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Understanding the nexus between savings and economic growth: A South African context

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ABSTRACT
The study examines the relationship between savings and economic growth in South Africa for the period 1986–2018. The Johansen cointegration technique and the Vector Error Correction Model were employed as methods of analysis. The findings from the study indicate that the effect of savings on economic growth in South Africa is negative . However, a positive relationship between the two variables was established in the short-run. Granger causality tests were also utilised to determine the direction of causality between savings and economic growth. The results revealed that the relationship runs from economic growth to gross domestic savings. Another important observation from the study is the role of investment which was found to have a positive effect on economic growth. This result also supports the idea of promoting investment if the country is to achieve sustainable economic growth.

KEYWORDS
Economic growth; savings; Vector Error Correction; South Africa

1. Introduction

Achieving sustainable economic growth in Africa has remained a major challenge despite several reforms which have been adopted in Africa. One of the areas which have remained a challenge is the level of savings in individual countries, considering the role of savings in the growth process. A careful examination of Sub Saharan Africa (SSA), indicates that the level of domestic savings is lower as compared to domestic investment. This has resulted in a financing gap which is usually supplemented by foreign capital flows such as foreign credit, foreign direct investment and foreign aid. This becomes important given that growth has been regarded as one of the pillars to solve much of the problems bedevilling these countries. Also, Patra *et al.* (2017) indicate that economic growth that is achieved through savings is sustainable as compared to that through borrowed capital. The authors also highlight savings to determine the economic health of a country.

Examining the link between domestic savings and economic growth is of importance for a country such as South Africa which has been experiencing low levels of savings. The South African National Treasury (2016) expressed that savings allow the country to

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absorb external shocks as well as domestic structural weaknesses. Within Sub-Saharan Africa, Gross Domestic Product (GDP) and savings have been dismal (World Bank, 2016a and World Bank, 2016b). When comparing South Africa to other developing emerging countries from around the world, concerning savings in 2014, South Africa stands third from the bottom of twelve countries at 14.89%, while GDP growth finds South Africa fourth from the bottom of the twelve emerging countries at 1.5%.

Nnadozie (2003) highlights that economic growth has emerged out as one of the ways to deal with problems of poverty and high levels of inequality in Africa. This also to a greater extent applies to South Africa given the levels of poverty within the country. Statistics South Africa (2018) shows that out of the five BRICS countries, South Africa is the most unequal country with a Gini coefficient of 0.639 when all the other countries are below 0.50 except Brazil which stood at 0.549. Savings have also emerged as one of the major drivers of economic growth through its effect on investment. However, as highlighted earlier, South Africa has a problem of low savings as well as low economic growth. Again, comparing with the other BRICS countries, except Brazil, as of 2017 South Africa recorded a very low growth rate of 1.3%. Several studies suggest that there exists a savings-growth nexus (see for example Sajid & Sarfraz, 2008; Agrawal *et al.*, 2009; AbuAl-Foul, 2010; Masih & Peters, 2010; Mistzal, 2011; Najarzadeh *et al.*, 2014; Sekantsi & Kalebe, 2015). Agrawal *et al.* (2009) found that long-term sustainable economic growth requires a high level of investment and domestic savings. Savings are mainly determined by income, access to banking institutions, foreign savings rate, and declining dependency rate and availability of banking facilities.

Tang & Tan (2014) indicate that savings are the foundation of capital accumulation. These authors conclude that an increase in savings would increase investment and thus increase economic growth. It is also important to note that there are different views regarding the relationship between savings and economic growth from a theoretical perspective. Najarzadeh *et al.* (2014) show that according to Romer (1986), an increase in savings has an effect on economic growth only in the short-run, in the long-run the effect is negligible. Further, there are arguments regarding the direction of the effect between savings and economic growth. Gutierrez & Solimano (2007) indicate that there is the Mill-Marshall-Solow view and the Marx-Schumpeter-Keynes view presents contrasting views on the direction of causality between the two variables. The first view suggests that savings lead to economic growth through its contribution to investment and economic growth in the short-run. On the other hand, the Marx-Schumpeter-Keynes view suggests that investment and innovation are the two important factors determining output. In this regard, savings adjust passively to the level of investment which ensures macroeconomic equilibrium and a certain level of the growth rate of output. According to this view, it is growth that leads to savings. This is also consistent with the Carroll-Weil hypothesis that suggests that it is economic growth that drives savings, not the other way around.

