# Mapping the effects of international trade on economic growth of South Africa: Econometric review

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**Abstract**

**Purpose**: The purpose of this study is to investigate the effects of international trade on the economic growth of South Africa.

**Method**: The study employed the autoregressive distributed lag (ARDL) approach for 50 years, from 1973 to 2022, and annual time series data from the World Bank database.

**Results**: The study results revealed that South Africa's economic growth is after the purchasing power parity theory and Heckscher-Ohlin theory, highlighting that international trade is used to drive higher inflation and to increase the level of exchange rate. There is evidence that South Africa has adopted measures that cause a loss of value in the currency and economic growth in general. Therefore, there is a need to design suitable policies that can help to promote international trade and economic growth mobility.

**Originality**: The novelty of this study lies in the fact that the South African government must be considerate and sensible when creating international trading strategies. This article contributes to the continuing discussion on international trade and economic growth to design appropriate policies that can help by aligning the relevant real interest rate that will assist in monitoring international trade channels and policies to enhance and sustain future economic growth. This study contributed to the understanding of the effects of international trade on economic growth debate particularly, by prompting the level of trade to drive South African economic growth to reach the desired level in the country's context and to further stimulate other developing countries.

**Keywords**: economic growth, international trade, developing countries, ARDL approach, South Africa

# Cartographie des effets du commerce international sur la croissance économique de l'Afrique du Sud : examen économétrique

**Abstrait**

**Objectif** : L'objectif de cette étude est d'étudier les effets du commerce international sur la croissance économique de l'Afrique du Sud.

**Méthode** : L'étude a utilisé l'approche ARDL (Autoregssive Distributed Lag) pendant 50 ans, de 1973 à 2022, et des données de séries chronologiques annuelles provenant de la base de données de la Banque mondiale.

**Résultats** : Les résultats de l'étude ont révélé que la croissance économique de l'Afrique du Sud est conforme à la théorie de la parité de pouvoir d'achat et à la théorie de Heckscher-Ohlin, soulignant que le commerce international est utilisé pour stimuler l'inflation et augmenter le niveau du taux de change. Il est prouvé que l'Afrique du Sud a adopté des mesures qui entraînent une perte de valeur de la monnaie et de la croissance économique en général. Par conséquent, il est nécessaire de concevoir des politiques appropriées qui peuvent contribuer à promouvoir le commerce international et la mobilité de la croissance économique.

**Originalité** : La nouveauté de cette étude réside dans le fait que le gouvernement sud-africain doit faire preuve de considération et de bon sens lorsqu'il crée des stratégies de commerce international. Cet article contribue à la discussion continue sur le commerce international et la croissance économique afin de concevoir des politiques appropriées qui peuvent aider en alignant le taux d'intérêt réel pertinent qui aidera à surveiller les canaux et les politiques du commerce international pour améliorer et soutenir la croissance économique future. Cette étude a contribué à la compréhension des effets du commerce international sur le débat sur la croissance économique, en particulier en incitant le niveau du commerce à stimuler la croissance économique sud-africaine pour atteindre le niveau souhaité dans le contexte du pays et à stimuler davantage d'autres pays en développement.

**Mots-clés** : croissance économique, commerce international, pays en développement, approche ARDL, Afrique du Sud

## 1. INTRODUCTION

Many economists have identified international trade as a process that can convert a country's growth and economic relations. International trade investigations across the globe reveal that consensual and multifaceted trade agreements are always increasing to display positive or negative economic transformation (Semosa & Aphane, 2017, Nguyen, 2020). The existence of slow economic growth challenges in South Africa has extended its threat to other challenges such as social scares of economic resources and conditions, unemployment, and xenophobic violence to list a few as also highlighted by Akinrinde, and Tar (2021) and Mutanda (2022). These sentiments affect trading and, ultimately, the economic growth of South Africa. There are numerous studies on economic growth, however, they are hooked on the benefits of international trade, foreign direct investment, capital formation, the balance of trade, and embryonic technology to mention a few, while domestic country economic growth exhibits unsatisfying efficacy (Zahonogo, 2017, Malefane & Odhiambo, 2018, Abendin & Duan, 2021 and Udeagha & Ngepah, 2021).

Although these studies found a long-run relationship between economic growth and trade, they disregard the fact that a country's economic growth may apply a nonlinear relationship based on economic activity change. These unstable economic activities are linked to bilateral and multilateral trade agreements that may swing international trade to benefit developed countries and detrimental outcomes to developing countries to make them indignant. According to Ajayi and Araoye (2019), numerous African countries engaged in international trade suffer the consequences of negative economic growth and exchange rate relationships. Even though international trade has advanced with the entrance of open-door policy to various countries inclusive of South Africa, the country's economic growth has been under pressure, and the value of the currency (Rand) keeps deteriorating. This raises alarms to various stakeholders and investors and prompts the need for balanced economic growth.

