

Chawarika, Admire; Madzokere, Faustino; Murimbika, Agrippa

Article

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Corresponding author: Admire Chawarika School of Economics and Management, Lund University, Lund, Sweden
E-mail: admirechawarika@yahoo.com

Reviewing editor:
Evan Lau, Department of Economics, Universiti Malaysia Sarawak, Kuching, MALAYSIA

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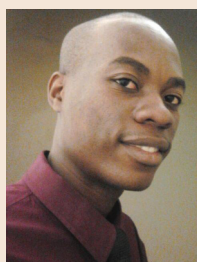
Regional trade agreements and agricultural trade: An analysis of Zimbabwe's agricultural trade flows

Admire Chawarika¹, Faustino Madzokere² and Agrippa Murimbika³

Abstract: The main aim of the study was to assess the impact of Economic Partnership Agreement (EPA) and Southern African Development Community Free Trade Area (SADC-FTA) on Zimbabwe's agricultural trade flows. Results highlight that Zimbabwe's membership in EPA initiated in 2012, enhanced the country's agricultural trade flows by 307.96%. Membership in SADC-FTA initiated in 2008 has enhanced the country's agricultural trade flows by 437.09%. Other independent variables including exchange rates and GDP negatively impacted the country's agricultural trade flows. From the empirical findings, it is critical for the government to conduct impact assessments.

Subjects: Agricultural Economics; Economics and Development; Economics; International Trade (incl. trade agreements & tariffs); Development Economics

Keywords: agricultural trade flows; regional trade agreements; fixed effects; Zimbabwe; EPA



Admire Chawarika

ABOUT THE AUTHOR

Admire Chawarika is a trade policy analyst and agricultural economist. He has experience in research including trade policy analysis, agricultural policy and environmental assessments. Admire Chawarika is currently involved in monitoring and evaluating several trade and agricultural projects. He combines both quantitative and qualitative research to proffer solutions for the transformation of trade policy initiatives. A graduate of Lund University and University of Zimbabwe, Admire Chawarika combines theoretical and practical aspects of research to tackle contemporary issues in international trade and agricultural policy.

PUBLIC INTEREST STATEMENT

Regional trade agreements have been noted to be critical to the overall development and economic growth of developing countries including Zimbabwe. Zimbabwe is part of multiple regional trade agreements which are key to the growth trajectory of several sectors of its economy. This study investigates the impact of two regional trade agreements on Zimbabwe's agricultural trade flows. These two regional trade agreements include Economic Partnership Agreement (EPA) and Southern African Development Community Free Trade Area (SADC-FTA). The study includes 11 countries over the period 2001–2018. The findings of this study show that regional trade agreements of EPA and SADC-FTA have positive impact on Zimbabwe's agricultural trade flows. However, the impact of these regional trade agreements vary according to the terms of the agreement and time of implementation. Thus, Zimbabwe should focus on policy propositions which enhance the positive impact of regional trade agreements on its agricultural trade flows and address challenges thereof.

1. Introduction

The Ministry of Lands and Agriculture (Ministry of Lands, Agriculture and Rural Resettlement, 2018), states that Zimbabwe's agricultural sector contributes about 18.5% to the country's GDP. Furthermore, about 70% of the country's working population is directly dependent on agriculture. The agricultural sector is central and critical to the economy of the country. ZIMSTAT (2017) highlighted that more than 60% of the raw materials used by the industries in Zimbabwe, is directly from the agricultural sector. Therefore, there is a link between the performance of agriculture and industrial production in the country. The country's goals on Agenda 2063 and Sustainable Development Goals (SDG's) are firmly hinged on the agricultural sector. It is critical to note that Agenda 2063 is the framework by African Union to achieve sustainable development across the continent. Hence, Agenda 2063 is a strategic framework set by AU for socio-economic transformation to build an inclusive growth with equity. Therefore, the sector plays a pivotal role in the overall economy of the country. Agricultural production in Zimbabwe is mainly carried out by large-scale commercial farmers and small-scale farmers with the latter being about 80% of the total farmers (Rukuni et al., 2006). These group of farmers are the main exporters of agricultural products including tobacco, cotton, tea, and sugarcane.

These major structural shifts have caused major internal and external imbalances as reflected in uneven and sluggish economic performance since independence, and deteriorating internal position (RBZ, 2015b). The agricultural sector of Zimbabwe has not been spared from the economic challenges which the country has faced. However, it is important to note that the agricultural sector is directly linked to the regional and international markets. Hence, the effects of regional trade agreements and partnerships becomes key to determine the forces affecting the country's agricultural trade flows (RBZ, 2019b). According to the Reserve Bank of Zimbabwe regional trade agreements contribute more than 40% to the ease of trade due to the enhanced trade facilitation as a result of the various partnerships (RBZ, 2019b). Furthermore, The Zimbabwe Investment Development Agency (2020) highlighted that about 20% of the foreign investment the country receives is directly as a result of the regional trade agreements which the country is signatory to. Hence, the importance of regional trade agreements to Zimbabwe's trade flows cannot be over-emphasized enough, given the facilitatory role in promoting investment and the overall economic growth of the country. Against this background, regional trade agreements and exchange rates become key determinants of Zimbabwe's agricultural trade flows.

