Foreign direct investment and economic growth: ADRL and causality analysis for South Africa

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Abstract

The article empirically investigated economic growth as a function of foreign direct investment and exports in South Africa. The article applied the autoregressive distributed lag model, known as the ARDL bounds testing approach to cointegration for the long run relationship between economic growth, foreign direct investment and exports. The error correction model was used to examine the short run dynamics; and the VECM Granger causality approach was used to investigate the direction of causality. The article confirmed cointegration between economic growth, foreign direct investment and exports. The article indicates that both foreign direct investment and exports spur economic growth. The VECM Granger causality analysis found unidirectional causality between economic growth and foreign direct investment running from foreign direct investment to economic growth, unidirectional causality between foreign direct investment and exports running from foreign direct investment to exports and bidirectional causality between economic growth and exports. The article confirms the FDI-led growth hypothesis for South Africa. On the policy front, the government should stimulate foreign direct investment through incentives to investors, creation of a good macroeconomic environment and a careful utilisation of loose monetary policy to grow the economy.

***Keywords**:* foreign direct investment; economic growth; exports; bounds testing; ARDL; VECM; Namibia

Biographical notes

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1. Introduction

There have been many arguments in both theoretical and empirical literatures, which suggest that economic prosperity is associated with significant inflows of foreign direct investment (FDI) into a country. This resulted in many researchers conducting studies that investigate the theories of FDI, various economic variables that influence FDI, the effects of economic integration on the movements of FDI, and the benefits and costs of FDI (see Adams, 2009; Frimpong, Oteng-Abayie, & others, 2006; Kandiero & Chitiga, 2006; Sharma & Dhakal, 1994; Gui-Diby, 2016; Ayanwale, 2007; Jenkins & Thomas, 2002; Afolabi & Bakar, 2016). The majority of these studies confirm there is a positive causal relationship between FDI and economic growth, in either the short run, or long run, or both. Frimpong, Oteng-Abayie, & others (2006) studied the causal relationship between FDI and economic performance in Ghana. Their findings suggest that there is no causality between FDI and economic growth in Ghana. However, studies by Afolabi & Bakar (2016) and Keho (2015) on the Nigerian and South African economies, respectively, established that there is bidirectional causality between FDI and economic growth.

The differences in the results alluded to above may imply that the advantages of FDI do not occur automatically, but rather depend on recipient countries' absorptive capacity, such as a free trade policy, export-oriented FDI policy and human capital development (Zhao & Du, 2007). Studies on causal relationship between FDI inflows and economic growth have a major role since they speak to economic development. If there is unidirectional causality from economic growth to FDI, this suggests that national income growth can be utilised as a catalyst to attract FDI inflows. On the other hand, if unidirectional causality runs from FDI to economic growth, this strongly suggests that FDI stimulates the economic growth, increase gross fixed capital formation and employment (Borensztein, De Gregorio, and Lee 1998; Lim and Maisom 2000; Zhang 2001). If a bi-directional causality exists between these variables, then both FDI and economic growth would have a reinforcing causal relationship and the policy makers can target both simultaneously to grow the economy.

Although numerous studies have been carried out on FDI and economic growth elsewhere, very few previous studies have examined the causality between FDI and economic growth for South Africa. In addition, there is very little literature on FDI and economic growth on Southern Africa. The country is chosen because it is one of the countries ranked as a middle-income country in the Southern Africa and it will be interesting to find out the role played by FDI to its economic prosperity. The main contribution of the article to literature is that it is

one of the few attempts to analyse the causal links between foreign direct investment and economic growth in a middle-income country of Southern Africa.

The remaining sections of the article are as follows. Section 2 presents brief empirical literature while, Section 3 provide the theoretical models linking FDI and economic growth. Section 4 discusses econometric techniques used in investigating the causal relationships. The results are discussed in Section 5, and finally the conclusions and policy implications are presented in Section 6.

