Research Article

The Effects of Currency Depreciation on Trade: The Case for SACU Countries

Journal of Contemporary Business Research
1–15

DOI: 10.1177/3049513X251401673
journals.sagepub.com/home/cbs
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Mofihli Ntsasa[1], Ojo Johnson Adelakun[1] and Mapalesa Rapapa[1]

Abstract

This study examines the effects of currency depreciation on trade in the Southern African Customs Union (SACU) countries: Botswana, Eswatini, Lesotho, Namibia and South Africa. The main research questions address how exchange rate depreciation impacts trade balances (TBs). The study fills a literature gap by focusing on the SACU region, which is underrepresented in empirical research on currency depreciation. Utilizing a pooled mean group regression model using data from 2000 to 2022, the analysis reveals that currency depreciation does not consistently improve TBs, contradicting traditional economic theories. Key findings indicate that the relationship between currency depreciation and TB is complex and context-dependent. The study contributes to the literature by highlighting the need for tailored economic policies that consider the unique socio-economic environments of SACU member states. This research underscores the potential of the African Continental Free Trade Area to aid in export diversification and industrial capacity enhancement while also recommending measures for managing exchange rate volatility through regional cooperation and prudent monetary policies.

Keywords

Currency depreciation, SACU, trade balance, pooled mean group regression, exchange rate volatility

Introduction

In recent years, global economic dynamics have been characterized by fluctuating exchange rates and currency depreciations across various regions. Financial market turbulence in 2018 illustrated that emerging market and developing economies (EMDEs) continue to face the risk of destabilizing exchange rate movements (Ha et al., 2020). Factors including monetary policy decisions, geopolitical tensions, trade imbalances and economic shocks have influenced these fluctuations.

The World Trade Organization currently notifies 16 customs unions (Stojanovic, 2020). The European Union (EU), the world's largest customs union by economic output, has maintained a stable exchange rate and trade surplus (European Union, 2020). Customs duties on goods imported into the EU constitute approximately 14% of the total EU budget as part of its traditional resources.

Figure 1 shows that the EU has maintained a trade surplus for the specified period from 2002 to 2021. This is an interesting observation given the euro's appreciation over the years.

The Southern African Customs Union (SACU), comprising Botswana, Eswatini, Lesotho, Namibia and South Africa, is the oldest customs union in the world, yet it remains underexplored in trade literature. SACU presents a unique case for studying trade dynamics due to its asymmetrical structure—South Africa dominates economic activity, while the smaller members rely heavily on SACU revenue and trade links with their larger neighbouring country (SACU, 2019). Unlike the EU, SACU members have experienced persistent trade deficits despite currency depreciations, raising questions about the effectiveness of depreciation as a tool for trade improvement.

[1] Department of Economics, National University of Lesotho, Roma, Maseru, Lesotho

Corresponding author:
Ojo Johnson Adelakun, Department of Economics, National University of Lesotho, P.O. Roma 180, Maseru, Lesotho.
E-mail: johnsonadelakun@gmail.com

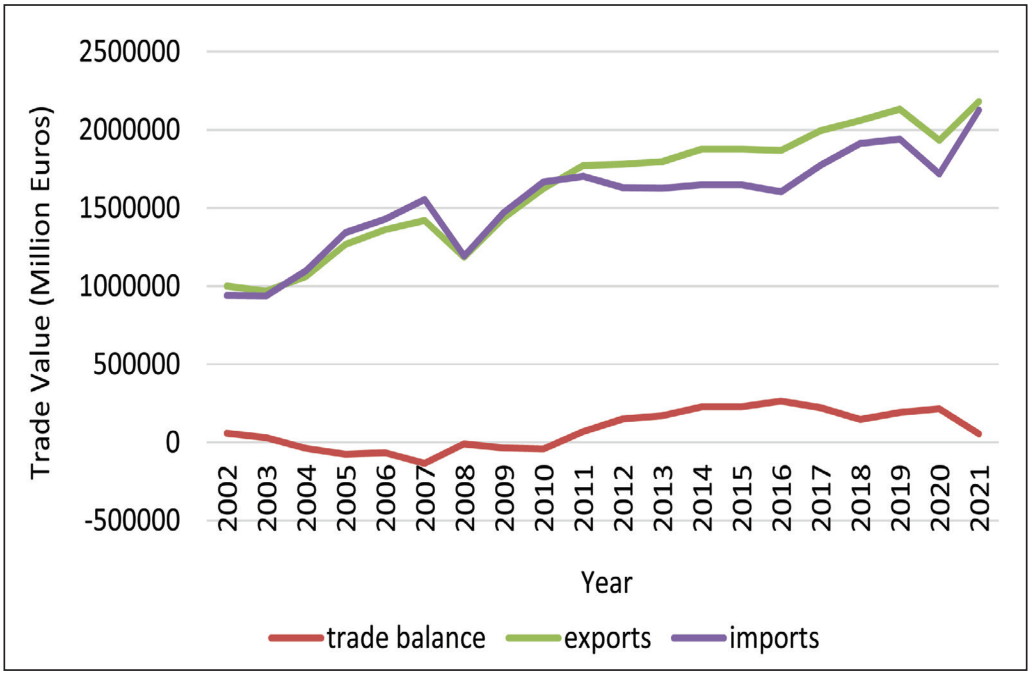

Figure 1. European Union Trade Balance.

Source: Author's computations, with data sourced from Statista (2025).

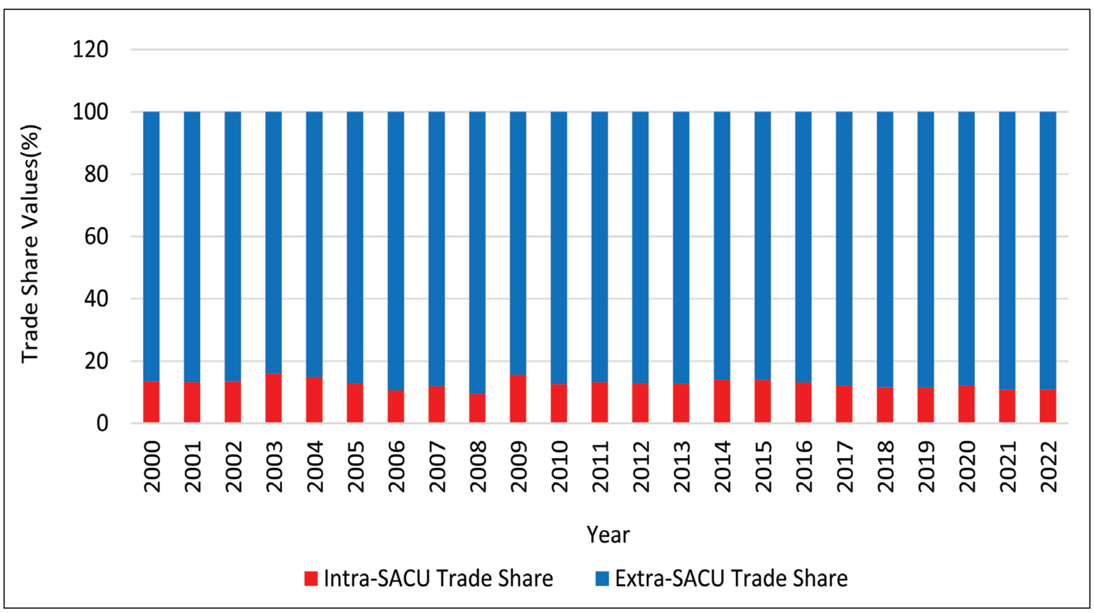

Figure 2. Share of Intra-SACU Versus Extra SACU Share of Trade.

