HOW APPLICABLE IS EXPORT-LED GROWTH AND IMPORT-LED GROWTH HYPOTHESES TO SOUTH AFRICAN ECONOMY? THE VECM AND CAUSALITY APPROACH

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Abstract

This paper investigated exports, imports and the economic growth nexus in the context of South Africa. The paper sets out to examine if long-run and causal relationships exist between these variables. Quarterly time series data ranging between 1998 and 2013 obtained from the South African Reserve Bank and Quantec databases was employed. Initial data analysis proved that the variables are integrated at their levels. The results further indicated that exports, imports and economic growth are co-integrated, confirming an existence of a long-run equilibrium relationship. Granger causal results were shown running from exports and imports to GDP and from imports to exports, validating export-led and import-led growth hypotheses in South Africa. A significant causality running from imports to exports, suggests that South Africa imported finished goods in excess. If this is not avoided, lots of problems could be caused. A suggestion was made to avoid such problematic issues as they may lead to replaced domestic output and displacement of employees. Another dreadful ramification may be an adverse effect on the economy which may further be experienced in the long-run.

Keywords: Exports, Imports, Economic Growth, Co-Integration Modeling, Causality Analysis

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1. Introduction

Economic growth of any country is led by many factors. Exports and imports are considered by many countries as very important and potential weapons for economic development and growth and this has not been proven in the South African economy. It is therefore necessary to provide empirical evidence of the relationship between these variables and economic growth. This has been the subject of intensive research in developed and developing economies. It is evident that the demand for imports is dictated by both economic and non-economic factors. Previous research suggested trade rates and/or relative costs, trade action, local and international economic positions, inventory and/or labour rates, and governmental conditions as the leading factors of imports. However, comparative costs and real earnings are regarded as main issues considerably influencing the demand for imports. Rivera-Batiz (1985) contends that an increase in economic action would bring about growth in imports, the motive being that increased revenue stimulates growth in economy. This signals a direct connection between imports and economic growth. Current external progression recreations have underlined imports as an imperative canal for outside innovations and information to stream into the household economy (Grossman and Helpman, 1991;

Lee, 1995; Mazumdar, 2001). New innovation could be personified in imports of transitional assets such as machine, equipment and labour efficiency.

On the contrary, exports appear to be an important tool used for gauging any country's economic growth. When expanded, this factor increases the country's economic growth and allows the utilization of economies of scale. Growth in exports stimulates specialisation in the manufacturing of export goods, which will boost the efficiency rate and cause overall rate of expertise to escalate in the division of export. The pace of economic growth of a country presents some of the most needed concerns among economic discussion. A country could speed up the level of economic growth through stimulating exports of goods and services. Universal trade serves a vital engine for the transfer of goods and services with the external industries (Grossman and Helpman, 1991).

Having said that, the South African import rates from China have been significantly lowered than some of the new European Union participating nations. However, if one studies the efficiency of imports from China, the criticalness of this development in imports is lifted in significance, especially considering that this late development is not off a low base. This solid development in Chinese imports has been a significant donor to the developing trade shortfall that has been clear in South

Africa's exchange balance. China represents about 10% of aggregate South African imports at present, which is up from 4% in 2001. An alternate variable in the breaking down trade balance has been the expanding measure of oil imports. This was as a result of the sharp increments in unrefined petroleum costs, which have arrived at levels not seen since the oil predicament of the 1970s. South Africa has additionally moved to getting more oil from African sources, thus the development in imports from Nigeria.

According to Gonanzalez-Nunez (2008), since the post-apartheid period, South Africa has quickly adopted an open economic stance. It is apparent there is a resilient growth in exports noted between 1992 and 1996. Throughout that time growth in world exports was also well up to period 2000. Nonetheless, the South African growth in exports started to deteriorate since 2001 and no significant increase has been noticed henceforth. If one contrast growth in latest years to that of selected crucial emerging nations, for example, China, India and Brazil; it is noticeable that South African export growth rate is not as rapid and stable as these nations. With this said, South Africa's growth in exports has been at least 11% slower than these countries. It is fascinating to note that like India, South African imports have grown at a quicker pace than its exports.

Empirical studies from the past to date support that growth of an economy is directly related to exports and imports. Therefore, the association effect of exports, imports on economic growth has become a crucial matter of discussion amongst economists and researchers all over the World. The current study explores the relationship between imports and export on the economic wellbeing of South Africa. The econometric framework is employed to quarterly data obtainable from the South African reserve Bank. The primary objective of any country is to maintain a sufficient level of foreign reserves and to create and maintain a sustainable reasonably exporting sector which contributes to job creation and high incomes. Since the beginning of a newly elected government in 1994, South Africa has been speedily reintegrated into the universal economy, with the involvement of exports and imports escalating powerfully as a proportion of economic growth. Growth in exports has been deteriorating while imports have rapidly increased, bringing about a widening trade shortfall, which kept on bothering the South African Reserve Bank. The question this study seeks to answer is, "does export-led growth (ELG) and import-led growth (ILG) hypotheses hold for to the South African economy?"

