Trade openness and economic prosperity in South Africa: Pre- and post-1994 analysis

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Abstract

This study empirically examines the causal relationship between trade openness and economic prosperity in South Africa with quarterly data from 1970 to 2017. The analysis is disaggregated into pre-1994 and post-1994 to capture the economic situation of South Africa during and after apartheid regimes. The long-run equilibrium is suggested between trade openness and economic prosperity using the Johansen cointegration process, during and after apartheid regimes. The Granger causality test suggested a unidirectional relationship running from economic prosperity to trade openness in the post-apartheid era but no causal relationship during the apartheid regime in South Africa. The vector error correction model (VECM) for short-run equilibrium suggests a positive relationship between trade openness and economic growth during the apartheid and post-apartheid era in South Africa. Therefore, the study suggests further trade liberalisation mechanisms in South Africa to enhance the export of excess domestic production, importation of capital goods and scarce skills and further development of technical know-how of local labour.

Keywords: Trade Openness; Economic Prosperity; Granger Causality; Vector Error Correction Model (VECM)

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1. Introduction

The lack of self-sufficiency in resources has caused different economies of the world to open their economy through different trade policies for both inflows and outflows of resources (Keho, 2017). Trade openness over the last six decades has been argued to contribute towards the economic performance of developed and less developed countries. From the conceptual framework, the channels through which trade openness can impact growth can both be direct and indirect. Even though the indirect channels are not amenable to empirical modelling and testing, some of the indirect channels, for example, include improvements in the quality of institutions and macroeconomic policy (Wacziarg, 2001). For instance, Sun and Heshmati (2010), revealed that better governance and liberalisation have resulted in improved productivity and trade competitiveness, and eventually, contributing to China's economic growth. Similarly, Nguyen (2020) established the impact of foreign direct investment on Vietnamese economic growth via the export-import indirect channel. Other indirect gains arise from forward and backward linkages from the expanding sectors and improvements in X-efficiency e.g. improved managerial skills. Past theories of trade based on comparative advantage have become weaker because of the evolution dynamics in global trade which is centered on Global Value Chains, high technological diffusion and increased mobility of factors. The trade theories that explain these channels include the traditional (static) (Ricardo, 1817), dynamic, and endogenous growth theory (Romer, 1986; Lucas, 1988; Romer, 1990), among others. The traditional (static) trade theory is based on channel through specialization gains and consumption gains. The dynamic trade theory is based on accelerated accumulation of physical capital and human capital, which may arise due to a higher rate of savings and enhanced technological transfer (Nowak-Lehmann, 2000; Baldwin, 1992). The endogenous growth theories provide an insight into the link between trade and economic growth after it became obvious that the standard neoclassical exogenous growth models (e.g. Solow, 1956; 1957) were theoretically unsatisfactory in explaining the long-run growth. For instance, they ignored technological change and predicted that economies could eventually converge to a steady state with zero per capita growth. The endogenous growth theory, on the other hand, recognises the fact that technological progress and innovation are part of the economic system (see Romer (1986, 1990); Grossman and Helpman (1991a, b); Rebelo (1991); Lucas (1988); Dollar (1992)). Thus, the theory provides a good framework for understanding the relationship between trade and growth.

The World trade volume, as a percentage of GDP, increased from 25.62% in 1960 to about 60% in 2013 (World Bank, 2015). Furthermore, cross-border capital flows increased to about 20% of the world GDP in 2007, but then decreased to 5% of the world GDP in 2012 (James et al., 2014). The volume of world trade continued to grow slowly in 2015 recording growth of 2.7 percent, revised down from a preliminary estimate of 2.8 percent in April 2016. Trade growth was roughly in line with world GDP growth of 2.4 percent (World Bank Group, 2014). Consequently, South Africa's trade policies over the years have changed both the pace, pattern, and structure of their participation in the international market scene before and after the apartheid regime which has stirred the interest of this study to investigate its impact on the economy. The Government of South Africa embarked on new economic and trade reforms following the end of apartheid and the holding of multi-party elections in 1994. The post-Apartheid government attempted to undo the economic catastrophe of the Apartheid regime. According to Lundahl and Petersson (2009), poor growth, unequal wealth distribution, inequality, and poor trade performance were some of the defining characteristics of the South African economy between the 1960s to early 1990s. In addition, the authors assert that these outcomes were facilitated by the macroeconomic policies of the Apartheid regime. In a similar context, Rodrik (2008), argues that the economic

sanctions imposed on South Africa caused a decline in the country's trade balance, foreign investment, and trade partners. Since then, the government has tried to increase investment, and to also focus on export promotion that will gradually re-integrate its economy into the multilateral trading system.

The main objective of South Africa's economic policy is to enhance the value of labour-intensive products with a view to reducing the level of unemployment (29 percent of the economically active population). Tariffs and "supply-side measures" are South Africa's main trade policy instruments while Quantitative restrictions have been dismantled to a large degree. In recent years, merchandise imports have grown faster than exports. South Africa's exports include machinery, motor vehicles and fertilizers to African countries, and minerals and agricultural products to developed markets, mainly Germany, Italy, Japan, the United Kingdom and the United States. These Countries have also remained South Africa's main suppliers of imports. Mining and related activities remain at the centre of the South African economy and account for some 40% of earnings from merchandise exports. Figure 1 reveals some interesting summary trends of the relationship between trade openness and economic growth of South Africa from 1970 to 2016. The trend between trade-growth nexus shows a negative relationship from 1970 to 1994 which signify the Apartheid Government while the graph shows a positive trend between trade-growth nexus from 1994 to 2016 in South Africa.
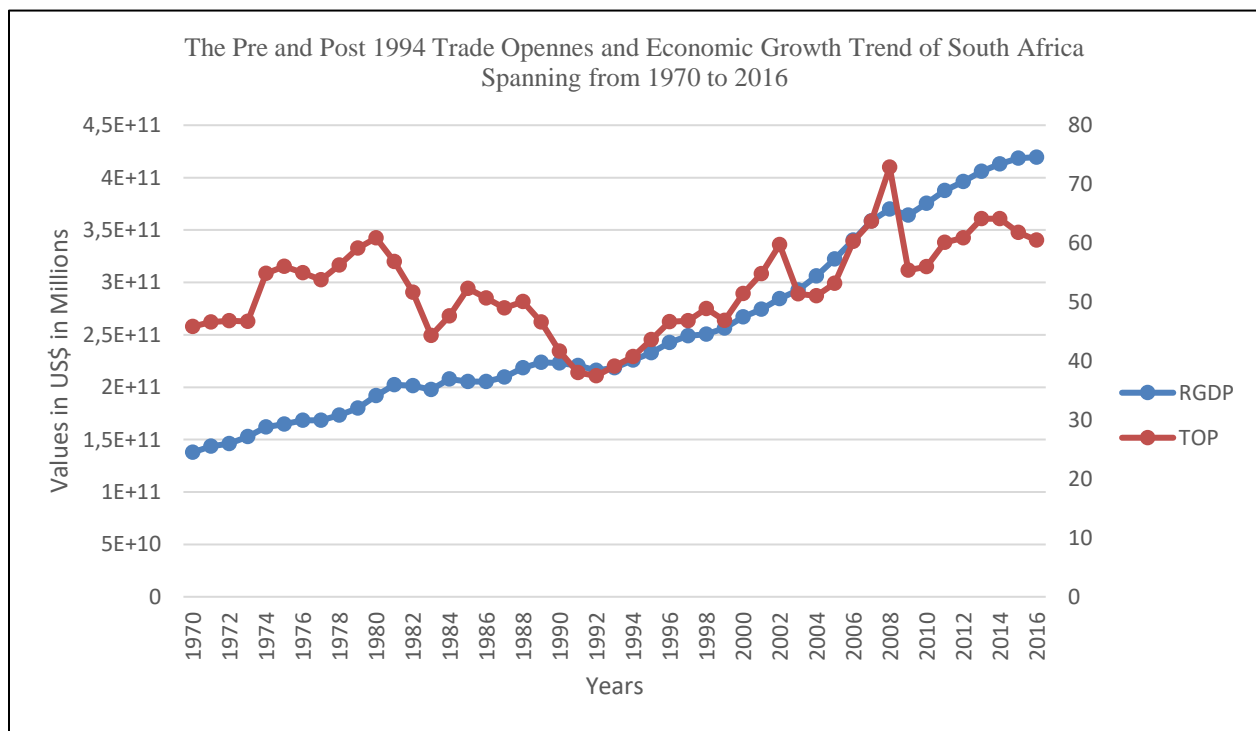
Figure 1. The relationship between trade openness and economic growth of South Africa in Apartheid and post-Apartheid periods.

