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Nexus of Exchange Rate Deregulation and Industrial Productivity in Nigeria: Cointegration Aprroach

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Abstract

The study examined the nexus of exchange rate deregulation and industrial productivity in Nigeria. Annual time series data employed were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin for the period 1986-2015. The period selected captured the period of Structural Adjustment Programme (SAP) and post SAP erra. The Johanson cointegration was conducted to test whether or not cointegrating relationship exist between the industrial productivity and exchange rate and interest rate. The specified short run dynamic error correction model shows that there is also well defined error correction term, which indicate about 94 percent of discrepancy between the actual and long run or equilibrium value of Industrial productivity is corrected or eliminated each year. Therefore, exchange rate deregulation has been favourable to industrial production. In the light of this finding, it was recommended that the monetary authority should carefully monitor the movement of the market determined exchange rate. This will ensure that exchange rate deregulation does not become counterproductive through price alterations on industrial production, trade and investment in the industrial sector.

Keyword: *Exchange rate, Industrial productivity, Cointegration*

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Background to the Study

The introduction of structural adjustment programme in Nigeria in mid 1986 was aimed at stabilizing the economy, stimulate and investment, and promote economic growth. Several measures have been taken, especially in removing administrative controls and introducing greater autonomy and competition into production and business. The industrial sector is assume to be the one of the leading sectors in the Nigerian economy in terms of its contributions to income, employment, foreign exchange earnings and domestic food supply. Despite the immense potentials of industrial sector to transform the Nigerian economy, industrial production to meet local demand has been a challenge over the years (Akinlo et al, 2015).

In an attempt to revive the industrial sector in Nigeria over theyears, several policy reforms have been put in place by successive governments and one of such policy reforms in time past is the Structural Adjustment Programme (SAP) introduced in July 1986 (Oyinbo and Emmanuel, 2012). A critical component of the reform is the exchange rate deregulation. The exchange rate over-valuation prior to deregulation helped to cheapen imports of competing food items as well as agro-based and industrial raw materials and the result was rapid expansion in the importation of these goods to the detriment of local production of similar goods (Imimole and Enoma,2011). This led to the abolition of the fixed exchange rate regime and the introduction of flexible exchange regime via the adoption of Structural adjustment programme. This new exchange rate policy helped to remove the over-valuation problem to the extent that the naira now became under-valued. The movement away from fixed to flexible exchange rate regimes allowing significant depreciation of Naira was aimed at enhancing export by making Nigerian goods cheaper (Shittu*et al.,* 2007).

This exchange rate deregulation is assumed enhance increased access to foreign exchange for production thereby increasing manufacturing output and employment while reducing inflation. Several Studies have analyzed the impact of exchange rate on economic growth and other macroeconomic variables. However, not many studies have analyzed the impact of exchange rate deregulation on industrial production. Analyzing the impact of exchange rate deregulation on industrial output is very crucial because this subsector together with agriculture constitutes the real sector of the economy. Undeniably, changes in this subsector will have serious effects on the other sub sectors and economic fundamentals such as employment and economic growth.

A market driven exchange rate policy is expected to be important in determining the importation of inputs for industrial production and also, the export of industrial produce through its influence on prices but it is worth noting that there exists a dearth of empirical information on the relationship between exchange rate deregulation and industrial growth in Nigeria which is in line with Petreski (2009), who posited that the relationship between exchange rate and economic growth remains blurred and requires in-depth empirical investigation. This study was therefore, designed with a specific objective to fill the gap in research by providing empirical information on the causal relationship between exchange rate deregulation and industrial production in Nigeria.

The rest of the paper is structured as follows: section two provides literature review. Section three provides a brief research method. Section four presents the results of the empirical analysis and section contains the summary and conclusion of the study.

Literature Review and Theoretical Framework

Conceptual Issues

Two key concepts are used in this study. These are exchange rate deregulation and industrial productivity. The concepts are defined as follows:

The Concept of Industrial Productivity

Industrial productivity connotes the value of output produced by the factors of production that are applied in the industrial sector of a given economy (Olaniyi et al., 2017). Often attention is concentrated on labour productivity, that is, the value of output produced by the labour input which can be measured by the number of workers, or by the number of hours of work to produce that output. However, a Total Factor Productivity (TFP) tries to capture the value of all inputs (labour, capital, intermediate materials) (Janakar, 2013).

