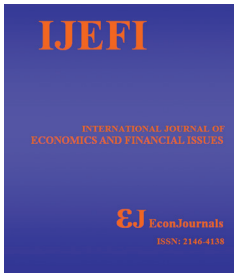

International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2024, 14(6), 64-76.

Analysing Real Exchange Rate Effects on the Trade Balance in South Africa

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Received: 19 May 2024 **Accepted:** 27 August 2024 **DOI:** https://doi.org/10.32479/ijefi.16808

ABSTRACT

For years, policymakers and economists have been researching the significance of the native currency value versus other currencies in favouring the country's trade balance and total. Therefore, this study investigates the impact of the real exchange rate change on the trade balance in South Africa. The study used annual time series data from 1980 through 2022. This study used the ARDL technique to analyse data. Variables used in this study include the trade balance, real exchange rate, terms of trade, money supply, South Africa's gross domestic product, and the Chinese gross domestic product. Bounds tests showed that the variables are cointegrated. According to the empirical findings, the real exchange rates have significantly influenced the trade balance positively in the short run but in the long run, have a negative significant influence on the trade balance. The terms of trade have a positive significant influence on the trade balance in the short run, but it appears to be positively significant in the long run. The money supply in the short run has an insignificant negative relationship with the trade balance but in the long run, has a significant positive relationship with the trade balance. The SA gross domestic product has a significant negative impact on the trade balance both in the short and long run. Lastly, the Chinese gross domestic product has a negative insignificant relationship with the trade balance in the short. However, in the long run, it has a positive significant relationship with the trade balance. This proves that a rise in Chinese GDP, as a proxy for foreign economic activity, boosts South African exports to the rest of the world in the long term. As a result, the trade balance improves as China imports minerals from South Africa for production purposes. The dependence on currency depreciation to enhance trade in South Africa can improve its trade balance, but it may also damage the economy due to the country's reliance on imports. However, the advice to weaken the South African currency should not be so harsh as to have a negative impact on the importation of key capital goods critical to the growth and development of the South African economy. It is recommended that the government reduce demand for imported products and boost domestic manufacturing, which might lead to domestic products being exported. The central bank must also stabilize the currency to increase competitiveness by decreasing the overseas price of exports and increasing the cost of imports.

Keywords: Exchange rate, Trade Balance, J-curve, Autoregressive Distributed Lag
JEL Classifications: 1C, 2C, 46P, 57P, 50P

1. INTRODUCTION

South Africa is one of several nations that adopted a fluctuating exchange rate regime after the Bretton Woods system with a fixed exchange rate fell short. South Africa now has a flexible exchange rate framework, which allows the currency rate to be regulated by demand and supply considerations (Mtonga, 2011). Given the extent of foreign market activity, such a system potentially causes huge changes in the rand's exchange rate. As a result, forecasting the road to exchange rate stability and, consequently, its implications on the trade balance becomes challenging. This piqued the interest of many scholars in the link between exchange rate impacts and trade balance.

Chiloane et al., (2014) stated that currency depreciation is meant to enhance export demand while lowering imports and improving the trade balance. Currency appreciation, on the other hand, is expected to reduce export demand while raising import demand, negatively affecting the trade balance. However, there is a lag period before imports and exports can respond to changes in the currency market.

According to Matlasedi (2016), the South African economy has been experiencing a trade deficit for decades. This indicates that South Africa's trading relationship with the rest of the globe has been unfavourable, resulting in a negative trade balance. A country with an extensive current account deficit is always vulnerable to currency depreciation. If capital flows are inadequate to pay the deficit, the exchange rate will decrease to reflect the imbalance in foreign fund flows. South Africa buys more products from abroad than it sells to foreign countries (known as a trade deficit), and there is proportionally less demand for its currency, which causes prices to fall, and the ZAR currency to lose value. In South Africa, the ongoing rising trade deficits have led the government to borrow funds from international banks making South Africa more exposed to external shocks (Isaacs and Kaltenbrunner, 2018).

1.1. Research Questions

Understanding the impact of the real exchange rate on the trade balance helps in efficiently implementing the monetary strategy that will sustain the currency and avoid trade deficits. Therefore, this study attempts to answer the following research questions: Does the exchange rate affect the trade balance in South Africa both in the short and long run? What policy perspective is set to improve or stabilize the currency and avoid a trade deficit?

1.2. Objectives

The overall objective of this study is to analyse the impact of the real exchange rate on the trade balance of South Africa. To achieve the above-stated objective of the study, the following specific objectives are set:

- To review trends of exchange rate and trade balance for South Africa from 1980 to 2022.
- To review theoretical and empirical literature that underpins exchange rate and trade balance.
- To determine the short-run and long-run impact of the real exchange rate on the trade balance in South Africa.
- Set a policy perspective to improve or stabilize the currency and avoid trade deficit through recommendations.

1.3. Hypothesis

The following hypothesis is tested by this study to reach the objectives of the study:

- H_0: Real exchange rates have no significant impact on the trade balance in South Africa.
- H_1: Real exchange rates have a significant impact on the trade balance in South Africa.

1.4. Contribution of the Study

To achieve the objectives and answer research questions, this study used the time series data using the ARDL model. The reason for using this model is that the existing literature points to no evidence of the application of the ARDL model on the impact of the real exchange rate on the trade balance. However, the existing literature reveals that prior studies applied the VECM model to examine the impact of the real exchange rate on trade balance (Dongfack and Ouyang, 2019; Schaling and Kabundi, 2014; Eita and Meniago, 2017; Ogbonna, 2013). Hence, the current study will use the ARDL model to evaluate the impact of the real exchange rate on the trade balance. To the authors' best knowledge, there are no or limited studies that evaluate the impact of the real exchange rate on the trade balance especially in South Africa. Moreover, this current study will add to the South African context in evaluating the impact of the real exchange rate on the trade balance in South Africa.

2. LITERATURE REVIEW

This section expands on the theoretical framework by looking into the economic theories that underpin the exchange rate and trade balance constructs. Furthermore, this section expands on the empirical literature undertaken by many scholars to evaluate the validity of these economic theories in South Africa.

2.1. Theoretical Framework

2.1.1. The elasticities approach

A Keynesian analysis is used in the elasticities approach to the balance of payment. It focuses on how exchange rate fluctuations impact the price elasticity of demand for exports and imports. Following currency depreciation, demand for imports reduces, as does the number of imports, improving the trade balance on the import front in the process (import price impact). Imports denominated in domestic currency make foreign exporting firms less profitable immediately after currency depreciation; supply and volume of imports fall, resulting in an improvement in the trade balance on the import front due to the value effect of imports (Wang, 2009).

2.1.1.1. J-curve theory

The J-Curve trade theory is a traditional economic theory that seeks to analyse the dynamic effect of fluctuations in the exchange rate on trade balance (Bahmani-Oskooee and Ratha, 2004). The J-curve theory was introduced by American sociologist James C. Davies in 1962, who argued that social and political discontent was caused by a brief period of a significant decrease in economic development following a lengthy period of economic growth and progress. The J-curve is the temporal path of a country's trade balance following a devaluation or depreciation of its currency. The theory assumes that a country's trade deficit will initially worsen after the depreciation of its currency. It believes that a depreciated currency makes imports more costly, and this generates a decline in the current account if the amounts of imports and exports fluctuate slightly initially. But, after a while, the number of exports begins to climb due to reduced prices to foreign purchasers, while local consumers buy fewer imports, which have become more expensive to them. Ultimately, the trade balance shifts to a smaller deficit or greater surplus than it was before the devaluation. The problem with the J-curve theory is that it relies much on how the exchange rate influences the trade balance, but it does not realize other factors that influence the trade balance like gross domestic products. The strength of the J-curve theory is that it demonstrates the effects of an event or action over a set period (Bahmani-Oskooee, 1985).