It is essential to verify these hypothesis so as that proper policies may be formulated to help place the economy on a path of development and maintainable growth. As a result, the major purpose of including the export and import variables in this paper is to capture possible productivity gains generated by these sectors which stimulate the domestic economy and also to take care of broad externality issues. These two are included as explanatory variables in an ad hoc manner and to help attain the general objective of this study, a co-integration and causal methods are employed To the best of our knowledge, no study in South Africa has attempted to assess the validity of ELG and ILG theories using the multivariate co-integration and causality frameworks over the period 1998 Q1 to 2013 Q4. This study may enrich the current economic literature and the findings on the subject, and such an exercise may provide an understanding of the interactions among the variables in the system. A significant light on the directions of the causality may also assist the South African policy makers to embark on effective policies with regards to exports, imports and economic growth.

2. Empirical Literature

Numerous observed studies have been pursued to investigate the legitimacy of the ELG and ILG theories in different economies. Awokuse (2003) tested the validity of the ELG theory for Canada. The study tested for Granger causality from exports to national growth established on vector error correction models (VECM) and the vector autoregressive (VAR) procedure developed by Toda and Yamamoto (1995). The experiential outcomes of this study revealed a stable long-run relationship between the variables and that Granger causality runs unidirectional from exports to GDP.

Abual-Foul (2004) tested the power of ELG for Jordan for data collected from 1976 to1997. Mentioning absence of a large data for Jordan, the results revealed no unit root and consequently did not investigate for co-integration. As a substitute, the study used three bivariate models, specifically, a vector autoregressive (VAR) in levels (accepted information is stationary), a VAR in first contrasts (the assumption is that data is integrated of order one), and an error correction model (ECM) (expected same level of integration, and the existence of co-integration). In view of the three bivariate models, Abu-Foul discovered confirmation of unidirectional causality from exports to output.

Though the quantity of empirical studies on the relationship between imports and growth is restricted, economists behind ILG hypothesis believe that economic growth is also triggered by imports. Failure to control imports leads to a deficit in the country's balance of payment. This also results in false relationship between exports and economic growth because export growth is stereotypically linked with speedy growth in imports. A few studies such as Dutta and Ahmed (2004) examined the ILG hypothesis. The authors examined the performance of Indian aggregate imports during the period 1971-1995. According to the econometric assessments of

the import-demand job for India, import-demand is mainly described by real GDP.

The study by Humpage (2000) asserted that there is an optimistic relationship between imports and economic growth. Though, the heading of direction flanked by imports and economic growth is not guaranteed. As per this study, the direction of causality ran primarily from income to imports at quarterly frequencies, not the other path around. An alternate study by Kotan and Saygili (1999) consolidated two diverse model details to assess an import demand capacity for Turkey. It is inferred that there is a long run, revenue level impacts imports substantially.

Mahadevan and Suardi (2008) explored the ELG and ILG theories for Japan and Korea. They found that economic development and trade remained autonomous in Korea, despite the fact that Japan's economic development is ILG rather than ELG. Similarly, Thangavelu and Rajaguru (2004) studied the association between exchange and labour efficiency for nine fast emerging Asian nations in a period arrangement data utilizing vector mistake redress model. The outcomes presumed that imports are vital than exports in stimulating output development with Granger causality running from imports to output development in India, Indonesia, Malaysia, Philippines, Singapore and Taiwan.

In the South African context, limited studies have explored the ELG theory. The list embraces the study by Ukpolo (1998) who studied the ELG standard for the period 1964-1993 utilising co-integration and Granger causality procedures. The study discovered evidence that exports does not Granger cause economic growth confirming the absence of ELG theory for the selected period. On the same note, Rangasamy (2009) utilized similar organizational method for the period 1960 Q1-2007 Q3. Empirical findings confirmed a unidirectional Granger causation running from exports to output. This implies that export growth helps stimulate economic growth. Likewise, Zimramba (2011) investigated the ELG hypothesis using the component of exports for the period 1960 Q1- 2008 Q3. The researcher applied the constraints test method for co-integration and the Toda-Yamamoto Granger causality procedure. Discoveries from latter procedure showed that merely merchandise exports lead to economic growth, whereas the former methods uncovers the presence of a long-run relationship between the variables.