The level of output in a single firm or corporation depends on the capital employed, the labour employed, and the level of technology used in production as these could be heterogeneous. Aggregate output may also depend on some "unobservable" such as infrastructural facilities, level of trust in society, property rights, the legal and administrative structures, political conditions, and the economic framework. Furthermore, aggregate output growth depends on the productivity of and linkage among the different sectors, including agriculture, manufacturing, and the service sectors. In general, agricultural output growth increases slowly, while that of manufacturing tends to grow faster because of technological change, specialization, learning-by-doing, economies of agglomeration, and static and dynamic economies of scale (Olaniyi et al., 2017). Hence, the larger the share of the manufacturing sector the greater the likelihood of a faster growth in productivity as labour moves from a relatively low productivity sector (agriculture) to a higher productivity sector (manufacturing). Aggregate output growth are driven by an increase in gross investment that embodies new technology, as well as general technological change that comes about with increased knowledge, innovation, and Research and Development. Aggregate productivity changes may be affected by the economic and social climate, investment, innovations, and entrepreneurial confidence in the economy. This may depend on the political climate and natural disasters like wars, floods, droughts, etc. which may have long lasting effects on the level and rate of change of productivity (Janakar, 2013). On the whole, this paper sees aggregate output growth as the same as the sustained growth of total output or GDP over time which is generally termed as economic growth.

Empirical Review

A review of relevant empirical studies (Rogers and Wang, 1995;Ghosh*et al.,* 1997;Levy-Yeyati and Sturzenegger, 2002; Bailliu*et al.,* 2003; Talvas, 2003;Eichengreen and Leblang,

2003; Edwards and Levy-Yeyati, 2003; Hernandez-Verme, 2004; Huang and Malhotra, 2004; Cavalho, 2005; Garofalo, 2005;Tyers *et al.*, 2006; Bleaney and Francisco, 2007, Rodrick, 2008; Darvas,2011;Afzal, (2012); Chen, 2012) has indicated two school of thoughts with regards to the influence of exchange rate on economic growth(gross domestic product) and this is attributed to variations in data periods, models and estimation methods.

One school of thought posited that fixed exchange rate policy is significant in influencing economic growth while the other school of thought asserted that market driven exchange rate policy is significant in influencing economic growth. There are also divergent views on exchange rate in Nigeria.

Akinlo et al. (2015) examines the impact of exchange rate on industrial production in Nigeria over the period 1986- 2010. The results of the study obtained using the Vector Error Correction Model (VECM), confirm the existence of long run relationship between industrial production index, exchange rate, money supply and inflation rate. Moreover, exchange rate depreciation had no perceptible impact on industrial production in the short run but had positive impact in the long run. However, their results show money supply explained a very large proportion of variation in industrial production in Nigeria

Oriavwote and Omojimite (2012) in a study on empirical investigation of exchange rate pass through into domestic prices in Nigeria opined that volatility of exchange rate has significant impact on domestic prices in Nigeria than the shocks from domestic price itself and therefore, exchange rate volatility should be given important consideration when implementing policies on stabilizing domestic inflation.

Omojimite (2012) in a study on institutions, Macroeconomic Policy and Growth of Agricultural Sector in Nigeria found out that exchange rate was negative and significant in influencing agricultural production

Chukuigwe, and Abili, (2008) in a study on econometric analysis of the impact of monetary and fiscal policies on non-oil exports in Nigeria noted that considering the importance of the exchange rate as a major price that affects all sectors of the economy and all economic agents, it is imperative to monitor the movements in the real exchange rate in order to foster competitiveness and improve the supply of exports in the medium to long term and that The Central Bank of Nigeria should continue to intervene in the foreign exchange market to maintain stability.

