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Examining the Role of Transport Infrastructure on Economic Development in South Africa

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Abstract: Economic development refers to economic growth accompanied by changes in output distribution and economic structures. These changes may include an improvement in the material wellbeing of the poorer half of the population, a decline in agriculture's share and an increase in service and industry's share of gross national product, an increase in the education and skill of the labour force, and substantial technical advances originating within the country. Transport infrastructure such as highways, bridges, ports, airports and railways is critical in achieving economic development and growth. The study examined the existing relationship between economic development and transport infrastructure in South Africa from 1960 to 2014. The study applied vector error correction model to examine the relationship between gross national income changes as a measure of economic development and transport infrastructure spending in South Africa. The methodology applied brought about a positive relationship between transport infrastructure and economic development. To promote development and improve productivity through transport infrastructure investment, the government should, therefore, increase funding at the same time maintain a low inflation rate. This can be achieved by monitoring fiscal and monetary policies to promote development rate of the aggregate demand in combination with public transport infrastructure policy and other policies as well. Development and management of transport infrastructure and the provision of public services is recommended to meet the growing transport infrastructure needs in South Africa.

Keywords: Economic development, New growth theory, Transport infrastructure, Vector error correction model

1. Introduction

The Accelerated and Shared Growth Initiative–South Africa (ASGI-SA) has identified inadequate infrastructure as one of the six most important constraints to growth in South Africa (Kirsten & Davies, 2008). If infrastructure is strongly linked to economic development it could play a major role in providing greater mobility and choice, leading to an improvement in incomes and welfare of society (Yemek, 2006). Infrastructure comprises of investments and related services that raise the productivity of other types of physical capital, for example transport, power, water and communication. Social infrastructure comprises of investments and services that raise the productivity of human capital, for example education and health (Perkins, Fedderke & Luiz, 2005). So, infrastructure development can influence economic development by improving the material wellbeing of the poorer citizens, an increase in the education and skill of the labour force, and substantial technical advances originating within the country (Nafziger, 2012).

Transport infrastructure such as highways, bridges, ports, airports and railways is critical in achieving economic development and growth. Economic development refers to the sustained, concerted actions of communities and policymakers that improve the standard of living and economic health of a specific locality (Nafziger, 2012). The definition of economic development according to Todaro and Smith (2010) is an increase in living conditions, improvement of the citizen's self-esteem needs and free and a just society. Infrastructure investments have been traditionally viewed as a policy instrument for development in several developing countries (Perkins *et al.*, 2005). According to the New Growth Path that was launched in 2010 by the Department of Economic Development, infrastructure has been targeted as one of the job drivers in the economy. Presenting the Infrastructure Development Cluster (IDC) briefing in February 2012, the Minister of Transport highlighted the South African government's interest to invest in infrastructure and making it a central priority in addressing problems of inequality, poverty and unemployment (Cheteni, 2013).

Governments around the world rank infrastructure policy among their greatest concerns. For instance, South Africa's infrastructure lies at the heart of government's stimulatory fiscal package and is a pivotal component of the New Growth Path (Department of Economic Development, 2010), accounting for just less than 8% of GDP in the 2012/13 fiscal year.

According to an International labour organisation (ILO) report, although infrastructure development is not identified as a direct Millennium Development Goal (MDG) target or indicator, without it, many of the targets will not be met (ILO, 2010). Infrastructure development is a prerequisite for poverty alleviation and employment creation in poor countries (Rust, 2008). The South African institute for civil engineers (SAICE) 2006 reported that, although the South African government had embarked on increasing infrastructure expenditure, there is still failure to invest in the maintenance and renewal of infrastructure. According to SAICE (2006), most of the infrastructure in South Africa is in either a fair, poor or very poor state.

Transport infrastructure expenditure is increased by the government every year. National accounts estimates show that public and private sector capital spending increased in real terms by 4.3 per cent and 4.6 per cent respectively in 2011, and 11.1 per cent and 4.3 per cent in the first three quarters of 2012 (Budget speech, 2013). However, as a percentage of GDP, capital spending has not yet recovered to the level reached in 2008, prior to the recession. Nominal public sector capital investment stood at 7.1 per cent of GDP in 2011, with private-sector investment at 11.9 per cent of GDP (Budget speech, 2013). Since government is increasing transport infrastructure expenditure, it was imperative to find out how is economic development affected. Therefore, the aim of this paper is to analyse the role of transport infrastructure on economic development in South Africa. Most researchers concentrated on the role of transport infrastructure on economic growth and this study looks at a broader concept which is economic development (Fourie, 2006). Literature on economic development is limited as reviewed on empirical literature whereas the topic focuses on changing the lives of people (Rust, 2008; Cheteni, 2013).

