REASSESSING THE EXPORT-LED GROWTH RELATIONSHIP THROUGH COINTEGRATION METHODS

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─Abstract ─

The purpose of this study was to assess the applicability of the export-led growth nexus in the context of Namibia for the period 1990 to 2013 through the application of the Vector Autoregression (VAR) technique, which incorporates the following processes: Unit root tests, determination of the optimal lag length, testing the stability of the vector autoregression system, cointegration tests, estimation of the long-run equation, diagnostic checks for serial correlation, heteroscedasticity and normality, as well as the pairwise Granger-causality tests. Quarterly time series datasets were engaged. The study found cointegrating relationships among the variables that were examined. Further, the study found that export is a good predictor of economic growth. Therefore, the need for Namibia to pay special attention to developments in the export sector of its economy cannot be overstated. Additional research opportunities for upcoming researchers to further probe the issue under consideration are suggested.

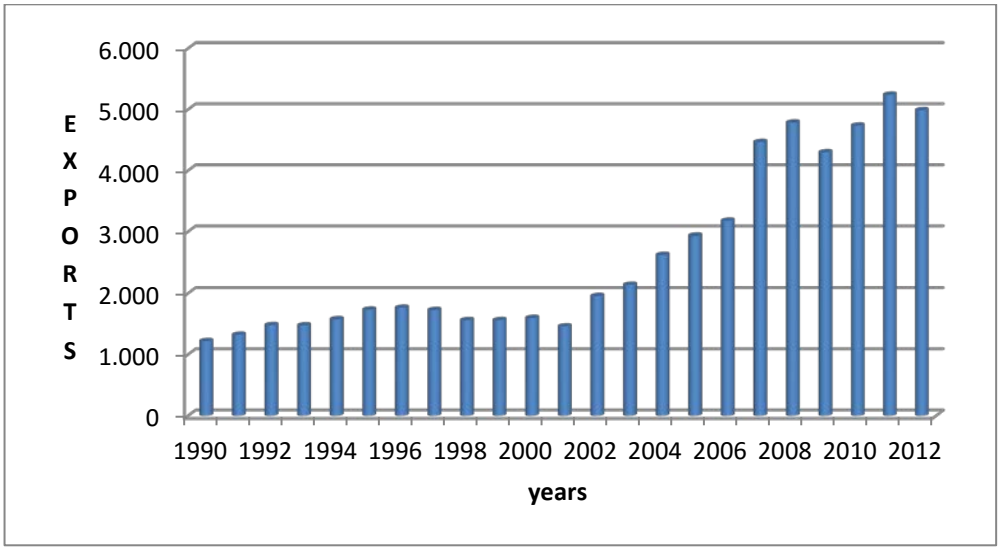
Key Words: *Granger-causality, cointegration, predictor, growth, time-series*

JEL Classification: C13, C20, F10, F21

1. INTRODUCTION

Empirical studies relating to the export-led growth nexus are extensive. Further studies in this area are likely to continue, especially in light of the phenomenon of globalisation, which is increasingly being facilitated through international trade. Namibia is a mineral paradise. No wonder that its primary exports are mainly solid minerals, such as diamonds, gold, uranium, zinc, as well as beef, fish, live animals and manufactured products. Further, Chow (1987) identified Namibia's major export partners as South Africa, Germany, USA and the UK with South Africa still playing the major role when it comes to markets for Namibia's exports. Figure 1 depicts Namibia's annual export data for the period 1990 to 2012.

Figure 1: Namibia's exports in millions USD, 1990 to 2012



Source: Author's construct

A further examination of Figure 1 shows that Namibia's export revenue was relatively stable between 1990 and 2001 due mainly to a consistent demand for its exports, especially solid minerals. However, there was a continuous rise in Namibia's exports revenue between the periods 2002 and 2006 due principally to the depreciation of its national currency, which ensures that its exports were cheaper in foreign markets. A much greater and continuous increase in its exports revenue was observed between the years 2007 and 2012 due mainly to

developments in its mining sector, especially the increase in foreign investment in uranium mining. The various free trade agreements that Namibia signed with some of its major trading partners did contribute to the rise in its exports revenue between 2007 and 2012.

The general objective of the study was to determine the impact of foreign trade on Namibia's economic growth for the period 1990 to 2013. Correspondingly, the specific objectives of the study were:

- To determine causality links between foreign trade and economic growth in respect of Namibia.
- To econometrically estimate a long-run relationship between trade and economic growth in Namibia.
- To econometrically evaluate if trade is a major propeller of economic growth in Namibia.