There are several country-specific and cross-sectional studies that have been carried out on South Africa regarding the relationship between the two variables, the notable being Odhiambo (2009) who highlights the importance of a country-specific study as opposed to a cross-sectional study. It is further highlighted that panel or cross-sectional studies may impose homogeneity on coefficients which in reality may vary across countries due to several factors such as institutional set-ups, domestic economic

policy, political and economic structures. The study expands on that by utilising a multivariate model which can deal with potential endogeneity between savings and economic growth for South Africa. The study also contributes to the available literature by investigating the causal relationship between savings and economic growth considering the role of investment considering that the majority of the available studies have largely focused on analysing the two variables (savings and economic growth only). Schmidt-Hebbel *et al.* (1992) indicate that understanding the relationship between savings and investment is important for two major reasons. Firstly, this may hold the key to the positive relationship between savings and economic growth. Secondly, if capital accumulation is regarded as the centrepiece of the growth engine, the interaction between savings and investment is of great importance in assessing the arguments in the literature that raising savings is the best approach to achieve sustainable economic growth. Given this, the focus of the study was to examine the causal relationship between savings and economic growth in South Africa. The study utilised the Johansen (1988) cointegration test in which a long-run relationship between the variables was established. Granger causality tests were also conducted which confirmed the evidence of unidirectional causality from savings to economic growth. The Granger-causality tests also revealed that savings granger causes investment, which does also granger cause economic growth. The results also provided evidence of demand following hypothesis given that GDP granger causes investment. Following the introduction, the second section discusses the different views on the link between the variables of interest. Data and methodology used in the study are presented in section 3. The presentation of empirical results and conclusion are presented in section 4 and 5 respectively.

2. Literature review

The literature on growth has been built on the influential contributions of the Solow Model (1956), Modigliani & Brumberg (1954) and the growth theory literature of the 1960s (Kotlikoff, 1989). Literature suggests that there are three common models used concerning savings and economic growth. Savings models include the Keynesian absolute income hypothesis, the permanent income hypothesis, and the life cycle hypothesis (Nnadozie, 2003), as well as the neoclassical growth model (the Harrod-Domar model, 1946) and the Solow-Swan model (1956). The study will review the Solow-Swan model, the Romer model and the Life cycle hypothesis.

2.1. The role of savings rate in growth models

The Solow-Swan model and the Romer model are discussed to show how savings affect economic growth. The Solow-Swan model indicates how the savings rate affect the steady-state output and its provisional effect on the growth rate(Hamilton & Monteagudo, 1998). On the other hand, the Romer model suggests that the savings rate does not affect the steady-state output, although there is a direct effect on the growth rate of output.

The Solow-Swan model (1956) argues that no impact on the rate of economic growth occurs but an upsurge in savings rate impacts the stock of capital and the level of *per capita* remuneration.

Based on the production function, the model shows that although the marginal product of capital is optimistic, even though declining, the labour force develops at a constant rate (g_L). Thus, the model can depict that a steady-state or equilibrium occurs where:

$$f(k) = \frac{g_L}{s}(k) \tag{1}$$

where $f(k)$ = actual output *per capita* produced for any capital-output ratio (k), i = savings rate and $\frac{g_L}{s}(k)$ = output required to preserve the equivalent capital-labour ratio.

Equation 1 shows that the steady-state *per capita* capital stock and *per capita* output will be raised by the rise in the savings rate. Therefore, the Solow-Swan model argues that an adjustment in the savings rate fluctuates the economy's balance growth track and thus *per capita* output in a steady-state, although, it does not affect the growth rate of output per worker on the balanced growth track. On the other hand, the Romer growth model includes technology as an endogenous variable, where a rise in the savings rate gives rise to *per capita* output in steady-state and gives rise to the growth rate of *per capita* output.

To validate the presence of spillover effects, Romm (2005) shows that the production function can be written as follows:

$$Y = F(K_F\ , K, L) \tag{2}$$

where Y = output, K_F = physical capital stock by firms aggregated over the economy, K = spillover effect from investment and L = labour input into production.