2. Literature Review

The complex and multidimensional problems of economic development have resulted into development of a number of theories, explanations, arguments and assertions (World Bank, 2000; Deaton 2010). These theories describe tools and strategies for making development goals achievable.

2.1 The Linear Stages of Growth Models

The model focused on the utility of massive injections of capital to achieve rapid GDP growth rates. The two famous models are Rostow's stages growth model and the Harrod-Domar model (Todaro & Smith, 2010). Rostow (1962) viewed the process of development as a sequence of historical stages namely the traditional society, the preconditions for take-off, the take-off, the drive to maturity and the age of high mass consumption. The decisive stage is the take-off, through which developing countries are expected to transit from an underdeveloped to a developed state. Increasing rate of investments especially on infrastructure is considered to be necessary to induce per-capita growth. The Harrod-Domar model emphasized that the prime mover of the economy is investments (Bersley & Ghatak, 2003). Every country therefore needs capital to generate investments. The key weakness of these models lies in their simplifying assumptions that a single production function is assumed for all countries whereas countries may pursue distinct development paths (Adelman, 1999).

2.2 New Growth Theory

Endogenous growth or the new growth theory emerged in the 1990s to explain the poor performance of many less developed countries, which have implemented policies as prescribed in neoclassical theories. Unlike the Solow model that considers technological change as an exogenous factor, the new growth model notes the evolution of economic development, that technological change has not been equal nor has it been exogenously transmitted in most developing countries (World Bank, 2000). New growth theorists linked the technological change to the production of knowledge (Romer, 1986; Lucas, 1988; Aghion & Howitt, 1992). The theory argues that the higher rate of returns as expected in the Solow model is greatly eroded by lower levels of complementary investments in human capital (education), infrastructure, or research and development (R&D). Therefore, the theory promotes the role of government and public policies in complementary investments in human capital formation and the encouragement of foreign private investments in knowledge-intensive industries such as computer software and telecommunications (Meier, 2000).

Although the new growth theory helps to explain the divergence in growth rates across economies, it was criticized for overlooking the importance of social and institutional structures (Skott & Auerbach, 1995). Its limited applicability lies in its assumptions. For example, it treats the economy as a single firm that does not permit the crucial growth-generating reallocation of labour and capital within the economy during the process of structural change. Moreover, there are many other factors which provide the incentives for economic growth that developing countries lack such as poor infrastructure, inadequate institutional structures and imperfect capital and goods markets (Cornwall & Cornwall, 1994). Policy-makers will therefore need to pay careful attention to all of the factors that determine the changes and their impacts on the aggregate growth rate.

2.3 Fundamental Theorems of Welfare Economics

There are two fundamental theorems of welfare economics. The first states that any competitive equilibrium or Walrasian equilibrium leads to a Pareto efficient allocation of resources. It is taken to be an analytical confirmation of Adam Smith's "invisible hand" hypothesis, namely that competitive markets tend toward an efficient allocation of resources (Swan, 1956; Torado & Smith, 2009). The second theorem states that out of all possible Pareto-efficient outcomes, one can achieve any particular one by enacting lump-sum wealth redistribution and then letting the market take over (Dwyer, 2005). This appears to make the case that intervention has a legitimate place in policy – redistributions can allow us to select from all efficient outcomes for one that has other desired features, such as distributional equity (Kularante, 2006). According to Clarke (2001) the shortcoming is that for the theorem to hold, the transfers have to be lump-sum and the government needs to have perfect information on individual consumers' tastes as well as the production possibilities of firms. An additional mathematical condition is that preferences and production technologies have to be convex.

2.4 Neoclassical Welfare Theory

Neoclassical economics is a term variously used for approaches to economics focusing on the determination of prices, outputs, and income distributions in markets. This is done through supply and demand, often mediated through a hypothesized maximization of utility by income-constrained individuals in accordance with rational choice theory (Grosman & Helpman, 1990). The essence of neoclassical welfare theory is that the performance of economic institutions can and should be judged according to whether they provide economic goods in quantities that accord with people's relative desires for those goods (Grosman & Helpman, 1990). High marks are given to economic systems that display a close "fit" between the relative terms on which economic goods are made available and people's relative preferences for those goods. According to neoclassical welfare theory, individual's manifest preferences are not data because they are assumed to be knowable, psychological, verifiable truths concerning an aspect of reality that we refer to as human happiness. The justification can be phrased in negative form of the classical liberalism.