However, several studies have investigated international trade and economic growth nexus and noted common (positive/negative) aspects. According to Emehelu (2021) and Agbonkhese et al. (2023), international trade and economic growth have a negative relationship. At the same time, a positive long-run relationship between international trade and economic growth was attested by Mogoe and Mongale (2014), Lawal and Ezeuchenne (2017), Bashir (2018), Ratombo (2019) and Ashrafi and Kalaiah (2020). Apart from that, most of these empirical studies are based on several African countries with the majority such as Afolabi, Danladi, and Azeez (2017), Abdulkadir and Idoko, (2018), Ajayi et al. (2019), Obisike, Onwuka, Okoli and Udeze (2020), Emehelu (2021), Ajayi and Oguntomi (2022) and Ali (2023) focused on Nigeria.

Lastly, even though the results from most countries reflect long-run relationships, their economic growth status is nonlinear. The current study contributes beyond earlier studies by extending its scope/period from 1973 to 2022 which captures international trade relationship with economic growth from the early 70s and beyond. This period also covered the xenophobic sentiments that affected South African economic growth in the 1990s and recent global crises such as the COVID-19 pandemic and the simmering geopolitical tensions. Other crises include the growing intensity and frequency of extreme weather events which have increased underlying risks and vulnerabilities. Furthermore, tight financial conditions also pose increasing risks to global trade and industrial production (UN, 2024). Another challenge regarding trade raised by the UN (2024) is that exports from developing economies like South Africa suffered setbacks, with demand from developed countries weakening and financial conditions restricting trade financing. Another bugbear facing the South African economy is the administered prices, such as those for electricity, water, and rates and taxes, rising at double digits and faster-targeted price inflation. Such pricing pressures necessitate that the interest rates be kept higher as a necessary evil that serves to lower consumer borrowing appetite

and crush household demand (Zaman, 2024). It is against this backdrop that this study is conducted in South Africa to narrow the paradoxes that previous scholars' findings created between international trade and economic growth.

The study aimed to determine the effects of international trade on the economic growth of South Africa by the ARDL approach from 1973 to 2022. The international trade variable was selected as a significant and influential determinant to explain the economic growth of South Africa due to its long-run outcomes and statistically significant behavior. Furthermore, the international trade variable was preferred to observe the movement of goods and services between South Africa and other countries and not the movement of capital. The layout of the paper follows hereafter; Section 2 outlines and presents the theoretical and empirical literature by linking international trade and economic growth. Section 3 presents the methodology and the empirical results in Section 4. Finally, the paper summary, conclusion, contributions, and recommendations are in Section 5.

## 2. LITERATURE REVIEW

This section focuses on theoretical and empirical literature.

### 2.1 Theoretical literature

The effects of international trade on economic growth have made huge theoretical and empirical impacts which are notable from the global to country context. Grounded on this notion, the current study pitched the mercantilist theory, the classical theories based on Adam Smith and David Ricardo's interpretation, and the Heckscher-Ohlin theory known as the HO model. According to the mercantilist theory, the wealth of a country is maintained through controlled imports and massive participation in exports of goods and services to other countries. Restricting imports from other countries results in an auspicious balance of trade and improves economic development as also alluded to by Semosa et al. (2017) and Agbonkhese et al. (2023). Mercantilism discourages international trade and promotes domestic trade.

According to Semosa et al. (2017) and Agbonkhese et al. (2023), the mercantilist theory was opposed by the classical theorists (Adam Smith and David Ricardo) who were credited with the absolute cost advantage and the proportional rate benefit theory. Adam Smith assumed that a country's level of returns including quantitative and qualitative production developments relies on the control of the division of labour. A well-balanced division of labour increases national wealth and reassures economic growth as also emphasized by Schumacher (2012), Semosa et al. (2017), and Agbonkhese et al. (2023). Moreover, David Ricardo elucidates the movements of exchange rates through the purchasing power parity (PPP Theory).

The PPP theory was introduced to extend the law of price which asserts the exchange rate, constant ratio, and price levels between trading countries. However, comparative PPP states that prices and exchange rates fluctuate to protect the purchasing power ratio of the internal currency against foreign currencies. Countries with a higher inflation gap tend to increase the exchange rates of their currencies by estimating, minimizing, and detecting the loss of value of their currency in advance (Mcknight & Sanchez, 2014). The PPP exchange rates help to minimize bogus interpretations that were encountered when using pragmatic market exchange rates as also distinguished by Spaho (2015) and Semosa et al. (2017). The classical theorists argue that international trade is beneficial to all countries if they are attentive to exporting lower-cost advantages and importing advanced cost-disadvantage goods, although trading benefits vary. This means some countries' benefits may be more compared to other countries based on their production capability. The classical theorists are the promoters of international trade who believed that countries should focus on their specialization to harvest the benefits of international trade, harness advanced technology, and attain higher productivity and economic growth. The classical theorists believed that economic growth and trade benefits depend on external trade.

