Effect of transportation infrastructure on economic growth in Algeria using The VECM approach (1995-2013)

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Abstract :

This paper examines the effect of transportation (RAIL and ROAD) infrastructure on economic growth in Algeria over the period (1995-2013). Using Vector Error Correction Model (VECM), the paper finds long run relationship between (RAIL and ROAD) transportation land and economic growth. The paper suggests that expansion of transport infrastructure (both RAIL and ROAD) along with gross capital formation will lead to substantial growth of the Algerian economy. Therefore, The transportation infrastructure constitutes one of the main axles of an integration of the Maghreb countries; an integration that ensures a connection with the European countries thanks to the interoperability of the networks.

Keywords : Infrastructure Transport(RAIL and ROAD) , Economic Growth, Cointegration and Vector Error Correction Model (VECM).

الملخص:

يفحص هذا المقال أثر هياكل النقل (النقل بالسكك الحديدية و النقل بالطرق) علي التنمية الاقتصادية في الجزائر خلال الفترة الممتدة بين (1995-2013) باستخدام نموذج تصحيح الخطأ. لقد توصلت الدراسة إلي وجود علاقة طويلة المدي بين هياكل النقل (النقل بالسكك الحديدية و النقل بالطرق) و التنمية الاقتصادية. فاقترحت الدراسة بتوسيع هياكل النقل (النقل بالسكك الحديدية و النقل بالطرق) مع تكوين اجمالي رأس المال الثابت الذي سوف يحدث نمو مستدام للاقتصاد الجزائري . مع ذلك، تشكل هياكل النقل واحد من أهم دعائم اندماج دول المغرب العربي مما يسهل في المستقبل القريب الاتصال مع دول الاتحاد الأوروبي .

الكلمات الافتتاحية : هياكل النقل (النقل بالسكك الحديدية و النقل بالطرق) ، التنمية المستدامة ،التكامل المشترك و نموذج تصحيح الخطأ.

Introduction :

The transportation[1] would be a key facilitator to sustainable economic growth[2] is rarely questioned. In Algeria[3] in particular, transportation has been noted to be a critical infrastructure required for economic growth (Raghuram & Babu, 2001). Indeed, the benefits and importance of transportation infrastructure land to economic growth have been recognized for a long time (see Phang, 2003)[4]. A well-oiled transportation infrastructure expands the productive capacity of a nation, both by increasing the mobilization of available resources, and by enhancing the productivity of those resources[5]. The support for this assertion is straightforward and there are many ways we can justify it. First, transportation infrastructure can enter in the production process as direct input and in many cases as an unpaid factor of production. Second, transportation infrastructure may make other existing inputs more productive. For instance, a well-designed road allows goods to be transported to market in less time and hence, reducing the transportation cost in the production process. Third, transport infrastructure can act as magnet of regional economic growth by attracting resources from other regions, which is called agglomeration. In this vein one would recall that throughout the growth of civilization, most centers of economic activities flourished along river banks and coast lines where water was the convenient prime carrier of raw materials, goods and labor.

Transportation[6] is a basic industry for national economic development, which associates with other industries interdependently and closely. On one hand, the development of transportation industry is an important precondition for maintaining the fast growth of national economy, which exerts a "pulling effect" on economic development. On the other hand, the fast development national economy needs developed transportation industry as the infrastructure[7]. Economic development exerts a "pushing effect" on transportation industry. Therefore, for a long period, the research on the relationship between transportation industry and economic growth is always the focus of domestic and foreign scholars in the field.

