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Examining the Effects of Exchange rate Regimes Choice on South Africa's Agricultural Trade: A Gravity Model Panel Approach

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Abstract

This paper investigates the impact of exchange rate regimes and exchange rates on South African agricultural exports, a vital sector of the economy. Employing an augmented gravity model, the study examines bilateral trade with 21 countries from 1988 to 2023. Key variables include de facto classification of exchange rate regimes, GDP, distance, and trade-related factors such as borders, common language, free trade agreements, and landlocked status. Estimations are conducted using pooled OLS, fixed effects, and random effects models. Results show that GDPs of both South Africa and its trading partners positively influence agricultural exports, while distance and exchange rate negatively affect them. Exchange rate regimes are found to play a significant role: fixed regimes are most constraining to export performance, whereas managed float regimes are less restrictive. These findings underscore the

importance of exchange rate policy in shaping South Africa's agricultural trade outcomes and guiding economic policy decisions.

Keywords: *South African Agricultural Trade; Exchange rate regimes; Bilateral trade; Gravity model; De facto exchange rate classification*

Journal of Economic Classification (JEL) codes: F14, F31, Q17, C23, F33, F1

1. Introduction

Agricultural trade plays a vital role in the South African economy, contributing significantly to export earnings and employment. In 2023, agricultural exports amounted to $12.61 billion, representing approximately 11.76% of South Africa's total exports (International Trade Centre, 2024). Despite its importance, the sector is exposed to numerous challenges, chief among them being exchange rate volatility, which affects export competitiveness by altering relative prices and increasing uncertainty.

Exchange rate volatility, defined as fluctuations in the value of one currency against others, has mixed theoretical and empirical implications for trade. Traditional trade theory suggests it can discourage exports by increasing profit uncertainty for risk-averse firms. However, some scholars (Moyo, 2024) argue that volatility can sometimes enhance trade, particularly when depreciation improves export competitiveness. Jordaan (2015) found that countries sharing a common currency trade significantly more, highlighting the role of exchange rate stability in promoting trade flows.

Exchange rate regimes, whether fixed, floating, or managed, play a crucial role in shaping the extent and impact of volatility (Gagnon, 2016). Different regimes influence how exchange rates respond to market forces and macroeconomic shocks, thereby altering trade dynamics. Despite a growing body of literature on exchange rate volatility and trade (Kandilov, 2008; Rahman & Serletis, 2009; Chit et al., 2010; Williams & Luo, 2017; Ali, 2020; Steinbach, 2021), limited attention has been paid to the interaction between exchange rate regimes and volatility, particularly in the context of South African agricultural exports.

This omission is significant, as exchange rate regimes directly shape the level and predictability of currency movements, which are especially impactful for agricultural trade. Agricultural goods are more price-sensitive and seasonally dependent than other sectors, making them more

vulnerable to volatility (Kandilov, 2008; Ijirshar et al., 2022). In addition, agriculture in developing countries is often affected by high transaction costs, imported inputs, and policy interventions – all of which can be destabilized by currency fluctuations.

Against this background, this study investigates the combined effects of exchange rate regimes and exchange rate volatility on South Africa's agricultural exports to its top 21 trading partners. By using a panel data approach within a gravity model framework, the analysis incorporates key determinants of trade, including GDP, distance, and institutional variables. The gravity model is widely applied in international trade studies for its robustness in explaining bilateral trade flows (Anderson, 2011).

By explicitly incorporating exchange rate regime types into the model, alongside real exchange rates, this study contributes to a more nuanced understanding of how exchange rate policies affect agricultural trade. The findings are expected to offer relevant policy insights into improving trade performance in a sector highly exposed to external shocks, while addressing a clear gap in the literature.

The rest of the paper is as follows: Section 2 reviews the relevant literature on exchange rate volatility, exchange rate regimes, and trade. Section 3 outlines the methodology, including the gravity model and the estimation techniques used. Results are discussed in Section 4. Lastly, conclusions and recommendations are made in Section 5.

2. Literature Review

The relationship between exchange rate regimes and macroeconomic performance remains a central theme in economic research, particularly in understanding how different regimes – fixed, flexible, or intermediate – affect macroeconomic outcomes.