Source: Author's computations, with data sourced from The Observatory of Economic Complexity (OEC).

Moreover, SACU's trade patterns are highly heterogeneous. While Botswana and Namibia benefit from resource-based exports (such as diamonds and minerals), Lesotho and Eswatini depend on textiles and agriculture. This diversity in economic structures suggests that exchange rate fluctuations may not have uniform effects across SACU members. Understanding how depreciation influences trade within SACU is critical for shaping policy responses tailored to these varied economies.

Currency depreciation has been a recurring phenomenon across African customs unions, influenced by factors such as commodity price fluctuations, political instability and external debt pressures (Laurent Kemoe et al., 2023). In January 2023, 29 out of 36 African currencies analyzed depreciated relative to the USD (African Development Bank, 2023). SACU nations have not been exempted from this trend.

Figure 2 shows that intra-SACU trade is a small fraction compared to extra-SACU trade, indicating that SACU countries are more dependent on external markets. This is due to factors such as limited product diversification and stronger trade links with larger economies, especially South Africa. The dominance of extra-SACU trade suggests that currency depreciation likely affects external trade more than regional trade, highlighting the need for policies that foster stronger intra-SACU trade.

Figure 2 highlights the relatively small share of intra-SACU trade compared to extra-SACU trade, underscoring the region's reliance on external markets. This trend reflects structural trade patterns, where SACU countries engage more with global markets than with each other.

Given South Africa's dominant role in SACU trade, we present two perspectives on the trade balance (TB) to better contextualize the region's trade performance. Figure 3 includes South Africa, reflecting the overall regional TB, while Figure 4 excludes South Africa to highlight the trade patterns of the smaller SACU economies. These figures illustrate TB trends from 1980 to 2021, showing that while Botswana has occasionally maintained trade surpluses due to diamond exports, South Africa and Lesotho have struggled with persistent deficits. The trade imbalances suggest

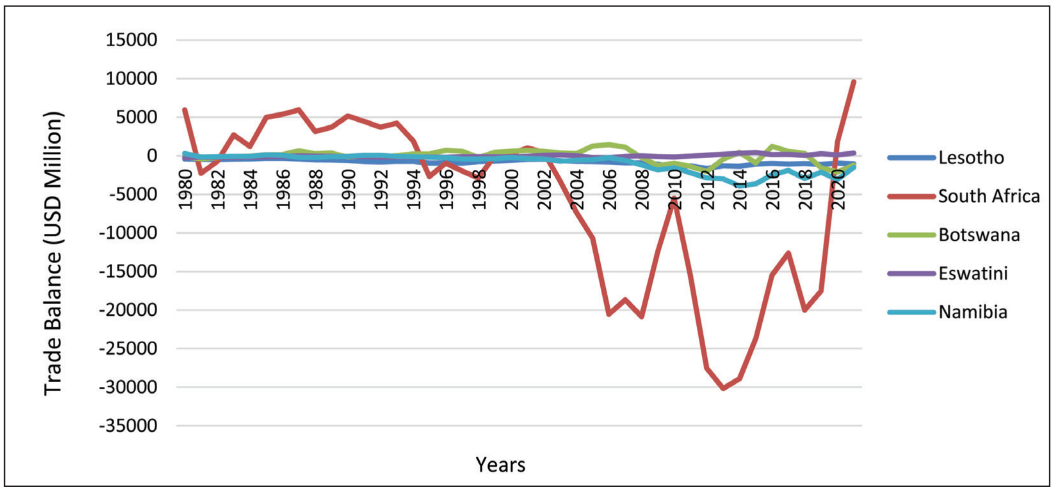

Figure 3. Trade Balance of SACU Countries (Including South Africa).

Source: Author's computations, with data sourced from OEC.
Note: The figure shows the overall trade balance for the SACU region, including South Africa, the largest economy in the union. of SACU (Excluding South Africa).

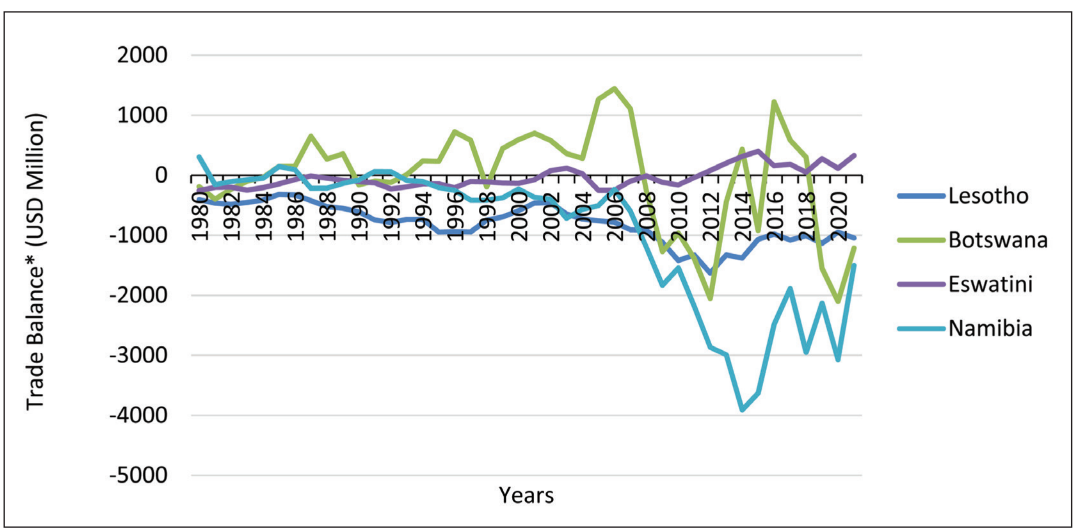

Figure 4. Trade Balance of SACU Countries (Excluding South Africa).

Source: Author's computations, with data sourced from OEC (available at: https://oec.world/en/profile/country/lso).
Note: To highlight the trade balance of smaller SACU member states, the figure presents the trade balance without South Africa.

that currency depreciation alone has not been sufficient to boost exports and improve TBs in SACU.

