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The Role of Transport Infrastructure in Attracting Foreign Direct Investment in South Africa

Lwando Mjacu[1]

Abstract: This study examined the role of transport infrastructure in attracting foreign direct investment in South Africa. The study used quarterly time series data for the period of 1994 to 2014. The Johansen cointegration and Vector Error Correction Model (VECM) were used to determine the impact of transport infrastructure on foreign direct investment in South Africa. The explanatory variables in this study were market size, transport infrastructure, labour cost, exchange rate and corporate tax. Results from this study showed that market size, transport infrastructure and corporate tax have a positive and significant impact on foreign direct investment, while exchange rate is positive but insignificant, and labour cost has a negative and insignificant impact on foreign direct investment in South Africa. The policy recommendation that comes from this study is that efforts should be made to improve the standard of transport infrastructure in order to enhance and attract more of foreign direct investment. The government should follow policies that will attract foreign direct investment.

Keywords: Vector Error Correction Model; Johansen Cointegration; Serial Correlation

JEL Classification: H54

1. Introduction

The significance of transport infrastructure in stimulating Foreign Direct Investment (FDI) has been approved by a number of researchers such as Pradhan et al. (2013), Pradhan and Bagchi (2013), and Seetanah and Khadaroo (2009). These researchers based their argument on a view that developed transport infrastructure is essential for both foreign and local companies to function effectively. According to Seetanah and Khadaroo (2009) poor transport infrastructure increases costs for the firms. Therefore, improved transport infrastructure lowers the costs of doing business for revenue maximising foreign and local companies equally. Improved transport infrastructure should as a result attract FDI for a country. Undeniably, He and Duchin (2007) argued that the comparative advantage of a country is affected by its transport infrastructure endowments.

According to Luiz and Charalambous (2009) transport infrastructure includes roads, rail, air and harbours. Good transport infrastructure is necessary in order to attract huge amounts of FDI. It encourages factor mobility and decreases trade costs (Kayode et al., 2013). Furthermore, it encourages market integration by providing avenues for the decrease of price volatility and reallocation of resources in line with comparative advantage. Developed transport infrastructure enables increased accessibility and reduces transport costs for both foreign and local firms. Similarly, foreign and local companies can also gain from developed transport infrastructure without paying straight to the development, since it is non-excludable to utilise public investment (Seetanah & Khadaroo, 2009). For example, improved highway maintenance, road design, and materials can decrease damage on foreign owned and operated automobiles, therefore decreasing the costs of transport.

Economic growth in developing countries such as South Africa has often been stimulated by Foreign Direct Investment (FDI), (Khadaroo & Seetanah 2009). FDI's perceived capability can overcome major challenges such as insufficiencies of monetary assets, expertise, and abilities which has

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attracted the attention of policy makers in emerging countries such as South Africa. According to Khadaroo and Seetanah (2009) a number of researchers have examined the factors affecting FDI and their studies have concentrated mostly on determinants such as cost of labour, size of country, openness of the economy, exchange rate regime, profit on capital and political effects. A small number of researches such as Pradhan and Bagchi (2013), Pradhan et al. (2013) and Seetanah and Khadaroo (2009) have focused on the role of transport infrastructure in stimulating FDI.

2. Problem Statement

South Africa has reached 21 years of freedom and democracy still facing serious challenges of poverty, inequality and unemployment. Throughout the past 21 years the government has implemented many economic development strategies in trying to overcome these challenges. The main objective of economic development is to attract huge amounts of FDI. According to Khadaroo and Seetanah (2010) transport infrastructure improvement has remained a significant factor in attracting foreign direct investors to provinces and regions. Therefore, FDI is observed as a beneficial factor to the host country in many ways, comprising entrance to markets that are not existing in the host country, improvement in economies of scale and increased exports, and enhancing productivity and decreasing inflationary pressures.

Studies by Moolman et al. (2006) and Gray (2011) concentrated on examining the factors affecting FDI in South Africa using general infrastructure together with other determinants. To our understanding, no study has examined the effect of transport infrastructure in drawing FDI inflows in South Africa.

This study sets off to bridge this gap in literature and tries to address these challenges by examining the role of transport infrastructure in attracting FDI in South Africa during the period 1994 to 2014.

