FOREIGN DIRECT INVESTMENT AND INDUSTRIAL GROWTH: LESSONS FROM NIGERIA-CHINA TRADE RELATIONS

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Abstract
The stunning fall in oil prices and the recent slowdown in Nigeria's economic growth have heightened the calls for sustainable economic development through Foreign Direct Investment (FDI) as an alternative source of investment financing. Unfortunately, the growth effect of FDI in Nigeria has not been sustained as a result of genuinely rooting issues. China has been the second largest recipient of FDI behind India and the most efficient user of FDI in the world which subsequently spurred their growth immeasurably. The need for Nigeria to observe and follow China’s FDI growth pattern becomes pertinent to achieving the desired industrial output growth across all sectors. In examining the underlying ideologies, this paper employed the classical linear regression model (OLS) and found that within the observed period, FDI impacted negatively on industrial output growth in Nigeria. The undesirable relationship between FDI and industrial output growth can be manipulated to benefits if the country makes a significant effort in increasing the FDI inflows into major sectors that have forward and backward linkages. Based on the findings, it recommends that policy reforms should be enacted by the government to ensure proper functioning of the market’s systems such that well-targeted driven foreign investors can be attracted. The government should do more on issues of security and the ease of doing business such that the lost investor’s confidence can be regained.

Keywords: Foreign Direct Investments, Industrial Growth, ARDL, China, Nigeria.
Introduction

In recent past, the Chinese economy grew remarkably owing to various policy framework adopted by the Chinese government. Since 2009, China is the world’s largest exporter of goods. Official estimates suggest Chinese exports amounted to $1.904 trillion in 2013. They became the largest trading nation in the world against the United States (Economic Complexity Index, ECI). Exports and foreign direct investment has performed a crucial function in influencing their rapid economic growth. They now appear as the new success story of the export-led growth strategy. They form the core to the Asian tigers which includes Japan, Hong Kong, Korea, Singapore, and Taiwan. China offered various incentives like tax concessions, import duty reduction and in some cases total exemptions, and an enabling environment to attract inflows of FDI to augment their productive capacity.

China in 1979 was close to autarky but today the second largest FDI recipient in the world CIA world fact book (2016). By the end of 2015, China had signed 659,800 foreign direct investment project contracts, and had actually received $899.06 billion of FDI (Chineses NBS, 2015). Moreover, FDI inflows as a percentage of GDP had increased from nearly 0% in 1979 to 2.49% in 2015. After three decades of economic reform, China has achieved remarkable economic growth with an annual average rate of approximately 10%, and the GDP per capital in 2015 was eleven times greater compared to 1979 (Ministry of Commerce, Peoples Republic of China, 2015). China has grown remarkably that their economy has transited from industrial sector to a service sector over the years. China’s services sector expanded 8.2% recently from 2016 (Chinese NBS). The pace of service growth in early 2017 is basically the same as at the start of last year (Chinese NBS) accounting for more than half of its growth.

However, Nigeria has not been able to use the FDI inflows to the country to rescue herself from the economic downturn in which it found itself today owing to its deficiency in tackling the numerous macroeconomic challenges that arises as a result of political problems which influence adversely industrial sector performance. The current dwindling in manufacturing, primary and service sectors and seemingly disintegration of socio-economic infrastructures of the Nigerian economy have detrimental effects. The productive sector is in a crisis as its average contribution to the nation’s Gross Domestic Product over the past few years has not gone beyond 5%. In 2016,
the manufacturing sector contribution to GDP in real terms contracted by 4.32% compared to a decline of 1.46% recorded in 2015. This reflects a number of challenges face by manufacturing sector in 2016, such as higher costs of imported inputs as a result of the exchange rate, and higher energy costs as a result of a fall in electricity generation, and more expensive fuel. Donors, financial institutions, international organizations, government and the public at large are of the concurrence that if Nigeria policy makers can observe and follow China’s FDI growth pattern, desired industrial output growth across all sectors will be inevitable. This paper proposes a framework that reviews trends in Chinese FDI-led growth outcomes and explains how Nigeria can follow the process to achieve desirable industrial output growth.