The indulgent effects take the practice of 'learning-in-action'. The impact on output is increased by the investment that comes to augment labour input. The assumption is that there are optimistically decreasing returns in factors of production. Romm (2005) also indicates that at the level of every firm, there are constant returns to scale in K_i (Capital stock of each firm) and labour (L), though, at the social level for an agreed labour input, there are constant social returns in K_i and K (assumed). The result of the latter is that the production function will show rising returns to scale at the social level, even though the production function of each firm continues to show constant returns to scale (Romm, 2005).

Under this model, it is assumed that the growth rate of the capital-labour ratio does not decrease. Therefore, a rise in the savings rate gives rise to the growth rate of capital-labour ratio and *per capita* output, and a rise in the growth rate would persist (Romm, 2005).

Todaro & Smith (2011) indicate that the Solow-Swan model differs from the Romer model in that it assumes the fixed capital to affect output positively at the industry level. This will result in increasing returns to scale at the economy-wide level (Romm, 2005). The Solow-Swan model illustrates that the savings rate consists of a short-term effect on the growth rate whereas the Romer model illustrates the effect to be permanent.

2.2. How economic growth causes savings: life cycle theory

The first two theories discussed shows that the direction of effect runs from savings to economic growth. On the other hand, Jappelli & Pagano (1994) state that the direction runs from economic growth to saving in the life cycle saving model of consumption

and saving. The latter consists of remuneration-earning households saving to have the ability to consume once retired and unable to earn. The assumption is that there are three stages a consumer lives through. During the second stage, the assumption is that this is the only stage that remuneration-earning occurs. Thus, it offers motivation for intergenerational borrowing between stages. When a consumer is young, the consumer may borrow to finance existing consumption. Once the consumer is at the middle stage of life, the consumer may pay back the loan that was taken during the first stage while saving for retirement. Once in the last stage, the consumer consumes the assets accrued during the second stage of their life. At the maximum, a young consumer may borrow a proportion Ø of the present value of the young consumer's lifetime remuneration, with liquidity constraints.

Taking into account all other factors in the life cycle model, in the steady-state net savings rate $\frac{(K_{t+1} - K_t)}{Y_t}$ is equal to the growth rate $\hat{K}_{t+1} = \frac{(K_{t+1} - K_t)}{K_t}$. When this is multiplied with the constant, the capital-output ratio becomes:

$$\frac{S_t}{Y_t} = \hat{K}_{t+1}\frac{K_t}{Y_t} = [(1+\rho)^{\frac{1}{(1-\alpha)}} - 1]\frac{K_0}{Y_0} \tag{3}$$

Thus: $= [(1+\rho)^{\frac{1}{(1-\alpha)}} - 1]\left[\frac{\beta(1-\emptyset)\alpha(1-\alpha)A(1+\rho)^{\frac{-1}{(1-\alpha)}}}{(1+\beta)[\alpha+\emptyset(1-\alpha)]}\right].$

The equation above shows that an increase in the steady-state growth gives rise to the savings rate (remember that $\frac{K_{t+1}}{K_t} = \frac{Y_{t+1}}{Y_t}$ in steady-state):

$$\frac{d\left(\frac{S_t}{Y_t}\right)}{d\left(\frac{K_{t+1}}{K_t}\right)} = (1+\rho)^{\frac{1}{(1-\alpha)}}\frac{K_0}{Y_0} \tag{4}$$

When there are liquidity constraints, the effect of growth on savings is stronger. Subsequently, the higher the Ø parameter, the greater will be $\frac{K_0}{Y_0}$. Savings are positively affected by growth as an additional added measure. Japelli & Pagano (1994) noted that young consumers' desire to borrow and reduce lifetime remuneration is affected by the interest rate which responded positively to an increase in growth. The above proposition holds the steady-state and change between steady states.