Furthermore, additional descriptive statistics on import and export trends, key trading partners and trade by sector are presented in Table 3 (Chapter 4). These statistics provide a clearer picture of SACU's external trade relationships. South Africa, as the regional economic hub, engages in diverse trade with China, the EU and the USA, while Botswana and Namibia depend heavily on commodity exports. In contrast, Lesotho's trade is dominated by textile exports to the USA under the African Growth and Opportunity Act (AGOA). The sectoral composition of trade within SACU underscores the need for a differentiated analysis of currency depreciation impacts.

Against this background, this study aims to assess the impact of currency depreciation on trade within the SACU region. Specifically, it investigates how exchange rate depreciation affects the TB of SACU member countries. The study addresses the following research question: How does exchange rate depreciation influence the overall TB of SACU member countries?

While much research on currency depreciation and trade focuses on large economies, there is limited empirical evidence on smaller, economically integrated regions like SACU. Given its reliance on a dominant member (South Africa) and significant intra-regional trade, SACU provides an ideal setting to examine how depreciation interacts with regional trade imbalances. This study aims to bridge this gap by employing a quantitative approach to evaluate the effects of currency fluctuations on SACU's trade competitiveness.

The findings will contribute to the broader literature on international trade and regional integration by highlighting the unique challenges faced by small customs unions. Policymakers in SACU member states can utilize these insights to design strategies that mitigate the adverse effects of currency volatility, ensuring that depreciation translates into tangible trade benefits. Additionally, businesses operating within SACU can use these findings to navigate exchange rate risks effectively, fostering economic stability and growth.

The remainder of this study is structured as follows: Section 2 provides a comprehensive literature review, covering theoretical and empirical research on exchange rates, trade and customs unions. Section 3 details the research methodology, including model specification and data sources. Section 4 presents empirical results and discusses their implications. Finally, Section 5 concludes with policy recommendations based on the study's findings.

Literature Review

Various studies have been carried out to explain the effect of exchange rates on the TB of both developed and developing countries. Studies show mixed results, implying the uniqueness of each study conducted for a particular country or region. Some studies have shown that there is a significant effect of exchange rates on TB, while others have found the opposite.

In recent years, there has been a growing body of literature examining the effects of currency depreciation on TBs in various regions and countries. The SACU region, comprised of Botswana, Namibia, Swaziland, Lesotho and South Africa, presents an interesting case for studying these effects due to its unique economic dynamics and trade relationships. However, while several studies have explored the impact of currency depreciation on TBs, there are notable weaknesses and critiques in the existing literature.

Izotov (2015) explored the impact of the Renminbi (RMB) appreciation on Russian-Chinese trade using regression analysis. The study found that RMB appreciation negatively affected Chinese imports and positively impacted Russian exports, particularly for commodity groups with insignificant shares in total bilateral trade. However, for major commodity groups, RMB appreciation had weak negative effects on Chinese exports to Russia and weak positive effects on Russian exports to China. Overall, RMB appreciation was projected to increase Russian exports to China and decrease Chinese imports to Russia without significant changes in the commodity structure of bilateral trade.

Işik et al. (2019) investigated the impact of exchange rate fluctuations on the tourism TB between Spain and Turkey using a non-linear ARDL cointegration approach. The study found that euro depreciation positively influenced tourist arrivals from Turkey, while euro appreciation had no significant effect on Spain's tourism balance. Based on these findings, the study proposed policy recommendations to leverage exchange rate dynamics to boost tourism and enhance TB in the tourism sector between Spain and Turkey.

Lucarelli et al. (2018) analyzed the impact of euro depreciation on trade between Germany, Italy and the USA at the industry level. The study found evidence of a J-curve pattern, indicating initial deterioration followed by long-run improvement in TBs. The findings highlighted the industry-specific effects of currency depreciation on trade dynamics.

Doojav (2018) explored the effect of real exchange rate depreciation on TB in Mongolia, a resource-rich developing country. Using a vector error correction model (VECM), the study found that exchange rate depreciation improves TB in both the short and long run. Specifically, the study observed the fulfilment of the Marshall–Lerner condition in the long run but found no evidence of classic J-curve effects in the short run. The results suggest that exchange rate flexibility may help address current account deficits and exchange rate risk in resource-rich economies like Mongolia. However, the study's focus on a single country and its specific characteristics may limit the generalizability of its findings to other regions or economies within the SACU context.

Kumar et al. (2020) focused on the impact of currency depreciation on exports in SAARC countries, including Bangladesh, India, Pakistan and Sri Lanka. Employing panel ARDL and ECM techniques, the study examined the relationship between currency depreciation and exports from 1981 to 2017. The findings suggest an inverse association between currency depreciation and exports in the long run, with significant short-run implications. The study highlights factors such as the inelastic nature of exportable products, lack of market diversification and limited regional integration among SAARC economies, which restrict the benefits of currency depreciation on exports. While the study provides valuable insights into the challenges faced by SAARC countries in enhancing export competitiveness, it may overlook certain country-specific factors and structural constraints influencing export dynamics.

An investigation by Bhat and Bhat (2021) offers insights into the asymmetric impact of exchange rate changes on India's TB, utilizing an asymmetric non-linear cointegration approach. The study challenges conventional notions of the J-curve phenomenon, particularly in the Indian context. It suggests that in the short run, currency appreciation deteriorates the TB while depreciation improves it. However, in the long run, only the impact of currency depreciation is statistically significant. This study provides valuable insights into the nuanced relationship between exchange rate changes and TB, especially in emerging economies like India. However, it may overlook certain structural factors that could influence trade dynamics, such as trade policies, institutional frameworks and global economic conditions.

Mhaka et al. (2020) examined industry-level evidence of J-curve effects in the SACU region. By disaggregating trade activity at an industry level for 19 trade products, the researchers determined whether industries benefit or are disadvantaged during periods of currency depreciation over the short and long run. The study found that exchange rate depreciations would be beneficial in 8 out of the 19 trade industries in the SACU region while harming the remaining 11 industries. In the strict theoretical sense, the study only found J-curve effects in 6 of the 19 industries in which exchange depreciation initially hurt TBs and then 'adjusted' toward positive long-run effects. However, a weakness in this study lies in its reliance on panel regression specifications, which may not adequately capture the complex interactions and heterogeneity across industries. Additionally, while the study offers insights into potential policy implications, it may overlook broader structural factors influencing trade dynamics in the SACU region, such as institutional frameworks and regional integration efforts.

Haansende and Nyambe (2020) focused on analyzing the relationship between exchange rate volatility and TB in selected SACU member states, including Botswana, Namibia, Swaziland and South Africa. Employing time series data from 1986 to 2016, the study utilizes the generalized autoregressive conditional heteroscedasticity (GARCH) model, impulse response functions and variance decompositions for analysis. While the study identifies a short-run relationship between exchange rate volatility and TB, it faces criticism for its limited scope, focusing solely on exchange rate volatility without considering other macroeconomic factors that could influence trade dynamics. Furthermore, the study's recommendations for central bank intervention to mitigate exchange rate volatility may overlook broader structural issues affecting trade competitiveness within the SACU region.