Okhiria and Saliu (2008) in a study on exchange rate variation and inflation in Nigeria noted that Dutch disease results from an appreciation of the exchange rate, caused by the large inflows of petroleum revenues, which again leads to reduced competitiveness of various non-petroleum sectors of the economy. Dutch disease will often have particularly serious effects on the poor because traditional sectors such as agriculture and other production in rural areas will lose out to imports that become more competitive as a result of currency appreciation. Enoma (2011) in a study on exchange rate depreciation and

inflation in Nigeria noted that theoretically, exchange rate is an important determinant of inflation rate. Although exchange rate depreciation may not directly control inflation, it helps to restructure the price mechanism of both import and export, such that Naira depreciation subtly tends to moderate prices in Nigeria, especially imported price inflation Alao (2010) in a study on interest rates determination in Nigeria found out that exchange rate adjustment is positive and significant in influencing interest rate spread in Nigeria. The resulting effect on interest rate spread affects agricultural production.

Amassoma *et al.* (2011) in a study on the Nexus of interest rate deregulation, lending rate and agricultural productivity in Nigeria noted that a decline in exchange rate implies reduction in the cost of imported agricultural inputs and consequently stimulating current agricultural output.

Wafure and Nurudeen (2010) in examining the determinants of foreign direct investment in Nigeria the revealed that exchange rate is significant in explaining changes in foreign direct investment and that 1 per cent depreciation in exchange rate causes FDI to increase by approximately 0.02.

Olubanjo *et al.* (2009) in a study on economic deregulation and supply response of cocoa farmers in Nigeria found out that exchange rate have a negative effect on output or cause decrease in output as their magnitudes increase. Unsurprisingly, increased exchange rate signifies Naira appreciation and hence represents price disincentive for local (cocoa) production. With regard to the nexus between exchange rate and industrial production, it follows the mixed pattern as outlined in previous empirical studies reviewed above. Exchange rate deregulation that increases investors' access to foreign exchange can lead to increased industrial output. Increased access to foreign exchange will enable the investors procure the needed imported raw material and equipment needed for production. In this wise, industrial output can be enhanced. Moreover, increased production can lead to increased employment which may eventually lead to improved wages and increased economic growth. Also, exchange rate depreciation can lead to increased industrial output where domestic firms are exporters.

Theoretical Framework

This study falls within the framework of the Cobb-Douglas production function, industrial output out put can be modeled as follows;

$$Y_t = f(AK^{\gamma}L^{\varphi}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y_t represents the quantity of output in period t, K is the capital usage during the same period, L denotes the hours of labour input, while A is used to indicate the level of technological efficiency with which the inputs are being combined; A, y and φ are all positive parameters.

$$\gamma, \varphi > 0$$

The Cobb-Douglas function demonstrated above has proved very useful and amenable to applied economic research both at the microeconomic and macroeconomic levels. This is because it can easily be linearized by logarithmizing the parameters y and φ. This is done by taking natural logarithm of both sides of the equation, and denoting lowercase variables as the natural logarithm of the respective upper case variables, the following equation results

$$logY_t = logA + \gamma logK_t + \varphi logL_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equation 2 above can be expressed in lower case alphabets form as below,

$$y_t = a + + \varphi l_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

The lower case alphabets represent the logarithm of the variables. In this case y and φ are the output elasticities of capital and labour respectively.

The coefficients α and β are the output elasticities of the factor inputs and can be interpreted as respective factor shares in total output. Also equation 3 can be intuitively interpreted as a fundamental growth accounting equation which decomposes the growth rate of output into growth rate of Total Factor Productivity (TFP) plus a weighted sum of the growth rates of capital and labour. The coefficients α and β are expected to assume positive signs. This study did not consider the absolute value of labour and capital as input, however, the exchange rate and interest rate will to a large extent determine the cost of factors, hence, the use of this theoretical framework.

Research Methods

The method employed in carrying out the study is presented as follows:

Data

This research, in view of its nature made use of secondary data. Annual data employed were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin for the period 1986-2015. The 30-year period is selected capture the period of Structural Adjustment Programme (SAP) and post SAP erra. The period also meet the requirement of the Central Limit Theorem that sample size must not be less than thirty years for normality purpose, and the fact that the larger the sample, the greater the reliability or validity of time series research findings (Gujarati, 2004).

