highest inflation of almost 30.7 percent in 2016.

GDP per capita averaged 3.35% for exporting countries and 3.34% for importing countries with a minimum of 2.5% from Malawi and a maximum of 4.23% from Seychelles. Lending rates averaged approximately 15.1 percent and 20 percent for exporting and importing countries respectively, with a minimum rate of 6.5 percent charged in Botswana and a maximum rate of 60 percent charged in Madagascar.

There is a lack of control over corruption with a mean of -0.339 for exporting countries and -0.254 for importing countries on average. Zimbabwe has the lowest index of -1.42, while Seychelles has a maximum index value of 1.182. In the SADC region, Seychelles relative to the rest of the member nations over the research period performed far better concerning reducing corruption.

On average, there is a lack of political stability, with a mean of 0.008 for exporting countries, and a mean of 0.123 for importing countries. Mozambique had the lowest index of -1.094, while Botswana had a maximum index of 1.104.

Botswana's economy is more stable politically, than other countries in the SADC region. Voice and accountability has a mean of -0.114 for exporting countries, and a mean of -0.06 for importing countries, with a minimum index of -1.47 from Zimbabwe, and a maximum index of 0.94 from Mauritius.

On average, import taxes are quite higher than international trade taxes and export taxes for sample countries in the region, with 16.9 percent in 2012. GDP per capita is below average while lending rates are much higher on average, showing 18.6 percent in 2016. Investment is lower in the region, showing that high lending rates impede borrowers from accessing funds from their banks to engage in trade. From Table 2 there is no multicollinearity in the variables used for the empirical analysis. There exists a negative correlation between inflation and GDP per capita. Distance and bilateral trade show a negative relationship as expected from the literature.

Table 2. *Correlation matrix*

	BT (NE)	IT1	IT2	ET1	ET2	ITT1	ITT2	L-GDP1	L-GDP2	L-DIST	L-INV1	L-INV2	LR1	LR2	INF1	INF2	CORR1	CORR2	POL-STAB1	POL-STAB2	VA1	VA2
BT (NE)	1.00																					
IT1	0.03	1.00																				
IT2	0.04	-0.01	1.00																			
ET1	0.01	-0.12	-0.02	1.00																		
ET2	-0.04	-0.02	-0.03	-0.02	1.00																	
ITT1	0.05	0.97	-0.01	-0.12	-0.03	1.00																
ITT2	-0.07	-0.05	0.13	-0.01	-0.11	-0.06	1.00															
LGDP1	-0.02	0.05	-0.02	-0.26	-0.06	0.07	-0.00	1.00														
LGDP2	0.1	-0.00	-0.01	0.06	-0.1	-0.01	0.22	-0.08	1.00													
LDIST	-0.03	-0.09	-0.1	0.09	-0.04	-0.1	-0.23	0.30	0.26	1.00												
LINV1	0.07	-0.07	-0.01	0.2	0.03	-0.02	-0.07	0.11	-0.00	0.01	1.00											
LINV2	0.15	0.04	0.03	0.01	0.15	0.03	0.06	-0.04	0.38	0.15	-0.06	1.00										
LR1	-0.1	-0.04	-0.00	0.05	-0.03	-0.09	0.08	-0.55	0.03	0.08	-0.32	-0.01	1.00									
LR2	-0.10	-0.02	-0.05	-0.03	-0.06	-0.01	-0.2	0.07	-0.72	-0.09	-0.01	-0.15	-0.05	1.00								
INF1	-0.10	-0.05	-0.06	0.03	-0.02	-0.11	0.03	-0.42	0.01	-0.04	-0.34	0.00	0.48	0.01	1.00							
INF2	-0.06	0.05	-0.07	-0.04	0.03	0.03	-0.28	0.04	-0.41	-0.02	-0.01	-0.21	-0.00	0.32	-0.02	1.00						
CORR1	-0.15	0.14	-0.04	-0.13	-0.10	0.09	0.02	0.79	-0.07	0.34	-0.12	-0.02	-0.23	0.07	-0.10	0.07	1.00					
CORR2	0.03	-0.08	0.07	0.05	-0.11	-0.07	0.59	-0.05	-0.58	-0.09	0.03	-0.13	0.02	-0.52	0.01	-0.58	-0.08	1.00				
POLSTAB1	-0.15	0.24	-0.04	-0.25	-0.07	0.20	0.01	0.69	-0.09	0.25	-0.14	-0.04	-0.26	0.08	-0.04	0.07	0.83	-0.08	1.00			
POLSTAB2	-0.07	-0.01	0.04	0.02	-0.17	-0.02	0.54	-0.02	0.72	-0.02	0.01	0.04	0.01	-0.54	0.01	-0.39	-0.03	0.83	-0.04	1.00		
VA1	-0.15	-0.00	-0.06	-0.08	-0.12	-0.05	0.03	0.60	-0.07	0.29	0.03	-0.07	-0.13	0.09	0.09	0.07	0.79	-0.06	0.7	-0.03	1.00	
VA2	0.15	-0.09	0.04	0.07	-0.12	-0.06	0.4	-0.02	0.44	-0.07	0.1	-0.13	-0.06	-0.41	-0.04	-0.51	-0.08	0.84	-0.09	0.75	-0.08	1.00