3. Empirical Literature

Researchers such as Asiedu (2002), Tsen (2005), Moolman et al. (2006), Mhlanga et al. (2009), Yol and Teng (2009), and Rehman et al., (2011) emphasised the role of transport infrastructure in FDI. They believed that developed infrastructures cause decline in transport costs and create a motive for domestic and foreign companies' entry and is accompanied by foreign investment attraction. Similarly, the study by Agiomirgianakis et al. (2004) examined the factors that may attract FDI via panel data regression analysis for a sample consisting of 20 Organisation for Economic Co-operation and Development (OECD) countries for the period 1975 to 1997. The results from the research showed that infrastructure has a positive impact on FDI for OECD countries.

Transport infrastructure development increases accessibility and minimises transport costs. The study by Khadaroo and Seetanah (2007), used both dynamic panel data and static approach to examine the influence of transport infrastructure in increasing the attractiveness of FDI in 33 Sub-Saharan African countries over the period 1984 to 2002. Their study showed that transport infrastructure availability has contributed in attracting FDI for countries in the sample. Similarly, Seetanah and Khadaroo (2009) used a dynamic panel data approach to examine the role of transport infrastructure in improving the attractiveness of FDI in 25 African countries during the period 1985 to 2004. They reported that transport infrastructure has remained a major component in encouraging FDI inflows for African countries in both the short and long run.

Gentvilaite (2010) used a cross-sectional fixed-effects panel regression to investigate the determinants of FDI inflow levels to 10 Central and Eastern European countries over the period 1990 to 2008. The results from the research reveal that a well-functioning infrastructure attracts higher levels of FDI.

Saidi and Hammami (2015) applied the method of least squares to identify the contribution of transport infrastructure in the attractiveness of foreign direct investment in Tunisia during the period

1975 to 2012. The results from the analysis showed that efficient transport infrastructure attracts huge amounts of FDI in Tunisia.

Abbas and Mosallamy (2016) estimated a dynamic panel data model to provide evidence on the main determinants of foreign direct investment inflows into the Middle East and North Africa (MENA) region over the period 2006 to 2013. The study showed that infrastructure development has a significant and positive effect on foreign direct investment into MENA countries.

4. Methodology

In order to capture the role of transport infrastructure in attracting foreign direct investment in South Africa, this study employed Vector Error Correction Model (VECM) approach as proposed by (Barzelaghi et al., 2012). The procedure was adopted because it is more appropriate for estimating the long-run relationship between the variables. The variables in the model were integrated to the same order I(1). The existence of long-run relationship between FDI and selected variables was modelled as follows:

The model can be expressed in linear form as:

FDI = *f* (MS, TRANS, LC, ER, CT) ………………………………………………………………..1

Where:

FDI: Foreign Direct Investment

MS: Market Size

TRANS: Transport Infrastructure

LC: Labour Cost

ER: Exchange Rate

CT: Corporate Tax

The econometric model of the FDI and its determinants is as follows:

$FDI_t = \beta_0 + \beta_1 MS_t + \beta_2 TRANS_t + \beta_3 LC_t + \beta_4 ER_t + \beta_5 CT_t + \varepsilon_t$………………………………………2

β0: The intercept

β1, β2, β3, β4, and β5: Shows the independent variables' coefficients

ε: Shows the stochastic error term which captures variables that are not included in the specification of the model

t: Stands for time series.

5. Unit Root Test

All variables were tested for stationarity and were subjected to all deterministic trend assumptions of constant and no trend, constant and trend, and no constant and no trend.

Table 1. Stationarity tests

	DICKEY-FULLER			AUGMENTED DICKEY-FULLER			
Variable		With constant & no trend	With constant & trend	With constant & no trend	With constant & trend	No constant & no trend	Order of integration
FDI		-1.590007	-3.041308	-2.339252	-3.330675	-1.683954	I(0)
DFDI		-10.71366*	-10.75790*	-13.02686*	-12.96452*	-13.09604*	I(1)
LMS		1.433012	-1.927025	-0.674507	-1.822590	2.774355	I(0)
DLMS		-4.478361*	-4.806697*	-4.794416*	-4.787029*	-2.118559**	I(1)
LTRANS		0.069617	-2.955545	-0.802148	-2.919162	1.753446	I(0)
DLTRANS		-10.48025*	-10.95536*	-11.42539*	-11.35370*	-11.13701*	I(1)
LLC		1.306626	-1.758239	0.467634	-2.171513	1.389278	I(0)
DLLC		-8.341164*	-8.488193*	-8.993923*	-9.039068*	-4.076155*	I(1)
ER		-1.182372	-2.208635	-2.163258	-3.133399	-1.008695	I(0)
DER		-9.042405*	-10.33437*	-10.78233*	-10.71344*	-10.85195*	I(1)
LCT		-0.450808	-0.711492	-1.666985	-0.468069	1.009540	I(0)
DLCT		-0.592177	-1.231569	-15.35606*	-15.67232*	-15.28126*	I(1)
Critical Value	1%	-2.593121	-3.644600	-3.511262	-4.072415	-2.593824	
Critical Value	5%	-1.614204	-3.084400	-2.896779	-3.464865	-1.944862	

