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Capacity Utilization and the Role of Services Sector in Industrialization of Nigeria

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Abstract

This paper investigates the impact of average manufacturing capacity utilization and the role of the services sector on industrial development in Nigeria from 1981 to 2015. Quantitative research technique based on ex-post facto research design was adopted for the study. The study also employed cross -sectional time-series alongside the co-integration and error correction mechanism as analytical tools. Results show that transportation and utility services have significant effect on industrial production index. This implies that services industry should be boosted in the push for industrialization in Nigeria. When industrial productivity was disaggregated, results show that capacity utilization and the service sector variables have significant effect on crude petroleum and natural gas while all the services variables have significant effect on solid minerals except transportation services and average capacity manufacturing utilization has significant impact on solid minerals development. However, all the explanatory variables have no significant effect on manufacturing sub-sector. The cointegration estimation evidence confirms that there is a long run positive relationship between index of industrial productivity and average manufacturing capacity utilization and the services sector in Nigeria. The vector error correction model result suggests that the short-run disequilibrium in the model would be corrected to the tune of 16% in the *next period. The causality result shows that at lag 2, that growth in capacity utilization would lead to growth in industrial production index. The study concludes that average manufacturing capacity utilization and the services sector hold the key to the industrialization process in Nigeria.*

Keywords: *Capacity Utilization, Services Sector, Industrialization, Industrial Development, Manufacturing Capacity and Nigeria.*

Introduction

Nigeria's economic aspirations have remained that of altering the structure of production and consumption patterns, diversifying the economic base and reducing dependence on oil, with the aim of putting the economy on a part of sustainable, all-inclusive and non-inflationary growth. The implication of this is that while rapid growth in output, as measured by the real gross domestic product (GDP), is important, the transformation of the various sectors of the economy is even more critical. This is consistent with the growth aspirations of most developing countries, as the structure of the economy is expected to change as growth progresses (Sanusi, 2010). Interestingly, modern manufacturing processes are characterized by high technological innovations, the development of managerial and entrepreneurial talents and improvement in technical skills which normally promote productivity and better living conditions. In recognition of this, successive governments in Nigeria have continued to articulate policy measures and programme to achieve industrial growth and development. This cannot be attained until manufacturing capacity is utilized to a reasonable extent. Fabayo (1982), coined capacity under-utilization as a phenomenon which obtains when for one reason or the other, an industry is unable to fully utilize its installed scale of plant on a sustained basis. The manufacturing capacity utilization in the late 1970s was as high as 78.70 percent and nosedived to as low as 43.80 percent in the 1980s. Between 2000 and 2005, it oscillated around 34.60 and 52.78 percents respectively (Simon-Oke & Awoyemi, 2010).

The industrial sector of an economy is often regarded as the engine of growth and economic development largely due to its pivotal role in broadening

the productive base of the economy
and enhancing its revenue earning
capacity (Okoye, Nwakoby and Okorie, 2016). Nigeria would be classified as industrially underdeveloped nation. Yet a lot of efforts have been put into the industrialization process. Plan after plan, investment policies have been renewed, fine-tuned and at times completely revamped. Resources are abundant and investment opportunities are almost unlimited. Various industrial development policies, perspective plans and medium–term economic plans acknowledged the importance of the manufacturing sector in the economy. For instance, as stated in the nation's 4th Plan, manufacturing is capable of sustaining a minimum growth rate of 15% per annum, contributing over 7% to gross domestic product, promoting employment and enhancing the value of natural resources, to mention but a few (Obioma, Anyanwu & Kalu, 2015).

The history of industrial development and manufacturing in Nigeria is a classic illustration of how a nation could neglect a vital sector through policy inconsistencies and distractions attributable to the discovery of oil (Adeola, 2005). From a modest 4.8% in 1960, manufacturing contribution to GDP increased to 7.2% in 1970 and to 7.4% in 1975. In 1980 it declined to 5.4%, but then surged to a record high of 10.7% in 1985. By 1990, the share of manufacturing in GDP stood at 8.1% but fell to 7.9% in 1992; 6.7% in 1995 and fell further to 6.3% in 1997. As at 2001 the share of manufacturing in GDP dropped to 3.4% from 6.2% in 2000. However, it increased to 4.16% in 2011 which is less than what it was in 1960. Currently, Nigeria's manufacturing sector's share in the Gross Domestic Product (GDP) remains minuscule (CBN, 2011). Compare that to the strong manufacturing sectors in other emerging economies, where structural change has already occurred and where millions have been lifted out of poverty as a result: manufacturing contributes 20 percent of GDP in Brazil, 34 percent in China, 30 percent in Malaysia, 35 percent in Thailand and 28 percent in Indonesia (Ogbu, 2012).

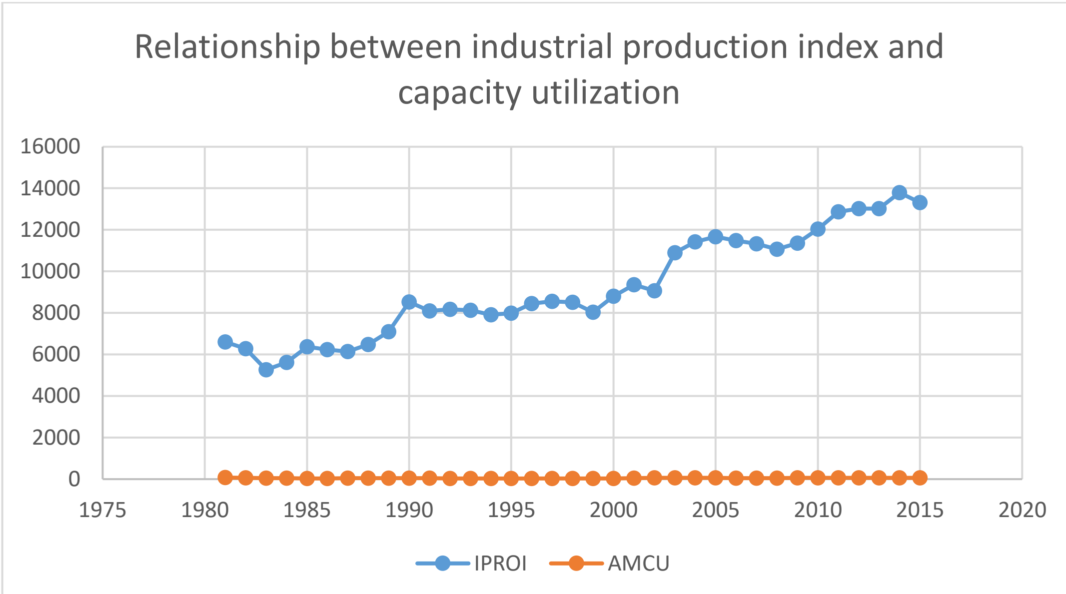

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Figure 1: Relationship between industrial production index and capacity utilization