Trade openness has become an important policy variable for developing countries for the last few decades, its impact on economic growth and development has recently received a great deal of attention from academic researchers and policy makers alike internationally, as many developing countries continue to embark on the

liberalisation of their trading system and signing bilateral, regional, and multilateral trade agreements with other countries all over the world. In spite of this, the precise effect of trade openness on economic growth, at least for developing countries, still remains an open question as both theoretical and empirical studies have not yet provided a definitive conclusion (Chaudhuri et al., 2006; Chandra et al., 2010; Claustre et al., 2008; Du, 2010). The relationship between trade openness and economic growth has witnessed both theoretical and empirical debate in the international trade literature and yet without reaching a consensus. Many theoretical models have been proposed to explain how trade openness may, or may not, have a positive impact on economic growth (see Grossman and Helpman, 1990, 1991; Rivera-Batiz and Romer, 1991; Young, 1991; Romer, 1993; Mountford, 1998; Spilimbergo, 2000; Ben-David and Loewy, 1998, 2000, 2003; Perera-Tallo, 2003). Empirically, a positive relationship between trade openness and economic growth has been supported by David (1993), Dollar (1992), Edwards (1998), Rutherford and Tarr (1998), Sachs and Warner (1995), Salinas and Aksoy (2006), Wacziarg and Welch (2003), Chang et al. (2009), Dollar and Kraay (2004), Frankel and Romer (1999), Freund and Bolaky (2008), among others. However, others have argued that a strong positive correlation between trade openness and growth is doubtful (e.g., Yanikkaya, 2003; Musila and Yiheyis, 2015; Polat et al., 2015; Ulaşan, 2015). The mixed results from the empirical literature might be attributed to the different econometric techniques (time series, cross-section, or panel data), the sample of countries, and the treatment of potential endogeneity of trade openness, the time period and the indicator used as a proxy for trade openness.

Few studies on trade and economic growth in Africa have been conducted including those by Fosu (1990), Ahmad and Kwan (1991), Bahmani-Oskooee et al. (1991), Onafowora and Owoye (1998), Addison and Baliamoune-Lutz (2006), Ahmed and Suardi (2009), Menyah et. al., (2014), Nicita et al., (2014), and Musila and Yiheyis (2015). These studies have produced mixed results. In a study conducted by Addison and Baliamoune-Lutz (2006) on North African countries, the results demonstrated the impact of economic reforms on growth is heavily influenced by the quality of institutions. Ahmad and Kwan (1991) investigated 47 African countries and found no causality between exports and growth. Ahmed and Suardi (2009) showed that trade liberalization is associated with greater output and consumption growth volatility in SSA. In a case study focusing on Kenya, Musila and Yiheyis (2015) found a negative effect of trade openness on economic growth. Although there is some positive impact on investment, they conclude that it is not large enough to lead to higher economic growth.

From the above discussion, most existing studies in empirical literature employ panel data regression approaches that impose cross-sectional homogeneity on coefficients, with the hope that the results could be applied to all countries. The cross-sectional homogeneity assumption is likely to be violated given the heterogeneity of economies with respect to trade policy, economic conditions and technological and institutional developments. For example, what do Burundi, Kenya, Mali, Nigeria, Germany, India, and France have in common to be included in the same panel data analysis? It is on this basis that the study seeks to focus mainly on South Africa by investigating whether or not trade-led growth hypothesis is valid for the apartheid and post-apartheid regimes. This is because, in the empirical literature, few studies have focused on South Africa, therefore, this paper aims at providing a new paradigm shift by considering the government regimes. Thus, the study disaggregated its analyses to pre- and post-1994 empirical evidence by complementing the previous literature in addressing and re-examining trade-growth nexus for South Africa by using a vector error correction for the period of 1970 to 2017. Therefore, the main objective of this study is to empirically examine the causal-relationship between trade openness and economic prosperity in South Africa with quarterly data

from 1970 to 2017. The analysis is disaggregated into pre-1994 and post-1994 to capture the economic situation of South Africa during and after apartheid regimes. This methodological framework allows us to test the causal relationship between trade openness and economic prosperity. Furthermore, this method enables us to distinguish between the short-run and long-term effects of trade and growth during and after the apartheid era. In particular, we shed light on the question of whether the benefits of trade or fears of negative effects of trade have characterised the economy of South Africa for different time horizons in its political and economic history. That is, finding a long-term positive causality from trade to growth or vice versa would provide evidence of the long-term benefits of international integration. By contrast, the presence of negative causal effects in the short term would be an indication of the pain of adjustment the South African economy has to sustain if a long-term benefit is the target.

The rest of the paper is organised as follows. In section 2, empirical literature on the impact of trade openness on economic growth is reviewed. Section 3 explains the empirical methodology. Section 4 discusses the empirical results. In the final and last section of the paper, we offer our concluding and policy recommendation remarks.

2. Trade openness and economic growth nexus

Several efforts have emerged to empirically evaluate the interaction between international trade and economic growth and the findings from these studies have been mixed. The existing empirical literature however does not provide clear evidence on the relationship between trade openness and economic growth. Many research works provide evidence that increasing trade internationally has a positive effect on GDP increase. On the other hand, some studies report that it is difficult to find a clearly defined positive relationship or even that there is a negative or depressing relationship between trade openness and growth. Yanikkaya (2003) uses the data of 100 developed and developing economies for the period 1970 to 1997 for a cross-country panel regression. The variables he included are human capital, physical capital, telephone mainlines, life expectancy, and a variable representing openness indicators. The study used two openness indicators, one using trade shares and another one using the ratio of imports plus exports to GDP. The coefficient of openness was positive and significant on growth.