Despite the huge revenue realised from exports by the government of Namibia, economic experts are still uncertain about the impact of this on the country's level of economic performance. Therefore, the study sets to empirically assess the impact of foreign trade on Namibia through the use of cointegration methods.

2. THEORETICAL LITERATURE ON GROWTH

It is pertinent to note that all growth theories, be they classical, neoclassical or modern in nature, recognises the need for every society to strive at attaining continual and sustained levels of economic growth. This is principally because economic growth is seen, among other things, as a necessary condition to eliminate poverty, raise the quality of life and influence the level and distribution of wealth within a country. Economic performances differ from one country to another. Hence, the impact of economic growth on developmental issues such as poverty alleviation, the standard of living, and the distribution of wealth usually is expected to differ from country to country.

More fundamentally, it would depend on the capacity, abilities, as well as the willingness of the political leadership of that country to translate economic growth into addressing these developmental issues. Other economic growth studies have concerned themselves with issues such as: Why have some countries grown at more rapid rates than others? What are some of the critical factors that impact economic growth within an economy? Should countries converge to steady state paths and at what rate, or diverge? In search of answers to these questions, various

theories have been advanced to provide a theoretical foundation for the empirical analysis of economic growth. The neoclassical theory and endogenous growth models (often called new growth theories) have received the widest attention in the literature. This inquiry acknowledges that a complete and exhaustive discussion of the economic growth literature in a single study will be too ambitious. Given this fact, the study considered essentially the neoclassical and endogenous growth theories, since they furnish the theoretical foundations to most of the empirical models found in the literature on growth. It is also instructive to note that the theoretical approaches have examined two key issues: convergence and diversity, as well as the sources of economic growth.

2.1 Neoclassical growth theory

In a sense, the neo-classical growth theory essentially expanded upon the Harrod-Domar formulation by bringing into the model two extra factors, namely labour and technology in the growth equation (Rebelo, 1991). Solow's neo-classical growth model manifested waning returns to labour and capital, when both factors are separated from each other, as well as constant returns when both factors are combined. According to traditional neo-classical growth theory, output growth arises from one or more of three factors. These factors are, namely, labour availability, capital stock and technology. Closed economies with lower saving rates, *ceteris paribus*, are generally characterised by sluggishness when it comes to economic growth, especially in the short-run in relation to those experiencing high savings. Open economies, however, whether with low or high saving rates demonstrate greater level of economic growth in both short-run and long-run periods. Further, openness could potentially lead to improvements in technology (Bhagwati, 1958).

The neo-classical approach to economic growth usually begins with an examination of Solow (1956) and Swan (1956). In view of this, the model is often referred to as the Solow-Swan growth model. An important aspect of Solow's work was the incorporation of factor substitutability to generate a stable equilibrium growth path. Subsequently, a huge amount of the literature has been developed overtime, representing various adaptations to the basic neoclassical framework. The neo-classical approach is anchored on a simple aggregate production function that takes the following form:

$$Y=AF(K, L)$$

Where F *i*s a functional notation, which relates national income or output (Y) to technological change (A) and two basic factors of production (physical capital, K and labour, L). Solow maintained that technical change is any development that shifts the production function. This change could be as a result of improvement in education or technology. In addition, the production function is assumed to exhibit constant returns to scale. Over the years, the neoclassical approach has faced a number of criticisms. The most significant one being the huge amount of the focus on achieving some degree of consistency with one or more of the stylised facts rather than developing models that are amenable to empirical estimation and evaluation (Arora and Athanasios, 2005.

Easterly (2001) succinctly identified five stylised facts pertaining to total factor productivity (TFP). These are specified as follows:

Factor accumulation does not explain the bulk of cross-country differences in the level or growth rate of gross domestic product per capita. However, TFP does. By implication, factor accumulation cannot be used to account for most of the differences that occur amongst countries, when it comes to accounting for their growth rate, while the concept of total factor productivity could easily be rely upon as a way of accounting for most of the differences that do exist amongst countries pertaining to their level of growth rate in terms of gross domestic product per capita. Differences in GDP per capita among countries will always exist. Therefore, studies should focus more on isolating the reasons for these differences as against attempting to narrow them. Growth is not importunate over time, but capital accumulation is. In other words, growth does not come to premature end overtime, while capital accumulation could terminate overtime. This is because innovative techniques can be used to sustain growth even in the absence of more capital availability or expansion.