Transport[8] is an essential element of the modern society and key to sustained economic growth (Ramanathan,2001; Banister and Berechman, 2001; Ramanathan and Parikh, 1999; Eisner, 1991). Adequacy of this vital infrastructure is an important determinant of the success of a nation's effort in diversifying its production base, expanding trade and linking together resources and markets into an integrated economy. However, the success of this sector is highly dependent upon the level of energy in the economy. In fact, transport sector is the largest user of energy in the economy (Reddy et al., 2001; Samimi, 1995). The consumption of energy[9] is likely to grow up further with economic growth, population growth, rapid industrialization, urbanization and agricultural modernization (Ramanathan and Parikh, 1999). The key question is that whether transport promotes energy consumption in the economy, particularly in Algeria. Theoretically, transport and energy are well integrated. On the one side, energy is a component to transport and on the other side, transport is a key determinant to energy. The nexus between the two, however, are not received adequate attention[10].

The literature provides many works on energy-growth nexus (Bowden and Payne, 2009; Odhiambo, 2009; Wolde-Rufael, 2009; Chiou-Wei et al., 2008; Narayan and Smyth, 2008; Yuan et al., 2008; Squalli, 2007; Morimoto and Hope, 2004; Oh and Lee, 2004; Glasure, 2002; Aqeel and Butt, 2001; Cheng, 1999; Glasure and Lee, 1997; Hwang and Gum, 1991) and transport-growth nexus separately (Broadstock and Hunt, 2010; Herranz-Lonca, 2007; Esfahani and Ramirez, 2003; Majumder, 2003; Jiang, 2001; Kulshreshtha et al., 2001; Munnell, 1992). But there is very less work on the nexus between transport, energy consumption and economic growth (Anson and Turner, 2009; Poudenx, 2008; Bauer et al., 2003; Lim, 1998). The study has many implications. It not only provides an insight with respect to the role of transportation on energy consumption and economic growth but also provides a basis for discussion of energy and transportation policies in the economy. For instance, a unidirectional causality running from transportation to energy consumption and economic growth implies that energy consumption and economic growth are dependent on transportation and a decrease in transport may restrain energy consumption as well as economic growth. Similarly, a unidirectional causality from economic growth to transportation and energy consumption represents that energy consumption and transportation depends upon economic growth. A substantial decline of economic growth may affect the level of transportation and energy consumption.

The purpose of this paper is to briefly highlight what is understood (and what is not understood) about the linkage between transport infrastructure and economic growth in developed economies[11]. The implications of this for the management of transport-related infrastructure services in Algeria are also examined[12]. To do this, an overview of some of the available literature has been completed, with a particular focus on documents produced by the European Council of the Ministers of Transport (ECMT,2002), the UK's Standing Advisory Committee on Trunk Road Assessment (SACTRA,1999) ,(Kumi Harischandra Ryan J. Orr, April 2009) , (European Communities, 2003),(IRF,2006) and (Banister and Berechman ,2000). The work by these organisations / researchers is targeted as they have all taken, at various times, a comprehensive look at the linkage between transport and economic growth.

The residual of the paper is organized as follows : Section (I) describes literature review .Section (II) describes econometric methodology and data descriptions. Section (III) follows empirical results and its discussion. The final section offers conclusion and policy implications.

1. Literature review:

A large part of effective factors on economic development : division of labor; specializing in production areas; mechanization of market development; linking production to consumption areas; optimization of plants, via reduction inproduction costs and making additional capacity, are related to transportation (Rokneddin Eftekhari, 1992:54). Economic benefits of transport development[13] are spread from building transport network infrastructure such as construction of roads; railways; tracklayers; airports, waterfronts; ancillary equipments and complementary installations toward exploiting infrastructure network in industrial development, construction of industrial centers, establishment of production centers, development of transport, garage services, development of transport facilities, facilitate the choice of the farmer, industrial and services locations, decrease in production costs, utilization of funds and distribution of economic activities[14]. Absence of roads in a region might limit goods production to that region's consumption. Therefore, despite its natural and geographical superiority, it would not be possible to produce commodities more than its market demand capacity it implies that in a closed economy there would be no possibility for growth and development (Sassan, 1985:13).