According to the Heckscher-Ohlin theory, international trade is used as a measure to drive and adjust countries' resources. This theory relies on the richness of the factors of production and the strength of the trading countries (Morrow, 2010, Semosa, et al., 2017, Agbonkhese, et al., 2023). The Heckscher-Ohlin theory is identified as the dual countries, two-fold goods, and double factors of production theory. This theory highlights that for a country to benefit from international trade it should export necessary, extra, or from its abundance factors of production and only import scarce and equivalent goods (Heckscher, 1919, Ohlin, 1933 and Agbonkhese, et al., 2023). The study opted for the above-mentioned models as they seem more appropriate for economic growth and international trade (movement of goods and services) than pure Solow economic growth. Although these theories vary by application and advantages, it was important to document them to understand how the effects of international trade on economic growth are managed in South Africa.

### 2.2 Empirical literature

According to Mukherji and Pandey (2014), Emehelu (2021), and Agbonkhese and Salihu (2023), international trade and economic growth have a negative relationship. Sun and Heshmati (2010) and Omoju and Adesanya (2012) support that international trade and economic growth are positively related and their benefits are attested in technological progress advancement and upgrades. Moreover, the level of participation by the domestic market in the internal market to promote active terms of productivity matters.

Afolabi, et al, (2017) discovered that the interest rate, import, and export are among the four factors which displayed a positive relationship with economic growth in Nigeria. The study applied the ordinary least-square (OLS) technique to assess the impact of international trade on Nigerian economic growth for the period 1981-2014. Abdullahi, et al, (2016) evaluated the impact of international trade on economic growth in West Africa covering 16 countries for the period 1991-2011. The result showed that export has a positive influence and was statistically significant to the economic growth of West African countries from 1991-2011. About a 1% increase in exports raised GDP growth by 5.11%. Moreover, imports displayed a positive effect on GDP even though it was statistically insignificant. On the other hand, the exchange rate had a negative stimulus but was statistically significant to economic growth for the period under investigation. Similarly, Lot (2017) investigated the impact of international trade on the economic growth of Nigeria using the OLS technique to cover the period from 1990 to 2016. The results exhibited the long-run cointegration among the coefficients, while in the short-run period, the import coefficient harmed economic growth.

Yakubu et al. (2022) examined the nexus between export diversification and economic growth in the G7 countries, and how the exchange rate volatility affects this relationship. The study applied the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) techniques. They revealed that export diversification and trade openness improved growth in the G7 countries even though is maltreated by exchange rate volatility during the 1995-2018 period.

The inconclusive debate between international trade and economic growth seems endless because most of the previous studies such as Lee (1995) and Melina et al. (2004) reported a bilateral causal relationship between economic growth and international trade since a country's choice of monetary policy plays a major role in its growth. Studies by Bento and Moutinho (2016), and Manwa et al. (2019) obtained negative nexus. For that reason, it necessitated the current study to investigate economic growth relation on international trade and only add one control variable in the form of the real interest rate.

## 3. RESEARCH METHODOLOGY

This section provides the sources of data, followed by the model specification and the explanation of the econometric techniques executed.

### 3.1 Data

This study employed annual time series data from 1973 to 2022. The data was sourced from the World Bank- and the ARDL bounds test approach was preferred for analysis. Table 1 below summarizes the data information and abbreviations of variables in the model of this study.

**Table 1: Definitions of variables**

| Variables and abbreviation | Definition of variables | Unit of measurement |
|---|---|---|
| Gross domestic product per capita (GDPPCGR) | GDP per capita is gross domestic product divided by midyear population. | Constant 2015 U.S. dollars |
| Trade opennesss (TO) | Trade is the sum of exports and imports of goods and services measured as a share of GDP. | % of GDP |
| Real interest rate (RIR) | The real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability. | % of GDP deflator |

Source: Authors' computation

### 3.2 Model specification

Following the recent literature such as Engin and Konuk (2022), Ajayi and Oguntomi (2022), and Agbonkhese et al. (2023), GDP per capita was used as a measure of economic growth (GDPPCGR). The data was in constant 2015 US dollars and was transformed into a natural logarithm form to improve standardization. International trade was measured by trade openness (TO), which comprises the sum of exports and imports of goods and services as a share of GDP. Lastly, the real interest rate (RIR), which is made up of the lending interest rate adjusted for inflation as measured by the GDP deflator was used as a control variable. However, the TO and RIR variables were provided in percentage. The periodicity was considered, and the variables were selected according to data availability.