* represents a stationary variable at 1% level of significance

** represents a stationary variable at 5% level of significance

Table 2. Stationarity tests

PHILLIPS-PERRON TEST					
Variable		Intercept	Trend and intercept	None	Order of integration
FDI		-2.434085	-2.596852	-1.906856	I(0)
DFI		-31.64066*	-32.97965*	-31.56199*	I(1)
LMS		-0.911085	-1.380203	1.393224	I(0)
DLMS		-4.794416*	-4.787029*	-2.443728**	I(1)
LTRANS		-0.919635	-2.727777	1.136708	I(0)
DLTRANS		-11.76085*	-11.68114*	-11.14924*	I(1)
LLC		0.477624	-2.239799	1.438527	I(0)
DLLC		-9.003317*	-9.039343*	-7.343916*	I(1)
ER		-2.195131	-3.165259	-1.052423	I(0)
DER		-26.24527*	-26.30744*	-26.47195*	I(1)
LCT		-2.845078	-3.332460	0.398946	I(0)
DLCT		-36.45084*	-46.71327*	-33.90099*	I(1)
Critical value	1%	-3.511262	-4.072415	-2.593121	
Critical value	5%	-2.896779	-3.464865	-1.944762	

***** represents a stationary variable at 1% level of significance

** represents a stationary variable at 5% level of significance

Table 1, and Table 2, respectively, show that all variables have a unit root at levels but become stationary after first differencing. The null hypothesis of unit root is accepted only if the t-statistics is smaller or less negative than the critical Mackinnon values for all deterministic trend assumptions. This means that the variables have a unit root in levels. However, the alternative hypothesis is accepted or the null hypothesis is rejected only if the t-statistics is bigger or more negative than the critical Mackinnon values for all deterministic trend assumptions. This means that the variables do not have a unit root after first differencing them once.

6. Johansen Cointegration Test Results

Cointegration defines the presence of an equilibrium or stationary relationship between two or more time series each of which is individually non-stationary. Therefore, if the variables are integrated of the same order, it is critical to determine whether there is a long-run equilibrium relationship between them. In this study cointegration studies the long-run relationship amongst the FDI and its determinants. To examine a long-run relationship between FDI and its determinants is very important because it allows for the valuable economic conclusions obtained from the results. To test for cointegration amongst variables this study uses the Johansen cointegration approach.

Table 3. Cointegration rank test (trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.403815	116.3977	95.75366	0.0009
At most 1*	0.257918	74.50420	69.81889	0.0201
At most 2 *	0.250894	50.34224	47.85613	0.0286
At most 3	0.201569	26.94337	29.79707	0.1030
At most 4	0.094282	8.709752	15.49471	0.3929
At most 5	0.008465	0.688558	3.841466	0.4067

Trace test indicates 3 cointegrating equations at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

** MacKinnon-Haug-Michelis (1999) p-values

Table 4. Cointegrating rank test (maximum eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.403815	41.89354	40.07757	0.0309
At most 1	0.257918	24.16196	33.87687	0.4438
At most 2	0.250894	23.39888	27.58434	0.1571
At most 3	0.201569	18.23362	21.13162	0.1213
At most 4	0.094282	8.021193	14.26460	0.3766
At most 5	0.008465	0.688558	3.841466	0.4067

Max-eigenvalue test indicates 1 cointegrating equations at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 3, shows the results of the trace statistics test which reflect that at least three cointegrating equations exist at 5 percent significance level. The null hypothesis of no cointegrating vectors is rejected since the trace statistics test is 116.3977 which is greater than the 5 per cent critical value of 95.75366. Using the same procedure, the null hypothesis that there are at most 3 cointegrating vector cannot be rejected since the trace statistics test is 26.94337 which is less than the 5 per cent critical of 29.79707. For the above mentioned reasons, the trace statistics test proposes 3 cointegrating relationships at 5 per cent significance level.