The review of both the Solow-Swan model and the Romer model shows that savings influences growth. However, the theories suggest that there are other important factors, which are at play such as technological advancement. In essence, the conclusion from the two theories reviewed is that, under the Solow-Swan model, the effect of savings on growth is viewed as temporal. On the other hand, under the Romer model, the effect is regarded as permanent. Overall, these theories suggest that savings do influence the growth rate. On the other hand, the life cycle hypothesis indicates that growth has

conflicting effects on saving. Growth gives rise to the current remuneration and savings of the middle-aged. While growth may increase the future remuneration of the young consumer, it encourages them to increase their borrowing, which is weakened by the existence of liquidity constraints and eventually evaporates completely if the young consumers do not have access to credit markets. The theories reviewed does show that growth may affect savings through opportunities it makes available to economic agents. At the same time, savings may affect economic growth through investment. Thus, this suggests that the relationship between the two variables can be bi-directional.

2.3. Empirical literature review

The nexus between savings and economic growth has for several years been the focus of literature (Carroll & Weil, 1994; Agrawal, 2001; Thirlwall, 2003; Agénor, 2004; Mohan, 2006; Sajid & Sarfraz, 2008; Aghion *et al.*, 2009; Odhiambo, 2009; AbuAl-Foul, 2010; Misztal, 2011; Mehrara *et al.*, 2012; Alomar, 2013; Najarzadeh *et al.*, 2014; Tang & Tan, 2014). At the same time, there have been debates amongst researchers concerning the causal relationship between savings and economic growth (Carroll & Weil, 1994; Sajid & Sarfraz, 2008; Aghion *et al.*, 2009; AbuAl-Foul, 2010; Alomar, 2013; Najarzadeh *et al.*, 2014; Tang & Tan, 2014; Sekantsi & Kalebe, 2015).

Regarding savings, Agrawal *et al.* (2009) found that long-term sustainable economic growth involved a high level of investment and domestic savings. Savings are mainly determined by income, access to banking institutions, foreign savings rate, and declining dependency rate and availability of banking facilities. On the other hand, Sekantsi & Kalebe (2015) found that savings precedes and drives short-term and long-term capital accumulation and also contributes to long-term economic growth. Lastly, Odhiambo (2008) shows that economic growth stimulates savings as well as driving the development of the financial sector.

It is important to note also that there is robust empirical evidence of the positive correlation between savings and growth (see for example Sajid & Sarfraz, 2008; Agrawal *et al.*, 2009; AbuAl-Foul, 2010; Masih & Peters, 2010; Mistzal, 2011; Najarzadeh *et al.*, 2014; Sekantsi & Kalebe, 2015). Starting with the work of Mistzal (2011), the author found results that are consistent with the hypothesis that economic growth causes savings and vice-versa. In another study, Masih & Peters (2010) found that in Mexico, GDP was driven in the long run by savings. Also, Carroll & Weil (1994) found that at a cumulative level, growth granger causes savings although savings does not granger cause economic growth and that the relationship between the variables depends on consumer habits.

The traditional view of higher savings leading to higher economic growth is not supported by Alomar (2013). The author suggested that there is evidence of causality from economic growth to savings. The author also argues that exporting oil and natural gas leads to development and economic growth as compared to relying on domestic savings. The author highlights that the income source of a country plays a vital role in determining the interaction between savings and economic growth. In the GCC, where the majority of the country's income comes from natural resources, a uni-directional causal effect from economic growth to savings was found for four countries except for Oman (Alomar, 2013). Bi-directional causality was found only in Bahrain.

Alomar (2013) indicate that there are other factors that might determine the link between the two variables of interest. These results were found to be consistent with Sajid & Sarfraz (2008) and Najarzadeh *et al.* (2014). However, they are contrary AbuAl-Foul (2010).

Other variables such as foreign capital flow and political instability are also observed as important factors determining the link between the variables of interest. In a study on South Africa, Odhiambo (2009) incorporates foreign capital inflow and found that foreign capital influx, short-run savings and economic growth drive each other. The granger causality tests established that there is bi-directional causality between foreign capital inflow and savings, and a unidirectional causal flow from economic growth to foreign capital inflow. In another study, Quazi (2003) noted that by creating an uncertain economic environment detrimental to long-term planning and by reducing economic growth and investment opportunities, political instability reduces the domestic savings rate and thus poses a formidable hurdle to achieving long-term development objectives in a developing country. Lastly, it is important to observe also that analysing the link between the variables of interest has been carried out utilising cross-section or panel data. However as indicated earlier, such studies may fail to observe country-specific factors which can play a role in determining the link between the variables of interest. On the other hand, country-specific studies include (Carroll & Weil 1994; Loayza *et al.* 2000; Aghion *et al.*, 2009).