The study formulated a simple linear regression model for only three variables after making adjustments to Semosa et al. (2017) and Agbonkhese et al. (2023) studies to attain the overall specification of the empirical model. The model is expressed as follows:

$$GDPPCGR = f(TO, RIR) \quad (1)$$

As stated in section 3.2 after converting GDPPCGR into logarithm, the model is specified as follows:

$$LGDPPCGR_t = \beta_0 + \beta_1 TO_t + \beta_2 RIR_t + \varepsilon_t \quad (2)$$

wherein; $\beta_0$ is a constant intercept term, $\beta_1 and\ \beta_2$ denotes coefficients of the explanatory variables and $\varepsilon_t$is the stochastic error term that captures the effect of omitted variables in the model (Gujarati, 2014).

**3.3 Econometric techniques**

This study executed various econometric estimation techniques to investigate the effects of international trade on the economic growth of South Africa using time series data. The use of time series data was vital as it contains collected and specific observations that are used to display their records, internal structures, and periods as also discovered by Li, Hinnov, and Kump (2019) and Hamilton (2020).

3.3.1 Descriptive statistics

The descriptive statistics test was conducted before unit root tests to display deviance and to identify the Jarque-Bera probability test results in the selected variables. Descriptive statistics were also selected to standardize the skewness and kurtosis. According to Ratombo (2019) and Kgomo (2019), the Jarque-Bera test hypothesis is that, at $H_o$, we do not reject the null (since residuals are normally distributed or the p-value is more than 0.05), stated level of significance and at $H_1$, we accept the alternative (the residuals are not normally distributed or the p-value is lower than 0.05) stated level of significant. Moreover, insignificant probability indicates that the stated model has a normal distribution.

3.3.2 Unit root

According to Semosa et al. (2017) and Bum (2024), ignorance of the unit root in variables produces false conclusions. To ascertain stationarity the study employs the Augmented Dickey-Fuller test (ADF) and Phillips Perron (PP) techniques. The ADF and PP are applied to formally test for the presence of unit root in the time series variables preferably under the level and first difference. This study will present formal ADF and PP test results in the table format to validate the characteristics in the time series data. According to Dickey and Fuller (1979) and Semosa et al. (2017), the ADF and PP tests are employed for their consistency and accuracy focus on the probability values, critical values, and the t-statistics values and ensuring that bogus results and problems related to autocorrelation and heteroscedasticity are avoided in the stated model.

3.3.3 ARDL bounds test

The proposed econometric techniques were selected to examine and support the existence of a long-run cointegrating relationship among variables (Ndlovu, 2013, Novalina & Sanusi, 2019). The system of modeling the short-run and long-run dynamics stabilizes the cointegration process and completes the methodological procedure (Kharusi & Ada, 2018, Novalina, et al., 2019). The ARDL technique is advantageous because it provides both the lagged values of the independent variables (distributed lag) and the dependent variable (autoregressive) at once as also noticed by Kharusi et al. (2018) and Khan, Teng, and Khan (2019). Furthermore, the ARDL improves the selection process of different lags of all the selected variables in a model (Khan, et al., 2019).

Moreover, the ARDL is renowned for being utilized for integrated orders, provided they are not I(2) and diverse optimal lags as also attested by Chong et al. (2012) and Kharusi et al. (2018). The ARDL approach further allows for different optimal lags to be used (Kharusi, et al., 2018). The approach also observes the Pesaran et al. (2001) assumption to validate cointegration through the computed F-statistics. According to Engle and Granger (1987) and Brooks (2008), the ARDL cointegration bounds test assists in observing the long-run relationship and utilizes the short-run effects to adjust the economic activity in a specified model through the negative error correction term (ECT). The study critiques the System-GMM (SGG) estimator since is focused more on panel data with “small T, large N” (lesser time intervals and numerous individuals) and analyzing autocorrelation and heteroscedasticity within individuals not across. The study also disregards the Ordinary Least Squares (OLS) estimator since it neglects all the unobserved time-invariant under its levels and uses its lagged dependent variables coefficient estimates to derive the upper and lower limits, respectively (Arellano & Bover, 1995, Blundell & Bond, 1998, 2000, and Hoeffler, 2002). Therefore, this study preferred the

ARDL cointegration estimator technique since it does not require pretests for unit roots, unlike other techniques. Consequently, the ARDL cointegration technique was preferable to deal with variables that are integrated of a different order, I(0), I(1), or a combination of both and, robust when there is a single long-run relationship between the underlying variables (Nkoro & Uko, 2016). The ADRL technique was opted for since the variables displayed a mixture of cointegration orders. However, the study critiqued the GMM and OLS methods due to their inability to provide long-run and short-run estimates concurrently.