Alam (2012) explored the connection between export, imports and economic growth in Pakistan utilizing data from 1971 to 2009. The empirical results confirmed the authenticity of ELG hypothesis if there should rise as occurrence in short-run and long-run period. Whereas ELG theory was confirmed to be legitimate in the short-run, no evidence was provided for ILG either in the short or long-run.

Udah (2012) used the co-integration and multivariate Granger Causality tests to investigate the long and short-run dynamics among exports growth, investment, population, imports and real output for Nigeria. Empirical evidence lends strong support to the existence of a long-run relationship among the variables. The study further established significant causality running from import to export but no strong evidence to support the ELG theory. However, the results showed that traditional and non-traditional factors were important in stimulating economic growth in Nigeria.

Amiri, Arshia and Gerdtham, Ulf-G, (2011) investigated the relationship between exports, imports and economic development in France over the period 1961-2006. The study utilized geostatistical models to study direct and indirect Granger causality between the selected variables. Outcomes of both vector error adjustment and enhanced vector error correction (with geostatistical routines) were indistinguishable and demonstrated the existence of long run unidirectional causality from exports and imports to economic development.

In spite of the broad literature examining the association of exports, imports and growth, reasonable conclusion has not been established especially in the context of South Africa. This study is a modest effort to assess the validity of both the ELG and ILG theories applying the multivariate co-integration and multivariate Granger-causality frameworks to recent quarterly data.

3. Materials and methods

This section discusses the procedure and data used in the study. The study adopts a four-step empirical framework to help achieve the objectives. The first step checks the data for stationarity using the Augmented Dickey-Fuller (1979) unit root tests. Secondly, the study performs co-integration analyses to check if series are integrated of the same order. Next the study, evaluates the short-run relationship using the VECM. In the last step, Granger causality procedure is utilized to determine the direction of dynamic relationships. Prior to describing the procedure, information on the data used is given below.

3.1 Data

This study uses quarterly time series data collected from the South African Reserve Bank and Quantec database for the first quarter of 1998 to the fourth quarter of 2013. The data includes imports and exports of goods and real gross domestic product (GDP) used as a proxy of economic growth. All the variables are measured in millions of rands. A total of 60 observations for each variable are used. Eviews version 8 is used for the analysis.

3.2. Methodology used

The following model is suggested;

$$lnGDP = \beta_0 + \beta_1 lnEXP_t + \beta_2 lnIMP_t + \varepsilon_t \qquad (1)$$

where
$lnGDP$Log =
of Gross Domestic Product, $lnEXP =$
Log of Exports,$lnIMP =$ Log of Imports, $\beta_0 =$
intercept, $\beta_t =$ slope and $\varepsilon_t =$ error term.

The variables are subjected to log transformation to simplify the interpretation of coefficients in terms of elasticity and also help in removing the irregularities in the data. The transformation further helps in smoothing the series by removing the cyclical and seasonal variations and also avoiding the issue of heteroscedasticity. To successfully and accurately fit the model, the following framework is adopted:

Unit Root Test

The first step in the analysis of time series data prior to applying formal tests is to provide plots of the series under study. Time series plots provide an initial clue about the nature of the series. Such an intuitive feel is the starting point of formal tests of stationarity and may help in making a choice of the appropriate equation (Moroke, 2014). Unit root tests are used to determine stationarity properties of the data, i.e. to assess if mean is equal to a unit and that the variance is constant. If this is not the case, which is usually expected in time series data, the problem can be solved by differencing the dataset (Wei, 2006). For this paper, the Augmented Dickey-Fuller (ADF) unit root test is used to determine the stationarity or the non-stationarity of time series variables under consideration. Engle and Granger (1988) recommend the ADF test due to the stability of its critical values and its power over different sampling experiments. The null hypothesis for this test is that the variables contain a unit root. The ADF test is based on the following regression equations;

$$\Delta Y_t = \alpha + \gamma_t + \beta X_{t-1} + \sum_{i=1}^{n} \beta_j \Delta X_{t-1} + \varepsilon_t, \qquad (2)$$

$$\Delta Y_t = \alpha + \beta X_{t-1} + \sum_{i=1}^{n} \beta_j \Delta X_{t-1} + \varepsilon_t, \text{and} \qquad (3)$$

$$\Delta Y_t = \beta X_{t-1} + \sum_{i=1}^{n} \beta_j \Delta X_{t-1} + \varepsilon_t \qquad (4)$$

These equations are described as follows;
- (2) has a drift term plus deterministic trend,
- (3) has random walk with drift and,
- (4) has pure random walk.

The calculation of a unit-root test requires an identification of the correct model and estimation of the parameters (Moroke, Tsoku and Seaketso, 2014).