3. Data and methodology

3.1. Data

Yearly data from 1986 to 2018 was used in the study. The data was sourced from the World Bank. The variables used are Gross Domestic Savings (GDS), real Gross Domestic Product growth (RGDP), Exchange Rate (EXCH), Gross Fixed Capital Formation (GFCF) and Total Labour Force (LAB).

3.2. Model specification

The study will benefit from the models discusses earlier, thus the Solo-Swan model and the Romer model where changes in the savings rate are assumed to affect growth. On the other hand, the Life cycle hypothesis discusses earlier again shows how economic growth influences the savings rate. Thus, the argument from all the models discussed as well as the empirical literature reviewed suggests that there is a two-way relationship between savings and economic growth. Following the work of Smith *et al.* (2001), a VAR based model was thus utilised in analysing the relationship between the variables of interest.

The restricted VAR model utilised in the study is presented as follows: Assuming that X_t is the $nx1$ vector of variables, the intraimpulse transmission process of which is to be captured by the study is 5, given the 5 variables utilised in the study. Using matrix algebra notations, a 5-variable structural dynamic model can be stated as:

$$BX_t = \mu + \Gamma X_{t-1} + \varepsilon_t \tag{5}$$

where B is the matrix of variable coefficients

X_t is the 5×1 vector of observations at time t of the variables of the study which is defined as

$$X_t = (\ nGDP_t, InGDS_t, InEXCH_t, InGFCF_t, InLAB_t)$$

In this regard, μ is the vector of constants

Γ is a matrix polynomial of appropriate dimension

ε_t is a diagonal matrix of structural innovations that is white noise

3.3. Variable definition and apriori expectations

Economic growth is measured by Gross Domestic Product (GDP). The *a priori* expectation is that savings have a positive effect on economic growth in South Africa. This aligns with the two models discussed earlier as well as Odhiambo (2009) and Najarzadeh *et al.* (2014). Savings (GDS) is proxied by the aggregate of total savings in South Africa. Previously discussed studies have shown that, firstly, savings can support economic growth, and secondly, savings precede and drive the short-term and long-term capital accumulation and also contribute to long-term economic growth. EXCH is the exchange rate that is measured by the dollar-rand exchange rate given the influence of the US economy on South Africa. The *a priori* expectation is that the exchange rate harms economic growth in South Africa (Sibanda *et al.*, 2013 and Acar, 2000). Investment is measured by Gross Fixed Capital Formation (GFCF). According to Akani & Ibibe (2019), capital formation refers to the utilisation of resources of goods and services for all economic activity. A positive relationship between investment and economic growth is expected. Sekantsi & Kalebe (2015) found that savings precede and drive short-term and long-term capital accumulation and contribute to long-term economic growth. The variable thus acts as an intermediate variable through which savings positively contributes towards investment. Thus, the variable is expected to have a positive relationship with economic growth. Lastly, LAB captures the economically active population group in a country. As in Shahid (2014), an increase in LAB is expected to contribute positively to economic growth.

3.4. Estimation techniques

The study utilised the Johansen cointegration test to check for the long-term relationship between the variables of interest. The Johansen cointegration test is desirable given its ability to deal with the problem of endogeneity. As indicated in the literature section, the Solow-Swan models and the Romer model suggest that savings affect growth. On the other hand, the life cycle model suggests that growth does influence savings. This suggests a simultaneous relationship between the variables of interest.

The test is based on an examination of the π matrix, where π can be interpreted as the long-run coefficient matrix. The π matrix is defined as the product of two indices:

$$\pi = \alpha\beta' \tag{6}$$

The β matrix provides the cointegrating vectors. On the other hand, α provides the adjustment parameter.

Having established cointegration, the Vector Error Correction Model (VECM) was also estimated to analyse both the long-run and short-run relationships. Brooks (2008) indicates that the VECM applies maximum likelihood estimation to simultaneously examine the long-run and short-run relationships between the variables of interest. The VECM estimated has the following specification:

$$\Delta y_t = \Pi y_{t-1} + \sum_{t=1}^{k} \Gamma_i \Delta \mathrm{y}_{t-1} + \varepsilon_{kt} \tag{7}$$

where $y_t = (y_1 + y_{2t} \ldots..)$ is the 5×1 vector, Δy is all I(0), Γ_i are the 5×5 coefficient matrices and ε_{kt} is the error term assumed to be white noise.