2.5 Transport Infrastructure

Van Wyk (2004) conducted a study on the role of transport infrastructure investment in South Africa, using a growth model. The study revealed a positive relationship between transport infrastructure investment and economic growth. It was found that road and development activities leads to the development of human resources. This implies that transport infrastructure is an important driver for social economic development and plays an essential role in poverty alleviation.

The impact of transport infrastructure investment and transport sector productivity on South African economic growth for the period 1975 to 2011 was examined by Cheteni (2013). Vector Error Correction Model (VECM) and Bayesian Vector Autoregressive model (BVAR) were employed and an insight into the dynamic shocks on economic growth through impulse responses was provided. The researcher recommended that in order to stimulate growth and productivity through infrastructure investment, the government should increase funding at the same time maintain a low inflation rate. Aschauer (1989) pioneered the research on the impact of the infrastructure investment on output and productivity growth. The results showed relatively slower growth in public capital accumulation in the United States during the 1970s and 80s, and was largely responsible for the private sector productivity slowdown.

Aschauer (1989), Lynde and Richmond (1993) investigated the causes for the decline in the US output and productivity growth since the early 1970s. it was found that the services of the public capital are an important part of the production process and that about 40% of the productivity decline in the United States was explained by the fall in public capital-labour ratio. Ford and Poret (1991) suggested that cross country differences in productivity growth might also be explained partly by differences in levels of infrastructure spending. Aschauer (1993) argued that the public infrastructure such as streets and highways, mass transit, water and sewer systems should be considered as factors of production, along with labour and private capital, in the private sector production process. Therefore, to raise productivity growth countries must boost the rate of capital accumulation on the tangible capital such as plant and equipment, or intangible capital such as that generated by research and development expenditures. Fedderke and Garlick (2008) did not found a significant relationship between infrastructure development and economic growth in South Africa when the ordinary least squares were used. However, macroeconomic policies such as ASGISA, RDP have been found to influence economic infrastructure development in South Africa.

3. Research Methods

This study focused on the impact of transport infrastructure on economic development in South Africa between the periods 1960 to 2014. The section exposes the model estimation techniques to be used in the study on quarterly data extracted from the South African Reserve Bank.

3.1 Empirical Model

The study employed an econometric model to evaluate the impact of transport infrastructure on economic development. Gross national income is modelled as a function of gross domestic product, inflation rate and transport infrastructure expenditure. Based on the insights given in the literature review section and on the availability of data, this study specified the model as follows:

$$GNI_t = \beta_0 + \beta_1 GDP_t + \beta_2 TIE_t + \beta_3 INFL_t + u_t \qquad (1)$$

Where:

GNI = the sum of a nation's gross domestic product (GDP) plus net income received from overseas. Gross national income (GNI) is defined as the sum of value added by all producers who are residents in a nation, plus any product taxes (minus subsidies) not included in output, plus income received from abroad such as employee compensation and property income. GNI is the proxy used to measure economic development.

TIE = these indicators cover freight, container and passenger transport, car registrations, road deaths and spending on infrastructure. Transport infrastructure expenditure shows transport equipment which is a proxy measure of transport infrastructure measured in millions of Rand.

GDP = the monetary value of all the finished goods and services produced within a country's borders in a specific time period. Gross Domestic Product in South Africa measured in one million rand (GDP at constant prices seasonally adjusted).

INFL = Inflation is a sustained increase in the general price level of goods and services in an economy over a period of time. When the price level rises, each unit of currency buys fewer goods and services. Inflation rate shows consumer price index, which is the proxy to measure inflation, and is measured in Millions in South Africa.

$B_{0\text{-}3}$ = parameter coefficient

UT = error term

3.2 Analytical Framework

This section outlines the econometric estimation techniques employed to determine the role of transport infrastructure on economic development.

