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# Air Transportation Development and Economic Growth in Nigeria

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**Abstract**
This work is an evaluation of the influence of air transport sector development on economic growth in Nigerian. Over the years, various governments of Nigeria have put in place a series of policy instruments for the development of the aviation sector as sinews to bolster the desired growth. But air transport system continues to mirror inefficiency, mismanagement and airline mishap. This study developed a series of econometrics models including dynamic ordinary regression equation, cointegration, error correction model and granger causality techniques to examine the relationship between air transport and economic growth. The analyses suggests a positive influence of air transport on economic growth, a long run equilibrium relationship and a causal unidirectional relations from air transport to economic growth. The diagnostic test for the normality of the model showed that the model functional form is adequate, stable with no serial correlation. From the analysis, this study recommends a proactive and dynamic cohesive transport policy that benefits all the stakeholders. Also, the sector must improve on its managerial expertise guided by adequate transparency and accountability in order to achieve results and develop the sector to an international standard worthy of emulation.
**Keywords:** Air transport, Economic growth, Econometric analysis

## 1. Introduction

Air transportation is an important aspect of economic development. It represents one of the yardsticks for gauging development. The aviation industry all over the world is credited for a significant influence in terms of development even in the face of airline mishaps that ravage the industry; a particular case is the recent Malaysia twin airline mishap within a space of five months. Despite the series of challenges in the aviation industry, there are over two thousand (2,000) airlines operating more than twenty-three thousand (23,000) aircraft that serves about three thousand seven hundred (3,700) airports around the world (Aerospace Global Report, 2011). Developing this sector, will facilitate increase economic activity round the World. Air transportation in Nigeria generates some economic benefits. First, air transport contributes to the provision of employment. About 159,000 indigenes and foreigners are gainfully employed directly or indirectly by the Nigeria aviation industry. Second, air transport industry is a viable means for generating revenue via personal income and profit taxes. Third, it has contributed over 4 per cent to gross domestic product (Oxford Economics, 2012). Other significant contributions are in the area of tourism development, globalization, trade development and foreign direct investment opportunity. Also, Passengers and Shippers gain from the aviation industry. Nigeria had its first commercial flight in 1935. As a result of the series of economic activity in Nigeria, in particular, oil industry business, the aviation industry has been witnessing increase patronage which in turn generates high tax revenue and boom in tourism. In 2010, International Aviation Safety Assessment (IASA) in United States Federal Aviation Administration (FAA) certifies Nigeria aviation with Category 1 Status because of the high performance in the air transport sector (aviation industry).

Following this rating or status, Nigeria's air safety rating has been enhanced and now puts the country in the premier league of nations that are highly rated in air transport. This rating has been sustained by IASA in 2014 (This day, 2014). Demand for air transport services has increased the influence of air transport in the nation and global economy, thereby enhancing rapid movement of passengers, goods and services to the domestic and world market. In essence it will help to generate higher revenue to the economy by way of fast in and out flow of goods and services. However, Amba and Danladi (2013) have identified some key difficulties in the transportation sector. These are high cost of operation and maintenance, insufficient financial resources, absence of transparency manifested in corruption and poor managerial ability, stagnation and poor response to emergency due to sudden air mishap.

The growth in the aviation sector cannot be matched by any transport units (road, rail and water) due to its unique technical skills and new innovations. This has improved economic and tourist development of the nation. The aviation industry plays an important role in the aspect of work and leisure to people around the globe. The sector helps to promote and improve quality of life, living standards of people within the nation. All this helps to generate economic growth and poverty alleviation by way of providing employment opportunities, increasing revenues from taxes. The employment opportunities would be generated through supply chain transformation from the airports. This makes the industry the gateway to any economy aspiring to develop, enabling globalization, trade facilitation and tourism development. It is very crucial in the promotion of foreign

direct investment (FDI) (Ladele, 2012). One can therefore say that the industry is crucial to the growth of the economy and national development. Ladele (2012) in her study of FDI, noted that as the emerging economies grow, their demand for air transportation will grow as their citizens becomes more financially empowered with increased disposable income. The Nigerian aviation sector is face with some factors militating against adequate air transportation service which has diminish its significant impetus to the growth of the sector and the Nigerian economy. It is in the interest of the series of the difficulties and the various policy initiative put in place in the aviation industry that warrant the need to conduct an investigation of the development of the air transport system and economic growth process of Nigeria. In this regard, the basic objective of this study is to determine the impact of air transport sector on the Nigeria economy. This study is divided into five sections. Section one is the introduction; section two is the review of relevant literature on air transport and economic growth. Section three discussed the methodology of the study while section four is the analysis. The final section is the conclusion.