Alesina and Tabellini (2005) analyses the impact of an economy's trade openness on economic growth for a sample of countries since 1960. The panel data relied on a three least square (3 SLS) procedure. The result reveals that a simultaneous consideration of an economy's openness and its size led to strong effects on economic growth. That is, openness has a large effect on small countries, but these effects become zero as the country's size increases. The measure of openness involves variables in current prices. Rodriguez (2007) studies the existence of a cross-country empirical relationship between openness to international trade and economic growth within the period 1990-2003. The research shows that growth does not display a significant correlation with any measure of trade openness over this period in which the trade to GDP ratio was used to measure it. The regression used was the least squares dummy variable (LSDV) technique. It is found that openness may be beneficial to the very poor but not the middle-income as well as the idea that tariffs on intermediate and capital goods (but not tariffs on consumer goods) are detrimental to growth. Jawaid (2014) examines the comparative effect of three different measures of trade openness on the economic growth in Pakistan. Autoregressive distributed lag (ARDL) method, cointegration and ordinary least square (OLS) were

used and the results suggest a significant positive long-run relationship between export and economic growth, but the total volume of trade and imports have a significant negative effect on economic growth. The Granger causality and variance decomposition analysis indicate that there exists a unidirectional causality between trade openness and economic growth. In the export model, causality runs from export to growth. Whereas, in the model with total volume of trade and import, causality runs from growth to total volume of trade.

Matthew and Adegboye (2014) investigate the impact of trade openness and institutions on economic growth in sub-Saharan Africa (SSA). The study employed econometric analyses involving the Panel Unit Root, Least Square Dummy Variables (LSDV), and the Generalized Method of Moments (GMM) techniques for the period 1985-2012 on thirty selected SSA countries. The major findings of the study revealed that institutions had a significant positive impact on economic growth, but trade openness only had a little significance on growth in the selected SSA countries. Therefore, the study recommended that the SSA countries should ensure that funds are channeled appropriately to projects of economic importance to further develop their institutions to have a meaningful impact on economic growth. Using a robust functional estimation procedure based on IV GMM principles, Ezeoha et al. (2018) investigated the impact of armed conflicts on intra-regional trade flows with a panel of 15 ECOWAS member and 19 COMESA member countries for the period 1997 to 2015. The results were found to be regionally comparable, with the evidence indicating that armed conflicts constrain intra-regional export and trade openness. The results indicate that the classical insurgency theory explains better the patterns of intra-regional export flows and trade openness, whereas the economic interest theory explains better the patterns of intra-regional import flows. The impact of armed conflict intensity on intra-regional trade flows is found to be sensitive to border proximity, trade diversification, mineral rents and national income levels. While border proximity on its own enhances intra-regional export and import flows, it also has the tendency to exacerbate the negative impact of armed conflicts. As armed conflicts intensify, for instance, member countries become more incentivised to implement secured border and trade policies as a way of guarding against counter flows of arms and illicit commodities.

Brueckner and Lederman (2015) examine the relationship between trade openness and economic growth in Sub-Saharan Africa. The instrumental variables estimate shows that economic growth has a significant negative contemporaneous effect on trade openness, while trade openness has a significant positive effect on economic growth. Dutta et al. (2017) investigated the causal relationship among foreign direct investment, domestic investment, trade openness, and economic growth in Bangladesh over the period 1976–2014. Unit root tests, cointegration methods, and Granger causality tests in the Vector Error Correction Model (VECM) framework were used to investigate the relationships. The results of the Granger causality test based on a stable VECM support a unidirectional causality running from foreign direct investment to growth, domestic investment to trade openness, growth to trade openness and bidirectional causality between domestic investment and growth and foreign direct investment and domestic investment. The importance of foreign direct investment to drive trade relationships between countries and economic growth is well documented in Africa since trade openness has a spillover effect on economic prosperity (Anyanwu and Erhijakpor, 2004; Anyanwu and Yameogo, 2015).

As touching further evidence from the empirical literature on the Sub-Saharan African countries, the previous studies are also mixed. For example, Deme (2002) validated the trade-led growth hypothesis for Nigeria. Chang and Ying (2008) confirmed the positive growth effects of trade and air freight for a sample of Economic Commission for Africa (ECA) countries. Gries et al. (2009) investigated the case of 16 Sub-Saharan

African countries and did not find significant long-run relationships among the variables for most of the sample. They also provideed evidence that economic growth causes trade openness in Ethiopia, Gabon, Kenya, Mauritius, Senegal, Sierra Leone, and Togo, whereas a feedback causal relationship exists for Cameroon, Cote d'Ivoire, Nigeria and Rwanda. On the contrary, no causal relationship between trade and growth was found for Burundi, Ghana, Madagascar, South Africa, and Gambia. For a sample of 34 African countries, Vlastou (2010) found that openness to trade has a negative impact on economic growth. He also reported a causal relationship running from openness to growth. In a study of 27 African least developed countries, Tekin (2012) finded no significant causality between foreign aid, trade openness and real per capita GDP. Asfaw (2015) analysed the impact of trade liberalization on economic growth in a sample of 47 Sub-Saharan African countries. The results revealed that openness to trade stimulates both economic growth and investment. Besides, trade policies such as average weighted tariff rate and real effective exchange rate affect economic performance through trade. Menyah et al. (2014), investigated the causal nexus among financial development, trade openness and economic growth in 21 Sub-Saharan African countries. They found limited support for the trade-led growth hypothesis, which was only evident in Benin, Sierra Leone, and South Africa. In a more recent work, Polat et al. (2015) found that trade openness actually hinders economic growth in South Africa. Finally, Lawal et al. (2016) used the ARDL methodology to analyse Nigeria and found a negative long-run impact of trade openness on economic growth but a positive short-term effect. They also identified a two-way causality between the two variables.

Table 1. Summary of further empirical findings on the trade openness-growth nexus

Authors (year)	Periods	Countries	Empirical Methods	Findings
Panel A: Cross-national Studies				
Fetahi-Vehapi et al. (2015)	1996 - 2012	South East European (SEE)	system GMM	The estimation results indicate that the positive effects of trade openness on economic growth are conditioned by the initial income per capita and other explanatory variables. Trade openness which favours countries with higher level of FDI and with higher gross fixed capital formation.
Zahonogo, (2016)	1980- 2012	sub-Saharan Africa (SSA)	Pooled Mean Group estimation technique	The empirical evidence indicates that below trade openness has beneficial effects on economic growth and above which the trade effect on growth declines. The relation between trade openness and economic growth is not linear for SSA.
Gries and Redlin (2012)	1970- 2009	158 countries	Panel cointegration tests and panel error-correction models (ECM) in combination with GMM estimation	The results suggest a long-run relationship between openness and economic growth with a short-run adjustment to the deviation from the equilibrium for both directions of dependency.

Table 1. *Cont.*

Authors (year)	Periods	Countries	Empirical Methods	Findings
Panel A: Cross-national Studies				
Nowbutsing (2014)	1997-2011	Indian Ocean Rim Countries	Panel unit root, cointegration and fully modified ordinaryleast square (FMOLS) technique	The results reveal that measures of openness positively affect economic growth. However, imports as a percentage of GDP have the highest impact on economic growth in terms of size.
Zeren and Ari (2013)	1970-2011	G7 countries	Granger non-causality test in heterogeneous panels	Trade opennnes↔growth
Wacziarg (2001)	1970-1989	57 Countries	Panel data	Positive effect on growth
Vamvakidis (2002)	1870-1990	89 Countries	OLS	No effect on growth
Brunner (2003)	1960-1992	125 Countries	Dynamic panel data	The results conclude that trade openness has a significant large effect on the level of national income, but small and non-robust effect on income growth
Lee et al. (2004)	1961-2000	100	Panel data	Positive effect on growth
Salinas and Aksoy (2006)	1970-2004	39 countries	Panel data	Positive effect on growth
Rassakh (2007)	1960-1985	150 Countries	OLS	Positive effect on per capita income and growth
Freund and Bolaky (2008)	2000-2005	126 Countries	OLS	Positive effect on per capita income.
Chang et al. (2009)	1960-2000	82 Countries	Panel data	Positive effect on growth
Hanh (2010)	1994-2008	29 Asian developing countries	Co-integration and Granger causality test	Bidirectional causality
Kim (2011)	1960-2000	61 Countries	OLS	Positive effect on growth depends on levels of development

