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Agricultural exports and economic growth in South Africa: A cointegration and error correction analysis

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Abstract: This study investigates the role of agricultural exports as a potential engine of economic growth in South Africa, employing a cointegration and error correction model (ECM) framework on time series data from 1980 to 2023. The results confirm a long-run equilibrium relationship between agricultural exports and economic growth, with lagged total exports and employment significantly influencing GDP growth in the short run. However, other factors like foreign direct investment, gross capital formation, and population growth did not exhibit a statistically significant impact. These findings underscore the importance of agricultural exports in driving South Africa's economic growth. To further enhance this potential, the study recommends establishing a consistent and transparent policy environment to foster investor confidence and long-term planning in the agricultural sector, expanding the range of agricultural exports to reduce vulnerability to external shocks and enhance overall economic resilience and streamlining customs procedures, reducing trade barriers, and improving logistics to enhance the competitiveness of South African agricultural exports in the global market. These policy recommendations, grounded in empirical evidence, offer a roadmap for harnessing the full potential of agricultural exports to drive sustainable economic growth in South Africa.

Keywords: agricultural exports; export-led growth hypothesis; trade integration; economic growth; cointegration; South Africa
JEL Codes: D62; O30; 041

1. Introduction

Economic growth is generally accepted to be a highly complicated process that depends on a number of factors, including income distribution, export growth, foreign direct investment, capital accumulation, exchange rate, factor endowment, political conditions, and even more on geographic location (IMF, 2023; Seleteng, 2013).

According to the export-led growth hypothesis (ELGH), increasing the exports of goods and services is one of the key factors influencing overall economic growth (Balassa, 1978). The theory argues that economic development can be achieved through export promotion, which will result to positive spill-over effects on other sectors. Proponents of the theory including Bhagwati (1978); Feder (1983); Krueger (1978) and Thornton (1996) hold the view that export promotion can serve as an "engine of growth". The relationship between exports and growth is sometimes associated to potential positive spill-over effects for the importing country such as resource reallocation, economies of scale, technology transfer, trade surplus and increased investment.

Over the past decades, a significant amount of research has been done on the export-led growth paradigm with a focus on developing countries. Empirical studies have been conducted and published throughout the 1980s on this theory, and findings indicate diverging views regarding the methodologies used, time periods, countries, econometric models applied, and the overall implications of export promotion policies (Haggard, 1990; Zimbalist, 1988).

An important observation with traditional studies is related to the statistical procedure adopted and other methodology considerations. Econometric results from theoretical studies are generally poor and are based on ad hoc production functions, whereas results from empirical findings have come under intense scrutiny for being inaccurate. Thus, early traditional studies might have been deceptive in that they indiscriminately promoted export growth. Indeed, numerous findings from literature show no evidence of the relationship between exports and growth, and this partially explains why there is still a dispute over the validity of the export led-growth theory in literature.

In contrast to many studies focusing on the relationship between exports and economic grow, the present study makes three distinct contributions to literature. Firstly, we estimated an augmented Cobb-Douglass functional form as opposed to the traditional form. The augmented Cobb-Douglas functional form adopted in this study includes additional variables that account for a more complex analysis of the production relationship (Acemoglu et al., 2018; Hsieh and Klenow, 2009; Syverson, 2011). Secondly, unlike many studies in literature, the current study focuses the analysis on the agricultural sector because of the direct and indirect contribution of this sector to food security, rural development and public policy. Thirdly, the study has gone beyond just testing for short-run effects and makes considerable contribution by empirically assessing the existence of a long-run relationship between exports and growth.

Thus, the goal of the study is to quantify the contribution of agricultural exports to the South African economy. The central research question of the study is whether a long-run equilibrium relationship exists between agricultural exports and economic growth in South Africa. We hypothesize that increased agricultural exports will lead to a significant increase in economic growth, both in the short run and long run.