3.2.1 Stationarity

A stationary time series can be defined as one with constant mean, constant variance and constant auto-covariance over time (Blungmart, 2000). Stationary time series give meaningful sample statistics such that means and variance correlates with other variables. Statistical measures with such qualities are vital for description of future behaviour in data modelling. Model lacking stationary test give spurious regression, biased t-ratios, incorrect inferences and artificial R-squared that is very close to one (Engle & Granger, 1987).

Stationary tests are intended to detect stochastic trends although they might have weakness in doing so through giving imbalanced and misleading inferences if deterministic trends exist. The Dickey-fuller (DF) and Augmented Dickey Fuller (ADF) are testing techniques conducted when testing for stationarity. ADF adds lagged dependent variables to the test equation which removes distortions to level of statistical significance (Maddala & Kim, 1998). The Phillips-Perron (PP) test involves fitting and, the results are used to calculate the test statistics. The PP tests corrects for any serial correlation and heteroscedasticity in the errors u_t non-parametrically by modifying the Dickey Fuller test statistics. Phillips and Perron's test statistics can be viewed as Dickey-Fuller statistics that have been made robust to serial correlation by using the Newey-West (1987) heteroscedasticity – and autocorrelation-consistent covariance matrix estimator (Engle & Granger, 1987).

3.2.2 Johansen Cointegration and Vector Error Correction Model (VECM)

The study used the vector autoregressive (VAR) analysis specially known as the VECM approach models for estimation. The VAR lag selection criteria shall be employed which will be followed by the Johansen cointegration test and the VECM methods in order to detect the impact of transport infrastructure on economic development. Cointegration test is conducted in order to determine whether any long run relationships exist within the set of the variables, thus to determine that the variables in the model are cointegrated or not.

VECM has been seen to have cointegration relations built into specification so that it restricts the long run behaviour the endogenous variables to converge to their co integration relationships while allowing for short-run adjustment dynamics (Engle & Granger, 1987). The Error Correction Model (ECMs) represents the speed of adjustment to restore equilibrium in the model, thus they directly estimate the speed at which a dependent variable returns to equilibrium after a change in an independent variable.

Gujarati (2004) argues that diagnostic tests should be performed so that the model finally chosen is a good model in the sense that all the estimated coefficients have the right signs, they are statistically significant on the basis of the t and F tests, the R- Squared value is reasonably high and the Durban -Watson d has acceptable value (around 2). Tests that were conducted under this study will include normality test, serial correlation LM test and heteroscedasticity test.

4. Findings and Discussions

The results obtained from the econometric analysis are reported in this section.

4.1 Tests for Stationarity Results

If the absolute computed statistic is greater than the critical values from the tables, we reject the null hypothesis and conclude that the time series is stationary (Engle & Granger, 1987). If the absolute value is less than the critical value, we do not reject the null and conclude that the time series is non-stationary. The Augmented Dickey Fuller and the Phillips Perron tests used for stationarity are reported in Table 1 below and Table 2 on the next page. These tables indicate that all the variables become stationary after being differenced.

Table 1: Augmented Dickey Fuller Results

Augmented Dickey Fuller			
Variable	**Intercept**	**Trend and intercept**	**None**
LGNI	-1.648111 -3.866640*	-2.543292 -4.026192*	2.831372* -2.496913**
LGDP	-2.052288 -4.154147*	-3.033451 -4.419391*	3.169269* -2.499420**
LINFRA	-1.485103 -15.86005*	-2.047432 -15.83607*	1.950226 -15.61169*
LINFL	-3.015719 -11.24553*	-2.968273 -11.26469*	-1.403516 -11.27175*

Source: Author compilation

Table 2: Phillips-Perron Test

Phillips-Perron Test			
Variable	**Intercept**	**Trend & intercept**	**None**
LGNI	-1.914264 -21.60508*	-2.806445 -22.53491*	5.787678* -17.85190*
LGDP	-2.351511 -22.43886*	-3.176743 -23.58297*	6.418400* -17.99224*
LINFRA	-1.561134 -21.93609*	-2.926933 -21.95110*	1.703554 -20.97032*
LINFL	-5.125000* -38.74790*	-5.088392* -58.34122*	-2.401704** -38.80809*

Source: Author compilation

Table 3a: Unrestricted Cointegration Rank Test: Trace

Hypothesized No of CE(S)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob **
None *	0.131785	52.79430	47.85613	0.0160
At most 1	0.083955	22.97670	29.79707	0.2472
At most 2	0.019048	4.474157	15.49471	0.8618
At most 3	0.001971	0.416217	3.841466	0.5188
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **Mackinnon-Haug-Michelis(1990) p-values				