2.1.1.2. Marshall-Lerner condition

This condition is named after the early 20th-century economists Alfred Marshall and Abba Lerner. According to Abbas (2020), when export and import volumes are elastic enough to benefit from currency depreciation while maintaining all other variables constant, this is known as the Marshall-Lerner condition. The

Marshall-Lerner condition is a criterion that indicates whether a country's trade balance will improve or deteriorate in response to an exchange rate adjustment. It assumes that if the total of the price elasticities of demand for the country's exports and imports is larger than one, a depreciation of the currency (a reduction in the exchange rate) would result in an improvement in the balance of trade. In other words, if a country's exports and imports are more sensitive to price fluctuations than its supply of these commodities, the trade balance will improve after the currency depreciates. The Marshall-Lerner condition's strengths are that it thoroughly evaluates how a currency's devaluation can lead to an improvement in the balance of payments if the sum of demand elasticity for imports and exports is greater than one. Its weaknesses are that it relies heavily on how currency devaluation can affect the trade balance and ignores other factors that have an impact on the trade balance.

2.1.2. The Absorption approaches

The shortcomings of the elasticities approach to currency depreciation (depreciation) analysis led to the creation of the absorption technique (Alexander, 1952). It expands on the elasticities method by pointing out that the elasticities in question are just partial elasticities. Specifically, the impact of price changes on quantities provided and desired while all other important variables stay constant. It then completes the study using what it refers to as total elasticities, which are the impacts of price changes on the quantities supplied and required when other important variables are permitted to vary. In other words, the absorption technique accounts for changes in income and consumption induced by devaluation (Bouchert et al., 2003). Despite similarities with the elasticities approach, the absorption approach distinguishes itself by arguing that the net effect of depreciation on the BOP is dependent not only on elasticities but also on changes in income and absorption, both of which have an impact on the balance of payments. Any rise in revenue attributable to a better BOP is certain to cause a surge in imports and hence a worsening in the current account. One of the shortcomings of the absorption method is that it places too much emphasis on measures aimed at influencing domestic absorption. It does not investigate the impact of devaluation on absorption by other nations.

2.1.3. The monetary approach

Mundell and Johnson (1968) established the monetary approach to the balance of payments. Other authors who contributed to it include Dornbusch et al., (2014) and Frankel (1998). The approach's essential premise is the awareness that the BOP imbalance is a monetary issue. It tries to explain BOP deficits and surpluses by looking at money demand and supply. While the elasticity method concentrates on trade elasticity and the absorption approach on economic real variables, the monetary approach deals with currency depreciation as a monetary phenomenon (Lencho, 2013, Ezzat and Ezzat 2018). Thus, the monetary method analyses the impact of currency depreciation on trade balance by examining how depreciation impacts the actual money supply (Ezzat and Ezzat 2018). Several critiques have been levelled at the monetary method of BOP adjustment. The first is that this technique assumes the money demand function is steady. In the long run, such an assumption may be correct. However, economists are unanimous in their belief that the money demand function is unstable in the near term. Second, the monetary method is theoretically appropriate for long-term balance-of-payments correction. The long monetary delays between recognizing the problem of the BOP deficit and implementing BOP adjustment are often ignored in this approach.

2.1.4. Balance of payments theory of exchange

Johnson and Gordon developed the balance of payment theory in 1923. The theory assumes that the demand for and supply of foreign currency are governed by the balance of payments situation. This indicates that supply and demand are driven primarily by variables that are independent of changes in the exchange rate or monetary policy. The balance of payments theory of exchange rate believes that the price of foreign money in terms of domestic money is determined by the free forces of demand and supply in the foreign exchange market. The theory's key advantage is that it is consistent with the general theory of value. Additionally, it demonstrates how the equilibrium exchange rate is established within the framework of the general equilibrium theory. The theory emphasizes the fact that several dominating forces impact the supply and demand for foreign exchange, which in turn affect the rate of exchange, in addition to the merchandise items (exports and imports of products) that are included in the balance of payments. As a result, the theory is more plausible since it considers a wide range of important factors, rather than just the purchasing power as an expression of overall price levels.

There are several drawbacks to this theory. Firstly, the theory is silent on what establishes a currency's intrinsic value, meaning that it cannot state the internal factors that determine the value of a currency. The power parity theory is then used as an alternative as it states the internal factors that determine the value of the currency. Secondly, the theory makes the supposition that there would be complete competition and no government interference in the foreign exchange market. Given the exchange regulations in place now, this is not particularly plausible. Thirdly, the theory makes the erroneous assumption that the balance of payments is constant. Fourthly, the theory's hypothesis contends that there is no causal relationship between the internal price level and the exchange rate. However, since the country's price-cost structure may have an impact on the balance of payments, there should be a link. Lastly, at any 1 time, the theory is undetermined. It claims that the exchange rate is determined by the balance of payments. However, the balance of payments itself depends on the currency rate. There is a tautology as a result, and it is unclear what determines what (Smriti, 2018).

2.2. Empirical Literature

In this section, an overview of previous studies on the impact of the exchange rate on the trade balance in South Africa, developed countries, and developing countries will be presented. These studies are reviewed from different methodologies that are used to analyse the impact of real exchange rates on the trade balance.

In the case of South Africa, Matlasedi (2016) evaluated the impact of the real effective exchange rate on South Africa's trade balance and whether the J-curve phenomenon and the Marshal-Lerner condition are satisfied in the economy. The study used data

spanning the period 1980Q1-2014Q4, using the autoregressive distributed lag (ARDL). The autoregressive distributed lag long-run model findings suggest that a ZAR depreciation improves the trade balance, confirming the Marshal-Lerner requirement. The ARDL error correction model demonstrates that a ZAR devaluation worsens the trade balance in the near run, validating the J-curve impact on the RSA economy. The findings are like those of Dongfack and Ouyang (2019) who evaluated the impact of real exchange rate depreciation on Cameroon's trade balance. The annual time-series data from 1980 to 2016 was used. The estimation of short-run and long-run relationships between the variables was done using Johansen cointegration and the vector error correction model (VECM). It was discovered that the j-curve holds in terms of Cameroon.

Ncube and Ndou (2013) evaluated the impact of contractionary monetary policy and exchange rate appreciation shocks of one standard deviation in size on the South African trade balance from 1983Q2 to 2010Q4. The study adopted the recursive and sign-restriction vector autoregressive models. The finding of this study also justifies the J-curve theory as the decrease in the exchange rate considerably has decreased the trade balance in the short run and then later started to increase. The findings align with the study by Schaling and Kabundi (2014) who evaluated the exchange rate, the trade balance, and the j-curve effect in South Africa from 1994Q1 to 2011Q4. The study also used the vector error correction model (VECM). It was discovered that in the long run, the net exports were boosted by a weaker real effective exchange rate. However, this effect does not hold in the short run. It was also discovered that empirical evidence supports the J-curve effect for South Africa.