Variables

Share of industry in gross domestic product is used as the dependent variable as it best reveals the industrial output; the data on it are easily accessible, and it is also considered appropriate in view of the theoretical underpinning of the study. While, the independent variables are the exchange rate and interest rate.

Model Specification

Based on the theoretical framework of this study, the econometric models used for the study is adapted from Akinlo*et al.* (2015) and are specified as follows:

$$lnIO_t = \beta_0 + \beta_1 lnEXt + \beta_2 lnINt + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad I$$

The variable IO in the industrial out put proxied by share of industry in gross domestic product. EX is the real exchange rate and IN is the interest rate are critical factors for nexus of exchange rate deregulation and industrial production. Hence, excluding the interest rate variables may cause a problem of omitting relevant variables which may result in imprecise estimation of the model. The $\beta_i$are the parameters and the ε is the error term.

Presentation of Results and Interpretation

The findings of the study are presented as follows.

Unit Root Test Results

The results of the unit root tests using ADF are as shown in Table 1.

Table 1: Unit Root Tests Results

		ADF Unit Root Test		
Variables	Critical Values	At level I(0)	Critical Values	At First Difference I(1)
lnIO			-4.339330	-4.693170***
InEX			-4.323979	-6.900168***
IN	-3.688193	-4.309824**		

Note: *** Statistical significance at 1% level; ** statistical significance at 5%;
* Statistical significance at 10%

Source: Eviews 9

The results show that the variables are integrated of different order. The logarithm of IO and EX are integrated of order I(0) while the logarithm interest rate was stationary at first difference.

Optimum Lag Selection

The optimum lag length selection criteria was carried out in order to determine the number of lag(s) to be included in the models prior. The results are presented in Table 2,

Table 2: Lag Length Selection for Model

Lag	AIC	SC	HQ
0	10.27880	10.42154	10.32244
1	4.581967	5.152912	4.756511
2	4.092926*	5.092080*	4.398377*

Source: Eviews 9

From Table 2, the Akaike Information Criterion (AIC), and Shwarz Criterion (SC) indicate that two maximum lags are to be included in the Johansen cointegration model. The results of the Johansen cointegration testing approach mare shown in Table 3.

Johanson Cointegration Test

Prior to the Johansen cointegration estimation, the maximum of two lag lengths were considered to reduce the problem of degree of freedom in the time series analysis. The Joanson cointegration regression was conducted to test whether or not cointegrating relationship exist between the industrial productivity and exchange rate and interest rate. The result is presented in the table below:

Table 3: Johanson Cointegration

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Values (0.05)	Prob.**
None *	0.557791	40.10361	29.79707	0.0023
At most 1 *	0.434398	18.07235	15.49471	0.0200
At most 2	0.094694	2.686011	3.841466	0.1012

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Eviews 9

The result presented in table 3 confirmed that there is cointegration among the variables. This is because the trace statistic values of 40.10361 and 18.07235 are greater than the critical value 29.79707 and 15.49471 at 5 percent leve of significance respectively. It therefore reject the null hypothesis of nonw** and almost 1* of the hypothezised number of cointegrating equations. Accordingly, the trace statistic test indicate 2 cointegrating equations at 5 percent level of significance.

Result of Error Correction Model (ECM)

The specified short run dynamic error correction model shows that there is also well defined error correctionterm Inresido (-1), which indicate about 94 percent of discrepancy between the actual and long run or equilibrium value of Industrial productivity is corrected or eliminated each year. The result are in appendix III

Estimated Long Run Coefficients of Model

Having conducted the unit root test, the optimum lag selection and the Johansen cointegration test. Next step is to examine the long run impacts of exchange rate and interest rate on industrial productivity in Nigeria using OLS technique. The estimate of the long run coefficients of the model is as follows.