In this context, it is imperative to note that Zimbabwe's agricultural trade flows have been influenced by internal and external factors. Internal factors include the economic and political factors which the government has instituted to meet its priorities including the monetary and fiscal policy. External factors include the regional trading agreements to which the country is a member. These regional trading agreements include Economic Partnership Agreement (EPA) and SADC-FTA among other Bilateral Trade Agreements (BIPAs). This has resulted in the country opening up its agricultural trade sector to regional and international competition (Rukuni et al., 2006). However, the country has seen significant fluctuations in the trend of agricultural growth. Against this background, it becomes important to ascertain the factors which are affecting Zimbabwe's agricultural trade flows to inform the policy makers on how to improve the sector. Although, the country is a member of these regional trading agreements, it becomes imperative to determine the nature and extent of how these trading blocs affect Zimbabwe's agricultural trade flows and the overall economy. Other factors including exchange rates and GDP, will also be analysed to assess their impact on agricultural trade flows.

1.1. Problem statement

Zimbabwe is experiencing a decline in agricultural growth rates as highlighted by increased imports and reduced exports of agricultural commodities (FEWSNET, 2020). Since the agricultural sector forms

an important component of the economy, this has negatively affected the country's budget and debt levels. The internal imbalances have been reflected by the slow growth of the GDP, which has been growing at low pace at an average of 2% over the past years (World Bank, 2016). Internal imbalances include the monetary and fiscal policies which have not been supportive of regional trade agreements which Zimbabwe is part of including SADC and COMESA. The fiscal deficits have affected implementation of critical regional trade agreements which are important to the agricultural sector and the overall economy through trade creation. Hence, the political will to ensure that Zimbabwe fully benefits from its various regional trade agreements is critical. Further, under dollarization, liquidity challenges have led to weak aggregate demand affecting economic growth. Fiscal space has greatly diminished due to low tax revenues, and rising domestic and external debt being pushed by agricultural imports. The debt building up is due to borrowing to finance current account deficits, resulting in the debt to GDP ratio increasing (AfdB & Undp, 2015). The internal and external imbalances have negatively affected incentives to produce goods for both the domestic, and the export markets. Zimbabwe is part of several regional agreements and blocks. Therefore, it is important to note that Zimbabwe's trade agreements are affected by internal policies including monetary policy, fiscal policy, and political decisions which affects its success. However, the impact of EPA and SADC-FTA on the country's agricultural trade flows have not been fully assessed. Furthermore, the effects of exchange rates and the economic size on the agricultural trade flows have not been explored. Hence, it becomes imperative to determine the impact of EPA and SADC-FTA to solve the country's economic challenges.

1.2. Research aim and question

The main aim of the study is to assess the impact of EPA and SADC-FTA regional trade agreement on Zimbabwe's agricultural trade flows.

The research question is, what is the impact of EPA and SADC-FTA regional trade agreement on Zimbabwe's agricultural trade flows?

1.2.1. Justification of the study

1.2.1.1. Gaps in literature. There has been various studies on the challenges facing the agricultural sector of Zimbabwe. Mutambara et al (2016), provided insights into some of the challenges confronting various stakeholders of Zimbabwe's trade agreements in the agricultural sector. However, there was a literature gap in terms of the extent to which regional trade agreements are affecting the agricultural trade flows of Zimbabwe and other countries. Furthermore, Sunge and Ngepah (2019) highlighted the economic benefits of regional trade agreements for countries including Zimbabwe. However, the magnitude of the benefit was not assessed. Hence, this study will fill these gaps by quantifying the extent of benefits of the regional trade agreements. Against this background, the study will determine the impact of EPA and SADC-FTA on Zimbabwe's agricultural trade flows. Implications of EPA and SADC-FTA regional integration, exchange rates, and economic size will form the basis of the main variables under study. Therefore besides identifying the challenges affecting the sector, the study will provide the requisite results of how regional integration, exchange rates, and economic size affect the agricultural trade flows. Hence, the study will contribute to research by covering an important gap in literature on the factors affecting the agricultural trade flows of Zimbabwe.