Source: *Author's calculations using WGI, WDI, DOTS, and CEPII data*.

3.2 Estimation Strategy/Technique

The empirical technique is centred on the estimate of the PPML estimation approach in the log-linearized form of the control variables. The net exports enter the model in their level form, as portrayed by equation 4.

The data has a panel structure, and the convention that is consistent with the theory of estimation of this dataset requires control of fixed effects by country pair and fixed effects by country time for both importer and exporter countries. The dissimilarity between country pairs has been adjusted for by taking into account country-pair fixed effects, to mitigate bias generated by heterogeneity across countries and control for endogeneity issues which may be caused by omitted variable bias and reverse causality (Correia *et al.*, 2020). Also, standard errors should be grouped at the country-pair level to allow for endogeneity in policy variables.

Further, country-time fixed effects will be incorporated in the regression to account for worldwide economic repercussions that may affect trade, and time-varying

multilateral resistance, that is, the barriers to trade that each country faces with all its trading partners. The PPML estimation method is the only remarkably accurate pseudo maximum likelihood estimator for gravity equations that is ideal for models with high-dimensional fixed effects and under extremely minimal requirements (Santos Silva and Tenreyro, 2022).

The likelihood-based goodness-of-fit measurements are similarly invalid because PPML is a non-linear model, so it is a reasonable theoretical justification for why OLS properties are not a problem with non-linear models (Santos Silva and Tenreyro, 2022).

3.3 Gravity Model

This study's theoretical foundation is centred around Newton's gravity, and the Gravity model technique which is founded on Newton's Law of Gravitation is employed (Anderson, 1979; Bergstrand, 1985; Khair-Uz-Zaman *et al.*, 2011; Tinbergen, 1962). This model estimates adjust for spatial and other observable and unobservable country attributes and allows me to focus on bilateral trade in the SADC region while most studies have focused on international trade in different countries.

The framework assumes that trade between two nations increases in proportion to the sum of their GDPs per capita GDPs (Vavrek, 2018). It also postulates that trade decreases with increasing distance. This is because proximity minimizes transportation as well as information fees (Khair-Uz-Zaman *et al.*, 2011).

The gravity model has its foundation in physics and the Newtonian Law of Gravitational Attraction which asserts that a particle's gravitational pull draws in other particles in space with an attraction that is directly related to the products of their masses and inversely related to the square of the distance between their centres (Vavrek, 2018).

Newton proposed that the attraction force between the two elements is given by:

$$\mathbf{F_{ij}} = \left(\frac{GM_iM_j}{D_{ij}^2}\right) \quad (1)$$

Where: $\mathbf{F_{ij}}$ is the force of attraction;
G is the gravitational constant;
M M is the product of the country's masses;
D is the squared distance between the two countries;
i and j are trading countries.

This force of attraction (1) is used by economists to provide an overview of trade between two countries. They hypothesized trade in goods is identical in its attracting power between two big economies, that is, their GDP is non-zero.

Trade between two countries i and j is expressed as:

$$\mathbf{T_{ij}} = \left(\frac{\propto Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}}\right) \quad (2)$$

Where: $\mathbf{T_{ij}}$ is trading between exporting and importing countries, i and j;
α is a constant;
Y is GDP;
D is the distance between countries i and j;
β's are parameters.

Equation 2 assumes that the larger the size of the economies, the more they are obligated to trade with one another. On the contrary, if the distance between the countries is short, those countries may engage in trade more easily with one another.

The gravity model of trade is multiplicative, so from equation 2, it means trade is equal to the products of other variables. It can be estimated by applying the natural logarithmic operators of the multiplicative form across both sides, by breaking the products into sums.

