Anthony Igwe (Nigeria), Chukwudi Emmanuel Edeh (Nigeria), Wilfred I. Ukpere (South Africa)

Impact of non-oil sector on economic growth: a managerial economic perspective

Abstract

This study is motivated by the need to examine the impact of non-oil export to economic growth in Nigeria for the period 1981-2012. The study adopted the export-led growth hypothesis as the framework of study. A production function which specified economic growth as a function of capital stock, labor and non-oil export is formulated to express the relationship between the dependent and the independent variables. The econometric techniques of Johansen cointegration and the vector error correction model are chosen to ascertain the impact and the long run relationship between the dependent and the explanatory variables. Also, the Granger causality technique is used to investigate a causality relationship between economic growth and the independent variables. Findings from the VEC analysis reveal that in both the short and long runs, non-oil export determines economic growth. Also, the cointegration analysis indicates a long run relationship between non-oil export and economic growth over the period under study. These two findings agree with the theory of export-led growth hypothesis. However, the Granger causality analysis indicates no causality relationship between non-oil export and economic growth. A uni-directional causality relationship runs from capital stock to economic growth. Also, a uni-directional causality relationship runs from economic growth to labor force.

Keywords: development, economic growth, export, non-oil sector.
JEL Classification: 011.

Introduction

The significance of export to international trade and economic growth is an issue that had bothered economists even before the days of Adam Smith. Abou Stait (2005) asserts that "Export is a catalyst necessary for the overall development of an economy". When the export sector is developed, employment opportunity for the people is created, unemployment is reduced, and the cost of living is improved. Increasing exports earnings help in lessening the pressure on balance of payment disequilibrium. Usman & Salami (2008) assert that "export helps in increasing the level of aggregate economic activities through its multipliers effects on the level of national income". The drive for increased export by countries is a program aimed at improving the performance of the real sector of the economy.

Export is a determinant of growth in both developed and developing economies. Exports of developing countries constitutes mainly of natural resources, while that of developed countries are mainly of capital goods. The policy thrust of the export-led growth hypothesis is non-natural resource based products. Kaldor (1970) asserts that increasing exports is the main engine of growth. This is because, "export creates positive externalities by employing a more efficient institutional structure and production methods" (Feder, 1982). In addition, Krugman (1977) avers that exports brings about economies of scale, relaxes foreign exchange barriers and makes foreign markets more reachable. Moreover, in the long run exports have the potency of increasing economic growth through high technical innovation and dynamic learning from abroad (Lucas, 1988; Alesina & Rodrick, 1999; Shah et al., 2014).

The export-led growth hypothesis is a framework that supports long run growth in developing countries spurred by non-natural resources output. The reasons for this notion are not far-fetched:

1. The first reason according to Lucas (1988), Grossman & Helpman (1991) is that natural resources are exhaustible (short run phenomenom), but export-led growth hypothesis is a long run phenomenom.
2. Second, previous empirical findings have shown that revenues from the exports of non-renewable natural resources affect economic growth negatively in the long run (Sachs and Warner, 1995). In particular, according to the Dutch disease concept, *"increasing revenues from the export of natural resources cause an appreciation of the real exchange rate, which undermines competitiveness of the non-resource tradable sector of economy while inducing demand for imports"* (Gylfason, 2001; Sachs and Warner, 1997; Gylfason and Zoega, 2002).

There is the need to seek ways of developing the export of non-renewable resources in parallel with the renewable natural resources (Sorsa, 1999). Herein lays the essence of this study for an oil rich developing and exporting country like Nigeria, where crude oil has constituted the bulk of its exports for over four decades.

Anthony Igwe, Department of Management, University of Nigeria Nsukka, Nigeria.
Chukwudi Emmanuel Edeh, Department of Economics, Enugu State University of Science and Technology, Nigeria.
Wilfred I. Ukpere, Department of Industrial Psychology and people Management, Faculty of Management, University of Johannesburg, South Africa.

The essence of this study stems from some anomalies that exist in Nigerian economy as it relates to non-oil export and economic growth. Firstly, there is the poor economic performance due to over reliance on crude oil without a meaningful and realistic economic diversification program (Igwe et al., 2014). Secondly, the neglect and decline in agriculture sector output over the years can be attributed to low yield, disease, pest attack, non-mechanized farming, etc. Thirdly, there is observed decline in non-oil exports due to poor competitiveness of local products in the global market, (cassava, cocoa, etc.). In spite of efforts by various governments to boost non-oil export, crude oil still dominates government and policy makers' attention.

For these reasons, this study aims at determining the impact of non-oil export to real gross domestic product in Nigeria. Also, this study intends to investigate a cause and effect relationship between non-oil exports versus economic growth in Nigeria for the period 1981-2012.

1. Literature review

1.1. Stylized facts. The Nigerian economy is a small open economy to a high degree. The openness of Nigeria's economy cannot be said to be helpful since its main product of international trade constitutes mainly of non-renewable resources (Okafor, 2014). Usman (2010) asserts that "from 1970 to date, oil exporting has constituted on the average of 90% of the total foreign exchange earnings". This feature has made Nigeria's economy vulnerable to the vagaries of fluctuations in oil prices in the world market. The Nigerian economy swings on a pendulum of "booms and dooms" (boom – periods of rising oil prices, while doom – periods of oil glut), occasioned by the fluctuations in the world oil market. During these periods, the non-oil sector was neglected. This ugly situation has become a source of constant panic to government. As a means to redress the situation, various programs were put in place by successive governments. The structural adjustment program was established in 1985 by then military government to reform and stabilize the economy. Apart from those policies, government introduced additional polices in its bid to ensure efficient management of oil resources. Today, policies like the Excess Crude oil account, Sovereign Wealth fund, Debt management framework, Fiscal responsibility Act, Medium Term Expenditure Framework among others are some of the efforts made by the governments to stifle the effect of crude oil price fluctuations on macroeconomic aggregates.

Ogunkola, Bankole & Adewuyi (2008 cited in Abogan, Akinola & Baruwa, 2014), affirm that in the 1960s, cocoa, rubber, groundnut, palm kernel, palm oil, cotton, coffee, tin ore, columbite, hides and skin, copper and others dominated most of Nigeria's exports. The implication is that the oil sector was not prominent during the period. They assert that over 66% of the nation's total exports on the average were accounted for by these commodities. Oyejide (1986) notes that the same pattern continued into the early 1970s. He maintained that:

Cocoa was the dominant export product at that time contributing about 15% of total exports in 1970. However, oil's dominance of the country's export basket began in 1973/74 and was greatly magnified during the 1980s. The crux of the problem was that while oil export was growing, non-oil exports were declining making the dominance much more rapid and pervasive. Teal (1983) estimates that the output of export crops grew at an average annual rate of 4.7% in 1950-1957 and 7.4% in 1960-1965, then declined by 17.3% in 1970-1975. The transformation of Nigeria from a net exporter of agricultural products to a large-scale importer of the same commodities was particularly marked during the period 1973-1982 (Oyejide, 1986).