The figure has shown that capacity utilization has not been contributing significantly to industrial production

The promotion of industrial development became a major challenge to the African continent during the1960s as the majority of African countries gained their independence at this time. The respective governments saw industrial development as a means for the continent to gain self-reliance and lower their dependence on the industrialized economies. The ideology and beliefs of Africa were based on the vision that industrialization would transform the African economies from traditional agrarian - to progressive and industrialized - based economies. Industrialization was perceived as an instrument of economic growth that will assist the continent to attain its macroeconomic objectives (high income, improved standard of living, self-reliance, job creation and balance of payment stability) (Aliya and Odoh, 2016).

Nigeria presents an example of a developing economy. The bulk of the gross domestic product is from the primary sector with agriculture carrying the greatest share. The oil and gas sector is a major player in the economy and contributes about 95% to the country's export earnings.

Compared to the industrial sector which only accounts for small portion (about 6%) of the economic activity. The manufacturing sector accounts for 4% of the

GDP. The Nigerian economy started experiencing serious difficulty in furthering its industrial development following the discovery of oil in the late 1960s. These difficulties can be attributed to: a weak raw material base (more attention was channeled into mining), inadequate technical manpower, poor policy implementation, poor entrepreneurship, political instability, corrupt government institutions and poor technical know-how (Chete, et al. 2014).

Against this background, the overall objective of this study is to appraise critically, the effect of capacity utilization and the role of services sector on industrialization process in Nigeria.

Literature Review

Conceptual Issues

Transportation, Communications, and Utilities Industry

The branch of manufacture and trade based on freight, transportation, communications, and utilities. Freight and transportation include railroads, trucking, and public transportation, including transit systems, highways, roads, and bridges. Communications include radio and television, but not newspapers and magazines (see manufacturing). Utilities include water, gas, electricity, sewage, and irrigation, including publically and privately owned infrastructure such as dams, and wastewater treatment plants.

Air Transportation Industry: All establishments engaged in furnishing domestic and foreign transportation by air and also those operating airports and flying fields and furnishing terminal services. This does not include establishments that may incidentally use airplanes, such as crop dusting and aerial photography.

Communications Industry: All establishments furnishing point-to-point communications services, whether intended to be received aurally or visually; and radio and television broadcasting. This also includes paging and beeper services, and microwave or satellite facilities. This does not include establishments that provide telephone answering services.

Electric, Gas, and Sanitary Service Industry: All establishments engaged in the generation, transmission and/or distribution of electricity or gas or steam. This also includes water and irrigation systems, and sanitary systems engaged in the collection and disposal of garbage, sewage, and other wastes by means of destroying or processing materials. This includes publically and privately owned infrastructure such as dams and wastewater treatment plants.

Highway Transportation: All public highways, roads, and bridges. This includes such related infrastructure as guardrails, streetlamps, rest stops, embankments, and sound barriers.

Local and Suburban Transit Industry: All establishments primarily engaged in furnishing local and suburban passenger transportation by bus, rail, or subway, either separately or in combination, and establishments engaged in furnishing highway passenger transportation and passenger terminal and maintenance facilities.

Motor Freight Transportation and Warehousing Industry: All establishments furnishing local or long-distance trucking or transfer services, or those engaged in the storage of farm products, furniture and other household goods, or commercial goods of any nature. This also includes terminal facilities for handling freight.

Pipelines, Except Natural Gas Industry: All establishments primarily engaged in the pipeline transportation of petroleum and other commodities. This does not include establishments primarily engaged in natural gas transmission

Railroad Transportation Industry: All establishments furnishing transportation by line-haul railroad, and switching and terminal establishments. This does not include railways serving single municipalities, contiguous municipalities, or a municipality and its suburban areas **Transportation Services Industry**: All establishments furnishing services incidental to transportation, such as forwarding and packing services, and the arrangement of passenger and freight transportation.

Nigerian Postal Service: All establishments of the Nigeria Postal Service. This does not include establishments transporting mail on a contract basis for the Nigerian Postal Service.

Water Transportation Industry: All establishments engaged in freight and passenger transportation on the open seas or inland waters, and establishments furnishing such incidental services as lighterage, towing, and canal operation. This also includes excursion boats, sightseeing boats, and water taxis.

Theoretical Underpinning

Manufacturing sector is very germane to the development of any nation most especially the underdeveloped ones. And over the years, Economists have for a long time discussed the causes of economic growth and the mechanisms behind it. The theory of the growth of conventional economy began with the neoclassical proposition of Solow (1956), which basically highlights issues such as "constant returns to scale, diminishing marginal productivity of capital, exogenously determined technical progress and substitutability between capital and labour". Consequently, Solow's initiative foregrounds the elements of savings and investment as important factor responsible for immediate growth in economy. For the long- time experience, progress and sophistication in technology is identified to be core, even though the foregoing is seen as „exogenous‟ to the economy concerned. Suffice to submit that even though the neoclassical growth approach favours labour and capital as indexes of growth in economy, other alternatives such as growth in technology, which is considered exogenous, have remained unexplored. This omission, as well as inconsistent practical evidence, has necessitated the quest for alternatives by researchers. Specifically, the contribution of progress in technology as an important stimulus to sustainable economic growth has been continuously adopted when regular and progressive returns to capital are emphasized.