## 2. Literature review

*2.1 Theoretical and Empirical consideration.*

Great efficiency and value are obtained when long distances are involved and high value payloads are moved, although, the time and cost efficiencies obtained decreases as distances traveled is reduced. Air transport is often worthwhile even for relatively short distances. It also provides a communication link, which is sometimes vital, between the different groups of people involved WIE (2011). Hayle (1973) maintained that transport development may not be precondition for economic development. However, he was quick to acknowledge the fact no industry thrives in the absence of transport, whether in the key areas of marketing of sourcing raw material, distribution of products, or movement of members of staff from home to factories. In the same vein Filani (1986) lend support to Hayle (1973) when he argued that for any economic progress to be achieve in any country, the aviation industry as an integral part of transport must be developed, this is sine-qua-non to development. Adefolalu (1977) opined that air transportation has introduced the most effective method of overcoming the barrier imposed by physical distances and difficult topography and its speed is far superior to any other mode of transport.

The International Air Transport Association (IATA) commissioned Oxford Economics (2012) to estimate the economic and social benefits of aviation in over 80 countries worldwide. The analysis includes the traditional economic footprint of the industry, measured by aviation's contribution to gross domestic product (GDP), jobs, and the tax revenues generated by the sector and its supply chain. However, the economic value created by the industry goes beyond the value captured by these measures. Therefore, the study also investigates the positive impacts of the connectivity provided by air transport services. The connections made between cities and markets produce an important infrastructure asset that facilitates activities that enhance a nation's productivity. More specifically, air transport enables foreign direct investment (FDI), business cluster development, specialization, and other spillover effects. The analysis produced by Oxford Economics is one of the first attempts to estimate these benefits of connectivity (Perovic, 2013). According to a report by Air Transport Action Group (ATAG), aviation plays a vital role in facilitating economic growth, particularly in developing countries. Aviation is indispensable for tourism, which is a major engine of economic growth, Globally, 51% of international tourists travel by air. Connectivity contributes to improved productivity by encouraging investment and innovation; improving business operations and efficiency; and allowing companies to attract high quality employees.

The air transport sector (Aviation) makes a substantial contribution to Nigerian public finance account. This is achieved through corporate tax paid by companies, income tax paid by all their employees, social security payments (employers and employees contributions), and the revenue generation through aviation sector taxes. All these provide an indication that taxes paid by the aviation sector's supply chain and taxes raised through induced spending channels contribute to total revenue in Nigeria (Oxford Economics, 2012). The impact of the air transport sector was analyzed by Nwaogbe, Wokili, Omoke and Asiegbu (2013), they reported that the air transport sector has contributed immensely to the economic development of Nigeria and the entire globe in two other ways. Firstly, through the taxes levied on Gross Value Added i.e. the sum of profits and wages. Secondly, through its lump sum investment and its use of higher advanced technology systems for its operations and maintenance. Stephens, Ikeogu and Ukpere (2014) carried out a study on the contribution of aviation industry on the Nigerian economy. It showed that the domestic air transport industry is fast growing when we measure demand for its services.

Adeniji (1993) opine that passengers who travel regularly demand consistency of service. Consistency of services in the form of computerized reservation system, corporate identification, computerized check in, through check in to final destination, frequent flyer tracking, branded or business lounges and above all recognition. Adeniyi (1998), explain that transport stimulates and enhances the productive uses of human and material resources and hence economic development of any society. Oyede (1995) examined the activities of agencies in the Nigerian air transport sector. His interest centered on Nigerian Aviation Handling Company

(NAHCO). Oyede maintained that the outstanding activities and responsibilities of NAHCO are the provision of assistance to foreign airlines in form of loading and unloading of both cargo and passengers.

Some researchers have examined the connection between high technology employment in a region and whether the region is served by a hub airport. For instance Button (2006) pointed out that in United States and Europe; more than 40% of air travels are for business purposes. The remaining trips are either for leisure or for visiting friends and relatives. Hummels (2006) found that the elasticity of air shipping costs, with respect to distance declined from 0.43% to 0.045% in 2004. That is doubling distance shipped cause a 43% increase in air shipping costs in 1974, but 4.5% increase in air shipping costs in 2004. Furthermore, Aizenman (2004) and Schaur (2006) retain the position that air shipping is more reliable and fast to handle international demand volatility. This is because air shipment takes hours rather than weeks. Air transport shipping provides real option of smooth demand shocks for organizations or firms. An efficient air transport system and shipping modes helps in quality improvement of the air transport system and also elevate international and domestic trade, business and economic growth of a nation.