This literature review provides a comprehensive overview of studies investigating the relationship between currency depreciation/appreciation and TBs across various regions and industries. Methodologically, the reviewed studies employed a range of quantitative techniques including regression analysis, ARDL models, VECM and GARCH models to analyze the impacts of exchange rate movements on TBs. Key findings from these studies include mixed effects of currency depreciation/appreciation on TBs, with factors such as import content of exports, productivity dynamics and industry-level effects playing significant roles. Weaknesses identified in some studies include limited sample sizes, potential data limitations and varying degrees of generalizability due to specific regional or industry contexts.

Some of the existing research studies provide valuable insights into the relationship between exchange rate movements and TBs in the SACU region. Mhaka et al. (2020) focused on industry-level evidence of J-curve effects, investigating how currency depreciation affects TBs across various sectors within SACU countries. They employed panel regression techniques to analyze the short- and long-term effects of exchange rate movements on TBs for different industries. On the other hand, the study by Haansende and Nyambe (2020) examined exchange rate volatility and its impact on TBs in SACU countries, utilizing time series data and employing the GARCH model.

However, there remains a notable gap in the literature regarding the comprehensive analysis of the effects of currency depreciation specifically on TBs in SACU countries. While both Mhaka et al. (2020) and Haansende and Nyambe (2020) touched upon aspects related to exchange rate dynamics and TBs, a focused investigation into the direct effects of currency depreciation on TBs is lacking. Specifically, the existing studies do not provide a thorough exploration of how currency depreciation, as opposed to general exchange rate movements or volatility, influences TBs at both the industry and aggregate levels within the SACU region.

Methods

Data

This study utilizes a panel dataset covering the period from 2000 to 2022 for the five SACU countries: Lesotho, Botswana, Eswatini, South Africa and Namibia. The timeframe was chosen primarily due to the availability and consistency of the required data starting from the year 2000.

Table 1 provides a quick glimpse of the notation, measures and data sources of the selected variables of the model.

Hypothesis

This study examines the relationship between exchange rate movements and TB within SACU. The primary hypothesis is:

H_1: A depreciation in the real effective exchange rate improves the TB in SACU countries.

Theoretical Framework

The model to be employed will adhere to a direct formulation outlined in the research of Buluswar et al. (1996). Several important factors influencing the imports, exports and TB in an economy will be considered as identified by economic theory. In this context, the TB of an economy is defined as the difference between export revenue (*X*) and import revenue (*M*), thus, the TB of SACU is articulated as follows:

$$TB = X - M = P_X\, Q_X(P_X, e, Y*) - eP_m^*\, Q_M(eP_m^* *, Y) \quad (1)$$

Where TB represents TB, *X* is export revenue, *M* is import expenditure, P_X is the SACU price of exports, Q_x is the quantity of exports, P_m^* is the foreign currency price of imports, Q_M is the quantity of imports, *e* is the value of foreign currency in terms of SACU Currency, *Y* is the domestic national income, y^* is foreign income.

The Two-country Imperfect Substitute Model

The two-country imperfect substitute model, developed by Rose and Yellen (1989), illuminates the connection between real exchange rates and TB in both the short and long term. According to this model, a depreciation of the real exchange rate enhances the TB. It assumes the absence of perfect substitutes for locally produced goods and services in both imports and exports, alongside positive price elasticities of demand and domestic and foreign income elasticities. Foreign income and the real exchange rate are found to positively influence the TB, while domestic income has a negative impact. The model's reduced form equation, linking the TB to the real exchange rate (RER), domestic income (*Y*) and foreign income (Y^*), is:

$$TB = F(RER, Y - Y^*) \quad (2)$$

Despite its advantages, such as simplicity and independence from structural parameters, the model incorporates variables from other models and is therefore not entirely standalone. Nevertheless, it remains a valuable tool in analysing trade dynamics. Studies by various authors, including Bahmani-Oskooee and Ratha (2004) and Arize (1994), have yielded differing conclusions regarding the long-run relationship between exchange rates and TB when employing this model. Rose (1991) and Rose and Yellen (1989) observed insignificant effects of exchange rates on TB within this framework (Ali et al., 2016).

Table 1. Description of the Variables and Data Sources.

Variable	Notation	Measure	Data Source
Trade balance	TB	Annual trade difference between exports and imports (current USD)	The Observatory of Economic Complexity (OEC)
Real effective exchange rate	REER	weighted averages of bilateral exchange rates adjusted by relative consumer prices index (CPI).[a]	FRED
Gross capital formation	GCF	The annual growth in the gross net investment in fixed capital assets by enterprises, government and household (% GDP)	World Development Indicator
Inflation	INF	Inflation, GDP deflator annual percentage growth (%)	World Development Indicator
Trade openness	TO	The sum of exports and imports of goods and services measured as a share of the GDP (% GDP)	World Development Indicator
GDP per capita of trading partner	GDPPCTP	Top 5 of SACU member trading partner's average GDP per capita over the years (weighted average)	World Integrated Trading Solutions (WITS)

Note: [a]While CPI-based REER does not directly reflect trade basket prices, it remains a useful proxy as it captures overall cost competitiveness and macroeconomic conditions influencing trade. Due to data constraints, a trade-weighted price index could not be included, but future research may refine this approach.

Table 1. Overall SACU Trade Summary (in Billion USD).

Variable	Obs	Mean	*SD*	Min	Max
Exports	115	20.7	37.6	0.175	147
Imports	115	18.4	32.6	0.336	119
Trade balance	115	1.65	7.48	–16	45.8
GDP	115	71.2	136	0.776	458

Source: Author's computation using OEC data.

Estimation Strategy

Traditional estimation techniques such as fixed effects (FE) and random effects (RE), as well as generalized method of moments (GMM) have been widely used in the estimation of panel data. The main critique of these conventional techniques is that they do not consider heterogeneity, an inherent issue in panel data analysis application. Furthermore, as argued by Kruiniger (2009), these techniques only permit the changes in the cross-sectional units' intercepts. It is also imperative to note that cross-sectional dependence is of greater concern to modern researchers worldwide.

In this research, the time dimension is much greater than the cross-sectional dimension (22 years versus 5 countries) and the dynamic mean group estimators (DMG: average mean group [AMG] and pooled mean group [PMG]) are well suited for these situations.