Regarding the importance of transportation network expansion and its role on an economy, effective investment in this sector is important. Investment in transportation facilities development leaves a trail of mutual impressibility of usefulness of labor and increases capital efficiency (Mahmoodi, 2010:355). Thus, convenient investments in transportation sector alleviate time and reduce costs and decrease the effect of frictional distance on spatial distribution of economic activities. In transportation investment path, merging market areas, space limitations reduce production areas to possible extent. This raises number of buyers and sellers in border market areas (Rahimi Boroujerdi, setoudeh mollashahi, 2007:68).

Researchers as Wheeler and Mody (1992:63), Loree and Guisinger (1995:290), Richaud (1999:6), Morisset (2000:14), Asiedu (2002:112) and Sekkat (2004:8) emphasized the role of transportation infrastructure in (FDI). They believed that strong infrastructures cause decline in transportation costs and create a motive for regional and multinational companies' entry and is accompanied by foreign investment attraction. Weak infrastructure increases companies' costs and results in foreign investment decrease. Inadequate transportation or use of defective equipments due to communicational problems represents the loss of loyalties for companies. Therefore, for high transportation costs they will not select that area for business. Thus, the infrastructure should provide investment climate for foreign investors. In order to attract (FDI), access to structures such as roads, highways, ports and communication networks in terms of production should be increased. (Wei ,2000:7) believes that position with a strong infrastructure is very attractive than elsewhere. (Khadaroo and Seetanah ,2010:106) studied the effect of transportation infrastructures on (FDI), by (ARDL) method, for Moritious Island, during (1960-2004). They also, investigated the same research for (20) African countries, by panel data method, during (1986-2000) and both resulted in positive and significant effect of transportation infrastructures on (FDI).

2. Data Set and Econometric Methodology:

Several ways transport and economic growth can be presented. The study is, however, restricted to road and rail transport for transport infrastructure. It is believed that other variables could have great impact on economic growth. The omission of these variables could bias the direction of causality between transport infrastructure and economic growth. Data used in this analysis are annual time series for Algeria during (1995-2013). The data are obtained from World Development Indicators, World Bank and Centre for Monitoring Algerian economy. The Table 1(see Appendix 2) provides the summary statistics for each variable.

There are two ways we can model the nexus between transport and economic growth: production function approach and causality approach. The first model is regression based approach, where there is no discussion on causality (Donaldson et al, 1990). Moreover, this model does not highlight the unit root and cointegration problems. The second model is purely based on causality approach, where the unit root and cointegration have been taken into consideration. The paper is all about on causality approach. Note that all these variables are used in natural logarithms so that their first differences approach the growth rates. The cointegration and Granger causality test have been applied to trace the nexus between transport and economic growth. (Engle and Granger ,1987) showed that, if two variables are individually integrated of order one and cointegrated then there is possibility of a causal relationship in at least one direction.

The detail procedure of modeling the nexus between economic growth and transport infrastructure is as follows :

Step 1: Normalization and aggregation of the transport data.

Step 2: Test the order of integration to know the stationarity of these time series variables.

Step 3: Test the cointegration to know the existence of long run equilibrium relationship between them.

Step 3: The error correction mechanism involves developing two models; the over-parameterized model (ECM1) and the parsimonious model (ECM2)[15]. (ECM1) involves leading and lagging of the variables while (ECM2) introduces short-run dynamism into the long-run equilibrium.

To analyze the nexus between transport infrastructure and economic growth, the following function is used :

$$LGDP=F\ (LRAIL\ ,LROAD) \qquad (3,1)$$

LGDP, natural logarithms of GDP[16].

LRAIL, natural logarithms of RAIL[17].