1.2.1.2. Importance of agricultural sector to the Zimbabwean economy. The agricultural sector is an important component of the Zimbabwean economy. According to the Ministry of Finance (2020), the agricultural sector contributes between 10 and 15% to the country's GDP. Furthermore, about 70% of the population is directly or indirectly dependent on the agricultural sector. The strong linkages between agriculture and other sectors of the economy such as employment, manufacturing, and trade, highlights the central role played by the sector in the economy. This means any disturbances in the sector has profound effect on the economy. Since

the country is operating on a constrained fiscal budget it becomes imperative to articulate the nature and extent of challenges bedevilling the sector. Hence, the study is formulated to deal with the issue of assessing the impact of EPA and SADC-FTA on Zimbabwe's agricultural trade flows. It is important to note that the RBZ governor's 2018 monetary policy stated agricultural trade competitiveness as one of the critical aspects to revive the economy. According to the RBZ (2018) reducing the country's agricultural imports is one of the priority concerns to revive the economy. Hence, study becomes important to critically assess the impact of EPA and SADC-FTA on agricultural trade flows of the sector and come up with insights on how to deal with the anomaly thereby contributing to government initiatives.

2. Literature review

2.1. Background to Zimbabwe-EPA regional trade agreement

Zimbabwe initially signed the EPA in 2009 together with Seychelles and Madagascar. However, the agreement was initiated in on 14 May 2012. Hence, the EPA between Zimbabwe and the European countries was initiated in 2012. The signed EPA includes provisions on trade defence, development cooperation, rules of origin, and dispute settlement. EU consolidated the issue of quota free, duty free access for Zimbabwean exports. In return Zimbabwe agreed to gradually open up markets for EU products over 15 years. However, the liberalisation of the Zimbabwean market excluded sensitive products including clothing, cereals and selected consumer electronics. Therefore, determining the impact of EPA on Zimbabwe's agricultural trade flows will be critical to fully initiate other provisions within the agreement which have not been implemented.

2.2. Background to SADC-FTA regional trade agreement

SADC formerly known as SADCC was formed in 1980 with the declaration signed in 1992. The main thrust of SADC is to tackle national issues through regional and collective action. SADC countries include Zimbabwe, South Africa, Zambia, Democratic Republic of Congo, Malawi, Mozambique, Mauritius, Botswana, Namibia, Seychelles, Angola, Tanzania, Swaziland, and Lesotho. The impact of the duration of membership of a country in a regional trade agreement has great implications on its trade flows. SADC started as a development co-operation in 1980 but the SADC-FTA has been in existence since 2008. Hence, the impact of the SADC-FTA since 2008, will be the basis of measuring its impact on Zimbabwe's agricultural trade flows.

2.3. Theoretical framework

Viner (1950) provides some of the earliest work on the theoretical basis for regional integration titled 'The customs union issue'. According to Viner (1950), the two main economic outcomes of regional integration are trade diversion and trade creation. Hence, any regional trade agreement should make enhance trade creation and reduce trade diversion. Likewise EPA and SADC-FTA is hinged on these two key aspects of trade creation and diversion. It is key to note that Viner theory is a partial equilibrium model, which attempts to explain the effects of various regional trade agreements. However, the current economic environment requires a general equilibrium which accounts for various economic factors. Lipsey (1982) and Plummer (2007) also provided an important view on regional trade agreements particularly customs union. Hence, their conclusions had similar emphasis on the issue of regional trade agreements. Lipsey (1982) and Plummer (2007) stated that regional trade agreements are key to having efficient multilateral trade agreements. These regional trade agreements are the key to a multilateral trading arrangement. However, the impact of these regional trade agreements has been question by some researchers. Furthermore, their research highlight the effects of regional trade agreements particularly customs union are measured in terms of welfare. Therefore, rather than concentrating on the trade creation and diversion earlier stated by Viner, the theory concentrated on welfare. Countries in EPA partnership should strive to increase welfare to their economies and inhabitants through regional integration.

Piermartini and Teh (2005) and another study by Costinot and Donaldson (2012) highlight that according to Ricardo theory all countries can gain from trade if they specialize in economic activities which they have comparative advantage. This is an important issue with respect to Zimbabwe's agricultural trade flows analysis. Countries in EPA and SADC-FTA can benefit by engaging in economic activities particularly agricultural production in entities they have comparative advantage. This comparative advantage is about low cost of production as a result of relative price differentials with technology having a great effect. However, it is important to note that the Ricardo theory has key weaknesses in its explanation of trade flows. These include the assumptions of constant costs, lack of demand aspect and the static nature of the model ignoring the dynamic effect of growth.