All factors of production usually flow to the same destinations, suggestive of imperative externalities. Usually destinations that are attractive to factors of production would serve as a pulling factor, when it comes to factors of production movements. National government policies do influence growth, especially in the long-run. However, whether government policies would lead to greater growth or dampened economic growth will be a function of the policy direction of the government. In response to the above-mentioned issues Mankiw, *et al*., (1992) formulated a model based on the neo-classical theory that paved way for econometric estimations and investigations. The main challenge of this approach lies in the fact that, in order to estimate the rate of depreciation for example, one

would need to rely on approximated figures. Temple (1999) subsequently responded to this weakness by suggesting an alternative approach in dealing with the issue.

Contributing to the discussion, Renelt (1991) assessed the theoretical and empirical literature concerning economic growth. He observed that one significant reason for the success of the standard neoclassical growth model is that it provided a convenient approach for organising data regarding the sources of economic growth. However, the model did not account for much of the growth taking place. An implication of the model is that countries with similar technologies and preferences will converge to the same steady state output levels. While this is true for some countries, there is little evidence of convergence, particularly in developing countries. Furthermore, some empirical findings have clearly shown that the gross national product (GNP) could display long-term resistance to shocks (Helpman, 1999).

In similar fashion, McCallum (1996) was of the opinion that the main issue arising from the neo-classical theory was its inability to explain several basic issues relating to the process of economic growth. Given the essential premise upon which the neoclassical notion was built, this theory tended to suggest either equal or different growth rates for all countries, which the model itself is unable to explain. The truth of the matter is that different economies have in fact achieved different growth rates in the long-run.

2.2 Endogenous growth theory

Endogenous growth economists generally believed that improvements in productivity are generally enhanced by innovation and human capital investment. Further, they stressed the involvement of the public, as well as the private sector in the process of innovation. In addition, they recognised knowledge as a factor that can contribute significantly to the growth process of a country (Grossman and Helpman, 1994). Besides, the proponents of endogenous growth theory stated that a knowledge-based economy is in a better position to maintain and sustain its competitive advantage in foreign markets, especially in fast-growth industries (Pack, 1994). Furthermore, the endogenous growth economists regarded technology as a variable rather than a constant term in growth models. This is because changes in policies can either suffocate or promote innovation and production.

Madsen *et al*., (2010) stated the other important economic ideas flowing from the proponents of endogenous growth theorists as follows: Firstly, they believe that either every market or industry has the potential to experience economies of scale or increasing returns to scale. Secondly, they consider investment in research and development as an effective source of technical progress. Thirdly, they advocated for government policies that would encourage entrepreneurs to create new businesses and also expand upon existing businesses in order to stimulate employment opportunities in the economy.

As earlier alluded to, this approach generally linked permanent changes in certain policy variables to permanent changes in economic growth rates. Endogenous growth models may be dichotomised further into two groups. The early sets of models were driven by the works of Lucas (1988), Rebelo (1991) and Romer (1986, 1987). Subsequently, the reports of Aghion and Howitt (1992) and, Grossman and Helpman (1994), which elaborated more specifically on endogenous technological change followed (Oviatt and McDougall, 1994). These later models also emphasised the role of research and development in technological change and promotion of economic growth. In contrast with the neo-classical model, endogenous growth theory regarded technical change as an endogenous variable (Melitz, 2003).

Romer (1986) maintained that the generation of knowledge is positively linked to the scale of economic activity, which is in turn assumed to be proportional to capital accumulation. In order to achieve sustained growth, constant returns to the reproducible factors are needed. Furthermore, he recognised the possibility of knowledge spill over, which may cause a single firm to experience diminishing returns to capital. However, in general there would still be increasing returns to scale. In similar fashion Lucas (1988) invoked and subsequently applied an aggregate production function approach that gave room for externalities to human capital.

Also contributing to the literature on endogenous growth, Aghion and Howitt (1992) advanced a Schumpeterian model of growth through creative destruction, allowing for learning-by-doing, as well as the fact that new innovations may make old ones out-of-date. Hufbauer (1991) in his contribution maintained that, like the neo-classical model, the endogenous growth theory has been attacked on several grounds. First, the challenge with measuring human capital has led to the use of various proxies for this particular variable. Examples of such proxies are primary and secondary enrolment ratios, literacy rates, and expenditure on education.

Secondly, it is very doubtful if any of the proxies used are consistent with the theoretical meaning of human capital. Further, the absence of a standard definition of human capital has led to wide disparities in the definition and measurements of the various proxies used over time and across various countries.

