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Trade Policy Incentives, Market Structure and Productivity

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Abstract

Trade policy incentives are drivers of within-sector productivity growth and rapid industrial transformation in many developing countries. In many African countries, the use of tariffs, trade prohibitions and a package of fiscal policy incentives are therefore components of industrialisation and backward integration programmes to accelerate the performance of priority sectors. However, the effectiveness of these policy instruments within specific industries, and the transmission mechanism of policy incentives to productivity has not been adequately explored in the literature. By focusing on oligopolistic market structure of the cement industry in Nigeria, this paper analysed the relative impact of trade policy incentives and market structure on the within-sector productivity. Using the autoregressive distributed lag model with structural breaks, the study finds that producer concentration ratio is the most significant driver of productivity. While the trade policy incentive indexed by effective rate of protection (ERP), and financing subsidies also impact productivity improvements, the magnitudes are significantly lower. The overwhelming significance of market structure nuance earlier research studies and provide new insights into the nexus between trade incentives and productivity in an oligopolistic industry.

Keywords: Trade policy; Trade incentives; Productivity; Industrial policy; Market structure.

1. Introduction

Over the past decade, there has been an increasing use of trade policy incentives such as tariffs, import quotas and import prohibition as a key feature of industrial policy in many developing countries, particularly African countries (United Nations Economic Commission for Africa, 2016). In Nigeria, since the early 2000s, there has notably been an increasing promotion of backward integration strategies (FMITI, 2014) supported by a mix of trade and fiscal policy incentives for key commodities like cement, and staple crops, amongst others (Emejo, 2019). The theoretical argument for the Backward Integration Programme (BIP) is infant-industry protection (Greenwald and Stiglitz, 2012; Rodrik, 2015). Implicit in both the BIP and infant-industry industrialisation strategy is the growth in value-added or productivity improvement that would accrue to the protected industry if provided with trade and fiscal incentives in its infancy. Absent these productivity improvements, the trade and fiscal incentives create empty growth, fiscal imbalances and further long-run distortions in the economy (Oyejide *et al.*, 2013).

However, there is a dearth of studies on the transmission mechanism of the instruments of trade policy incentives to industrial performance. This poses a lot of difficulties for the central planner to identify the right balance among various incentive structures (Harrison and Rodiguez-Clare, 2010; Melitz, 2005; United Nations Economic Commission for Africa, 2017). In Africa, there are many contradictory and inconclusive studies on level of trade protection and required industrial policy incentives to stimulate the manufacturing sector (Harrison and Rodiguez-Clare, 2010). This issue needs to be addressed, especially the transmission mechanism in order to provide justification for the huge incentives. Furthermore, the preponderance of imperfect markets, calls for the need to consider the impact of market structure when analysing the ability of the protected firms to take advantage of the trade policy incentives to boost of performance and productivity (Adenikinju and Chete, 2002; Akinyoade and Uche, 2018; Fasan, 2015; Oyejide *et al.*, 2013).

The basic objective of the paper is to analyse the effect of trade policy incentives on productivity of the cement industry within the context of the oligopolistic market structure. The choice of the Nigerian cement industry is necessitated by the homogeneity of the product and the significant growth the sector has recorded in Africa (Akinyoade and Uche, 2018). Moreover, the cement industry is one of the key beneficiaries of the trade and industrial policy incentives of Nigeria. Since the inception of the Backward Integration Programme (BIP) in 2002, the capacity of the Nigeria cement industry has recorded seven-fold multiplication from less than 5 million tonnes to 35 million tonnes per annum during the period of 15 years, making it the largest on the African continent. This growth has been largely driven by the successful strategic trade policy of promoting a domestic manufacturer in an oligopolistic industry against Western cement manufacturers to the effect that a Nigerian-owned company now dominates cement production on the continent (Edwards, 2017). The analysis is based on specific data on trade and industrial policy incentives in Nigeria in order to provide empirical evidence on the effectiveness of policy incentives to a protected industry in a developing country.