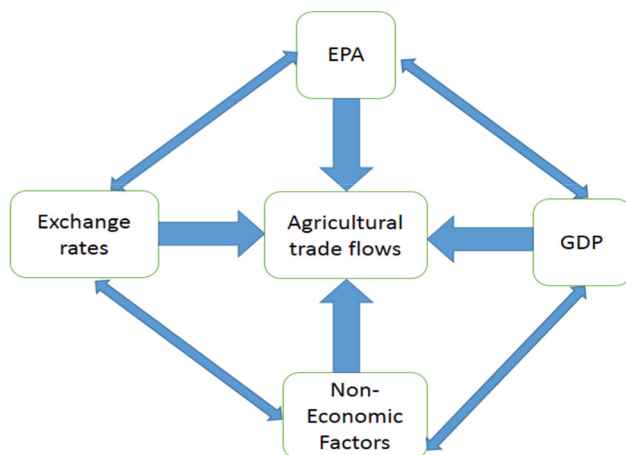
Krugman (1991) stated that regional integration between countries that are close has significant economic benefits due to the issue of low transport costs. Against this background, intra-regional trade between close countries becomes key in determining the trade flows. Hence, it is expected that that countries close to Zimbabwe in EPA and SADC-FTA will have a greater impact on the country's agricultural trade flows. However, it is important to note that a country can be distant but still trade more with a country due to the economic size (GDP). This highlights that the variables affect the trade flows to a different extent depending on the GDP, distance and other economic variables. Krugman presents an important view of scale economics which guides trade among private firms and countries. Countries should therefore become cost efficient to have comparative advantage in a regional trade agreement. Bergstrand (1989) stated that the gravity model is based on monopolistic competition as highlighted by Krugman (1980). Differentiated products produced by countries were noted as the "push factors" enabling trade between countries.

2.4. Review of empirical studies

Afesorgbor (2017) and Riedel and Slany (2018) introduced the welfare effects of regional trade agreements by using methodologies including the gravity model. Afesorgbor (2017) carried out a meta-analysis study on the effects of regional integration on Africa trade. The meta-analysis used compiled a variation of the gravity models to determine the impact of regional integration on Africa trade. Variation in gravity models included fixed effects, poisson maximum likelihood, weighted least squares, and random effects. The results indicated that regional trade agreements contributed to 27–32% to Africa trade, among other variables. However, it is important to note that the study used different methods of the gravity model which produce different coefficients in terms of their bias and consistency. Therefore, the conclusion that regional trade agreements have contributed to 27–32% on Africa trade is an average of results from different gravity methods. Furthermore, the study failed to account for multilateral resistance term. Multilateral resistance term highlights the aspect that trade between countries is not only determined by bilateral factors but the relative position of the countries in question. Although, distance can be a proxy for the multilateral resistance term, it is not effective to explain the benefits or costs of the position of a country in a geographical space.

Riedel and Slany (2018) conducted a study on the potential regional integration on Africa trade by focusing on the COMESA-EAC-SADC tripartite. The Poisson pseudo maximum likelihood method was used as there were more instances of zero trade value between the countries. Results indicated that the tripartite could result in more imports for the region particularly for EAC member states. Therefore, regional trade agreements can increase intra-regional trade but most of it can be imports from non-members. The study introduced an explanatory variable of trade barriers which was represented by the proxy of average tariff data on imports. However, issues of endogeneity were not fully explored. Trade barriers affect the trade flows between countries, but also the amount of trade between countries can affect the trade barriers imposed. Hence causation can be interchanged between the variables trade flows and trade barriers. Hence, it's key to deal with endogeneity issues in gravity model to have consistent and unbiased estimates.

Figure 1. Conceptual framework.



Kahouli and Maktouf (2015) conducted a study on the influence of FTAs among Mediterranean countries. The research focused on how the Arab Maghreb Union and AGADIR agreement (FTA between Morocco, Jordan, Egypt and Tunisia) had an impact on the trade creation and diversion within the region. Panel data results using the gravity model from 1980 to 2011 indicated that FTA members in the Arab Maghreb Union benefited from trade creation as a result of the agreement. However, it is important to note that trade diversion was also highlighted to have affected the FTA. Furthermore, unequal benefits of the FTA was towards more advanced and stable countries including Egypt. Panel data analysis, in this case highlights the importance of regional trade agreements on the trade flows between countries. However, the dummy variable only indicated whether membership to a regional agreement resulted in trade creation or diversion between the members. The research did not quantify the impact of regional agreement (AGADIR) by transforming the dummy variable into a quantifiable variable. Against this background, it is key to note that the study main aim was to determine benefits of membership to an FTA, without quantifying the benefits in terms of trade creation.

2.5. Conceptual framework

From Figure 1 above, the conceptual framework highlights the several factors which affect Zimbabwe's agricultural trade flows including regional trade agreement of EPA. Factors affecting Zimbabwe's agricultural trade flows are derived from the Porter's (1990) framework of analysis.

3. Model and methodology

The study utilizes secondary data from various sources for its analysis. Panel data on bilateral agricultural trade flows between Zimbabwe and 11 other countries spanning 18 years from 2001 to 2018 was sourced from World Integrated Trade Solutions (WITS) database. Countries in the analysis include South Africa, Kenya, Zambia, Egypt, Mozambique, China, the United States, Netherlands, Belgium, the United Kingdom, and Botswana. These countries represent different agricultural exports and imports destinations. The panel data include an aggregation of both exports and imports and excludes forestry and fish products according to the Harmonized Commodity Description and Coding System (HS). GDP figures and population figures were taken from the World Development Indicators database. Distance between major cities data was obtained from <http://www.cepii.fr>. Exchange rates statistics were obtained from IMF

International Financial Statistics database and the Reserve Bank of Zimbabwe. Regional trade agreement used in the study is EPA. STATA is used as the main statistical package.