In other studies, it was discovered that the value of non-oil exports has been on the decline ever since. For example, "the share of agricultural products in total exports declined from 84% in 1960 to 1.80% in 1995" (CBN, 2000 cited in Okoh, 2004; Ogunkola and Oyejide, 2001). Consequently, there was an overall fall in the export of these agricultural commodities and other non-oil products. According to CBN (2000), "Manufactures sector decreased from 13.10% in 1960 to 0.66% in 1995. Also, WTO (2003, cited in Okoh, 2004) affirms that manufacturing sector remained within the same range in 2002.

The analysis in Figure 1 reveals an increasing pattern of the percentage contribution of non-oil export to GDP over the period under study

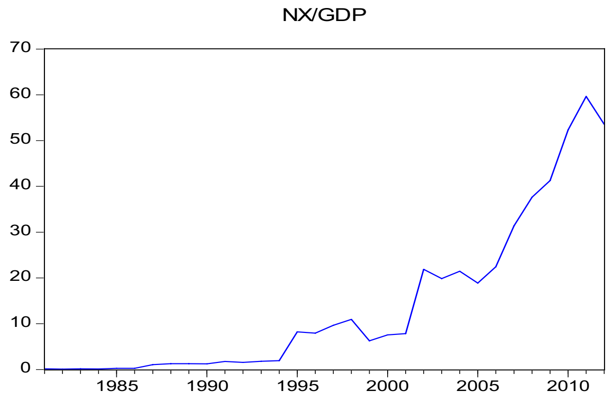

Fig. 1. Percentage contribution of non-oil export to GDP

The figure above shows that between 1980-1985, the contribution of non-oil export to gross domestic product was nothing to write home about, as it contributed less than one percent to GDP. However, with the emergence of the Structural Adjustment Programme in 1986, the trend changed. The graph showed volatile fluctuations between 1995 to year 2000. After then the trend showed an upward pattern onwards.

Table 1 shows that between 1987 and 1995, the percentage contribution of non-oil export to GDP rose sharply from 1.25% to 8.20%. By the year 2002, the figure rose to 21.8%. The percentage contribution of non-oil export to GDP rose again sharply from 31.42% from 2007 to 41.27% in 2009. Between 2010 and 2012, the figure rose sharply from 52.33% to 59.66% respectively. However, the figure fell to 53.56 by 2012 (CBN, 2012).

Table 1. Percentage contribution of non-oil export to gross domestic product

Year	GDP	Net export	(NX/GDP)%
1981	205,222.06	342.8	0.167039
1982	199,685.25	203.2	0.10176
1983	185,598.14	301.3	0.16234
1984	183,562.95	247.4	0.134777
1985	201,036.27	497.1	0.247269
1986	205,971.44	552.1	0.268047
1987	204,806.54	2,152.0	1.050748
1988	219,875.63	2,757.4	1.254073
1989	236,729.58	2,954.4	1.248006
1990	267,549.99	3,259.6	1.218314
1991	265,379.14	4,677.3	1.762497
1992	271,365.52	4,227.8	1.557972
1993	274,833.29	4,991.3	1.816119
1994	275,450.56	5,349.0	1.941909
1995	281,407.40	23,096.1	8.207353
1996	293,745.38	23,327.5	7.941401
1997	302,022.48	29,163.3	9.656003
1998	310,890.05	34,070.2	10.95892
1999	312,183.48	19,492.9	6.244052
2000	329,178.74	24,822.9	7.540858
2001	356,994.26	28,008.6	7.845672
2002	433,203.51	94,731.8	21.86775
2003	477,532.98	94,776.4	19.8471
2004	527,576.04	113,309.4	21.47735
2005	561,931.39	105,955.9	18.85566
2006	595,821.61	133,595.0	22.42198
2007	634,251.14	199,257.9	31.41625
2008	672,202.55	252903.7	37.62314
2009	718,977.33	296696.1	41.2664
2010	775,525.70	405856.1	52.33303
2011	834,000.83	497608.6	59.66524
2012	888,893.00	476110.7	53.56221

Source: Central Bank of Nigeria Statistical Bulletin (2012).

In a bid to examine the factors that affect the poor performance of the non-oil sector over the years, Onwualu (2009, cited in Onodugo, Ikpe & Anowor, 2013), highlight key barriers to the growth of the non-oil sector as follows: "Weak infrastructure – a national challenge; supply side constraints – due to low level of technology. This constraint is particularly prominent in the agricultural sector; low level of human capital development – general; weak institutional framework – general; and poor access to finance – general".

They further outlined the following efforts made by the government to encourage the non-oil sector and encourage economic diversification. These efforts can be categorized into the following: Protectionism Policy (1960 to 1986); Trade Liberalization Policy (1986 SAP era); and Export Promotion Policy (Post SAP period). The aim of the protectionism policy was to offer protection to those industries that produced import substitute commodities. Government aimed at deregulating, commercializing and liberalization of the economy in Trade liberalization policy, while in the Export Promotion Policy, government's aim was to diversify the economy through the support of SMEs and their exports (Hoeyi & Dzansi, 2014).

Onwualu (2012) asserts that *"export grant is given to exporters to cushion the impact of infrastructural disadvantages faced by Nigerian exporters and to make exports competitive in the international market"*. In addition, as at the year 2014, government efforts have become channelled towards the automobile industry. The current ban on some imported vehicles and various incentives given to local automobile industry in Nigeria are current efforts by the government to diversify the economy.

1.2. Theoretical framework. *1.2.1. The export-led growth hypothesis.* According to international trade theory, exports can contribute to economic performance through many channels". As Adams Smith (1776) postulated, *"international trade improves productivity by enhancing market size and enjoying economies of scale"*. Furthermore, David Ricardo (cited in Akmal Ahmad and Ali, 2013) *"documented that international trade plays an important role in economic growth. A country can attain specialization in the production of a good through trade in which it is comparatively advantaged. This attained specialization may perk up the efficiency of resources exploitation by raising the capital formation which improves the total factor productivity (TFP)"*.

Sachs and Warner (1997) carried out a study to examine the relationship between natural resource abundance and economic growth. Using time series variables from 1970-1990 for 18 countries, the growth regression analysis result shows that countries that have high ratio of natural resource export to GDP grew slowly during the period. The study discovered that even after incorporating other control variables (initial GDP, openness, rates of investment, human capital, terms of trade, and efficiency of government institutions), there still exists a negative relationship between natural resources export and economic growth.

History of economic thought has traced the evolution of the emphasis on exports from the Mercantilist era. Medina-Smith (2001) regarded exports as *"an engine of growth"*. Akmal et al. (2013) went further to assert that *"Exports are often considered as an important source of economic growth. The association between exports and economic growth has been investigated in developed and developing economies extensively"*.

According to Medina-Smith (2001) *"The growth hypothesis (ELGH) postulates that export expansion is one of the main determinants of growth. It holds that the overall growth of countries can be generated not only by increasing the amounts of labor and capital within the economy, but also by expanding exports. According to its advocates, exports can perform as an engine of growth"*. Hassan (2011) in his description of export-led growth hypothesis admits that expansion in exports of a country can lead to the economic growth of the country. He affirms that "the overall growth of economies does not owe to increase in the labor and capital stock only, but also expansion in exports".