For all three equations [2], [3] and [4], the unit-root test is equivalent to testing $H_0: \phi_1 - 0$ and is given as;

$$\tau_{ADF} = \frac{\phi_1 - 1}{se(\hat{\phi}_1)} \qquad (5)$$

The aim is to reject the null hypothesis of a unit root $H_0: \phi_1 - 1$ if $\hat{\tau}_{ADF}$ is less than the appropriate critical value, at some level of significance. If $H_0: \phi_1 - 1$ is not rejected in the final selected model, we conclude that the series has a unit root. Moroke et al., (2014) suggested the repetition of these steps after differencing the series to test if further differencing is needed. Rejecting the null hypothesis implies that co-integration between the variables is necessary.

Co-integration Test

It is crucial to test whether a collection of variables are exclusively integrated of the same order and that at least one liner grouping of these variables that is stationary is present (Dickey and Fuller, 1979). Testing for co-integration implies checking for the possible existence of long-run relationship among economic variables. This paper uses the Johansen (1988) and Johansen and Juselius (1990) co-integration as one method for data analysis. This procedure is important for this study since two exogenous variables are used. In essence, the Johansen framework for co-integration is a multivariate unit root test which estimates the co-integration rank *r* in the multivariate case. The test is further used to estimate the parameters of co-integrating relationships (Udah, 2012). The starting point of co-integration analysis is specifying the VAR model for a *k*-dimensional stationary time series y_t as;

$$y_t = \propto + \sum_{k=1}^{p} \prod k \, y_{t-k} + \varepsilon_t \qquad (6)$$

Where
$y_t =$ vector of non − stationary variables,
$\propto =$ constant, $\prod k =$ coefficient matrix,
$p =$ the lag length, $\varepsilon_t =$ error term .

To help decide on the appropriate model, the study tests the hypotheses $H_0: r = 0$ versus $H_1: r + 1 \neq 0$. The Johansen trace and maximum eigenvalue statistics are used in validating these hypotheses expressed as follows;

$$\lambda_{trace}(\gamma) = -T \sum_{i=\gamma+1}^{n} \ln(1 - \lambda_i), \qquad (7)$$

where $T =$ number of obvervations,
$\quad n$ number of variables,

γ_i the correlation between i$^{\text{th}}$ pair of variables λ_{trace} has a chi square distribution with N − r degrees of freedom.

$$\lambda_{max}(\gamma, \gamma + 1) = -T \sum ln \left(1 - \lambda_{\gamma+1}\right), \qquad (8)$$

where

T represents the sample size and λ_{max} is the maximum eigenvalue. Reject the null hypothesis if the (7) and (8) exceed their critical values, implying an existence of co-integrating relationships among the variables. Optimal lag length is determined using the Akaike and the Schwartz information Criteria. Both criteria select the model with least number of lags and are given as;

$$AIC = ln \left(\overline{\sigma}^2_\ell\right) + \frac{2\ell}{T}, \qquad (9)$$

$$SIC = ln \left(\overline{\sigma}^2_\ell\right) + \frac{\ell ln(T)}{T}, \qquad (10)$$

where ln = log of the likelihood function, k = number of parameters in the model, T = number of observations.

The variations in the related variables characterize short-run elasticity, whereas the coefficient of the error correction term signifies the speed of adjustment back to the long-run association among the variables. The estimated ECM is shown below;

$$\Delta yt = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - \gamma_{xt-1}) + \mu_t \qquad (11)$$

The error correction term is given by $y_{t-1} - \gamma_{x_{t-1}}$. The implied coefficient on x_{t-1} suggests a proportional long run relationship between *x* and *y,* where y is purported to change between $t-1$ and t as a result of changes in the values of the explanatory variables *x*. The error correction term would appear without any lag for this would imply that *y* changes between $t-1$ and t in response to a disequilibrium at time. γ defines the long run relationship between *x* and *y* while β_1 describes the short run relationship between changes in *x* and changes in *y*. β_2 describes the speed of adjustment back to equilibrium, and its strict definition is that it measures the proportion of last period's equilibrium error that is corrected for.

For the purpose of this study where exports and imports are factored as explanatory variables, the vector error correction model (VECM) becomes;

$$\Delta lnGDP = \Delta \sum_{i=1}^{p} \beta_1 ln\, EXP_{t-i} + \Delta \sum_{i=1}^{p} \beta_2 ln\, IMP_{t-i} + \psi_1 ECT_{t-1} + \upsilon_{1t}, \qquad (12)$$

with the ECT representing a one period lagged error-correction term from the long-run co-integrating relationship. Other terms are described in a similar manner as (11).