3.3.4 Granger

The causality test aims to detect whether the variables used to respond to one other previously or historically and to determine the correlation in the paired time series data as also alluded to by Mohr (2012) and Stern (2018). Moreover, the Granger causality test helps to perceive the current model level of the forecast.

3.3.5 Diagnostic and Stability Testing

Various econometric tests such as the Breusch-Pagan-Godfrey, Arch, Glejser, and Harvey were conducted to detect if the time series model has heteroskedasticity or homoscedasticity. According to Pesaran (2015), Khan et al. (2019), and Mishra et al. (2019), this process outlines the extent to which the regression errors display withdrawals from normality. Assessment of this prerequisite to reveal normality is vital and it provides support to the outcome revealed under Jarque Bera or descriptive statistics. The selected heteroskedasticity tests were opted for to monitor if the variance of the residuals is persistent during the investigated period. The diagnostic tests measure of heteroskedasticity or homoscedasticity are based on test statistics, equivalent p-value, and any other parameters used including the degrees of freedom as also alluded by Tyndale and Murie (2018). The current study applied the Ramsey reset test, the cumulative sum of recursive residuals (CUSUM), and the cumulative sum of squares of recursive residuals (CUSUMSq) to determine the level of coefficient stability in the model (Khan, et al., 2019).

This study's prior expectations are outlined as follows: It is expected that international trade (trade openness) should have a positive relationship with economic growth, while real interest rates could have a positive or negative relationship with economic growth based on the South African government policy direction.

## 4. EMPIRICAL RESULTS

### 4.1 Descriptive statistics test results

Descriptive statistics test results are presented in Table 2 below.

**Table 2: Descriptive statistics results, 1973 – 2022**

| Variables | LGDPPCGR | TO | RIR |
|---|---|---|---|
| Minimum | 3.630 | 5.189 | 34.321 |
| Maximum | 3.796 | 9.685 | 65.974 |
| Mean | 3.722 | 7.147 | 48.789 |
| Standard Deviation | 0.052 | 1.262 | 7.352 |
| Skewness | 0.076 | 0.096 | 0.061 |
| Kurtosis | 1.805 | 1.815 | 2.656 |
| Jarque-Bera | 3.022 | 2.998 | 0.277 |
| Probability | 0.220 | 0.223 | 0.870 |
| Observation | 50 | 50 | 50 |

Source: Authors' computation

The mean, minimum and maximum values for LGDPPCGR are mirrored as follows (3.630), the minimum value of (4.391) and the maximum value of (3.722, 4.391 and 3.796) is followed by the standard deviation which shows nonconformity of (0.052). however, the RIR has the highest maximum value and standard deviation level which raises suspicions on its influence on the economic growth of South Africa. This deviation is expected to capture various levels which cause an increase in economic growth of South Africa during the short-run to enforce long-run balance. All variables are positively skewed and have and long right tail. Jarque-Bera normal distribution shows that the residuals are normally distributed in all the variables probability values are more than 0.05 level of significance. The study accepts $H_o$ since the residual distribution is normal. Descriptive statistics results are in agreement with Ratombo et al. (2019) and Kgomo (2019) who described the Jarque-Bera test outcome as a normality distributor irrespective of their p-values.

**4.2 Unit root tests results**

The study executed the ADF and PP - Fisher Chi-square tests to determine the variables' order of integration. Variables were differenced once to maintain consistency in the unit root test. After differencing all the unit root outcomes were significant and reported at a 5% level of significance. This means that the study disapproved of the claim that the null hypothesis of classification is uncertain at a 5% stated level of significance from 1973 to 2022 (Dickey, et al., 1979, Semosa, et al., 2017 and Pamba, 2020).