Traditional trade theories offer valuable insights into agricultural trade patterns and their interaction with exchange rate regimes. Comparative advantage suggests countries benefit from specializing in goods they produce more efficiently, such as agriculture in resource-abundant economies, while the Heckscher-Ohlin model explains that nations export goods aligned with their factor endowments, such as land and labour. However, these advantages can be constrained or amplified by exchange rate regimes, which affect price competitiveness and trade stability (Ahmed, 2012). New Trade Theory adds that scale economies and product differentiation, particularly in agro-processed goods, mean

that exchange rate volatility can influence firms' ability to compete internationally (Kim & Lim, 2024). While classical theories explain the basis and direction of trade, this study builds on them by examining how exchange rate regimes shape actual trade flows, particularly in the agricultural sector, where both price sensitivity and market access are critical.

Although these traditional theories provide a foundation for understanding trade patterns, particularly in agriculture, empirical studies offer mixed evidence on how exchange rates and their regimes influence actual trade flows in practice. Much of the literature focuses on the macroeconomic (aggregated) effects of exchange rates (Petreski, 2009; De Vita & Kyaw, 2011; Ahmed, 2020; Ha & Hoang, 2020; Ameziane & Benyacoub, 2022; Abouelkhair & Tamsamani, 2023), but fewer studies have explored their implications for trade flows specifically (Kandilov, 2008; Rahman & Serletis, 2009; Chit et al., 2010; Williams & Luo, 2017; Ali, 2020; Steinbach, 2021). Even more limited is the literature investigating the interaction between exchange rates, exchange rate regimes, and sector-specific trade outcomes, particularly in agriculture. This study seeks to bridge that gap by focusing on disaggregated trade data to avoid aggregation bias, and by evaluating the joint effects of exchange rate movements and regime types.

Across empirical studies, a common theme is the influence of exchange rate volatility on trade performance. Poon and Hooy (2013) found that exchange rate volatility generally exerts a lagged negative effect on trade flows in OIC countries. However, their results also show that countries with flexible regimes experienced export gains, suggesting that the impact of volatility is regime-dependent. Similarly, Santana-Gallego and Pérez-Rodríguez (2019) revealed that intermediate regimes foster greater trade, especially during crises, although effects vary depending on the anchor currency and the nature of the crisis. These studies underscore the importance of institutional context and the structure of exchange rate regimes in shaping trade outcomes.

Several studies suggest that the exchange rate-trade relationship has evolved, particularly in the post-global financial crisis period. Kang and Dagli (2018), for instance, demonstrated that while real exchange rates positively influenced exports before the GFC, this relationship weakened in subsequent years, largely due to deeper integration into global and regional value chains. This finding highlights the increasing complexity of trade dynamics, where factors such as supply chain participation and

external debt now play a more dominant role than traditional price competitiveness.

At the sectoral level, evidence remains scarce. Seti (2023) offers one of the few studies examining the exchange rate-trade nexus within the agricultural sector, using a gravity model to analyse South African agricultural exports to African countries. While GDP and infrastructure quality were found to positively influence exports, the study did not account for the type of exchange rate regime, leaving a critical gap in understanding how regime choice might mediate these effects.

Other studies provide mixed evidence on the role of exchange rate levels. Ahmad et al. (2017) found that exchange rates had a statistically insignificant impact on Pakistan's exports, while global income had a strong positive effect. In contrast, Ijirshar et al. (2022) provided more nuanced insights using linear and non-linear ARDL models. They confirmed the J-Curve hypothesis in Nigeria, showing that currency depreciation negatively affects trade in the short term but improves it over time, consistent with the Marshall-Lerner condition. These contrasting results point to the importance of methodological choices and country-specific contexts in shaping empirical outcomes.

3. Methodology

3.1 Study area

This study investigates the impact of exchange rate regimes and exchange rate volatility on agricultural trade, using panel data from South Africa and 21 of its major trading partners from 1988 to 2023. An augmented gravity model is employed, incorporating exchange rate factors to assess their influence on trade flows. South Africa, with its export-oriented agricultural sector and diverse trade relationships, serves as the central case. [1]The selected countries, comprising both developed and developing economies, were chosen based on their importance to South Africa's agricultural trade, ensuring a balanced analysis of varying exchange rate regimes and trade dynamics.