**Literature review**

**Theoretical review**

The neo-classical growth theory relates FDI with positive output growth since directly injects capital into productive activities if the host country or the productive efficiency which put the nation on a desirable growth path. Hence, FDI has an influence on economic growth other than the potential efficiency boost. Many studies have found positive relationship to confirm this assertion but contrary evidence from official statistics show practical decline in the contribution of manufacturing sector to GDP. However, China has been able to use FDI to grow its industrial sector into a service sector and became the largest exporter of goods in the world (CIA World Fact Book, 2016). It becomes pertinent for Nigeria to observe the growth pattern in the Chinese FDI-led growth path and draw lesson needed to improve its dwindling industrial sector output.

The endogenous growth model attributed a greater growth potential to FDI as a result of the influence it has in the production function and on the growth rate. The stick of capital in the host country will be augmented as more FDI inflows are received. The potential growth effects of FDI ranges from increment in capital and intermediate goods, substantial funds needed to expand productive capacity, technological knowhow among others. All this growth potentials can only increase productivity (Borensztein et al., 1998). In addition, FDI can permanently increase the growth rate through spillovers and the transfer and diffusion of technologies, ideas, management and production processes, etc. Thus, forming the four channels through which
technological spillovers from FDI can impact on the host economy (Kinoshita, 2001, Halpern et al, 2005).

**Empirical review**

Studies on China growth model as a mirror for growth pattern in Nigeria has grown over the years but the impact of foreign direct investment (FDI) on industrial output growth vis-à-vis the Chinese FDI growth strategy remains a gap in extant literature. Nabine (2009); Ayoola (2013); Oloni, Brismah and Afolabi (2013); Nnanna (2015); Igbinoba (2016) all examined impact of Chinese trade on economic growth of Nigeria. Their studies were narrowed toward Chinese trade implication for the Nigerian economy neglecting the overall FDI inflow from around the world and subsequently its implication for growth in Nigeria. However, Onakoya (2012); Awolusi (2012); Adejumo (2013); Uma, Eboh and Uwaka (2015); Orji et al (2015); Ekienabor, Aguwamba and Liman (2016); Akpan and Oweke (2017) all examined the growth effect of FDI on the Nigerian economy neglecting the Chinese FDI-led growth strategy as a benchmark for FDI success in the Nigeria. The need to observe the FDI growth path of the Chinese economy is essential to sustainable industrial sector growth in Nigeria.

Bouoyiour (2003) conducted a study on the determinants of FDI over the period of 1990-1999 using the time series data. The result shows that labour cost, human capital and infrastructure of the economy were paramount factors responsible for inflow of FDI in that country. The result further reveals that there is a significant relationship between FDI and variables such as real exchange rate, inflation rate, the market size (proxied by GDP) and trade performance. Similarly, Marwah and Tavakoli (2004) tested the effect of FDI on economic growth in Indonesia, Malaysia, Philippines, and Thailand. Using time series annual data over the period 1970-1998, they find that FDI has positive correlation with economic growth for all four countries. Vu et al (2006) studied sector-specific FDI inflows for both China over the period 1985-2002 and Vietnam over the period 1990-2002. Using an augmented production function specification and regression methodology, they conclude that FDI has positive and direct impact on economic growth as well as an indirect effect through its impact on labor productivity. They also find that the manufacturing sector appears to gain more than other sectors from sector-specific FDI.
Li and Liu (2005) applied both single equation and simultaneous equation system techniques to investigate endogenous relationship between FDI and economic growth. Based on a panel of data for 84 countries over the period 1970-1999, they find positive effect of FDI on economic growth through its interaction with human capital in developing countries, but a negative effect of FDI on economic growth via its interaction with the technology gap. Castejón and Woerz (2005) employed the Nair-Reichert and Weinhold (NRW) model to check whether an increase in FDI will lead to an increase in the growth rate of output, controlling for time-invariant country-specific characteristics and for other dynamic control variables in Vienna for the period of 1987-2002. Empirical evidences from this study shows that a significant and positive relationship emerges when FDI interacts with investment or export orientation.