Authors (year)	Periods	Countries	Empirical Methods	Findings
Panel B: National studies				
Dutta, Haider and Das (2017)	1976–2014	Bangladesh	Unit root tests, cointegration methods and Granger causality tests in Vector Error Correction Model (VECM)	Growth→trade Openness

Table 1. *Cont.*

Authors (year)	Periods	Countries	Empirical Methods	Findings
Panel B: National studies				
Matadeen et al. (2011)	1989-2009	Mauritius	Vector Error Correction Model (VECM).	Significant positive links were revealed both in the long-run and the short-run, indicating that openness is an important engine of economic growth in the island. The VECM depicted the presence of a bi-directional causality between the trade liberalization proxy and economic growth
Umer (2014)	1960-2011	Pakistan	Autoregressive Distributed Lag (ARDL)	The overall empirical results show that trade volume, investment and human capital have positive and significant impact on economic growth
Muhammad et al. (2012)	1965-2010	Australia	ARDL bounds testing approach	The results show exports, imports and trade openness have a positive impact on economic growth in Australia
Sun and Heshmati (2012)	2002-2007	China	Econometric and non-parametric techniques	The estimates revealed an increased participation in international trade helps stimulate rapid economic growth in china.
Abughalia and Abusalem (2013)	1980-2010	Libyan	Descriptive, statistical and linear regression analysis	The gains from export were higher than the loss for import, where this situation has led to positive balance of payment.
Jin (2003)	1953-1999	North Korea	Granger causality test	The result supports the hypothesis that free trade arouses the economic growth
Utkulu and Kahyaoglu (2005)	1990-2004	Turkey	Non-linear Time Series and Markow Modelling	They found that trade openness in Turkey affected the growth positively
Yaprakli (2007)	1990-2006	Turkey	Johansen Cointegraiton Method	He identified that economic growth was affected positively from trade openness and there was a mutual causality between openness and economic growth in short term.
Kurt and Berber (2008)	1989-2003	Turkey	VAR analysis	Their finding shows that the hypothesis that openness claimed by endogeneous growth theories would increase the growth was applicable for Turkish economy.
Chimobi (2010)	1970-2005	Nigeria	Cointegration and Granger causality test	The Granger-causality empirical findings suggest that trade openness and financial development does have causal impact on economic growth.
Lacheheb et al. (2013)	1980-2010	Algeria	autoregressive distributed lag (ARDL) cointegration framework	The results of their study reveal that, openness has a significantly positive effect on economic growth
Tash and Sheidaei (2012)	1966-2010	Iran	Johansen co-integration and principal component analysis	The empirical findings show that positive relationship between trade liberalization, financial development have a joint impact on economic growth.

Table 1. *Cont.*

Authors (year)	Periods	Countries	Empirical Methods	Findings
Panel B: National studies				
Omisakin et al. (2009)	1970-2006	Nigeria	Toda-Yamamoto causality and ARDL Method	There is a positive relationship between openness and growth

Notes: Trade openness → real income or growth means a causal relationship from trade openness to real income or growth. Real income or growth ← trade openness depicts a causal relationship from real income to trade openness. Trade openness ↔ growth represents bidirectional causality between trade openness and growth. VAR vector autoregressive model. GMM denotes the Generalized Method of Moments. ARDL denotes the autoregressive distributed lag approach. ECM Error Correction Model.

The impact of trade openness on economic growth is a subject of debate in the existing literature as it can be seen from the literature review. The impact was found to be positive in some studies and nonsignificant or even negative in others. The mixed results might be attributed to analytical framework and country specific characteristics. It is on this basis that this study contributes to the debate by focusing on the apartheid and post- apartheid regimes analysis. Therefore, in accordance with the scant literature and the aforementioned conclusions, this study hypothesizes that:

H1: Trade openness causes economic prosperity in the pre-1994 apartheid regime in both short- and long-run.

H2: Trade openness causes economic prosperity in the post-1994 apartheid regime in both short- and long-run.

3. Methodology

The impact of trade openness on the economic growth in South Africa during 1970-2017 has been evaluated by utilising secondary data from the Statistics of South Africa database. Augmented Dickey Fuller (ADF) unit root tests was applied to test the data properties and their stationarity. The existence of log-run relationship between the series of variable was evaluated. Vector ECM (VECM) was established to identify short-run relationship and error correction term (ECT). According to Asteriou et al. (2016), the VECM is a more specialized version of the VAR model, this is because the VECM accounts for the presence of cointegration among the stated variables. In addition, the VECM captures both short run and long run equilibrium relationship among the variables. This characteristic separates the VECM from the VAR model because the VAR model only focuses on the short-term relationships between the variables. Granger causality was applied to examine the nature of causal relationship between the variables.

3.1. Empirical models

In this section, VECM is applied to examine the causal relationship between trade openness and economic growth. Trade openness is measured with the ratio of the sum of value of exports and imports. Economic prosperity is measured with the value of real gross domestic product and other macroeconomic indicators included are physical capital stock, labour and foreign direct investment (measure for technology transfer).

The time series data for all variables during the period 1970-2017 was obtained from South Africa Reserve Bank. The data is sourced from the SARB data base the data is freely and publicly available. Adopting error correction mechanism in examining the relationship between trade openness and RGDP involves three main steps. First, determining the integration order by using ADF unit root test, second, running co-integration test, Third and last, investigating the long-run and short-run causality relationship.

3.2. Model specification

Following previous studies, the basic theoretical model used to estimate the relationship between trade openness and economic prosperity for South Africa follows Asfaw (2015), Zarra-Nezhad et al. (2014), Brueckner and Lederman (2015), Vlastou (2010), Polat et al. (2015), Ulaşan (2015), Were (2015); Lawal et al. (2016) and Keho (2017) with modifications. Our estimated model also includes other macroeconomic variables that determine growth because they serve as a channel of transmission between trade openness and growth in the empirical literature. The research model is given below as:

$$LRGDP_t = \alpha_1 + \beta_1 LTOP_t + \delta_1 LHC_t + \gamma_1 LGFCF_t + \tau_1 LEMPLYMNT_t + \vartheta_1 FDI_t + \varepsilon_{t1} \qquad (1)$$

Where: RGDP= Logarithmic of real gross domestic product (proxy for economic prosperity); LTOP= Logarithmic of trade openness; LHC= Logarithmic of human capital; LGFCF= Logarithmic of gross fixed capital formation; LEMPLYMENT= Logarithmic of employment; and FDI= Foreign direct investment.

The data for this study were sourced from the annual statistical records from South African Reserved Bank for various issues. The data were in annual time series but later transformed to quarterly data through data splicing techniques for both periods under study; apartheid regime (1970-1993) and post-apartheid regime (1994-2017) regimes. Data splicing technique is a method that aggregates data from different sources to create a larger more comprehensive dataset. This method was relevant to this study in order to transform annual data into quarterly data to extend the sample size and ensure that the data series has sufficient data points (n>30) for estimation and that the data series is normally distributed. Therefore, ensuring that the dataset provides more accurate statistical inferences and predictions.