3.2. The Gravity Model

[1] Trading partners include Australia, Argentina, Botswana, Brazil, China, Eswatini, France, Italy, India, Indonesia, Germany, Japan, Lesotho, Thailand, Spain, Zambia, Zimbabwe, New Zealand, Canada, the United States, and the United Kingdom

This section investigates the effect of exchange rate regimes on bilateral agricultural trade flows between South Africa and its top 21 agricultural trading partners. The study adopts a Gravity model of international trade. The fundamental theory behind the Gravity model of trade is that the volume of trade between two countries is positively related to their GDPs but inversely related to their geographical distance (Dell'Ariccia, 1999; Magomani et al., 2023; Kim & Lim, 2024). Among the early pioneers of the use of Newton`s Law of Gravity model to explain trade between countries, Tinbergen (1962) postulates that GDP is an important factor in a country's trade attractiveness to other nations. However, attractiveness can be significantly reduced by geographic distance between trading partners, which represents high transaction costs. As the distance between two trading countries increases, trade flows will be reduced (Marimoutou, Peguin & Peguin-Feissolle, 2009; Anderson, 2011; Jordaan, 2015).

The standard form of the gravity model regresses trade volume, GDP of trading partners, and the geographic distance between countries, as presented below (Krugman et al. 2012).

$$T_{ij} = \frac{A\gamma_i\gamma_j}{D_{ij}} \quad \text{.....(1)}$$

Where *i* denotes the export country, *j* represents the importer; *T*ij denotes volume of trade between exporter and importer country *i* and *j*; represents a constant; γi is the GDP of the export country *i*; γj represents the GDP of the importer *j*; and *D*ij denotes geographic distance between country *i* and *j*.
Based on the literature, the gravity model is generally estimated in its log-linear version, as shown below:

$$InT_{ij} = InA + \alpha_1 + InY_1 + \alpha_2 InY_j + \alpha_3 InD_{ij} + \varepsilon_{ij} \text{.....} \quad (2)$$

Where distance between trading partners (Dij) is expected to negatively affect trade due to higher trade costs. Several authors (Marimoutou et al., 2009; Jordaan, 2015; Magomani et al., 2023; Seti, 2023) have extended the gravity model by adding additional trade-influencing factors to improve its explanatory power. This study extends the traditional gravity

model by adding variables such as shared borders, common language, FTAs, colonial ties, landlocked status, real exchange rates, and exchange rate regimes to capture broader trade influences beyond standard gravity factors. The augmented gravity model is represented below.

$$InExpo_{it} = \beta_0 + \beta_1 InSAGDP_{it} + \beta_2 InIMGDP_{it} + \beta_3 InEXC_{it} + \beta_4 InDIS_{ij} + \beta_6 Bord_{ij} + \beta_7 Lang_{ij} + \beta_8 landlo_{ij} + \beta_9 colo_{ij} + \beta_{10} FTA_{it} + \beta_{11} Fix_{it} + \beta_{12} Cwal_{it} + \beta_{13} Manag_{it} + \beta_{14} Float_{it} + \beta_{15} Fall_{it} + \varepsilon_{it} \quad \text{.....(3)}$$

Where $InExpo_{it}$ representing agricultural exports (USD) for South Africa in logarithm form to country *i* in the year *t*; $InSAGDP_{it}$ is the log of GDP for South Africa in the year *t*; $InIMGDP_{it}$ represents the GDP of importer country *i*'s in the year *t*; $InEXC_{it}$ is the real bilateral exchange rate between the exporter and the importer country in year *t*; $InDIS_{ij}$ represents geographic distance between trading countries in log form ; FTA_{it} is a dummy variable equating to 1 if the exporter and importer countries are part of the same Free Trade Agreement and 0 otherwise; $Bord_{ij}$ is a dummy variable, which is equal to 1 if the exporter and importer countries share a border and 0 otherwise; $landlo_{it}$ takes the value of 1 if the importer country is landlocked and 0 otherwise. $Lang_{ij}$ takes the value of 1 if the trading partners share a common language and 0 otherwise. $Colo_{ij}$ is a dummy variable, which is equal to 1 if trading countries have the same colonizer. $Fix_{it}; Cwal_{it}; Manag_{it}; Float_{it}; Fall_{it}$ are dummy variables representing the adoption of various exchange rate regimes such as fixed/peg, crawling peg, managed float, freely floating and freely falling respectively. ε_{it} is the error term, and lastly $\beta_0 \ldots \ldots \beta_{15}$ are parameters to be estimated.