3. EMPIRICAL LITERATURE

Over the years, a huge amount of empirical studies concerning the impact of trade on economic performance in modern economies have been documented. This section attempts to review a few of such studies in a successive manner bearing in mind the driving objective of the study under consideration.

Oyejide (1974) made an inquiry into the economy of Nigeria specifically to determine the connection between exports and its economic performance. The study observed that an increase in export proceeds will lead to an expansion of the stock of money in the national economy. Further, he maintained that some parts of this increase will be devoted to consumer spending, while the remaining part will be saved. Savings, be it voluntary or forced savings, would constitute an important source of domestic capital formation, which is one of the principal agents needed to drive economic growth and development processes in all modern economies.

In similar fashion, Ram (1976) estimated this relationship for India for the period running from 1950 to 1971. He claimed that exports performed a dominant role in the economic growth of India during the period under consideration. By utilising a double-log transformation regression model, he was able to generate elasticity values. He noted that a 1 percent increase in the earnings of total exports is associated with a 0.73 percent rise in economic growth. The use of double-log transformation regression models, which allowed the researcher to determine the responsiveness of economic growth to changes relating to the independent variables used in the model is highly commendable.

Tyler (1981) investigated the possibility of a relationship between export and economic growth through the use of 55 middle income developing countries covering the period stretching from 1960 to 1977. He made use of both simple and multiple regression models to carry out the estimation process. The study found that higher growth rate of exports is associated with a higher growth rate of GDP. Therefore, the study maintains that countries need to first, improve upon their export competitiveness in order for them to achieve a higher economic growth rate.

Panas and Vamvoukas (2002) performed the co-integration procedure, error correction model and multivariate Granger causality test in order to determine the relationship between exports and output for Greece. The authors used annual time series data covering the period 1948 to 1997. The results of this study indicate that the causality runs from output growth to export growth in the case of Greece.

Al-Mamun and Nath (2005) employed cointegration procedures to estimate the export-led growth nexus for Bangladesh. The study reported the following findings: Firstly, the study found a long-run relationship between exports and industrial production. Secondly, the study found a unidirectional relationship running from exports to economic growth, as well as from exports to industrial production. However, the study did not find evidence of a short-run causal relationship between exports and industrial production.

Cui and Shen (2011) assessed the relationship between international trade, financial services and economic growth in China through the use of multiple regression models, cointegration and error correction procedures. The results are that there is a long-run equilibrium relationship between the two modes of financial service trade, and that both of them improved the economic growth of China during the Manni *et al*., (2012) established the connection between trade and the economy of Bangladesh for the period running from 1980 to 2010 using OLS techniques. This study analysed the achievements of the economy in terms of important variables such as growth, inflation, export and import after the implementation of trade liberalisation policies in Bangladesh. The analysis clearly indicates that GDP growth increased consequent to liberalisation. Trade liberalisation does not seem to have affected inflation in the economy. The analysis also suggests that greater openness has had a favourable effect on economic development. Both real exports and imports have increased with greater openness. The liberalisation policy certainly improves exports of the country, which eventually led to higher economic growth during the period under consideration. The findings of this study can be an interesting example of a trade liberalisation policy study in developing countries. It would be useful for other developing countries that are currently fraternising with liberalisation policies to also conduct similar studies in order to determine the effectiveness of this policy on their economies.

In similar fashion Bojanic (2012) assessed the relationship between economic growth, financial development and trade openness using annual macro-economic time-series data for Bolivia during the period stretching from 1940 to 2010. The

study tested the possibility of a long-run relationship among the variables specified in the econometric model. Secondly, the study carried out a causality analysis among the variables used in the econometric model. Thirdly, the study estimated an error correction model in order to correct for long-run disequilibrium in the econometric model. The econometric results, indeed, suggests the existence of long-run relationships among the variables used in the study. In addition, the study found a unidirectional relationship running from the indicators of financial development and trade openness to economic growth.

Arodoye and Iyoha (2014) estimated the relationship between foreign trade and economic growth in Nigeria for the period stretching from 1981 to 2010. The authors made use of quarterly time series data in the study. The result arising from the study confirms the existence of a long-run relationship between foreign trade and economic growth. The result also reinforces the assertion that the principal sources of Nigeria's economic growth variation are largely propelled by foreign trade innovations and "own shocks". The study, therefore, considers the adoption of a dynamic trade policy as one of the most effective ways of accelerating the process of economic growth in Nigeria.