Table 4: Estimated Long Run Coefficients of Model

Dependent Variable: LIO		
Independent Variables	Coefficients	P-values
C	4.083863***	0.0000
LEX	1.244062***	0.0000
IN	-0.089920***	0.0002
R^2 = 0.922163; F-Statistic = 35.52970 (0.000000)		
Durbin-Watson Statistic = 1.230102		

Note: *** Statistical significance at 1% level; ** statistical significance at 5%;
* Statistical significance at 10%

Source: Eviews 9

From Table 10, exchange rate have positive long run effect on industrial productivity in Nigeria. Conversely, interest rate has reducing long run effect on industrial productivity in Nigeria. These results follows the earlier empirical work done. The coefficient of determination (R^2) is 0.922163, which implies that 92% of variation in industrial ouput is caused by variation in the explanatory variables. The Durbin Watson statistics is 1.230102 which shows the absence of serial correlation. The F-statistic (35.52970) is significant at 1% which implies that the model is adequate.

Conclusion and Recommendation

The paper examined the nexus between exchange rate deregulation on industrial production in Nigeria over the period 1986-2015.Using the Johansen cointegration techinique, findings reveals the following: first, the three variables namely industrial production, exchange rate, and interest rate tend to move together in the long run. The main implications of the findings are: one, increased access to exchange rate for production could have significant impact on industrial production in the long run. This, therefore, suggests that more foreign exchange should be made available to reduce the gap between the supply and demand for exchange rate thereby enhancing the value of the domestic currency. Two, interest rate should be pro industrial sector so as to have significant effect on industrial production in Nigeria. Enhancing access to credit through investment friendly interest rate will impact output in the subsector.

Therefore, exchange rate deregulation has been favourable to industrial production. In the light of this finding, it is recommended that the Central Bank of Nigeria should carefully monitor the movement of the market determined exchange rate. This will ensure that exchange rate deregulation does not become counterproductive through price alterations on industrial production, trade and investment in the industrial sector.

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Appendix I
Data Presentation

year	IO	EX	IN
1986	**51.08**	2.02	9.93
1987	**65.50**	4.02	13.96
1988	**86.08**	4.54	16.62
1989	**122.73**	7.39	20.44
1990	**147.96**	8.04	25.3
1991	**187.38**	9.91	20.04
1992	**303.28**	17.3	24.76
1993	**365.92**	22.05	31.65
1994	**487.57**	21.89	20.48
1995	**862.24**	81.2	20.23
1996	**1,153.53**	81.2	19.84
1997	**1,171.35**	82	17.8
1998	**1,053.41**	84	18.18
1999	**1,314.29**	93.95	20.29
2000	**2,100.51**	102.1	21.27
2001	**1,964.89**	111.93	23.44
2002	**2,178.51**	121	24.77
2003	**2,902.81**	129.3	20.71
2004	**3,992.28**	133.5	19.18
2005	**5,080.16**	131.66	17.95
2006	**6,157.84**	128.65	16.9
2007	**6,800.15**	134.05	16.94
2008	**8,072.50**	132.37	15.48
2009	**7,513.88**	132.6	18.36
2010	**12,033.20**	148.68	17.59
2011	**15,626.42**	146.2	16.02
2012	**16,975.34**	150.2	12
2013	**17,614.29**	156	12
2014	**18,402.19**	158.55	13
2015	**15,073.78**	192.44	11

Source: CBN Statistical Bulletin 2015

Where:
IO = the industrial output proxied by share of industry in gross domestic product.
EX = the real exchange rate
IN= the interest rate are

Appendix II
Stationarity Results for each variables from Eviews 9

Null Hypothesis: D(LIO) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.693170	0.0045
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.900168	0.0000
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LIN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.688193	0.0395
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Appendix II
Regression Result

Dependent Variable: IND
Method: Least Squares
Date: 11/14/17 Time: 22:31
Sample: 1 30
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7257.805	3309.852	2.192788	0.0371
EXC	66.89599	11.64386	5.745172	0.0000
INT	-450.2811	145.6787	-3.090919	0.0046

R-squared	0.706831	Mean dependent var	4995.370
Adjusted R-squared	0.685115	S.D. dependent var	6103.888
S.E. of regression	3425.173	Akaike info criterion	19.21033
Sum squared resid	3.17E+08	Schwarz criterion	19.35045
Log likelihood	-285.1550	Hannan-Quinn criter.	19.25516
F-statistic	32.54857	Durbin-Watson stat	0.429132
Prob(F-statistic)	0.000000		