2. Literature review

This study section provides a rigorous examination of the complex relationship between agricultural export promotion policies and economic growth. The analysis encompasses both theoretical underpinnings and empirical evidence. It explores the economic mechanisms through which agricultural exports can drive growth, including enhanced productivity through specialization, economies of scale, technology transfer, and improved resource allocation. The study further includes a comprehensive review of the empirical literature, analysing key studies across diverse methodologies, countries, and time periods to assess the causal link between agricultural exports and overall economic development. By synthesizing theoretical insights with empirical findings, this study contributes a nuanced understanding of the impact of agricultural export promotion policies on economic growth dynamics.

2.1. Theoretical literature

Several theoretical studies have been developed that offer evidence of the positive relationship between exports and economic growth. These studies include the works of Baldwin and Forslid (1996), Feenstra (1990), Grossman and Helpman (1990), Rivera-Batiz and Romer (1991) and Segerstrom et al. (1990). The fundamental findings explained in these traditional studies is that trade openness has the potential to enhance total factor productivity. This is primarily attributed to the influence of factor productivity on economies of scale and other endogenous factors, including technology transfer, enhancement of skills among employees and managers, and the expansion of production capacity within the economy. One further benefit of export-oriented policies is that they enhance resource allocation efficiency, thereby accurately reflecting the opportunity cost associated with scarce resources.

Additionally, advocates of the export-led growth paradigm postulated that developing countries, primarily in Asia and Africa, that adopted import substitution policies performed very poor compared to countries that adopted trade openness (Balassa, 1980). Evidence from a study by Balassa showed that between 1960 and 1990, developing countries that were not inclined to trade openness had food insecurity problems, decreased economic growth and low production output (Barro and Sala-i-Martin, 1995).

Conclusively, despite substantial theoretical evidence linking export growth to economic growth, the debate remains unsettled. While classical and endogenous growth theories suggest that exports can stimulate economic growth through various mechanisms, empirical findings are mixed. The impact of export promotion policies on economic development is complex and depends on various economic, social, and political factors. Therefore, the subsequent section provides a concise overview of the empirical literature pertaining to the export-led hypothesis.

2.2. Empirical literature

Table 1 presents a comprehensive review of empirical studies examining the relationship between exports and economic growth. The table encompasses various aspects of these studies, including their timeframe, methodologies, variables, econometric techniques, and key findings. Notably, earlier studies often relying on cross-sectional data, generally reported a positive correlation between exports and economic growth.

However, more recent research reveals mixed and inconclusive results. While some studies find evidence of export-led growth (e.g., Bal et al., 2019; Fouad, 2005), others find no significant long-run relationship between exports and growth (e.g., Faridi, 2012; Mbingui and Eke-Lemuel, 2021). These divergence in findings highlights the ongoing debate regarding the effectiveness of export-oriented policies as a driver of economic growth. Consequently, this study aims to contribute to the existing literature by specifically examining the relationship between agricultural exports and economic growth in the context of South Africa.

Table 1. Empirical literature associated to the export-led hypothesis.