4. Causality test

The Granger causality test (Granger, 1988) in this paper is used to regulate if historical values of a variable assist to predict changes in another variable. To be specific, in the provisional circulation, lagged values of Y_t add no information to explanation of movements of X_t beyond that provided by lagged values of X_t itself (Greene, 2003). The null hypothesis states that there is no granger causality between the variables. Therefore, Granger causality test is based on specifying a multivariate p^{th} order model as follows;

$$\begin{bmatrix} lnGDP_t \\ lnEXP_t \\ lnIMP_t \end{bmatrix} = \begin{bmatrix} \alpha_{1t} \\ \alpha_{2t} \\ \alpha_{3t} \end{bmatrix} + \sum_{i=1}^{k+\alpha} \begin{bmatrix} \beta_{1t} & \delta_{1t} \\ \beta_{2t} & \delta_{1t} \\ \beta_{3t} & \delta_{1t} \end{bmatrix} \begin{bmatrix} lnGDP_{t-1} \\ lnEXP_{t-1} \\ lnIMP_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix}, \qquad (13)$$

Where
β_{it} and δ_{jt} are the coeffiecients of variables respectively. The null hypothesis is rejected if the error correction value is greater than the level of significance. A significance error correction term is interpreted as the long-term causal effect.

5. Empirical results

This section covers the discussion based on the empirical results. Firstly it presents the graphical illustration of the variables, unit root testing, co-integration analysis, the VECM and then causality testing results. These results are presented as figures and tables in the sections below.

5.1 Preliminary results

Before investigating time series data, an initial graphical presentation of the data is crucial. Gujarati and Porter (2009) suggest that a visual illustration of the series provides necessary affirmation of the expected nature of the sequence by admiration to the presence or absence of a trend, a constant or both in the model. This analysis is prepared through viewing plots of all the variables. Natural logs of raw data are plotted as Figures 1 through 3 to assess the nature of the data. The plots further help in revealing the stochastic properties which may be included in the model. These plots further reveal whether the seasonal or non-seasonal variations are present or not. This helps in deciding on the type of differencing to be imposed.

Figure 1. lnGDP
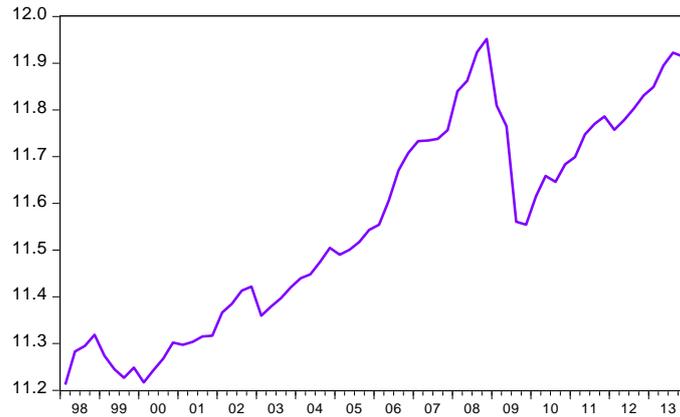
Figure 1 shows that GDP has consistently grown from 1998 until 2008. During the first quarter of 2008, GDP was at its peak and the rate of growth began to decline gradually in 2009 and saw a performance which was not strong enough on average. This could be as a result of the spill over effects of the economic predicament which occurred during 2007-2008. Though the crisis began in the United States of America, a vast number of economies were affected including South Africa. The 2008 economic recession which hit the country hard could also be a reason for a sudden and abrupt decline in GDP. This sector expanded by about 2.5% in 2012, having profited from enhanced depictions in producing agriculture, monetary and commercial services (African Economic Outlook, 2013). In 2013, the peak was almost equal to that in 2008 symbolizing growth in the economy. Figure 1 is explained by non-stationarity properties and this was expected due to the nature of the data. The mean and the variance of this series are not constant over time.