**Table 3: Formal unit root test results, 1973 – 2022**

| Variable | | ADF | | | PP | | |
|---|---|---|---|---|---|---|---|
| | Model | Level | first-difference | order | Level | first-difference | order |
| **LGDPPCGR** | Intercept | -2.923 | -2.923** | I(1) | 2.922 | -2.923** | I(1) |
| | Trend & intercept | (0.806) | (0.000) | | (0.829) | (0.000) | |
| | Intercept | -3.506 | -3.506** | I(1) | 3.504 | -3.506** | I(1) |
| | Trend & intercept | (0.720) | (0.000) | | (0.854) | (0.001) | |
| **TO** | Intercept | -2.922 | -2.925** | I(1) | 2.922 | -2.923** | I(1) |
| | Trend & intercept | (0.350) | (0.000) | | (0.350) | (0.000) | |
| | Intercept | -3.504 | -3.508** | I(1) | 3.504 | -3.506** | I(1) |
| | Trend & intercept | (0.516) | (0.000) | | (0.470) | (0.000) | |
| **RIR** | Intercept | -2.922 | -2.923** | I(1) | 2.922 | -2.923** | I(1) |
| | Trend & intercept | (0.417) | (0.000) | | (0.492) | (0.000) | |
| | Intercept | -3.504 | -3.506** | I(1) | 3.504 | -3.506** | I(1) |
| | Trend & intercept | (0.473) | (0.000) | | (0.530) | (0.000) | |

*Note*: ** denotes the level of significance @ 5%. P-values are displayed inside the brackets, while statistics values are tracked with an asterisk to display a level of significance and I(1) denotes the order of integration. L denotes the logged variable.

Source: Authors' computation

Differenced stationarity or I(1) for all variables are reported from t-statistics at a 5% level of significance implied under intercept and trend and intercept outcomes. The outcome of the table above emphasizes that the ADF and PP tests are correct and in line with economic theory as also distinguished by Dickey et al. (1979), Semosa et al. (2017), and Pamba, (2020). From the above test results, the succeeding step is testing whether there is long-run cointegration among the selected variables during the sample period of this study.

### 4.3 Bounds-testing approach results

Table 4 below presents the bounds test results using the Akaike Information Criterion (AIC) to accommodate the variables in question.

**Table 4: ARDL cointegration bounds results, 1973 – 2022**

| Test statistic | Value | Significant level | Critical value bound | |
|---|---|---|---|---|
| | | | Lower bound I(0) | Upper bound I(1) |
| F-statistics | 10.60 | 10% | 2.63 | 3.35 |
| K | 2 | 5% | 3.1 | 3.87 |
| | | 1% | 4.13 | 5 |

Source: Authors' computation

The estimated model F-statistics of 10.60 is greater than the lower bound critical value of 3.1 and the upper bound critical value of 3.87 at a 5% level of significance. Therefore this signifies the existence of long-run cointegration between the variables which denotes that this study rejects the null hypothesis of no balance in favor of the alternative hypothesis which symbolizes that there is an equilibrium relationship between the variables at the stated 5% level of significance. The current study findings supported Kharusi et al. (2018) and Novalina et al. (2019) studies that viewed cointegration as a process and system to stabilize the methodology. The cointegration test was performed before the ADRL long-run and short-run.

**Table 5: ARDL long-run and short-run test results, 1973 – 2022**

| **Long-run** | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Standard Error | T-Statistic | Probability |
| TO | 0.004 | 0.001 | 2.831 | 0.006** |
| RIR | 0.001 | 0.000 | 3.847 | 0.000** |
| | | | | |
| **Short-run** | | | | |
| D(TO) | 0.019 | 0.007 | 2.667 | 0.010** |
| D(RIR) | 0.005 | 0.001 | 68.893 | 0.000** |
| **ECT** | -0.210 | 0.031 | -6.726 | 0.000** |

Note: **denotes rejection of the hypothesis at the 5% level of significant

Source: Authors' computation

The economic growth as a standardized endogenous variable of the regression with the associated coefficients represents the long-run equilibrium relationship thus:

$$\text{LGDPPCGR} + TO + RIR = 0 \quad (3)$$

$$\text{LGDPPCGR} + 0.004TO + 0.001RIR = 0 \quad (4)$$

$$\text{LGDPPCGR} = 0.004TO + R0.001IR \quad (5)$$

Equation (5) suggests a positive long-run economic growth relationship between international trade and real interest rate. Table 5 presents the ARDL results summary of the long-run and short-run. International trade and real interest rates are positively related to economic growth and are statistically significant in both terms of economic growth. The trade coefficient display is 0.004, which suggests that a 1% increase in international trade leads to a 0.00% improvement in economic growth in the long-run ceteris paribus. RIR coefficient displays that its contribution to economic growth is equal to 0.001 which suggests that a 1% increase in RIR leads to a 0.00% increase in economic growth in the long-run ceteris paribus.

However, these degrees of increase in trade and RIR were also noticed in the short-run period of the study. Even though both international trade and real interest rate (0.019, 0.005) short-run contributions to economic growth are better than in the long run. The short-run results also present the error correction term of -0.210 as expected and it is significant at 0.05 level of significance as conventional. It will take South Africa about 21.0% which may be more than thrice to come back to the speed of adjustment. The error correction term is very low, as a result, this is an indication that it will take a long time to restore steady-state or speed of adjustment if the system is distributed. However, the long-run results follow the study's prior expectation and are supported by Abdullahi et al. (2016), Lot (2017), and Afolabi et al. (2017) who also discovered positive outcomes during the long run. However, the study contradicts Ajayi et al. (2019) findings which emphasized that numerous African countries that are engaged in international trade suffer the consequences of negative economic growth and exchange rate relationship.