3.3. Unit root test

To examine the above-mentioned relationship, the first and most important phase to run a non-spurious regression, detecting the non-stationary variables has been carried out. Data series was examined for the existence of possible unit roots to detect the integration order of the model variables. ADF, initially formulated by Dickey and Fuller (1979; 1981), unit root test was obtained to check data stationarity. The stationarity tests were conducted on three conditions: None, which is a test condition that does not consider the constant term and trend component. The second condition is Trend, this condition considers only the deterministic trend in the model. The final condition is Trend and Intercept, this condition considers both the constant term and the deterministic trend component, moreover, this condition considers the autocorrelation process. Since the absolute value of ADF statistic at level is lower than the critical value; the six variables have a unit root (not stationary). But they became stationary after the first difference (with intercept, with intercept and trend, and without both), at 1% level of significance, as shown in the table below. When the first difference was taken, the

unit root was eliminated. Thus, the first difference series can be directly used for the time series econometric modeling (co-integration regression).

$$
\begin{aligned}
\Delta \text{LRGDP}_t &= \alpha_1 + \varphi_1 LRGDP_{t-1} + \beta_1 LTOP_{t-1} + \delta_1 LHC_{t-1} + \gamma_1 LGFCF_{t-1} + \tau_1 \text{LEMPLYMNT}_{t-1} + \vartheta_1 \text{FDI}_{t-1} \\
&+ \omega_1 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_1 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_1 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_1 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_1 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_1 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t1}
\end{aligned}
$$

(2)

$$
\begin{aligned}
\Delta \text{LTOP}_t &= \alpha_2 + \varphi_2 LRGDP_{t-1} + \beta_2 LTOP_{t-1} + \delta_2 LHC_{t-1} + \gamma_2 LGFCF_{t-1} + \tau_2 \text{LEMPLYMNT}_{t-1} + \vartheta_2 \text{FDI}_{t-1} \\
&+ \omega_2 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_2 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_2 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_2 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_2 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_2 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t2}
\end{aligned}
$$

(3)

$$
\begin{aligned}
\Delta \text{LHC}_t &= \alpha_3 + \varphi_3 LRGDP_{t-1} + \beta_3 LTOP_{t-1} + \delta_3 LHC_{t-1} + \gamma_3 LGFCF_{t-1} + \tau_3 \text{LEMPLYMNT}_{t-1} + \vartheta_3 \text{FDI}_{t-1} \\
&+ \omega_3 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_3 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_3 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_3 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_3 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_3 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t3}
\end{aligned}
$$

(4)

$$
\begin{aligned}
\Delta \text{LGFCF}_t &= \alpha_4 + \varphi_4 LRGDP_{t-1} + \beta_4 LTOP_{t-1} + \delta_4 LHC_{t-1} + \gamma_4 LGFCF_{t-1} + \tau_4 \text{LEMPLYMNT}_{t-1} + \vartheta_4 \text{FDI}_{t-1} \\
&+ \omega_4 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_4 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_4 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_4 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_4 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_4 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t4}
\end{aligned}
$$

(5)

$$
\begin{aligned}
\Delta \text{EMPLYMNT}_t &= \alpha_5 + \varphi_5 LRGDP_{t-1} + \beta_5 LTOP_{t-1} + \delta_5 LHC_{t-1} + \gamma_5 LGFCF_{t-1} + \tau_5 \text{LEMPLYMNT}_{t-1} + \vartheta_5 \text{FDI}_{t-1} \\
&+ \omega_5 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_5 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_5 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_5 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_5 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_5 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t5}
\end{aligned}
$$

(6)

$$
\begin{aligned}
\Delta \text{FDI}_t &= \alpha_6 + \varphi_6 LRGDP_{t-1} + \beta_6 LTOP_{t-1} + \delta_6 LHC_{t-1} + \gamma_6 LGFCF_{t-1} + \tau_6 \text{LEMPLYMNT}_{t-1} + \vartheta_6 \text{FDI}_{t-1} \\
&+ \omega_6 \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_6 \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_6 \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_6 \sum_{i=0}^{p} \Delta LGFCF_{t-i} \\
&+ \rho_6 \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_6 \sum_{i=0}^{p} \Delta FDI_{t-i} + \varepsilon_{t6}
\end{aligned}
$$

(7)

As Johansen (1991) approach is quite sensitive to lag length, the suitable number of lag should be determined in a systematic manner. To do that, several selection information criteria can be used. In this study, Akaike information criterion (AIC) has been selected. The criterion specified optimal lag length at P = 2 (2nd

order) of the VAR models subjected to co-integration restrictions. The two suggested tests find out the number of co-integration vectors when the trace and maximal Eigen value statistics are applied.

3.4. VECM and causality test

As series are known to be co-integrated confirming one co-integration vectors, hence a long-run equilibrium relationship existed between trade openness, real gross domestic product, human capital, gross fixed capital formation, labour and foreign direct investment. Granger causality test and the VECM can be carried out at this stage. ECT is demonstrated as shown in the following equations:

$$
\Delta \text{LRGDP}_t = \alpha_{11} + \omega_{11} \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_{11} \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_{11} \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_{11} \sum_{i=0}^{p} \Delta LGFCF_{t-i}
$$
$$
+ \rho_{11} \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_{11} \sum_{i=0}^{p} \Delta FDI_{t-i} + \eta_1 ECT_{t-1}
$$
$$
+ \varepsilon_{t1} \tag{8}
$$

$$
\Delta \text{LTOP}_t = \alpha_{22} + \omega_{22} \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_{22} \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_{22} \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_{22} \sum_{i=0}^{p} \Delta LGFCF_{t-i}
$$
$$
+ \rho_{22} \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_{22} \sum_{i=0}^{p} \Delta FDI_{t-i} + \eta_2 ECT_{t-1}
$$
$$
+ \varepsilon_{t2} \tag{9}
$$

$$
\Delta \text{LHC}_t = \alpha_{33} + \omega_{33} \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_{33} \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_{33} \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_{33} \sum_{i=0}^{p} \Delta LGFCF_{t-i}
$$
$$
+ \rho_{33} \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_{33} \sum_{i=0}^{p} \Delta FDI_{t-i} + \eta_3 ECT_{t-1}
$$
$$
+ \varepsilon_{t3} \tag{10}
$$

$$
\Delta \text{LGFCF}_t = \alpha_{44} + \omega_{44} \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_{44} \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_{44} \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_{44} \sum_{i=0}^{p} \Delta LGFCF_{t-i}
$$
$$
+ \rho_{44} \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_{44} \sum_{i=0}^{p} \Delta FDI_{t-i} + \eta_4 ECT_{t-1}
$$
$$
+ \varepsilon_{t4} \tag{11}
$$

$$
\Delta \text{LEMPLYMNT}_t = \alpha_{55} + \omega_{55} \sum_{i=0}^{p} \Delta LRGDP_{t-i} + \theta_{55} \sum_{i=0}^{p} \Delta LTOP_{t-i} + \emptyset_{55} \sum_{i=0}^{p} \Delta LHC_{t-i} + \pi_{55} \sum_{i=0}^{p} \Delta LGFCF_{t-i}
$$
$$
+ \rho_{55} \sum_{i=0}^{p} \Delta LEMPLYMNT_{t-i} + \mu_{55} \sum_{i=0}^{p} \Delta FDI_{t-i} + \eta_5 ECT_{t-1}
$$
$$
+ \varepsilon_{t5} \tag{12}
$$

$$\Delta\text{FDI}_t = \alpha_{66} + \omega_{66}\sum_{i=0}^{p}\Delta LRGDP_{t-i} + \theta_{66}\sum_{i=0}^{p}\Delta LTOP_{t-i} + \emptyset_{66}\sum_{i=0}^{p}\Delta LHC_{t-i} + \pi_{65}\sum_{i=0}^{p}\Delta LGFCF_{t-i}$$

$$+ \rho_{66}\sum_{i=0}^{p}\Delta LEMPLYMNT_{t-i} + \mu_{66}\sum_{i=0}^{p}\Delta FDI_{t-i} + \eta_6 ECT_{t-1}$$

$$+ \varepsilon_{t6} \tag{13}$$

These models guide on the estimation of the VECM and causality tests of the relationship between trade openness and economic prosperity in South Africa.