Equation 2 then becomes:

$$\ln T_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j - \beta_3 \ln D_{ij} + \varepsilon_{ij} \quad (3)$$

Despite the gravity model's empirical success in accurately predicting trade flows, the ways considered to deal with heteroscedasticity issues and the existence of a large number of zeros trade observations represent one of the issues surrounding the accuracy of trade data (Solleder, 2013), and some estimation practices have been an area under discussion to criticism.

This paper further adopts the Poisson Pseudo Maximum Likelihood approach instigated by Gourieroux *et al.* (1984). The PPML has been suggested by Silva and Tenreyro (2006) and Yotov *et al.* (2016), who presented an easy panacea to this issue of concern after criticizing the procedures of the log-linearized gravity trade models.

They argued that the equation for gravity in its additive structure can potentially be calculated by employing a Poisson Pseudo Maximum Likelihood (PPML) estimation technique, which naturally includes zero observations. The PPML structure is an improved version of the Generalized Nonlinear Linear Model (GNLM) structure that

is resilient to multiple types of heteroscedasticity and surpasses the inefficiency problem, providing consistent estimates of the original nonlinear model (Mnasri and Nechi, 2019).

The estimation performed using PPML employs the command syntax invented by Correia *et al.* (2020) the statistical package, STATA (PPMLHDFE), which is more effective in the existence of sizable fixed effects because it allows one to incorporate as many countries as possible to encompass all multilateral resistance.

The developments that the PPML approach has contributed to the estimation of gravity models have made it good and popular in the international trade literature, as it has become frequently utilized to estimate gravity equations (Durguti and Malaj, 2022; Levin *et al.*, 2002; Martin and Pham, 2020; Yotov, 2012) among others. See Appendices 1-4 for variable description.

Model specifications:

To ascertain the papers' objectives, the model to be utilized to examine the implications of an import tax, export tax, and international trade tax on bilateral trade in the region is:

$$BT_{ijt} = \beta_0 + \beta_1 IT_{ijt} + \beta_2 ET_{ijt} + \beta_3 ITT_{ijt} + \beta_4 \ln GDPcapita_{ijt} + \beta_5 \ln Dist_{ijt} + \beta_6 LR_{ijt} + \beta_7 \ln INV_{ijt} + \beta_8 INF_{ijt} + \beta_9 CORR_{ijt} + \beta_{10} POLSTAB_{ijt} + \beta_{11} VA_{ijt} + \propto_{it} + \delta_{jt} + \gamma_{ijt} + \varepsilon_{ijt} \quad (4)$$

With: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_6, \beta_7, \beta_8, \beta_9$, *and* β_{10} *are all > 0*

$\beta_5 < 0$

Where: BT_{ijt} is bilateral trade between countries i and j at time t;

α_{it} is exporter time fixed effects;

δ_{jt} is importer time fixed effects;

γ_{ijt} is country pair fixed effects;

ε_{ijt} is an error term, covering the leftover effects. It is assumed as distributed independently and normally with zero (0) mean and constant variance.

Regression and correlation analyses are employed for the evaluation of data.

3.4 Robustness Tests/Checks

Two key criticisms in gravity model analysis have always been the inability to take care of zero trade values and the problem of heteroscedasticity. To address the issues of zero trade values, this study employed an inverse hyperbolic sine transformation to transform the negative values and zero trade values of the net exports, since in PPML, the dependent variable cannot be negative. To transform the negative values, the paper employed the formula below:

$$Y = ln(X + \sqrt{X^2 + 1})$$

And for heteroscedasticity, the *ppmlhdfe* command used in the paper provides output with robust standard errors, which ensures that the standard errors of the regression output are valid. Also, the PPML caters for heteroskedasticity automatically (Correia *et al.*, 2020).

4. Research Results and Discussion

In this section, the paper demonstrates the results of the PPMLHDFE regression analysis and their discussions and interpretations, and further discusses the techniques for absorbing zero trade flows.