Lima and Verables (2001) observed that a 10% increase in transport costs reduces trade volume by 20%. Furthermore, recent studies have observed that a 10% increase in time reduces bilateral trade volume between 5% and 8% (Hausman, Lee and Subramanian, 2005; Djankov, Migiel, Qian, Roland and Zhuravskaya, 2005). Obviously, aviation is fully superior to other shipping modes of transport especially, in the area of fastness or time saving. However, high cost of transportation is associated with air transportation. But, Swan (2007) observed that since 1970, both price and production cost for air travel have been declining at about 1% annually. Ugboaja (2013) conducted a study on the sustainability assessment of Nigerian transport policy. The paper used a Survey research method. The data analyses revealed that the overall mean score was 2.22 which is lower than the expected value of 3.00 on a five point Likert scale. Therefore, it was concluded that the extent to which the Transport Policy enhances Social Sustainability in Nigeria was below the average. Which is an indication, that the policy had little or no influence in reducing the negative social impact emanating from Nigeria's Transport system. Nwaogbe, Wokili, Omoke and Asiegbu (2013), carried out a descriptive analysis of the impact of air transport on economic development in Nigeria. The study find that air transport sector supports gross domestic product and the employment of Nigerians through four different routes: direct route, indirect route, induced route and catalytic route.

Isaac (2013), examined the role of airport infrastructural development on socio-economic development of Nigeria. The study utilized a descriptive survey method. The result reveals that, there is a correlation between airport infrastructure development and socio-economic development of the country. The study conclude that, for any proper achievements to be achieve in aviation sector, government must step up its contribution, regulation and due process must be followed in awarding of contract and making decision that relates to the development of aviation. Akanbi, Bamidele and Dunni (2013) employed an OLS regression technique to investigate empirically the impact of transportation infrastructure improvement on economic growth in Nigeria. They found that transport output and investment made on transport infrastructure in Nigeria is positive and significant on growth. In a similar development, Oyesiku, Adegbemi and Folawewo (2013) using OLS regression technique, they conducted a research on the impact of public sector investment in transport on economic growth. The data for the study spanned 1977 to 2009. The outcome of the estimated result showed that transportation impacted negatively on economic growth in Nigeria. According to Oluwakoya and Olufemi (2013), the aftermath of the deregulation and liberalization policy has increased air line services at the air terminals of Nigeria. The study utilizes primary and secondary data. The regression result revealed that reforms in aviation sector, have improve service delivery of the air line operators in Nigeria. Ikpechukwu and Urael (2012) investigated the impact of quality of transport infrastructure on the economy. They apply Pearson correlation coefficient (r) to test the hypothesis of the study. The study revealed a positive correlation quality of transport and economic growth in Nigeria. Ladan (2012), opined that Nigeria air transport is bedeviled by a coherent transport policy, bad management, decaying facilities, loose security, closure of airport, intermittent air crashes and a host of other factors.

The review of literature has shown that the impact of air transport on economic growth is mixed. This open has opened a gap in the literature. In the light of this, this present study is an attempt to examine or assess the impact of air transport on economic growth in Nigeria.

## 3. Research methodology

### *3.1 Source of data and Empirical framework of the model*

This study depends completely on time series data for the analysis. The source of the historical data is the Central bank of Nigeria statistical bulletin volume 23 (2012). The generating process of the time series data was examined. In other words, the test for the order of integration was performed by using standard tests for unit root such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, but Harris and Sollis (2003) have argued that these tests are not generally reliable in small samples, and this is because of their poor size and power properties. Put differently, they tend to over-reject the null hypothesis when it is true and under-reject it

when it is false. Because of this, this study also applied Elliott Rosenberg, Stock optimal point (ERS) (1996) unit root test to address these problems and also the problem of sensitivity of unit root testing to choice of lag. They propose a new information criterion, the modified information criteria (MIC). The distinction between the MIC and the standard information criteria such as the Akaike and the Schwartz Bayesian criteria is that the former takes into account the fact that the bias in the sum of the autoregressive coefficients is highly dependent on the number of lags. In addition the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) unit root test was utilized to test for the null hypothesis of the ADF and PP unit root tests. This was to ascertain the stationary level of the null hypothesis. The ADF model for the unit root test is expressed as:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{p} \alpha\Delta Y_i + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{p} \alpha\Delta Y_i + \delta_t + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Given the unit root equation, the null hypothesis is that the coefficient statistically equal to zero that is $\alpha = 0$. If there is no unit root, the series $Y_{t-1}$ will be stationary at the level or integrated of order zero expressed as I(0). The presence of unit root as a result of first differencing of the series will give stationary level, that is first order of integration denoted as I(1). Where $Y_t$ is a process of autoregressive AR(1), it represent the time series and its linear time trend. Change ($\Delta$) is the first difference operator and $\alpha_0$ is the constant, p is the optimum number of lags in dependent variable, e is the white noise. The method of analysis adopted in this study is analytical