The gravity model is well-suited for this study for several reasons. First, it has proven to be one of the most empirically successful frameworks for modelling bilateral trade flows, particularly in agricultural trade, where factors such as distance, size of economies, and institutional ties (e.g. trade agreements) matter greatly (Magomani et al., 2023; Seti, 2023). Second, the model allows for the inclusion of policy-related variables such as exchange rates and exchange rate regimes that influence trade costs and price competitiveness (Moyo, 2024). Given that exchange rate regimes can alter the relative price of exports, their inclusion enables this study to evaluate both structural and policy-driven factors affecting

South Africa's agricultural export performance. Furthermore, the extended gravity model framework accommodates dummy variables that reflect historical and geographical ties, capturing heterogeneity across trading partners and improving estimation robustness.

3.3 Data

The extended gravity model was estimated using panel data from 21 countries over 36 years (1988–2023), with the study period chosen according to data availability. Data on GDP and exchange rates were sourced from the World Bank's World Development Indicators and International Financial Statistics. Other gravity model variables, including distance and dummies for landlocked status, borders, and colonial ties, were obtained from the CEPII Gravity Database.

Trade data (imports and exports) were sourced from the Quantec database. The data related to Free Trade Agreements (FTAs) is often sourced from the World Trade Organization (WTO), which is widely regarded as the most reliable and authoritative source of information on global trade agreements.

Lastly, data on exchange rate regimes de facto was sourced from Ilzetzki, Reinhart and Rogoff (2021) The RR classification categories reported exchange rate regimes by member countries of the IMF into 5 groups: (1) the *fixed exchange rate regime*: (2) a *crawling peg;* (3) the *managed float regime*; (4) the *free float regime*; and (5) the "*free-falling" regime*. Since exchange rate regime data are available monthly, but the study uses annual data, the dominant regime for each year was selected. The dominant regime was defined as the regime in place for at least 7 out of 12 months of the year. If no regime met this criterion, the regime in place during the second half of the year was used, consistent with the approach in Bénassy-Quéré and Coeuré (2002). Due to a lack of updated data after 2019, this study assumes countries maintained their 2019 de facto exchange rate regimes through 2023. While this may overlook regime changes, it ensures consistency given the data limitations.

3.4. Economic Specifications

3.4.1 Panel data estimation procedure

For model estimation, three econometric techniques are employed: Pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random

Effects (RE). These models allow for the control of various forms of heterogeneity in the data, such as individual country-specific effects and time-invariant factors, which could bias the results if not properly accounted for (Gujarati, 2011; Santana-Gallego & Pérez-Rodríguez, 2019). Equation 3 in natural logarithms was estimated to analyze the relationships among the variables for 21 South African trading partners. Pooled OLS was used as the baseline regression. These models differ in how they address individual-specific effects and unobserved heterogeneity.

Pooled OLS assumes cross-country homogeneity and ignores country-specific effects, risking bias. Fixed effects control for unobserved country traits but exclude time-invariant variables, while random effects allow their inclusion and offer greater efficiency if assumptions are met (Gujarati, 2011; Jordaan, 2015; Seti, 2023; Moyo, 2024; Kim & Lim, 2024). To assess differences in the impact of exchange rates and regimes, the sample was split into developed and developing countries, and Equation 3 was estimated separately for each group.

3.4.2 Model selection

After estimating the three models, the Hausman test was used to determine the best fit. A p-value below 0.05 indicates that the fixed effects model is preferred, as it rejects the null hypothesis of no systematic difference between estimators (Gujarati, 2011; Seti, 2023).