2. Brief literature review

There are a few studies analysing foreign direct investment and economic growth in Africa among which the following can be cited as recent: Akinlo (2004), Fedderke & Romm (2006), Agbloyor *et al.* (2014), Adams & Opoku (2015) and Seyoum, Wu, & Lin (2015). Articles by Akinlo (2004) and Fedderke & Romm (2006) analyse the relationship between FDI and economic growth using cointegration analysis for Nigeria and South Africa during the periods 1970 to 2001 and 1956 to 2001, respectively. Adams (2009), Agbloyor *et al.* (2014), Adams & Opoku (2015) and Seyoum, Wu & Lin (2015) focus on subsets of African countries, using other types of estimation methods such as instrumental variable methods, and vector auto-regressive models. Using ordinary least squares estimators and fixed effect models on 42 Sub-Saharan African countries for the period 1990 to 2003, Adams (2009) established that FDI does not influence economic growth. In another study, Adams & Opoku (2015), applied the generalized method of moments (GMM) estimators to a dataset of 22 Sub-Saharan African countries for the period 1980 to 2011 and concluded that FDI does not have an independent impact on economic growth. Moreover, Agbloyor *et al.* (2014) found that FDI has a negative impact on economic growth in the case of 14 African countries based on GMM estimators. Borensztein, De Gregorio, & Lee (1998) tested the effect of foreign direct investment (FDI) on economic growth in a cross-country regression framework, utilising data on FDI flows from industrial countries to 69 developing countries over the last two decades. Their results suggest that FDI is a significant vehicle for the transfer of technology, contributing relatively more to growth than domestic investment. However, the higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital. A study by Frimpong, Oteng-Abayie, & others (2006) analysed the causal relationship between FDI and economic performance in Ghana and found that there is no causality between FDI and economic growth in Ghana. However, studies by Afolabi & Bakar (2016) and Keho (2015) on the Nigerian and South African economies, respectively,

established that there is bidirectional causality between FDI and economic growth. The results summarised above show that there is no consensus about the effect of FDI on economic growth in African economies. Criticisms of some of the studies may be based the choice of countries at different levels of development, periods studied, methods used, etc.[1]

Theoretical Models

3.1 FDI-led Growth hypothesis

The hypothesis of FDI-led economic growth is based on the endogenous growth model, which states that FDI associated with other factors such as human capital, exports, technology transfer and capital have had important effects in spurring economic growth (Borensztein, De Gregorio, and Lee 1998; Lim and Maisom 2000). These growth-spurring factors might be introduced and nurtured, to stimulate economic growth through FDI. In addition, some recent studies recommend the inflow of FDI might be able to stimulate a country's economic performance through technology transfer and spill over efficiency (See Shakar & Aslam, 2015 and Borensztein, De Gregorio, & Lee, 1998). Shakar & Aslam (2015) further argue that spill over efficiency is thought to occur when domestic firms are capable of absorbing the tangible and intangible assets of multinational corporations (MNCs) embodied in FDI. Further, as FDI generates backward and forward linkages, when MNCs contribute technical assistance to domestic firms, it is anticipated that the level of technology and productivity (for both labour and capital) of domestic producers will rise (Borensztein et al., 1998).

3.2 Growth-led FDI hypothesis

In contrast to the hypothesis of FDI-led economic growth, the GDP-led FDI hypothesis is mainly based on the theory of MNCs. According to Dunning (1977, 1993 and 1995)'s Eclectic theory, MNCs with certain ownership advantages invest in another country with locational advantages, and both advantages can be captured effectively by "internalising" production, through FDI. The hypothesis of growth-led FDI, therefore, centres on locational factors, such as market size (proxied by GDP or GNP), as the most important factor in attracting foreign direct investment. A high rate of economic growth, ceteris paribus, will increase foreign direct investment, and this results from the expected higher level of profitability. High rates of economic growth will cause levels of aggregate demand for investments (both domestic and foreign) to rise (Zhang 2001). In addition, better economic performance suggests better infrastructural facilities and greater opportunities for making

[1] The article does not criticise any particular article on its own for brevity's sake.

profits. As a result, the greater the market size the greater the inflows of FDI into the recipient countries.

3.3 Feedback causality hypothesis

Seetanah & Khadaroo (2007) contend that there is a possibility that feedback causality exists between FDI and economic growth. This is because large market size leads to rapid economic growth, which in turn increases the flow of FDI and subsequently increases profitability levels. Moreover, this fosters economic performance resulting from the high level of aggregate demand. Therefore, it is not surprising to conclude that there exists positive feedback between FDI and economic growth, due to the interdependence between these two variables. The next section covers the methodological issues and procedures employed in the article.

3. Estimation and testing procedures

In this section, we discuss all the relevant techniques employed to carry out this article. These include the unit root tests and Bounds Test for cointegration and causality within the ARDL modelling approach. This model was developed by Pesaran et al. (2001); and can be applied irrespective of the order of integration of the variables (irrespective of whether regressors are purely I(0), purely I(1) or mutually cointegrated. This is specifically linked with the ECM models that are called VECMs.