Source: Author compilation

Table 3b: Unrestricted Cointegration Rank Test: Eigen Value

Hypothesized No of CE(S)	Eigen Value	Max-Eigen Statistic	0.05 Critical Value	Prob **
None *	0.131785	29.81760	27.58434	0.0254
At most 1	0.083955	18.50254	21.13162	0.1122
At most 2	0.019048	4.057940	14.26460	0.8532
At most 3	0.001971	0.416217	3.841466	0.5188
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level **Mackinnon-Haug-Michelis(1990) p-values				

Source: Author compilation

4.2 Johansen Cointegration Tests

Cointegration has been noted to determine the possibility of a linear equation and to see if the variables are stationary. However, if there is evidence that a linear combination of the series exists, we can conclude and say that there is cointegration, and the variables have a long run relationship. Tables 3a and 3b present the Johansen cointegration tests on trace and maximum eigen value statistics.

In Table 3a, the Johansen cointegration test results show the rejection of null hypothesis which is rejected only when the trace statistic is greater than the critical value. At none, the test reveals that there is one integrating equation at 5%. The trace statistic is 52.7 greater than the critical value which is at 47.8. However, the 'At most 1, 2 and 3' rows show that the trace statistic is lower than the critical values of which we fail to reject the null hypothesis.

The eigen value at none in Table 3b shows the test statistic of the maximum eigen value at 34.06 and the critical value being 27.58 and therefore reject the null hypothesis since it is greater than the critical value of 27.58 at 5%. The results confirm that there is one cointegrating equations between the variables. However, at most 1, 2, and 3 we fail to reject the null hypothesis as the critical value is greater than the maximum eigen statistic. The cointegration test from both Tables 3a and 3b have proved that variables in the model are cointegrated. It can be concluded that there's one cointegrating equation, and therefore there is a long run relationship which in this aspect the VECM model can be estimated.

4.3 Vector Error Correction Model (VECM) Results

The study proceeds to use VECM to estimate the model where economic development is estimated as a function of gross domestic product, transport infrastructure expenditure and inflation. Table 4 presents the results of the estimates in the long run relationship.

The standard procedure in VECM analysis is to report positive as negative and negative as positive, thus multiply all the coefficients with minus. The results shown above reflect that there is a positive relationship between transport infrastructure expenditure and economic development. A one-unit increase in transport infrastructure will induce 0.95 unit increases in economic development. Gross Domestic Product (LGDP) on the other hand shows a positive relationship with economic development, as a unit increase in LGDP will induce a 0.069197 increase in economic development. This is in line with both empirical evidence and economic theory which shows consistency as an increase in gross domestic product tends to promote or improve economic development (Aschauer, 1993).

Empirical evidence and economic theory show that in the long run an increase in inflation can lead to prices increasing and cost of production increasing of which this will lead to a decline in economic development (Cheteni, 2013). A one-unit increase in inflation will lead to a 0.001001 decrease in economic development. The relationship is however, not statistically significant because t-statistics of 0.00052 is smaller than the standard value of 2.

The speed of adjustment is 0.54747 which means that in the error correction model, variables adjust to long run shocks affecting the natural equilibrium at 54.75 per cent and there is a short run relationship in the series. The relationship between gross domestic and economic development is positive in the short run. There is a positive relationship between economic development and transport infrastructure as witnessed by Chandra & Thompson (2000). A unit increase in transport infrastructure would increase economic development by 0.953182 units. The relationship is supported by theories of Bersley and Ghatak (2003) that increasing rate of investments especially on infrastructure is considered to be necessary to induce economic development.

4.4 Impulse Response

Gujarati (2009) explained that the impulse response function (IRF) traces out the response of the dependent variable in the VAR system to shocks to each of the variables. Figure 1 on the next page illustrates the shocks or reactions of economic development to a one standard deviation of changes on the independent variables. It also indicates the directions and persistence of the response to each of the shock over a particular period of 10 months. The first graph shows the response of economic development to itself, a standard deviation (own shock), however leads to economic development trending upwards and downwards. In the first period towards the fourth period the shock is seen by a decline in economic development but however it shows some trend of improvement from the period fifth period.