Author (s)	Sample and Period	Methodology		Conclusion
		Model variables	Econometric method	
Bal et al. (2019)	Bangladesh; 1974–2015	Industrial production index (INP), exports, Imports, grossed fixed capital, GDP	ARDL bounds testing approach, Granger causality, Toda–Yamamoto	Validates the ELG hypothesis
Fouad (2005)	Egypt; 1977–2003	Exports, imports, GDP, employment	Cointegration and Causality analysis	Supports the export-led hypothesis
Subasat (2002)	83 Countries; 1987–1996	Manufacturing, oil, transport, population, GDP	Cross sectional data	ELG hypothesis only valid for Low-High income countries
Boriss (2005)	Chile	Capital stock, GDP, labour, mining exports, Imports	Vector Autoregressive, Granger causality analysis	Support the export-led growth hypothesis
Usman (2012)	Luxemburg; 1975–2009	Exports, government expenditure, education expenditure and GDP	OLS technique	Export growth is associated with economic growth
Bakari and Mabrouki, (2017)	Panama; 1980–2015	Exports, imports and GDP	Johansen co-integration, Vector auto regression, and the Granger-causality tests	Supports the export-led growth hypothesis
Faridi, (2012)	Pakistan; 1972–2008	Labour force, consumer price index, agricultural exports, GDP, fixed capital formation, non-agricultural exports	Johansen co-integration, Granger causality analysis	Agricultural exports have a negative and significant effect on economic growth
Onose and Aras, (2021)	Brazil, India, Nigeria, China, South Africa; 1980–2019	Gross capital formation, labour, foreign direct investment, services exports	Autoregressive distributed lags	Export-led hypothesis is only valid in the short-run
Schmidt, (2020)	Brazil; 1990–2018	GDP, exports, gross capital formation, FDI and labour force	Vector error correction, Granger causality	Rejection of the Export-led growth hypothesis
Keong et al. (2005)	Malaysia; 1960–2001	GDP, exports, imports, labour force	Autoregressive distributed lag (ARDL), Johansen co-integration	Study supports the export led growth hypothesis
Kilavuz and Topcu (2012)	22 countries; 1998–2006	Gross domestic products, investment, population, high and low-tech manufacturing industry exports and high and low-tech manufacturing industry imports	Ordinary least squares, Random Effects, Fixed Effects and Panel Corrected Standard Errors	Export variables have a positive and significant effect on growth
Simasiku and Sheefeni (2017)	Namibia; 1990–2014; quarterly data	Agricultural exports, non-agricultural exports, GDP, fixed capital formation, Consumer price index	Augmented Dicky Fuller test, Johansen co-integration test, and error correction techniques	Confirmation of the export Led growth hypothesis

Table 1. (*Continued*).

Author (s)	Sample and Period	Methodology		Conclusion
		Model variables	**Econometric method**	
Hemzawi & Umutoni (2021)	Rwanda; 2006–2020	Gross domestic product, capital, labour, exports of goods and services, imports of goods and services.	Johansen co-integration	Results supports the export Led growth hypothesis
Silajdzic and Mehic (2018)	10 Central-Eastern European Economies; 1995–2013	Domestic investment, applied tariff rate, GDP per capita, trade openness	Autocorrelation, prais-winsten-correlated panels corrected standard errors	Trade intensity is positively associated with economic growth
Oppong-Baah et al. (2022)	Ghana and Nigeria; 1998–2017	Trade openness, inflation, real exchange, and investment and GDP	Pooled ordinary least squares (OLS), Fixed effects, Random effects	Results supports the export Led growth hypothesis
Asoanomenjanahary et al. (2022)	Madagascar; 1993–2020	Labour force, consumer price index, trade and foreign direct investment	Vector error correlation Model	Rejects the export Led growth hypothesis
Mbingui and Eke-Lemuel, (2021)	Republic of Congo; 1986–2016	Fixed capital formation, secondary school enrolment, FDI, GDP, Labour force	Vector error correction Model (VECM)	Rejects the export Led growth hypothesis
Marilyne Huchet et al. (2018)	169 countries; 1988–2014	Export quality, export variety, education, life expectancy, GDP per capita and investment	Generalized method of moments estimator	Mixed results

Source: Author's compilation.

3. Research methodology

The study used secondary time series data that spanned a period of 44 years. This means data comprised of 43 observations for all the considered variables from 1980 to 2023. The variables selection for the model include the Gross Domestic Product (GDP), Gross Capital Formation (GCF), Employment (E), Exports (X), Consumer Price Index (CPI), and Terms of trade (TOT).

These variables were selected due to their established significance in economic growth theory. GDP is the primary indicator of economic activity, while GCF represents investment, a key driver of economic growth. Employment captures the labor force's contribution, and exports reflect the role of international trade. CPI and TOT are crucial for understanding the impact of inflation and trade conditions on growth. **Table 2** presents a summary of the variables, measurement and sources from which data was obtained.

Table 2. Summary of variables, measurement, and data source.

Variable	Unit of measurement	Data source	Prior expectation
Gross domestic product	Million (rands)	World development indicator	+
Gross capital formation	Million (rands	World development indicator	−
Employed labor force	Million (rands)	Handbook of statistics of South Africa 2023	+
Exports	Million (rand)	World development indicator	+/−
Consumer price index	Ratio of prices	World development indicator	+/−
Terms of trade	Ratio of prices	Handbook of statistics of South Africa 2023	+/−

Source: Author's compilation.