Equation 3 illustrates the model with a homogenous slope coefficient while Equation 4 demonstrates the panel model with a heterogeneous slope coefficient. Equation 4 demonstrates a panel model with a heterogeneous slope coefficient.

$$Y_{it} = a1_0 + \beta 1X1_{it} + \beta 2X2_{it} + \beta 3X3_{it} + \varepsilon_{it} \quad (3)$$

$$Y_{it} = a2_0 + B1_I X1_{it} + B2_I X2_{it} + B3_I X3_{it} + v_{it} \quad (4)$$

Where i = Cross-section, t = Time series, y = Dependent variable, x = Independent variable. If Equation 3 holds, the panel model is estimated using conventional panel model techniques such as FE, RE or GMM. Conversely, if Equation 4 is valid, the panel model can be estimated using methodologies like PMG or DMG. Nonetheless, model estimation with heterogeneous slope coefficients is often preferred in empirical research due to its greater consistency and alignment with economic realities (Fazli & Abbasi, 2018).

Equation 5 presents the DMG estimators with panel ARDL (p, q_1, q_2, q_3, ... q_n)

$$Y_{it} = \sum\nolimits_{j=1}^{p} \gamma_{ij} y_{i,t-j} + \sum\nolimits_{j=0}^{q} \delta_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

Where, Y_{it} = The dependent variable for Group 1

x_{ij} = A vector of the independent variable of Group 1
δ_{ij} = Vector of coefficients
I = 1,2,3, …, N(Groups)
T = 1, 2, 3 …, T(Time)

However, it is more appropriate to estimate the model with the re-parameterization of Equation 5. The analysis employs structured co-integration within the DMG framework to derive long- and short-run estimates. The selection between DMG variants, namely AMG and PMG, is determined through the Hausman test.

The PMG estimation assumes that error terms are independent and not serially correlated with explanatory variables (exogenous). Another crucial assumption of PMG is the existence of a long-term relationship between variables (both endogenous and exogenous). Additionally, PMG assumes that the parameters of the long run are consistent across different cross-sections, although they may vary in the short run. The PMG estimator also offers flexibility by allowing homogeneity in long-run coefficients across subgroups of countries or variables. Thus, employing this estimation approach can help mitigate conventional estimation challenges.

$$\Delta Y_{it} = (\varphi_i Y_{i,t-1} B_1^{'} X_{it}) + \sum\nolimits_{j=1}^{p-1} \lambda_{ij}^{*} \Delta Y_{i,t-1} + \sum\nolimits_{j=0}^{q-1} \delta_{ij}^{'*} \Delta X_{i,t-j} + \mu_i + \epsilon_i \quad (6)$$

The error correction from PMG is estimated as follows:

$$\Delta Y_{it} = \varnothing_i (Y_{i,t-1} - \vartheta_1^{'} X_{it}) + \sum\nolimits_{j=1}^{p-1} \lambda_{ij}^{*} \Delta Y_{i,t-1} + \sum\nolimits_{j=0}^{q-1} \delta_{ij}^{'*} \Delta X_{i,t-j} + \mu_i + \epsilon_i \quad (7)$$

The parameter ϕ_i represents the speed of adjustment term for error correction. A value of ϕ_i closer to zero suggests no evidence for a long-run relationship. It is anticipated that this parameter will be significantly negative under the assumption that variables return to a long-run equilibrium. Of particular significance is the vector ϑ', which encompasses the long-run relationships between the variables.

Model Specification

The generalized ARDL (p, q) model is specified as:

$$y_{it} = \sum\nolimits_{j=1}^{p} \delta_i Y_{I,\,y-j} + \sum\nolimits_{i=0}^{q} B'_{ij} X_{i,\,t-j} + \varphi_i + \varepsilon_{it} \quad (8)$$

In Equation 8, Y_{it} represents a vector of dependent variables and (X_{it}) denotes a K*1 vector of explanatory variables, such as real effective exchange rate (REER), gross capital formation (GCF), inflation (INF) and trade openness (TO). These explanatory variables are allowed to exhibit different degrees of stationarity, ranging from purely I(0) to I(1), or they may be co-integrated. δ_i represents the coefficient of the lagged dependent variable, often referred to as scalars. β'_{ij} represents 1*k coefficient vectors capturing the relationship between the explanatory variables and the dependent variable. φ_i denotes unit root-specific FEs. The index I range from 1 to N, representing the cross-sectional units, while t ranges from 1 to T, representing time. p and q represent the optimal lag orders. ε_{it} is the error term.

The study starts by assuming the following long-run relationship for trade measures:

$$Y_{it} = \theta_{0i} + B1_{1i}\,REER_{it} + B2_{2i}\,GCF_{it} + B3_{3i}\,INF_{it} + B4_{4i}\,X_{it}^{4} + B5_{Ri}\,X_{it}^{R} + v_{it} \quad (9)$$

The starting point will then be the following ARDL specification in its error correction form:

$$\Delta trade_{it} = \varnothing_i (trade_{i,\,t-1} - \vartheta_1' X_{it}) + \sum\nolimits_{j=1}^{p-1} \lambda_{ij}^{*} \Delta\, trade_{i,\,t-1} + \sum\nolimits_{j=0}^{q-1} \delta_{ij}^{\prime *} \Delta\, X_{i,\,t-j} + \mu_i + \epsilon_i \quad (10)$$

Results and Discussion

SADC Descriptive Statistics

We now proceed to our results, beginning with the descriptive statistics for the overall SACU trade and SACU trade by sector. Following this, we present the summary statistics and delve into the correlation analysis to explore the relationships between key variables. The subsequent sections include Pesaran's CD-test for cross-sectional dependence and the unit root results, essential for understanding the stationarity of our data. We then discuss the co-integration results, providing insights into the long-term relationships among the variables, followed by the results of the Hausman test to determine the appropriate model specification. Next, we present the optimal lag selection criteria, leading to the PMG regression results, which are central to our analysis of the effects of currency devaluation on trade. We conclude with a discussion of the diagnostic tests to ensure the robustness and reliability of our findings.

Table 2 provides a general overview of SACU's trade performance, including exports, imports, TB and GDP. The results indicate that exports exceed imports on average, leading to a positive TB, though with some fluctuations. The high standard deviations suggest significant trade variations across SACU countries, likely influenced by country-specific economic structures and trade policies.

Table 3 disaggregates SACU trade into commodities, manufacturing and services sectors. Commodity trade dominates, reflecting SACU's reliance on primary exports. Manufacturing trade shows a trade deficit, suggesting dependence on imported industrial goods. The services sector also exhibits a trade deficit, though smaller in magnitude, highlighting structural weaknesses in service exports.

Summary Statistics

Table 4 provides an overview of the six key variables relevant to the analysis of the effects of currency depreciation on trade. The significant variability in the TB among SACU countries, with a mean of 0.39 and a standard deviation of 20.73, may be indicative of short-term adjustments post-currency depreciation, as described by the J-curve effect (Krugman & Obstfeld, 2003). According to Menyah et al. (2014), similar volatility in TBs was observed in other developing countries undergoing exchange rate adjustments, highlighting the role of price elasticity in determining the impact on trade. The Marshall–Lerner condition suggests that for SACU countries, the sum of price elasticities might be low, explaining the observed fluctuations (Krugman et al., 2018).