The study developed analytical techniques such as dynamic ordinary least square (DOLS) cointegration, Granger causality and error correction model (ECM). This study covers the period 1980 – 2012. While the DOLS model was used to test the individual impact of each independent variable on the dependent variable, the cointegration model was adopted to determine the long run equilibrium relationship of the variables, the ECM technique is to correct any drift in the long run equilibrium relationship. The causality test attempt to identify the causal direction of the variables in the model. The functional form of the OLS model of this study is specified as follow:

$$GDP = F(AT, ES, AR, MG, GFCF) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

The stochastic form of the model above is provided in equation 2 below

$$GDP_t = a_0 + a_1 AT_t + a_2 ES_t + a_3 AR_t + a_4 MG_t + a_5 GFCF_t + GDP_t(-1) + e_1 \quad \ldots\ldots\ldots\ldots\ldots 4$$

GDP = gross domestic product at market prices
AT = air transport service GDP at market prices, which is a proxy for aviation sector output
GFCF= gross fixed capital formation representing investment in the host nation.
AR = agricultural sector GDP at market prices
MG = manufacture sector GDP at market prices
ES = electricity sector GDP at market prices
GDP(-1) = Lagged GDP by previous year.
The GFCF which is a proxy for investment in this study is expected to impact positively on economic growth. In other words the level of Nigeria's investment is expected to increase economic growth, e is the error term which capture other variables that can explain GDP but were not included in this study
t= the subscript t represent time series data

*3.2 The cointegration test procedure*

This study shall proceed further to apply the Johansen cointegration test. The cointegration of two or more series indicates the presence of long run equilibrium relationship. The systems approach developed by Johansen and Juselius (1990), Johansen (1991, 1995) can be applied to a set of variables containing possible mixture of I(0), I(1) and I(2) (Perasan et al 2001). The estimation procedure assumes a vector autoregressive (VAR) base cointegration test (Johansen 1991) of order p which is given as

$$Y_t = A1y_{t-1} + \ldots + Apy_{t-p} + Bx_t + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where $y_t$ is a - vector of $x_t$ non-stationary I(1) variables, is a d -vector of deterministic variables, and $e_t$ is a vector of innovations. This VAR model for cointegration is given as follow:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma\Delta y_{t-1} + Bx_t + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

Where

$\Pi = + \sum_{i=1}^{p} Ai - I$ and $\Gamma i = \sum_{j=i+1}^{p} Aj$ ……..7

With the presence of cointegrating equations, it becomes necessary for equation 1 to be modified into a dynamic structural model. Because of the obvious reasons that long run information may be lost or a drift in the long run relationship, it suggests the need to employ the vector error correction model (VECM). A vector error correction (VEC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VECM has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the *error correction* term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. A Vector Error Correction Model (VECM) is a restricted Vector Autoregressive (VAR) model designed for use with nonstationary series that are known to be cointegrated. The purpose of the VECM is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. The greater the coefficient of the parameter, the higher the speed of adjustment of the model from the short-run to the long run state will be. The dynamic log linear VECM is given as:

$$\Delta LGDP_t = \alpha_0 + \alpha_1^1 \sum_{j=1}^{k} \Delta LAT_{t-1} + \alpha_2^1 \sum_{j=1}^{k} \Delta LESGDP_{t-1} + \alpha_3^1 \sum_{j=1}^{k} \Delta LARGDP_{t-1} + \alpha_4^1 \sum_{j=1}^{k} \Delta LMGDP_{t-1}$$

$$+ \alpha_5^1 \sum_{j=1}^{k} \Delta LGFCF_{t-1} + \Psi_6 VECM_{t-1}. + \varepsilon_{1t} \text{.....8}$$

$\alpha_{1\_}\alpha_4$ are parameters to be estimate, $\Delta$ is the difference operator, k is the maximum distributed lag length, $\alpha_0$ is the constant, j is the lag length, L is log of variables and $\varepsilon_t$ is the error term.