The literature reviewed indicates differences in empirical results regarding the impact of trade on economic growth. This study uses macroeconomic data based on Namibia to test the export-led growth relationship.

4. RESEARCH APPROACH

The macroeconomic datasets used in the inquiry were obtained from the various annual reports of Bank of Namibia and the Namibia Statistical Agency's publications. The annual macroeconomic data used in the study covered the period 1990 to 2013. Prior to estimation the datasets were first converted into quarterly datasets**.** The various macroeconomic data used in the estimation process were first transformed into their respective natural logarithmic forms. Moreover, the datasets were also deflated before proceeding with the estimation process as a matter of technical necessity. In this study, real gross domestic product (Gdpr) refers to the dependent variable, while exchange rate (Echr), exports (Eps) and foreign direct investment (Fdinv) are the explanatory variables.

The study employed the Vector Autoregression (VAR) technique that followed the following sequence: Firstly, unit roots test are performed in order to check for stationarity of variables. In this context, the study utilized the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) procedures in testing for unit roots, since the

literature alludes to the fact that it is highly efficient in relation to most of the other documented approaches. Secondly, the study proceeds with the determination of the optimal lag length so as to show the convergence of the lag length for the VAR system. In this regard, the study employed the final prediction error criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQIC). Thirdly, the study proceeds to check if VAR satisfies the stability condition by estimating the roots of characteristics polynomial. A VAR system is considered to be stable if all the inverse roots of the characteristic AR polynomial have a modulus of less than one and lie inside the unit circle. Fourthly, a cointegration test is performed to find out if the variables in the model have long-run relationships. The presence of at least one co-integrating equation provides a basis for the estimation of a long-run equation, as well as a vector error correction model. In this regard, the study employed the Johansen cointegration test in determining the existence of long-run relationships among the variables in the model. Next, the study estimated the long-run equilibrium equation, and, thereafter, tested the model for serial correlation, heteroscedasticity and normality. Finally, the study proceeds with the pairwise Granger-causality test.

5. DISCUSSION OF RESULTS

The discussion pertaining to the estimated results follows the steps as discussed under research approach.

5.1 Unit roots test

Table 1 reports on the unit roots test results.

Table 1: Unit root tests: KPSS in levels and difference

Variable	Model specification			
		Levels	**First difference**	**Order of integration**
$lnGdpr_t$	Intercept and trend	0.230	0.0593**	1
	Intercept	1.203	0.093**	1
$lnEps_t$	Intercept and trend	0.343	0.169**	1
	Intercept	1.116	0.151**	1
$lnFdinv_t$	Intercept and trend	0.076**	0.024**	0
	Intercept	0.371**	0.047**	0
$lnEchr_t$	Intercept and trend	0.085**	0.069**	0
	Intercept	0.098**	0.091**	0

Notes: (a) ** implies rejection of the null hypothesis at 5 percent.
Source: Author's compilation.

The results reported in table 1 indicates that foreign direct investment and exchange rate variables attained a stationary status in levels, while real gross domestic product and exports only became stationary after first differencing.

5.2 The determination of the optimal lag length

The optimal lag length results are reported in Table 2.

Table 2: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-74.4821	NA	8.46e-09	2.654134	2.561726	2.452883
1	242.3338	518.5654	3.15e-04	-6.4285754	-5.278234	-5.239744
2	313.1466	124.44382	7.16e-01	-7.138635	-6.173903	-6.577993
3	316.5361	16.562375	9.42e-06	-8.242556	-6.458208	-5.794279
4	312.7814	7.563018	3.91e-29	-9.173589	-5.984521	-6.893427
5	325.8712	89.45407	6.17e-52	-9.971624	-6.094813	-5.613953
6	469.7024	37.52167*	3.28e-28*	-8.082614*	-6.249057	-7.893510*
7	489.7951	7.9839135	6.77e-63	-7.103514	-5.241187	-7.793205

* indicates lag order selected by the criterion

Source: Author's compilation.

The results show that the lag convergence is 6.

5.3 Stability test

The results reported in Table 3 demonstrates that the estimated VAR meets the stability condition since no root lies outside the unit circle.

Table 3: Roots of characteristic polynomial

Root	Modulus
0.977320	0.954210
0.774256 - 0.268112i	0.843362
0.751327 + 0.112024i	0.847291
0.651726 - 0.261721i	0.774725
0.621334 + 0.372156i	0.727547
0.577467	0.577467
0.462127 - 0.262143i	0.598556
0.484266 + 0.279843i	0.557973

Source: Author's construct.