The variables selected for this study are grounded in both economic theory and empirical evidence from the existing literature on economic growth and the export-led growth hypothesis.

Gross Domestic Product (GDP): GDP is the fundamental measure of a country's overall economic activity and is universally recognized as the primary indicator of economic growth. Changes in GDP reflect the combined effects of various economic factors, making it the dependent variable in this analysis.

Agricultural Exports (AGX): The core focus of this study is to examine the impact of agricultural exports on economic growth. This choice is motivated by the significance of the agricultural sector in South Africa's economy and its potential to drive export-led growth, as suggested by the theoretical literature (Balassa, 1978; Feder, 1983).

Gross Capital Formation (GCF): GCF represents the total investment in a country's capital stock, including machinery, equipment, and infrastructure. Economic theory posits that investment is a crucial driver of economic growth, as it enhances productivity and expands the economy's productive capacity (Acemoglu et al., 2018).

Employment: The size and productivity of the labor force are essential determinants of economic output. Including employment in the model allows the study to capture the contribution of labor to economic growth, aligning with standard economic growth models (Mankiw et al., 1992).

Consumer Price Index (CPI): The CPI measures the average change in prices paid by consumers for a basket of goods and services. Inflation, as reflected in the CPI, can affect economic growth through various channels, such as influencing investment decisions and international competitiveness.

Terms of Trade (TOT): The TOT represents the ratio of export prices to import prices. Changes in the TOT can impact a country's trade balance and, consequently, its economic growth. Including the TOT allows us to account for the effects of international trade conditions on South Africa's economic performance.

3.1. Model selection and specification

The study adopted both a cointegration and error correction model (ECM) for modelling the relationship between agricultural exports and economic growth (Gujarati and Porter, 2009). The ECM was selected because most economic time series variables are non-stationary (i.e., exhibit random walk) and can be brought into stationarity by being modelled together as having a long run relationship (cointegration). Therefore, the ECM considers short-run and long-run dynamics of the structure of the economy (Ekanayake, 1999). Thus, the short run as well as long run effects of agricultural exports on economic growth can be studied within this framework. Moreover, this model considers several lags for the variables under consideration. Thus, GDP was considered as endogenous variables (i.e., being determined inside the model). This is because the growth exports can lead to economic growth.

The long-run equation of the model is represented as follows:

$$GDP_t = \alpha + \beta_1 AGX_t + \beta_2 GCF_t + \beta_3 EMP_t + \beta_4 CPI_t + \beta_5 TOT_t + \epsilon_t \qquad (1)$$

where GDP_t is gross domestic product, AGX_t is agricultural exports, GCF_t is gross capital formation, EMP_t is employment, CPI_t is consumer price index, and TOT_t is the terms of trade. α represents the intercept, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the coefficients to be estimated, and ϵ_t is the error term

The short-term dynamics are captured by the following ECM equation:

$$\Delta GDP_t = \gamma + \delta_1 \Delta AGX_{t-1} + \delta_2 \Delta GCF_{t-1} + \delta_3 \Delta EMP_{t-1} + \delta_4 \Delta CPI_{t-1} + \delta_5 \Delta TOT_{t-1} + \lambda ECM_{t-1} + \eta_t \qquad (2)$$

where Δ denotes the first difference, λ is the speed of adjustment coefficient, $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5$ are the short-term coefficient, ECM_{t-1} is the error correction term from the long-term equation, and η_t is the error term.

3.2. Estimation techniques

The analysis was performed using EViews statistical software. Descriptive statistics were calculated for each variable, and stationarity was assessed via the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979). In accordance with established time series methodology (Emerson, 2007), optimal lag length was

determined using various information criteria prior to cointegration analysis. The Engle-Granger two-step procedure was then employed to test for cointegration and estimate the error correction model (ECM) (Engle and Granger, 1987). Finally, diagnostic tests were conducted on the ECM residuals to assess the validity of OLS assumptions. This methodology aligns with standard time series econometric practices for examining both short-run and long-run relationships between exports and economic growth (Juselius, 2006).