These approaches, called endogenous growth theories, posits that the application of novel accumulative indexes will engender self –sustaining economic growth. These indexes include knowledge, innovation etc. Romer (1986) and Lucas (1988) have made reliable inputs along the line being pursued. Romer presents a formal model that yields positive, long run growth rates on the basis of technological progress driven by the role of externalities, arising from learning by doing and knowledge spillover. Lucas suggests a model where human capital is believed to be highly supportive of economic growth that is devoid of redundant physical capital accumulation. The works of the duo of Romer and Lucas have signalled the impact of technological advancement on economic growth. Based on the above, new knowledge (Romer, 1990; Grossman and Helpman, 1991) innovation (Aghion and Howitt, 1992) and public infrastructure (Barro, 1990) are recognized as important sources of growth. As a result, and in contrast to the neoclassic counterpart, policies are deemed to play a substantial role in advancing growth on a long-run basis. Dwelling on the polemic of convergence/ divergence, the endogenous growth approach offers that notwithstanding the appreciable returns to scale, convergence would not take place. The adaptation of endogenous growth theory has gone beyond the national sphere to regional space (Magrini, 1997). One thing that is central to neoclassical and endogenous growth models is investment. However, whereas the former influences periods of transition, the latter produce more enduring results. The emphasis placed on investment by these approaches has resulted into huge practical enquiries targeted at unpacking the connection of investment and economic growth. However, we have interwoven results.

Empirical Literature Review

Kormendi and Meguire (1985), examining 47 countries in the period 1950-1977, have found that investment-to-income ratio is critical for economic growth. De-Long and Summers (1991) provided cross-country evidence that high levels of equipment investment for the period 1960-85 are linked to high levels of GDP per worker growth over this period, while non-equipment investment does not seem to relate to economic growth. In order to handle the problem of causality, the above researchers have used instrumental variables suggesting that investment drives growth. Levine and Renelt (1992) have concluded that investment is one of the few robust factors affecting growth. The robustness of investment in cross-country regressions has also, been shown by Sala-i-Martin (1997). This positive and significant relationship has been found in a wide range of studies using both cross-section and panel analysis (e.g. (Mankiw *et al.*, 1992; Barro and Sala-i-Martin, 1995; Caselli *et al.*, 1996)). However, such findings have been criticized for several reasons. Auerbach *et al.* (1994) criticize De Long and Summers's work on the grounds of empirical robustness problems, while Blomstrom *et al.* (1996) suggest that the causality link runs in the opposite direction for a sample of 101 countries. Podrecca and Carmeci (2001), using panel data, show that causality between investment and growth runs in both directions, while Easterly and Levine (1997) finds an ambiguous role for investment using panel data analysis.

Chenery (1960) suggested a stable arrangement of industrial sector improvement. He believed that, as industrial sector development continues, changes are generally noticed in economic structures. An increase in the relative importance of the industrial sector leads to changes in the production methods and sources of supply for industrial produces.

Tamuno and Edoumiekumo (2012) determined production functions using constant substitution of electricity to the Nigerian industrial sector which was centered on a study of the industrial sector from 1962-1975 and discovered that labor and capital have a positive relationship and are also of economic and political importance. They also found that the substitution level in the Nigerian industrial sector is very low.

Clunies-Ross et al., (2010) state that the industrial growth, or basically industrialization, has two different meanings. It can be perceived as a change in a country's form of production and work force towards producing or minor industries. Relating it to income levels attaining certain level. On this basis nations can be grouped into different income levels (high-income, higher upper income, lower upper income, higher middle income, lowers middle income and the low income countries). This is a larger element of industrialization.

There are works relating to industrial development and economic growth. Blomstrom et al., (1994) suggest that industrial development through foreign investors can have a positive influence on economic growth level. They claimed that the industrial development contribution to economic growth level is dependent upon a critical minimum level of income. Below this level the contribution of industries to economic growth is insignificant and above this level, it is significant. The reason given is that, countries that have attained certain level of income are those that can benefit efficiently from the experience of those overseas industries and foreign stakeholders with which they come in contact. The benefits include managerial skills, human capital improvement and new technologies.

Shafaeddin (2005) evaluates the economic performance of unindustrialized countries that have commenced economic transformations since the early 80s with the motive of increasing exports and broadening their industrialized sector. The findings obtained were significantly different to those of Clunies-Ross et al. Forty percent of the model economies achieved a very rapid improvement in the export of produced goods. For some of the sample economies, mainly those from Eastern Asia, speedy export growth was also followed by a rapid increase of industrial supply capability.

However, the performance of most of the sample economies, mainly those from Latin America and Africa is unsatisfactory. Half of the sample economies suffered poor industrialization. Poor export growth and poor industrialization was followed by a weakening of the economy, mostly the industrial sector, to external influences mainly as far as depending on imports is concerned. Most industries that had been successful during the import substitution period survived. Although, to be successful in production there had to be active exports and high investment.

The import replacing industrial development approach which became popular due to Hirschman's (1958) - 'unstable growth principle' has been often been directed to focus on the most well-known - but nevertheless - wrong industries so that, many developing economies did not simply continue to be unstable but became unstable in in the wrong way due supporting just those sectors having the highest comparative disadvantage.

Empirical Evidences on Transport Services and Economic Growth

To access the contribution of road infrastructure to economic growth, a number of studies specified an aggregate production function that included transportation infrastructures among the explanatory variables. Antle in Uwagboe (2011), for example estimated a Cobb-Douglas production function for 47 developing countries and 19 developed countries. Infrastructure was specified as gross national output from transportation and communication industries per square kilometer of land area. Antle found that transportation infrastructure was an effective factor of production. Canning and Bennathan (2000), using cointegration methods, estimated the rate of returns to paved roads for a period of 41 countries over the past four decades. Canning found out that the highest rate of return to roads infrastructure occurs in countries with infrastructures shortages. Canning and Bennathan also analyzed whether physical capital, labour and other infrastructure variables are complement or substitute to road is highly correlated with physical and human capital. He however found that the margined return to roads decline rapidly if the length of paved roads increased in Isolation from other inputs. A study carried out by Fan et al. on the impact of road investment a promoting production growth in China consistently showed the importance of road investments in promoting production growth in China (Fan S, and Chan-Kang 2005).