Figure 2. lnExports
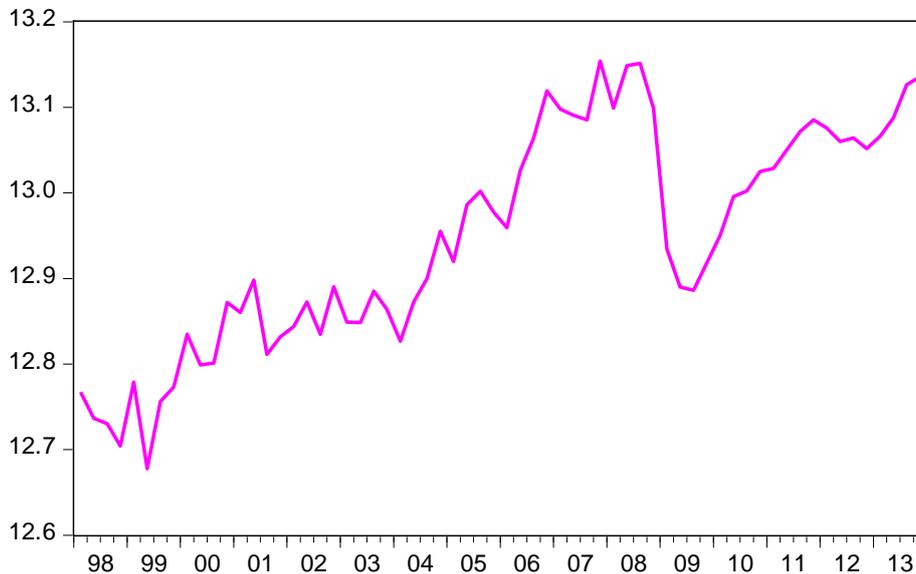
Figure 2 depicts how exports ratio has risen steadily from 1994 until 2008, underlying the dynamic inauguration of the South African economy that has transpired during this period. The figure started dropping promptly after 2008. During the year 2007-2008, the United States Federal Reserve raised interest rates with the hope of helping the citizens of the country to lower their mortgage bonds. This however caused the financial crisis that affected almost the entire world. South Africa is entirely dependent on trade with other countries which probably were worse-off during the 2007-2008 financial crisis, hence the figure. Some of the businesses closed, people were laid off, and more people entered into debt to try maintain their mortgages. Exports are also explained by non-stationary trends in the mean and variance.

Figure 3. Imports
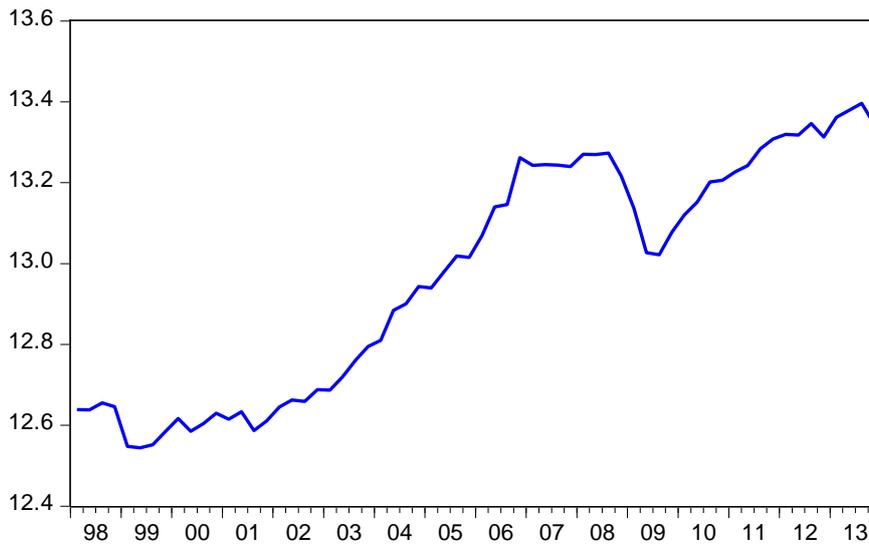
As shown in Figure 3, imports show a broadly similar pattern as exports, although smoother. Over the period, imports exhibited a strong upward trend from 1998 except for a dip in late 2009 when this sector decreased by about 13.3 %. Economic highlights explain that a sudden intensification in imports was as a result of China becoming major importers. Post the 2007-2008 financial crises, the South African imports started increasing with the highest peak in 2013. It is consequently clear that the stochastic properties of this sector are not constant over time.

Since the natural logs of the three series are non-stationary at levels, differencing may render them stationary. This is a prerequisite for co-integration analysis. This is also an important step prior to incorporating time series in investigation. Assessing the series for unit root assists in escaping mis-specified or spurious regressions (Engle and Granger, 1988). The series have to be integrated of the same order before co-integration framework can be applied. The results in Figure 4 are obtained after differencing the three series once.