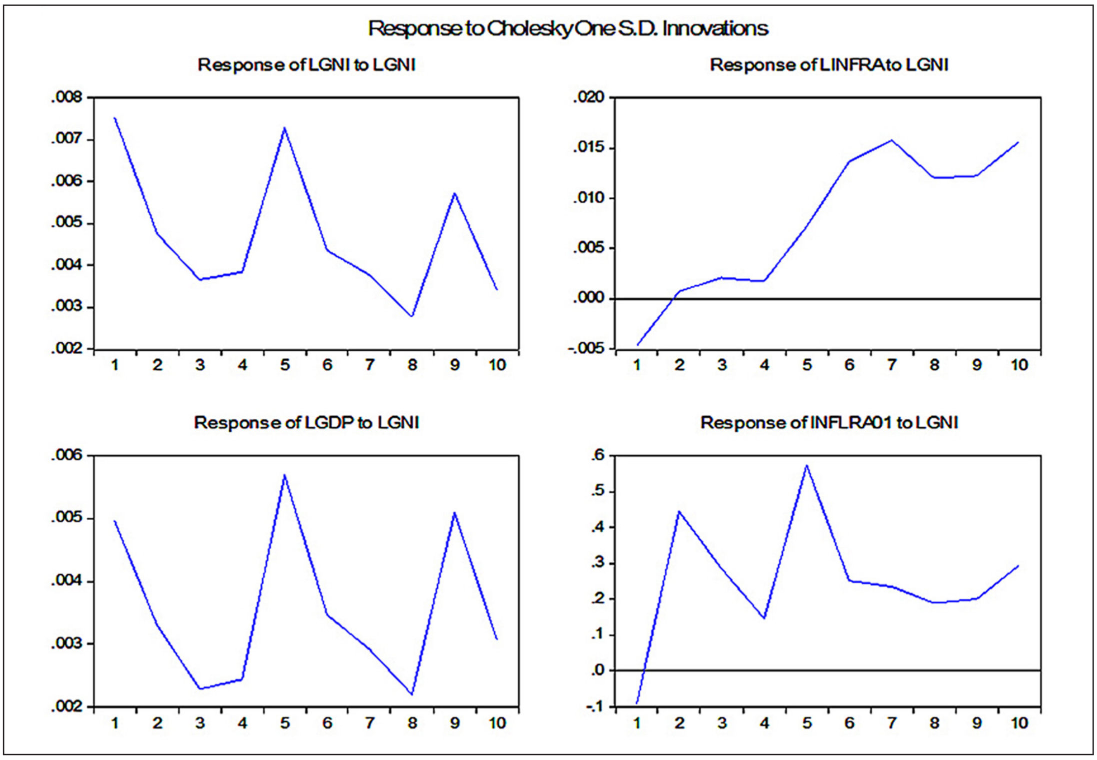
The second graph shows the response of economic development to economic growth of which one

Table 4: VECM Results (Long Run Relationships)

Variable	Coefficient	Standard Error	t-statistic
LGNI	1.000000	-	-
LGDP	-0.069197	(0.02053)	[-3.37132]
LINFRA	-0.953182	(0.02577)	[-36.9820]
INFL	0.001001	(0.00052)	[1.93835]

Source: Author compilation

Figure 1: Presentation of Impulse Responses



Source: Author compilation

Table 5: Variance Decomposition

PERIOD	S.E	LGNI	LINFRA	LGDP	INFL
1	0.007343	100.0000	0.000000	0.000000	0.000000
2	0.008978	99.69342	0.023936	0.240803	0.041844
3	0.009842	97.64579	0.630005	1.311016	0.413187
4	0.011193	90.04478	4.579514	1.494807	3.880895
5	0.013488	90.23679	4.498552	1.179466	4.085193
6	0.014599	89.42538	5.074433	1.056884	4.443306
7	0.015656	86.89137	5.172133	0.984998	6.951494
8	0.016903	80.23332	8.483297	0.909700	10.37369
9	0.018591	80.19051	8.740892	0.847493	10.22110
10	0.019475	79.17014	9.630987	0.809216	10.38966

Source: Author compilation

standard deviation shock to growth would lead to a decline in economic growth (Figure 1). The effect on development is felt strongly on the fifth period where it tends to take a sharp decline. However, with transport infrastructure one standard shock deviation leads to economic development being below zero for the first two periods but however in the long run thus the tenth month the effect is later on felt with time. Transport infrastructure seems to have a slighter effect on economic development.