4.1 Testing for unit roots

The first step is to determine the order of integration of each variable since the ARDL uses each variable at the level at which it is stationary. To test the stationarity of the series, the article uses the Augmented Dickey Fuller (ADF) unit root testing procedure (Dickey and Fuller, 1979) and the Phillips Peron (PP) test (Phillips & Perron, 1988). In both the ADF and the PP tests, the size of the coefficient δ_2 is the one that we want to determine in the following equation:

$$\Delta Z_t = \delta_0 + \delta_1 t + \delta_2 Z_{t-i} + \sum_{i=1}^{n} \beta_i \Delta Z_{t-i} + \varepsilon_t \qquad [1]$$

The ADF regression tests for the existence of unit root of Z_t, in all model variables at time *t*. The variable ΔZ_{t-1} expresses the first differences with n lags and final ε_t is the variable that adjusts the errors of autocorrelation. The coefficients, δ_0, δ_1, δ_2, and β_i are the ones

estimated. The null and the alternative hypothesis for the existence of unit root in variable Z_t is:

$H_0: \delta_2 = 0 \qquad H_1: \delta_2 < 0$

The other method used to test for unit roots is the Phillips Peron method, which corrects for serial correlation and heteroscedasticity in the error terms by directly modifying the test statistics without including lags (Enders, 2004). Thus, the equations and hypothesis to be tested are similar to the ones for the ADF above except that the lags of the variables are excluded from the models.

$$\Delta Z_t = \delta_0 + \delta_1 t + \delta_2 Z_{t-i} + \varepsilon_t \qquad [2]$$

4.2 Testing for Granger causality in the Bounds test approach

Since the application of the model has proved capable of generating more reliable estimates in the context of endogenous variables (Gujarati, 2009), the current article also applies the Bounds Test to examine the causality between FDI and economic growth in South Africa. If applied correctly the ARDL Bounds Test is a useful tool for estimating and interpreting the dynamic relationships of economic variables (Dixit, 2014; Ravinthirakumaran, 2014; Jalil, Feridun, & Ma, 2010). It is against this backdrop that the article chooses the lag length using Schwartz information criterion; tests unit roots of all variables by using the ADF and the PP tests; and conducts cointegration tests by applying the LR test technique propounded by Johansen (1995).

The model for the relationship between economic development and FDI utilised in this article is derived from the model: $GDP_t = f(CF_t, EMP_t, FDI_t, HC_t, M_t, TRD_t,$ where $GDP_t, CF_t, EMP_t, FDI_t, HC_t, M_t, TRD_t$ represent output, capital formation, labour employment, the amount of FDI, human capital, new technique and international trade (UNCTAD, 1992). Since the degrees of freedom and inadequate sample sizes matter a lot in VARs and VECMs, the article only uses output, FDI and exports. The following are the error correction models estimated under the ARDL Bounds testing approach:

$$LNGDP_t = \alpha_{11} + \delta_{12} LNGDP_{t-1} + \delta_{13} LNFDI_{t-1} + \delta_{14} LNEXP_{t-1} + \sum_{i=1}^{p} \phi_{1i} LNGDP_{t-i} + \sum_{i=1}^{p} \beta_{1i} LNFDI_{t-i} + \sum_{i=1}^{p} \psi_{1i} LNEXP_{t-i} + \upsilon_{1t} \qquad [3a]$$

$$LNFDI_t = \alpha_{21} + \delta_{22}LNGDP_{t-1} + \delta_{23}LNFDI_{t-1} + \delta_{24}LNEXP_{t-1} + \sum_{i=1}^{p} \phi_{2i}\, LNGDP_{t-i} + \sum_{i=1}^{p} \beta_{2i}\, LNFDI_{t-i} + \sum_{i=1}^{p} \psi_{2i}\, LNEXP_{t-i} + \upsilon_{2t} \quad [3b]$$

$$LNEXP_t = \alpha_{31} + \delta_{32}LNGDP_{t-1} + \delta_{33}LNFDI_{t-1} + \delta_{34}LNEXP_{t-1} + \sum_{i=1}^{p} \phi_{3i}\, LNGDP_{t-i} + \sum_{i=1}^{p} \beta_{3i}\, LNFDI_{t-i} + \sum_{i=1}^{p} \psi_{3i}\, LNEXP_{t-i} + \upsilon_{3t} \quad [3c]$$

Where α_{11}, α_{21} and α_{31} are the constants for three equations. We can test for cointegration among $LNFDI_t$, $LNEXP_t$ and $LNGDP_t$ using the Bounds test approach. For equations [3a], [3b] and [3c] the F-test (normal Wald test) is used for investigating one or more long run relationships. In the case of one or more long run relationships, the F-test indicates which variable should be normalised (Koop, 2005).