3.4.3 Diagnostic tests

Diagnostic tests were performed to ensure the reliability of the augmented gravity model. Heteroscedasticity was tested using the Breusch-Pagan test, where a p-value above 0.05 indicates homoscedasticity (Gujarati, 2011; Magomani et al., 2023). Serial correlation was assessed using the Wooldridge test for panel data; a p-value above 0.05 suggests no serial correlation (Santana-Gallego & Pérez-Rodríguez, 2019). Addressing these issues supports robust and efficient model estimates.

4. Results of the Model

This section presents a detailed analysis of the results from the estimated regressions. It begins by giving a summary of statistics. The countries

selected for this study adopted different exchange rate regimes over the review period. Some, such as Botswana, France, and Eswatini, consistently maintained a pegged regime, while the U.S. maintained a managed float. South Africa alternated between a managed float and a freely floating regime. Among developing countries (360 observations), the fixed (peg) regime was most common (116 cases), followed by managed float (92), crawling peg (87), floating (39), and freely falling (30). In developed countries, the fixed regime also dominated (189 cases), followed by floating (119), managed float (57), and crawling peg (31). No developed country adopted a freely falling regime, reflecting greater exchange rate stability.

4.1 Panel data estimation model selection

The Hausman test results indicate that the fixed effects model is preferred, as shown by a significant p-value ($p < 0.01$) and a high chi-squared statistic.

Table 1: Hausman test results

Data sample	**Chi-Square test**	**Probability**	**Preferred model**
Full sample	34.66	0.0001	Fixed model
Developing countries	22.09	0.0004	Fixed model
Developed countries	18.09	0.0116	Fixed model

Source: Authors' compilation from STATA 14 output

4.2 Diagnostic test results

The Breusch-Pagan test results indicate no heteroscedasticity across all models ($p > 0.05$), while the Wooldridge test confirms the absence of serial correlation, suggesting the models are statistically reliable.

Table 2: Diagnostic test results

Data sample	Breusch-Pagan test	Wooldridge test
Full sample	0.3457	0.109
Developing countries	0.0723	0.976
Developed countries	0.0678	0.678

Source: Authors' compilation from STATA 14 output

4.3 Model estimation results

Table 3 below presents the estimation results of the gravity model for full sample countries.

4.3.1 Model estimation results: full sample

Table 3 model estimation results: full sample

Variables	Pooled OLS	Fixed	Random
lnSAGDP	1.115061 [0.000]***	0.9454534 [0.000]***	0.9933886 [0.000]***
lnGDPPART	0.5058907 [0.000]***	0.7899483 [0.000]***	0.7287596 [0.000]***
lnDIST	1.030203 [0.074]	-1.318387 [0.000]	0.0191432 [0.973]
lnRE2010	-3.084512 [0.000]***	-3.020168 [0.000]***	-3.045614 [0.000]***
landlocked	0.6470873 [0.107]	[omitted]	1.094579 [0.414]
Border	1.142108 [0.038]**	[omitted]	-0.235908 [0.896]
samecol	1.47052 [0.000]***	[omitted]	0.877616 [0.232]
Comlang	-0.8341175 [0.000]***	[omitted]	-1.059835 [0.190]
FTA	1.013681 [0.000]***	[omitted]	1.023181 [0.131]
dpeg	0.5130563 [0.121]	-1.816013 [0.000]***	-1.51105 [0.000]***
DcwalPEG	-0.448568 [0.189]	-0.885138 [0.003]***	-0.8017141 [0.007]***
Dmanagedfloat	-0.9268894 [0.005]***	-0.5931774 [0.026]**	-0.5689728 [0.033]**
Dfrelfloa	-0.6478225 [0.055]**	-0.8045888 [0.004]***	-0.7692928 [0.006]***
Dfrelfalling	0.4559482 [0.162]	0.209301 [0.446]	0.1916311 [0.487]
constant	6.509556 [0.084]*	4.674484 [0.896]	15.76938 [0.007]***
sigma_u		2.2799324	1.12223
sigma_e		1.2387717	1.2387717
rho		0.77207252	0.45075886
Observations	756	756	756
Number of countries	21	21	21