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2. Literature Review

Conceptually, the impact of trade protection on industrial performance is measured using key indices of productivity, market competitiveness or structural change (OECD, 2014). Trade protection is a potential tool for industrial transformation as part of an overall strategy of economic growth or economic transformation (Jouanjean *et al.*, 2015). Indeed, industrial transformation in the context of economic transformation is the process of raising productivity in the industrial sector of economy. Jouanjean *et al.* (2015) therefore suggest that industrial transformation could be viewed as the process of moving labour and other resources from lower-productivity to higher-productivity activities and raising within-sector productivity growth. Based on this definition, industrial transformation has two main components: within-sector productivity-growth and structural transformation. Due to the limited rate of structural transformation in many developing countries, within-sector productivity growth is important to achieve industrial transformation. Jouanjean *et al.* (2015), provides justifications for huge government incentives in form of tariffs, reduced taxes, or subsidies to priority industries in the realisation of sectoral productivity growth and plausible explanation for the East Asia miracle.

Diao (2017), indicates that within-sector productivity growth has not played an important role in industrial productivity increases in Africa. Till date, the growth of many African countries is driven by structural transformation, rather than within-sector productivity growth. This raises issue of sustainability Diao (2017). Although structural transformation appears more important than within-sector productivity growth in explaining Africa's growth, the asymptotic nature of growth has brought to the fore the need for a detailed examination of the theoretical justification for incentivising within-sector productivity growth (Rodrik, 2015; United Nations Economic Commission for Africa, 2017).

Despite the centrality of realising productivity growth in incentivised industries or infant-industries, there are many conflicting positions on the sources of growth. Stiroh (2001), acknowledges that productivity enhancement remains crucial to the drive for rapid industrialization in developing countries. The neoclassical and "new growth" theories offer divergent explanations for productivity growth. To the neoclassical theories, exogenous technical progress drives long-run productivity growth as capital is subject to diminishing returns. Conversely, the new growth models yield long-run growth endogenously, either by avoiding diminishing returns to capital or by explaining technical progress internally. The new growth theory also posits that productivity growth is achievable without the impetus of exogenous technical progress (Romer, 2011). In summary, models from the neoclassical theory provide a means to measure the rate of technical progress, while the new growth economists provide an internal explanation on sources of technical progress or productivity (Stiroh, 2001).

Most of the literature on the subject focuses on the nexus between trade liberalisation and productivity, a detailed review of which has been covered exhaustively by Redding (2011), Harrison and Rodiguez-Clare (2010), and Meng-Chi Tang (2017), Hanson and Ohanian (2016) recognise the primacy of technologies, industrial and trade policy incentives as sources of long-run changes in macroeconomic variables. Several empirical studies support this. For instance, using the new growth models, Syverson (2004) finds a strong correlation between market structure and plant density with productivity in ready-mixed concrete cement plants in the United States. Similarly, Polemis and Stengos (2015) find that market structure is positively correlated with the market size providing strong evidence that market size increases labour productivity. Using a smooth coefficient semiparametric model to account for nonlinear effects, the evidence suggests a nonlinear relationship between market concentration and labour productivity.

In developing countries, much of the evidence on intra-industry allocations of productivity emanate from studies on trade liberalisation, but the endogenous sources of productivity increases are a subject of ongoing research (Melitz, 2003; Redding, 2011). For African countries, conclusive researches are sparse. Ramachandran *et al.* (2009) for instance in a study based on the World Bank's Enterprise Survey on 41 countries find that despite the clear correlation between productivity and country-level characteristics and firm-level factors, it is difficult to identify the effect of market structure on productivity. Tyce (2019) and Karacaovali (2006) corroborate the importance of country-level studies to determine the drivers of industrial performance and productivity in developing markets. Adenikinju and Chete (2002), study on the link between trade, market structure and productivity found a non-linear and significant relationship between productivity and the concentration index, with productivity at the industry level exhibiting a U-shape possibly due to the domination of multinationals in the affected industries. On the other hand, average nominal tariff rates and effective protection rates negatively and significantly affects productivity. Zeitlin (2012), also find a significant positive correlation between market structure and producer productivity within the context of a two-year doubling of cocoa output in Ghana. However, both studies on West African markets are short-panelled covering less than a decade, thereby limiting the applicability of the findings.