LROAD, natural logarithms of ROAD[18].

where (LGDP) is economic growth, (LRAIL) is the first variable and the second variable (LROAD) . The data employed for this research are annual and cover the period (1995 to 2013) obtained from World Development Indicators reported by World Bank and Infrastructure Statistics, Ministry of Statistics and Programme implementation, Government of Algeria[19]. To estimate the model, gross domestic product , Rail and Road data are extracted from the most recent information and time series data of national accounts of central bank of Algeria and (GDP , RAIL and ROAD) data are extracted from world bank data (WDI, 2013).The detail econometric approach of these three tests is described below:

A. Test for Order of Integration:

The test for order of integration means to know the stationarity of the time series variables. In this section, by Eviews software Augmented Dickey Fuller test (ADF) and The Phillips and Peron (PP) are used to examine stationarity of variables (applied to detect the order of integration). On this basis, all variables became stationary by first order difference. In other words above variables are augmented of first order (table (3,1) and (3,2)). Moreover, cointegration Johansen Juselius test is used to estimate the model. In fact, cointegration tests examine consistency of statistical feature of equation with theory. Economic variables are usually non-stationary. But cointegration is an exception to this principle and has close relation with economic theories[20].

Table(3,1) : studied variables stationarity in the model

Variables Trend and Intercept	t-Statistics	Critical Value at 5% or 10%	t-Statistics	Critical Value at 5% or 10%
		Levels		First difference
ADF: Augmented Dickey-Fuller Test)(Test for unit root				
LGDP	-3.440833	-3.040391	-7.55949	-3.052169
LRAIL	-3.288383	-3.040391	-4.960168	-3.065585
LRAOD	-0.814337	-3.040391	-5.898401	-3.052169
PP : Phillips-Perron)(Test for unit root				
LGDP	-3.496509	-3.040391	-7.678009	-3.052169
LRAIL	-3.311205	-3.040391	-8.430174	-3.052169
LRAOD	-0.600075	-3.040391	-7.988718	-3.052169

Source : Computed by author from the Eviews 5.1.

Table (3,2): classifications results.

Variables classifications		
Test of ADF		classification
LGDP		I(1)
LRAIL		I(1)
LRAOD		(1)
Test of PP		classification
LGDP		I(1)
LRAIL		I(1)
LRAOD		(1)

Source : Computed by author from the Eviews 5.1.

The variables are tested for stationarity using the (ADF and PP) test statistic[21]. The results are presented in Table (3,1) and Table (3,2) indicates that three variables contain a unit root or they are nonstationary in levels. They are I(1) because they become stationary after first differences. Before testing for cointegration by using the Johansen-Juselius procedure, we test for the order of integration of all categories of transport infrastructure variables and the Economics Growth. The Table (3, 1) and (3,2) show the results of the unit root test for the test of the order of integration of the economic time series under investigation. Clearly the (ADF and PP) test statistics indicate that the (LGDP) and (LRAIL, LROAD) in Algeria are difference stationary, in other words, they are I(1) . Thus, it is reasonable to assume that all variables are actually non-stationary I (1) variables and continue our long-run cointegration analysis.

B. VAR lag order selection criteria:

The lag order is chosen using the information criteria as well as the theoretical underpinnings of the model. The selection is drawn from a maximum of (3) lags since the series are annually. Furthermore using (3) lags will allow for adjustment in the model and for the attainment of well-behaved residuals. Table (3,3) summarizes the lag lengths selected by each of the models.

Table (3,3) : lag order selection

VAR Lag Order Selection Criteria

Endogenous variables: GDP RAIL ROAD

Exogenous variables: C

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Sample: 1995 2013

Included observations: 16

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-226.7460	NA	5.96e+08	28.71826	28.86312	28.72567
1	-209.2447	26.25197*	2.12e+08	27.65559	28.23503*	27.68526
2	-201.3912	8.835243	2.87e+08	27.79890	28.81292	27.85082
3	-185.3110	12.06013	1.87e+08*	26.9138*	28.36248	26.98806*

* indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level).

FPE: Final prediction error.

AIC: Akaike information criterion.

SC: Schwarz information criterion.

HQ: Hannan-Quinn information criterion.

Source : Computed by author from the Eviews 5.1.