In equation [3a] when $LNGDP_t$ is the dependent variable the null hypothesis of no cointegration is H_0: $\delta_{12} = \delta_{13} = \delta_{14} = 0$ and the alternative hypothesis of cointegration is H_1: $\delta_{12} \neq \delta_{13} \neq \delta_{14} \neq 0$. In equation [3b] the null hypothesis of no cointegration is H_0: $\delta_{22} = \delta_{23} = \delta_{24} = 0$ and the alternative hypothesis of cointegration is H_1: $\delta_{22} \neq \delta_{23} \neq \delta_{24} \neq 0$. Lastly, in equation [3c] the null hypothesis of no cointegration is H_0: $\delta_{32} = \delta_{33} = \delta_{34} = 0$ and the alternative hypothesis of cointegration is H_1: $\delta_{32} \neq \delta_{33} \neq \delta_{34} \neq 0$. The distribution of F-statistic developed by Pesaran et al. (2001) is non-standard. The reason being that the F-statistic is based on the assumption that variables are integrated at I(0) or I(1) as alluded to earlier. If the calculated F-statistic is less than the lower critical bound (LCB) then the hypothesis of no cointegration may be accepted. Cointegration may be found if the calculated F-statistic exceeds the upper critical bound (UCB). In addition, the long run relation is inconclusive if the calculated F-statistic lies between the lower and the upper critical values.

Once cointegration is established then there must be causality at least from one direction. Granger pointed out that the existence of cointegration between variables means that there is information about the long run and short run Granger causality. In this case, the vector autoregression (VAR) model is used to test the direction of causality between economic growth, foreign direct investment and exports for South Africa. For empirical purposes, the

following error correction representation can be developed from the VECM Granger approach:

$$(1-L)\begin{bmatrix} LNGDP_t \\ LNFDI_t \\ LNEXP_t \end{bmatrix} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} \phi_{1i} & \beta_{1i} & \psi_{1i} \\ \phi_{2i} & \beta_{2i} & \psi_{2i} \\ \phi_{3i} & \beta_{3i} & \psi_{3i} \end{bmatrix} + \begin{bmatrix} \theta \\ \varpi \\ \xi \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \\ \eta_{3t} \end{bmatrix} \qquad [4]$$

where $(1-L)$ is the difference operator, ECM_{t-1} is the lagged error correction term which is derived from the long run cointegrating relationship while η_{1t}, η_{2t} and η_{3t} are white noise serially independent random error terms. The existence of a significant relationship in first differences of the variables provides evidence on the direction of short run causality while long run causality is shown by a significant t-statistic pertaining to the error correction term (ECM_{t-1}).

4.3 **Data sources**

Data for economic growth rate (GDP), Foreign Direct Investment as a percentage of gross domestic product (FDI) and exports as a percentage of gross domestic product (EXP) for South Africa was principally obtained from the Bank of Namibia Annual Reports and the Namibia Statistical Agency for the period 1990 to 2014.

5. Discussion of empirical results

5.1 Unit roots and cointegration tests

Table 1 provides information on the descriptive statistics of the data. Based on the statistics the Jarque-Bera test confirms that the series of LNGDP, LNFDI and LNEXP are normally distributed. The correlation coefficients indicate that all the three variables are positively correlated, albeit weakly. In this data, the highest correlation is observed between LNGDP and LNFDI.