In Nigeria, the government policy of accelerating industrial growth in selected priority industries has become a core part of the industrial development strategy since 2001 when the Backward Integration Program (BIP) was launched (Alayande, 2017). The oligopolistic cement industry was the pioneer industry for the BIP for several reasons in addition to the industry and product characteristics of oligopoly, product homogeneity, and low substitutability. In addition, the government's strategic trade policy intent to sponsor a domestic manufacturer against foreign oligopolists raise questions of the relative importance of market structure in the success of that policy.

This study attempts to fill the research gaps in earlier inconclusive or short-panelled studies on African countries by conducting a multi-decade study, while using distinct indices of trade and fiscal policy incentives, and also introducing market structure so as to understand the transmission mechanism of policy incentive and productivity. This study is therefore very topical in contributing a quantitative, evidence-based industry study using objective measures in international trade and industrial economics to analyse the policy impact of trade protection on a large manufacturing industry.

3. Theoretical Framework and Methodology

3.1. Theoretical Framework

The theoretical framework for trade protection is mainly hinged on the infant-industry argument to enhance manufacturing competitiveness in domestic industries. The framework for the paper is derived from Harrison and Rodiguez-Clare (2010) and Tapalova and Khandelwal (2010). From first principles, the Brander and Krugman (1983) model and the Helpman and Krugman (1985) new-trade-theory model stipulate the presence of increasing returns to scale and imperfect competition as sufficient conditions to drive increased firm-level and industry-level output growth in the short-run, and increased productivity in the medium-term (Brander and Krugman, 1983; Helpman and Krugman, 1985). The absence of within-sector productivity increases would imply empty-growth in the protected sector; hence the importance of measuring productivity increases over manufacturing value-added (Jouanjean *et al.*, 2015).

Based on a simplified Harrison and Rodiguez-Clare (2010) version of the BK and HK models, productivity is endogenously determined in response to trade and industrial policy incentives. The Marshallian externalities arise as an automatic consequence of the scale of the sector, as the sector necessarily experiences an increase in labor productivity as it becomes larger.

The choice of factor productivity as the preferred measure for productivity growth in the study over total factor productivity is three-fold, and based on the peculiarities of the Nigerian cement cement industry that has witnessed multiple mergers in the past three decades. First, an accurate measure of total factor productivity (TFP) requires accurate measurements of capital stock and reasonable assumptions about depreciation which may be challenging given the significant level of changes in the structure of the cement industry and in the reporting standards over the time series used (Sargent and Rodriguez, 2000). The second is the volatile fluctuations in capacity utilization in the survey period. As this capacity utilization in the focus cement industry is largely endogenously determined within the duopoly, identification is inherently weak, and the validity of any TFP estimates uncertain. Third, preliminary evidence suggests that TFP growth in Nigeria may have been largely dependent on capital accumulation in the period under review, thereby violating the growth assumptions for its use as a better measure of productivity (Sargent and Rodriguez, 2000). These stated factors result in a compound violation of the competitive assumptions for the use of total factor productivity. On the other hand, labour input is less amenable to endogenous manipulation even in a Stackelberg duopoly and displays a more consistent pattern in the dataset.

3.2. Methodology

This study extends earlier models of the Nigerian cement industry used by Mojekwu *et al.* (2013) and Oyejide *et al.* (2013) modified with indices for the incentives to the protected industry: the effective rate of protection and financing subsidies. In addition to these two incentives, four explanatory variables of concentration ratio, capital intensity, installed capacity and demand-supply gap are included. The justification for inclusion of market structure, capital, and industry capacity is based on earlier research findings that these variables do impact productivity in capital-intensive industries Syverson (2004). Standard definitions are used for effective rate of protection calculated using the Corden method; and for concentration ratio measured using the 2-firm concentration ratio. For financing subsidies, given the limited data on the fiscal subsidies to cement manufacturers including concessional pricing for low-pour fuel oil (LPFO) and gas, with a direct objective to reduce their financing costs, the proxy of financing costs is used (Oyejide *et al.*, 2013).