This approach, according to Hailegiorgis (2012) *"leads to better resource allocation, creating economies of scale and production efficiency through technological development, capital formation, employment creation and hence economic growth"*. The choice of this framework in this study is owed to the fact that it stresses that long run growth depends on export of resources that have a lifespan.

1.3. Empirical studies. Many empirical specific studies exist in the literature as regards the impact of non-oil sector on economic growth in Nigeria. Usman (2010) examined the determinants of non-oil export and its impact of non-oil export on economic growth in Nigeria. The researcher employed the technique of multi-linear regressions to examine whether or not there is a linear relationship between the non-oil export and GDP. It has an analytical tools using data set from Central Bank of Nigeria sources that ranged from 1989 to 2008. The outcome of the analyses revealed that Nigeria's non-oil export has some significant contribution in determining economic growth in Nigeria over the period under study.

Adebile & Amusan (2011) in their study examine the contribution of non-oil sector export to the Nigerian and in particular the contribution of cocoa export. Using the method of content analysis, it emphasizes the huge opportunities and advantages that are available in non-oil exports sector. Nigeria's dependence on the oil export as a major contributor to the country's GDP (gross domestic product) poses a threat to the continued sustenance of the GDP. The study also investigates the trend of cocoa beans export over some regime changes and found that inconsistent policies and inadequate attention given to the agricultural sector is not in the best interest of the country. It observes that investment in cocoa production is likely to boost the GDP and will also offer employment opportunities to the citizenry. It concludes that Nigeria's involvement in the non-oil export sector is a key to a realistic growth and sustainable development in Nigeria.

The study by Nasreen (2011) sought to examine the validity of export-growth nexus for some selected Asian developing countries. The study period of 1975-2008 was chosen for the study in testing the causal and long relationship between exports and growth. The econometric techniques of panel cointegration panel causality were employed to test the hypotheses of the study. Panel cointegration rank test analysis confirms the existence of unique co-integration relation between economic growth and exports in the countries under study. Findings reveal that in the long run, increase in export require higher growth. Also, the panel homogenous causality test shows the significant effect of economic growth on export in the panel selected. Panel non-homogenous causality hypothesis result reveals the existence of bi-directional causality between economic growth and exports. Panel heterogeneous causality result shows that the causality is found running from economic growth to exports in case of Sri Lanka, Indonesia, and Pakistan, and from exports to economic growth in Thailand and Malaysia. Bi-directional causality also exists in case of India, Sri Lanka and Indonesia while a neutral hypothesis is discovered in the case of Bangladesh.

Monir, Ebrahim & Hamed (2012) examines the effects of oil and non-oil export on economic growth for the period 1973-2007. The study employed the use of the method of VAR (vector auto regressive) analysis in predicting the impact of the independent on the dependent variables. The proxy for the dependent variable is Real GDP, while the explanatory variables were real oil export and real non-oil export. The result of the analysis shows that real non-oil export and real oil export have positive impact on economic growth in Iran.

Onodugo et al. (2013) in their study investigates the specific impact of the non-oil exports to the economic growth in Nigeria using data between 1981 and 2012. The study adopted the Augmented Production Function (APF), employing the Endogenous Growth Model (EGM) in its analysis. The conventional tests for mean reversion and cointegration were employed. Findings reveal a very weak and infinitesimal impact of non-oil export in influencing rate of change in level of economic growth in Nigeria. The study, apart from empirically providing information that has failed to give backing to recent claims of non-oil exports led growth in Nigeria, has also set a data benchmark for appraisal of possible improvements in future performances of non-oil export trade, with respect to its contributions to the growth of the Nigerian economy.

Adesoji & Sotubo (2013) in their study evaluates the performance of Nigeria's export promotion strategies to see if it has been able to enhance the diversification of the Nigeria economy away from the oil sector. The period of this study runs from 1981 to 2010. The researchers employed the methods of ordinary least square and correlation matrix for data analysis. Findings from the study reveal that non-oil exports have performed below expectations giving reason to doubt the effectiveness of the export promotion programs that has been adopted by the country. The study reveals that the economy of Nigeria is still far from diversifying from crude oil export and as such, the crude oil sub-sector continues to be the single most important sector of the economy.

The study by Olayiwola & Okodua (2013) examines the contribution of Foreign Direct Investment (FDI) to the performance of non-oil exports in Nigeria within the framework of the export-led growth (ELG) hypothesis. The Granger causality analysis was adopted in verifying the suitability of the ELG hypothesis. Variance decomposition and impulse response analysis were also used in investigating the interplay among FDI, non-oil export and economic growth. The study reveals a uni-directional causality runs from FDI to non-oil export. The VDA shows that the contribution of FDI and non-oil sector to economic growth was not significant.

Abogan et al. (2014) investigate the impact of non-oil export on economic growth in Nigeria using time series data for the period 1980-2010. The methodologies of ordinary least square methods involving error correction mechanism, over-parametization and parsimonious were adopted. Johansen cointegration test reveals that the variables are co-integrated which confirms the existence of long-run equilibrium relationship between the variables. The study reveals a moderate impact of non-oil export on the economic growth. A 1 per cent increase in non-oil export causes output to increase by 26% in Nigeria during the period under study.

The review above shows that the empirical finding on the impact of non-oil sector is not uniformed. While some studies find significant impact of the non-oil sector on economic growth, other studies agreed on insignificant and weak impact of the non-oil export on economic growth. Also, there is also a controversy on the nature of the relationship between non-oil sector on economic growth. While some of the studies agree on a positive relationship subsisting between non-oil sector and economic growth, other studies put forward a negative relationship. The reason for these discrepancies may be linked to the methodologies employed in these previous studies. What is needed to address this issue is the use of a more dynamic model that shows both the long short and long run relationship between economic growth and non-oil export. Hence, this study employs a 32-data point observation to investigate the relationship and impact of non-oil sector on economic growth in Nigeria, using the vector error correction and Granger causality analysis.

2. Methodology

The time series econometric procedures were used in order to examine the impacts of non-oil exports on economic growth. There are four steps involved in estimating the relationships. The first step is to test the stationarity of the time series data using the method of the Augmented Dickey-Fuller unit root test. The principle behind the diagnostic test of stationarity and others is to ensure that the results of the regression analysis are not spurious.

After establishing their orders of integration, we proceed to an examination of the time series data for the presence of a long run relationship among all variables in the model. However, the long run coefficients are estimated using the associated co-integration model, proposed by Johansen (1991). Decisions about the presence of cointegration will be done using the trace test and the eigenvalues tests. Once the cointegration is confirmed in the model, the vector error correction model is estimated to check the degree of adjustment of the economy when there is a shock. This model will help us to establish the long and short run impact on net exports on economic growth.

Lastly, the causality relationship between non-oil export and economic growth was analyzed using the Granger causality technique. This technique follows the F-distribution, as the variables will be lagged at lag 2.