C. Testing for Cointegration:

The Cointegration test is meant to know the existence of long run equilibrium relationship between the variables. The long run equilibrium relationship, as a statistical point of view, means the variables move together over time so that short term disturbances from the long term trend will be corrected. A lack of cointegration suggests that such variable have no long run equilibrium relationship and in principle, they can wander arbitrarily far away from each other (Dickey et al., 1991). Note that regression among integrated series is meaningful, if they involve cointegrated variables. The Johansen (1988) maximum likelihood (ML) test is applied to examine the cointegration between transport infrastructure and economic growth. In this method, first, existence of cointegration and long run equilibrium relation(s) should be defined by maximum Eigene value and matrix trace statistics tests[22].

The table below shows the summary of result from analysis conducted on the specified model. The tables((3,4) and (3,5)) report results for testing the number of cointegrating relations (Johansen test)[23]. The two types of test statistics are reported: trace statistics and the maximum eigenvalue statistics. For each table, the first column includes the number of cointegrating relations under the null hypothesis, the third column shows the test statistic, and the last column shows the p-value of the test statistic.

Table (3,4): defining number of cointegration vectors according to Trace Value Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.1 Critical Value	Prob.**
None *	0.698135	36.53373	27.06695	0.0072
At most 1 *	0.624811	17.36934	13.42878	0.0258
At most 2	0.099908	1.684128	2.705545	0.1944

Trace test indicates 2 cointegrating eqn(s) at the 0.1 level
* denotes rejection of the hypothesis at the 0.1 level
**MacKinnon-Haug-Michelis (1999) p-values

Source : Computed by author from the Eviews 5.1.

Table (3,5): defining number of cointegration vectors according to Maximum Eigene Value Test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.1 Critical Value	Prob.**
None *	0.698135	19.16439	18.89282	0.0922
At most 1 *	0.624811	15.68522	12.29652	0.0296
At most 2	0.099908	1.684128	2.705545	0.1944

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.1 level
* denotes rejection of the hypothesis at the 0.1 level
**MacKinnon-Haug-Michelis (1999) p-values

Source : Computed by author from the Eviews 5.1.

It means that there are (2) co-integrated vectors in long run results. It shows high association between explanatory and dependent variables used in current study. The result of the Johansen cointegration test suggests the existence of (2) cointegrating equation at both the (10%) using the trace and max-eigen statistics. The existence of at least (2) cointegrating equation permits us to estimate the overparameterize and parsimonious (ECM) models. The following equilibrium relationship (with standard error in parenthesis) can be obtained from the Cointegrating vector in the Table ((3,4) and (3,5)). If cointegration has been detected between series we know that there exists a long-term equilibrium relationship between them so we apply (VECM)[24] in order to evaluate the short run properties of the cointegrated series.

Both trace and maximum eigenvalue tests indicate two cointegrating equations at the (10%) level . From the table above, it could be deduced that the Trace value of (36.53373) is greater than (10%) critical value of (27.06695) and also, the maximum eigenvalue of (19.16439) is greater than (10%) critical value of (18.89282). This shows the existence of a long-run equilibrium relationship among the variables. The estimated values of the trace statistics and the Max-eigenvalue statistics are reported in Table ((3,4) and (3,5)).According to the results of the two tests, we conclude that there are two cointegration relation between these three variables at (10%) percent significance level. These statistics confirm the appropriateness of proceeding with the vector error correction methodology (VECM).

Table (3,6): Summary Johansen Co-integration (Long run Estimates)

1 Cointegrating Equation(s):	Log likelihood	-193.9957
Normalized cointegrating coefficients (standard error in parentheses)		
GDP	RAI	ROAD
1.000000	8.73E-05	-5.37E-06
SE	(2.3E-05)	(1.9E-06)
Adjustment coefficients (standard error in parentheses)		
D(GDP)	0.258231	
	(0.22985)	
D(RAIL)	-12203.48	
	(4504.80)	
D(ROAD)	-14597.98	
	(14624.5)	

Source : Computed by author from the Eviews 5.1.