4. Data and results

4.1. Summary statistics results analysis

The summary statistics for the indicators used in this study are shown in Tables 2a and 2b. The logarithmic mean value of real gross domestic product (LRGDP) and trade openness (LTOP) were lower during the apartheid era when compared to the post-apartheid era. These results imply that the apartheid government limited the potential of the South African economy as a result of less trading relationships with other countries.

Table 2a. Results of the descriptive statistics for the apartheid regime (1970-1993)

	LRGDP	LTOP	LHC	LGFCF	LEMPLYMNT	FDI
Mean	14.130	7.910	14.204	9.846	4.385	2189
Median	14.186	7.890	14.331	10.067	4.449	4469
Maximum	14.312	9.664	14.893	11.186	4.618	7.64E+08
Minimum	13.806	5.869	13.160	8.009	3.974	-1.13E+09
Std. Dev.	0.152	1.116	0.492	0.957	0.195	3.75E+08
Skewness	-0.565	-0.153	-0.534	-0.282	-0.477	-0.598
Kurtosis	2.003	1.902	2.182	1.872	1.981	4.090
Jarque-Bera	9.090	5.200	7.231	6.356	7.790	10.481
Probability	0.011	0.074	0.027	0.042	0.020	0.005
Sum	1356.45	759.361	1363.599	945.254	420.920	2.10E+09
Sum Sq. Dev.	2.110	118.261	23.023	86.932	3.622	1.33E+19
Observations	96	96	96	96	96	96

Table 2b. Results of the descriptive statistics for the post-apartheid regime (1994-2017)

	LRGDP	LTOP	LHC	LGFCF	LEMPLYMNT	FDI
Mean	14.658	11.327	15.269	12.576	4.673	2.97E+10
Median	14.676	11.340	15.295	12.546	4.663	2.10E+10
Maximum	14.940	12.528	15.397	13.659	4.761	8.44E+10
Minimum	14.210	9.643	15.009	11.229	4.585	-1.47E+09

Table 2b. *Cont.*

	LRGDP	LTOP	LHC	LGFCF	LEMPLYMNT	FDI
Std. Dev.	0.208	0.835	0.083	0.767	0.057	2.71E+10
Skewness	-0.137	-0.300	-0.400	-0.078	0.077	0.664
Kurtosis	1.549	1.863	2.866	1.554	1.412	2.095
Jarque-Bera	8.357	6.337	5.579	8.113	9.756	9.896
Probability	0.015	0.042	0.061	0.017	0.008	0.007
Sum	1348.571	1042.066	1404.765	1157.019	429.951	2.73E+12
Sum Sq. Dev.	3.930	63.488	0.629	53.578	0.295	6.68E+22
Observations	92	92	92	92	92	92

Based on the results above, it can be concluded that trade liberalisation significantly contributes to economic prosperity, which is immediately observed once the democratic system is restored in South Africa. The democratic system increases the confidence of other countries around the world in forming trading partnerships with South Africa. The correlation and summary statistics in this study are focused on key variables (trade openness and economic growth), with other variables analysed extensively in the following sections.

Table 3a. Results of the ADF unit root for the apartheid regime (1970-1993)

Variables	At level			First difference		
	No intercept/no trend	Intercept	Intercept and trend	No intercept/no trend	Intercept	Intercept and trend
LRGDP	3.190	-2.154	-1.263	-6.997***	-8.013***	-8.323***
LTOP	4.416	-0.752	-2.742	-14.929***	-17.099***	-17.028***
LHC	-1.855	-1.512	-2.573	2.371**	-3.075**	-2.573
LGFCF	2.472	-2.341	-2.094	-2.078**	-3.478**	-3.719**
LEMPLYMNT	3.000	-2.572	-0.716	-3.123**	-5.468***	-6.134***
FDI	-3.364***	-3.356**	-3.300*	-5.554***	-5.525***	-5.680***

*Notes: ***, ** and * are 1%, 5% and 10% significance level respectively.*

The empirical results of the unit root tests revealed that the majority of the variables were stationary at first difference in both apartheid and post-apartheid regimes. This suggests that the series are integrated of order one [I (1)]. These results indicate the possibility of a cointegration relationship between real gross domestic product, trade openness, human capital, gross fixed capital formation, level of employment, and foreign direct investment during both apartheid and post-apartheid regimes in South Africa.

Table 3b. Results of the ADF unit root for the post-apartheid regime (1994-2017)

Variables	At level			First difference		
	No intercept/no trend	Intercept	Intercept and trend	No intercept/no trend	Intercept	Intercept and trend
LRGDP	3.580	-1.421	-0.739	-2.436**	-4.894***	-5.091***
LTOP	3.622	-1.638	-2.906	-8.479***	-9.626***	9.692***
LHC	2.107	-1.195	-2.750	-6.523***	6.900***	-6.6898***
LGFCF	3.269	-1.232	-1.667	-3.508***	-5.026***	-5.124***
LEMPLYMNT	1.513	-0.592	-7.271***	-7.271***	-7.480***	-7.444***
FDI	-0.819	-2.399	-4.500***	-3.888***	-6.500***	-6.428***

Notes: ***, ** and * are 1%, 5% and 10% significance level respectively

4.2. Cointegration test results analysis

The cointegration tests using trace and max-eigen statistic techniques suggested that there is at least one cointegrating equations since the null hypothesis of "no cointegration" is not accepted. These results implied that there are long-run relationships between real gross domestic product, trade openness, human capital, gross fixed capital formation, level of employment and foreign direct investment during the apartheid and post-apartheid regimes in South Africa. With these results, this study concludes that there are cointegrating error terms in the system of the vector autoregressive (VAR) equations [restricted VAR/vector error correction model (VECM)] since the series are an integration of the same order [I (1)] as revealed by the ADF unit root test. In order to detect the time of adjustment of the error term and causal relationships between real gross domestic product, trade openness, human capital, gross fixed capital formation, level of employment and foreign direct investment during the apartheid and post-apartheid regimes in South Africa, the study employed the VECM.

Table 4a. Results of the Johansen co-integration test for the apartheid regime (1970-1993)

Results of Johansen co-integration test

Hypothesized number of CE (s)	Trace statistic	0.05 critical value	Max-Eigen statistic	0.05 critical value
None *	112.400*	95.754	60.248*	40.078
At most 1	52.152	69.819	20.889	33.877
At most 2	31.263	47.856	11.199	27.584
At most 3	20.064	29.797	9.769	21.132
At most 4	10.296	15.495	7.165	14.265
At most 5	3.131	3.842	3.131	3.842

Notes: ***, ** and * are 1%, 5% and 10% significance level respectively.