Figure 4. First difference of GDP, exports and imports
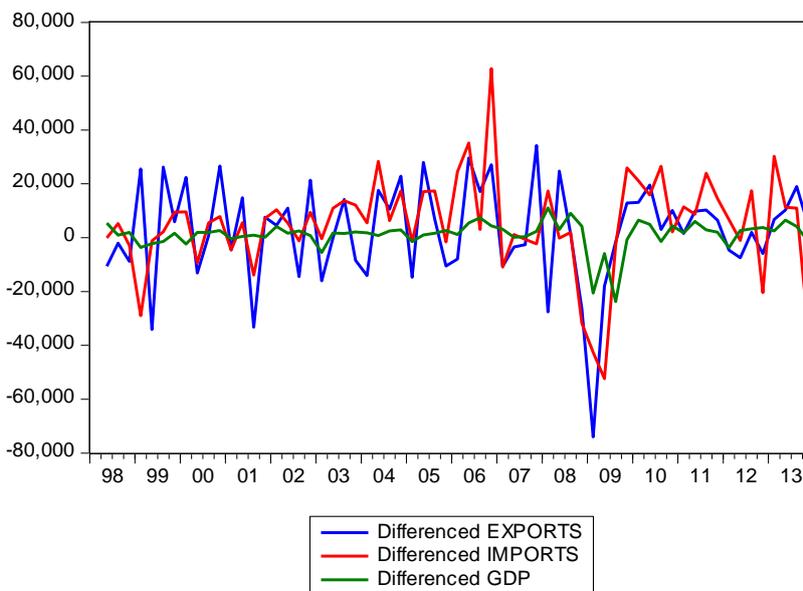
The plots reveal constant mean and variance implying that the variables are rendered stationary after first differencing (Dickey and Fuller, 1979). Relevant unit root test, ADF as described in the methodology section is used to verify this and the

results are summarized in Table 1. This test is applied to determine the order of integration on both level and first difference of the lagged variables. Stationarity of all variables is tested at trend due to the properties displayed by the original plots.

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Table 1. ADF unit root test

variables	level	t-stats	prob	Integration Order	1st Difference	T-stats	prob	Integration order
GDP	-3.49	-3.53	.045	I(0)	-3.44	-5.87	.000	I(1)
EXPORTS	-3.48	-2.50	.035	I(0)	-3.49	-8.19	.000	I(1)
IMPORTS	-3.46	-2.85	.019	I(0)	-3.48	-578	.000	I(1)

The results of the Augmented Dickey Fuller test suggests that the null hypothesis of a unit root in the series could not be rejected at 5% level of significance. Hence no time series appears to be stationary at their level I (0). The first difference of series eliminates the non-stationary components in the series and rendered all the variables integrated of order I (1). The null hypothesis of unit root is rejected at 5 % level of significance. The next task would be to investigate whether the series under consideration are co-integrated. This will help in in coming up with a well-defined model describing the relationship between the variables in the long-run.

5.2 Primary analysis results

This section discusses the results obtained according to the co-integration and causality frameworks and the objectives set for the study. These results are a follow-up from the preliminary analysis discussed in the sections above.

Optimal Lag Length

Before conducting the co-integration test, the optimum lag length of the model VAR is selected based on the least values of AIC and the SIC and the results are summarized in Table 2.

Table 2. Minimum information criterion

Lag length	AIC	SIC
0	69.518	69.623
1	63.752*	64.178*
2	63.759	64.485
3	63.992	65.039
4	63.965	65.326

Source: Authors own calculations

Though the analysis was based on lags of up to four since quarterly data was analyzed, the results supports a choice of optimum lag one. It can be deduced from the results that the AIC and SIC criteria perform similarly to one another for the lag length selection. These criteria are both minimum at lag one. This lag is used for further analysis in the next sections.

Co-integration test results

Since all variables are integrated of the same order i.e. I (1) the hypothesis of co-integration is examined using the Johansen co-integration tests. The trace statistics and eigenvalue statistics results are given in Table 3 and Table 4 respectively.

Table 3. Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% critical value	Prob.***
None*	0.305	38.079	29.797	0.005
At most 1*	0.219	15.543	15.495	0.049
At most 2	0.002	0.140	3.841	0.708

Source: Authors own calculation

Table 4. Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% critical value	Prob.***
None*	0.305	22.536	21.132	0.032
At most 1*	0.219	15.403	14.265	0.033
At most 2	0.002	0.1402	3.841	0.708

The results indicate that there is a long run association among the variables. In both situations, both tests support that at most two co-integrating equations may be fitted. Thus, the Johansen co-integration test approves the presence of a long run association between the variables; explicitly, GDP, exports and imports. The hypothesis of zero co-integrating vectors is rejected in favour of the alternative hypothesis that there are two co-integrating vectors. This suggests the presence of co-integration in time series variables implying that normalized co-integration coefficient represented as

(13) gives the long run equilibrium relationship between the variables;

$$GDP = 0.048 exports + 0.164 imports. \quad (14)$$
$$\quad (0.059) \qquad\quad (0.025)$$