Table 2. SACU Trade by Sector (in Billion USD).

Sector	Obs	Mean	*SD*	Min	Max
Commodities exports	115	14.5	27.7	0.025	124
Commodities imports	115	6.62	11.8	0.099	49.9
Commodities trade balance	115	7.88	16.9	–1.15	80.9
Manufacturing exports	115	7.26	13	0.151	41.7
Manufacturing imports	115	11.5	20.2	0.243	67.1
Manufacturing trade balance	115	–4.27	7.37	–28.3	2.14
Services exports	115	2.88	5.36	0.013	17.9
Services imports	115	3.28	5.85	0.188	20.6
Services trade balance	115	–0.399	0.869	–5.52	0.616

Source: Author's computation using OEC data.

Table 3. Descriptive Statistics

Variable	Obs	Mean	*SD*	Min	Max
Ln TB	115	.394	20.73	–23.50	24.55
Ln REER	115	4.51	.13	4.26	4.96
Ln GCF	115	3.06	.33	2.47	3.72
Ln INF	115	–2.64	1.22	–3.97	4.97
Ln TO	115	4.55	.38	3.82	5.35
Ln GDPPCTP	115	8.1	.62	6.46	9.01

Source: Author's computation using World Bank data.

Table 4. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Ln TB	1.000					
(2) Ln REER	–0.209*	1.000				
	(0.025)					
(3) Ln GCF	–0.567*	0.200*	1.000			
	(0.000)	(0.032)				
(4) Ln INF	–0.045	0.178	0.188*	1.000		
	(0.636)	(0.057)	(0.044)			
(5) Ln TO	–0.400*	0.272*	0.526*	0.148	1.000	
	(0.000)	(0.003)	(0.000)	(0.113)		
(6) Ln GDPPCTP	–0.332*	0.132	0.589*	0.052	0.091	1.000
	(0.000)	(0.159)	(0.000)	(0.581)	(0.336)	

Source: Author's computation using World Bank Development indicators.
Note: ****p* value < .01; ***p* value < .05; **p* value < .1.

Table 5. Hausman (1978) Specification Test Between DFE and PMG.

	Coef.
Chi-square test value	0.10
p value	.9999

Correlation Analysis

Table 5 shows the correlation matrix that demonstrates the linear relationships and strengths among variables. The regressors are not linearly dependent on one another, indicating no perfect linear relationships among the variables. From the correlation analysis, TB has a weak negative correlation with the REER (–0.209, $p = .025$), GCF (–0.567, $p < .001$), TO (–0.400, $p < .001$) and GDP per capita for partner countries (–0.332, $p < .001$). GCF is positively correlated with the log of the REER (0.200, $p = .032$) and INF (0.188, $p = .044$). TO shows significant positive correlations with both REERs (0.272, $p = .003$) and GCF (0.526, $p < .001$). There is no evidence of multicollinearity between the variables since the highest (absolute) correlation is between GCF and GDP per capita for partner countries (0.589). Following the correlation analysis, the study does not drop any variables since there is no evidence of perfect collinearity. These correlations underscore the interconnectedness of trade policies, investment levels and economic conditions within the SACU countries.

Pesaran's CD-test for Cross-sectional Dependence, Unit Root Results and Co-integration Results

The results in Table A1, based on the Pesaran CD test, indicate significant cross-sectional dependence for trade balance (Ln TB) and real effective exchange rate (Ln REER), at the 1% level, suggesting that shocks to these variables in one cross-section affect others. Conversely, Ln GCF, Ln INF, Ln TO and Ln GDPPCTP do not exhibit significant cross-sectional dependence, as their Pesaran CD test results are not statistically significant. This implies that Ln GCF, Ln INF, Ln TO and Ln GDPPCTP are less influenced by cross-sectional shocks compared to Ln TB and Ln REER.

Table A2 presents the results of various unit root tests, revealing different levels of stationarity across the variables. First-generation tests indicate that gross capital formation (Ln GCF) and inflation (Ln INF) are stationary at both levels and first differences, while trade openness (Ln TO) is only stationary at first difference. GDP per capita of trading partners (Ln GDPPCTP) is significant at both levels and first difference. Second-generation tests, which account for cross-sectional dependence, show that Ln TB and Ln REER are stationary at both levels and first differences. These results highlight the importance of considering cross-sectional dependence when assessing stationarity in panel data.

The cointegration results in Tables A3 and A4 reveal long-term equilibrium relationships among the variables.

First-generation tests, such as the Augmented Dickey–Fuller *t*-test, consistently indicate cointegration at the 5% level, with *p* values below 0.05. Second-generation tests show mixed results; while the Pa and Pt statistics indicate cointegration at the 1% and 5% levels, the Gt and Ga statistics do not support this conclusion. The evidence suggests that despite cross-sectional dependence, a long-term equilibrium relationship exists among the variables, providing a robust basis for further econometric analysis.

Results of the Hausman Test and Optimal Lag Selection

The acceptance of the alternative hypothesis in Table 6 allows the employment of the PMG-ARDL technique. Thus, the result of the Hausman test allows us to estimate the dynamics of the main model (Fazli & Abbasi, 2018).

The optimal lag lengths in Table 7 were selected using the Schwarz Bayesian Information Criterion (BIC), which is the default criterion in Stata. BIC is known for favouring more parsimonious models by imposing a larger penalty for additional parameters, leading to a model that balances the goodness of fit and model simplicity. The optimal lag lengths are (1 0 0 0 1 0) for the TB, REER, GCF, INF, TO and GDP per capita of trading partners, respectively.

Pooled Mean Group Regression Results

The negative and statistically significant coefficient of the REER suggests that, in the long run, an increase in the REER is associated with a deterioration in the TB. This implies that currency depreciation negatively impacts the TB in the SACU countries within the sample period. These results align with previous studies, such as those of Kofoworade (2023) and Phan and Jeong (2015).

The negative and statistically significant coefficient for GCF indicates that higher GCF is associated with a lower TB. This relationship is likely due to the increased imports of capital goods that often accompany higher levels of capital formation, leading to a deterioration in the TB. These results are consistent with the findings of Abille and Meçik (2023), who also identified a negative impact of increased domestic economic activity on TBs, albeit through the domestic income variable rather than capital formation directly. Both studies highlight that higher domestic economic activity, whether through increased income or capital formation, tends to boost imports, thereby negatively affecting the TB.

The positive and statistically significant coefficient for INF suggests that higher INF is associated with an improvement in the TB. These results align with previous studies, such as those of Yiheyis and Musila (2018), who show that an increase in relative income and a real depreciation are both found to be inflationary and statistically significant in the long run (Yiheyis & Musila, 2018).