Given the two-way relationship between Economic growth and Savings, Granger causality tests were also estimated to examine that kind of relationship. The equations estimated are:

$$\Delta \mathrm{InGDP}_t = \alpha_0 + \sum_{i=1}^{r} \alpha_{1i} \Delta \mathrm{InGDP}_{t-i} + \sum_{j=1}^{r} \alpha_{2j}\, \Delta \mathrm{InGDS}_{t-j} + \mu_t \tag{8}$$

$$\Delta \mathrm{InGDS}_t = \beta_0 + \sum_{i=1}^{s} \beta_{Ii} \mathrm{InGDP}_{t-i} + \sum_{j=1}^{s} \beta_{2j}\, \Delta \mathrm{InGDS}_{t-j} + \varepsilon_t \tag{9}$$

where Δ = change operator indicates that the model is stationary; Δ lnGDPt = growth rate of GDP (described as an adjustment in the natural logarithm of GDP in period t); Δ lnGDSt = growth rate of gross domestic savings (described as an adjustment in the natural logarithm of GDS in period t); r = the operational lag lengths determined by AIC and SBIC; α_{1i} = coefficients of GDP; α_{2i} = coefficients of GDS; β_{1i} = coefficients of GDP; and β_{2i} = coefficients of GDS; μ_t and ε_t = stochastic error terms; s = the operational lag lengths determined by Akaike Information and Schwartz-Bayesian criterion.

However, before analysis, the time series properties of the data were analysed through the Augmented Dickey-Fuller (ADF) and Phillips Peron (PP) tests. The two tests were used to obtain robust results.

4. Empirical results

4.1. Test of the order of integration (stationary test)

The study employed two frequently used techniques to test for stationarity in data, the ADF and PP tests, to examine the order of integration. The Johansen cointegration test requires that the variables employed be integrated of order one, I(1). Thus, in this study, to confirm if the data employed is stationary, the tau statistic is compared to the critical values generated by Eviews. The variables were examined for stationarity. Brooks (2008) indicates that a shock to a stationary variable does not last forever. Therefore, results from such variables can be used for forecasting. The Augmented Dickey-Fuller and Phillips Peron tests were utilised for this.

Table 1. Unit root test results.

	Augmented Dickey Fuller Test			Phillips Perron Test		
Variable	Constant	Constant and trend	None	Constant	Constant and trend	None
RGDP	−5.266***	−5.266***	−5.266***	−7.192***	−7.192***	−7.192***
GDS	−3.099***	−3.099***	−3.099***	−3.859***	−3.859***	−3.859***
EXCH	−3.746***	−3.746***	−3.746***	−3.550***	−3.550***	−3.550***
GFCF	−5.463***	−5.463***	−5.463***	−6.717***	−6.717***	−6.717***
LAB	−3.732***	−3.732***	−3.732***	−3.401***	−3.401***	−3.401***

***denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.

4.2. Augmented Dickey-Fuller test at levels

All variables were found to be non-stationary at their level series. The variables were thus examined for unit root at the first difference and the results are reported in Table 1.

The results in Table 1 shows that at first different all series are stationary. Thus, the null hypothesis of a unit root is therefore rejected for all the variables. The Johansen cointegration test requires that all variables be integrated of order 1, I(1). The series in this study satisfies this condition.

4.2.1. Johansen cointegration test

Before estimating the Johansen cointegration tests, the optimum lag length was determined empirically and the majority of the information criterion chose a lag of 1. Then the Johansen cointegration test was estimated therefore based on a lag of 1 to examine the long-run relationship between variables under study. This approach uses two test statistics: Trace statistics and Maximum Eigen-value statistics. The results from this test are reported in Table 2.

The results presented in Table 2 shows that both these tests suggested two cointegrating equations at a 5% level of significance. Given that the Trace statistic and the Max-Eigen value statistics are greater than the critical values, it is concluded that there exists a long-term relationship between economic growth and the variables regressed against it. In a way, it can be concluded that the variables of interest have a long-term relationship in South Africa.