Table 3. *PPML estimates*

Dependent variable: Net exports	**PPML 1**	**PPML 2**	**PPML 3**
Import tax for exporting countries	0.1567*** (0.000)	0.1206* (0.054)	0.0872** (0.029)
Import tax for importing countries	0.0004 (0.146)	0.0004* (0.088)	0.0004 (0.129)
Export tax for exporting countries	2.2245*** (0.000)	1.4451*** (0.005)	0.5363 (0.265)
Export tax for importing countries	-4.8321** (0.015)	-5.6669*** (0.000)	-4.4489** (0.013)
International trade tax for exporting countries	-0.0749* (0.052)	-0.0506 (0.399)	-0.0043 (0.905)
International trade tax for importing countries	0.0101 (0.564)	-0.0040 (0.770)	0.0193 (0.163)
Log of GDP per capita for exporting countries	4.9730*** (0.000)	4.0512*** (0.000)	2.4110*** (0.000)
Log of GDP per capita for importing countries	1.9076*** (0.003)	-1.2197* (0.090)	1.9592*** (0.002)
Log of distance	-3.9622*** (0.000)	-0.9470 (0.160)	-3.847*** (0.000)
Log of investment for exporting countries	-0.1313 (0.389)	-0.0348 (0.833)	0.1452 (0.433)
Log of investment for importing countries	0.5278*** (0.000)	1.3622*** (0.005)	0.4886*** (0.000)
Lending rates for exporting countries	0.0216 (0.477)	0.0017 (0.977)	-0.0208 (0.619)
Lending rates for importing countries	-0.0154 (0.255)	-0.0209* (0.093)	-0.0123 (0.386)
Inflation rates for exporting countries	0.0226 (0.321)	0.0054 (0.856)	-0.0142 (0.639)
Inflation rates for importing countries	0.0031 (0.929)	0.0524 (0.150)	-0.0087 (0.809)
Corruption control for exporting countries	-4.3917***	-4.5161***	

	(0.000)	(0.000)	
Corruption control for importing countries	0.7187 (0.136)	-0.4883 (0.453)	
Political stability and absence of violence/ terrorism for exporting countries	-0.8116 (0.101)		-2.381*** (0.000)
Political stability and absence of violence/ terrorism for importing countries	-4.0289*** (0.000)		-3.7003*** (0.000)
Voice and accountability for exporting countries	2.4255*** (0.000)	1.6845*** (0.003)	1.1708*** (0.008)
Voice and accountability for importing countries	2.2483*** (0.000)	2.1552*** (0.000)	2.5468*** (0.000)
exp_time	YES	YES	YES
imp_time	YES	YES	YES
pairid	YES	YES	YES
Constant	-14.0913*** (0.001)	-23.1514*** (0.005)	-5.8126* (0.052)
Pseudo R2	0.7265	0.5885	0.7024
Observations	546	546	546

Note: *Probability values in parentheses *** p<0.01, ** p<0.05, * p<0.1*
Source: *Author's calculations using WGI, WDI, DOTS, and CEPII data*.

The overall objective of the paper is to examine the effect of import taxes, export taxes, and international trade taxes on bilateral trade in the SADC region. The results have an R squared of 0.7265 implying that 72.65 percent of the variation in bilateral trade is explained by the independent variables incorporated in the analysis.
The fitted model is as follows:

$$\begin{aligned} \boldsymbol{BT} = {} & -14.0913 + 0.1567\boldsymbol{IT_X} + 2.2245\boldsymbol{ET_X} - 4.8321\boldsymbol{ET_M} - 0.0749\boldsymbol{ITT_X} \\ & + 4.9730 \ln \boldsymbol{GDPcapita_X} + 1.9076 \ln \boldsymbol{GDPcapita_M} \\ & - 3.9622 \ln \boldsymbol{Dist} + 0.5278 \ln \boldsymbol{INV_M} - 4.3917\boldsymbol{CORR_X} \\ & - 4.0289\boldsymbol{POLSTAB_M} + 2.4255\boldsymbol{VA_X} + 2.2483\boldsymbol{VA_M} \end{aligned}$$

On average, all other factors held constant, a unit increase in the share of import taxable earnings as a percentage of total tax revenue for exporting countries, increases bilateral trade by 0.1567. For exporting countries to stimulate growth, they tend to export more to importing counterparts because the burden of import taxes is borne by importers only, as a result, a share of import tax revenue to total tax revenue positively influences bilateral trade.

As the share of import tax revenue to total tax revenue increases, it means the cost of importing is increasing and so reduces imports for the exporting countries and therefore increases net exports for the exporting countries. These results are surprisingly conflicting with the results by Suravonic (2010), who rather found a negative influence on trade, and argued that a rise in taxes on imports as a share of

total tax revenue alters trade as exporting countries do not have a monopsony power in trade. Meanwhile, import tax shows a positive relationship with bilateral trade for importing countries but this association is not significant at a level of significance equivalent to 5% for all 3 models.