Summary statistics the correlation matrix

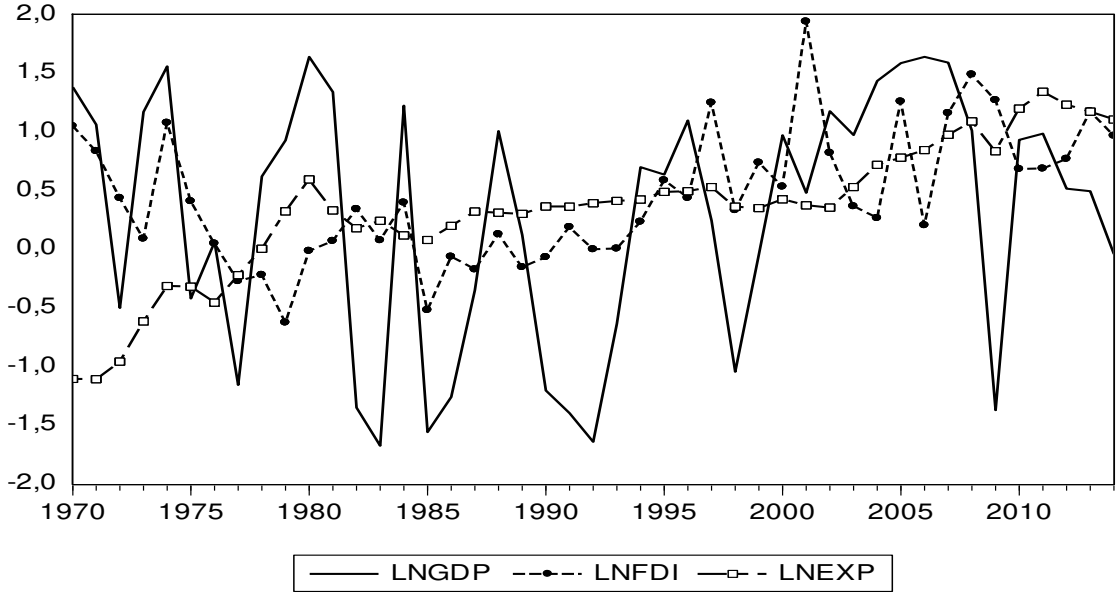
Statistic	LNGDP1	LNFDI1	LNEXP1
Mean	0.289746	0.452082	0.336993
Median	0.623655	0.369389	0.364817
Std. Dev.	1.068653	0.560548	0.578373
Skewness	-0.529755	0.449283	-0.680666
Kurtosis	1.903839	2.757416	3.511569
Jarque-Bera	4.357740	1.624255	3.965494
Probability	0.113169	0.443913	0.137691
LNGDP	1		
LNFDI	0.32807	1	
LNEXP	0.11114	0.24466	1

Source: Author's own computation

The article applied the ARDL bounds testing approach to cointegration to test the long run relationship between economic growth rate, foreign direct investment as a percentage of GDP and export as a percentage of GDP in the case of South Africa. This is a pre-test to check the stationarity properties of the variables to ensure that no series is at I(2) and above that order (Quattara, 2004). The ARDL bounds testing approach becomes invalid if any series is integrated of order two. However, the ARDL bounds testing approach to cointegration is flexible to apply when the variables are I(1) and I(0) or mutually integrated.

The next step is to analyse the stationarity properties of the data. Visual analysis of the logarithms of economic growth rate, foreign direct investment as a percentage of gross domestic product and exports as a percentage of gross domestic product plotted in Figure 1 suggest that economic growth rate and foreign direct investment as a percentage of gross domestic product are stationary in levels. Moreover, the export as a percentage of gross domestic product series is non-stationary in levels (see Figure 1). This suggests that some of the variables are integrated of order zero while the other variable has an order of integration greater than zero.

Figure 1: Trend diagrams of the variables



Source: BoN and Author's own computations

The formal unit root test results are presented in Table 2. These results confirm the visual findings alluded to above. The results confirm that economic growth and foreign direct investment are integrated of order zero I[0], while exports is integrated of order one [I(1)]. This implies that there is a possibility of cointegrating relationships in the VAR models. The

stationarity results are also important for Granger causality testing because the variables have to be used at the levels at which they are stationary.