Tang et al (2008) explored the causal link between FDI, domestic investment and economic growth in China between 1988-2003 using the multivariate VAR and ECM. Their results indicate that there is a bi-directional causality between domestic investment and economic growth, while there is single-directional causality from FDI to domestic investment and to economic growth. They concluded that there is a higher level of complementarities between FDI and domestic resources. Similarly, Chandran et al (2008) explored the short and long run dynamics of Foreign Direct Investment (FDI) over the manufacturing growth in Malaysia for the period of 1970-2003 using the autoregressive distributed lag (ARDL) model. The result shows that FDI has played an important role in stimulating the growth of the manufacturing sectors in Malaysia. In addition, the results also showed that labour and technological progress has positively contributed to the growth. As a whole, since FDI have become increasingly important, the policy direction focusing on human capital, improving productivity and innovative capabilities of the manufacturing sectors and strengthening the supporting industries and institutions are proposed. This in turn will promote and make Malaysia an attractive destination for FDI. Rehman et al (2011) analyzed the role of infrastructure for and in ascertaining captivations of foreign direct investment (FDI). This work investigated the effects of host country's infrastructure availability along with exchange rate and market size on inflows of FDI towards Pakistan for the period 1975-2008. This study employed autoregressive distributed lag (ARDL) approach to Co-integration
and an error correction model based on ARDL approach using time series data. The results reveal a strong positive impact of infrastructure in attracting foreign direct investment, in short and in long run. None of these studies have examined the FDI growth effect of industrial in Nigeria vis-à-vis the Chinese economy. Their inability to observe the trend of FDI strategies adopted by the Chinese economy has led to various industrial outputs dwindling evident in recent years. Ability to model our FDI usage in consonance with the Chinese counterpart seems more likely to guarantee industrial output growth in Nigeria. It is against this background that this study draws its motivation.

Stylized Facts about FDI-led Growth in China and Nigeria
Foreign Direct Investment in China has grown remarkably over the years and has contributed significantly to GDP. FDI has become predominantly essential ever since 1990s. It grew remarkably in 1992 and since then, the inflow has been on the rise. The foreign direct investment inflow between the periods of 1990 and 1999 account for 3.9% of GDP of China. The world trade organization accession of 2001 significantly helps the inflow of FDI in China. The period of global financial crises in 2008 saw a sharp decline in FDI inflow to China but soon after the menace, FDI grew remarkably accounting for average annual rate of 7.1% between 2008 and 2015.

Economic reforms since 1978
The third plenum of the 11th Central Committee in 1978 marked not only the assumption of power by Deng Xiaoping but also the beginning of China’s reform era under the general policy of “reform and opening up” Naughton (1995); Bramall (2000); Zhu (2012). The Chinese reforms have followed a rather gradual/incremental and evolutionary as well as an experimental approach Rawski (1994); Prasad and Rajan (2006) which is often described as a “process of trial and error” or in a more literally way as “crossing the river by feeling for the stones” (mo shitou guohe); Lin (1995); Naughton (1995).
Most research identifies three reform phases Zheng et al. (2009); Zhu (2012); other studies distinguish between two extended periods Kanbur and Zhang (2005), Brandt et al. (2014) or integrate smaller phases Lin (1995). We adopt the three-phase approach. The most important reforms and their main
impacts on China’s economic development during the three reform phases are summarized in the following:

First phase of reforms (1978–1984): The reforms during the first phase targeted the agricultural sector and encompassed three policy measures: 1. an increase in agricultural goods’ prices around 1979 Lin (1992) 2. the household responsibility system (HRS) reform over the period 1981–1984, which increased the productivity in the agricultural sector Lin (1992) McMillan et al. (2000); and 3. An increase in arable land over the period 1982–1985. For various reasons the Chinese Government’s decision to first reform the agricultural sector made sense. First, the majority of the population lived in rural areas Yao (1999). Second, China intended to ensure food security, in particular after the food crisis before 1978 Zhu (2012) Brandt et al. (2014). Third, among all three sectors, the agricultural sector was least centralized Yao (1999); therefore, reforms in that sector would not have been regarded as affecting the Chinese socialist orientation (as long as they did not involve changes in the state sector); Guo (2013). As a result of the reforms, the agricultural output increased sharply Lin (1992); McMillan et al. (2000); Zheng et al. (2009); Zhu (2012). However, there was a trend reversal around 1984, when the agricultural growth declined Lin (1992) and the agricultural growth slowed down Zheng et al. (2009). One major reason for this development can be attributed to the fact that the reform was completed in 1984 when 99% of production teams had adopted the plans Lin (1992).