Bahmani-Oskooee, Halicioglu, and Bahmani (2017) evaluated the short- and long-term impact of exchange rate changes on Turkey's trade balance with its important trading partners from 2000 to 2015. The study adopted the auto-distributive regression line (ADRL) lag method. The model is advantageous because it is crucial in analysing an economic situation since changes in one economic variable might affect changes in another over time. It was discovered that the lira's appreciation did not have any significant effects on Turkey's trade balance but rather the lira's depreciation has significantly favourable effects on Turkey's trade balance. The study has similar results to those of Dogru et al., (2019) who investigated how changes in exchange rates affected the balance of trade in the tourist industry in the USA from 2008 to 2017. The findings demonstrated that the U.S. trade balance improved because of the dollar's decline. Both studies experience the same phenomena.

Wilson and McLean (2014) examined the impact of the trade balance and real exchange rate compared to the US and Japan for bilateral trade in goods between Singapore, Korea, and Malaysia. A panel econometric technique was utilized using annual data over the period 1980-2012. The study used the panel autoregressive distributed lag (PARDL) approach. The panel ARDL model is appropriate because it forecasts short- and long-run dynamics concurrently and supports different orders of integration. Apart from Korean trade with the US, no proof of a J-curve impact was discovered. The findings of these studies are like those of Baharumshah (2001) who identified the effect of the exchange rates on the bilateral trade balances of the US and Japan over the period 1980-1996. The results from Johansen's cointegration revealed evidence that the depreciation of the real exchange rate improved the trade balance of both countries in the long run, but there was no J-curve effect in the short run.

Akorli (2017) evaluated the effects of exchange rates on trade balance in Ghana. The study used annual time series data from 1980 to 2016 in the analyses. A simple OLS regression was conducted to estimate the long-run relationship of the variables on trade balance. The Johansen cointegration test and error correction model were used to establish short-run relationships. It was discovered that the exchange rate has a negative impact on the trade balance in the long run while GDP was revealed to have impacted the trade balance negatively thus suggesting that an increase in the GDP leads to a deteriorating trade balance. The J-Curve phenomenon was however found to be non-existent in Ghana. The results are consistent with those of Venkatraja (2018) who examined the response of India's trade balance to exchange rate shocks using monthly data for the period from 2009 to 2017. The results also did not support the J-curve pattern of trade balance rather it follows an inverted J-curve.

Anoke et al., (2016) examined the impact of currency rate depreciation on Nigeria's trade balance using annual data from 1986 to 2014. The study adopted the cointegration test, vector error correction model, Wald test, and Granger causality test. It was then discovered that the trade balance in Nigeria and exchange rate depreciation have a long-term relationship. Although exchange rate depreciation had no appreciable impact on Nigeria's trade balance, the vector error correction term, and the causative link between the balance of trade and exchange rate both showed that the exchange rate Granger caused the balance of trade. Similarly, Eita and Meniago (2017) examined how changes in exchange rates affected Sub-Saharan Africa's imports, exports, and trade balance (SSA) from 1995 to 2013 using the VECM model. The study discovered that a decline in the exchange rate has little or no impact on imports. This is ascribed to the fact that some nations are heavily reliant on imports and frequently exhibit exchange rate invariance.

Based on the literature that is reviewed, it is clear that a lot of studies used the vector error correction model (VECM) as it is appropriate because it can explain not only the dynamic behaviour of endogenous and exogenous variable interactions but also the connection between endogenous variables. However, this study adopted the auto-distributive regression lag method (ARDL). The model is advantageous because it is crucial in analysing an economic situation since changes in one economic variable might affect changes in another over time. According to Bryman (2003), employing many approaches in conducting research produces more solid and persuasive results than using a single method in all studies.

3. METHODOLOGY

This section discusses the technique used in this investigation, as well as the model specification, estimating methodologies, and modelling approach used in this work. The prior section's

theoretical foundation influences the analysis of this investigation. The primary goal of this section is to describe the methods and tools used to meet the study's objectives.

This study followed the model by Schaling and Kabundi (2014) which evaluated the exchange rate, the trade balance, and the J-curve effect in South Africa for the period 1994 to 2011. Schaling and Kabundi's (2014) regression equation is as follows:

$$TRB_t = \beta_0 + \beta_1 REER_t + \beta_2 SAGDP_t + \beta_3 USAGDP_t + \varepsilon_t \quad (3.1)$$

Where (TRB) denotes the trade balance, (REER) denotes the real effective exchange rate, (GDP) denotes South African gross domestic product, (USA GDP) denotes United States real gross domestic product, and () denotes regression residuals. The United States (US) real GDP (USGDP) was used as a proxy for foreign economic activity. This study adopts and modifies equation (4.1) to explore the impact of the real exchange rate on the trade balance in South Africa. The change is made by adding the terms of trade (TOT), money supply (MS), and Chinese gross domestic product (CH GDP). Chinese gross domestic product (CH GDP) is selected as a proxy to capture foreign economic activities.

The main independent variable is the real exchange rate (REER), and the dependent variable is the trade balance (TB). The control variables are terms of trade (TOT), South African gross domestic product (SA GDP), Chinese gross domestic product (CH GDP) and money supply (MS). After modification, the model will be as follows:

$$TB_t = \beta_0 + \beta_1 REER_t + \beta_2 MS_t + \beta_3 TOT_t + \beta_4 SA\,GDP_t + CH\,GDP\ \varepsilon_t \quad (3.2)$$

The (ϵ_t) denotes the error term, (TB) denotes trade balance, (TOT) denotes the terms of trade, (REER) denotes the exchange rate, (LSA GDP) denotes South African gross domestic product, Chinese gross domestic product (CH GDP), and money supply (MS).

$$TB_t = \beta_0 + \beta_1 LREER_t + \beta_2 LMS_t + \beta_3 TOT_t + \beta_4 LSAGDP_t + LCH\,GDP\,\varepsilon_t \ldots\ldots \quad (3.3)$$

Equation 4.3 it's an equation that contains logged variables like LREER, LMS, LSA GDP, and LCH GDP. The logarithm operator is added because it helps to stabilize the variance of the logged variables. The trade balance is calculated as a ratio of merchandise imports to merchandise exports, the exchange rate is measured by the index of the official exchange rate, M2 is the money supply, the ratio of a country's export prices to import prices is represented by the log of the terms of trade, the South African Gross Domestic Product and is used as a proxy for national income and lastly, Chinese GDP is utilized as a proxy for the international activities in which South Africa participates.

The independent variables of this study are selected based on the relationship with the dependent variable. For instance, according to the well-known Keynesian analysis of Harberger (1950) and Laursen and Metzler (1950), when the terms of trade deteriorate, the trade balance deteriorates, and savings decline because a fall in the purchasing power of exports is a reduction in income. In relation to money supply, Obstfeld and Rogoff (2005), stated that when the money supply exceeds the demand for money, the excess supply of money is reduced by outflows of money overseas, which worsens the trade balance. Interest rates are often higher in countries with large and chronic trade deficits than in countries with a trade surplus or balanced trade (Batra and Beladi, 2013). In relation to China's GDP as a proxy to capture foreign economic activities, China is the major trading partner of South Africa. According to Le Pere (2021), China imported commodities from South Africa worth 20.06 billion dollars for the year 2021. In relation to the real exchange rate, the j curve theory confirms the relationship between the trade balance and the real exchange rate. In relation to the South African GDP and is used as a proxy for national income. A rise in domestic income levels would make foreign-produced goods more desirable to domestic consumers and that is expected to worsen the trade balance.