Moreover, the study supports the purchasing power parity theory and Heckscher-Ohlin theory which states that countries use international trade to drive a higher inflation gap by increasing the exchange rate of their currencies even though it may cause a loss of value of their currency (Mcknight, et al., 2014). Moreover, international trade reveals the richness of the factors of production and the strength of the trading countries. Furthermore, countries are exposed if they benefit from international trade because the following questions will be answered automatically. Firstly, are they exporting when it is necessary? Secondly, are they exporting from extra or their abundance of factors of production? Lastly, are they only importing scarce and equivalent goods? As also outlined under the HO theory by Morrow (2010), Semosa et al. (2017), and Agbonkhese et al. (2023).

**Table 6: Granger causality results, 1973 – 2022**

| Null hypothesis | | | F-Statistic | Probability |
|---|---|---|---|---|
| TO | x−↮ | LGDPPCGR | 8.979 | (0.000** ) |
| LGDPPCGR | x−↮ | TO | 10.383 | (0.000** ) |
| RIR | x−↮ | LGDPPCGR | 0.785 | (0.462) |
| LGDPPCGR | x−↮ | RIR | 5.578 | (0.007** ) |
| RIR | x−↮ | TO | 2.567 | (0.088) |
| TO | x−↮ | RIR | 3.067 | (0.056** ) |

Notes: F-statistics values are followed by the p-valued which are presented in brackets. x−↮ indicates Granger causality and** (asterisk) indicates rejection of the null hypothesis @ 5% level of significant

Source: Authors' own computation

The study displays that there is granger causality flowing from international trade to economic growth and real interest rate. Moreover, economic growth does influence international trade and the real interest rate of the country at a 5% level of significance. Notably, the real interest rate which is made of the lending interest rate adjusted for inflation as measured by the GDP deflator does not influence either international trade or economic growth of South Africa at a 5% level of significance. This may assume that South Africa's economic growth may be limited by lending rate while on the other hand causing a higher inflation rate. The study findings are supported by Stern (2018) who interprets the Granger causality test as a sign to help the country to adjust its economic growth forecast.

### 4.3 Diagnostic and stability test results

To make earlier inferences in the model-building process valid, diagnostic tests are conducted. The diagnostic test results are summarised in Table 5. Stability tests are illustrated in Figures 1 and 2, namely, the CUSUM test and the CUSUM test of squares test graph.

**Table 7: Diagnostic test results, 1973 – 2022**

| Tests | Null Hypothesis | T-Statistic | P-Value | Conclusion |
|---|---|---|---|---|
| BreuschPaganGodfrey | No serial correlation | 0.619 | 0.713 | We do not reject $H_0$ as the P-value is greater than the level of significance at 5%, therefore there is no serial correlation. |
| Arch | No heteroskedasticity | 0.000 | 0.989 | We do not reject $H_0$ as the P-value is greater than the level of significance at 5%, therefore there is no serial correlation. |
| Glejser | No heteroskedasticity | 0.524 | 0.786 | We do not reject $H_0$ as the P-value is greater than the level of significance at 5%, therefore, no heteroskedasticity in the model, but there is homoscedasticity which is desirable. |
| Harvey | No heteroskedasticity | 0.960 | 0.464 | We do not reject $H_0$ as the P-value is greater than the level of significance at 5%, therefore there is no serial correlation. |

Notes: Null hypothesis: Homoskedacicity Alternative hypothesis: Heteroskedasticity
Null hypothesis: No Serial correlation Alternative hypothesis: Serial correlation

Source: Author estimations

A summary of the diagnostic test results is demonstrated in Table 7 above. The diagnostic test results were necessary to validate the outcome of the Jarque-Bera normality test results shown in section 4.1 above that there is a normal distribution of the error terms. According to the Breusch-Godfrey test outcome, there is no serial correlation because the detected R-squared of 0.619 and a probability chi-square or p-value of 0.713 display greater value than the stated level of significance of 0.05. Furthermore, Arch, Glejser, and Harvey show probability values of (0.989, 0.786, and 0.464) which are above the stated level of significance at 5%, meaning we accept the null hypothesis of a constant variance because the model is free from heteroscedasticity. The current study findings are in agreement with Tyndale et al. (2018) who discovered that the selected period is vital to monitor perseverance of the residuals or heteroskedasticity based on the t-statistic, equivalent p-value, and

any other parameters used including the degrees of freedom. Indeed, the current study's econometric model results yield accurate estimates and satisfy the diagnostic test requirement.
Stability test results are presented hereafter:

**Table 8: Ramsey Reset tests results 1973 – 2022**

| Test | Null hypothesis | T-Statistic | P-Value | Conclusion |
|---|---|---|---|---|
| Ramsey Reset | Accepts $H_0$ | 0.299 | 0.766 | Correctly specified |

Notes: Null hypothesis (accept $H_0$) Alternative hypothesis: (accept $H_1$)

Source: Author estimations

The CUSUM and CUSUMSQ results are displayed in Figure 1 and Figure 2 below.