The research data employed in analyzing the impacts of non-oil exports on economic growth were secondary data. The secondary sources of the data are useful relying on the efficiency of validated model built by economic experts in this field to analyze such data. The data were sourced from the Central Bank of Nigeria Statistical Bulletin for the period 1981-2012. The choice of this type of analysis is borne out of the claims in econometrics that information about the behavior of variables is contained in their historical time series data.

2.1. Model specification. Following Solow (1957), it is assumed that output (Y) depends positively on both capital (K) and labor (L). Thus the production function becomes:

$$Y = \mathrm{f}\,(K, L). \quad (1)$$

To augment the traditional neo-classical production function above, we include non-oil export value into the above equation. This is based on the claim of the export-led growth hypothesis that export drives growth. Therefore, a new variable non-oil export is added to equation 1 to become:

$$Y = \mathrm{f}\,(K, L, NX). \quad (2)$$

The research model is set explicitly in double-logarithmic form, as follows.

We have:

$$\text{Log}\,(GDP) = \beta_0 + \beta_1 K + \beta_2 L + \beta_3 L + \mu. \quad (3)$$

Where: GDP = Gross domestic product (proxy for economic growth); K = gross fixed capital formation (proxy for capital stock); L= remunerations for labor (proxy for labor force); β_0, β_1, β_2, and β_3 = regression coefficients

2.2. Results and analysis. The result of the unit root test for stationarity is presented in Table 2 below:

Table 2. Result of ADF unit root test of stationarity

Variables	t-statistic with trend	5% critical value	Order of integration
Log(Y)	-3.358596	-2.963972	I(1)
Log(K)	-5.021629	-2.963972	I(1)
Log(L)	-6.200624	-2.963972	I(1)
Log(NX)	-6.988129	-2.963972	I(1)

Source: author's computations with Eviews 6.

The result above showed that all the time series variables are integrated at first difference with trend. Stationarity occurs where the absolute value of the t-statistic is greater than the 5% critical value. This condition existed in all the time series variables. Having established this, we proceed to establish if the time variables could be used for long run prediction. The result of the Johansen cointegration test is presented in Table 3 below:

Table 3. Result of Johansen cointegration analysis

Unrestricted cointegration rank test (trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.726993	68.81399	47.85613	0.0002
At most 1 *	0.467595	29.86628	29.79707	0.0491
At most 2	0.259831	10.95574	15.49471	0.2142
At most 3	0.062290	1.929452	3.841466	0.1648
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
** MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized		Max-eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.726993	38.94771	27.58434	0.0012
At most 1	0.467595	18.91054	21.13162	0.0995
At most 2	0.259831	9.026288	14.26460	0.2840
At most 3	0.062290	1.929452	3.841466	0.1648
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 3 above indicates two cointegration equations at those ranks where the values of the trace statistics exceed the 5% critical values. This occurred in two places in the table. In addition, this was confirmed by the results of the maximum eigenvalues where cointegration exists at ranks where the value of eigenvalues is at least 0.5. The discovery here is that while the trace statistic result yielded two cointegrations, while the max-eigenvalue test indicated one cointegration. However, theory agrees that cointegration exists where there is at least one cointegration.

Table 4. Result of the vector error correction model analysis

Standard errors in ( ) & *t*-statistics in [ ]				
Cointegrating eq:	CointEq1	CointEq2		
Log(*Y*(-1))	1.000000	0.000000		
Log(*K*(-1))	0.000000	1.000000		
Log(*L*(-1))	-0.160896	-0.574393		
	(0.02110)	(0.03687)		
	[-7.62559]	[-15.5773]		
Log(*NX*(-1))	-0.165176	-0.114378		
	(0.00988)	(0.01726)		
	[-16.7224]	[-6.62595]		
C	-9.501468	-3.593838		
Error correction:	D(Log(*Y*))	D(Log(*K*))	D(Log(*L*))	D(Log(*NX*))
CointEq1	-0.048746	1.331930	3.158521	2.130258
	(0.07209)	(1.27137)	(0.98384)	(1.33530)
	[-0.67613]	[1.04763]	[3.21039]	[1.59534]
CointEq2	-0.141823	-0.544791	-0.581429	0.131590
	(0.02398)	(0.42283)	(0.32720)	(0.44409)
	[-5.91494]	[-1.28845]	[-1.77697]	[0.29632]
D(Log(*Y*(-1)))	-0.052068	-3.070042	-4.432281	-0.382948
	(0.15850)	(2.79509)	(2.16296)	(2.93564)
	[-0.32851]	[-1.09837]	[-2.04917]	[-0.13045]
D(Log(*Y*(-2)))	-0.393241	0.874653	-1.081103	-1.134286
	(0.15744)	(2.77644)	(2.14854)	(2.91606)
	[-2.49768]	[0.31503]	[-0.50318]	[-0.38898]
D(Log(*K*(-1)))	0.035747	0.343611	0.813140	-0.513294
	(0.02063)	(0.36387)	(0.28158)	(0.38217)
	[1.73246]	[0.94432]	[2.88779]	[-1.34312]
D(Log(*K*(-2)))	0.056781	0.123255	0.630076	0.125575
	(0.01831)	(0.32294)	(0.24991)	(0.33918)
	[3.10061]	[0.38166]	[2.52126]	[0.37023]
D(Log(*L*(-1)))	-0.065376	-0.319818	-0.723620	0.215662
	(0.01928)	(0.33999)	(0.26310)	(0.35709)
	[-3.39094]	[-0.94067]	[-2.75037]	[0.60395]
D(Log(*L*(-2)))	-0.062507	-0.117047	-0.611647	-0.113732
	(0.01508)	(0.26590)	(0.20577)	(0.27927)
	[-4.14547]	[-0.44019]	[-2.97253]	[-0.40724]
D(Log(*NX*(-1)))	-0.033048	0.179063	0.226669	0.032425
	(0.01588)	(0.28012)	(0.21677)	(0.29421)
	[-2.08050]	[0.63923]	[1.04566]	[0.11021]
D(Log(*NX*(-2)))	-0.019632	0.414746	0.307341	0.276644
	(0.01285)	(0.22661)	(0.17536)	(0.23800)
	[-1.52777]	[1.83025]	[1.75264]	[1.16236]
C	0.091775	-0.013940	0.200038	0.249377
	(0.01343)	(0.23686)	(0.18329)	(0.24877)
	[6.83298]	[-0.05886]	[1.09138]	[1.00246]
R-squared	0.820070	0.521841	0.740249	0.361282
Adj. *R*-squared	0.720109	0.256198	0.595943	0.006438
Sum sq. resids	0.009911	3.082194	1.845726	3.399962
S.E. equation	0.023465	0.413803	0.320219	0.434611
F-statistic	8.203879	1.964441	5.129717	1.018143
Log likelihood	74.58091	-8.645235	-1.210079	-10.06801
Akaike AIC	-4.384891	1.354844	0.842074	1.452966
Schwarz SC	-3.866261	1.873473	1.360704	1.971596
Mean dependent	0.054014	0.014006	0.034932	0.253976
S.D. dependent	0.044354	0.479805	0.503763	0.436017

A look at Table 4 above indicates that in the long run, non-oil export is significant in determining economic growth. Also in the second section of the table, all the variables including non-oil export were statistically significant in determining GDP in the short run. The adequacy of the model is very high at 82%. Both cointegrating equations were well behaved since they possess the required negative signs. The value of the ECM coefficient is 0.048746. This implies that if there are short run fluctuations, GDP will converge to its long run equilibrium path at a speed of about 4.9% in each period.