This study uses annual time series data from the years 1980 to 2022. Time series analysis is used in a wide range of scenarios to understand how a certain measure develops over time and to estimate future values. This study investigates the impact of real exchange rate on the trade balance utilising the auto regressive distributed lag (ARDL) technique. Pesaran and Shin (1999) developed the ARDL method, which accomplishes a sole cointegrating equation and was further improved by Pesaran et al. (2001). The method is chosen because it has the dynamic capability to detect short-run and long- run coefficients with an error correction term. This method has many advantages over other symmetric methodologies; it is also suitable and applicable for estimating I(0) variables, I(1) variables, or a hybrid of the two. ARDL is also useful regardless of whether the sample observation is small or large, unlike the Engle and Granger test, Johansen and Juselius test and Johansen test, which all require variables to be integrated at I(1). Moreover, the ARDL model yields better outcomes even with small sample size. Therefore, the ARDL model can be presented as follows:

$$Y_t = \sigma + \chi Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + \varepsilon_t \quad (3.4)$$

Where Y_i denotes the dependent variables lagged by 1 year, X_t denotes independent variables lagged by 1 year, ϵ_t represents the error term. The ARDL is specified by selecting lags for each variable included in the regressed model (Pesaran, et al., 2001). The equation (3.4) is rephrased into autoregressive form as:

$$Y_t = \sigma(1 + \chi + \chi^2 + \ldots) + (1 + \chi L + \chi^2 L^2 + \ldots)(\beta_0 X_t + \beta_1 X_{t-1} + \varepsilon_t) \quad (3.5)$$

The equation (5.5) proves that $|\chi| < 1$. Equation (3.5) is the autoregressive technique that estimates the changes in X_t on the future values of Y_t. From equation (3.4) the long-run static equilibrium (Y, X) can be derived as:

$$Y_t = Y_{t-1} = Y, X_t = X_{t-1} = X \quad (3.6)$$

In equation (3.6) the error term is zero.

$$\text{Therefore, } Y\frac{\sigma}{1-\chi}+\frac{\beta_0+\beta_1}{1-\chi}X \tag{3.7}$$

Where Y_t is replaced by $Y_{t-1}+\Delta Y_t$ and where Δ denoted the first difference operator and X_t with, $X_{t-1}+\Delta X_t$ in equation in equation (3.5) to yield the following equation.

$$\Delta Y=\sigma+\beta_0\Delta X_t-(1-\chi)\left[Y_{t-1}-\frac{\sigma}{1-\chi}-\frac{\beta_0+\beta_1}{1-\chi}X_{t-1}\right]+\varepsilon_t \tag{3.8}$$

The terms in the brackets in equation (4.8) represent the long-run equilibrium parameters of the ARDL model. Equation (4.8) is known as the error correction model. According to Pesaran and Shin (1995), Pesaran and Shin used equation (4.8) to develop the ARDL model to incorporate the bounds test for cointegration, short-run, and long-run parameters simultaneously. Therefore, the following equation was developed to account for the error correction term which does not have restricted error corrections.

$$\Delta Y_t=\partial_{0Y}+\sum_{i=1}^{p}\beta_{iY}\Delta Y_{t-i}+\sum_{i=1}^{p}\varsigma_{iY}\Delta X_{t-i}+\alpha_{1Y}\Delta Y_{t-1}$$
$$+\alpha_{2Y}\Delta X_{t-i}+\varepsilon_{1t} \tag{3.9}$$

In equation (4.9) P denotes the lag structure Y_t and X_t denote the underlying variables and ϵ_{lt} denotes the error term with zero mean and finite covariance matrix. Pesaran et al. (2001) state that the null hypothesis of no long-run equilibrium is tested against the alternative hypothesis of the long-run equilibrium in equation (3.9). The null hypothesis H_0: $\alpha_{1Y}=\alpha_{2Y}=0$ and the alternative hypothesis. If ECT is equal to zero, therefore, there is no cointegration of variables. For the variables to be cointegrated, ECT must consist of a sign that is negative and is statistically significant. Like any other econometric technique, the unit root analysis comes first in the ARDL analysis. The order of integration for the main variables is determined using the Augmented Dickey-Fuller (ADF) and Phillip-Perron test (PP) in this study.

The second step entails selecting the optimal lags based on three main information criteria using an ARDL model. To choose the best long-run model, the optimum lag length must be established using suitable model order selection criteria, like Akaike Information Criterion (AIC), Schwarz Bayesian Information Criterion (SBIC), and Hannah Quinn Information Criterion (HQIC). All these selection criteria should have lower statistics (Menegaki, 2019).

The third step is to cointegrate the variables. It is vital to take a cointegration test as it determines whether a model empirically displays a long-run relationship. Even though there are many cointegration tests, this study mainly focuses on time series data, and therefore the cointegration test is utilised. The panel cointegration test used is the ARDL cointegration test or bounds test endorsed by Pesaran et al. (2001). With the bounds test approach, the short-run and the long-run relationship are captured simultaneously (Pesaran et al., 2001). The ARDL cointegration approach gives two critical values, which are (1) the lower bound critical value and (2) the upper bound critical value.

The fourth step, the ARDL model is recommended over the Johansen framework due to its ability to incorporate variables, which have a different level of integration (Pesaran and Shin, 1997). The bound test technique possesses some econometric advantages over other cointegration testing methods. Firstly, ARDL captures both the short-run and the long-run relationship simultaneously (Pesaran et al., 2001). Secondly, regardless of whether the order of integration of the variables is stationary at level or at the first difference the bounds test for cointegration can be utilised. Thirdly, it assumes that all the variables of the model are endogenous. Fourthly, it allows small sample data to be used in the model without giving spurious results, and lastly, it can accommodate structural breaks in the time series data (Pesaran et al., 1997). The study adopts the error correction mechanism (ECM) version of the ARDL model to test for the speed of adjustment. The error correction mechanism (ECM) is used to reunite the short-run behaviour of the economic variables with the long-run behaviour.

In the fifth step, the study runs diagnostic tests like heteroscedasticity tests, Ramsey RESET test, Serial correlation test and Jarque-bera test to verify if the model is reliable and efficient (Gujarati and Porter, 2009). The time series models must satisfy the assumption of the normal linear regression model (Gujarati and Porter, 2009). The CUSUM test is also used to demonstrate the stability and statistical significance of the model.

4. RESULTS

This study strove to examine the impact of the real exchange rate on the trade balance in South Africa. Therefore, the purpose of this section is to present the key findings. The requisite pre-estimation tests for series are discussed, including the unit root test, lag length selection criteria, and the cointegration tests, which were computed using Eviews 9. ARDL estimation results including the ECM, diagnostic, and stability test are reported, accompanied by a sustained discussion. Table 1 shows the descriptive statistics.

As shown in Table 1, the sign of skewness coefficients of the variables like LREER, TOT and LSA GDP is positive which implies that the distribution of these variables is skewed to the left. The remaining variables TB, LMS, and LCH GDP have negative skewness coefficients which imply that the distribution of this variable is skewed to the right. In study, the normality assumption for all variables, the Jarque-Bera statistic illustrates that the trade balance, exchange rate, terms of trade, money supply, South African gross domestic product, and Chinese gross domestic product are statistically insignificant and accept the null hypothesis of normal distribution meaning they are normally distributed. The probability value of the trade balance, terms of trade and South African GDP are significant, and all the remaining variables are insignificant as their values are more than the observed value of.05 under the null hypothesis meaning that the null hypothesis will be rejected as they are normally distributed. The next section presents pairwise correlation results.