Second phase of reforms (1985–1992): During the second phase of reforms, a dual-track system was established (in the manufacturing sector) and the Government created a favorable policy environment for the so-called “township and village enterprises” Lin (1995); Perotti et al. (1998); Lin and Yao (1999). The latter gained quickly in importance measured as their contribution to the GDP. The town and villages enterprises (TVEs) were characterized by relatively high productivity in comparison with state-owned enterprises (due to better incentive structures in these enterprises) Jefferson and Rawski (1994).
Overall, the reforms of the second phase primarily dealt with (gradually) increasing the productivity of the manufacturing sector.

**Third phase of reforms (1992–present):** Deng Xiaoping’s southern tour in 1992 and his commitment to the open-door policy, which gave a decisive push to the renewed liberalization reform momentum, marked the beginning of the third reform phase Brandt et al. (2014). Accordingly, the third phase reforms primarily dealt with the fostering of FDI and the further liberalization of trade. Although liberalization reforms had already taken place during the first two reform phases, 10 of these reforms were restricted to the coastal area, and it was not until 1992 that China followed a more nationwide implementation of FDI enhancing policies (by opening the inland region to FDI and by extending the preferential policies to inland cities). Furthermore, in anticipation of China’s world trade organization accession in 2001, the Chinese Government lowered its tariffs, reduced its restrictions on trade in services and strengthened its intellectual property rights, thus creating a more favorable business environment for foreign investors Chen (2011).
However, Nigeria witnessed a sharp increase in FDI inflow in 1988 and 1989, with a decline in 1990 to 1992. The inflow of FDI to Nigeria was fluctuating during the periods of up until 2004. A remarkable surge in the value of FDI inflow was witnessed from 2004 to 2009 before the decline in 2010. It picked in 2010 but since then it has been on the decline up until now.

Fig 2: Data Source. FDI ($million dollars) World Development Indicator (1986-2016)

Methodology
In analysing the relationship between foreign direct investment and industrial output growth in Nigeria, the study made use of a 2-stage econometric procedure. First, the Augmented Dickey-Fuller (ADF) test was conducted to ascertain the order of Integration of the variables, and then the Auto Regressive and Distributed Lag (ARDL) model was employed to account for long-run and short-run dynamics. The ARDL model was introduced originally by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001). The ARDL approach has the advantage that it does not require all variables to be I(1) as the Johansen framework and it is still applicable if we
have I(0) and I(1) variables in our set. The study employed annual secondary time-series data on Foreign Direct Investment (FDI), Gross Capital Formation (GCF), Trade Openness (TR_OP), Exchange rate (EXC_R) and lending rate (LEND_R) since all these indicators inform the volume of FDI into any economy (Onakoya (2012); Awolusi (2012); Adejumo (2013); Uma, Eboh and Uwaka (2015); Orji et al (2015); Ekienabor, Aguwamba and Liman (2016); Akpan and Oweke (2017)) and industrial output growth (industry value added) from 1986 to 2016. The data are obtained from Central Bank Statistical bulletin for various years and World Bank Development Indicators (WDI).

Model Specification
From the selected variables above, we draw a function for Inflation in Nigeria with the form:

\[ IND_{Out} = f(FDI, GCF, TR_{Op}, EXC_R, LEND_R) \]  \hspace{1cm} (1)

Where \( IND_{Out} \) is Industry Value Added, GCF is Gross Capital Formation, \( TR_{Op} \) is Trade openness, \( EXC_R \) is nominal exchange rate, and \( LEND_R \) is official cost of borrowing. Since the study is a time series analysis, the equation can be expressed as:

\[ IND_{Out_t} = \beta_0 + \beta_1 FDI_t + \beta_2 GCF_t + \beta_3 TR_{Op_t} + \beta_4 EXC_{R_t} + \beta_5 LEND_{R_t} + \varepsilon_t \]  \hspace{1cm} (2)

Here, \( \varepsilon_t \) represents the white noise error term at time t, \( \beta_0 \) is a constant which represents the estimated value of industrial output when the explanatory variables are zero. \( \beta_1-5 \) are the slope coefficients of \( FDI, GCF, TR_{Op}, EXC_R, LEND_R \) respectively while \( t \) represents the time index. The a priori expectation of the explanatory variables in the model is expected to be;

\( \beta_1, \beta_2, \beta_3 > 0 \) while \( \beta_4, \beta_5 < 0 \).