Finally, we present the result of the Granger causality test in Table 5 below.

Table 5. Result of Granger causality test

Lags: 2			
Null hypothesis:	Obs	*F*-statistic	Prob.
Log(*K*) does not Granger cause Log(*Y*)	30	9.91186	0.0007
Log(*Y*) does not Granger cause Log(*K*)		2.18960	0.1330
Log(*L*) does not Granger cause Log(*Y*)	30	1.55332	0.2313
Log(*Y*) does not Granger cause Log(*L*)		3.62212	0.0416
Log(*NX*) does not Granger cause Log(*Y*)	30	0.85806	0.4361
Log(*Y*) does not Granger cause Log(*NX*)		0.36639	0.6969

At lag 2, the result indicates that there is no causality relationship between economic growth and non-oil sector. This is surprising as it does not support the export-led growth hypothesis. However, a uni-directional causality relationship runs from capital stock to economic growth. Also, another uni-directional causality relationship runs from economic growth to labor force.

Conclusion and recommendations

There is a need to develop non-resource sector, especially its export capacity in parallel with the windfall of natural resource revenues. This study has endeavored to determine the impact of non-oil export to economic growth in Nigeria. It also made an effort to investigate a causality relationship between non-oil export and economic growth in Nigeria for the period 1981-2012. After an extensive review of the literature, the study adopted the export-led growth hypothesis as the framework of study. A neo-classical production function which specified output as a function of capital stock, labor, and non-oil export was formulated. The econometric techniques of Johansen cointegration, and the vector error correction model were chosen to ascertain the impact and the long run relationship between the dependent and the explanatory variables. Also, the Granger causality technique was used to investigate a causality relationship between economic growth and the independent variables.

Findings from the VEC analysis reveal that in both the short and long runs, non-oil export determines economic growth. This finding is supported by Monir et al. (2012) findings in Iran. However, the findings of Onodugo et al. (2013), Adesoji and Sotubo (2013), Olayiwola and Okodua (2013) reveal that non-oil sector is not statistically significant in determining economic growth in Nigeria. These differences could be attributed to the nature of data and techniques used in the studies.

Also, the cointegration analysis indicates a long run relationship between non-oil export and economic growth over the period under study. These two findings agree with the theory of export-led growth hypothesis. This is supported by the studies of Nasreen (2011) and Abogan et al. (2014) who establish a long run relationship between non-oil export and economic growth.

However, the Granger causality analysis indicates no causality relationship between non-oil export and economic growth. This finding is in contrast with Olayiwola and Okodua (2013) who found a uni-directional causality relation running from FDI to non-oil exports. Also, the findings of Nasreen (2011) disagree with the present finding by establishing a bi-directional causality relationship between non-oil export and economic growth. A uni-directional causality relationship runs from capital stock to economic growth. Also, a uni-directional causality relationship runs from economic growth to labor force.

This study therefore recommends for the formulation of pragmatic policies aimed at re-inventing in the non-oil sector, especially the agro-allied sector for better economic growth. Hence, there is need to reinforce the existing policies on non-oil sector for more diversification of the economy which will yield better outcomes.

References

1. Abou-Strait, F. (2005). *Are Exports The Engine Of Economic Growth? An Application of Cointegration and Causality Analysis for Egypt, 1977-2003*. African Development Bank, Economic Research Working Paper.
2. Abogan, O.P., Akinola, E.B. & Baruwa, O.I. (2014). Non-oil export and Economic growth in Nigeria (1980-2011), *Journal of Research in Economics and International Finance*, 3 (1), pp. 1-11.
3. Adebile, A.S. & Amusan, A.S. (2011). The Non-Oil Sector and The Nigeria: A case study of Cocoa export since 1960, *International Journal of Asian Social Science*, 5, pp. 142-151.
4. Adesoji, A.A. & Sotubo, O.D. (2013). Non-Oil Exports in the Economic Growth of Nigeria: A Study of Agricultural and Mineral Resources, *Journal of Educational and Social Research*, 3 (2).
5. Akmal, M.S., Ahmad, K. & Ali, M. (2013). *Export-Led Growth Hypothesis in Pakistan: Further Evidence*. Munich Personal RePEc Archive, MPRA paper 16043. Available at: Mpra.ub.uni-muenchen.de/16043/. Retrieved on 6/11/2014.
6. Alesina, A. & Rodrik, D. (1999). Distributive politics and economic growth, *Quarterly Journal of Economics*, 109, pp. 443-465.
7. Central Bank of Nigeria (2012). *Statistical Bulletin*. Available at: www.centralbank.org.
8. Feder, G. (1982). On export and economic growth, *Journal of Development Economist*, 12, pp. 59-73.
9. Gylfason, T. (2001). *Lessons from the Dutch Disease Causes, Treatment, and Cures*. Institute of Economic Studies. Working paper series, W01:06.
10. Gylfason, T. & G. Zoega (2002). *Natural Resources and Economic Growth: The Role of Investment*. Working Paper No. 142, Central Bank of Chile.
11. Grossman, G. & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge, M.A.: The MIT Press.
12. Hassan, M.A. (2011). An Econometric Analysis of Export-Led Growth Hypothesis: Reflections from Pakistan, *Interdisciplinary Journal of contemporary Research in Business*, 2 (12).
13. Hailegiorgis, B.A. (2012). The Effect of Export-Led Growth Strategy on the Ethiopian Economy, *American Journal of Economics*, 2 (3), pp. 50-56.
14. Hoeyi, P.K. & Dzansi, D.Y. (2014). The productive Ingenuity of the Human Factor in an Ambiguous Environment, *Mediterranean Journal of Social Sciences*, 5 (23), pp. 11-19.
15. Igwe, A., Edeh, C.E., Ukpere, W.I. (2014). Financial Deepening and Economic Growth in Nigeria (1981-2012), *Risk Governance & Control: Financial Market and Institutions*, 4 (4), pp. 120-125.
16. Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, *Econometrica*, 59 (6), pp. 1551-1580.
17. Kaldor, N. (1970). The Case of Regional Policies, *Scottish Journal of Political Economy*.
18. Krugman, P.R. (1997). *The Age of Diminished Expectation*, Cambridge: MIT Press.
19. Lucas, R.E. (1988). On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22, pp. 3-42.
20. Medina-Smith, E.J. (2001). *Is the Export Led Growth Hypothesis Valid for the Developing Countries? A Case Study for Costa Rica*, Policy Issues in International Trade and Commodities, Study Series Number 7, United Nations Conference on Trade and Development.
21. Monir, S.M.M., Ebrahim, N. & Hamed, E.M. (2012). Survey of Oil and Non-oil Export Effects on Economic Growth in Iran, *Greener Journal of Economics and Accountancy*, 1 (1), pp. 008-018.