4. Results and discussion

4.1. Test for stationarity

The variables considered for model development were assessed for a unit root using the Augmented Dicky Fuller (ADF) test. The unit root testing considered various model: a model with only the intercept(τ_μ); with a trend intercept(τ_τ); and a model with no intercept and trend (τ). A unit root test is a test for stationarity of the variables. **Table 3** presents the ADF test result of stationarity.

Table 3. Unit root testing results.

Variable	Model	Augmented Dicky-Fuller Test (ADF)	
		lags	$\tau_\mu, \tau_\tau, \tau$
LTEX_CONS$_t$	Intercept	0	–0.876
	Trend & intercept	0	–3.701**
	None	0	–0.979
LFDI$_t$	Intercept	0	–2.653*
	Trend & intercept	0	–3.402*
	None	1	1.198
GCFG$_t$	Intercept	0	–5.887***
	Trend & intercept	0	–5.764***
	None	0	–5.878***
LEMP	Intercept	0	–1.559
	Trend & intercept	1	–3.643**
	None	0	1.129
TRADE	Intercept	0	–1.950
	Trend & intercept	0	–3.402*
	None	0	–0.295
LPOP	Intercept	3	–1.939
	Trend & intercept	3	–4.260**
	None	3	0.548
ΔLTEX_CONS$_t$	Intercept	1	–6.387***
	Trend & intercept	3	–4.952***
	None	0	–6.227***

Table 3. (*Continued*).

Variable	Model	Augmented Dicky-Fuller Test (ADF)	
		lags	$\tau_\mu, \tau_\tau, \tau$
ΔLFDI$_t$	Intercept	0	−8.963***
	Trend & intercept	0	−9.054***
	None	0	−8.429***
ΔLEMP$_t$	Intercept	0	−5.906***
	Trend & intercept	0	−5.829***
	None	0	−5.820***
ΔTRADE$_t$	Intercept	0	−6.403***
	Trend & intercept	0	−6.418***
	None	0	−6.493***
ΔLPOP$_t$	Intercept	2	−1.134
	Trend & intercept	2	−1.334
	None	2	−1.396
ΔΔLPOP$_t$	Intercept	1	−5.388***
	Trend & intercept	1	−5.335***
	None	1	−5.304***

Source: Author's compilation, EViews.

All the time series variables, except the gross capital formation, were not stationery in their original form. First differencing needed to be performed to make them stationery. This means that these time series variables were integrated of order (i.e., I (1)). These variables include the log of foreign direct investment, log of population growth, log of employment, trade openness and exchange rate. The result was expected because most economic time series are integrated of order 1. The non-stationery nurture of the variables meant that a cointegration need to be performed to assess if there is a long run equilibrium between agricultural exports and GDP.

4.2. Test for co-integration

Having confirmed that all variables within the specified economic growth model are integrated of order one, I (1), the analysis proceeded to investigate the existence of a long-run equilibrium relationship between economic growth and agricultural exports in South Africa (Engle and Granger, 1987; Johansen, 1991). The study employed the two-step Engle-Granger procedure to assess cointegration. This procedure involves regressing each variable on the others and testing the residuals for stationarity. **Table 4** presents the results of the cointegration tests, which clarify the nature and significance of any long-term relationship between these key economic variables.

The results of the Engle-Granger cointegration test, as shown in **Table 4**, reveal the presence of a cointegrating equation between GDP and agricultural exports, thus rejecting the null hypothesis of no cointegration. This indicates a long-run equilibrium relationship between these variables, implying that they share a common stochastic trend and move together over time (Asteriou and Hall, 2016). This finding is consistent with a growing body of empirical evidence highlighting the role of agricultural exports

in driving economic growth, particularly in developing economies (e.g., Diao et al., 2017; Keho, 2020; Lee and Huang, 2022). Having confirmed the presence of cointegration, the analysis proceeds to estimate the long-run parameters using the error correction model (ECM), a methodology well-suited to quantifying short-run and long-term relationships in cointegrated equations (Engle and Granger, 1987).

Table 4. Unit root tests on residuals of the cointegrating regression.