These expectations are based on economic theory that an increase in \( FDI, GCF, TR_{Op} \) will lead to an increase in \( IND_{Out} \) while an increase \( EXC_R, LEND_R \) would lead to a decrease in \( IND_{Out} \).

Presentation and Analysis of Results

<table>
<thead>
<tr>
<th>Description</th>
<th>( \ln(IND_{Out}) )</th>
<th>( \ln(FDI) )</th>
<th>( \ln(GCF) )</th>
<th>( \ln(Trad_{Op}) )</th>
<th>( \ln(Exch_R) )</th>
<th>( Lend_R )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std. Dev.</td>
<td>1.313406</td>
<td>0.992423</td>
<td>1.354046</td>
<td>2.054935</td>
<td>1.405924</td>
<td>3.987655</td>
</tr>
</tbody>
</table>
Table 1 above showed that the means and medians of all the variables lie within the maximum and minimum values indicating that the variables had high tendency to be normally distributed. The skewness statistic showed that industry value added (IND_out), Gross Capital Formation (GCF), and lending rate (LEND_R), were positively skewed while Foreign Direct Investment (FDI), Trade Openness (TR_op), and Exchange rate (EXC_R) were negatively skewed. The kurtosis statistics showed that IND_out, FDI, GCF, TR_op, and LEND_R were platykurtic, suggesting that their distributions were flat relative to normal distribution while EXC_R was leptokurtic, suggesting that it distribution was peaked relative to normal distribution. Finally, the Jarque-Bera statistic rejected the null hypotheses of not normally distributed for IND_out, EXC_R, and LEND_R at five percent critical value while the null hypotheses of not normally distributed for the other variables were accepted at the same critical value.

Correlation Matrix

**Table 2: Correlation Matrix of the Indicators**

<table>
<thead>
<tr>
<th>INDUSTRIAL OUTPUT</th>
<th>FDI</th>
<th>LEND_R</th>
<th>GCF</th>
<th>EXCH_RATE</th>
<th>TR_OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDUSTRIAL OUTPUT</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>0.499872</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEND_R</td>
<td>-0.33377</td>
<td>-0.35183</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCF</td>
<td>0.975833</td>
<td>0.61284</td>
<td>3</td>
<td>0.3519</td>
<td>1</td>
</tr>
<tr>
<td>EXCH_RATE</td>
<td>0.502729</td>
<td>0.65927</td>
<td>-</td>
<td>0.559315</td>
<td>1</td>
</tr>
<tr>
<td>TR_OP</td>
<td>0.807456</td>
<td>0.87649</td>
<td>-</td>
<td>0.89000</td>
<td>0.7002</td>
</tr>
</tbody>
</table>

Source: Author, 2017
Result in Table 2 above gives a preliminary idea of the relationship among the variables. A brief look at the table shows that FDI has a positive relationship with INDOut; LENDR has a negative relationship with INDOut and FDI; GCF has positive relationship with INDOut, FDI, and LENDR; EXCR has positive relationship with INDOut FDI, GCF and LENDR; and TROp has positive relationship with INDOut FDI, GCF, EXCR, and LENDR.

**Time Series Properties of the Variables**

The ADF test is used to test for stationarity of the data. The ADF test consists of estimating the following regression.

\[
\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{i=1}^{m} \varphi_i \Delta Y_{t-i} + \varepsilon_t 
\]

(3)

Where \( \alpha \) represents the drift, \( t \) represents deterministic trend and \( m \) is an optimal lag length ample enough to ensure that \( \varepsilon_t \) is a white noise error term.