Further, a unit increment in the proportion of revenue from export taxes to revenue from the total tax for all the 3 models is significant and expectedly reduces bilateral trade for importing countries by 4.8321, and significantly increases bilateral trade for exporting countries by 2.2245 on average and ceteris paribus. When export taxes increase, it becomes expensive for importers to purchase from foreign markets because taxes imply an additional cost to the initial price.

Imports will then reduce for exporting countries, as a result, increase net exports for exporting countries. Giordani *et al.* (2012) found that a price increase drives governments to enforce export barriers, resulting in a reduction in global supply and a subsequent rise in prices, advocating additional restrictions on exports.

On average, a unit rise in the ratio of international trade tax revenue to total tax revenue reduces bilateral trade for exporting countries, for both model 1, 2, and 3. When a share of revenue from international trade taxes as a percentage of overall tax revenue increases, it implies a boost in international trade tax.

Earnings from investments abroad will reduce from high international trade tax charges, reducing investment for exporting countries as a larger share of profits from an international investment will go back to their foreign economy, leaving only a small portion of the return on investments, reducing exports for exporting countries, hence, a reduction in net exports for exporting countries.

Keen and Syed (2006) however emphasized that increases in international trade tax, whether measured by earnings or tax rates are connected with a temporary surge in net exports, a trend linked to drive investments internationally. Though insignificant at 5% for all models, international trade tax increases bilateral trade for importing countries and reduces bilateral trade for importing countries.

A percentage point increase in GDP per capita remarkably and substantially increases bilateral trade for both exporting and importing countries, on average all other factors held constant, by 2.41% and 1.96% consecutively. GDP per capita conveys a country's degree of development, and when it escalates, the standard of living increases, production in exporting countries and supply to importing countries increase, increasing exports and net exports significantly for exporting countries.

Similarly, a spike in the level of development for importing countries implies a reduction in imports due to less dependency on foreign markets, hence an increase in net exports. The results are consistent for all the 3 models. Other research studies found similar conclusions. Schmitt *et al.* (2019) are an ideal example who found an

upward correlation between the two variables, and concluded that nations with higher GDP growth rates are probable to experience higher trade growth rates as a share of output.

During this study, for countries in the SADC region, geographical distance is linked to a significant decrease of 3.85% in their bilateral trade volume on average. The results are consistent with the empirical literature and gravity theory, and they comply with the results of Disdier and Head (2008). Even after controlling for various significant different major variables in samples and techniques, they found a negative and substantial association between distance and trade.

Moreover, a percentage increase in investment for importing countries is significantly and positively associated with a 0.49% increase in bilateral trade on average, all other factors held constant. Investment is pertinent to a country's economic growth and development, so there is a greater circulation of goods and services domestically, reducing imports for importing countries, hence, an increase in net exports.

The findings are the same in magnitude and significance for all the specified models. The results complement the results by Sohail *et al.* (2021). He established a strong and positive causal relationship between investment and trade. Investment in exporting countries reduces bilateral trade and is insignificant at 10%.

A unit increase in the lack of corruption control index for exporting countries reduces bilateral trade by 4.3917. The results are consistent for model 1 and model 2. When exporting countries suffer from a severe degree of corruption, it means there is mismanagement of resources and there is unequal fairness in the economy.

Also, the exploitation of public office for private gain makes citizens lack trust in their government, threatening market reliability. This imperils economic development, increasing imports, hence reducing the net exports.

On average, a unit rise in the political instability index reduces the volume of bilateral trade by 4.0289. The results corroborate the outcomes by Qadri *et al.* (2020) who found that political instability badly weighs down trade in the long run. When there is high instability and terrorism in the economy, there is no harmony, and the country’s resources are mismanaged, chasing away investors and a climate for business and reducing exports.

The coefficient on perspectives of a country's residents' ability to participate in the selection of its government, as well as the freedom to express themselves, is positive and significant in the region for both exporting and importing countries. When citizens can voice out their expressions, there is a sense of belonging and prosperity, enhancing economic activity, thus an improvement in bilateral trade rising from a rise in exports and a drop in imports.

5. Conclusion and Recommendations

The study examined the effects of import tax, export tax, and international trade tax on bilateral trade in the SADC region. The relationship between taxation and international trade acquired attention from researchers and policymakers that have led to a plethora of literature on this relationship. This paper is unique because it is the first of its kind to examine the effects of import tax, export tax, and bilateral trade in the context of the SADC region. For its empirical analysis, the study utilized Poisson Pseudo Maximum Likelihood high dimensional fixed effects approach to the gravity type trade model, using secondary data for a panel of thirteen SADC member countries from 2012 to 2018.