The positive and statistically significant coefficient for TO suggests that increased TO substantially boosts the TB. Specifically, greater integration into the global economy enhances export performance and trade dynamics in SACU countries. These findings align with the studies of Baharin and Guangqin (2023) which also observed that higher TO positively impacts the TB. The rationale behind this relationship is that greater openness allows countries to exploit their comparative advantages more effectively, thereby increasing export volumes and improving the TB. Furthermore, increased TO often leads to better access to larger markets, advanced technologies and investment opportunities, all of which contribute to a healthier TB.

Table 6. Optimal Lag Selection.

Variables	Lag
Ln TB	1
Ln REER	0
Ln GCF	0
Ln INF	0
Ln TO	1
Ln GDPPC-trading partner	0

Table 7. Long-run Estimates.[a]

Dependent variable: d (log of trade balance)
Estimated model: f[Ln (REER), Ln(inflation), Ln(GCF)]
Model selection method: Schwarz BIC
Selected Lag Length: (1 0 0 0 1 0) Variables

Variables	Coefficients	*SE*	*Z*-statistic	Prob.
Ln REER	–63.219**	24.625	–2.57	0.010
Ln GCF	–64.509***	18.545	–3.48	0.001
Ln INF	6.112**	2.795	–2.19	0.029
Ln TO	48.895***	17.019	2.87	0.004
Ln GDPPCTP	6.520	5.632	1.16	0.247

Note: [a]In our estimation, we distinguish between short-term and long-term effects of exchange rate changes on trade balance. Short-term effects capture the immediate response of trade balance to REER fluctuations, accounting for market rigidities such as contractual obligations and adjustment delays. In contrast, long-term estimates reflect the equilibrium effects once economic agents fully adjust to exchange rate changes, incorporating structural shifts in trade patterns and policy responses.

Table 8. Short-run Estimates.

Dependent variable: d (log of trade balance) Estimated model: f [Ln (REER), Ln(inflation), Ln (GCF)] Model selection method: Schwarz BIC Selected Lag Length: (1 0 0 0 1 0) Variables				
Variables	Coefficients	*SE*	*Z*-statistic	Prob.
ECT	–0.558***	.1598	–3.49	0.000
Ln REER				
D1.	–0.697	19.020	–0.04	0.971
Ln GCF				
D1.	20.579	18.534	1.11	0.267
Ln INF				
D1.	–0.931	3.482	–0.27	0.789
Ln TO				
D1	–23.429	22.266	–1.05	0.293
Ln GDPPCTP				
D1	16.570*	7.781	2.13	0.033
Constant	128.342***	35.806	3.58	0.000

Source: Author's computation using World Bank Development indicators.
Note: ***, and * indicate significance levels at 1%, 5% and 10%, respectively.

Table 9. Sector Specific Analysis Results.

Sector	Impact of REER (Long Run)	Short-run Adjustment (ECT)	Interpretation
Commodities	Negative (–13.11, *p* = .092)	Moderate (–0.68, *p* = .021)	Depreciation weakly worsens the commodity trade balance, with a moderate speed of adjustment.
Manufacturing	Positive (0.26, *p* = .642)	Fast (–0.85, *p* = .000)	Depreciation has an insignificant long-run effect but the sector adjusts quickly to shocks.
Services	Positive (0.29, *p* = .968)	Slow (–0.81, *p* = .119)	Weak impact in the long run; services take longer to adjust.

The positive coefficient for the GDPPCTPs suggests that higher GDPPCTPs is associated with an improvement in the TB. However, the high *p* value indicates that this relationship is not statistically significant, implying that changes in the GDPPCTPs do not have a substantial impact on the TB in the SACU countries within the sample period (Table 8).

Table 9 presents the short-run coefficients of the panel model. The error correction term (ECT) is highly significant (*p* = .000) and negative (–0.5576339), indicating a strong adjustment mechanism where deviations from the long-run equilibrium in the TB are corrected at a rate of approximately 56% per period. The estimated model, selected using the Schwarz BIC with a lag structure of (1 0 0 0 1 0), assesses the first difference of the log of TB.

The short-run coefficients for Ln REER,[1] Ln GCF, Ln INF and Ln TO are not statistically significant, implying that exchange rate fluctuations, investment, INF and TO do not exert an immediate effect on the TB. However, Ln GDPPCTP (D1) is significant at the 10% level (*p* = .033), suggesting a positive short-term impact of trading partner GDP per capita on TB. Additionally, the constant term is significant (*p* = .000), indicating a substantial base level of TB.

Sector-specific Analysis of the Impact of Currency Depreciation on Trade Balance in SACU Countries

The heterogeneity in SACU's trade structure necessitates a sector-specific analysis of exchange rate effects. The results indicate that REER has a weak negative impact on the commodity TB (–13.11, *p* = .092), suggesting that depreciation does not significantly enhance trade performance in resource-exporting countries such as Botswana and Namibia. In manufacturing, the long-run effect of REER is insignificant (0.26, *p* = .642), while the services sector also shows a weak response (0.29, *p* = .968). These findings suggest that exchange rate policy alone is not a key driver of trade performance across sectors, highlighting the need for targeted trade strategies beyond currency adjustments.

Comparative Results: Including Versus Excluding South Africa

Excluding South Africa weakens the REER effect on TB (–63.22 to 1.21), suggesting that SA largely drives SACU's overall trade response (Table 10).

Table 10. Comparative Results.

Variable	With SA (*p* Value)	Without SA (*p* Value)
REER (long run)	–63.22 (.010)	1.21 (.066)
Trade openness	48.90 (.004)	3.17 (.000)
ECT (speed of adjustment)	–0.56 (.000)	–0.84 (.000)

Diagnostic Test

The diagnostic test results reveal that the Breusch–Pagan test indicates homoscedasticity of the residuals (chi^2 = 0.48, p = .489). The VIF results show low to moderate correlations among predictor variables, with a mean VIF of 1.58, suggesting multicollinearity is not a significant issue. The CUSUM and CUSUM of squares tests confirm that the Panel ARDL model is stable within the 5% significance threshold.

Conclusions, Policy Recommendations and Areas for Further Research

Conclusion

This study aimed to assess the impact of currency depreciation on trade within the SACU. It analyzed the relationship between exchange rate fluctuations and TBs, focusing on how currency depreciation affects export competitiveness, import costs and overall economic stability. The study utilized various theoretical frameworks, including the elasticities approach, the Marshall–Lerner condition and the J-curve phenomenon, to understand the complex interplay between currency depreciation and trade dynamics.

The findings indicate that currency depreciation in SACU countries does not consistently lead to improved TBs. Despite the theoretical expectation that depreciation makes exports more competitive, the empirical evidence shows that SACU countries often experience persistent trade deficits. Factors such as the inelastic nature of demand for certain goods, the complexities of global value chains and the volatility of revenue streams from the SACU common revenue pool contribute to these outcomes.