LAG Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LIND LEXC INT
Exogenous variables: C
Date: 11/15/17 Time: 03:43
Sample: 1 30
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-140.9033	NA	5.843120	10.27880	10.42154	10.32244
1	-52.14754	152.1527	0.019727	4.581967	5.152912	4.756511
2	-36.30097	23.76986*	0.012423*	4.092926*	5.092080*	4.398377*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Cointegration

Date: 11/15/17 Time: 03:45
Sample (adjusted): 4 30
Included observations: 27 after adjustments
Trend assumption: Linear deterministic trend
Series: LIND LEXC INT
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.557791	40.10361	29.79707	0.0023
At most 1 *	0.434398	18.07235	15.49471	0.0200
At most 2	0.094694	2.686011	3.841466	0.1012

Trace test indicates 2 cointegratingeqn(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 No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.557791	22.03126	21.13162	0.0373
At most 1 *	0.434398	15.38634	14.26460	0.0331
At most 2	0.094694	2.686011	3.841466	0.1012

Max-eigenvalue test indicates 2 cointegratingeqn(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):

LIND	LEXC	INT
-0.705204	-0.542033	-0.119039
-1.595944	2.589332	-0.458770
-1.577081	1.991117	0.034330

Unrestricted Adjustment Coefficients (alpha):

D(LIND)	0.025652	-0.075513	0.031815
D(LEXC)	0.082526	-0.071721	-0.022507
D(INT)	2.209075	0.875398	-0.015799

1 Cointegrating Equation(s):	Log likelihood	-34.37994

Normalized cointegrating coefficients (standard error in parentheses)

LIND	LEXC	INT
1.000000	0.768620	0.168801
	(0.44687)	(0.10070)

Adjustment coefficients (standard error in parentheses)

D(LIND)	-0.018090
	(0.02524)
D(LEXC)	-0.058198
	(0.02432)
D(INT)	-1.557848
	(0.38407)

2 Cointegrating Equation(s):	Log likelihood	-26.68677

Normalized cointegrating coefficients (standard error in parentheses)

LIND	LEXC	INT
1.000000	0.000000	0.206945
		(0.06935)
0.000000	1.000000	-0.049626
		(0.04745)

Adjustment coefficients (standard error in parentheses)

D(LIND)	0.102425	-0.209433
	(0.05464)	(0.08285)
D(LEXC)	0.056265	-0.230441
	(0.05287)	(0.08016)
D(INT)	-2.954935	1.069305
	(0.88328)	(1.33923)

OLS to Estimate Long Run Coeficient of the Parameters

Dependent Variable: LIND
Method: Least Squares
Date: 11/15/17 Time: 03:47
Sample: 1 30
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.083863	0.522754	7.812203	0.0000
LEXC	1.244062	0.073951	16.82290	0.0000
INT	-0.089920	0.021054	-4.270946	0.0002

R-squared	0.922163	Mean dependent var	7.387747
Adjusted R-squared	0.916398	S.D. dependent var	1.837174
S.E. of regression	0.531202	Akaike info criterion	1.667290
Sum squared resid	7.618732	Schwarz criterion	1.807409
Log likelihood	-22.00934	Hannan-Quinn criter.	1.712115
F-statistic	159.9402	Durbin-Watson stat	1.238942
Prob(F-statistic)	0.000000		

Error Correction Model

Dependent Variable: D(IND)
Method: Least Squares
Date: 11/15/17 Time: 03:50
Sample (adjusted): 2 30
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	634.2842	287.5946	2.205480	0.0368
D(LEXC)	-737.5231	938.0979	-0.786190	0.4391
D(INT)	-15.83076	78.64608	-0.201291	0.8421
ECM(-1)	-0.9417	516.4713	0.669237	0.5095

R-squared	0.053185	Mean dependent var	518.0242
Adjusted R-squared	-0.060432	S.D. dependent var	1294.303
S.E. of regression	1332.839	Akaike info criterion	17.35545
Sum squared resid	44411466	Schwarz criterion	17.54404
Log likelihood	-247.6540	Hannan-Quinn criter.	17.41452
F-statistic	0.468108	Durbin-Watson stat	1.326511
Prob(F-statistic)	0.707163		