Dependent	tau-statistic	Prob.*	*z*-statistic	Prob.*
LGDP	−3.716786	0.4308	−21.27531	0.3934
LTEX_CONS	−5.051909	0.0628	−55.66109	0.0000
LFDI	−5.725409	0.0159	−35.30834	0.0176
LEMP	−4.700306	0.1117	−24.64970	0.2303
GCFG	−6.161913	0.0062	−36.89989	0.0106
LPOP	−4.073544	0.2840	−22.49881	0.3289

Source: Author's compilation, EViews.

4.3. Long-run and short-run dynamics: ECM results

The results (**Table 5**) of the error correction model revelead a moderately high adjusted R-squared value of 0.65, indicating that the included independent variables collectively explain 65% of the short-run variability in GDP. While the coefficients for foreign direct investment, gross capital formation, exchange rate, and the democracy dummy variable were not found to be statistically significant, the overall model remains significant at the 1% level, as evidenced by the *F*-statistic.

Table 5. Long run relationship between agricultural export and economic growth.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
RESID02_LR (−1)	−0.368167	0.154427	−2.384083	0.0239
D (LTEX_CONS (−1))	0.084729	0.025311	3.347517	0.0122
D (LFDI)	−0.041774	0.043842	−0.952834	0.3485
D (GCFG)	−0.001775	0.004440	−0.399666	0.6923
D (LEMP)	0.092471	0.041681	2.218541	0.0206
D (LPOP)	−20.28775	10.45048	−1.941323	0.0620
D (LEX)	0.004702	0.272875	0.017230	0.9864
DEM	−0.180320	0.225072	−0.801168	0.4296
TRADE	0.007980	0.003939	2.025894	0.0334
R-squared	0.655059			
Adjusted R-squared	0.646110			
Durbin-Watson stat	2.016889			

Source: Author's compilation, Eviews.

The presence of a negative and statistically significant error correction term (RESID02_LR) at the 5% level confirms the existence of a long-run equilibrium relationship among the variables, aligning with the findings of Pesaran et al. (1999).

The estimated speed of adjustment (−0.37) indicates a gradual convergence towards equilibrium, with approximately 36% of any short-run disequilibrium being corrected within a year. This finding aligns with empirical evidence from comparable studies examining adjustment dynamics in open economies (Kweka and Morrissey, 2000).

Lagged total exports growth: The results of the model indicate that a 1% increase in the growth of total agricultural exports (previous period) is associated with a 0.085% increase in GDP in the current period. This suggests a positive relationship between export growth and economic growth, supporting the export-led growth hypothesis, as documented in numerous studies (e.g., Giles and Williams, 2000; Vlastou, 2010).

Employment growth: Employment was also significant translating that a 1% increase in employment is associated with a 0.093% increase in GDP. This indicates that employment growth is a significant driver of economic growth, consistent with the findings of Mankiw et al. (1992).

Trade: Also returned a positive and significant coefficient suggesting that an increase in trade openness is associated with higher economic growth. This could be due to various channels associated with the benefits of trade openess, such as increased efficiency, technology transfer, or access to larger markets, as highlighted in the literature (e.g., Dollar and Kraay, 2004; Frankel and Romer, 1999).

Short-run dynamics of the model

The results of the error correction model (ECM) presented in **Table 6** shed light on the short-run dynamics between agricultural exports and economic growth in South Africa. The error correction term (RESID02_LR (−1)), with a coefficient of −0.368167 and a p-value of 0.0239, is negative and statistically significant. This confirms the presence of a long-run relationship between the variables and indicates that deviations from the long-run equilibrium are corrected over time at a moderate speed of 37% per year.

Table 6. Short-run relationship—Error correction model.