Table 1: illustrates descriptive statistics

	TB	LREER	LMS	TOT	LSA_GDP	LCH_GDP
Mean	0.914809	2.074707	1.054278	0.843277	6.485686	12.47671
Median	0.915941	2.071882	1.130012	0.762712	6.462855	12.47727
Maximum	1.251227	2.232996	1.547036	1.249811	6.662688	13.21286
Minimum	0.554865	1.959041	0.235528	0.626866	6.307990	11.62610
SD	0.134334	0.061172	0.292249	0.166814	0.126244	0.498331
Skewness	−0.657311	0.503571	−0.706800	0.728450	0.131238	−0.113208
Kurtosis	4.511232	2.920797	2.926231	2.318866	1.404013	1.735824
Jarque-Bera	7.188267	1.828593	3.589973	4.634150	4.687124	2.955183
Probability	0.027484	0.400798	0.166130	0.098561	0.095985	0.228187
Sum	39.33678	89.21242	45.33395	36.26093	278.8845	536.4984
Sum Sq. Dev.	0.757917	0.157162	3.587187	1.168726	0.669379	10.43001
Observation	43	43	43	43	43	43

Source: Estimation by researcher using Eviews 9.

Table 2: Correlation matrix results

	TB	LREER	LMS	TOT	LSA_GDP	LCH_GDP
TB	1	−0.6880	−0.4522	0.5199	0.5156	0.6310
LREER	−0.6880	1	0.4097	−0.5892	−0.7154	−0.7545
LMS	−0.4522	0.4097	1	−0.5346	−0.5574	−0.5733
TOT	0.5199	−0.5892	−0.5346	1	0.9039	0.8749
LSA_GDP	0.5156	−0.7154	−0.5574	0.9039	1	0.9811
LCH_GDP	0.6310	−0.7545	−0.5733	0.8749	0.9811	1

Source: Estimation by researcher using Eviews 9

Table 2 show that the real exchange rate (LREER) coefficient is at −0.6880 and has a negative high correlation with the trade balance (TB). The terms of trade (TOT) coefficient is at 0.5199 and has a positive and moderate correlation with the trade balance (TB). The money supply (LMS) coefficient is at −0.4522 and has a negative and moderate correlation with the trade balance (TB) in South Africa. The Chinese gross domestic product (LCH GDP) coefficient is at 0.6310 and has a positive and moderate correlation with the trade balance (TB). South Africa's gross domestic product (LSA GDP) coefficient is at 0.5156 and has a positive and moderate correlation with the trade balance (TB).

Both tests in Tables 3 and 4, reveal that LMS is the only variable that is stationary at level, while TB, LREER, LSA GDP, LCH GDP, and TOT are stationary when differenced as the visual inspection/formal test indicated. Therefore, this confirms that LREER, LSA GDP, TOT, LCH GDP, and TB are integrated of order I (1) and LMS integrated at I (0). This further serves as an indication that the variables specified can be utilised by making use of the ARDL modelling since the ARDL modelling requires that variables should be integrated of order 1(0) and 1(1) jointly or separately.

Table 5 shows the optimal lag results. For this study, the ideal lag length is determined using Eviews 12 software's automatic model selection. The maximum dependent variable and regressors lag of four was chosen for automatic selection using AIC, SBC, and HQ to determine selection criteria with a lower value. Table 5 illustrates that the AIC has the lowest value of all. Therefore, the best model selected is ARDL (2.2.2.1.2).

In Table 6 of bounds tests, the F-statistics in this model is 5.411321, and it is greater than the lower bounds critical value standing at 3.06. The F-statistic is also greater than the upper bounds critical value standing at 4.15. The findings show that the study rejects the null hypothesis of no co-integration, meaning that there is cointegration. As a result, this suggests that the real exchange rate and trade balance of South Africa cointegrate in the long run.

Table 7 shows the long-run results. In the long run, the real exchange rate (LREER) has a t statistic of −2.888111 and it is statistically significant. This means in the long run, an increase in the real exchange rate has a significant long−term negative effect on the trade balance. This suggests that in the long term, a 1% increase in the real exchange rate will significantly result in a −1.447743% decrease in the trade balance. In the products market, a positive shock to the home currency's exchange rate makes exports more costly and imports less expensive. As a result, competition from overseas markets will reduce demand for domestic items, resulting in lower domestic output and prices. The results align with those of Matlasedi (2016), who evaluated the impact of the real effective exchange rate on the trade balance in South Africa. It was discovered that the real effective exchange rate harms the trade balance in South Africa in the long run. Similarly, Schaling and Kabundi (2014) evaluated the exchange rate and the trade balance in South Africa. It was discovered that in the long run, the increase in the real exchange rate results in a decrease in the trade balance. This result is also consistent with economic theory, specifically the elasticities approach to a balance of payments adjustment, which states that after a currency depreciation, import prices rise, causing decreased demand and a decrease in import volume, resulting in an improvement in the trade balance due to the price effect of imports. When the rand rises in value, foreign goods (imports) become more affordable; as a result, the number of imports is likely to rise, impacting the trade balance. Moreover, exports become cheaper from the viewpoint of consumption in the foreign country following currency depreciation, resulting in greater demand for exports. The price effect of exports increases the volume of exports as well as the value of exports in terms of

Table 3: ADF unit root test

Variables	Augmented dickey-fuller						Order of Integration
	Levels			1st Difference			
	T-stats	C-value	P-value	T-stats	C-value	P-value	
TB							
Trend	−3.3381	−3.6009	0.0194**	−5.2869	−3.6055	0.0001***	I (1)
Trend and Intercept	−3.5955	−4.1985	0.0426	−5.2410	−4.2050	0.0006***	I (1)
None	0.8209	−2.6240	0.8851	−5.1492	−2.6240	0.0000***	I (1)
LREER							
Trend	−2.2360	−3.5966	0.1971	−5.8529	−3.6009	0.0000***	I (1)
Trend and Intercept	−3.9887	−4.1985	0.0169**	−5.8345	−4.1985	0.0001***	I (1)
None	−0.6316	−2.6211	0.4377	−5.8567	−2.6225	0.0000***	I (1)
TOT							
Trend	0.1391	−3.5966	0.9651	−4.7797	−3.6009	0.0004***	I (1)
Trend and Intercept	−3.2277	−4.1923	0.0930	−4.3949	−4.1985	0.0060***	I (1)
None	1.1591	−2.6211	0.9340	−4.5683	−2.6225	0.0000***	I (1)
LMS							
Trend	−4.1581	−3.5966	0.0022***	−8.7473	−3.6009	0.0000***	I (0)
Trend and Intercept	−5.4096	−4.1923	0.0003***	−8.6351	−4.1985	0.0000***	I (0)
None	−1.9687	−2.6225	0.0253**	−8.8314	−2.6225	0.0000***	I (0)
LSA GDP							
Trend	−0.2836	−3.5966	0.9188	−5.3662	−3.6009	0.0001***	I (1)
Trend and Intercept	−1.9930	−4.1985	0.5877	−5.3051	−4.1985	0.0005***	I (1)
None	5.1567	−2.6211	1.0000	−3.9078	−2.6225	0.0002***	I (1)
LCHI GDP							
Trend	−2.5088	−3.6009	0.1208	−3.0013	−3.6009	0.0431***	I (1)
Trend and Intercept	−0.5039	−4.1985	0.9794	−3.8566	−4.1985	0.0233**	I (1)
None	2.4833	−2.6225	0.9962	−2.9155	−2.6225	0.0138***	I (1)