The estimation technique is the Autoregressive Distributed Lag (ARDL) estimation technique with structural breaks. This technique is suitable in the presence of non-stationarity at levels in the time series data as reported in table 4.4. In other words, the ARDL technique is more robust and the most suitable technique when the series exhibit different orders of integration (Pesaran *et al.*, 2001). Aside the reason mentioned above, the ARDL technique also provides a framework for checking the existence of the long run relationship among non-stationary time series data, using the Bounds *Test.* Unlike other residual based co-integration test such as Engle-granger and Johansen co-integration test suitable when the series are all integrated at order one (Dimitrios, 2006), the Bounds test is suitable for mixed order of integration. The relative productivity growth model of Harrison and Rodiguez-Clare (2010), tests for performance of the protected industry while identifying determinants for the superior productivity growth in the infant-industry. Hence, we specify the model as:

$$\underset{(+)}{Lp}\,(t) = f\,[\,\underset{(+)}{CI}\,(t\text{-}i),\ \underset{(-)}{FC}\,(t\text{-}i),\ \underset{(+)}{ERP}\,(t\text{-}i),\ \underset{(+)}{CONC}\,(t\text{-}i)\},\ \underset{(+)}{DSGap}\,(t\text{-}i)\,,\ \underset{(+)}{CAP}\,(t\text{-}i),\}$$

Where:

Lp_{CEMENT}: *Labour productivity of cement sector*
CI *(t-i):* *Lagged variables of capital intensity, where i =1*
FC *(t-i):* *Lagged variables of financing cost*
ERP (t-i): *Lagged variables of Effective rate of protection*
CONC(t-i): *Concentration ratio, Measure of industrial structure.*
DSGap (t-i): Lagged variables of Demand-supply gap of cement in the country. The demand-supply gap is calculated as the difference in any particular year between estimated demand in the country of Nigeria, and the supply of locally produced cement in that year.

CAP (t-i): Lagged variables of installed capacity.

The data of relevant variables were obtained from the manufacturing sector database of the Nigeria Bureau of Statistics (NBS, 2017), and the published annual reports of cement companies. Computations of the ratios for the industry indices are then done from available raw data of the manufacturing firms. Due to limited availability of data, firm-level data had to be computed by the author for individual manufacturing companies over 36 years across all variables, and then aggregated to the industry. For the macroeconomic data, data from the Central Bank of Nigeria and the NBS are used. Analysis of data was executed using the *eViews* software. Ordinary Least Squares (OLS) estimation was done followed by error correction.

4. Results and Discussion

4.1. Trends and Summary Statistics of the Cement Industry in Nigeria

The Nigerian cement industry is an oligopolistic industry with a 2-firm concentration ration that has risen from about 0.60 in 1980 to approximately 0.90 in 2015, and is currently dominated by Dangote Cement Plc and Lafarge Africa Plc (2016) (formerly West African Portland Cement Company), a member of the Lafarge Holcim multinational group with operations in 80 countries (Dangote Cement Plc, 2017; Lafarge Holcim, 2019). Despite Lafarge's cement manufacturing operations in Nigeria since 1960 through its predecessor company, West African Portland Cement Company, the company's market share had been overtaken by the locally-sponsored Dangote Cement Plc with less than a decade in cement manufacturing, by 2008 (Agusto and Co, 2015; Akinyoade and Uche, 2018). The growth of the locally-sponsored Dangote Cement Plc has been attributed to over-riding elements of strategic trade protection.

The summary of the indices for cement production in Nigeria are presented in Table 4.1 the indices for tariff and fiscal incentives in Table 4.2, while the descriptive statistics are in Table 4.3.