3.1. Gravity model specification

Anderson and Van Wincoop (2003) provided key contribution to the gravity model through the issue of multilateral resistance. According to Anderson and Van Wincoop (2003), gravity model specification does should control for relative trade costs and deal with multilateral resistance issues. Hence, this guided the inclusion for the dummy variables of EPA and SADC-FTA in the model specification. Analysis conducted by McCallum (1995) states that output, distance, and shared border are key fundamentals in the determination of trade flows between two countries. The analysis will use agricultural imports and exports as proxy for output, however will use fixed effects model to deal with multilateral resistance issues which include a shared border or not.

The gravity model to determine the factors affecting agricultural trade flows of Zimbabwe, is specified as highlighted:

$$\ln AGT_{ijt} = \beta_0 + \beta_1 \ln Ex_{ijt} + \beta_2 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln N_{it} + \beta_4 \ln N_{jt} + \beta_5 \ln D_{ij} + \beta_6 SADC_FTA_{ij} + \beta_7 EPA_{ij} + \varepsilon_{ijt}$$

Where:

i : is country i which is Zimbabwe

j : is partner countries 1, ... ,n

AGT_{ijt} : Zimbabwe's agricultural trade with country j in time t (USD\$ monetary term)

Y_{it} : Zimbabwe's GDP in time t

Y_{jt} :GDP of partner j in time t

Ex_{ijt} :Exchange rate between Zimbabwe and country j in time t

N_{it} :Population of country i (Zimbabwe) in time t

N_{jt} :Population of partner country j in year t

D_{ij} :Distance between capital of Zimbabwe and country j

$SADC_FTA_{ij}$:Dummy variable before and after SADC FTA (0 = before 2008 and 1 = after 2008)

EPA_{ij} :Dummy variable before and after EPA (0 = before 2012 and 1 = after 2012)

ε_{ijt} :Error term

3.2. Hausman test to use fixed effects or random effects

A central assumption in the random effects estimation is the assumption that the random effects are uncorrelated with explanatory variables. The common method for testing this assumption is to employ the Hausman (1978) test to compare the fixed and random effects estimates of coefficients. This test is conditioned by the null hypothesis, stating that neither correlation seems to

exist between individual effects and any regressors in the model or any misspecification (exogeneity) of any regressors (Hausman, 1978).

For the consistency of the regressions' estimates, the null hypothesis and the alternative one are illustrated as follows: $H_0: (u_{it}/X_{it}) = 0$ and $H_A: (u_{it}/X_{it}) \neq 0$, where individual and/or time effects may be represented by u_{it} and X_{it} stands for any regressors in the model.

Based on both models' estimators, the Hausman test statistic can be described by:

$$m_1 = \hat{q}_1' [\text{var}(\hat{q}_1)]^{-1} \hat{q}_1 H_0 \tilde{\chi}_K^2$$

The dimension of \hat{q}_1 , which is the number of slope coefficients vector β , is designated by K . This test relies on $\hat{q}_1 = \hat{\beta}_{GLS} - \hat{\beta}_{within}$. Clearly then, in order to compute this test and make it functional, Ω should be replaced by $\hat{\Omega} - a$ consistent estimator in this case. In addition, this test appears to be asymptotically distributed as χ_K^2 is subject to the null hypothesis.

According to the Hausman specification test (Hausman, 1978), both the fixed effects model and the random effects model may possibly generate consistent estimate parameters if there is no correlation between the random individual effect and any of the independent variables. Therefore, the random effects model should be adopted in order to furnish more efficient estimators. On the other hand, when there is correlation between individual effects and any of the regressors, the fixed effects model is more appropriate and should be selected to reveal the heterogeneity across country pairs and generate consistent estimators (Greene, 2012). In fact, the fixed effects model (slope coefficients) is coherent whether the null hypothesis is rejected or not.

3.3. Variable description and measurement

The section highlights how the dependent and independent variables will be measured.

3.3.1. Dependent variable

The dependent variable is bilateral agricultural trade flows between Zimbabwe and the various trading partners. Aggregated exports and imports in monetary value (USD\$) will be the main basis for the measurement of the dependent variable. Forestry and fishery products are excluded from analysis in line with WTO Harmonised System which measures forestry and fishery separately. Agricultural trading partners, which are trading destinations of Zimbabwe to be used in the analysis include South Africa, Kenya, Zambia, Egypt, Mozambique, China, the United States, Netherlands, Belgium, the United Kingdom, and Botswana.