***, **, * represents levels of significance at 1%, 5% and 10% respectively
Source: Author's own drawings using EViews 9 software

Table 4: PP test for unit root

Variables	Phillips Perron test						Order of integration
	Levels			1st Difference			
	T-stats	C-value	P-value	T-stats	C-value	P-value	
TB							
Trend	−1.9744	−3.5966	0.2966	−5.8417	−3.6009	0.0000***	I (1)
Trend and Intercept	−2.5633	−4.1923	0.2981	−5.8030	−4.1985	0.0001***	I (1)
None	0.7854	−2.6211	0.8790	−5.6864	−2.6225	0.0000***	I (1)
LREER							
Trend	−1.9864	−3.5966	0.2915	−6.7422	−3.6009	0.0000***	I (1)
Trend and Intercept	−2.7610	−4.1923	0.2191	−8.9121	−4.1985	0.0000***	I (1)
None	−1.1887	−2.6211	0.2107	−6.0925	−2.6225	0.0000***	I (1)
TOT							
Trend	0.0634	−3.5966	0.9590	−4.7959	−3.6009	0.0003***	I (1)
Trend and Intercept	−3.2393	−4.1923	0.0908*	−3.8166	−4.1985	0.0256**	I (1)
None	1.1090	−2.6211	0.9280	−4.4333	−2.6225	0.0000***	I (1)
LMS							
Trend	−4.0911	−3.5966	0.0026***	−25.859	−3.6009	0.0001***	I (0)
Trend and Intercept	−5.3290	−4.1923	0.0004***	−25.359	−4.1985	0.0000***	I (0)
None	−1.9769	−2.6211	0.0502**	−17.076	−2.6225	0.0000***	I (0)
LSA GDP							
Trend	−0.3145	−3.5966	0.9140	−5.3949	−3.6009	0.0001***	I (1)
Trend and Intercept	−1.5614	−4.1923	0.7913	−5.3370	−4.1985	0.0004***	I (1)
None	4.6319	−2.6211	1.0000	−3.9574	−2.6225	0.0002***	I (1)
LCHI GDP							
Trend	−2.1245	−3.5966	0.2364	−3.1034	−3.6009	0.0341**	I (1)
Trend and Intercept	1.1471	−4.1923	0.9999	−3.9201	−4.1985	0.0200**	I (1)
None	12.169	−2.6211	1.0000	−2.7091	−2.6225	0.0034***	I (1)

***, **, * represents levels of significance at 1%, 5% and 10% respectively
Source: Author's own drawings using EViews 9 software.

domestic currency, increasing the export trade balance.

Chinese gross domestic product (LCH GDP) has a t statistic of 2.847127 and it is statistically significant. This means in the long run, an increase in the Chinese gross domestic product has a significant long-term positive effect on the trade balance. That

Table 5: Optimal lags results

Model	LogL	AIC*	BIC	HQ	Specification
1	80.274418	−3.037776	−2.285477	−2.763830	ARDL (2, 2, 2, 2, 2, 2)
2	77.739709	−2.962913	−2.252407	−2.704186	ARDL (2, 2, 2, 2, 2, 1)
4	79.799960	−3.063413	−2.352907	−2.804686	ARDL (2, 2, 2, 2, 1, 2)
6	75.917339	−2.971578	−2.344661	−2.743289	ARDL (2, 2, 2, 2, 1, 0)

NB: * signifies the ideal model. Source: Estimation by the researcher using EViews 9 with data from the World Bank

Table 6: Bounds test results

Model		F-statistics
TB=f (LREER, TOT, LMS, LSA GDP, LCH GDP)		5.411321
Significance	**Lower bound I (0)**	**Upper bound I (1)**
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Source: Estimation by the researcher using EViews 9 with data from World Bank *** stipulate cointegration at a 1% level of significant

Table 7: Long run results

Variable	Coefficient	SE	T-statistic	Probability
LREER	−1.447743	0.501277	−2.888111	0.0071
LMS	0.206827	0.141771	1.458881	0.0549
TOT	0.773367	0.308573	2.506272	0.0179
LSA_GDP	−3.296104	0.867550	−3.799326	0.0007
LCH_GDP	0.640117	0.224829	2.847127	0.0079
C	16.476787	3.626754	4.543123	0.0001

Source: Estimation by the researcher using EViews 9 with data from the World Bank

Table 8: Short run results

Variable	Coefficient	SE	T-statistic	Probability
LREER	0.010201	0.061962	0.164639	0.0703
D (LMS)	−0.005855	0.026505	−0.220897	0.8267
D (TOT)	0.913141	0.197845	4.615433	0.0001
D (LSA_GDP)	−3.176811	0.741420	−4.284765	0.0002
LCH_GDP	−0.000640	0.010253	−0.062422	0.9506
ECT	−0.424983	0.098583	−4.310896	0.0002

Source: Estimation by the researcher using EViews 9 with data from the World Bank

is, in the long term, a 1% increase in the Chinese gross domestic product will significantly result in a 0.640117% increase in the trade balance. According to Mhaka and Jeke (2018), China is South Africa's major trading partner, importing 20.6 billion dollars in minerals from South Africa to make final goods in 2021 (Mia, 2023). An upward trajectory of Chinese GDP, which serves as a proxy for international economic activity, supports South African exports to the rest of the globe. As a result, the trade balance will begin to improve. It is possible to assume that the South African economy is closely connected to global economic growth. As a result, every decline in the output of foreign economies has a negative influence on the SA trade balance. The results align with those of Bhat (2021) who evaluated the impact of exchange rate changes on the trade balance of India. It was then discovered that a foreign demand hike improves the trade balance relatively by a higher magnitude both in the short and long run. Similarly, Hunegnaw and Kim (2017) evaluated the foreign exchange rate and trade balance dynamics in East African countries. It was discovered that an increase in foreign real gross domestic product improves the trade balance. Schaling and Kabundi (2014) evaluated the exchange rate and the trade balance in South Africa. It was discovered that in the long run, an increase in USA gross domestic product as a proxy for foreign activities increases the South African trade balance. When a country's goods are in great demand, it tends to export more than it imports, raising demand for its currency and improving the trade balance. According to the economic theory of mercantilism, it is required for a country to sell more than it imports to maintain a favourable trade balance. This suggests that the higher the import level of South African commodities, the better the trade balance. The findings of the diagnostic and stability tests are presented in the next section.

The terms of trade (TOT) have a t statistic of 2.506272 and it is statistically significant. This means in the long run, an increase in the terms of trade has a significant long-term positive effect on the trade balance. That is, in the long term, a 1% increase in the terms of trade will significantly result in a 0.773367 unit increase in the trade balance. An increase in the TOT might thus be advantageous since the country needs fewer exports to purchase the same number of imports. When the TOT rises, it may also have a beneficial influence on domestic cost-push inflation because the rise is suggestive of lowering import prices to export prices. The results align with the results of Lencho (2010) who evaluated the effect of exchange rate movement on trade balance in Ethiopia. It was then discovered that terms of trade have a positive impact on the trade balance of Ethiopia in the short run. Matlasedi (2016), evaluated the impact of the real effective exchange rate on the trade balance in South Africa. It was discovered that an increase in terms of trade has a positive impact on the trade balance in South Africa in the long run. According to the Harberger-Laursen-Metzler effect (HLME), proposed by Laursen and Metzler (1950) and Harberger (1950), an improvement in trade terms will cause an increase in income when the marginal propensity to consume is less than one, private savings will increase, and the trade balance will improve. However, according to Sachs et al., (1981), this will only apply when there is a temporary shock in trade terms rather than a permanent one.