*Source: Author`s compilation from STATA 14 output *, **, ***Statistical significance at 10%, 5%, and 1%, respectively, p-values are given in brackets below the coefficient.*

4.3.1.1 Fixed effects results

The results show that South Africa's GDP (SAGDP) is a significant driver of agricultural exports, with a 1% increase in GDP leading to a 0.94% rise in exports, significant at the 1% level. This supports the theory that higher GDP enhances productive capacity and economic growth (Moyo, 2024). Similarly, the GDP of importing countries positively influences exports, with a 1% increase linked to a 0.78% rise in exports, also significantly at the 1% level. This reflects greater demand due to higher income and purchasing power. These findings are consistent with Marimoutou et al. (2009), Jordaan (2015), and Seti (2023), who found GDP levels of both exporters and importers to be positively associated with trade.

Distance negatively affects South African agricultural exports, with a 1% increase in distance leading to a 1.3% decrease in exports, significant at the 1% level. This aligns with findings by Wang et al. (2010) and Magomani et al. (2023), who also reported that greater distance reduces export volumes.

The Real Effective Exchange Rate is negatively associated with South African agricultural exports, where a 1% increase leads to a 3% decline in exports, significant at the 1% level. This suggests a stronger rand reduces export competitiveness. These findings align with Wang et al. (2010), Kandilov (2008), and Chit et al. (2010), who found that exchange rate volatility reduces trade. However, they contrast with Fogarasi (2011), who reported a positive relationship.

To avoid multicollinearity, the fixed effects model excluded dummy variables for landlocked status, borders, colonial ties, and FTAs. In contrast, pooled OLS and random effects show positive, significant impacts for these variables: border (1.1%), colonial history (1.4%), and FTA (1.1%) increase agricultural exports. Trade also tends to rise with landlocked importers. These findings align with Wang et al. (2010), Alam (2010), and Magomani et al. (2023), confirming that such trade-related factors enhance exports. Contrary to theory, common language shows a negative and significant effect (at the 1% level), contradicting Magomani et al. (2023) and Seti (2023), who found it boosts trade flows. This result can be attributed to several factors. First, South Africa's agricultural exports are more concentrated in non-English-speaking African countries, where trade relationships are shaped more by historical trade routes, regional agreements, or logistical considerations than by linguistic

ties. Second, English-speaking countries tend to exhibit characteristics such as market saturation, weaker demand for South African agricultural products, or the prevalence of informal trade channels, all of which reduce formal export flows.

The results show that fixed exchange rate regimes are negatively and significantly associated with agricultural exports, with a 1.8% decline, significant at the 1% level. This suggests that fixed regimes may hinder export competitiveness by limiting exchange rate flexibility. More flexible regimes such as crawling peg, managed float, and freely floating, also show negative effects, with export reductions of 0.8%, 0.5%, and 0.8% respectively, all statistically significant at the 1% level. Among these, the managed float has the least negative impact, making it the preferred regime. Overall, the findings highlight the critical role of exchange rate regimes in shaping agricultural export performance, with fixed regimes being the most restrictive.

4.4 Model estimation results: developing countries

Table 4 below presents the results of the effects of exchange rates and exchange rate regimes on agricultural output in developing countries.
Table 4: Model estimation results: developing countries