4.5 Variance Decomposition

Variance decompositions separate the proportions of a change in the dependent variables that can be attributed to their "own" shocks and shocks to other variables (Maddala & Kim, 1998). A shock to a variable will affect that variable directly, but will also be transmitted to the other variables through the dynamic structure of the VAR. Table 5 will show movements thus own shocks and variance decomposition of economic development and other variables and analyse the relative importance of each of the determinants or variables influencing these movements.

Table 5 notes variance decomposition for 10 periods and also to explain clearly how the variables have an effect towards economic development fluctuation in the short and the long run. If we consider the second quarter period of, impulse or innovation shock, economic development accounts to 100% of its own shock or fluctuation to itself. However, with shocks to transport infrastructure expenditure, gross domestic and inflation the fluctuations for economic development are 0.02%, 0.24% and 0.04% respectively and don't account much for the fluctuation towards economic development.

In the long run, thus for period 10, economic development accounts to 79% of fluctuations to its own shocks. Transport infrastructure in the long run is 9.6% that accounts to economic development fluctuation, and gross domestic product, inflation has values of 0.8% and 10.3% respectively. In the long run transport infrastructure is seen to have a more effects on economic development fluctuations as it causes 9.6% of the fluctuations in the long run. Throughout the whole period economic development is influenced by its own shocks in the short run and of which in the long run influence is seen to be taken over by transport infrastructure as it accounts for most of the fluctuations in economic development as shown in Table 5.

4.6 Diagnostic Tests

Diagnostic tests were conducted to ensure if the model is robust. The normality test was conducted to see if the model is normally distributed of which the Jarque Bera repeated p value of 0.068294 which shows that residuals are normally distributed. The model was also tested for serial correlation thus the LM test of which there is no reflection of serial correlation within the model. The probability for the LM test was 0.567 which is more than the standard value of 0.05. Lastly there was no heteroscedasticity test was conducted which showed the probability result of 0.3842 which is greater than 0.05.

5. Conclusion and Recommendations

The paper examined the existing relationship between economic development and transport infrastructure in South Africa in the period 1960-2014. Cointegration, vector error correction model, variance decomposition and impulse response functions have been employed to investigate the relationship. Some diagnostic tests have been used to test for the reliability of the model.

The positive relationship between the transport infrastructure and economic development as revealed by the study has brought forth some interesting aspects, of which the government should try by all means to improve the quality of infrastructure, especially the transport sector. To promote development and improve productivity through transport infrastructure investment, the government should, therefore, increase funding at the same time maintain a low inflation rate. This can be achieved by monitoring fiscal and monetary policies to promote development rate of the aggregate demand in combination with public transport infrastructure policy and other policies as well. Development and management of transport infrastructure and the provision of public services is indeed the only way to meet the growing transport infrastructure needs in South Africa.

References

Agbaeze, E.K. & Onwuka I.O. 2014. Impact of Micro-Credit on Poverty Alleviation in Nigeria. *Business and Management Review,* 2(1): 1-27.

Adelman, I. 1999. The Role of Government in Economic Development. Department of Agricultural and Resource Economics. University of California: Berkeley Working Paper No. 890. California.

Amjadi, A. & Yeats, A.J. 1995. *Have Transport Costs Contributed to the Relative Decline of African Exports? Some Preliminary Empirical Evidence*. Washington, D.C.: World Bank International Economics Dept. International Trade Division.

Arvanits, A. 2002. *Foreign Direct Investment in South why has it been low.* p.1.

Aschauer, D.A. 1989. Is public expenditure productive? *Journal of Monetary Economics*, 23(2): 177-200.

Aschauer, D.A. 1993. Genuine economic returns to infrastructure investment. *Policy Studies Journal,* 21(2):380-390.

Bersley, T. & Ghatak, M. 2003. Incentives, choice and accountability in the provision of public services. *Oxford Review of Economic policy,* 19(2):235-249.

Blungmart, M. 2000. The Augmented Dickey-Fuller tests. *Journal of Econometrics*. 21(1):131-143.

Budget speech. 2013. National Treasury. Government Gazzette. Pretoria.

Chandra, A. & Thompson, E. 2000. Does Public Infrastructure Affect Economic Activity? *Journal of Regional Science and Urban Economics,* (30):457-490.

Cheteni, P. 2013. Transport Infrastructure Investment and Transport Sector Productivity on Economic Growth in South Africa (1975-2011). *Mediterranean Journal of Social Sciences,* 4(13):61-772.