The analysis of results divulged novel observations. During the period of the study, import tax for exporting countries significantly increases bilateral trade, while export tax for exporting countries increases bilateral trade, and export tax for importing countries significantly reduces bilateral trade in the region. International trade tax for exporting countries significantly reduces bilateral trade despite the inclusion of other control variables. The results on country size and distance corroborate the literature on the gravity model. As a result, the paper views GDP per capita as an essential factor influencing bilateral trade while it views increasing distance between countries involved in trade as a resistant factor for bilateral trade in the region.

Investment in importing countries significantly increases bilateral trade on average. Institutional variables, corruption control and political stability, and absence of violence reduce the volume of bilateral trade, whereas voice and accountability enhance bilateral trade volume in the region. However, the paper found a trivial relationship between inflation, lending rates, and bilateral trade.

Though operating under the free trade zone, the SADC region trade performance has been observed to be slow, and their growth rate has been declining over the years. It is therefore of great importance to learn how taxation affects bilateral trade to provide experts in policymaking come up and implement strategic taxation policy that will attract trade because a better tax regime is known to create a relaxed environment for trade and investment. It has also been observable that geographical distance is a hindrance to bilateral trade in the region.

The findings gave rise to the following recommendations:

- Taxation, though crucial in generating revenue for economies and protecting domestic commodities against foreign competition, negatively impacts bilateral trade in the region. Authorities should formulate a more effective and rational approaches to taxation, that is, increase their tax net and reduce tax rates on struggling companies, so that taxes work well and do not become a hindrance, but rather, a pivotal determinant of trade, growth and development in the region. Countries should lower export tax rates for their

manufacturing enterprises and corporations to boost growth through lower prices. This will increase the level of exports to importing economies. Countries can encourage the import of raw materials and the export of finished goods by establishing price standards for raw material imports, or by lowering import tax rates on raw materials and lowering export tax rates on processed products.

- Further, distance is negatively correlated with bilateral trade. Because of high transportation costs, governments should invest in a more robust transportation infrastructure that links SADC member countries such as through railways and roads to curb high transportation costs and increase proximity and access to foreign markets.

- Indexes for instituions are very low. This implies poor governance performance in the region; there is a high rate of corruption and political instability. To increase intra-region trade, public authorities should, therefore, devise and implement transparent policies that will mitigate high corruption.

References:

Agbeyegbe, T.D., Stotsky, J., WoldeMariam, A. 2006. Trade liberalization, exchange rate changes, and tax revenue in Sub-Saharan Africa. Journal of Asian Economics, 17(2), 261-284. https://doi.org/10.1016/j.asieco.2005.09.003.

Alinaghi, N., Reed, W.R. 2021. Taxes and Economic Growth in OECD Countries: A Meta-analysis. Public Finance Review, 49(1), 3-40. https://doi.org/10.1177/1091142120961775.

Anderson, J.E. 1979. A Theoretical Foundation for the Gravity Equation. American Economic Review, 69(1), 106-116.

Beck, S., Chaves, A. 2013. The Impact of Taxes on Trade Competitiveness. Working Papers 11-09, University of Delaware, Department of Economics.

Bergstrand, J.H. 1985. The Gravity Equation in International Trade : Some Microeconomic Foundations and Empirical Evidence. The Review of Economics and Statistics, 67(3), 474-481.

Correia, S., Guimarães, P., Zylkin, T.Z. 2020. Fast Poisson estimation with high-dimensional fixed effects. Stata Journal, 20(1), 95-115. https://doi.org/10.1177/1536867X20909691.

Durguti, E.A., Malaj, A. 2022. A Dynamic Panel Gravity Model Application on Trade Openness Determinants: Evidence From Southern and Western European Countries. Journal of Global Business and Technology, 18(1), 1-16.

Giordani, P.E., Rocha, N., Ruta, M. 2012. Food Prices and the Multiplier Effect of Export Policy. In: SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2042474.

Gourieroux, C., Monfort, A., Trognon, A. 1984. Pseudo Maximum Likelihood Methods: Theory. Journal of Econometric Society, 52(3), 681-700.

Holzner, M., Jovanovic, B., Vuksic, G. 2021. How do Corporate Taxes affect International Trade ? Working Paper 212. https://EconPapers.repec.org/RePEc:wii:wpaper:212.