Variables	Pooled OLS	Fixed	Random
lnSAGDP	3.308852 [0.000]***	2.725394 [0.000]***	3.308852 [0.000]***
lnGDPPAR	-0.4932857 [0.004]***	-0.0396757 0.853	-0.4932857 [0.004]***
lnDIS	0.2706007 [0.34]	[omitted]	0.2706007 [0.339]
lnREER	-6.228009 [0.000]***	-5.611295 [0.000]***	-6.228009 [0.000]***
Border	0.2092852 [0.746]	[omitted]	0.2092852 [0.745]
landlocked	0.3040407 [0.521]	[omitted]	0.3040407 [0.52]
samecol	-1.126084 [0.019]***	[omitted]	-1.126084 [0.018]***
FTA	-1.338916 [0.002]	[omitted]	-1.338916 [0.002]***
Comlang	2.213567 [0.000]***	[omitted]	2.213567 [0.000]
dpeg	-0.6954636 [0.077]*	-1.498227 [0.004]***	-0.6954636 [0.076]*
DcwalPEG	-0.6722864 [0.077]*	-0.8506666 [0.038]**	-0.6722864 [0.076]*
DcrawBandmanagedfloat	-1.227255 [0.001]***	-0.9888423 [0.004]***	-1.227255 [0.000]***
Dfrelfloa	-0.6964439 [0.099]*	-0.6647388 [0.087]*	-0.6964439 [0.098]*
Dfrelfalling	0.6190094 [0.084]*	0.3106197 [0.364]	0.6190094 [0.083]*
_cons	18.41265 [0.001]***	19.53443 [0.000]***	18.41265 [0.001]***
sigma_u		1.0563395	0
sigma_e		1.4677723	1.4677723
rho		0.3412177	0
Observations	360	360	360
Number of countries	10	10	10

*Source: Author`s compilation from STATA 14 output *, **, ***Statistical significance at 10%, 5%, and 1% respectively, p- p-values are given in brackets below the coefficient.*

4.4.1 Estimation results for developing countries

The regression results highlight key drivers of South Africa's agricultural exports. South Africa's GDP (InSAGDP) has a strong and positive impact, where a 1% increase leads to a 2.71% rise in exports, underscoring the sector's central role in trade. Conversely, the partner country GDP (InGDPPART) shows a negative but insignificant effect,

which may reflect income-driven shifts away from agricultural imports in favour of services or manufacturing, as suggested by McMillan and Rodrik (2011).

The real effective exchange rate (InREER) is negatively and significantly associated with exports' 1% appreciation, which leads to a 5.66% decline, highlighting the importance of exchange rate competitiveness. This aligns with findings from Seti (2023) and others.

In the pooled and random effects models, colonial ties and FTA membership surprisingly show negative effects, possibly indicating path dependency or underperformance in established trade blocks. Common language, however, positively and significantly influences exports, supporting the role of communication efficiency in trade facilitation.

Exchange rate regimes generally exhibit negative effects. Fixed and crawling peg regimes are associated with lower export performance, likely due to reduced flexibility. The managed float has the largest negative effect, suggesting policy uncertainty. The freely falling regime shows a weak but positive effect, possibly reflecting gains from depreciation. Freely floating regimes also reduce exports, though to a lesser extent, due to volatility concerns.

4.4.2 Model estimation results: developed countries

Table 5 below presents the results of the effects of exchange rates and exchange rate regimes on agricultural output in developed countries.

Table 5: Model estimation results: developed countries

Variables	**Pooled OLS**	**Fixed**	**Random**
InSAGDP	-0.0425949	0.5508743	0.545855
	[0.86]	[0.004]***	[0.004]***
InGDPPAR	1.387913	0.6380691	0.64772
	[0.000]***	[0.002]***	[0.002]***
InDIS	-6.988445	1.910176	-0.49627
	[0.000]***	[0.472]	[0.826]
InREER	-1.25173	-1.842789	-1.82888
	[0.001]***	[0.000]***	[0.000]***
Border	-	-	-
	omitted	omitted	omitted
landlocked	-	-	-

	omitted	omitted	omitted
samecol	2.683297	-	1.117869
	[0.000]***	omitted	[0.397]
FTA	1.554613	-	1.927663
	[0.000]***	omitted	[0.081]*
Comlang	-1.091663	-	-1.99116
	[0.000]***	omitted	[0.149]
dpeg	0.0414955	-0.9001101	-0.86353
	[0.871]	[0.000]***	[0.000]***
DcwalPEG	-	-0.7041357	-0.70329
	omitted	[0.002]***	[0.002]***
managedfloat	-1.205908	0.3489524	0.306999
	[0.000]***	[0.178]	[0.231]
Dfrelfloa	0.354275	-	-
	[0.179]	omitted	omitted
Dfrelfalling	-	-	-
	omitted	omitted	omitted
_cons	71.93546	-2.636659	18.94148
	[0.000]***	[0.915]	[0.361]
sigma_u		1.8535308	1.629766
sigma_e		0.8209674	0.820967
rho		0.83599538	0.797609
Observations	396	396	396
Number of countries	11	11	11