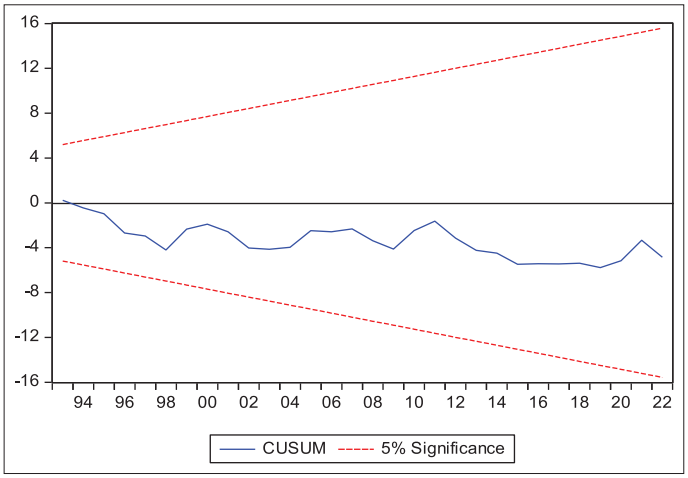
The money supply (LMS) has a t statistic of 1.458881 and it is statistically significant. This means in the long run, an increase in the money supply has a significant long-term positive effect on the trade balance. That is, in the long term, a 1% increase in the money supply will significantly result in a 1.493704% increase in the trade balance. A fast enough increase in money supply can lead to increases in production, leading to decreases in unemployment in the country. The results align with the results of Agheli (2016) who evaluated the trade balance and money supply in Iran. It was discovered that a prompt increase in money supply improves the trade balance, Similarly, Adeyemi et al. (2020), evaluated the effects of money demand on trade balance in Nigeria. It was discovered that when money demand is equivalent to money

Table 9: Stability and diagnostics results

Diagnostics and stability test				
Test	**Type Of Test**	**T-stats**	**P-value**	**Decision**
Normality test	Jacque-Bera	1.301052	0.5217	Residuals are normally distributed.
Heteroscedasticity	Glejser	19.88439	0.3036	There is no heteroscedasticity.
Heteroskedasticity	Breusch-Pagan-Godfrey	19.59726	0.3330	There is no heteroscedasticity
Specification error	Ramsey RESET test	0.350811	0.7283	There are no misspecification errors
Serial correlation	Breusch Godfrey	1.965394	0.3743	There is no serial correlation

Source: Estimation by the researcher using EViews 9 with data from the World Bank

Figure 1: CUSUM results



supply, the trade balance improves. This discovery concluded that money demand had significantly influenced the trade balance, increased goods output and encouraged investment, resulting in enhanced growth. Perpetual expansion in a country's money supply causes a proportional depreciation of its currency, which may result in cheap exports since the currency has lost value. When a currency falls in value, it boosts exports while lowering imports because they become more costly. This result is also consistent with economic theory, specifically the elasticities approach to a balance of payments adjustment, which states that after a currency depreciation, import prices rise, causing decreased demand and a decrease in import volume, resulting in an improvement in the import trade balance due to the price effect of imports. When the rand rises in value, foreign goods (imports) become more affordable; as a result, the number of imports is likely to rise, impacting the trade balance.

South Africa's gross domestic product (LSA GDP) has a t statistic of −3.799326 and it is statistically significant. This means in the long run, an increase in South Africa's gross domestic product has a significant long-term negative effect on the trade balance. South Africa's gross domestic product (LSA GDP) is used as a proxy for national income. The income elasticity of the trade balance stands at −3.296104, suggesting a negative relationship between LSA GDP and TB. That is, in the long term, a 1% increase in South Africa's gross domestic product will significantly result in a −3.296104% decrease in the trade balance. South Africa, being a non-producing country, relies heavily on imported products and services. The results indicate that if the domestic income level rises, domestic consumers will raise their consumption of imported items and vice versa. The findings align with those of Schaling and Kabundi (2014) who evaluated the exchange rate and the trade balance in South Africa. It was discovered that in the long run, the increase in South African GDP results in a decrease in the trade balance. Similarly, Christensen (2012) evaluated the effect of gross domestic product and exchange rates on the trade balance of the United States. The results showed that a decrease in US GDP has a positive influence on the trade balance and vice versa. Matlasedi (2016), evaluated the impact of the real effective exchange rate on the trade balance in South Africa. It was discovered that an increase in South African GDP harms the trade balance in South Africa in the long run. The findings are also consistent with the income elasticity of demand theory, which argues that change in consumer income is proportional to the amount of an item that a consumer desires. The amount demanded for highly elastic commodities will fluctuate fast as income varies. Since South Africa depends much on imported goods when the South African GNI rises, so does its demand for imported products, and vice versa.

Table 8 shows that the error correction term (ECT) is significant and negative in the short run, suggesting that if the variables are disequilibrium in the short run, they will drift back to the equilibrium point in the long run. The coefficient of ECT is −0.424983, which means that the model will adjust at a speed of −42.4983% back to equilibrium.

In the short run, the real exchange rate (LREER) has a t statistic of 0.164639 and it is statistically significant. This means in the short run, an increase in the real exchange rate has a significant long-term positive effect on the trade balance. This suggests that in the long term, a 1% increase in the real exchange rate will significantly result in a +0.010201% increase in the trade balance and a 1% decrease in the real exchange rate will significantly result in a −0.010201% decrease in the trade balance. This finding also supports the J-curve effect in the South African economy. According to Reinert et al (2009), while a currency depreciation may enhance the trade balance in the long term, it may deteriorate in the short run, following the pattern of a slanted J-curve to the right. According to Salvatore (2019), this worsening may be due to import prices rising faster than export prices shortly after currency devaluation, whereas quantities move only by a modest margin. The results align with those of Omer et al., (2023), who evaluated whether exchange rate depreciation improves the trade balance of Pakistan using data from 1968 to 2019. The study discovered the existence of the J-curve. Moreover, Khatoon et al (2022) examined the short- and long-term relationships between the trade balance and the change in the currency rate. It was also discovered that the J-curve phenomenon holds in the case of Bangladesh.

The terms of trade (TOT) have a t statistic of 4.615433 and are highly statistically significant. This means in the short run, an increase in the terms of trade has a significant short-term positive effect on the trade balance. That is, in the short term, a 1% increase in the terms of trade will significantly result in a 0.913141 unit increase in the trade balance. The results align with the results of Lencho (2010) who evaluated the effect of exchange rate movement on trade balance in Ethiopia. It was determined that terms of trade have a positive impact on the trade balance of Ethiopia in the short run. According to the Harberger-Laursen-Metzler effect (HLME), proposed by Laursen and Metzler (1950) and Harberger (1950), an improvement in trade terms will cause an increase in income when the marginal propensity to consume is less than one, private savings will increase, and the trade balance will improve. However, according to Sachs et al., (1981), this will only apply when there is a temporary shock in trade terms rather than a permanent one.

The money supply (LMS) has a t statistic of −0.220897 and it is not statistically significant. This means in the long run, an increase in the money supply has an insignificant short-term positive effect on the trade balance. That is, in the short term, a 1% increase in the money supply will insignificantly result in a −0.005855 per cent decrease in the trade balance but the results are insignificant.