Table 4b. Results of Johansen co-integration test for the post-apartheid regime (1994-2017)

Results of Johansen co-integration test

Hypothesized number of CE (s)	Trace statistic	0.05 critical value	Max-Eigen statistic	0.05 critical value
None *	127.646*	95.754	45.568*	40.078
At most 1	82.078*	69.819	29.285	33.877
At most 2	52.794*	47.856	23.224	27.584
At most 3	29.569	29.797	13.909	21.132
At most 4	15.660	15.495	8.885	14.265
At most 5	6.775	3.842	6.775	3.842

Notes: ***, ** and * are 1%, 5% and 10% significance level respectively.

4.3. Lag criterion test results analysis

The lag tests were carried out using final prediction error (FPE), akaike information criterion (AIC), schwarz information criterion (SC) and hannan-quinn information criterion (HQ) techniques to ascertain the most appropriate lags for estimation of the VAR system of equations. These tests measure the reliability of the model and balance the trade-off between the goodness of fit and model complexity (Asteriou and Hall, 2021).

Table 5a. Results of the lag selection test for the apartheid regime (1970-1993)

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-1513.655	NA	6283892.	32.681	32.844	32.747
1	-853.047	1221.770	9.233	19.248	20.392*	19.710
2	-775.697	133.076*	3.829*	18.359*	20.483	19.217*
3	-746.932	45.776	4.583	18.515	21.619	19.768

* Represents 5% significance level.

Table 5b. Results of the lag selection test for the post-apartheid regime (1994-2017)

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-1580.147	NA	1.22e+08	35.644	35.812	35.711
1	-825.306	1390.945	11.760	19.490	20.664*	19.963
2	-748.806	130.651*	4.784*	18.580*	20.761	19.459*
3	-726.395	35.253	6.673	18.885	22.073	20.170

Notes: * Represents 5% significance level

The empirical results shown in Table 5a and Table 5b for the optimal lag selection revealed that lag 2 is the most appropriate for estimation of VAR system of equation for measurement of dynamism in trade openness and economic growth in apartheid and post-apartheid eras in South Africa. With these results, the subsequent lags of the dynamic estimations are carried out on the basis of these lag criterion test suggestions. For simplicity, this study focuses on variables of interest (economic growth and trade openness) in the analysis, but estimations are conducted for other highlighted variables.

4.4. Causality test results analysis

The direction of causality between economic growth and trade openness is examined in both eras (apartheid and post-apartheid) in South Africa. The study employed the Granger causality techniques as depicted in Table 6. The results show that no causality between economic growth and trade openness during the apartheid regime as revealed in Table 1, but unidirectional causality exists between economic growth and trade openness running from economic growth to trade openness during the post-apartheid regime in South Africa. These results clearly show that if there is a democratic system of government, there is a possibility of economic growth influencing trade openness.

Table 6. Results of the causality test for the apartheid regime (1970-1993)

Null hypothesis	F-statistic	Direction of relationship observed
LTOP does not Granger Cause LRGDP	0.950 (0.391)	NC
LRGDP does not Granger Cause LTOP	0.857 (0.428)	
Results of the causality test for the post-apartheid regime (1994-2017)		
LTOP does not Granger Cause LRGDP	0.936 (0.396)	LRGDP $\Rightarrow$ LTOP
LRGDP does not Granger Cause LTOP	7.284*** (0.001)	

*Notes: ***, ** and * are 1%, 5% and 10% significance level respectively*

4.5. Vector error correction mechanism (VECM) results analysis

The short-run equilibrium is estimated with VECM techniques where the speed of the adjustment of the previous error term of the long-run equilibrium is taken into consideration. In Table 7, the short-run equilibrium estimates for trade openness and economic growth are depicted.

The empirical results revealed that a 1 percent decrease in trade openness results in a 0.48 percent increase in economic growth in the short-run, ceteris paribus. Whilst 1 percent increase in economic growth yields a 2.71 percent increase in trade openness during the apartheid regime in South Africa, ceteris paribus. In the short-run, the previous period's deviation from long-run equilibrium of economic growth is corrected in the current period at a speed of 11.77 percent but that of trade openness' error term takes 40.56 percent speed of adjustment period. For the post-apartheid regime as shown in Table 7, ceteris paribus, trade openness has a 0.23 percent incremental impact on economic growth in the short-run. Whilst trade openness responds by an 87.15 percent increase when a 1 percent increase occurs in economic growth in the short-run in South Africa, ceteris paribus. The speed of adjustment time of error in the long-run equilibrium to short-run equilibrium are 12.76 percent and 209.99 percent in economic growth and trade openness respectively during the post-apartheid regime in South Africa.

Table 7. Vector error correction mechanism (VECM) results

Independent variable	Dependent variable for apartheid regime (1970 -1993)		Dependent variables for post-apartheid regime (1994 - 2017)	
	LRGDP	LTOP	LRGDP	LTOP
Constant	-0.001	0.071	0.005	0.044
	[-0.695]	[3.041]	[4.377]	[2.330]
LRGDP$_{t-1}$	0.048	0.027	0.312	0.872
	[0.443]	[0.020]	[2.335]	[0.432]
LTOP$_{t-1}$	-0.005	-0.546	0.002	-0.107
	[-0.522]	[-4.611]	[0.299]	[-0.914]
LHC$_{t-1}$	0.062	0.096	-0.023	-0.482
	[1.576]	[0.190]	[-0.203]	[-0.286]
LGFCF$_{t-1}$	-0.017	-0.038	0.007	0.749
	[-0.593]	[-0.101]	[0.293]	[1.958]
LEMPLYMNT$_{t-1}$	0.648	-0.192	0.081	0.206
	[4.257]	[-0.099]	[0.971]	[0.165]
FDI$_{t-1}$	1.08E-11	-4.00E-11	2.13E-14	7.46E-13
	[1.931]	[-0.561]	[0.370]	[0.856]
ECM$_{t-1}$	-0.118	-0.406	0.128	2.100
	[-3.036]	[-0.821]	[2.653]	[2.891]
R-squared	0.367	0.330	0.455	0.304
F-statistic	3.523	2.997	4.822	2.519

Notes: Values in parentheses [ ] is t-statistics.

***, ** and * are 1%, 5% and 10% significance level respectively

The short-run impact of human capital, gross fixed capital formation, level of employment and foreign direct investment are estimated and shown in Table 7 but are not analysed in order to simplify the results analysis. The results of this study show that trade openness plays a significant role in the economic prosperity of South Africa for both apartheid and post-apartheid regimes, which validates the trade-led growth hypothesis. This finding accords with Asfaw (2015), Zarra-Nezhad et al. (2014), Brueckner and Lederman (2015) and Keho (2017), but contradicts with Vlastou (2010), Polat et al. (2015), Ulaşan (2015), Were (2015) and Lawal et al. (2016) who reported a negative or insignificant impact of trade openness on economic growth. Some of these studies do not include in the analysis capital or labor as additional explanatory variables like our study did. It is well-known that econometric tests are sensitive to omitted variables and hence studies relying on a bivariate framework may be subject to misspecification bias (Lutkepohl, 1982). On the other hand, differences in economic structure/system and trade policy may explain why the trade growth nexus is country-specific, most especially in the context of this study. The fact is that South Africa's economy mainly relies on exports of agricultural products and mineral resources. Agriculture is of major importance to South Africa. Among the

major crops are corn (maize), wheat, sugarcane, sorghum, peanuts (groundnuts), citrus and other fruits, tobacco, etc. South Africa is also rich in a variety of minerals. In addition to diamonds and gold, the country also contains reserves of iron ore, platinum, manganese, chromium, copper, uranium, silver, beryllium, and titanium. It produces a significant portion of exports and contributes greatly to the domestic economy, especially as an employer, though land and water resources are generally poor. Since the late 1970s, South Africa has had continuing economic problems, initially because its apartheid policies led many countries to withhold foreign investment and to impose increasingly severe trade sanctions against it. But after the apartheid regime in 1994, the trade sanctions against it were lifted and this is reflected in the results of this study.