Kaufmann, D., Kraay, A., Mastruzzi, M. 2010. The Worldwide Governance Indicators: A

Summary of Methodology, Data and Analytical Issues. In: World Bank Policy Research Working Paper No 5430. https://doi.org/10.1017/S1876404511200046.

Keen, M., Syed, M.H. 2006. Domestic Taxes and International Trade: Some Evidence. IMF Working Papers, 06(47), 1. https://doi.org/10.5089/9781451863079.001.

Khair-Uz-Zaman, Aman, Q., Khan, A., Awan, Z. 2011. Empirical Evidence of Trade Integration between Pakistan and Turkey A Gravity Approach. Journal of Managerial Sciences, IV(2).

Khumbuzile, D., Khobai, H. 2018. The Impact of Taxation on Economic Growth in South Africa. MPRA Paper, 86219.

Levin, A., Lin, C.F., Chu, C.S.J. 2002. Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. Journal of Econometrics, 108(1), 1-24. https://doi.org/10.1016/S0304-4076(01)00098-7.

Longoni, E., April, N., Bicocca, M. 2009. Trade Liberalization and Trade Tax Revenues in African Countries. Working Papers from University of Milano-Bicocca, Department of Economics, Issue 158.

Macek, R. 2015. The Impact of Taxation on Economic Growth: Case study of OECD Countries. Review of Economic Perspectives, 14(4), 309-328. https://doi.org/10.1515/revecp-2015-0002.

Martin, W., Pham, C.S. 2008. Estimating the Gravity Model when Zero Trade Flows are Frequent. Applied Economics, 52(26), 2766-2779. https://doi.org/10.1080/00036846.2019.1687838.

McHugh, M., Hudson-Barr, D. 2003. Descriptive Statistics, Part II: Most Commonly Used Descriptive Statistics. Journal for Specialists in Pediatric Nursing: JSPN, 8(3), 111-116. https://doi.org/10.1111/j.1088-145X.2003.00111.x.

Mnasri, A., Nechi, S. 2019. New Approach to Estimating Gravity Models with Heteroscedasticity and Zero Trade Values. SSRN Electronic Journal, 93426.

Report, A.U. 2021. African Integration Report 2021. https://au.int/endocuments/african-integration-report-2021.

SADC. 2020. Regional Economic Perfomance and the Business Environment in 2020 and Medium-Term Prospects - SADC. Macroeconomic Policies and Convergence, 8(75).

Santos Silva, J.M.C., Tenreyro, S. 2022. The Log of Gravity at 15. Portuguese Economic Journal, 21(3), 423-437. https://doi.org/10.1007/s10258-021-00203-w.

Silva, S.J., Tenreyro, S. 2006. The Log of Gravity. The Review of Economics and Statistics, 88(4), 641-658. https://doi.org/10.1080/00036846.2011.599786.

Sohail, H.M., Zatullah, M., Li, Z. 2021. Effect of Foreign Direct Investment on Bilateral Trade: Experience from Asian Emerging Economies. SAGE Open, 11(4). https://doi.org/10.1177/21582440211054487.

Solleder, O. 2013. Trade Effects of Export Taxes, Graduate Institute of International and Development Studies Working Paper. Graduate Institute of International and Development Studies, Geneva, 08/2013.

Tinbergen, J. 1962. Shaping the World Economy: Suggestions for an International Economic Policy. Twentieth Century Fund, Vol. 76, No. 301, 92-95

UNESCO. 2021. Economic and Social Conditions in Southern Africa for 2020, and Prospects for 2021. In: United Nations Economic and Social Council (Vol. 3).

Vavrek, S. 2018. Estimation Methods of Gravity Models. https://github.com/pachadotdev/gravity/issues/.

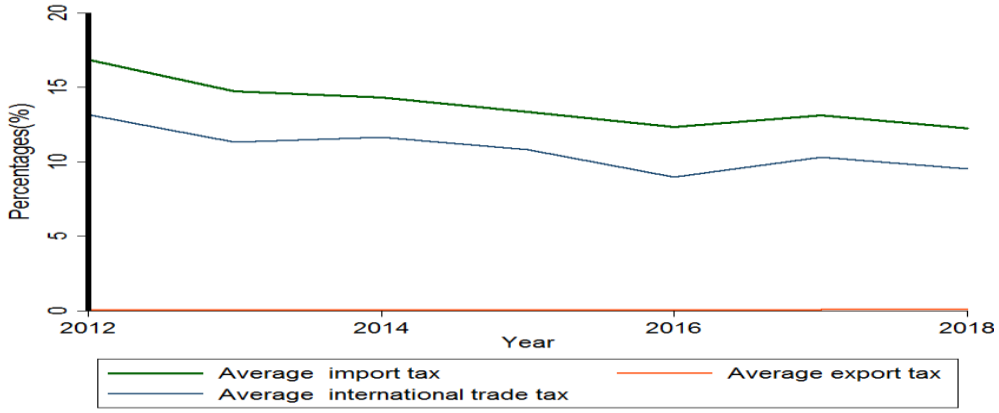
Yotov, Y.V., Piermartini, R., Monteiro, J.A., Larch, M. 2016. An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model. WTO Publications. https://doi.org/10.30875/abc0167e-en.