Table 2. Cointegration test using the Trace Test.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.963	108.662	69.819	0.000
At most 1	0.891	59.101	47.856	0.003
At most 2	0.866	25.912	29.797	0.131
At most 3	0.821	11.839	15.495	0.165
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.963	45.498	40.078	0.030
At most 1	0.891	25.398	33.876	0.029
At most 2	0.866	14.949	27.584	0.752
At most 3	0.821	11.678	21.131	0.579

Max-eigenvalue test and Trace test indicates 2 cointegrating eqn(s) at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) *p*-values.

4.3. The VECM estimation result

To estimate both the long-run and short-run relationship between gross domestic savings and economic growth, the study adopted the VECM approach. The results obtained are presented in Tables 3 and 4 below.

4.3.1. The long-run estimation

Table 3 presents the long-run empirical results of the relationship between GDP and savings in South Africa.

The results in Table 3 can be presented in the form of an equation as follows:

$$RGDP_t = -11.610 - 0.345\, GDSAV_t = -11.610 - 0.345\, GDSAV_t - 2.624\, EXCH_t + 11.849\, GFCF_t + 16.612\, LAB_t \tag{10}$$

The empirical results in Table 3 show that savings have a negative and insignificant effect on economic growth in South Africa. These results are contrary to the *a priori* expectations and theory which suggest that there is a positive relationship between savings and economic growth. However, these results are consistent with the studies of Alomar (2013) and Carroll & Weil (1994). Both authors suggest that countries should rather focus on promoting exports of natural resources that lead to the development and economic growth instead of domestic savings. However, in the case of South Africa, this can be attributed to the low rate of savings that is being experienced in the country. Low savings suggest that the country is relying more on foreign savings in the form of FDI, ODA and cross-border bank flows. Recent studies such as Samarina *et al.* (2015) highlight that when a country receives more foreign capital it results in competition between foreign and domestic credit providers. In the end, domestic capital is concentrated on consumption activities that are not strongly linked to growth, hence the negative relationship between domestic savings and growth.

This study further discovered a long-run negative relationship between RGDP and EXCH in South Africa. This confirms the *a priori* expectation of a negative relationship between RGDP and EXCH. LAB and GFCF were found to be positively related to RGDP as was perceived by the Solow exogenous growth model. Also, aligning with the *a priori* expectation was the finding that should LAB and GFCF increase, GDP would increase as well, showing a positive relationship. The latter confirms, as stated by Shahid (2014), that LAB and GFCF have a positive relationship.

Table 3. Vector error correction long-run results normalised on RGDP.

Dependent variable: GDP			
Variable	Coefficient	Standard Error	*t*-statistic
GDS (−1)	−0.345	0.902	−0.382
EXCH(−1)	−2.624	0.873	−3.005
GFCF(−1)	11.849	1.487	7.968
LAB (−1)	16.612	2.464	6.740

***denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%

Table 4. Vector Error Correction short-run results: dependent variable: GDP.

Variable(s)	Coefficient	Standard errors	*t*-statistics
CointEq1	−0.091	0.033	−2.753
Δ(RGDP(−1))	−0.762	0.333	−2.288
Δ (RGDP(−2))	−0.571	0.331	−1.724
Δ (GDS(−1))	1.631	0.678	2.408
Δ (GDS(−2))	0.797	0.623	1.281
Δ (EXCH(−1))	−1.028	0.526	−1.028
Δ (EXCH(−2))	−0.745	0.561	−1.327
Δ (GFCF (−1))	−0.467	0.410	−1.142
Δ (GFCF(−2))	−0.356	0.490	−0.726
Δ (LAB(−1))	1.067	0.778	1.371
Δ (LAB(−2))	1.265	0.602	2.103

***denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.

4.3.2. Short-run estimation

Having analysed the long-term relationship between the variables of interest, the study proceeded to examine the short-term relationships between the variables of interest. This is presented in Table 4.

The short-run results show that savings have a positive effect on economic growth in the short-run. This is consistent with Odhiambo (2009) in the case of South Africa. It is also important to note that the coefficient of the error term is −0.09 and is statistically significant with a t-value of −2.75. This suggests that about 9% of the variation in the real GDP from its equilibrium level is correlated within a year. Based on this result, the adjustment of the GDP to restore long-run equilibrium is weak at 9% per annum.