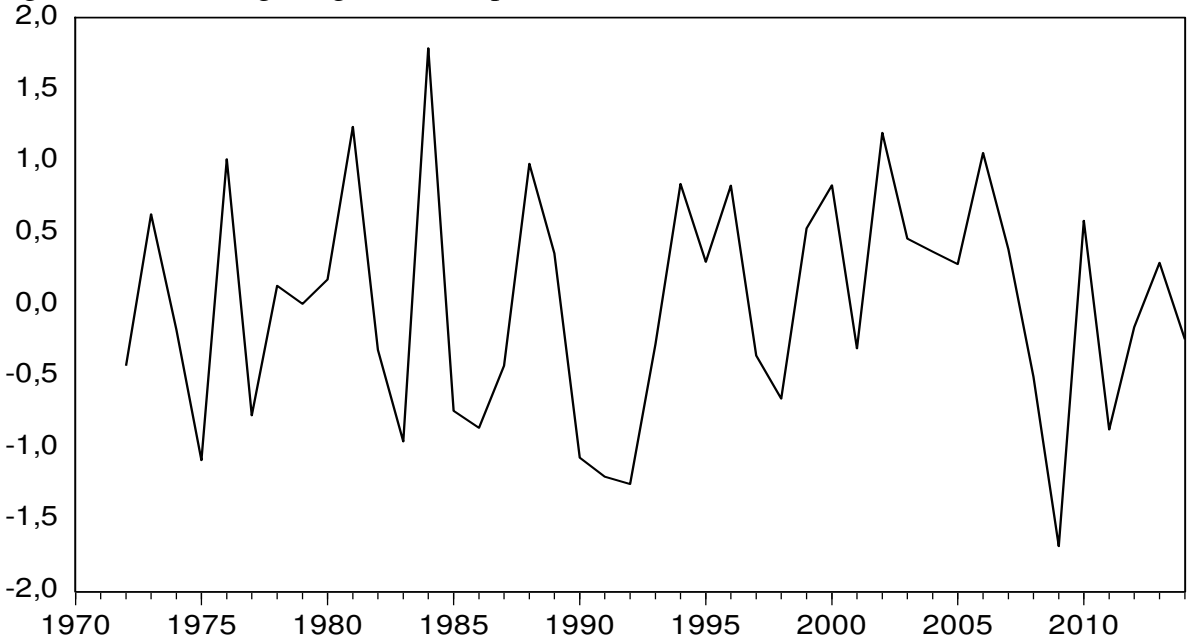
Table 2: Unit root testing using the ADF and the PP tests

Variable	Model	Augmented Dickey Fuller Test (ADF)		Phillips Perron Test (PP)		Decision
		Levels	First Difference	Levels	First Difference	
LNFDI	Constant	-3.142***		-3.145**		
	Trend	-3.655**		-3.640**		I(0)
	None	-2.382**		-2.382**		
LNGDP	Constant	-4.557***		-4.532***		
	Trend	-4.631***		-4.555***		I(0)
	None	-4.445***		-4.463***		
LNEXP	Constant	-0.139	-4.341***	-0.103	-4.316***	
	Trend	-1.956	-3.800**	-1.961	-4.219**	I(1)
	None	2.5433	-3.618***	2.6604	-3.619***	

( ) indicates the t-stats, and (***), (**),(*) indicate 1%, 5% and 10% level of significance, respectively.
Source: Author's own computation

The presence of cointegrating vectors for the model is further confirmed by analysing the plot of the cointegrating relationship normalised with respect to economic growth as given in Figure 2. Since this corresponds to the error-correction term (that is, the residuals of the cointegrating equation), the evidence of stationarity bolster the results of cointegrating relations.

Figure 2: The cointegrating relationship



Source: Author's own computation

The analysis of the ARDL bounds testing approach to cointegration reported in Table 3 indicate that the calculated F-statistic, that is, 9.24784 is higher than the UCB at 1, 5, and 10

percent levels of significance. This indicates that a cointegrating relationship is found between LNGDP, LNFDI and LNEXP in the case of South Africa over the period 1970 to 2014.

Table 3: The results of the cointegration test

Panel 1: Bounds testing to cointegration		
Estimated Equation	$LNGDP_t = f(LNFDI_t, LNEXP_t)$	
Optimal lag structure	(1, 0, 2)	
F-statistics	9.24784	
Significance level	Critical values	
	Lower bounds (I0)	Upper bounds, (I1)
1 percent	2.63	3.35
5 percent	3.1	3.87
10 percent	4.13	5
Panel 2: Diagnostic tests	Statistics	
R^2	0.562651	
Adjusted R^2	0.503550	
F-statistic (probability)	9.520118	

Source: Author's own computation

The cointegrating relationship is given by equation [5]: $\text{Cointeq} = \text{LNGDP1} - (0.4929 * \text{LNFDI1} + 0.4637 * \text{LNEXP1} - 0.4672)$ [5]. The results reported in Table 4 show the long run and short run impacts of economic growth, foreign direct investment and exports in South Africa. The long run analysis results show that both LNFDI and LNEXP are determinants of LNGDP at the 5 percent level of significance. All things equal a 1 percent increase in LNGDP increases foreign direct investment and exports by 49 percent and 46 percent, respectively.