Appencices:

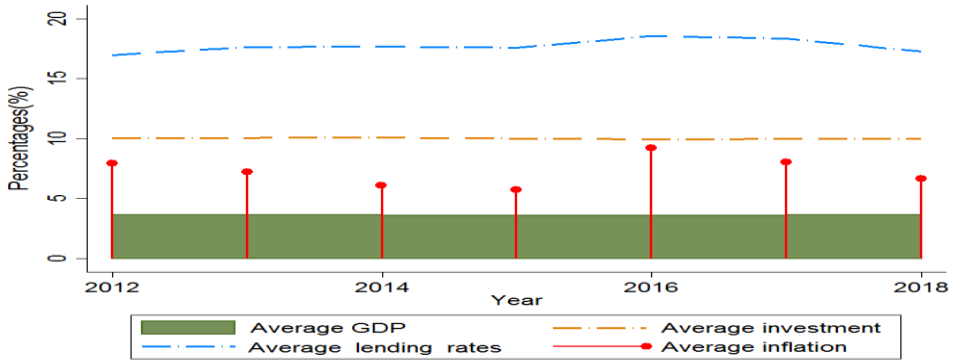
Appendix 1: *List of SADC countries included in the analysis*

Angola	Mauritius	United Republic of Tanzania
Botswana	Republic of Mozambique	Zambia
Kingdom of Lesotho	Namibia	Zimbabwe
Republic of Madagascar	Seychelles	
Malawi	South Africa	

Appendix 2: *Yearly trends in mean import tax rates, mean export tax rates and mean international trade tax rates for sample countries in the SADC region between 2012 and 2018*



Appendix 3: *Yearly trends in GDP per capita, Investment, Lending rates and Inflation for sample countries in the SADC region between 2012 and 2018*



Appendix 4: *List of variables*

Variable	**Description**	**Proxy used**	**Source**	**Expected sign**
Bilateral trade (BT)	Bilateral trade flows between exporting and importing countries. Exports are goods and services sold abroad and recorded on FOB principle, while imports are products carried into a country for sale and expressed on CIF premise	Net exports Total exports less total imports	IMF	
Import tax (IT)	A payment imposed by a country's customs and border protection authority on goods carried into a country	customs and import duty income as a proportion of total tax revenue for a country	WDI	-
Export tax (ET)	It is a levy on goods that are shipping out of the nation's borders to foreigners.	revenue from export taxes as a share of a country's total tax revenue	WDI	-
International trade tax (ITT)	It is a levy that includes import and export levies, earnings from export and import monopolies, exchange profits, and exchange taxes.	income from international trade taxes as a portion of a country's overall tax collection	WDI	-
Trade cost (DIST)	Cost of trade between trading countries	Distance	CEPII	-
GDP per capita	Reflects a country's state of development	GDP/Population	WDI	+
Inflation (INF)	An overall increase in the general price level.	CPI	WDI	-
Lending rate (LR)	The bank charge that regularly accommodates the private sector's	Lending rate	WDI	+/-

	short- and medium-term borrowing demands			
Investment (INV)	It is an asset or item acquired to generate income	Gross fixed capital formation	WDI	+
Corruption control (CORR)	It indicates opinions of the extent to which government authority is abused for personal advantage, encompassing both small and large kinds of corruption, as well as control of the state by leaders (Kaufmann et al., 2010).	Corruption control index	WGI	-
Political stability & absence of violence (POLSTAB)	It determines opinions of possibilities of political unrest as well as politically driven violence, including terrorist attacks (Kaufmann et al., 2010)	Political stability index	WGI	-
Voice and accountability (VA)	Indicates opinions of a country's residents' ability to participate in the selection of its government, as well as the freedom to express themselves, and associate (Kaufmann et al., 2010).	Voice and accountability index	WGI	+