South Africa's gross domestic product (LSA GDP) has a t statistic of −4.284765 and it is statistically significant. This means in the short run, an increase in South Africa's gross domestic product has a significant short-term negative effect on the trade balance. South Africa's gross domestic product (LSA GDP) is used as a proxy for national income. The income elasticity of the trade balance stands at −3.176811, suggesting a negative relationship between LSA GDP and TB. That is, in the long term, a 1% increase in South Africa's gross domestic product will significantly result in a −3.176811% decrease in the trade balance. South Africa, being a non-producing country, relies heavily on imported products and services. The results indicate that if the domestic income level rises, domestic consumers will raise their consumption of imported items and vice versa. The results align with the results of Christensen (2012) who evaluated the effect of gross domestic product and exchange rates on the trade balance of the United States. The results showed that a decrease in US GDP has a positive influence on the trade balance and vice versa. The findings are also consistent with the income elasticity of demand theory, which argues that change in consumer income is proportional to the amount of an item that a consumer desires. The amount demanded for highly elastic commodities will fluctuate fast as income varies. Since South Africa depends much on imported goods when the South African GNI rises, so does its demand for imported products, and vice versa.

The Chinese gross domestic product (LCH GDP) has a t statistic of −0.062422 and it is not statistically significant. This means in the long run, an increase in the money supply has an insignificant short-term negative effect on the trade balance. That is, in the short term, a 1% increase in the money supply will insignificantly result in a −0.000640% decrease in the trade balance but the results are insignificant.

The stability and diagnostics test results are shown in Table 9. The findings show a JB statistic of 1.301052 and a probability value of 0.521771, both are over the threshold of significance of 5%. As a result, the analysis concludes that the residuals are normally distributed even if it fails to reject the null hypothesis. Additionally, the probability value of 0.3743 for the serial correlation test is above the 5% level of significance, suggesting that the null hypothesis cannot be rejected and pointing to the absence of serial correlation. The Glejser and Breusch-Godfrey tests for heteroscedasticity revealed that the probability values of 0.3036 and 0.3330 are larger than the 5% threshold of significance, suggesting that there is no heteroscedasticity, and the null hypothesis cannot be rejected. The Ramsey reset test was also performed, and the results show that it is impossible to reject the null hypothesis that there are no misspecification errors since the probability value of 0.7283 is significantly higher than the threshold of significance of 5%. The next section presents the CUSUM test.

Figure 1 represents the results obtained from the CUSUM test. The CUSUM test is applied to demonstrate the stability of a model. For the model to be stable, the cumulative sum of squares must be within the specified critical threshold of significance, which is 5%. Because the plot recursive residuals, which are shown by the line within the 5% parameter, fit within the confidence band, the test verifies that the model used is truly stable. As a result, this shows that the diagnostics and stability tests comply with the CLRM's underlying premise.

5. DISCUSSION AND CONCLUSION

The primary goal of this study was to investigate the short-run and long-run impacts of exchange rates on the trade balance in South Africa. The secondary aim of the study was to look at the policy perspective that can be set to improve or stabilize the currency and avoid trade deficits through recommendations. The Autoregressive distributive lag (ARDL) approach was employed to achieve these objectives.

In reporting on the sub-objective of examining the nature of the relationship between the real exchange rate and the trade balance in South Africa, the estimated ARDL findings demonstrated that LREER has positive significant effects on TB in South Africa in the short run. This means that in the short run, the real exchange rate has a significant effect on the trade balance in South Africa. In the long run, the results show that there is a negative significant relationship between the trade balance and the real exchange rate. This shows that in the long run real exchange rate has a significant negative effect on the trade balance in South Africa. This result confirms the J-curve holds in the case of South Africa.

The terms of trade as a control variable were discovered to have an impact on the trade balance in South Africa over the short and long run. In the short run, the results showed that there is a positive significant relationship between the trade balance and terms of trade. Similarly, in the long run, the results showed that there is a positive significant relationship between the trade balance and terms of trade. The money supply is another control variable, and it was found to have an impact on the trade balance in South Africa

in the short and long run. In the short run, the results showed that there is a negative yet insignificant relationship between the trade balance and money supply. However, in the long run, the results showed that there is a positive significant relationship between the trade balance and money supply.

South African gross domestic product is a control variable that has an impact on the trade balance in South Africa over the short run and long run. In the short run, the results showed that there is a negative significant relationship between the trade balance and the South African gross domestic product. Similarly, in the long run, the results showed that there is a negative significant relationship between the trade balance and South African gross domestic product. The Chinese GDP is the last control variable, and it has an impact on the trade balance in South Africa over the short run and long run. In the short run, the results showed that there is a negative insignificant relationship between the trade balance and the Chinese GDP. However, in the long run, the results showed that there is a positive significant relationship between the trade balance and Chinese GDP. This proves that a rise in Chinese GDP, as a proxy for foreign economic activity, boosts South African exports to the rest of the world in the long term. As a result, the trade balance improves as China imports minerals from South Africa for production purposes.

Moreover, in terms of accepting or rejecting this study's null hypothesis, the null hypothesis states that the real exchange rate has no significant influence on the trade balance in South Africa. The estimated long run ARDL model demonstrates that the influence of the real exchange rate on the trade balance is significant. As a result, we reject the null hypothesis and conclude that the exchange rate has an influence on the trade balance in South Africa in the long run.

6. RECOMMENDATIONS, IMPLICATIONS FOR POLICY AND LIMITATIONS

The study's findings have policy implications. Since the results suggest that a depreciation of the currency can have a favourable influence on the trade balance in the long run, a policy aiming at depreciating the South African exchange rate to enhance the trade balance can be proposed. This advice to weaken the South African currency should, however, not be too extreme as to have a detrimental influence on the importation of essential capital goods important to the South African economy's growth and development. The findings also revealed that increasing South African exports to the rest of the globe improves the country's trade balance in the long run. The government must implement measures to boost productivity and stimulate investment in export-oriented sectors. The findings also revealed that increasing the money supply improves the trade balance. When money demand equals money supply, the trade balance improves, and a rapid increase in money supply can lead to an increase in productivity. The monetary authorities may pursue an expansionary monetary policy by modestly expanding the money supply to improve the trade balance, as it will allow businesses to access loans to expand their businesses and increase the production of exported products leading to improved trade balance. However, this proposal to pursue an expansionary monetary policy should not be overly aggressive so as not to harm the currency's value. The findings further indicate that an increase in South African GDP, which serves as a proxy for national income, reduces the trade balance. When South Africa's national income rises, so does the demand for imported commodities, resulting in a trade deficit. The government may enact policies aimed at controlling demand and limiting spending on imports, restricting their demand by imposing import and export quotas or tariffs.

It is critical to highlight that it is practically hard to include all elements in a single study, hence the study has significant limitations. The study examined the influence of real exchange on the trade balance in the setting of South Africa, implying that the first limitation is South African territory. The study's conclusions are exclusively applicable in the setting of South Africa. The study only investigated the 42 years from 1980 to 2022, implying that the findings only apply to the period from 1980 to 2022.

Furthermore, because this study only focused on the impact of the real exchange rate on the trade balance in the South African context, future research should attempt to conduct a comparative study in which they investigate South Africa alongside its main trading partner/s and compare their results to see if the real exchange rate affects these countries the same or not.

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