22. Nasreen, S. (2011). Export-Growth Linkages in Selected Asian Developing Countries: Evidence from Panel Data Analysis, *Asian Journal of Empirical Research*, 1 (1), pp. 1-13.
23. Okafor, F.O. (2014). *Economic and Financial Inclusion Strategies for Arresting Systemic Poverty amidst robust Economic growth in Nigeria*. A paper presented at the Accounting and Financing Research Association (AFRA) International Conference held at Abakaliki on 4th November, 2014.
24. Okoh, R. (2004). *Global Integration and the Growth of Nigeria's Non-oil Exports*, a paper presented at the African Conference, 21-22 March at Oxford, UK. Available at: www.csae.ox.ac.uk/conference, retrieved online on 8/11/2014.
25. Ogunkola, E.O. & Oyejide, T.A. (2001). Market Access for Nigeria's Exports in the European Union: An assessment of impact of the Lome Convention and Uruguay Round, *The Nigerian Journal of Economic and Social Studies*, 43 (1).
26. Ogunkola, E.O., Bankole, A.S., Adewuyi, A. (2008). *China-Nigeria Economic Relations, AERC Scoping Studies on China-Africa Relations* [Revised Report submitted to the African Economic Research Consortium (AERC), February, 2008]. Available at: www.aercafrica.org/documents/ china_africa_relations/Nigeria.pdf, pp. 2-3.
27. Olayiwola, K. & Okodua, H. (2013). Foreign Direct Investment, Non-Oil Exports, And Economic Growth in Nigeria: A Causality Analysis, *Asian Economic and Financial Review*, 3 (11), pp. 1479-1496.
28. Onodugo, V.A., Ikpe, M. & Anowor, O.F. (2013). Non-oil export and Economic Growth in Nigeria: a time series Econometric model, *International Journal of Business Management & Research*, 3 (2), pp. 115-124.
29. Onwualu, A.P. (2012). *Agricultural sector and National Development: focus on value chain Approach*. 5th Annual Lecture, Onitsha chamber of commerce.
30. Oyejide, T.A. (1986). *The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria*. Research Report 55 International Food Policy Research Institute, Washington, D.C.
31. Sachs, J. & Warner, A. (1995). Economic Reform and the Process of Global Integration, *Brookings Papers on Economic Activity*, 1, pp. 1-118.
32. Sachs, J.D. & Warner, A.M (1997). *Natural Resource Abundance and Economic Growth*. Center for International Development and Harvard Institute for International Development. An updated and extended version of our earlier NBER working paper with the same title (NBER #5398, October 1995).
33. Shah, R., Halder, A. & Rao, N.S.V.D. (2014). Economic Value Added: A Financial Flexibility Tool, *Corporate Ownership & Control*, 12 (1), pp. 703-708.
34. Smith, A. (1776). *An Inquiry into the Nature And Causes Of Wealth Of Nations*. New York: Random House, 1937.
35. Solow, R. (1957). A contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70, pp. 65-94.
36. Sorsa, P. (1999). *Algeria – The Real Exchange Rate, Export Diversification, and Trade Protection*. Policy Development and Review Department, International Monetary Fund.
37. Usman and Salami (2008). The contribution of Nigerian Export-Import (NEXIM). Bank towards export (Non-Oil Growth in Nigeria (19990-2005), *International Business Management*, 2 (3), pp. 85-90.
38. Usman, O.A. (2010). Non-Oil Export Determinant and Economic Growth Nigeria (1988-2008), *European Journal of Business and Management*, 3 (3).

Appendix

Regression output for non-oil sector paper

Dependent variable: Log(*Y*)				
Method: least squares				
Date: 09/23/14, time: 19:30				
Sample: 1981 2012				
Included observations: 32				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	9.667505	0.270847	35.69366	0.0000
Log(*K*)	-0.030316	0.046693	-0.649259	0.5215
Log(*L*)	0.166095	0.037749	4.399980	0.0001
Log(*NX*)	0.176597	0.007675	23.01079	0.0000
R-squared	0.962977	Mean dependent var		12.75179
Adjusted *R*-squared	0.959010	S.D. dependent var		0.491502
S.E. of regression	0.099509	Akaike info criterion		-1.660664
Sum squared resid	0.277258	Schwarz criterion		-1.477447
Log likelihood	30.57062	Hannan-Quinn criter.		-1.599933
F-statistic	242.7620	Durbin-Watson stat		1.280747
Prob(*F*-statistic)	0.000000			

Unit root test for stationarity

Null hypothesis: Log(*Y*) has a unit root				
Exogenous: constant				
Lag length: 1 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			0.895224	0.9940
Test critical values:		1% level	-3.670170	
		5% level	-2.963972	
		10% level	-2.621007	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*Y*))				
Method: least squares				
Date: 09/23/14, time: 19:31				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
Log(*Y*(-1))	0.018138	0.020261	0.895224	0.3786
D(Log(*Y*(-1)))	0.382111	0.184493	2.071137	0.0480
C	-0.199122	0.254032	-0.783847	0.4400

R-squared	0.254282	Mean dependent var	0.049774
Adjusted *R*-squared	0.199043	S.D. dependent var	0.049381
S.E. of regression	0.044194	Akaike info criterion	-3.305795
Sum squared resid	0.052735	Schwarz criterion	-3.165676
Log likelihood	52.58693	Hannan-Quinn criter.	-3.260970
F-statistic	4.603347	Durbin-Watson stat	1.970703
Prob(*F*-statistic)	0.019044		

Null hypothesis: D(Log(*Y*)) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.358596	0.0209
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(Y),2)				
Method: least squares				
Date: 09/23/14, time: 19:32				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
D(Log(*Y*(-1)))	-0.535822	0.159538	-3.358596	0.0023
C	0.028080	0.010966	2.560732	0.0161
R-squared	0.287172	Mean dependent var		0.003036
Adjusted *R*-squared	0.261714	S.D. dependent var		0.051252
S.E. of regression	0.044037	Akaike info criterion		-3.343212
Sum squared resid	0.054300	Schwarz criterion		-3.249798
Log likelihood	52.14817	Hannan-Quinn criter.		-3.313328
F-statistic	11.28017	Durbin-Watson stat		2.040156
Prob(*F*-statistic)	0.002272			

Null hypothesis: Log(*K*) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.011024	0.2808
Test critical values:	1% level		-3.661661	
	5% level		-2.960411	
	10% level		-2.619160	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*K*))				
Method: least squares				
Date: 09/23/14, time: 19:34				
Sample (adjusted): 1982 2012				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
Log(*K*(-1))	-0.226461	0.112610	-2.011024	0.0537
C	2.406880	1.203889	1.999253	0.0550