### Table 3: Unit Root Test: Augmented Dickey-Fuller Test (ADF)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level T-Stat</th>
<th>Critical Value @ 5%</th>
<th>First Difference T-Stat</th>
<th>Critical Value @ 5%</th>
<th>Order of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(INDOut)</td>
<td>1.932990</td>
<td>-2.991878</td>
<td>-3.192274</td>
<td>-2.967767</td>
<td>I(1)</td>
</tr>
<tr>
<td>ln(FDI)</td>
<td>-2.526224</td>
<td>-2.963972</td>
<td>-9.636820</td>
<td>-2.967767</td>
<td>I(1)</td>
</tr>
<tr>
<td>ln(GCF)</td>
<td>0.420591</td>
<td>-2.963972</td>
<td>-4.900135</td>
<td>-2.967767</td>
<td>I(1)</td>
</tr>
<tr>
<td>ln(TradOpen)</td>
<td>-2.540792</td>
<td>-2.963972</td>
<td>-3.482906</td>
<td>-2.967767</td>
<td>I(1)</td>
</tr>
<tr>
<td>ln(ExchR)</td>
<td>-1.484556</td>
<td>-2.963972</td>
<td>-7.105544</td>
<td>-2.967767</td>
<td>I(1)</td>
</tr>
<tr>
<td>Lend</td>
<td>-3.240517</td>
<td>-2.963972</td>
<td>-6.144295</td>
<td>-2.967767</td>
<td>I(0)</td>
</tr>
</tbody>
</table>

Source: Author, 2017

The time series properties of the variables were conducted using Augmented Dickey-Fuller (ADF) test and the results from this test showed that all the indicators are stationary at I(0) except lending rate. The appropriate modus operandi of analysis that captures the combination of I(1) and I(0) stationary variables, according to Pesaran et al (2001), is the ARDL model.

The primary form of the ARDL model is given as:

\[
\Delta{IND}_{Out_t} = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta{IND}_{Out_{t-1}} + \sum_{i=1}^{n} \beta_{2i} FDI_{t-1} + \sum_{i=1}^{n} \beta_{3i} \Delta{GCF}_{t-1} + \sum_{i=1}^{n} \beta_{4i} \Delta{TROp}_{t-1} + \sum_{i=1}^{n} \beta_{5i} \Delta{EXCR}_{t-1} + \varepsilon_t 
\]
$$\sum_{i=1}^{n} \beta_i \Delta LEND_{Rt-1} + \alpha_1 IND_{Outt-1} + \alpha_2 FDI_{t-1} + \alpha_3 GCF_{t-1} + \alpha_4 TR_{Op_{t-1}} + \alpha_5 EXC_{Rt-1} + \alpha_6 LEND_{Rt-1} + \mu_t$$

(4)

where $\Delta$ is the first difference operator, $\beta_0$ is the drift component and $\mu_t$ is the white noise error term.

The equation above connotes the term with the summation sign represents the error correction dynamics i.e. $\beta_{1-6}$, while the second part $\alpha_{1-6}$ represents the long-run relationship. Accounting for the short term relationship, the primary form becomes;

$$\Delta IND_{Outt} = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta IND_{Outt-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta FDI_{t-1} + \sum_{i=1}^{n} \alpha_{3i} \Delta GCF_{t-1} + \sum_{i=1}^{n} \alpha_{4i} \Delta TR_{Op_{t-1}} + \sum_{i=1}^{n} \alpha_{5i} \Delta EXC_{Rt-1} + \sum_{i=1}^{n} \alpha_{6i} \Delta LEND_{Rt-1} + \delta ECT_{t-1} + \epsilon_t$$

(5)

Where $ECT$ is the error correction term which is the residuals retrieved from the estimated long-run relationship.

**Lag Length Selection**

The next step in our analysis is to select the optimal lag length for the cointegration equation based on the hypothesis that the residuals are serially orthogonal. The lag length which minimises the Akaike Information Criterion (AIC) and Schwarz Criterion (SC) and at which the model does not have autocorrelation is the optimal lag length. For this analysis, we would make use of the SC as the choice for the selection of our optimal lag length.

**Table 4: Lag Length Result**

<table>
<thead>
<tr>
<th>Lag Length</th>
<th>AIC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.971430</td>
<td>9.933106</td>
</tr>
<tr>
<td>2</td>
<td>7.966434</td>
<td>11.64399</td>
</tr>
<tr>
<td>3</td>
<td>4.124362</td>
<td>9.548337*</td>
</tr>
</tbody>
</table>

*Source: Authors computation (E-views), 2017*

Based on the result in table 2, the lag length which minimises SC is lag three and thus our optimal lag length. Given our optimal lag length, we proceed to test for long-run relationship among the variables.

**Bound Test**

To investigate the presence of long-run relationships among the variables, the bound testing under Pesaran, et al. (2001) procedure is used. The bound testing procedure is based on the F-test. The F-test is basically a test of the
assumption of no cointegration among the variables against the premise of its existence, denoted as:

\[ H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \]

i.e., there is no cointegration among the variables.

\[ H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0 \]

i.e., there is cointegration among the variables.