Empirical Evidences on Telecommunications Service and Economic Growth

Despite the obvious policy relevance of telecommunication infrastructure, there are far few studies that accentuated on the specific impact of telecommunications on economic growth. Using data for over 15 developed and 45 developing nations from 1960 to 1973, Hardy (2014) regressed Gross Domestic product per capital on lagged telephone per capita and the number of lagged radios. He concluded that telephone per capita do have a significant impact on GDP, whereas the spread of radio does not. However, when the regression was attempted for developed and developing economies separately, no significant effects occurred. Calderon and Serven (2004) employed the causality and reverse causality analysis to confirm the existence of feedback process in which economic activities and growth stimulates demand for telecommunication services. As the economy grows, more telecommunication facilities are needed to conduct the increased business transactions in Calderon and Serven investigated this relationship at the state and sub state levels of United States. This study confirm at both the state and country's level using data from the state of Pennsylvania, USA, that telecommunication investment affects economic activities and that economic activities can also affects telecommunication investment. Roller and Waverman (2001) on their part estimated the impact of telecommunication infrastructures on economic growth from 21 OECD countries over the past 20 years using simultaneous approach. After accounting for simultaneity and country specific fixed effect, Roller and Waverman found that the impact between telecommunication infrastructure and aggregated output was much reduced and statistically insignificant.

Methodology and Data

In an attempt to model the effect of manufacturing capacity utilization and service sector on industrial development in Nigeria, Quantitative research technique based on ex-post facto research design would be adopted for the study. The study set out that Index of industrial development will be the function of Industrial contribution to GDP, Agriculture contribution to GDP, capacity utilization, and service sector variables which include: transport, communication, utilities (electricity and water), hotel and restaurant, finance and insurance, real estate and business services; producers of government services (public administration, education and health), community, social and peers services (private non-profit organizations, other Services and broadcasting) (the Independent variables). The baseline model which follows the study by Simon-Oke & Awoyemi (2010) is stated as:

$IIDt = \psi_0 + \psi_1 CUT + \psi_1 SEV + V_i$ -- (1)

where, IID is Index of industrial development, CUT is a vector for capacity utilization variables, SEV is a vector for service sector variables (transport services, communication services and utility services) and V_i is the stochastic error term. This would be expanded in the course of the study.

The time series properties of the data as well as their short and long-run dynamics would be examined. The Augmented Dickey-Fuller (ADF) unit root tests would be used to test for stationarity of the data. Johansen (1990) method would be adopted in testing for co-integration while the vector error correction mechanism (VECM) would be used to capture the short and long-run relationship between endogenous and exogenous variables.

In this study, we would also employ cross -sectional time-series data as used by Baltagi (2008). The implicit representation of the model is expressed as:

$$Y_{it} = \lambda_1 + \sum_{j=2}^{k} \lambda j\, X_{jit} + \sum_{p=1}^{s} \psi_p W_{pi} + \varphi t + \varepsilon_{it} \text{ --- } (2)$$

where Y is the dependent variable, the X_j are observed explanatory variables, and φ_t the are unobserved explanatory variables. The index "i" represents the unit of observation, "t" stands for the time period; "j" and "p" stand for the difference between observed and unobserved explanatory variables. ε is an error term or a random variable that had well-defined probabilistic properties.

Because the variables are unobserved, there is no means of obtaining information about the Σsp = 1 component of the model and it is convenient to rewrite equation 1 as:

$$Y_{it} = \lambda_1 + \sum_{j=2}^{k} \lambda j\, X_{jit} + \alpha_i + \varphi t + \varepsilon_{it} \text{ --- } (3)$$

$$\alpha_i = \sum_{p=1}^{s} \psi_p W_{pi} \text{ --- } (4)$$

α_i, known as the unobserved effect, represents the joint impact of the on Y_i. Conveniently, the unit of observation will now be referred to as an
individual, and to the αi as the individual-specific unobserved effect, but it should be borne in mind that the individual in question may actually be a household or an enterprise, etc. If αi is correlated with any of the Xj variables, the regression estimates from a regression of Y on the Xj variables will be subject to unobserved heterogeneity bias. Even if the unobserved effect is not correlated with any of the explanatory variables, its presence will in general cause Ordinary Least Square (OLS) to yield inefficient estimates and invalid standard errors. To overcome this problem, the two main approaches to the fitting of models using panel data, known as fixed effects regressions, and

random effects regressions are employed. For the fixed effects approach, the first differences regression model, the unobserved effect is eliminated by subtracting the observation for the previous time period from the observation for the current time period, for all time periods. The model may be written for individual “i” in time period “t” as

$$Y_{it} = \lambda_1 + \sum_{j=2}^{k} \lambda j \, X_{jit} + \varphi_t + \alpha_i + \varepsilon_{it} \text{ ----------------- } (5)$$

For the former time period, the relationship becomes:

$$Y_{it-1} = \lambda_1 + \sum_{j=2}^{k} \lambda j \, X_{jit-1} + \varphi_t\,(t-1) + \alpha_i + \varepsilon_{it-1} \text{ ----------------- } (6)$$

Subtracting (6) from (5), one obtains

$$\Delta Y_{it} = \sum_{j=2}^{k} \lambda j \, \Delta X_{jit} + \varphi_t + \varepsilon_{it} - \varepsilon_{it-1} \text{ ----------------- } (7)$$

$$Y_{it} = \lambda_1 + \sum_{j=2}^{k} \lambda j \, X_{jit} + \alpha_i + \varphi t + \varepsilon_{it} \text{ ----------------- } (8)$$

$$= \lambda_1 + \sum_{j=2}^{k} \lambda j \, X_{jit} + \varphi t + \acute{\omega}_{it} \text{ ----------------- } (9)$$

where

$$\acute{\omega}_{it} = \alpha_i + \varepsilon_{it} \text{ ----------------- } (10)$$

Consequent upon this, we have dealt with the unobserved effect by subsuming it into the disturbance term.