According to tables ((3,4),(3,5) and (3,6)) we can derive a cointegrating equation among the (LRAIL, LROAD) and (LGDP) as follows :

LGDP= -8.73E-05LRail + 5.37E-06 LRoad (3,2)

(2.3E-05) (1.9E-06)

It can be deduced from the result that the constant parameter in the long-run is positive and negative . This implies that if all the explanatory variables are held constant, (GDP) will increase or decrease by units. The result also indicates that coefficient of (Road) is positive (5.37E-06). This implies that there exists a positive relationship between(Road and GDP) in the long-run. A unit increase in (Road) leads to an increase in (GDP) by (5.37E-06) units. The coefficient of Rail is negative (-8.73E-05). This implies that a negative relationship with (GDP) in the long-run and the negative influence in the long-run . Any attempt to increase any of this variable in the long-run will enhance a decrease in (GDP). This relationship is called cointegration of long-term relationship between the coefficients of (GDP) and (RAIL ,RAOD) of the Algerian economy. Following the existence of cointegration relationship, it is obvious to estimate error correction model (ECM), since the variables are integrated of order one.

D. Vector Error Correction Model (Short run Results)[25]:

The error correction model is then a representation of the short-run dynamic relationship between (X and Y), in which the error correction term incorporates the long-run information about (X and Y) into our model. This implies that the error correction term will be significant, if cointegration exists. In the previous section the cointegrating relationships of the variables are identified, and it will be included explicitly as error-correction terms into a short-run system. The table (3,7) discusses the short run results using vector error correction model. Values without brackets are short run coefficients, values in round brackets are showing standard errors and square brackets are denoting t–statistics. The most important thing in the short run results is speed of adjustment term. It shows that how much time would be taken by the economy to reach at long run equilibrium.

The (VECM) results distinguish between short-run and long-run Granger causality. The coefficients of the lagged error correction term show that there is a long-run causal relationship between economic growth and independent variables. The coefficients (and the magnitudes) of the (ECM)[26] indicate the speed of adjustment to the long-run equilibrium relationship. In this equation, we note that all of the coefficients are correctly signed and all statistically significant . the fact that the (RAIL) has a negative effect on the equilibrium rate and (ROAD) has a positive effect on Growth (GDP) is proved empirically.

Table (3,7): Vector Error Correction (Short-run dynamics analysis)

Vector Error Correction Estimates
Date: 06/29/14 Time: 16:26
Sample (adjusted): 1998 2013
Included observations: 16 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Error Correction:	D(GDP)	D(RAIL)	D(ROAD)
CointEq1	0.258231	-12203.48	-14597.98
	(0.22985)	(4504.80)	(14624.5)
	[1.12349]	[-2.70899]	[-0.99819]
D(GDP(-1))	-0.933022	15816.77	17976.63
	(0.35813)	(7018.96)	(22786.5)
	[-2.60529]	[2.25344]	[0.78892]
D(GDP(-2))	-0.364648	14999.69	-1960.420
	(0.32598)	(6389.00)	(20741.3)
	[-1.11861]	[2.34774]	[-0.09452]
D(RAIL(-1))	-1.81E-05	-0.204892	1.153782
	(1.8E-05)	(0.34329)	(1.11445)
	[-1.03367]	[-0.59685]	[1.03529]
D(RAIL(-2))	-1.98E-05	-0.112978	-0.878094
	(1.4E-05)	(0.26555)	(0.86208)
	[-1.46032]	[-0.42545]	[-1.01858]
D(ROAD(-1))	7.80E-06	-0.128672	-0.419655
	(5.5E-06)	(0.10801)	(0.35065)
	[1.41617]	[-1.19128]	[-1.19679]
D(ROAD(-2))	2.70E-06	-0.053636	-0.397213
	(5.0E-06)	(0.09789)	(0.31781)
	[0.54057]	[-0.54789]	[-1.24986]
C	-0.004249	138.2609	1053.708
	(0.00705)	(138.170)	(448.557)
	[-0.60277]	[1.00066]	[2.34911]
R-squared	0.547314	0.777851	0.531962
Adj. R-squared	0.15123	0.583470	0.122428
Sum sq. resids	0.003092	1187759.	12518047
S.E. equation	0.019660	385.3179	1250.902
F-statistic	1.381754	4.001687	1.298945
Log likelihood	45.70892	-112.4229	-131.2638
Akaike AIC	-4.713614	15.05287	17.40797
Schwarz SC	-4.327320	15.43916	17.79426