To take the simplest possible example, consider a two variable system with one cointegrating equation and no lagged difference terms. The cointegrating equation is:

*3.3 The Granger causality test model*

The OLS reveals the correlation between variables but does not help in determining the direction of the relationship Dominnick and Derrick (2001). According to Granger (1969), is said to 'Granger-cause" X if and only if X is better predicted by using the past values of Y then by not doing so with the past values of X being used in either case. In short, if a scalar Y can help to forecast another scalar X, then we say that Y Granger-causes X. If Y causes X and X does not cause Y, it is said that unidirectional causality exists from Y to X. If Y causes X and X causes Y, it is said to be a feedback effect or a bilateral relationship exist between X and Y. Essentially, Granger's definition of causality is framed in terms of predictability. The Pairwise Granger causality equation is of the form:

$$AT_t = X_1 + \sum yiAT_{t-1} + \sum \beta FDGDP_{t-1} + \sum {}_{1t} \text{.....9}$$

$$GDP_t = X_2 + \sum \beta_1 GDP_{t-1} + \sum yiAT_{t-1} + \sum {}_{2t} \text{.....10}$$

Where

$H_{01}$: AT does not Granger cause GDP

$H_{02}$: GDP does not Granger cause AT

Where $M_1$ and $M_2$ are constants and $E_{1t}$ and $E_{2t}$ is the stochastic term

A Wald F-test was used to test the following hypotheses

**4. Presentation of Estimated Results and Discussion**

Table 4.1: Results of unit root test using Augmented Dickey Fuller (ADF), Phillip Peron (PP) and Elliott-Rothenberg – Stock point optimal (ERS) unit root statistics tests.

Table 4.1 Unit Root test

| Augmented Dickey Fuller Unit Root Test (A) | | | | Phillips –Perron Unit Root Test (B) | | | |
|---|---|---|---|---|---|---|---|
| Variables | ADF Critical value | T-Stat @5% | Order of integration | PP Critical value | PP T-stat @5% | Order of integration | |
| GDP | -4.89 | -3.57 | I(1) | -4.90 | -3.56 | I(1) | |
| AT | -6.42 | -3.58 | I(2) | -15.61 | -3.57 | I(2) | |
| AR | -4.90 | -3.57 | I(1) | -4.90 | -3.56 | I(1) | |
| ES | -6.19 | -3.57 | I(1) | -31.58 | -3.56 | I(1) | |
| MG | -5.76 | -3.58 | I(2) | -6.19 | -3.57 | I(2) | |
| GFCF | -5.28 | -3.57 | I(1) | -5.11 | -3.56 | I(1) | |
| Elliot Rothenberg Stock Point –Optimal (ERS) unit Root Test (C) | | | | Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit Root Test (D) | | | |
| Variables | ERS Critical value | T-Stat @5% | Order of integration | KPSS T-Stat | Asymptotic Critical value@5% | Order of integration | Null Hypothesis |
| GDP | 116.49 | 5.72 | I(1) | 0.12 | 0.146 | I(1) | stationary |
| AT | 8.70 | 5.72 | I(1) | 0.17 | 0.146 | I(1) | stationary |
| AR | 9.10 | 5.72 | I(1) | 0.98 | 0.146 | I(1) | stationary |
| ES | 158.74 | 5.72 | I(1) | 0.42 | 0.146 | I(1) | stationary |
| MG | 8.94 | 5.72 | I(1) | 0.19 | 0.146 | I(1) | stationary |
| GFCF | 5.02 | 5.72 | I(1) | 0.85 | 0.146 | I(1) | stationary |

* Significant at @ 5 per cent. Author's Computation

*4.1. Interpretation of ADF, PP and ERS unit root statistic test*

The result of the Augmented Dickey-Fuller (ADF), Phillip Peron (PP), Elliott- Rothenberg – Stock point optimal (ERS) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) unit root statistics tests are depicted in table 4.1 (A,B,C and D) respectively above. All variables are non stationery at the level, but after first and second differencing at 5 per cent level of significance, the variables became stationery in ADF (table 4.1A) and PP (table 4.1B) unit root tests respectively. Included in the equation is trend and intercept, a maximum lag length of 1 was adopted and the Schwarz information criterion (SIC) was employed in the computation of the ADF unit root test. With respect to the PP unit root test result, the newey west bandwidth, trend and intercept as well as the estimation method of Bartlett Kernel were utilized. Similarly, the ERS (table 4.1C) unit root test applied Bartlett Kernel spectral estimation method and the newey –west bandwidth. The result showed that the computed t-critical values are superior to the t- statistic at 5 per cent level of significance. This is an indication that the variables are integrated of order one I(1). The variables are significant at 5 per cent level. The result of KPSS (table 4.1D) reveals that the null hypothesis is stationary and integrated of order one - I(1) at 5 per cent level, thus the null hypothesis cannot be rejected, thus the KPSS test result further confirm that the ADF and PP unit root statistic test results are stationary. Certainly the data are genuine and not spuriously related.