The second condition is that the variables are distributed independently of all of the Xj variables. If this is not the case, α, and hence, will not be uncorrelated with the Xj variables and the random effects estimation will be biased and inconsistent. Despite the fact that the first condition seems to be satisfied, yet, we would have to use fixed effects estimation.

If the two conditions are satisfied, we may use (equation 9) as our regression specification, but there is a complication. It needs to be tested for autocorrelation, therefore, we make use of an estimation technique to account for this. First, we will check the other regression model conditions relating to the disturbance term. Given our assumption that satisfies the usual regression model conditions, we can see that it satisfies the condition that its expectation be zero, since;

$E(\acute{\omega}_{it}) = E(\alpha_i + \varepsilon_{it}) = E(\alpha_i) + E(\varepsilon_{it}) = 0$ for both in "i" and "t" ----------------- (11)

Here we are assuming without loss of generality that E(αi) = 0, any nonzero component being absorbed by the intercept, β_1. This will also satisfy the condition that it should have constant variance, since;

$E(\acute{\omega}_{it}) = E(\alpha_i + \varepsilon_{it}) = E(\alpha_i) + E(\varepsilon_{it}) = 0$ for both in "i" and "t" ---------------- (11)

$\delta^2\acute{\omega}_{it} = \delta^2_{\alpha i + \varepsilon it} = \delta^2\alpha + \delta^2\varepsilon + 2\delta_{\alpha + \varepsilon} = \delta^2_{\alpha} + \delta^2_{\varepsilon}$ for both in "i" and "t" ---------- (12)

The term $\acute{\omega}_{it}$ is zero on the assumption that αi is distributed independently of Y_{it} and will also satisfy the regression model condition that it be distributed independently of the values of Xj, since both αi and ε_{it} are assumed to satisfy this condition.

In both equations 7 and 9

Y= Industrial production index (IPROI); i = entity; and t =time

X= Independent variables which are, capacity utilization, transport services, communication services and utility services.

The data that were used in this study were secondary (annual) data (1981-2015) from the Central Bank of Nigeria Statistical Bulletin (2015). For all the variables, their natural logarithmic values were used.

Results and Discussion

Pre-estimation test (Unit Root)

Non-stationarity being a common phenomenon with time series data, the variables means were not reverting and the variances were not constant. After using Augmented Dickey-Fuller test, results show that all the variables were stationary after the first difference showing mean reverting and constant variance properties (see appendix 1).

Table 1: Relationship between industrial production index, capacity utilization and services

Before Differencing

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6995.135	711.0552	9.837682	0.0000
AMCU	-53.45173	15.40505	-3.469754	0.0016
TRASVC	12.13850	2.819372	4.305391	0.0002
COMSVC	-0.889418	0.223759	-3.974893	0.0004
UTLSVC	17.48830	4.578860	3.819357	0.0006
Augmented Dickey Fuller test				

The results above show that all the variables have significant effect on industrial production index. This could be labeled spurious and if relied on, could misinform policy. What follows is the rate of change of the variables.

Table 2: Relationship between industrial production index, capacity utilization and services

After introducing logarithm but before differencing

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.734264	0.502789	15.38272	0.0000
LOG(AMCU)	-0.373104	0.077121	-4.837884	0.0000
LOG(TRASVC)	0.579836	0.163134	3.554348	0.0013
LOG(COMSVC)	-0.232732	0.087507	-2.659588	0.0124
LOG(UTLSVC)	0.248475	0.053462	4.647656	0.0001
Augmented Dickey Fuller test				

After introducing logarithm to obtain the rate of change, the study found that all the explanatory variables still have significant effect on industrial production index in Nigeria.

Table 3: Relationship between industrial production index, capacity utilization and services

After Differencing

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	152.9145	132.0489	1.158014	0.2563
D(AMCU)	16.03259	24.73155	0.648264	0.5219
D(TRASVC)	2.735025	0.569730	4.800563	0.0000
D(COMSVC)	0.142511	0.353637	0.402987	0.6899

D(UTLSVC)	3.932500	1.831057	2.147667	0.0223

Augmented Dickey-Fuller test

Results of table 3, show that transportation and utility services have significant effect on industrial production index. This implies that services industry should be boosted in the push for industrialization in Nigeria. However, average manufacturing capacity utilization is still low. This is why it has not provided the needed momentum for industrialization.

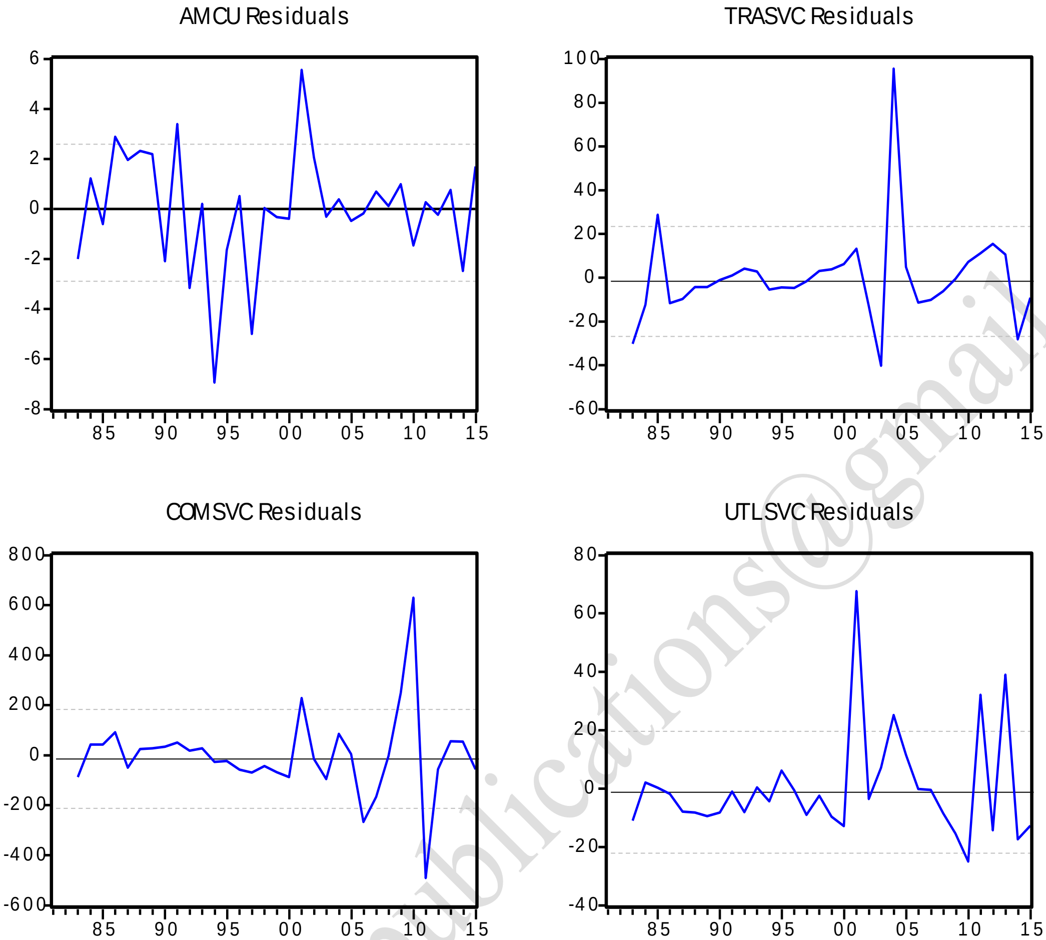
Table 4: Linear Deterministic trend (Johansen Cointegration)
Lags interval: 1 to 1