The associated *t*-ratios of the coefficients are not significant at 5 % significance level implying that the effect of exports and imports on GDP in the long-run is not significant. The model representing the short-run relationship between the three variables is given as;

$$DGDP = -453536 + 0.115 EXP_t + 0.141 IMP_t - 0.787 ECT_{t-1} \quad (15)$$
$$[-0.584] \quad\; [3.774] \qquad [10.832] \qquad [-9.243]$$
$$(0.561) \qquad (0.0004) \qquad (0.0000) \qquad (0.0000)$$
$$R^2 = 0.963, \qquad AdjR^2 = 0.961$$

The short-run approximation of exports advocates that a 1% rise in this variable generates 11.5 % rise in GDP flows. Similarly, a 1 % increase in imports produces about 14.1% increase in GDP flows. Both variables are statistically significant at 5% significance level. As the theory suggests, the error correction term is negative and statistically significant, suggesting that 78.7 % of disequilibrium in the long run may be effected to correct for short run dynamics per quarter. The R^2 and R^2 adjusted are very high, implying that the model is generally good.

6. Granger causality test results

The next task is to determine the direction of causality between the variables. The presence of a long run relationship does allow one to make conclusions about causality. However, if causal effect is determined, it could be concluded that there is nexus between the variables. To assess the causal association between GDP, exports and imports Granger causality tests were executed. The test assumes that the majority of appropriate information to estimate particular variables will be held exclusively in the time arrangement information on these variables (Gujarati 1998). The model is utilized in order to regulate the Granger causal relationships between variables. The results are summarized in Table 5.

Table 5. Granger causality between exports, imports and GDP (1998 Q1-2013 Q4)

Null hypothesis	Obs	F-Statistics	probability
Export does not Granger Cause GDP	56	3.969	0.002**
GDP does not Granger Cause export	56	0.675	0.710
Import does not Granger Cause GDP	56	5.079	0.057*
GDP does not Granger Cause import	56	3.398	0.081*
Import does not Granger Cause export	56	2.844	0.014**
Export does not Granger Cause import	56	1.245	0.299

** Significant at 5 %, significant at 10 %

The results in Table 5 confirm a unidirectional causal association running from exports to GDP using significance level of 5 % and 10 %. The results are only significant with respect to imports only at 10 % significance. However, not enough evidence is provided to conclude that GDP causes export. The causality and co-integration results are in accordance about relationships between the variables. The evidence gathered is enough to conclude that the export-led growth and import-led growth hypotheses are valid for South Africa. The fact that not enough information could be gathered about causal effect running from GDP to exports suggests that in the

process of economic development, the country barely depends on exported inputs. Exports in this instance do play a significant role in the development process. A significant causality running from imports to exports, suggests that South Africa imported finished goods in excess during the selected period. If this is not avoided, lots of problems for the country may be caused and may result in replaced domestic output and displacement of employees. Another dreadful ramification may be an adverse effect on the economy which may further be experienced in the future.

7. Conclusion

This paper attempts to investigate the validity of exports-led and imports-led growth hypotheses using time series data from South Africa. Multivariate co-integration and causality framework is adopted for verification of the hypotheses. Initial analyses of data confirmed that the series are not stationary at their levels and first differencing rendered them stationary. The findings indicate the existence of long-run relationship between real GDP, exports and imports. The calculated error correction term suggest that about 78.7 % of disequilibrium in the long run could be corrected in the short run per quarter.

Granger causality test confirmed the presence of causal relationship running from export and import to GDP implying that export-led and import-led growth theory is valid for South Africa. Finally another conclusion of the study is the causation between exports and imports. There is a unidirectional feedback from exports to imports. The findings regarding the association between these variables indicate that exports affect economic growth significantly through imports. This suggests that South Africa import goods excessively posing a threat to the entire economy. This explains high unemployment rates in the country.

Based on the findings of this study, a number of recommendations are formulated. First and foremost, the study recommends a reasonable absorption through growth in import demand as a form of economic development. Quick development of imports particularly of transitional and speculation merchandise may be perceived to grow as a straight outcome of hurrying growth and further reshuffling of the economy of South Africa. Secondly, importing exchange procedures converging on exports and excluding imports as a progress machine of the economy might create slow-down not only in economic growth but also in the techniques of rearranging South African economic growth. However, as import-based development will prompt fast expansion of goods and services demands. This may lead to continuing decline in the distant position of South Africa. Consequently, in order to avoid major financial difficulties and to sustain maintainable growth, it may be vital that import demands in South Africa be protected by suitable exports profits. The paper further recommends studies that dig into the role of key machineries of industrial exports which may be used as drivers of economic growth and employment. Such information may be informative with regard to policy formulation. This could ensure job security and may prevent closure of most thee businesses in the country.

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