4.6. Diagnostic tests

4.6.1. Serial correlation and Heteroskedasticity results analysis

The residual diagnostic test of autocorrelation is conducted using VEC serial correlation LM tests for apartheid and post-apartheid regimes in South Africa as shown in Table 8. The tests are conducted with the assumption that serial correlation don does not exist at a 5 percent significance level. The empirical results reveal that the null hypotheses for residuals of apartheid and post-apartheid regimes' models do not have presence of autocorrelation since the null hypotheses are accepted. This study concludes that the VEC models are valid for estimation of the dynamic (short-run) relationship between economic growth and trade openness in South Africa.

The heteroscdasticity tests in Table 8 further show that the models are homoscedastic since the null hypotheses of no heteroscedaticity are accepted in the models. The absence of heteroscedasticity in the model implies that the model is accurate and correctly specified. This is because heteroscedasticity could have serious implications for the validity and reliability of regression analysis. Therefore, these results ascertained that no relationship exists between the regressors (trade openness, human capital, gross fixed capital formation, level of employment and foreign direct investment) and the stochastic components in the apartheid and post-apartheid eras in South Africa.

Table 8. VEC residual serial correlation LM

Regime	LM-Statistic	p-value	observations
Apartheid (1970 – 1993)	43.483	0.183	93
Post-apartheid (1994 – 2017)	48.008	0.087	89
Heteroskedasticity results analysis			
VEC Residual Heteroscedasticity tests: No Cross Terms (only levels and squares)			
Regime	**Chi square Statistic**	**p-value**	**df**
Apartheid (1970 – 1993)	443.476	0.100	546
Post-apartheid (1994 – 2017)	488.509	0.963	546

Notes: Null hypothesis: No serial correlation

* represents 5% significance level respectively

5. Conclusion and policy recommendations

The objective of this study was to empirically examine the causal-relationship between trade openness and economic prosperity in South Africa. The analysis is disaggregated into pre-1994 and post-1994 to capture the economic situation of South Africa during and after apartheid regimes. The apartheid regime covered 1970 to 1993 and the post-apartheid regime covered 1994 to 2017. The study further analysed the aggregated trade openness and economic prosperity to capture the total effect in South Africa. The quarterly data from 1970 to 2017 were used to establish the relationship that exists between trade openness and economic prosperity in South Africa. The main estimation techniques adopted to achieve the objective of this study include the Granger causality test and the vector error correction model (VECM).

5.1. Summary of findings

The main findings of this study show that: (i) the unit root tests revealed that the majority of the variables are stationary at first difference for both apartheid and post-apartheid regimes; (ii) the Johansen cointegration process established long-run relationship between trade openness and economic prosperity and other variable of interest of the study during the apartheid and post-apartheid regimes; (iii) the Granger causality test suggested a bidirectional relationship between trade openness and economic prosperity; (iv) the VECM for short-run equilibrium suggests the statistical importance of trade openness to economic prosperity with positive relationship existence. Furthermore, the empirical results suggest that trade openness promotes economic prosperity during the apartheid regime in South Africa, and vice versa. While during the post-apartheid regime, trade openness has an incremental impact on economic prosperity, and vice versa. Therefore, the results of the study validate the trade-led growth hypothesis in the case of South Africa for both regimes. This implies that a substantial portion of the economic expansion of South Africa is external.

5.2. Recommendations

Therefore, the study suggests further trade liberalisation mechanisms in South Africa to enhance export of excess domestic production, importation of capital goods and scarce skills and further development of technical know-how of local labour. The causality tests findings from the post-apartheid regime strongly support Brazil, Russia, India, China and South Africa (BRICS) bloc economic integration agreement signed by the South African government in 2010 and the recently signed African Continental Free Trade Area (AfCFTA) agreement by South African government. This is because trade openness of the South African economy has the potential to bring about further economic prosperity to South Africa and other African countries.

The pace of trade openness in South Africa should be complimented with other policies and strategies such as embarking on further trade and investment reforms by putting into consideration the changing economic environment. The policies should be geared towards more free trade and the elimination of trade barriers. This will help the country to attract more trade and investments which promote economic prosperity. More incentives should be provided to qualified foreign investors who are interested in investing in South Africa. Furthermore, serious caution is needed because heavy dependence on international trade may be detrimental to fiscal sustainability and economic growth under the Prebisch–Singer law of decline in the terms of trade. We also recommend policies that encourage the pursuit of sustainable economic prosperity, minimizing

dependence on commodity price fluctuations. This includes advocating for diversification of the export base beyond primary products to mitigate vulnerability to price volatility, supporting initiatives that enhance the competitiveness of local industries in the global market, and recommending investment in human capital development to build the skills necessary for value-added production.

Since South Africa majorly exports primary products, which prices are unstable and determined on the international market. For outward-oriented strategy to have a much larger impact on economic prosperity, the country should modify the composition of trade by switching from exports of raw materials and semi-manufactured goods to high valued-added goods. In addition, trade policy should promote investments in capital intensive sectors and develop human capital that can absorb technologies coming from advanced countries. Modern technology via technology transfer is highly recommended in order to promote efficiency and competition. There is a need to impart innovations and modern technology in production. The produced goods will be price competitive and of high quality which will ensure higher value in the market. Over time, this could help the country to eliminate the existing trade deficit. To further address the potential trade deficit in South Africa, government policies should strongly support: industries with high export potential beyond traditional sectors; investment in research and development to enhance the value-added content of exports; incentives for industries that focuses on producing higher value-added goods, fostering innovation and competitiveness, among others. Implementing these recommendations may face challenges such as political resistance, economic constraints, and infrastructure limitations. Strategies to overcome these include fostering public-private partnerships, leveraging international agreements like BRICS and AfCFTA, investing in infrastructure and human capital, and creating a conducive environment for innovation and technological adoption. Additionally, engaging in diplomatic efforts to build consensus on trade reforms and providing incentives for value-added production can help navigate these obstacles.

In conclusion, this study underscores the critical role of trade openness in driving economic prosperity in South Africa, both during and after the apartheid era. The findings support the trade-led growth hypothesis and highlight the potential of trade liberalization, alongside other policy measures, to foster sustainable economic development. By embracing these recommendations, South Africa can enhance its export competitiveness, attract foreign investment, and ultimately achieve greater economic prosperity, benefiting not only itself but also the broader African continent.

5.3. Limitations

Despite the results of this study, it still suffers from the fact that the empirical analysis has been conducted using trade at the aggregate level. An area of fruitful future research would be to analyse the trade composition in terms of goods and its impact on economic prosperity of South Africa for both apartheid and post-apartheid regimes. A more detailed analysis of trade composition could provide even deeper insights into the relationship between trade and economic prosperity. This kind of analysis will inform policy makers about what underpins the positive impact of trade on economic prosperity. It will throw light on whether the trade-led growth in South Africa is due to agricultural exports or non-agricultural imports.

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