4.4. Granger Causality tests

The Granger Causality tests were performed to examine the causal relationship between economic growth and savings in South Africa. The causality test is imperative given that literature shows that the relationship between the two variables can go either way. The Granger causality test results are presented in Table 5.

Table 5 shows that gross domestic savings does not Granger-cause economic growth in South Africa. On the other hand, the results show that economic growth does

Table 5. Pairwise Granger Causality results.

VAR Granger causality/block exogeneity Wald tests			
Dependent variable: RGDP			
Excluded	Chi-sq	df	Prob.
GDS	1.883628	2	0.1528
GFCF	7.988604	2	0.0100
All	7.296160	4	0.0210
Dependent variable: GDS			
Excluded	Chi-sq	df	Prob.
RGDP	8.367315	2	0.0048
GFCF	1.427904	2	0.4897
All	3.302706	4	0.5085
Dependent variable: GFCF			
Excluded	Chi-sq	df	Prob.
RGDP	16.17322	2	0.0003
GDS	12.06270	2	0.0016
All	22.64122	4	0.0001

Granger-cause GDS. This simply implies that domestic savings have little effect when it comes to economic growth in South Africa. These results corroborate the earlier findings. This could be due to the low levels of savings that the country is having. The results also indicate that GDP granger causes GFCF. This does also highlight the importance of growth as a factor determining investment in South Africa. Apart from investment influencing growth, growth does also influence investment. The minimum effect of savings on growth means the country has to rely more on foreign investment to achieve high levels of growth. These results were found to be consistent with Odhiambo (2008) and Tang & Tan (2014) which established similar results.

Impulse response functions presented in the Appendix were also constructed to further analyse the relationship between the variables. The ordering of variables follows the work of Goyenko *et al.* (2011) in which variables are ordered according to how they influence others. Of much interest in the study are the results relating to the relationship between savings and economic growth. The results show that shocks to GDP from savings results in the variable increasing initially, reaching its peak within the first two periods and becoming negative afterwards however stabilising in the long-run even though there are periods in which it is negative. These results corroborate the findings from the long-run and the short-run. On the other hand, the results show that shocks from GDP to savings initially results in the variable increasing, reaching its peak in the firth period and stabilising after. It is also important to observe that the variable remains positive.

5. Conclusions and recommendations

This study endeavoured to analyse the relationship between savings and economic growth in South Africa. Several methodologies such as the Johansen cointegration technique and the Granger causality tests were employed. The findings from the study revealed that in the long-run the effect of savings on economic growth is insignificant and negative. However, in the short-run, the results reveal that savings have a positive and significant effect on the economic growth. The Granger causality tests on the other hand revealed that economic growth Granger-causes savings. Thus, economic growth significantly contributes to savings in South Africa. Another interesting result obtained is the positive influence of investment on economic growth in both the short run and the long run. These results strongly support the view that investment plays a very important role as far as long-term economic growth is concerned in the country.

Furthermore, the results obtained in the study have several implications. Firstly, the country is experiencing low levels of savings. Thus, it is possible to attribute much of the contribution to economic growth to foreign direct investments (FDI), therefore the negative insignificant relationship between GDP and savings could be attributed to low levels of savings in the country. Even though the country is experiencing low levels of savings, the importance of savings to the country cannot be underestimated. The South African government should therefore implement policies that will boost economic growth to achieve an improvement in savings. Secondly, gross fixed capital formation has a positive effect on economic growth in South Africa. Policies aimed at boosting investment in the country should be pursued due to the imperative role of savings on growth in emerging economies. Giving rise to gross domestic savings and

attaining economic growth is done by directing gross domestic savings towards productive investments. This aligns with previous studies such as Bayar (2014) and Bairamli & Kostoglou (2010). Such initiatives may include creating a welcoming and enticing climate for investments, which are advocated by studies such as Zahir & Rehman (2019). Other initiatives include investing in infrastructure which is currently being prioritised in the country. The findings of the study also highlighted that economic growth does influence the level of investment in the country as well.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix. Impulsive response function