5.4 Cointegration test

The cointegration results are reported in Table 4.

Table 4: Johansen cointegration test

Maximum Eigen test				Trace test			
H_0: rank = r	H_a: rank = r	Statistic	95% Critical value	H_0: rank = r	H_a: rank = r	Statistic	95% Critical value
r = 0	r =1	37.579	33.552	r = 0	r >=1	92.511	74.629
r <=1	r = 2	21.523	24.423	r <= 1	r >= 2	33.553	27.895
r <=2	r = 3	14.776	21.885	r <= 2	r >= 3	13.332	20.863
r <=3	r = 4	3.219	5.954	r <= 3	r >= 4	2.533	6.134

Note: The Maximum Eigen test shows one cointegrating equation, while the trace test indicates two cointegrating equations at the 5% level.

Source: Author's construct.

The results reported in Table 5 imply the existence of a long-run relationship among the four variables under investigation. This provides justification for the estimation of the long-run equation.

The long-run equation estimated result is shown as:

$$\Delta \text{In RGdpr}=1.085+0.748\Delta \text{InEps}+0.841\Delta \text{InFdinv}+0.872\text{InEchr} \quad (1)$$

The estimated equation implies the presence of a positive relationship amongst the variables under assessment. Besides, a 10 percent increase in export is expected to lead to a 7.48 percent jump in economic growth, while a 10 percent increase in foreign direct investment would lead to approximately 8.4 percent rise in economic growth. Moreover, a 10 percent increase in exchange rate would lead to approximately 8.7 percent enlargement in economic growth.

5.5 Diagnostic checks

The results of the diagnostic checks which are displayed in Table 5 indicates the absence of autocorrelation and conditional heteroscedastic. Besides, the model was also found to be normally distributed. This is so since all the computed probability values were found to be greater than 0.05.

Table 5: Diagnostic checks

Test	Null hypothesis	t-statistic	probability
Langrange multiplier (LM)	No autocorrelation	35.114	0.619
Jarque-Bera (JB)	There is normality	11.084	0.722
White (chi-square)	No conditional heteroscedasticity	41.428	0.309

Source: Author's construct.

5.6 Pairwise Granger-causality test

The Granger-causality results are reported in Table 6.

Table 6: Pairwise Granger-Causality Test Results

Null Hypotheses:	Observations	Prob.
Gdpr does not Granger Cause Eps	92	0.463
Eps does not Granger-cause Gdpr		**0.019****
Gdpr does not Granger Cause Fdinv	92	0.352
Fdinv does not Granger-cause Gdpr		0.271
Gdpr does not Granger Cause Eps	92	0.915
Eps does not Granger-cause Gdpr		0.522
Eps does not Granger Cause Fdinv	92	0.674
Fdinv does not Granger-cause Eps		0.866
Eps does not Granger Cause Echr	92	0.859
Echr does not Granger-cause Eps		0.917
Fdinv does not Granger Cause Echr	92	0.921
Echr does not Granger-cause Fdinv		0.860

Note that ** implies the rejection of the null hypothesis at 5 percent.
Source: Author's computation.

It is evident from the results displayed in Table 6 that there is a unidirectional relationship between exports and economic growth suggesting that exports, indeed do Granger-cause economic growth. The other pairs of variables analysed did not display any form of causality relationship.

6. CONCLUSION

This study found compelling evidence to suggest that exports do play a pivotal role, when it comes to the promotion of economic growth in Namibia. Indeed, improving upon a country's export competitiveness in foreign markets is always necessary for the attainment of greater economic performance. Therefore, the need for the government of Namibia to invest massively in its export sector, especially in infrastructures cannot be overstated. Besides, the government should consider the implementation of various incentives so as to encourage firms operating in this crucial sector to contribute more towards the competitiveness of the country's exports in foreign markets. Moreover, measures to check and control unnecessary imports into the country should be established as a matter of priority. Furthermore, Namibia should capitalise on their membership of regional economic blocs, as well as trade agreements with other regional blocs outside Africa in marketing the country's exports.

It will be desirable for future inquiry into the issue under assessment to increase the number of explanatory variables used in the estimation process. Furthermore, there is the need to disaggregate the export data into subsectors so as to test the impact of the individual subsectors on growth. Also, it will be worthwhile to explore the possibility of applying at least two econometric time series techniques in future investigation for purposes of testing the export-led growth relationship for Namibia.

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