Table 4, shows the results of the Maximum Eigenvalue test which reflects that at least 1 cointegrating equation exists at 5 per cent significance level. The Maximum Eigenvalue test rejects the null hypothesis of no cointegration, but fails to reject the null hypothesis of at most 1 cointegrating vector exists, since the test statistic of 24.16196 is less than the 5 per cent critical value of 33.87687. Therefore, by using the trace test it can be concluded that there are 3 cointegrating equations to be included in the FDI model. Since the variable can either have a short run or a long run effect, the VECM model is proposed to disaggregate these effects.

7. Vector Error Correction and the Long Run Relationship

Vector error correction approach allows the long run and the short run changing aspects to be estimated in a single step. This approach separates the speed of adjustment parameter which indicates how quickly the system returns to equilibrium after a random shock. Therefore if the gap between the long run and short run rates is large relative to the long run relationship, this approach must be applied.

Table 5. VECM long run estimates

Sample (adjusted): 1996Q1 2014Q4						
Included observations: 76 after adjustments						
Standard errors in ( ) & t-statistics in [ ]						
Cointegrating Eq:	CointEq1	CointEq2	CointEq3			
FDI(-1)	1.000000	0.000000	0.000000			
LMS(-1)	0.000000	1.000000	0.000000			
LTRANS(-1)	0.000000	0.000000	1.000000			
LLC(-1)	-7.22E+09	-0.179417	-0.427627			
	(1.7E+09)	(0.05860)	(0.12285)			
	[-4.28513]	[-3.06194]	[-3.48080]			
LCT(-1)	1.54E+10	-0.664688	-0.615212			
	(3.1E+09)	(0.10661)	(0.22352)			
	[5.01276]	[-6.23466]	[-2.75233]			
ER(-1)	1.09E+09	0.002477	0.090247			
	(2.9E+08)	(0.01020)	(0.02138)			
	[3.72592]	[0.24297]	[4.22187]			
C	-1.56E+10	-11.84348	-6.789977			
Error Correction:	D(FDI)	D(LMS)	D(LTRANS)	D(LLC)	D(LCT)	D(ER)
CointEq1	-1.505427	9.47E-13	2.60E-11	-5.75E-12	1.61E-10	-7.93E-09
	(0.75363)	(2.8E-12)	(4.6E-11)	(9.2E-12)	(6.1E-11)	(2.5E-09)
	[-1.99756]	[0.33359]	[0.56075]	[-0.62311]	[2.63056]	[-3.21180]
CointEq2	-4.13E+10	0.062739	0.749591	-0.465175	8.579994	-243.5271
	(3.0E+10)	(0.11280)	(1.83908)	(0.36637)	(2.42946)	(98.1105)
	[-1.37931]	[0.55622]	[0.40759]	[-1.26969]	[3.53164]	[-2.48217]
CointEq3	1.30E+10	0.003648	-0.386734	0.008951	-2.718555	7.330218
	(8.3E+09)	(0.03109)	(0.50697)	(0.10100)	(0.66972)	(27.0456)
	[1.57416]	[0.11733]	[-0.76284]	[0.08863]	[-4.05926]	[0.27103]

8. VECM Short Run Parameters

The VECM approach enables the long-run and short-run dynamics to be estimated in a single step. Since the long-run relationship has been established, the short-run estimates are reported in Table 6.

Table 6. VECM short run parameters

Variable	Coefficient	t-statistics
CONSTANT	-9.16	-1.21
D(LOG_MS)	2.56	2.17
D(LOG_TRANS)	3.20	2.9
D(LOG_LC)	-2.79	-0.68
D(ER)	5.13	1.13
D(LOG_CT)	6.26	2.24

R^2 = 0.857014

SE = 1.43

F-statistic = 1.682439

9. Analysis of Results

Table 5, show confirmation of error correction mechanism. By looking at the error correction terms exchange rate (ER in CointEqual 1) has the most significant coefficient and is the most significant with a t-value of -3.21180 and has the correct and negative sign. Also the FDI and labour cost variables have a negative coefficients. The market size and transport infrastructure variables hold a positive coefficient signs hence insignificant. Corporate tax variable holds a positive coefficient sign and hence it is significant. In the second cointegrating equation exchange rate has the most significant coefficient with a t-value of -2.48217 and has the correct negative sign. FDI and labour cost have the negative coefficient and hence insignificant. The market size and transport infrastructure variables hold positive coefficients and hence are insignificant. Corporate tax variable holds a positive coefficient sign and hence it is significant. In the third cointegrating equation the corporate tax variable has a negative and significant coefficient with at-value of -4.05926. Also the transport infrastructure variable holds a negative and insignificant coefficient sign. The rest of the variables possess positive coefficient signs and are insignificant.