Table 4.2: Estimated ordinary least square regression line.

| Dependent Variable GDP | | |
|---|---|---|
| Independent Variables | Coefficient | t-statistics |
| AT | 1975.63 | 2.72* |
| ES | 0.0003 | 5.94* |
| MG | -13.56 | -1.66 |
| AR | -21.74 | -2.74* |
| GFCF | 0.63 | 0.75 |
| GDP(-1) | 0.93 | 5.84* |
| C | 1386532 | 2.72 |
| $R^2$ | 0.89 | |
| $R^{-2}$ | 0.86 | |
| F-statistics | 31.35 | |
| DW | 2.33 | |

* = Significant at @ 5 per cent. Author's Computation

*4.2 Interpretation of the Regression Line*

Table 4.2 above reveals the estimated OLS regression line. The dependent variable is GDP whereas other variables (AT, ES, MG, AR, and GFCF) are independent variables. The adjusted coefficient of determination ($R^2$) is 0.86; it represents goodness of fit for the regression line. It is an indication that 86 per cent of the change in GDP is the joint responsibility of the independent variables in the regression line, hence only about 14 per cent of the change or variation in GDP is unaccounted for by other variables (error term) outside the regression line. Equally, the F-statistics supports a good fit. The Durbin Watson (DW) statistic test result is a measure of the serial correlation. The DW statistic test result of 2.33 does not support the presence of serial correlation in the model. From the coefficients of the regression line in table 4.2 above reveals that AT is signed positive (1975.63). This is an indication that air transport (AT) is directly related to GDP. A one per cent increase in GDP will increase GDP by 1975.63 per cent. This is an indication that AT impact positively on GDP. This finding does not support the work of Amba and Danladi (2013) and Ugboaja (2013) but is in consonance with Shufen and Yanjun (2011). The result also showed that AT is statistically significant at 5 percent. This is because the calculated t-Statistic value of 2.78 is greater than the t-table distribution value of 2.04. This outcome was anticipated for this study. The coefficient of the regression line revealed that gross fixed capital formation (GFCF) is signed positive (0.63). This is an indication that GFCF has an increasing influence on the behavior of GDP, but the result is statistically insignificant at 5 per cent level. The regression result show that the coefficient of electricity supply (ES) although was signed positive (0.0003) but had a slow positive impact on the growth behavior of GDP. This is an indication of the critical need to improve on the mega watt of electricity in Nigeria. The result was statistically significant at 5 per cent level. The contribution of agriculture (AR) to the growth of GDP as depicted by the estimated dynamic regression line suggests a negative effect. This simply concludes that AR has a decreasing effect on GDP. However, the result shows that AR is statistically significant at 5 per cent level. The manufacturing sector contribution to GDP show a decreasing effect as coefficient is signed negative. Similarly, the result is statistically insignificant at 5 per cent level. The dynamic regression result show that the gross domestic product (GDP(-1)) lagged previous year (one year) is signed positive and statistically significant at 5 per cent level.

*4.3 The Johansen Cointegration Result.*

Table 4.3 and 4.4 below represents the result of Johansen co-integration test of two likelihood ratio test statistics: that is the trace statistic and the Maximum Eigen-value which are commonly used to determine the number of co-integrating vectors. The result suggests that AT, AR, ES and MG demonstrate a positive relationship with GDP. In other words, the Johnasen co-integration test reveals that there are at least four co integrating vectors in the series. This is an indication of the presence of long-run equilibrium relationship. Table 4.3 shows the result of the trace statistics. The trace statistics for null hypothesis of no co-integration relationship is rejected at 5% level. Table 4.4 represents Maximum Eigen value statistic test. It is confirmed from the Maximum-Eigen statistic test that the null hypothesis is rejected at 5% level. This implies that the results of the unrestricted co-integration rank test confirmed a long run significant relationship between GDP and all its determinants. This outcome has been established by Mehmood, Younas and Shahid (2014).

Table 4.3 Johansen cointegration

| Unrestricted cointegration rank test (trace) Statistics | | | |
|---|---|---|---|
| $H_0$ | $H_A$ | Trace statistic | Critical value (5%) |
| $r \leq 0$ | $r > 0$ | 144.2061* | 40.07757 |
| $r \leq 1$ | $r > 1$ | 75.26017* | 33.87687 |
| $r \leq 2$ | $r > 2$ | 72.58946* | 27.58434 |
| $r \leq 3$ | $r > 3$ | 34.00982* | 21.13162 |
| $r \leq 4$ | $r > 4$ | 10.08144 | 14.26460 |
| $r \leq 5$ | $r > 5$ | 0.114382 | 3.841466 |

Trace test shows 4 cointegrating equation @ 0.05 level. Author's Computation

* Significant at @ 5 per cent

Table 4.4 Johansen cointegration

| Unrestricted cointegration rank test (Maximum Eigenvalue) statistics | | | |
|---|---|---|---|
| $H_0$ | $H_A$ | Trace statistic | Critical value (5%) |
| $r \leq 0$ | $r > 0$ | 144.2061* | 40.07757 |
| $r \leq 1$ | $r > 1$ | 75.26017* | 33.87687 |
| $r \leq 2$ | $r > 2$ | 72.58946* | 27.58434 |
| $r \leq 3$ | $r > 3$ | 34.00982* | 21.13162 |
| $r \leq 4$ | $r > 4$ | 10.08144 | 14.26460 |
| $r \leq 5$ | $r > 5$ | 0.114382 | 3.841466 |

Maximum-eigenvalue test shows 4 cointegrating equation @ 0.05 level.
* Significant at @ 5 per cent. Author's Computation.