Dependent Variable: D (LGDP)				
Independent Variables	**Coefficient**	**Std. Error**	***t*-Statistic**	***P*-value**
RESID02_LR (−1)	−0.368167	0.154427	−2.384083	0.0239
D (LTEX_CONS (−1))	0.084729	0.025311	3.347517	0.0122
D (LFDI)	−0.041774	0.043842	−0.952834	0.3485
D (GCFG)	−0.001775	0.004440	−0.399666	0.6923
D (LEMP)	0.092471	0.041681	2.218541	0.0206
D (LPOP)	−20.28775	10.45048	−1.941323	0.0620
D (LEX)	0.004702	0.272875	0.017230	0.9864
DEM	−0.180320	0.225072	−0.801168	0.4296
TRADE	0.007980	0.003939	2.025894	0.0334

R-squared = 0.655059
Adjusted R-squared = 0.646110
S.E. of regression = 0.331869
Sample period = 1982 2021
Source: Author's compilation, EViews.

In the short run, the model reveals that lagged total exports (D (LTEX_CONS (−1))) and employment (D (LEMP)) have a positive and statistically significant impact on GDP growth, with coefficients of 0.084729 and 0.092471, respectively ($p < 0.05$). This suggests that a 1% increase in lagged total exports leads to a 0.085% increase in GDP growth, while a 1% increase in employment results in a 0.092% increase in GDP growth. Additionally, the terms of trade (TRADE) variable exhibit a positive and significant coefficient of 0.007980 ($p < 0.05$), indicating that favourable terms of trade also contribute to short-run economic growth.

However, the coefficients for foreign direct investment (D (LFDI)), government capital formation (D (GCFG)), population (D (LPOP)), exchange rate (D (LEX)), and the dummy variable (DEM) are not statistically significant in the short run. This suggests that these factors do not have a direct and immediate impact on GDP growth in the context of this model.

5. Conclusion and policy recommendations

The aim of the present study was to investigate the influence of agricultural exports on economic growth in South Africa. The empirical findings of this study offer valuable insights into the relationship between agricultural exports and economic growth in South Africa. The confirmation of cointegration between agricultural exports and GDP, along with other key macroeconomic variables, underscores the existence of a long-run equilibrium relationship. This suggests that agricultural exports play a crucial role in driving and sustaining economic growth in the long term.

The long-run relationship, confirmed by cointegration, indicates that agricultural exports and GDP in South Africa share a common trend over time. This implies that agricultural exports are not just a temporary boost to the economy but a fundamental driver of long-term economic growth. The presence of cointegration suggests that policies aimed at promoting agricultural exports can have lasting effects on the country's economic development. The short-run relationship, captured by the error correction model (ECM), reveals the immediate impact of changes in agricultural exports on GDP growth. The positive and significant coefficient of lagged total exports in the ECM indicates that an increase in agricultural exports in one period leads to a corresponding increase in GDP growth in the next period. This highlights the short-term responsiveness of the economy to fluctuations in agricultural exports, making it a crucial factor for policymakers to consider when formulating economic policies.

However, the findings also reveal that foreign direct investment, government capital formation, population growth, and the real exchange rate do not have a statistically significant impact on GDP growth in either the short or long run. This suggests that while these factors may play a role in the broader economic landscape, their direct influence on economic growth through agricultural exports is limited in the South African context.

Given the significant role of agricultural exports in South Africa's economic growth, as evidenced by this study, the issue of dysfunctional land policies, such as the expropriation of land without compensation, raises concerns about the sector's future potential. Such policies can lead to uncertainty and instability in the agricultural sector, discouraging investment, reducing productivity, and potentially hindering

export growth. Therefore, addressing these land policy issues is crucial to ensure the continued positive contribution of agricultural exports to South Africa's economic development. Lastly, it is important for South Africa's agricultural sector to diversify their export basket to reduce vulnerability to external shocks and price fluctuations in specific commodities. This could involve promoting value addition in agricultural products and exploring new export markets in across the African continent.

Future research

The current study, while insightful, it has its own limitations. Primarily, it relies on secondary time-series data, which may not fully capture the total significance of the agricultural sector's impact on economic growth. Additionally, the model, while comprehensive, could be enhanced by incorporating other relevant variables, such as agricultural productivity, climate change or specific policy indicators. Future research could address these limitations by collecting primary data, including qualitative insights from farmers, experts, government officials and other stakeholders in the agricultural sector, and by expanding the model to include a wider range of variables. This would provide a more nuanced and comprehensive understanding of the relationship between agricultural exports and economic growth in South Africa.

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