Table 6, shows that the model has an adjusted R^2 of 0.86 meaning that 86 per cent of variation in FDI is explained by the explanatory variables included in the model. The adjusted R^2 showed that all the coefficients of the model are consistent estimates. The F-statistic which tests for the overall significance of the regression model is 1.682 and is statistically significant. The standard error 1.38 is low, indicating that the model is good. The short-run estimates of the model show strong outcomes. Market Size has the expected positive sign and is significant at 5 per cent significance level. The results show a positive relationship between FDI and market size. The market size coefficient value is 2.56 which is significant as the t-statistics for this coefficient is 2.17. This indicates that 1 per cent increase in MS leads to 2.56 per cent increase in FDI. This conforms to the literature discussed in chapter 2. Transport infrastructure has the positive sign and is significant as expected. The coefficient value for transport infrastructure is 3.20 and is significant at 5 per cent significance level with a t-value of 2.9. Hence a 1 per cent increase in transport infrastructure leads to 3.2 per cent increase in FDI inflows in South Africa. Labour cost has a negative coefficient sign as expected. The coefficient of labour cost is -2.79 and is insignificant at 5 per cent significance level since its t-statistic is -0.68. This coefficient value means that a 1 per cent increase in labour cost will lead to 2.79 per cent decrease in FDI inflows in South Africa. Exchange rate has a positive coefficient sign. The coefficient value of exchange rate is 5.13 with a t-value of 1.13 which is insignificant at 5 per cent significance level. The exchange rate coefficient value means that a 1 per cent increase in exchange rates brings about 5.13 per cent increase in FDI inflows in South Africa. Corporate tax has positive coefficient sign. The coefficient value of corporate tax is 6.26 with a t-value of 2.24 which is significant at 5 percent significance level. The corporate tax coefficient value shows that a 1 per cent increase in corporate tax leads to 6.26 per cent increase in FDI inflows into South Africa.

Table 7. Diagnostic tests

Test	Null Hypothesis	t-statistics	Probability
AR(LM) test	No serial correlation	4.999316	0.0821
Breusch-Pagan-Godfrey test	No heteroscedasticity	51.38973	0.3424
Normality test	There is a normal distribution	3.000906	0.223029
Ramsey reset test	No misspecifications	-0.704801	0.4830

Table 7, shows that diagnostic tests such as serial correlation, heteroscedasticity, and normality test were carried out. Firstly, the AR (LM) test was used to test for serial correlation. The result show that the probability of 0.0821 is greater than 5 per cent significance level. Therefore, we cannot reject the null hypothesis of no serial correlation. Secondly, the Breusch-Pagan-Godfrey test was used to test for heteroscedasticity. The results show that the probability of 0.3424 is greater than 5 per cent significance level. Hence, we fail to reject the null hypothesis of no heteroscedasticity. Thirdly, the normality test was used to test for the normal distribution of the residuals. The results show that the probability of 0.223029 is greater than 5 per cent significance level. This means we cannot reject the null hypothesis, hence there is a normal distribution of residuals. Fourthly, the Ramsey reset test for misspecification suggest that there are no misspecifications in the model. Therefore, we fail to reject the null hypothesis of no misspecification. All the diagnostic tests disclose that the model is correctly specified. Therefore these tests support the statistical fitness of the equation. Diagnostic tests suggest that the residuals are serially uncorrelated, homoscedastic, and normally distributed.

10. Conclusion

This paper examines the role of transport infrastructure in attracting foreign direct investment in South Africa. It is based on the time series data over the 1994-2014 period. The results show that transport infrastructure has a significant and positive impact on FDI. These findings imply that transport infrastructure development is an important element of the strategy to attract FDI inflows particularly for South Africa where there is much to be done in that respect. The results should be meaningful for the Transport Ministry in formulating policies. Therefore, it is recommends that the South African government should focus on the maintenance of transport infrastructure to increase the quality in future. The importance of transport infrastructure in attracting FDI in South Africa requires a further research and the use of different methodologies.

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