Table 4.5: The Vector Error correction model result

| Variables | Coefficient | statistic | |
|---|---|---|---|
| LAT(-1) | 4557.89 | 2.41* | $R^2 = 95$ |
| LAR(-1) | 22.64 | 2.60* | $R^{-2} = 91$ |
| LES(-1) | -5.80 | 2.25* | F stat. = 23.44 |
| LMG(-1) | -25.55 | -2.81* | |
| LGFCF(-1) | -0.95 | -1.34 | |
| VECM | -0.41 | 1.61 | |
| C | 38223.35 | 0.22 | |

* Significant at @ 5 per cent. Author's Computation

*4.4 Analysis of Vector Error Correction Result*

With the presence of cointegration, it is required that vector error correction model be applied to determine the dynamic relationship. The vector error correction term ensure that the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The table 4.5 above depicts the result of the VECM. The lag length is '2' which is established on the basis of SIC and AIC. The cointegration vector confirms the expected positive relationship between air transport and economic growth. The coefficient of air transport indicates that an increase of 1 per cent in AT will lead to 4557.89 per cent increase in GDP. The result is statistically significant at 5 per cent level. The coefficient of VECM -0.41 is signed negative. This was anticipated. The VECM value measures the gradual speed of adjustment of the short run dynamic model back to long run equilibrium position. The VECM gradual speed of adjustment is 41 per cent. This means that a total of 41 per cent of the previous year drift from long run equilibrium was corrected by the dynamic short run model. The feedback effect (41 per cent) cannot be said to be very slow, hence the feedback effect is gradual and moderate, but statistically insignificant at 5 per cent level.

Table 4.6:Granger Causality test Result
Sample: 1981 2012.
Lags: 7

| Null Hypothesis | Observations | F-Statistics | Probability |
|---|---|---|---|
| AT does not Granger cause GDP | 24 | 4.13752 | 0.2216 |
| GDP does not Granger cause AT | | 1.19889 | 0.0918 |

* Significant at @ 5 per cent. Author's Computation

*4.5: Interpretation of Granger Causality Result*

Table 4.6 above is the estimated result of Granger causality test. The optimal lag length is 7 based on the SIC and AIC. From the table, it is evident that air transport Granger cause gross domestic product. But gross domestic product does not granger cause air transport. This is an indication of a unidirectional causality from air transport to gross domestic product without a feedback mechanism. Obviously, the outcome of this work show that increase in aviation activity spur economic growth. The hypothesis that air transport does not granger cause gross domestic product is rejected at 5 per cent level of significance. This relationship has been established by Onikosi (2012) and Mukka and Terde (2012). However, the work of Mehmood, Younas and Shahid (2014) does not support this direction of causality.

Table 4.7 Diagnostic estimated test of the dynamic ordinary regression line

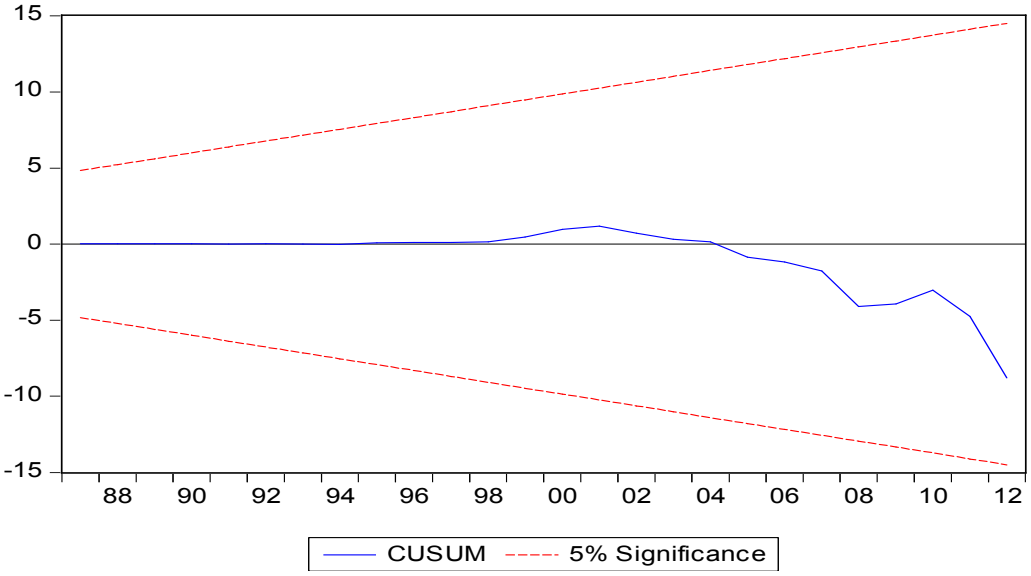
| | Diagnostic Test | | | | | | |
|---|---|---|---|---|---|---|---|
| | Functional Form | | Stability Test | Autocorrelation | | | |
| | Jacque-Bera Normality test | AIC | Ramsey RESET | CUSUM | DW | Breusch-Godfrey | White Heteroscesdasticity |
| 1 | 2.64 (0.29) | 31.29 | 1.33 (0.12) | Stable | 2.33 | 1.14 (0.34) | 1.57 (0.22) |