	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	Critical Value	Critical Value	No. of CE(s)
0.702595	79.28447	47.21	54.46	None **
0.531793	39.26667	29.68	35.65	At most 1 **
0.343841	14.22480	15.41	20.04	At most 2
0.009655	0.320165	3.76	6.65	At most 3

***(**) denotes rejection of the hypothesis at 5%(1%) significance level**

The Johansen cointegration result depicts that there is only one cointegrating equation in the system of equations and suggests that there exist a long-run relationship between industrial production index and the explanatory variables under investigation.

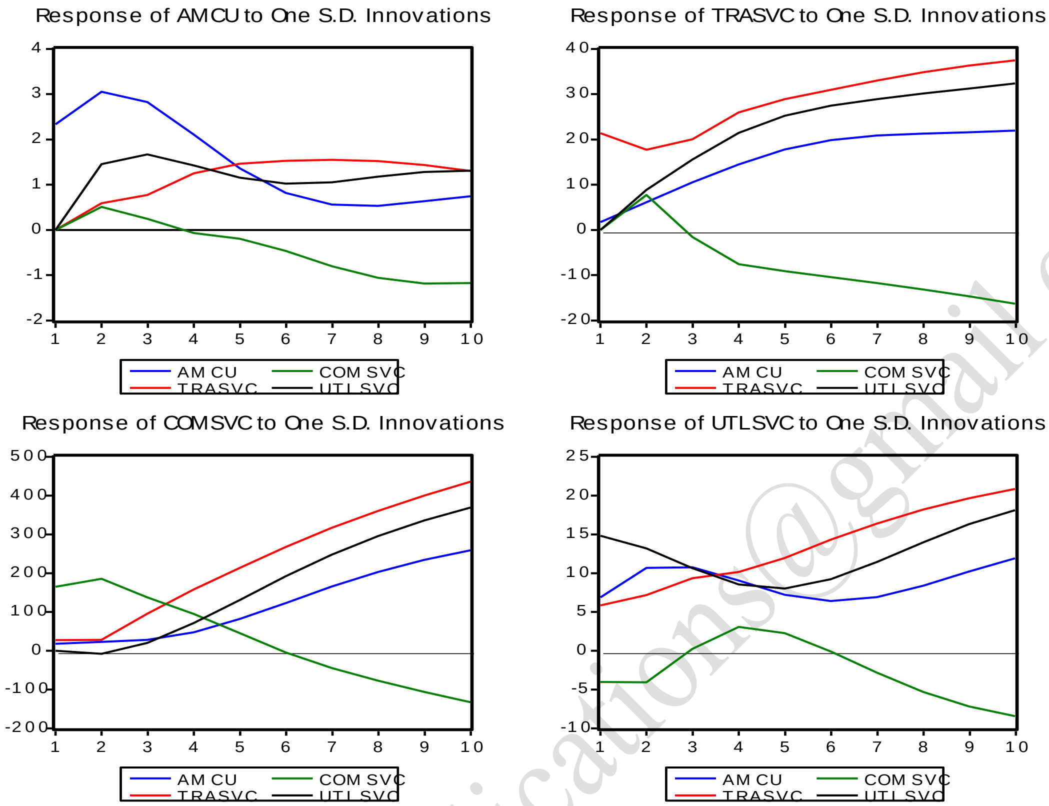
The vector error correction model result suggests that the short-run disequilibrium in the model would be corrected to the tune of 16% in the next period (see appendix 2)



Linear Deterministic trend (Johansen Cointegration)

Figure 2: Idiosyncratic error term graphs

The graphs suggest that the residuals of the variables are mean reversing.



Linear Deterministic trend (Johansen Cointegration)

Figure 3: Impulse response to shocks

The figure above suggests positive responses to shocks for all the explanatory variables except communication services which shocks in other variables affect negatively.

Table 5a: Causality result

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
AMCU does not Granger Cause IPROI	33	3.79633	0.03477
IPROI does not Granger Cause AMCU		2.77987	0.07920
TRASVC does not Granger Cause IPROI	33	1.44468	0.25286
IPROI does not Granger Cause TRASVC		5.76947	0.00798
COMSVC does not Granger Cause IPROI	33	0.77672	0.46957
IPROI does not Granger Cause COMSVC		2.52448	0.09818
UTLSVC does not Granger Cause IPROI	33	0.42106	0.66044

IPROI does not Granger Cause UTLSVC		2.08881	0.14271
Generated by the Author			

Table 5 shows that at lag 2, there is a unidirectional causality between average manufacturing capacity utilization and industrial production index. Simply put, growth in capacity utilization would lead to growth in industrial production index. Again, the study found that changes in industrial production index would cause a change in transport services (this is an interesting outcome).