R-squared	0.122388	Mean dependent var	-0.008708
Adjusted *R*-squared	0.092126	S.D. dependent var	0.472298
S.E. of regression	0.450017	Akaike info criterion	1.303276
Sum squared resid	5.872934	Schwarz criterion	1.395792
Log likelihood	-18.20078	Hannan-Quinn criter.	1.333434
F-statistic	4.044219	Durbin-Watson stat	1.712303
Prob(*F*-statistic)	0.053701		

Null hypothesis: D(Log(*K*)) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.021629	0.0003
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*K*),2)				
Method: least squares				
Date: 09/23/14, time: 19:34				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
D(Log(*K*(-1)))	-0.946540	0.188493	-5.021629	0.0000
C	-0.000439	0.088713	-0.004945	0.9961
R-squared	0.473850	Mean dependent var		0.001084
Adjusted *R*-squared	0.455059	S.D. dependent var		0.658217
S.E. of regression	0.485896	Akaike info criterion		1.458698
Sum squared resid	6.610671	Schwarz criterion		1.552111
Log likelihood	-19.88047	Hannan-Quinn criter.		1.488582
F-statistic	25.21676	Durbin-Watson stat		1.999780
Prob(*F*-statistic)	0.000026			

Null hypothesis: Log(L) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.119381	0.6954
Test critical values:	1% level		-3.661661	
	5% level		-2.960411	
	10% level		-2.619160	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*L*))				
Method: least squares				
Date: 09/23/14, time: 19:36				
Sample (adjusted): 1982 2012				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
Log(*L*(-1))	-0.110457	0.098677	-1.119381	0.2722
C	1.164733	1.021354	1.140381	0.2635
R-squared	0.041418	Mean dependent var		0.025658
Adjusted *R*-squared	0.008363	S.D. dependent var		0.489634
S.E. of regression	0.487582	Akaike info criterion		1.463623

Sum squared resid	6.894344	Schwarz criterion		1.556139
Log likelihood	-20.68616	Hannan-Quinn criter.		1.493781
F-statistic	1.253015	Durbin-Watson stat		2.160051
Prob(*F*-statistic)	0.272163			

Null yypothesis: D(Log(*L*)) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.200624	0.0000
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*L*),2)				
Method: least squares				
Date: 09/23/14, time: 19:37				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
D(Log(*L*(-1)))	-1.158098	0.186771	-6.200624	0.0000
C	0.029631	0.091532	0.323720	0.7486
R-squared	0.578616	Mean dependent var		-0.004389
Adjusted *R*-squared	0.563567	S.D. dependent var		0.757520
S.E. of regression	0.500441	Akaike info criterion		1.517688
Sum squared resid	7.012363	Schwarz criterion		1.611101
Log likelihood	-20.76532	Hannan-Quinn criter.		1.547571
F-statistic	38.44774	Durbin-Watson stat		2.016605
Prob(*F*-statistic)	0.000001			

Null hypothesis: Log(*NX*) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG=1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.632269	0.8491
Test critical values:	1% level		-3.661661	
	5% level		-2.960411	
	10% level		-2.619160	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*NX*))				
Method: least squares				
Date: 09/23/14, time: 19:38				
Sample (adjusted): 1982 2012				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
Log(*NX*(-1))	-0.021674	0.034279	-0.632269	0.5322
C	0.438092	0.333602	1.313216	0.1994
R-squared	0.013598	Mean dependent var		0.233428
Adjusted *R*-squared	-0.020416	S.D. dependent var		0.444718
S.E. of regression	0.449235	Akaike info criterion		1.299798
Sum squared resid	5.852541	Schwarz criterion		1.392313
Log likelihood	-18.14687	Hannan-Quinn criter.		1.329956
F-statistic	0.399765	Durbin-Watson stat		2.314351
Prob(*F*-statistic)	0.532165			

Null hypothesis: D(Log(*NX*)) has a unit root				
Exogenous: constant				
Lag length: 0 (Automatic based on SIC, MAXLAG = 1)				
			t-statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.988129	0.0000
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	
*MacKinnon (1996) one-sided *p*-values.				
Augmented Dickey-Fuller test equation				
Dependent variable: D(Log(*NX*),2)				
Method: least squares				
Date: 09/26/14, time: 11:44				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
D(Log(*NX*(-1)))	-1.225844	0.175418	-6.988129	0.0000
C	0.313448	0.088410	3.545384	0.0014
R-squared	0.635578	Mean dependent var		0.015960
Adjusted *R*-squared	0.622563	S.D. dependent var		0.690817
S.E. of regression	0.424410	Akaike info criterion		1.188106
Sum squared resid	5.043465	Schwarz criterion		1.281520
Log likelihood	-15.82160	Hannan-Quinn criter.		1.217990
F-statistic	48.83394	Durbin-Watson stat		1.940491
Prob(*F*-statistic)	0.000000			

Johansen cointegration test

Date: 09/23/14, time: 19:42				
Sample (adjusted): 1983 2012				
Included observations: 30 after adjustments				
Trend assumption: Linear deterministic trend				
Series: *Y K L NX*				
Lags interval (in first differences): 1 to 1				
Unrestricted cointegration rank test (trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.726993	68.81399	47.85613	0.0002
At most 1 *	0.467595	29.86628	29.79707	0.0491
At most 2	0.259831	10.95574	15.49471	0.2142
At most 3	0.062290	1.929452	3.841466	0.1648
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) *p*-values				
Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized		Max-eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None *	0.726993	38.94771	27.58434	0.0012
At most 1	0.467595	18.91054	21.13162	0.0995
At most 2	0.259831	9.026288	14.26460	0.2840
At most 3	0.062290	1.929452	3.841466	0.1648
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) *p*-values				
Unrestricted cointegrating coefficients (normalized by b'*S11*b=I):				
Y	K	L	NX	
4.04E-06	-8.02E-05	3.29E-05	9.05E-06	
1.66E-05	-3.67E-06	4.81E-05	-4.12E-05	