Mean dependent	0.001375	0.000000	603.4375
S.D. dependent	0.021339	597.0298	1335.310
Determinant resid covariance (dof adj.)		54585022	
Determinant resid covariance		6823128.	
Log likelihood		-193.9957	
Akaike information criterion		27.62446	
Schwarz criterion		28.92820	

Source : Computed by author from the Eviews 5.1.

The error correction term is positive and significant at (10%), so the model is stable and supporting the cointegration results. The coefficient of error correction term is positive in (GDP) equation which means that any exogenous shock in one of the variables may be lead to divergence from equilibrium. A value of (0.258231) of the coefficient of error correction terms suggests that the Algerian economy (25,82%) movement back towards equilibrium following a back towards long run equilibrium, after the shock of Rail infrastructure or Road infrastructure.

E. The Granger Causality Results :

The study has found interesting results of granger causality in table (3,8) based on significant probability values less than or equal to (0.10). The Granger causality in the table (3,8) shows that there is no short run causality running from lag of independent variables to dependent variables. Since all values are not significant (as Probability are more than 0.10) in the table (3,8) so we can not reject null meaning that there is no short causality running from independent variables to dependent variables.

Table (3,8): Test of Granger Causality Results

Pairwise Granger Causality Tests
Date: 07/02/14 Time: 16:44
Sample: 1995 2013
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
RAIL does not Granger Cause GDP	17	0.46217	0.64067
GDP does not Granger Cause RAIL		0.20545	0.81709
ROAD does not Granger Cause GDP	17	0.26278	0.77323
GDP does not Granger Cause ROAD		0.15715	0.85631
ROAD does not Granger Cause RAIL	17	1.38730	0.28707
RAIL does not Granger Cause ROAD		1.75725	0.21412

Source : Computed by author from the Eviews 5.1.

Conclusion:

In this study to investigate the effect of transportation infrastructures on Economic Growth in Algeria during (1995-2013), two modern time series econometrics approaches were used: cointegration method to estimate long run and error correction model to estimate short run relations. As a result of data analysis, there was positive and significant effect of transportation infrastructures index on Growth Economic in long run, which implied that a (1%) increase in ROAD transportation infrastructure caused to (5.37%) rise in (GDP). In short run analysis causality among variables from short to long term there were no causality relations among (GDP, RAIL and ROAD)[27].

The results suggest strong links among (GDP) and certain macroeconomic factors in Algeria , which could be applied to further studies concerning Green revenue (GDP) forecasting. Moreover, cointegration and error correction theory are shown in this paper appropriate and effective for (GDP) analysis and forecasting using Algerian economic situation. The study carries out long run as well as short run estimates of some factors influencing Economic growth in Algeria. The results of the analysis reveal that in the long run (RAIL and ROAD) infrastructure are contributed in raising Economic Growth.

We can conclude from the above equation(3,2) that the (GDP) of Algeria is more elastic to changes in Road (elastic) than of Rail (inelastic). The level of (GDP) increases as a result of (Road shock) for linear and asymmetric Road specifications. This is expected, as a positive shock to (Road) represents a positive supply shock for a major Road investment economy. It induces an increase in incomes and wealth and supports consumption, given a constant propensity to consumption from income and wealth. Also the level of (Rail) effect on the level of (GDP) is examined. As long as Algeria is the oil producing country, It is generally recognized that the depreciation of Rail infrastructure would encourage imports and reduce exports. So, investment land transport infrastructure considered as a leading indicator of economic activity, prosperity and hence economic growth.