Author's Computation.

*4.6: Explanation of the Diagnostic test Results*

The regression line for this paper was subjected to a diagnostic test. Table 4.7 depicted the estimated result of the diagnostic test. The coefficient of the Jarque – Bera statistics s how that the study does not have any bases to reject the hypothesis that true error terms in the air transportation and economic growth are normally distributed. In other words, the residual normality assumption was adequate and not violated which in essence implies the functional normality of the regression line for this study. The coefficient of the Breusch-Godfrey LM was estimated with one (1) lag length. The LM test result is an indication of the absence of serial correlation in the regression line. In the same direction, ARCH LM or the Heteroskedasticity statistic was estimated with two (2) lag lengths. The statistic values of ARCH LM conform to absence of serial correlation. Following the computation of the Ramsey RESET test statistic, it was obvious that the functional form of the regression line was adequately specified and as such robust for policy making and analysis. The recursive residual test, also known as cumulative sum (CUSUM) was conducted to determine the stability of the regression line parameters. The CUSUM was plotted against the break points. The plot of the CUSUM statistics in figure 1 below is within the critical bounds. Whenever the CUSUM qualify within the range of the critical bounds at 5 per cent significant level, it suggests that the null hypothesis which states that all coefficients in the regression line equation are stable cannot be rejected. Since the plot of the CUSUM did not diverge from the critical region, it implies that the variance is stable and the estimated regression line coefficients or parameters are equally stable.

Figure 1: Recursive CUSUM estimation test




**5. Conclusion**

This study has investigated the influence of air transport sector development on economic growth in Nigerian between 1981 and 2012. The study examined the contribution of air transport to gross domestic product in Nigerian. Series of works have been done in this regard with divergence of contributions. The absence of consensus amongst the authors has generated this present article. Over the years, the governments of Nigeria have put in place a series of policy measures for the development of the aviation sector in order to kick start the desired level of growth that will impact on the economy. Despite the improvement, the aviation sector mirrors inefficiency, mismanagement and airline mishap. In order to effectively analyze air transport sector in relation to the economy, this study employed a series of econometrics models including a dynamic ordinary regression line equation, cointegration, error correction and granger causality techniques. The analyses showed that the dynamic regression and error correction tests results supports a positive impact of air transport on economic growth in

Nigeria given the period under review. The cointegration test revealed a long run equilibrium relationship between gross domestic product and air transport. The causality test result showed a unidirectional causality that run from air transport to economic growth. Earlier on, the time series properties of the data collated from Central Bank of Nigeria statistical bulletin volume 22 are investigated using Augmented Dickey-Fuller (ADF), Phillip Peron (PP), Elliott- Rothenberg – Stock point optimal (ERS) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS). The outcome of the estimated unit root test revealed that the data are stationary and integrated of I(1) and I(2) given the ADF and PP tests. The ERS showed that all the variables are integrated of order one I(1). Similarly, the KPSS result suggests I(1) and the series is stationary as the null hypothesis cannot be rejected. The diagnostic test for the normality of the model revealed that the model has a functional form, stable and free of any serious autocorrelation or serial correlation. The implication of this study is that a more cohesive transport policy that benefits all the sub units in the transport sector should be pursued vigorously; else development in the transport sector will plummet given the experience of Malaysia air transport disaster that nosedive recently. Also, the Federal Government should ensure that air transportation is well managed in line with best practices and high standard, accountability and transparency, guided by innovative sophisticated expertise in order to achieve results and develop the sector to international standards.

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