Crossley, P., Chamen, T. & Kienzle, J. 2009. Rural transport and traction enterprises for improved livelihoods. *Food and Agriculture Organization of the United Nations.* Rome.

Deaton, A. 2010. Understanding the Mechanisms of Economic Development. *Journal of Economic Perspectives, American Economic Association*, 24(3):3-16.

Department of Economic Development. 2010. Pretoria

Department of Transport. 2012. *Transnet Limited Annual Report 2009.* Available at: http://www.transport.gov.za/. Accessed on 17 October 2015.

Development Bank of Southern Africa. 1998. Infrastructure: A Foundation for Development. Development Report 1998. Pretoria: DBSA.

Dwyer, G.P. 2005. *Economic growth theory and financial development: basic theories of growth.* Available at: www.jerrdweyer.com. Accessed on 20 May 2016.

Engle, R. & Granger, C. 1987. Cointegration and error correction: representation, estimation and testing. *Econometrica,* 35:251-276.

Engle, R. 1984. Wald, Likelihood Ratio and Lagrange Multiplier tests in Econometrics. In Z. Griliches and M.D. Intriligator. *Handbook of Econometrics, Volume II.* Elsevier Science Publishers BV.

Engle, R., Granger C. & Clive, W.J. 1987. Co-integration and error correction: Representation, estimation and testing. *Econometrica,* 55(2):251-276.

Fedderke, J. & Bogeti, Z. 2006. Infrastructure and Growth in South Africa: Direct and Indirect Productivity Impacts of 19 Infrastructure Measures, *World Bank Policy Research Working Paper 3989,* August 2006.

Fedderke, J. & Garlick, R. 2008. Infrastructure Development and Economic Growth in South Africa: A review of the accumulated evidence, *Policy Paper Number 12; School of Economics*, University of Cape Town and Economic Research Southern Africa. Cape Town.

Fourie, J. 2006. Economic Infrastructure: A Review of Definitions, Theory and Empirics. *South African Journal of Economics,* 74(3):530-556.

Grosman, G. & Helpman E. 1990. Comparative advantage and long-run growth. *American Economic Review*, 80(4):796-815.

Gujarati, D. 2004. *Basic Econometrics*. New York: Springer.

ILO. 2010. Local Development through Infrastructure Investments and Jobs – Advisory Support, Information Services and Training Programme (ASIST-AP), ILO Regional Offices for Asia and the Pacific. Available at: http://www.ilo.org/asia/whatwedo/projects/lang—en/WCMS_098915/index.htm. Accessed on 24 March 2010.

Kirsten, M. & Davies, G. 2008. ASGISA: *Is the Bar Set High Enough? Will the Accelerated Infrastructure Spend Assist in Meeting the Targets?* TIPS Conference, 29-31 October 2008. Cape Town: Development Bank of Southern Africa.

Lynde, C. & Richmond, J. 1993. Public capital and total factor productivity, *International Economic Review,* 34(2):401-414.

Maddala, G.S. & Kim I.M. 1998. *Unit Roots, Cointegration and Structural Change.* Cambridge: Cambridge University Press.

Nafziger, E.W. 2012. *Economic Development.* Cambridge: Cambridge University Press.

Perkins, P., Fedderke, J. & Luiz, J. 2005. An Analysis of Economic Infrastructure Investment in South Africa. *South African Journal of Economics,* 73(2):211-228.

Rostow, W.W. 1962. *The stages of economics growth.* London. Cambridge University Press.

Rust, F.C. 2008. A systems approach to managing research and technology development in the road infrastructure sector in South Africa. Confidential CSIR Report, CSIR/BE/SRM/IR/2008/0001/B, CSIR, Pretoria.

South African Institute for Civil Engineers. 2006. Report card 2006. Pretoria: South African Institute for Civil Engineers.

Todaro, M.P. & Smith, S.C. 2010. *Economic Development.* Addison-Wesley: Pearson

Van Wyk, L. 2004. *A Review of the South African Construction Industry Part 2: Sustainable construction activities.* Pretoria, South Africa: CSIR Boutek. Available at: http://www.csir.co.za/akani. Accessed on 29 October 2009.

Yemek, E. 2006. *Budgetary Perspectives in Shared Growth Policy Interventions in South Africa. Occasional pape*r, IDASA- Africa. Budget unit.