*Source: Author`s compilation from STATA 14 output *, **, ***Statistical significance at 10%, 5%, and 1%, respectively, p- values are given in brackets below coefficient.*

4.4.2.1 Estimation results for developed countries

For developed countries, the real effective exchange rate (REER) has a consistently negative and significant effect, indicating that currency appreciation reduces agricultural output. Partner country GDP positively influences output, reflecting the benefits of higher income levels. The significance of InDIS (distance) varies, being highly negative in pooled OLS but losing significance in the fixed and random effects models. In the fixed effects model, the unexpected positive sign of the distance variable may result from the model absorbing time-invariant factors, such

as geography and infrastructure. Additionally, South Africa exports agricultural products to distant but high-income countries, such as China, Germany, the UK, and the USA, where strong demand offsets the usual trade barriers associated with distance. This suggests that economic relationships and market potential may outweigh geographic proximity. Similar findings have been reported by Shepherd (2013), Emlinger et al. (2008), and Disdier and Head (2008), particularly in agricultural trade involving high-value products.

Trade-related variables have mixed effects: FTAs boost trade, while a common language surprisingly hinders it. Pegged and crawling peg exchange rate regimes negatively impact agricultural exports, whereas managed floats show weak effects. High rho values suggest strong country-specific effects, supporting the use of fixed or random effects over pooled OLS. Overall, flexible exchange rate regimes appear more favourable for agricultural trade, especially in developed countries.

5. Conclusions and Recommendations

5.1 Conclusions

This study applied an augmented gravity model to examine the key determinants of South African agricultural exports, with particular attention to exchange rate regimes, exchange rate fluctuations, and trade-related variables. The results confirm that the economic size of both the exporter (South Africa) and its trading partners significantly boosts agricultural exports, in line with gravity model theory. Distance was found to negatively affect exports, highlighting the role of transport costs in shaping trade flows. Historical and institutional factors such as colonial ties, shared borders, and Free Trade Agreements generally had positive effects on trade. However, the impact of a common language was unexpectedly negative, suggesting that language does not always facilitate trade, and may require further investigation.

Comparative analysis between developed and developing countries revealed that the agricultural sector GDP consistently supported export growth in both groups. However, in developing countries, higher GDP in partner countries was associated with reduced exports, possibly due to market saturation or shifts in demand. This pattern was less evident in developed countries, suggesting differences in trade relationships and product specialization. In developed countries, distance was found to be positively related to exports.

Exchange rate regimes were found to play a critical role in influencing export performance. Fixed regimes, including hard pegs, had the strongest negative impact on exports, while more flexible arrangements like crawling pegs and managed floats were associated with smaller negative effects. Notably, the freely falling exchange rate regime showed a positive but weakly significant impact, indicating that currency depreciation may enhance export competitiveness under certain conditions.

Overall, the findings emphasize the importance of adopting flexible exchange rate regimes to enhance export competitiveness, especially for developing countries. They also highlight the complex role of institutional factors such as FTAs and common language in shaping trade dynamics.

5.2 Recommendations

In light of the findings, it is recommended that South Africa adopt more flexible exchange rate regimes, such as managed floats or crawling pegs, to enhance the competitiveness of its agricultural exports. Given the strong and consistent contribution of the agricultural sector to export growth, policy should also prioritize sustained investment in agricultural productivity, infrastructure, and market access. Furthermore, trade policy should focus on strengthening economic ties with high-potential export markets, particularly in developed countries, where demand for agricultural products is more stable. Finally, deepening regional integration and expanding bilateral and multilateral Free Trade Agreements, especially with countries that share historical or geographical ties, can further enhance trade flows by reducing institutional and policy barriers.

Future research should explore the impact of exchange rate regimes on specific agricultural sub-sectors using disaggregated or firm-level data. The unexpected negative effect of common language also warrants further investigation. Additionally, regional comparisons (e.g. SADC vs. ECOWAS) could offer deeper insights into integration and trade dynamics.

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