3.3.2. Independent variables

3.4. Regional trade agreements

SADC-FTA and EPA dummy variables are the basis on which the impact of regional trade agreements on Zimbabwe's agricultural trade flows will be determined. However, it is important to note that we cannot determine the impact of a dummy variable in terms of elasticity, since it cannot be quantified. The dummy variable can only indicate whether SADC-FTA or EPA has positive effects on Zimbabwe's agricultural trade flows, without highlighting the extent. Against this background, the study will transform the dummy variables of SADC-FTA and EPA to continuous variables to measure impact in terms of elasticity. The Halvorsen and Palmquist (1980) method of transformation of dummy variables, will be the basis for the analysis. According to Halvorsen and Palmquist (1980) method, a dummy variable in a model is transformed as following to measure impact in terms of elasticity:

$$\text{Elasticity} = \{e^{\beta_i} - 1\} \times 100$$

Where:

Elasticity: represents the percentage impact of the dummy variable on trade flows

e: is the exponential

β_i : is the coefficient of the dummy variable from regression results

The above formula highlights how the impact of regional trade agreements (SADC-FTA, EPA) will be measured.

SADC-FTA was initiated in 2008, hence the dummy variable will be 0 before the FTA and 1 after the FTA was implemented. Zimbabwe-EPA was initiated in 2012 with 0 before the EPA and 1 after EPA was implemented. This is done to evaluate policy change.

3.5. Exchange rates

The impact of the exchange rate fluctuations provides an important highlight on how the monetary policy has influenced agricultural trade flows in Zimbabwe. Nominal exchange rates are used as an explanatory variable in the study. Exchange rates impact on trade flows are based on Marshall-Lerner condition and empirical works by Berman et al (2012) and Li et al (2015). According to Abildgren (2005), we observe nominal exchange rates to determine the performance of various macroeconomic indicators in an economy. Hence, exchange rates are a critical independent variable in the economy. The exchange rate for the local currency Zimbabwean dollar (ZWS\$) to various currencies of trading partners is determined from 2001 to 2008. However, from 2009 to present, the country dollarized with the US\$ being the base currency for its transactions. Therefore, from 2009 to 2018 the exchange rate will be for US\$ to other trading partners currencies.

3.6. Gross domestic product

Gross domestic product will be the proxy for economic size in the gravity model. The impact of GDP is a key variable to determine how the economic performance of a country influences its agricultural trade flows. Nominal GDP values in US\$ of Zimbabwe and its trading partners in the study will be the basis for the analysis.

3.7. Distance

Distance represents the transport costs and ease of transacting. The distance between the capital city of Zimbabwe and partner countries, in kilometres will be used as measurement for the variable.

3.8. Population

Population measures the market size of a country and is another variable from the mass factor in the original Newton gravity model. It is expected that countries with higher population have a bigger market size which translates to more demand for goods and services. Therefore, a positive coefficient is expected for the coefficient of the population variable. However, a bigger

Table 1. Hausman test for random effects and fixed effects

Model	Chibar2 (5) value	P value
Random effects	11.18**	0.048

**p < 0.05; H₀: Random Effects model is preferred.

Table 2. Modified wald test for heteroscedasticity

Model	Chi2 (11) value	P value
Fixed effects	326.92***	0.0000

***p < 0.01; H₀: Homoscedastic

population does not necessarily translate to higher trade flows between countries as other factors are more important.

4. Results and discussion

4.1. Hausman test

Hausman test result determined whether the Fixed Effects or Random Effects is the appropriate test. Table 1 highlights that the Fixed Effects is the appropriate test as compared to the Random Effects.

The above table highlights that we reject the null hypothesis, which states that the Random Effects model is appropriate. Hence the study opted for the Fixed Effects model.

4.2. Heteroscedasticity test

The study determined presence of heteroscedasticity using the Modified Wald test below:

Table 2 highlights presence of heteroscedasticity. Null hypothesis, that the Fixed Effects model is homoscedastic is rejected since Modified-Wald test is significant at 1%. The study, used the Fixed Effects model with robust standard errors to correct for heteroscedasticity. Wooldridge test for autocorrelation highlighted that there is no first-order autocorrelation in the model (see appendix).

Table 3. Fixed effects estimates

Variable	Coefficient	t-statistic	P value
EPA	1.406*** (0.371)	3.79	0.004
SADC-FTA	1.681*** (0.340)	4.94	0.001
ln GDP _{it}	−1.385* (0.627)	−2.21	0.052
ln GDP _{jt}	−0.008 (0.021)	−0.37	0.716
ln Exchangerate _{ij}	−0.040*** (0.012)	−3.26	0.009
ln Population _{it}	3.754 (2.851)	1.32	0.217
ln Population _{jt}	0.718 (0.434)	1.65	0.129
Constant	29.767** (10.331)	2.88	0.016
Number of observations	198		

Note: Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1

4.3. Fixed effects estimation results

Table 3 shows results of the Fixed Effects with robust standard errors and how the independent variables impact Zimbabwe's agricultural trade flows.