Furthermore, at lag 4 the study found a similar outcome such as lag 2.

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
AMCU does not Granger Cause IPROI	31	4.00796	0.01368
IPROI does not Granger Cause AMCU		0.59658	0.66889
TRASVC does not Granger Cause IPROI	31	0.76066	0.56199
IPROI does not Granger Cause TRASVC		3.10191	0.03627
COMSVC does not Granger Cause IPROI	31	0.58746	0.67512
IPROI does not Granger Cause COMSVC		2.14838	0.10875
UTLSVC does not Granger Cause IPROI	31	1.48915	0.23963
IPROI does not Granger Cause UTLSVC		2.26153	0.09514
Generated by the Author			

Cross-sectional outcome

The study found that Grain Mills Products, Manufacture of Animal Feeds, Manufacture of Sugar, Sugar/Confectionery, Spirit, Carpets & Rugs; Cordage, Rope & Twine, Tan & Leather Finishing,

Manufacture of Pulp, Paper and Paperboard, and Motor Vehicles Assembly are the subsectors with the highest capacity utilization as at 2010. On the average, each of these sectors use above 70 percent of their installed capacity.

Industrial productivity components

The study attempted to disaggregate industrial productivity into crude petroleum and natural gas, solid minerals, and manufacturing sector. The study found that capacity utilization and the service sector variables have significant effect on crude petroleum and natural gas (see appendix 3).

Also, all the services variables have significant effect on solid minerals except transportation services. Again, average capacity manufacturing utilization has significant impact on solid minerals development.
Lastly, all the explanatory variables have no significant effect on manufacturing sub-sector. This could be attributed to poor business environment (see appendix 3).

Conclusion

The study concludes by arguing that the key to reversing the poor performance of Nigerian industrial output is by an increase in its investment in utility services (transport, communication, and electricity), adequate capacity utilization, importation of technology to boost local manufacturing. The study also agrees with Soderbom and Teal (2002) that more efficient manufacturing firms are more likely to export, more likely to invest and pay their workers more. A major ingredient in the successful transformation of most economies where there are sustained rises in per-capita incomes has been the growth in manufacturing output with attendant industrialization. An important policy issues facing Nigerian government is understanding and addressing factors that will enable efficiency of firms and their competitiveness to increase. The study believes that a comprehensive economic policy is immensely important for industrialization and that poor policy results in a bond of constraints from which escape is challenging, but not impossible. The study concludes that average manufacturing capacity utilization and the services sector hold the key to the industrialization process in Nigeria.

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APPENDIX

Stationarity Tests

UNIT ROOT IPROI

ADF Test Statistic	**-4.905741**	**1% Critical Value***		**-4.2712**
		5% Critical Value		-3.5562
		10% Critical Value		-3.2109
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(IPROI,2)				
Method: Least Squares				
Date: 08/02/17 Time: 14:46				
Sample(adjusted): 1984 2015				
Included observations: 32 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IPROI(-1))	-1.227159	0.250147	-4.905741	0.0000
D(IPROI(-1),2)	0.165264	0.178253	0.927128	0.3618
C	279.8838	219.2083	1.276794	0.2122
@TREND(1981)	1.052139	10.89939	0.096532	0.9238
R-squared	0.574066	Mean dependent var		16.74455
Adjusted R-squared	0.528431	S.D. dependent var		805.8051
S.E. of regression	553.3537	Akaike info criterion		15.58634

Sum squared resid	8573609.	Schwarz criterion	15.76956
Log likelihood	-245.3814	F-statistic	12.57931
Durbin-Watson stat	1.969387	Prob(F-statistic)	0.000022

ADF FOR AMCU

ADF Test Statistic	**-3.971430**	**1% Critical Value***		**-3.6496**
		5% Critical Value		-2.9558
		10% Critical Value		-2.6164
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(AMCU,2)				
Method: Least Squares				
Date: 08/02/17 Time: 14:49				
Sample(adjusted): 1984 2015				
Included observations: 32 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AMCU(-1))	-0.568974	0.143267	-3.971430	0.0004
D(AMCU(-1),2)	-0.082743	0.151518	-0.546093	0.5892
C	0.323892	0.563819	0.574462	0.5701
R-squared	0.421181	Mean dependent var		0.416390
Adjusted R-squared	0.381262	S.D. dependent var		4.023198
S.E. of regression	3.164643	Akaike info criterion		5.231018
Sum squared resid	290.4341	Schwarz criterion		5.368430
Log likelihood	-80.69628	F-statistic		10.55100
Durbin-Watson stat	2.066268	Prob(F-statistic)		0.000360

ADF FOR TRASVC

ADF Test Statistic	**-2.088047**	**1% Critical Value***		**-2.6369**
		5% Critical Value		-1.9517
		10% Critical Value		-1.6213
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(TRASVC,2)				
Method: Least Squares				
Date: 08/02/17 Time: 15:06				
Sample(adjusted): 1984 2015				
Included observations: 32 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TRASVC(-1))	-0.390225	0.186885	-2.088047	0.0454
D(TRASVC(-1),2)	-0.403007	0.164059	-2.456480	0.0200
R-squared	0.433508	Mean dependent var		2.135434
Adjusted R-squared	0.414625	S.D. dependent var		42.13985

S.E. of regression	32.24112	Akaike info criterion	9.844824
Sum squared resid	31184.69	Schwarz criterion	9.936432
Log likelihood	-155.5172	Durbin-Watson stat	2.086788

ADF FOR COMSVC

ADF Test Statistic	**-3.267113**		**1% Critical Value***	**-4.2712**
			5% Critical Value	-3.5562
			10% Critical Value	-3.2109
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(COMSVC,2)				
Method: Least Squares				
Date: 08/02/17 Time: 15:12				
Sample(adjusted): 1984 2015				
Included observations: 32 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(COMSVC(-1))	-0.658564	0.201574	-3.267113	0.0029
D(COMSVC(-1),2)	0.129642	0.186563	0.694897	0.4928
C	-145.2020	102.7826	-1.412710	0.1688
@TREND(1981)	16.27509	6.606179	2.463617	0.0202
R-squared	0.303799	Mean dependent var		14.17190
Adjusted R-squared	0.229206	S.D. dependent var		259.5855
S.E. of regression	227.9027	Akaike info criterion		13.81218
Sum squared resid	1454310.	Schwarz criterion		13.99540
Log likelihood	-216.9949	F-statistic		4.072760
Durbin-Watson stat	1.970247	Prob(F-statistic)		0.016090