**Figure 1: CUSUM test graph**

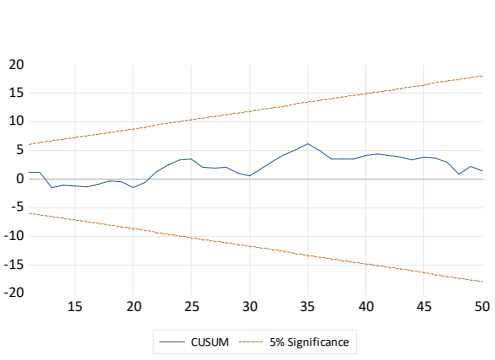
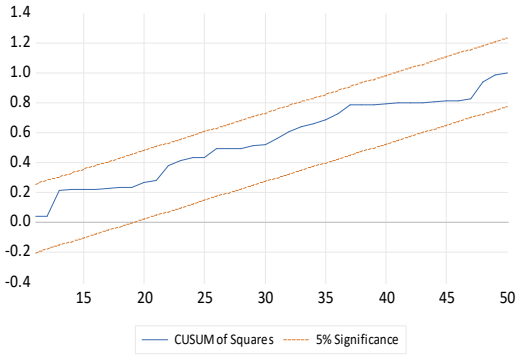



***Figure 2:* CUSUM of squares test graph**




Source: Author estimations

Table 8 above reports that the results from the Ramsey Reset test accept $H_0$ since the model is correctly stated. The P-value of 0.766 is greater than the specified level of significance at 5%. This study confirms that the economic growth model under the investigated period is correctly specified and stable. Both Figure 1 and Figure 2 above support the Ramsey Reset test outcome by showing that the model is stable, as the line moves within the critical dotted lines of a 5% level of significance during the investigated period. The study fulfilled the stability test outcome as also alluded to by Khan et al. (2019).

## 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study analyzed how international trade affects the economic growth of South Africa aiming to address international trade and economic growth relationship and real interest rate and economic growth relationship for the past 50 years. The World Bank was used as the source of the data. From descriptive statistics, some of the econometric techniques were performed before the ARDL. The study findings were that international trade and real interest rates have influenced South Africa's economic growth in both terms. It was noted that South Africa tends to prioritize more real interest rates as its main determinants of economic growth.

The study exposes that both international trade and real interest rates are important variables in explaining variations in the economic growth of South Africa. These outcomes support many researchers who believe that international trade causes economic growth and contrast with numerous empirical studies that suggested that interest rates spur negative intentions. This may be based on the fact that the study applied a real interest rate not an exchange rate as many scholars opted for. This outcome means that South African economic growth is unique in its activities domestically and abroad since it prioritizes real interest rates more than its abundant resources to participate in international

trade. The study makes it clear that there is stability in the economic growth of the South African economy, even though its adjustment process is very long. This study outcome can be utilized globally to clear the economic growth doubt at a country level and to review which theories are used to support the level of economic growth.

It is worthwhile noting that international trade and real interest rate influence on economic growth is below their expected level and significant. Their invisible contributions were also revealed by the lower level of error correction term (ECT), which means that the South African economy takes a long to act or address economic growth issues. It takes longer for the country to adjust to equilibrium because of a lower speed of adjustment of 21%. This is the speed that a dependent variable or economic growth will use to return to its equilibrium state after a change in international trade and real interest rate. The projected error correction value of -0.21 (0.000) is statistically significant. Furthermore, it is supported by a suitable (negative) sign and directs a fair speed of return toward equilibrium following a shock wave. This implies that about 21% of imbalances in the present were instigated by the former year's shock. This outcome may be because the South African economy is capable of raising levels of real interest rates, particularly the tax, lending, and inflation rate part far beyond international trade and economic growth as displayed by the descriptive statistics. South African economic growth can keep crawling based on the country's policies which tend to value more real interest rate without reviewing its contribution and damage to economic growth. Therefore, it is recommended that South African policymakers, should prioritize economic growth by taking advantage of their country level to ensure economic growth stability.

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