Table 4: Long run and short run analysis

Dependent Variable = LNGDP (Long run)				Dependent Variable = Δ LNGDP (Short run)			
Variable	Coefficient	Std. error	t-stat	Variable	Coefficient	Std. error	t-stat
Constant	-0.467203	0.211151	-2.212**	ΔLNFDI	0.415868	0.217441	1.913*
LNFDI	0.492904	0.240395	2.050**	ΔLNEXP	0.229741	0.730749	4.283***
LNEXP	0.463733	0.229560	2.020***	ECT(-1)	-0.846409	0.199541	-4.443***
Diagnostic tests		Statistics		Diagnostic tests		Statistics	
J-B normality test		0.847359 (0.6556)		J-B normality test		0.6742 (0.7138)	
LM test		1.048067 (0.5921)		LM test		0.1962 (3.2574)	
ARCH test		0.169121 (0.6809)		ARCH test		0.7955 (0.3724)	
Ramsey reset		0.33300 (0.96280)		Ramsey reset		0.2083 (1.6381)	
CUSUM		Stable**		CUSUM		Stable**	
CUSUMsq		Stable**		CUSUMsq		Stable**	

Note: (*), (**) and (***) show significance at 10%, 5% and 1%, respectively.
Source: Author's own computation

The short run results are also are also in line with the a-priori assumptions since they show that both foreign direct investment and exports significantly and positively influence

economic growth. In addition, as expected, the sign of the estimate of the lagged error term, i.e., ECT_{t-1} is negative and statistically significant at 1 percent level of significance. This confirms the long run relationship between the variables established earlier. The coefficient of ECT_{t-1} is -0.846 implying that LNGDP adjusts towards its long run equilibrium at the rate of 85 percent each year. The diagnostic tests for both the short- and the long run models show that the error terms are normally distributed and they are serially uncorrelated. There is also no evidence of autoregressive heteroscedasticity and misspecification in both models. The low standard errors in both models show that the models are efficient and that their results can be relied upon.

The existence of cointegration between economic growth, foreign direct investment and exports leads to the investigation of the causality relationships between the variables by applying the VECM Granger causality framework. This gives a clear picture to policy makers about what needs to be done depending on the results obtained among economic growth, exports and foreign direct investment. The results relating to VECM Granger causality are reported in Table 5. The existence of cointegration among the variables permits the division of the causality results into long- and short run. It should be noted that the significance of the coefficient of ECT_{t-1} indicates long run Granger causality using t-statistic. In addition, the short run Granger causality is indicated by the joint significance of the LR test.

In the short run, the VECM analysis shows that there is unidirectional causality between economic growth and foreign direct investment running from foreign direct investment to economic growth. The results also indicate that economic growth and foreign direct investment Granger cause exports. It is clear that economic growth and exports do not Granger cause foreign direct investment.

The long run results show a slightly different picture. Whereas we found that in the short run, only foreign direct investment, Granger causes economic growth, in the long run, exports and foreign direct investment Granger cause economic growth. Just as in the short run case, there is unidirectional causality between foreign direct investment and exports running from foreign direct investment to exports and bidirectional causality between economic growth and exports. The results of the long run t-statistic of the ECT_{t-1} confirm these findings. The Granger causality tests cannot provide us information about the relative strength of causality beyond the chosen time span (Wolde-Rufael, 2009; Shahbaz & Mafizur Rahman, 2014). Wolde-Rufael (2009 further argues that the tests do not tell us anything about the magnitude

of the feedback from one variable to the other. The variance decomposition can assist in this regard.

Table 5: The VECM Granger causality results

Type of Granger Causality				
Short-run				Long run t-statistic
	F-statistics (p-values)			
Dependent Variable	$\Delta LNGDP_t$	$\Delta LNFDI_t$	$\Delta LNEXP_t$	ECT_{t-1}
$\Delta LNGDP_t$	-	5.305** [0.0213]	0.80597 [0.369]	-5675*** [-3.1556]
$\Delta LNFDI_t$	0.45223 [0.501]	-	0.35356 [0.5521	0.05918 [0.6482]
$\Delta LNEXP_t$	4.723** [0.030]	5.483** [0.014]	-	-0.713** [2.3229]
Joint (short run and long run)				
F-statistics (p-values)				
Dependent Variable	$\Delta LNGDP_t, ECT_{t-1}$		$\Delta LNFDI_t, ECT_{t-1}$	$\Delta LNEXP_t, ECT_{t-1}$
$\Delta LNGDP_t$	-		11.9721*** [0.0025]	17.296*** [0.0002]
$\Delta LNFDI_t$	1.40210 [0.4961]		-	0.80777 [0.6677]
$\Delta LNEXP_t$	7.3551** [0.0253]		10.4308*** [0.0054]	-