ADF FOR UTLSVC

ADF Test Statistic	**-2.321491**		**1% Critical Value***	**-2.6369**
			5% Critical Value	-1.9517
			10% Critical Value	-1.6213
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(UTLSVC,2)				
Method: Least Squares				
Date: 08/02/17 Time: 15:25				
Sample(adjusted): 1984 2015				
Included observations: 32 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(UTLSVC(-1))	-0.454863	0.195936	-2.321491	0.0272
D(UTLSVC(-1),2)	-0.229509	0.178913	-1.282795	0.2094
R-squared	0.330492	Mean dependent var		-0.631730

Adjusted R-squared	0.308175	S.D. dependent var	27.34194
S.E. of regression	22.74194	Akaike info criterion	9.146760
Sum squared resid	15515.88	Schwarz criterion	9.238369
Log likelihood	-144.3482	Durbin-Watson stat	1.905901

COINTEGRATION

Date: 08/02/17 Time: 15:37				
Sample: 1981 2015				
Included observations: 33				
Test assumption: Linear deterministic trend in the data				
Series: AMCU TRASVC COMSVC UTLSVC				
Lags interval: 1 to 1				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.702595	79.28447	47.21	54.46	None **
0.531793	39.26667	29.68	35.65	At most 1 **
0.343841	14.22480	15.41	20.04	At most 2
0.009655	0.320165	3.76	6.65	At most 3
***(**) denotes rejection of the hypothesis at 5%(1%) significance level**				
L.R. test indicates 2 cointegrating equation(s) at 5% significance level				
Unnormalized Cointegrating Coefficients:				
AMCU	TRASVC	COMSVC	UTLSVC	
-0.017731	-0.003024	-7.04E-05	0.006174	
0.002264	0.000547	-0.000271	0.005169	
0.021057	-0.003886	0.000206	0.000943	
0.006101	0.001764	-0.000167	-0.001836	
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
AMCU	TRASVC	COMSVC	UTLSVC	C
1.000000	0.170561	0.003968	-0.348226	-75.54152
	(0.04799)	(0.00230)	(0.06516)	
Log likelihood	-593.2754			
Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)				

AMCU	TRASVC	COMSVC	UTLSVC	C
1.000000	0.000000	0.299907	-6.654684	149.5248
		(2.24710)	(49.8348)	
0.000000	1.000000	-1.735094	36.97484	-1319.566
		(13.1234)	(291.043)	
Log likelihood	-580.7544			
Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)				
AMCU	TRASVC	COMSVC	UTLSVC	C
1.000000	0.000000	0.000000	-0.009386	-44.58233
			(0.02156)	
0.000000	1.000000	0.000000	-1.471104	-196.5723
			(0.11213)	
0.000000	0.000000	1.000000	-22.15784	647.2237
			(1.71256)	
Log likelihood	-573.8021			

Disaggregated

PETR MODEL

Dependent Variable: LOG(PETR)				
Method: Least Squares				
Date: 08/02/17 Time: 16:21				
Sample: 1981 2015				
Included observations: 35				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.259075	0.739753	11.16464	0.0000
LOG(AMCU)	-0.458213	0.113469	-4.038241	0.0003
LOG(TRASVC)	0.637008	0.240019	2.653991	0.0126
LOG(COMSVC)	-0.450613	0.128749	-3.499942	0.0015
LOG(UTLSVC)	0.402364	0.078659	5.115293	0.0000
R-squared	0.764110	Mean dependent var		8.797063
Adjusted R-squared	0.732658	S.D. dependent var		0.232219
S.E. of regression	0.120069	Akaike info criterion		-1.269938
Sum squared resid	0.432496	Schwarz criterion		-1.047745
Log likelihood	27.22392	F-statistic		24.29448
Durbin-Watson stat	0.877929	Prob(F-statistic)		0.000000

SOLM MODEL

Dependent Variable: LOG(SOLM)
Method: Least Squares
Date: 08/02/17 Time: 16:41

Sample: 1981 2015				
Included observations: 35				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.061563	1.716963	-1.783127	0.0847
LOG(AMCU)	1.398610	0.263360	5.310641	0.0000
LOG(TRASVC)	-0.222699	0.557083	-0.399758	0.6922
LOG(COMSVC)	0.870187	0.298825	2.912025	0.0067
LOG(UTLSVC)	-0.801768	0.182567	-4.391630	0.0001
R-squared	0.730539	Mean dependent var		3.540546
Adjusted R-squared	0.694611	S.D. dependent var		0.504287
S.E. of regression	0.278679	Akaike info criterion		0.414055
Sum squared resid	2.329867	Schwarz criterion		0.636247
Log likelihood	-2.245956	F-statistic		20.33333
Durbin-Watson stat	0.596964	Prob(F-statistic)		0.000000

MANUFACTURING MODEL

Dependent Variable: LOG(MANU)				
Method: Least Squares				
Date: 08/02/17 Time: 16:46				
Sample: 1981 2015				
Included observations: 35				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.683075	1.204826	3.056934	0.0047
LOG(AMCU)	-0.083924	0.184805	-0.454124	0.6530
LOG(TRASVC)	0.575391	0.390916	1.471903	0.1515
LOG(COMSVC)	0.236525	0.209692	1.127965	0.2683
LOG(UTLSVC)	-0.144545	0.128111	-1.128276	0.2681
R-squared	0.859188	Mean dependent var		7.649514
Adjusted R-squared	0.840413	S.D. dependent var		0.489519
S.E. of regression	0.195555	Akaike info criterion		-0.294388
Sum squared resid	1.147251	Schwarz criterion		-0.072195
Log likelihood	10.15179	F-statistic		45.76247
Durbin-Watson stat	0.389249	Prob(F-statistic)		0.000000