1.24E-05	3.76E-05	-5.69E-05	-3.41E-07	
-6.94E-06	2.62E-06	2.04E-05	1.89E-05	
Unrestricted adjustment coefficients (alpha):				
D(*Y*)	6500.912	2111.467	4384.422	1616.460
D(*K*)	7385.017	5588.210	716.0097	-1352.375
D(*L*)	-962.6575	1881.558	8160.893	-2107.160
D(*NX*)	-1057.176	13489.01	7755.696	1981.001
1 Cointegrating equation(s):		Log likelihood	-1304.508	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	*K*	*L*	*NX*	
1.000000	-19.87472	8.148034	2.243377	
	(2.74726)	(2.59977)	(0.92792)	
Adjustment coefficients (standard error in parentheses)				
D(*Y*)	0.026235			
	(0.00979)			
D(*K*)	0.029803			
	(0.00897)			
D(*L*)	-0.003885			
	(0.01509)			
D(*NX*)	-0.004266			
	(0.02155)			
2 Cointegrating equation(s):		Log likelihood	-1295.052	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	*K*	*L*	*NX*	
1.000000	0.000000	2.838062	-2.536497	
		(0.83633)	(0.39198)	
0.000000	1.000000	-0.267172	-0.240500	
		(0.10789)	(0.05057)	
Adjustment coefficients (standard error in parentheses)				
D(*Y*)	0.061279	-0.529175		
	(0.04079)	(0.19175)		
D(*K*)	0.122550	-0.612862		
	(0.03259)	(0.15320)		
D(*L*)	0.027343	0.070298		
	(0.06353)	(0.29862)		
D(*NX*)	0.219609	0.035225		
	(0.07812)	(0.36724)		
3 Cointegrating equation(s):		Log likelihood	-1290.539	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	*K*	*L*	*NX*	
1.000000	0.000000	0.000000	-1.148002	
			(0.26283)	
0.000000	1.000000	0.000000	-0.371212	
			(0.04702)	
0.000000	0.000000	1.000000	-0.489241	
			(0.09246)	
Adjustment coefficients (standard error in parentheses)				
D(*Y*)	0.115666	-0.364524	0.065805	
	(0.04674)	(0.19626)	(0.18030)	
D(*K*)	0.131432	-0.585973	0.470800	
	(0.04016)	(0.16863)	(0.15492)	
D(*L*)	0.128576	0.376769	-0.405563	
	(0.07020)	(0.29475)	(0.27079)	
D(*NX*)	0.315816	0.326480	0.172527	
	(0.09059)	(0.38037)	(0.34945)	

Vector error correction estimates				
Date: 09/23/14, time: 19:46				
Sample (adjusted): 1984 2012				
Included observations: 29 after adjustments				
Standard errors in ( ) & *t*-statistics in [ ]				
Cointegrating Eq:	CointEq1	CointEq2		
Log(*Y*(-1))	1.000000	0.000000		
Log(*K*(-1))	0.000000	1.000000		
Log(*L*(-1))	-0.160896	-0.574393		
	(0.02110)	(0.03687)		
	[-7.62559]	[-15.5773]		
Log(*NX*(-1))	-0.165176	-0.114378		
	(0.00988)	(0.01726)		
	[-16.7224]	[-6.62595]		
C	-9.501468	-3.593838		
Error correction:	D(Log(*Y*))	D(Log(*K*))	D(Log(*L*))	D(Log(*NX*))
CointEq1	-0.048746	1.331930	3.158521	2.130258
	(0.07209)	(1.27137)	(0.98384)	(1.33530)
	[-0.67613]	[1.04763]	[3.21039]	[1.59534]
CointEq2	-0.141823	-0.544791	-0.581429	0.131590
	(0.02398)	(0.42283)	(0.32720)	(0.44409)
	[-5.91494]	[-1.28845]	[-1.77697]	[0.29632]
D(Log(*Y*(-1)))	-0.052068	-3.070042	-4.432281	-0.382948
	(0.15850)	(2.79509)	(2.16296)	(2.93564)
	[-0.32851]	[-1.09837]	[-2.04917]	[-0.13045]
D(Log(*Y*(-2)))	-0.393241	0.874653	-1.081103	-1.134286
	(0.15744)	(2.77644)	(2.14854)	(2.91606)
	[-2.49768]	[0.31503]	[-0.50318]	[-0.38898]
D(Log(*K*(-1)))	0.035747	0.343611	0.813140	-0.513294
	(0.02063)	(0.36387)	(0.28158)	(0.38217)
	[1.73246]	[0.94432]	[2.88779]	[-1.34312]
D(Log(*K*(-2)))	0.056781	0.123255	0.630076	0.125575
	(0.01831)	(0.32294)	(0.24991)	(0.33918)
	[3.10061]	[0.38166]	[2.52126]	[0.37023]
D(Log(*L*(-1)))	-0.065376	-0.319818	-0.723620	0.215662
	(0.01928)	(0.33999)	(0.26310)	(0.35709)
	[-3.39094]	[-0.94067]	[-2.75037]	[0.60395]
D(Log(*L*(-2)))	-0.062507	-0.117047	-0.611647	-0.113732
	(0.01508)	(0.26590)	(0.20577)	(0.27927)
	[-4.14547]	[-0.44019]	[-2.97253]	[-0.40724]
D(Log(*NX*(-1)))	-0.033048	0.179063	0.226669	0.032425
	(0.01588)	(0.28012)	(0.21677)	(0.29421)
	[-2.08050]	[0.63923]	[1.04566]	[0.11021]
D(Log(*NX*(-2)))	-0.019632	0.414746	0.307341	0.276644
	(0.01285)	(0.22661)	(0.17536)	(0.23800)
	[-1.52777]	[1.83025]	[1.75264]	[1.16236]
C	0.091775	-0.013940	0.200038	0.249377
	(0.01343)	(0.23686)	(0.18329)	(0.24877)
	[6.83298]	[-0.05886]	[1.09138]	[1.00246]
R-squared	0.820070	0.521841	0.740249	0.361282
Adj. *R*-squared	0.720109	0.256198	0.595943	0.006438
Sum sq. resids	0.009911	3.082194	1.845726	3.399962
S.E. equation	0.023465	0.413803	0.320219	0.434611
F-statistic	8.203879	1.964441	5.129717	1.018143
Log likelihood	74.58091	-8.645235	-1.210079	-10.06801
Akaike AIC	-4.384891	1.354844	0.842074	1.452966
Schwarz SC	-3.866261	1.873473	1.360704	1.971596

Mean dependent	0.054014	0.014006	0.034932	0.253976
S.D. dependent	0.044354	0.479805	0.503763	0.436017
Determinant resid covariance (dof adj.)		1.20E-06		
Determinant resid covariance		1.78E-07		
Log likelihood		60.71902		
Akaike information criterion		-0.601312		
Schwarz criterion		1.850391		

Pairwise Granger causality tests		
Date: 09/26/14, time: 11:14		
Sample: 1981 2012		
Lags: 2		

Null hypothesis:	Obs	*F*-statistic	Prob.
Log(*K*) does not Granger cause Log(*Y*)	30	9.91186	0.0007
Log(*Y*) does not Granger cause Log(*K*)		2.18960	0.1330
Log(*L*) does not Granger cause Log(*Y*)	30	1.55332	0.2313
Log(*Y*) does not Granger cause Log(*L*)		3.62212	0.0416
Log(*NX*) does not Granger cause Log(*Y*)	30	0.85806	0.4361
Log(*Y*) does not Granger cause Log(*NX*)		0.36639	0.6969
Log(*L*) does not Granger cause Log(*K*)	30	2.83781	0.0775
Log(*K*) does not Granger cause Log(*L*)		3.12260	0.0616
Log(*NX*) does not Granger cause Log(*K*)	30	1.39290	0.2670
Log(*K*) does not Granger cause Log(*NX*)		2.39680	0.1116
Log(*NX*) does not Granger cause Log(*L*)	30	2.69564	0.0871
Log(*L*) does not Granger cause Log(*NX*)		0.46968	0.6306