Dependent Variable: AGT_{ijt} Zimbabwe's Agricultural Trade with partner j in year

4.4. Impact of EPA

Estimated coefficient for EPA from the empirical results in Table 3 is 1.406 significant at 1%. However, it is critical to note that the coefficient is not explained directly as elasticity. This is because, EPA is a dummy variable which must be transformed to measure impact in terms of elasticity. The following mathematical transformation, according to Halvorsen and Palmquist (1980) was used to compute the elasticity as a percentage:

$$EPAElasticity = \{e^{1.406} - 1\} \times 100$$

$$EPAElasticity = 307.96\%$$

Membership in EPA which was initiated in 2012 has enhanced agricultural trade flows between Zimbabwe and its trading partners under analysis by 307.96%. Hence, membership in EPA has a positive impact on Zimbabwe's agricultural trade flows with its trading partners by a magnitude of 307.96%. This is consistent with literature and expected theory of trade creation as a result of regional trade creation. These results confirm the theory that regional trade agreements are likely to have positive impact on the trade flows of the country with its trading partners. Zimbabwe initiated EPA in 2012 and has already experienced increased agricultural trade flows. EPA presents an enhanced market for Zimbabwe's agricultural products, which greatly influences the country's agricultural trade flows in terms of the exports and imports. EPA has duty free access for selected products from Zimbabwe. This improves trade creation within the region, hence the enhanced agricultural trade flows for Zimbabwe. The findings are consistent with research conducted by Chenaf-Nicet and Rougier (2016), who highlighted the positive impact of trade agreements between European and Mediterranean countries as shown by the EURO-Mediterranean agreement due trade creation. However, the results are inconsistent with a study done by Jalles (2012). Jalles (2012) carried out an analysis on the impact of ASEAN Free Trade Area (AFTA) on South Asian countries between 1980 and 2004. Results highlighted that AFTA regional trade agreement had a negative impact on the output of the Asian countries due to trade diversion. Trade agreements can have a trade creation or diversion effect based on the nature of regional trade agreements. EPA, has been a source of trade creation as shown in the discussion above. Endogeneity between regional trade agreements and trade flows can be an explanatory factor to the high percentage of the impact of EPA on Zimbabwe's agricultural trade flows.

4.5. Impact of SADC-FTA

The estimated coefficient for SADC-FTA regional trade agreement from the empirical results in Table 3 is 1.681 significant at 1%. The coefficient for SADC-FTA is not explained directly as elasticity. This is because, SADC-FTA is a dummy variable which must be transformed to measure impact in terms of elasticity. Hence, the mathematical transformation, according to Halvorsen and Palmquist (1980) was used to compute the elasticity as a percentage:

$$SADC_{FTA}Elasticity = \{e^{1.681} - 1\} \times 100 \quad (1)$$

$$SADC_{FTA}Elasticity = 437.09\% \quad (2)$$

Elasticity for SADC-FTA dummy variable is shown as 437.09%. Therefore, membership in SADC-FTA regional trade agreement which was initiated in 2008 has enhanced agricultural trade flows between Zimbabwe and its partners under analysis by 437.09%. This is consistent with literature and expected theory of trade creation as a result of regional trade creation. These results confirm the theory that regional trade agreements are likely to have positive impact on trade flows. It is critical to note that membership in SADC-FTA has a positive impact on Zimbabwe's agricultural trade flows with its trading partners by a magnitude of 437.09%. There are various economic explanations which could highlight the reason SADC-FTA has positively impacted Zimbabwe's agricultural trade flows with its trading partners. South Africa has a huge market, which requires constant supply of agricultural products from neighbouring SADC member states (Booyens and Hart, 2019). Hence, the dominance of South African agricultural market in the region, can enhance demand for Zimbabwe's agricultural products. This is because South Africa is able to demand agricultural products in greater quantities. Essentially, the competitiveness of the South African agricultural market is key in explaining the positive impact of SADC-FTA regional trade agreement on Zimbabwe's agricultural sector. Trade facilitation improvements comprising infrastructure and customs clearance efficiency also contributes to the positive impact of SADC-FTA on Zimbabwe's agricultural trade flows. These factors have a cumulative impact on Zimbabwe's agricultural trade flows. The results for SADC-FTA dummy variable are consistent with findings by MacPhee and Sattayanuwat (2014) which indicated positive impact on key economic sectors of CEMAC member states. Positive impact for CEMAC member states was identified to be caused by trade creation. However, the results are inconsistent with a study carried out by Martuscelli and Gasioerek (2019) who noted the long-term negative impact of regional trade agreements which include free trade arrangements using the gravity model. Therefore, SADC-FTA has enhanced Zimbabwe's agricultural trade flows since it was implemented in 2008.