Policy implications and recommendations:

The results of this study have a number of policy implications:

- ✓ The evidence of a long-run relationship between the (GDP) and its determinants, implies that policy makers in Algeria can control the behaviour of the (GDP) by influencing one of the exogenous variables. By adjusting one of the variables which influences the (GDP) , policy makers can affect the path of the (GDP). The results for Algeria reveal that the (ROAD) variable has the greatest effect on the (GDP).
- ✓ The results also suggest that the (GDP) is affected by other shocks in the system outside the control of the policy makers, such as the terms of trade shocks experienced in Algeria.
- ✓ The results from the (GDP) model for Algeria highlight that since the implementation of Structural Adjustment Programs in Algeria. It would thus be useful for policy makers to target those variables that cause an increase of (GDP).

In Algeria for instance, an increase in government consumption expenditure would appreciate the investment transport infrastructure land , which would help to rise the Economic growth. indicate that over time , higher investment in (Rail and Road) land transport infrastructure in Algeria give rise to more Economic Growth. There is also need to restore confidence to the market by regulatory authorities' activities that portray transparency, fair trading transactions and dealings in the stock exchange. It must also address the reported cases of abuses and sharp practices by some companies in the market. This is necessary to prevent the increase in number of deals and decrease in the market capitalization after the boom recorded in the previous year.

In particular, the following recommendations are made based on the results obtained in this study:

- ✓ Ensure an entrenched macroeconomic stability.
- ✓ Implement medium term policy measures that would lead to the creation of a conducive investment environment that in turn would attract foreign direct investments private (FDI).
- ✓ Pursue of an export diversification strategy .
- ✓ We specified five dimensions; (1) transportation and trade, (2) transportation infrastructure, (3) transportation privatization, (4) transportation and environment, and (5) transport movements.

- ✓ Promotion of public transport to minimize car use. The advantages of public transport are many, amongst them are its effective use of space, more energy efficient, emit less air bone pollutants, minimize the amount of land used for transport purposes including parking and generally result in better physical environment.
- ✓ Substitution of transport through the use of telecommunications. With advancement in Information Technology and telecommunications system, many physical movements are now being converted to wireless interaction. This will reduce congestion, air pollution and environmental degradation.
- ✓ Evolve safety measures for reducing road traffic accidents.
- ✓ Adherence to and implementation of the main (UN) Agreements and Conventions on Road Transport.
- ✓ Border crossing facilitation(Standardising trade procedures: standardised trade documents, codes, and information and communications applications).
- ✓ Training(Transport operators and professional drivers).
- ✓ Addressing bottlenecks (Impediments at logistics level: infrastructure,transport, support services to international trade, Lack of managerial staff and technicians specialised in international trade, logistics and transpor).
- ✓ Developing ancillary infrastructure network, safe and secure parking areas, particularly near border crossings and along main national and international corridors.

Limitations of the study and areas of further research:

The issue that many researchers are confronted with when modeling Economic Growth for developing countries is the unavailability of data. This means that some variables have to be omitted from the models albeit with the risk of omitted variable bias. Alternatively, proxies for the variables without data can be created. However, the problem with using proxies is that they may not correctly represent the true value of the variable. It would be useful for further research to look into finding proxies for the explanatory variables which better represent the determinants and improve the performance of the model.

A pertinent issue in the estimation of the Economic growth models for Algeria is that the data for most of the variables is in its annual frequency. The annual data must be converted to quarterly data using the data frequency conversion method of interpolation. The risk of using interpolated data is that although the interpolated series may be accurate and precise it is not the actual value of the quarterly data, hence there is room for error.

This study faced two major limitations that may have introduced greater margins of error into econometric estimates that aimed to uncover the long-run relationship between (GDP) and its fundamental determinants in Algeria under review they are:

- ✓ Data limitations that seriously hampered the assessment of (RAIL and ROAD land transport infrastructure),
- ✓ Structural factors (road signs and telecommunications).
- ✓ Data about green Economic Growth and land transport infrastructure.

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