**Table 5: Bound Test Result**

<table>
<thead>
<tr>
<th>F-Statistics</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower bound</td>
<td>Upper bound</td>
<td>Lower bound</td>
</tr>
<tr>
<td>3.921137</td>
<td>3.41</td>
<td>4.68</td>
<td>2.62</td>
</tr>
</tbody>
</table>

*Source: Author, 2017.*

Given the result of the Bound Test, the F-statistic value should be compared with the Pesaran critical value at traditional levels of significance. It is noted by Narayan (2005), the current critical values reported in Pesaran et al. (2001) cannot be used for small sample sizes because they are predicated on the premise of the existence of large sample sizes. Narayan (2001) provided a set of critical values for sample sizes ranging from 30 to 80 observations. They are 2.496 – 3.346 at 10% level of significance, 2.962 – 3.910 at 5% level of significance and 4.068 – 5.250 at 1% level of significance.

Since the F-statistic 3.921137, is greater than the upper bound critical value at 5% level of significance (3.79), we thus reject the null hypothesis and conclude that industrial output growth, foreign direct investment, gross capital formation, trade openness, exchange rate, and cost of capital have co-movements in the long-run in Nigeria. From the result, we can hence estimate the long-run relationship between industrial output growth and the explanatory variables.

**Table 6: ARDL Long-Run Result**

Dependent Variable: \((LIND_{out})\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>t-statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>6.438739</td>
<td>1.929964</td>
<td>3.336197</td>
<td>0.0033</td>
</tr>
</tbody>
</table>
### Table 7: ARDL short-run relationship

**Dependent Variable:** \( (LIND_{Out}) \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>t-statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3.409726</td>
<td>2.501984</td>
<td>1.362809</td>
<td>0.1931</td>
</tr>
<tr>
<td>LIND_OUT(-1)</td>
<td>0.785408</td>
<td>0.202425</td>
<td>3.879994</td>
<td>0.0015*</td>
</tr>
<tr>
<td>LFDI</td>
<td>-0.205770</td>
<td>0.138664</td>
<td>-1.483942</td>
<td>0.0485**</td>
</tr>
<tr>
<td>LGCF</td>
<td>0.892724</td>
<td>0.146750</td>
<td>6.083296</td>
<td>0.0000*</td>
</tr>
<tr>
<td>LGCF(-1)</td>
<td>-0.724529</td>
<td>0.272179</td>
<td>-2.661960</td>
<td>0.0178**</td>
</tr>
<tr>
<td>LTR_OP</td>
<td>-0.746184</td>
<td>0.350646</td>
<td>-2.128026</td>
<td>0.0503**</td>
</tr>
<tr>
<td>LTR_OP(-1)</td>
<td>0.915495</td>
<td>0.337385</td>
<td>2.713501</td>
<td>0.0160**</td>
</tr>
<tr>
<td>LEXCH</td>
<td>-0.114871</td>
<td>0.054022</td>
<td>-2.126352</td>
<td>0.0505**</td>
</tr>
<tr>
<td>LEND_R</td>
<td>-0.016060</td>
<td>0.016115</td>
<td>-0.996559</td>
<td>0.3348</td>
</tr>
<tr>
<td>LEND_R(-1)</td>
<td>0.022537</td>
<td>0.015292</td>
<td>1.473845</td>
<td>0.1612</td>
</tr>
<tr>
<td>ECT(-1)</td>
<td>-0.729936</td>
<td>0.329626</td>
<td>-2.214438</td>
<td>0.0427**</td>
</tr>
<tr>
<td>R-squared=0.596131</td>
<td>Adjusted R-squared=0.788344</td>
<td>F-stat(prob)=6.396219</td>
<td>Durbin-Watson stat=2.005427</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Authors computation (E-views), 2017.