Furthermore, the socio-economic context of SACU countries, characterized by high-income inequality and unemployment rates, adds complexity to the relationship between currency depreciation and trade. While currency depreciation theoretically enhances export competitiveness, its impact on broader socio-economic indicators, including employment and income distribution, must be carefully considered.

Policy Implications

Based on the findings of this study, several key policy recommendations for SACU member countries emerge. First, diversifying the export base is critical to reducing dependency on a narrow range of commodities, thereby mitigating the adverse effects of currency depreciation and enhancing resilience to external shocks. The African Continental Free Trade Area (AfCFTA) presents an opportune pathway for SACU's drive towards export market diversification and enhancement of its industrial capacity, providing broader markets and fostering greater economic stability through increased trade within the continent (SACU, 2023).

Second, improving the quality and competitiveness of exports through investments in technology, infrastructure, and skills development is essential for producing higher value-added goods that can compete effectively in international markets. Third, SACU countries should explore monetary policy tools, utilize foreign exchange reserves and foster regional cooperation to stabilize exchange rates.

Drawing inspiration from the EU's approach to exchange rate stability, SACU countries could consider deeper monetary integration and the possibility of a common currency or closely coordinated exchange rate policies to reduce volatility and enhance economic stability within the region. This could lead to an improved TB within the SACU region.

Areas for Further Research

While this study provides valuable insights into the impact of currency depreciation on trade within SACU, several areas warrant further investigation. Future research could focus on the sectoral impacts of currency depreciation, examining how different industries within SACU countries are affected by exchange rate fluctuations. Long-term studies that track the effects of currency depreciation over extended periods would provide a deeper understanding of the dynamic relationship between exchange rates and TBs. Comparative analyses between SACU and other customs unions or regional trade blocs could shed light on unique challenges and opportunities faced by SACU countries. Additionally, further research is needed to explore how integration into global value chains influences the effects of currency depreciation on trade in SACU countries. Investigating the broader socio-economic impacts of currency depreciation, including effects on poverty, inequality and employment, would provide a more comprehensive understanding of its implications. Finally, evaluating the effectiveness of various policy interventions aimed at mitigating the adverse effects of currency depreciation could provide practical guidance for policymakers in SACU countries.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

ORCID iDs

Mofihli Ntsasa https://orcid.org/0009-0004-5276-5811
Ojo Johnson Adelakun https://orcid.org/0000-0002-5984-8976

Note

1. As a robustness check, trade balance as a percentage of GDP was used as the dependent variable to account for exchange rate fluctuations. The results show that in the long run, the real effective exchange rate (REER) has a positive but weakly significant effect on trade balance (coef. = 0.8302, p = .095). In the short run, REER has a negative but insignificant impact (coef. = –1.838, p = .425), suggesting that while REER influences trade balance over time, its short-term effects are limited.

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Appendix A. Tables and Results

Table A1. Cross-sectional Dependence Test on the Residual of the Independent Variable.

Variable	Breusch–Pagan	Pesaran ScaledLM	Pesaran CD
Ln TB	27.72781***	3.964081***	3.139652***
Ln REER	104.1085***	21.04331***	9.316206***
Ln GCF	14.25220	0.950820	1.549321
Ln INF	15.57379	1.246336	0.234960
Ln TO	17.19006*	1.607747	1.559854
Ln GDPPCTP	22.42768**	2.778913***	–0.620923

Note: ***, ** and * indicate significance levels at 1%, 5% and 10%, respectively.

Table A2. Panel Unit Root Results.

First-generation Panel Unit Root Tests (Not Applicable Under Cross-sectional Dependence)										
	LLC Test (Trend and Intercept)					IPS Test (Trend and Intercept)				
	I (0)		I (1)			I (0)		I (1)		
	t-stat	Prob	*t*-stat	Prob	Decision	*t*-stat	Prob.	*t*-stat	Prob.	Decision
Ln GCF	–1.744	0.041	–7.082	0.000	I (1)	–0.312	0.622	–6.750	0.000	I (1)
Ln INF	–4.120	0.000	–11.340	0.000	I (0)	–3.566	0.000	–10.240	0.000	I (0)
Ln TO	–0.633	0.263	–6.061	0.000	I (1)	0.389	0.651	–5.600	0.000	I (1)
Ln GDPPCTP	–3.962	0.000	–11.270	0.000	I (0)	–3.132	0.000	–10.691	0.000	I (0)
	Fisher–DFuller Test					**Hadri Test**				
Ln GCF	2.844	0.002	5.147	0.000	I (0)	10.832	0.000	–0.616	0.731	I (0)
Ln INF	5.085	0.000	13.679	0.000	I (0)	–0.537	0.704	–2.049	0.980	I (–)
Ln TO	1.069	0.142	9.148	0.000	I (1)	12.773	0.000	–0.701	0.758	I (0)
Ln GDPPCTP	2.461	0.007	16.883	0.000		4.600	0.000	–1.808	0.965	I (0)
Breitung Test										
Ln GCF	–0.238	0.406	–2.966	0.406	I (1)					
Ln INF	–2.543	0.006	–3.062	0.001	I (0)					
Ln TO	–1.284	0.099	–2.991	0.001	I (1)					
Ln GDPPCTP	–2.414	0.008	–4.981	0.000	I (0)					

(Table A2 Continued)

(Table A2 Continued)

Second-generation Panel Unit Root Tests (Applicable in the Presence of Cross-sectional Dependence)										
	PESCADF Test					XTCIPS Test				
	I (0)		I (1)		Decision	I (0)		I (1)		Decision
Ln TB	–3.858	0.000	–4.409	0.000	I (0)	–4.346	0.000	–5.210	0.000	I (0)
Ln REER	–2.134	0.000	–3.623	0.000	I (0)	–1.940	0.002	–4.337	0.000	I (0)

Notes: Several first generational unit root tests were undertaken. Fisher-type unit-root test based on augmented Dickey–Fuller tests and Im–Pesaran–Shin (IPS) unit-root test.
I (0) and I (1) represent an integration of orders 0 and 1, respectively.
Second-generation unit root tests such as PESCADF and XTCIPS were also undertaken.

Table A3. First Generational Co-integration Test.

	Statistic	*p* Value
Modified Dickey–Fuller *t*	–1.7537	.0397
Dickey–Fuller *t*	–1.6937	.0452
Augmented Dickey–Fuller *t*	–2.3982	.0082
Unadjusted Modified Dickey–Fuller *t*	–3.0273	.0012
Unadjusted Dickey–Fuller *t*	–2.1974	.0140

Source: Author's computation using World Bank Development indicators.

Table A4. Second-generational Panel Cointegration Test.

Statistic	Value	*Z*-value	*p* Value
Gt	–1.181	–0.440	.330
Ga	–4.175	–0.183	.427
Pt	–3.857	–2.326	.010
Pa	–5.763	–3.658	.000

Source: Author's computation using World Bank Development indicators.