4.6. Impact of economic size

Coefficient for the GDP of Zimbabwe is -1.385 significant at 10%. Therefore, a 1% increase in Zimbabwe's GDP will decrease agricultural trade flows by 1.385%. This is an unexpected result, as an increase in GDP "in theory" is associated with increased trade flows. Hence, this refutes the theory that GDP is likely to have a positive impact on trade flows. Possible reasons include that Zimbabwe is experiencing a transformation of the economy as shown by the growth rate of the service sector (Chinomona, 2012). Hence, the decrease in agricultural trade flows as the GDP increases reflects the changes in the structure of the economy. The government of Zimbabwe is striving to diversify the economy. It is critical to note that as the GDP increases, its impact on Zimbabwe's agricultural trade flows is negative. This reflects the trade diversion from the agricultural sector to other critical sectors of the economy including the services and manufacturing sectors. The results are consistent with an analysis conducted by Kirkpatrick et al (2005). Kirkpatrick et al (2005) conducted a study on effects of GDP and regional trade agreement between East African Community member states between 1970 and 2001. Results, indicated that enhanced GDP growth of trading partners was a key determinant of trade between member states and had a different impact depending on the structure of the economy in East Africa Community member states. For other countries the GDP had negative impact whilst for other member states it had positive impact. Hence, although it is unexpected, enhanced GDP can be associated with lower agricultural trade flows. Furthermore, from the results in Table 3, the GDP of Zimbabwe's agricultural trading partners was insignificant in impacting the country's GDP. This can be attributed to the issue that as the domestic market of these countries increases, they are able to absorb a huge proportion of the products produced as a result of the increase in their GDP (Sohn Chan-Hyun, 2001). Therefore, less agricultural trade with Zimbabwe as the trading partners are now more domestically oriented or have found alternative trading partners. Economic size does

not greatly impact Zimbabwe's agricultural trade flows, hence the low percentage effect as compared to EPA regional trade agreement.

4.7. Impact of exchange rates

The coefficient for exchange rate is -0.040 significant at 1%. This is interpreted directly as an elasticity since exchange rate is a continuous variable. Therefore, a 1% increase in the exchange rate (devaluation) with Zimbabwe's trading partners decreases agricultural trade flows by a magnitude of 0.040% for the period under analysis. These results do not confirm the Marshall-Lerner theory that devaluation increases exports and resultantly trade flows. According to the Marshall-Lerner condition, the devaluation of a country's currency will lead to an improvement in its balance of trade with the rest of the world. However, the theory was not confirmed in this case. This is because, Zimbabwe has gone through a period of hyperinflation (2007–8) and the country adopted the US\$ as the currency for its transactions in 2009. Devaluation in theory is expected to make exports cheaper and imports more expensive. However, in this case, devaluation is highlighted to be associated with low agricultural trade flows because of the high-inflation rates over the same period. Zimbabwe has limited exports and has a huge trade deficit. Hence, a devaluation of the currency is expected to make imports expensive and reduce the quantities imported, hence a decrease in agricultural trade flows. Furthermore, the hyperinflation recorded in Zimbabwe suppressed trade with the country's trading partners as imports of agricultural products decreased (Mutambara et al, 2016). Therefore, an increase in the exchange rate is highlighted as having a negative impact on Zimbabwe's agricultural trade flows.

5. Conclusion and policy recommendations

Zimbabwe should take advantage of EPA by increasing agricultural exports through a quota and duty free access granted by the EU. This is because results of the study highlight the positive impact which EPA has on Zimbabwe's agricultural trade flows. Trade agreements signed between Zimbabwe and any country or trading bloc should conduct policy simulations on their impact on agricultural trade flows, since the sector is an important pillar of the economy as shown in the study. Future research should aim to investigate how trade agreements impact Zimbabwe's other sub-sectors of the economy including the services and manufacturing sectors. This will be key in having a comprehensive overview of how regional trade agreements impact Zimbabwe's economic sectors. Furthermore, simulation studies on how recently signed agreements including African Continental Free Trade Area (AfCFTA) impact Zimbabwe's agricultural trade flows will be key to guide policy initiatives in the country.

6. Policy implications

Zimbabwe should take advantage of the EPA by increasing agricultural exports through a quota and duty free access granted by the EU. This is because results of the study highlight the positive impact which EPA has on Zimbabwe's agricultural trade flows.

Trade agreements signed between Zimbabwe and any country or trading bloc should conduct policy simulations on their impact on agricultural trade flows, since the sector is an important pillar of the economy as shown in the study.

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7. Limitations

The study sought to conduct an analysis on a bigger dataset consisting of large number of countries. However, other countries have not reported their data on key variables to IMF financial Statistics and World Development Indicators. Nevertheless, the study managed to acquire data on a sizeable number of countries, to be able to make key policy recommendations.

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Author details

Admire Chawarika¹
 E-mail: admirechawarika@yahoo.com
 ORCID ID: <http://orcid.org/0000-0002-3548-1030>
 Faustino Madzokere²
 Agrippa Murimbika³
 Evan Lau
¹ School of Economics and Management, Lund University, Lund, Sweden.
² Faculty of Agribusiness and Commerce, Manicaland State University of Applied Sciences, Zimbabwe.
³ Monitoring and Evaluation Department, Catholic Agency for Overseas Development (CAFOD), Zimbabwe.

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