** significant at 5%  * significant at 1%
The result in table above shows that in the short-run, industrial output has a cogent relationship with its one period lag value i.e. Industrial output growth depends on its previous value in the short-run. The result also shows that gross capital formation and trade openness have a significant one year lag effect on Industrial output growth in the short run in Nigeria. Also, FDI, Gross Capital formation, trade openness, and exchange rate have a significant relationship with Industrial output growth in the short-run. However, lending rate and its past values does not have significant relationship with Industrial output growth. From the result, a percentage increase in industry value added at year $t-1$ is precursory to a 0.78 percentage increase in Industrial output growth at year $t$ in the short run while a percentage increase in foreign direct investment at year $t$ would lead to a 0.21 percentage decrease in Industrial output growth at year $t+1$. From the result, it can also be seen that one period lag value of gross capital formation, exchange rate and trade openness has a negative relationship with Industrial output growth in the short run while one period lag value of trade openness has a positive relationship with Industrial output growth in the same short run. The R-squared value of 0.60 indicates that 60 percent of the variations in Inflation is explained by the regressors in the model, and after taking cognisance of the degree of freedom, the adjusted R-squared value of 0.79 indicates that 79 percent of the variation in Industrial output growth is explained by the regressors and the F-statistic probability value of 0.000000 indicates that all the explanatory variables have a joint significant consequence on Industrial output growth in Nigeria in the short-run. The Error Correction Term which denotes the speed of adjustment towards long-run equilibrium is 72.99 percent. This explains that the whole system can achieve long run equilibrium at the speed of 72.99%. The Durbin-Watson value of 2.0 indicates that this model is free from serial correlation. We go further by using the LM test to confirm the non-existent of serial correlation in our model.

### Table 8: Serial Correlation Test

<table>
<thead>
<tr>
<th>Breusch-Godfrey Serial Correlation LM Test:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.718071</td>
</tr>
<tr>
<td>Prob. F(3,25)</td>
<td>0.5601</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>4.109290</td>
</tr>
<tr>
<td>Prob. Chi-Square(3)</td>
<td>0.2499</td>
</tr>
</tbody>
</table>
Given the probability value of 0.2499 percent, we fail to reject the null hypothesis and conclude that our short run model is free from serial correlation.

**Figure 3: CUSUM Stability Test**

![CUSUM Stability Test](image)

Source: Authors’ computation (E-views), 2017.

The above figure shows that the CUSUM line is within the critical bounds of 5 percent level of significance which indicates that the model has structural stability.

**Conclusion**

In the study, Chinese FDI growth strategy has been reviewed vis-à-vis the inflow of FDI needed for augmenting Industrial output growth in Nigeria. Also, Industrial output growth as induced by foreign direct investment in Nigeria has been estimated using the Autoregressive and Distributed Lag (ARDL) model technique to cointegration. The empirical result reveals that there exists a long-run relationship among industry value added; foreign direct investment, gross capital formation, trade openness, exchange rate, and cost of capital in the Nigerian case. The result also shows that in the short-run model, the interaction among Gross capital formation, trade openness, exchange rage and lending rate and Industrial output follows apriori expectations while foreign direct investment does not follow apriori
expectations. It is therefore recommended that short run policies should be
tailored towards the attraction of foreign direct investment to augment
capital needed for expansion of and improve productivity of the industrial
sector. The government should do more on issues of security and the ease of
doing business such that the lost investor's confidence can be regained.

As a result of the negative effect of foreign direct investment on industrial
output growth for the periods of investigation, though insignificant, it explains
that there is need for Nigeria to adopt Chinese FDI-led growth strategy to
improve its falling industrial sector. The reform has to be genuinely rooted
such that the growth can be broad based. Strong institutional framework
needs to be adopted to negate against the problems of corruption and
insecurity.

References
Adejumo A. V. (2013) Foreign Direct Investments and Manufacturing Sector
Management Research. 2(6), 321-345.
Domestic Economy. Research Journal of Finance and Accounting. 4(17),
25-68
Awolusi, O. D. (2012) Foreign Direct Investment and Economic Growth in
Nigeria: A Vector Error Correction Modeling. Journal of Research in
Oxford University Press: Oxford
Brandt, Loren, Ma, Debin, and Rawski, Thomas G. (2014) From Divergence to
Convergence: Reevaluating the History Behind China’s Economic Boom.
Journal of Economic Literature 52(1): 45-123.
Chen, Chunlai (2011) Foreign Direct Investment in China – Location
Determinants, Investor Differences and Economic Impact. Edward Elgar
Publishing: Northampton
Economic Complexity Index
July, 2017)