Note: (*), (**) and (***) show significance at 10%, 5% and 1%, respectively.
Source: Author's own computation

Applying the variance decomposition method the article establishes that close to 100 percent of the variations in economic growth are explained by shocks to economic growth in the short run, while in the long-run about 88 percent and 8 percent of the variation is explained by economic growth and foreign direct investment, respectively. In addition, the variation in foreign direct investment is explained by shocks to foreign direct investment (85.7 and 82.3) and exports (12.4 and 15.2) in both the short- and long run respectively. The contribution of economic growth to variations in foreign direct investment is negligible in both the short- and long run. Lastly, variations in exports are significantly explained by both economic growth and foreign direct investment in both the short- and long run. The variance decomposition results bolster the Granger causality finding explained above.

Table 6: Variance decomposition results

Time	Variance decomposition of LNGDP			Variance Decomposition of LNFDI			Variance Decomposition of LNEXP		
	LNGDP	LNFDI	LNEXP	LNGDP	LNFDI	LNEXP	LNGDP	LNFDI	LNEXP
1	100.00	0.0000	0.0000	3.2789	96.721	0.0000	24.584	6.4011	69.014
2	96.231	1.1808	2.5879	1.9015	85.664	12.433	26.392	16.188	57.419
4	93.683	4.4337	1.8825	2.4485	80.932	16.618	22.294	37.464	40.240
6	90.467	6.4520	3.0803	2.2798	81.638	16.081	22.162	46.449	31.377
8	89.084	7.4496	3.4661	2.3827	82.092	15.525	22.786	51.220	25.993
10	88.149	8.1008	3.7493	2.4522	82.345	15.203	22.567	53.935	23.496

Source: Author's own computation

The findings of the current article are slightly different from Keho (2015) who found bidirectional causality between economic growth and foreign direct investment. In addition, the results from what Adams (2009) found. Adams found that foreign direct investment does not influence economic growth. In another study, Adams and Opoku (2015) found that foreign direct investment does not influence economic growth. The differences in the findings with the current study could be explained in terms of the methodologies used, the frequency of the data used and the differences in the lengths of the periods studied. The results also confirm Fedderke & Romm (2006) who found complementarity of foreign and domestic capital in the long run, implying a positive technological spill-over from foreign to domestic capital which in turn increased economic growth.

6. Conclusions and policy recommendations

The article empirically investigated economic growth as a function of foreign direct investment and exports in South Africa. The article applied the autoregressive distributed lag model, known as the ARDL bounds testing approach to cointegration for the long run relationship between economic growth, foreign direct investment and exports. The error correction model was used to examine the short run dynamics; and the VECM Granger causality approach was used to investigate the direction of causality.

The results confirmed cointegration between economic growth, foreign direct investment and exports. This implies that economic growth, foreign direct investment and exports move in the same direction if one considers the raw data, i.e., trending upwards. The results indicate that both foreign direct investment and exports spur economic growth. The VECM Granger causality analysis found unidirectional causality between economic growth and foreign direct investment running from foreign direct investment to economic growth, unidirectional causality between foreign direct investment and exports running from foreign direct investment to exports and bidirectional causality between economic growth and exports. The results confirm the FDI-led growth hypothesis.

Given the findings of this research, it may be suggested that the government of South Africa should endeavour to accelerate the attraction of foreign direct investment since foreign direct investment stimulates the economic growth, increase gross fixed capital formation and employment. This can be done by offering incentives, such as, tax holidays etc., to foreign investors who bring their capital into the local economy. To increase foreign direct

investment indirectly the government can create a good macroeconomic environment, develop infrastructure, and reduce or abolish all sorts of trade barriers. The latter will increase local production and exports and generate competition and efficiency in the economy. In the same vein, the central bank can be directed to pursue a loose monetary policy to enhance capitalisation of the economy, which enhances exports volume, economic growth and ultimately foreign direct investment. This is important because the size of the economy is one of the major determinants of foreign direct investment.

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