Table-4.1. Indices of Cement Industry Production in Nigeria

	1980	1985	1990	1995	2000	2005	2010	2015
Cement Industry Gross Sales (*Millions of Naira*)	119	241.7	1,162.70	11,464.87	13,323.16	37,005.54	257,588.46	516,811
Cement Industry Production (*Million of Metric Tons)*	3.5	3.5	3.03	2.61	2.29	2.85	10.11	31
Cement Industry Capital Employed (*Millions of Naira)*	251	318.7	1,109.86	6,918.49	17,324.63	28,755.93	387,933.63	1,317,201.46
Cement Industry Capital Intensity	2.1	1.32	0.96	0.6	1.3	0.78	1.51	2.55
Demand-Supply Gap	0.15	0.243	0.91	1.09	3.33	6.63	5.71	0.01
2-firm Concentration Ratio	0.61	0.625	0.64	0.66	0.67	0.76	0.83	0.92
Installed Capacity (*Million Tons)*	3.69	3.5	3.5	3.01	3	4.6	11	35

Table-4.2. Indices of Fiscal and Tariff Incentives to the Cement Industry in Nigeria

Year	1980	1985	1990	1995	2000	2005	2010	2015
Cement Industry Financing Cost %	1.05	1.195	0.025	0.257	0.171	0.266	0.107	0.797
Cement Industry Effective Tax Rate %	0.11	3.234	0.365	0.148	0.043	-0.00004	0.084	0.041
Effective Rate of Trade protection	0.29	0.329	0.347	0.544	0.939	1.075	1.634	1.763
Real Exchange rate	100	166.72	24.08	29.21	23.69	29.12	29.75	37.51

Source: Author Computations from Annual Reports of various companies

Table-4.3. Summary Descriptive Statistics of the Cement Industry in Nigeria

	LP	CI	FC	DSGAP	ERP	CON	CAP
Mean	10274.15	1.187992	0.461200	2.742268	0.842936	0.707500	7.0994
Median	2446.355	1.043295	0.209040	1.839428	0.608609	0.662500	3.5000
Maximum	48971.20	2.548710	1.498140	6.977000	1.762642	0.921000	35.0000
Minimum	54.04540	0.578130	0.025340	0.000000	0.270000	0.610000	3.0000
Std. Dev.	15712.12	0.447058	0.472486	2.558024	0.516241	0.093805	8.9343
Skewness	1.563792	0.970084	0.868696	0.509360	0.458671	0.884282	2.3916
Kurtosis	3.866308	3.705573	2.139785	1.614920	1.657925	2.418830	7.1941
Jarque-Bera	15.79840	6.393133	5.637755	4.434355	3.964023	5.198368	60.7053
Probability	0.000371	0.040902	0.059673	0.108916	0.137792	0.074334	0.0000
Sum	369869.6	42.76770	16.60321	98.72165	30.34570	25.47000	255.5800
Sum Sq. Dev.	8.64E+09	6.995137	7.813507	229.0220	9.327676	0.307977	2793.7490
Observations	36	36	36	36	36	36	36

Source: Author Computations from Annual Reports of various companies

Tables 4.1 to 4.3 reflect the rapid growth rate in the Nigerian cement industry especially after the introduction of backward integration in 2001 to 2002. Many of the indices are positively skewed reflecting faster growth in recent years.

4.2. Results and Interpretation

The presence of several trade policy regimes in Nigeria in the period between 1980 and 2015, especially the new trade and foreign exchange regime around 1992, and the introduction of trade protection for selected infant-industries from 2001, necessitate a review of the trend of the series to test for probable structural breaks. A structural break is the unexpected change overtime in the properties of a series, which tends to affect the parameters of the variables. An observed break in the trend warrant a unit root test with structural breaks (Perron, 1989), such as the modified augmented Dickey Fuller test (modified ADF) which allows for levels and trend that differ around a single break date. Given the results of the unit root with structural break test (Table 4.4) the study therefore employs the Autoregressive Distributed Lag (ARDL) with structural breaks estimation technique. This technique is suitable in the presence of non-stationarity at levels time series data as reported in table 4.4. The ARDL technique is therefore more robust and the most suitable technique when the series exhibit difference stationarity or different order of integration (Pesaran *et al.*, 2001). However, the study includes the structural break because of the intercept an trend shift observed in the model.

Aside the reason mentioned above, the ARDL technique also provides a framework for checking the existence of the long run relationship among non-stationary time series data refers to as *Bounds Test.* Unlike other residual based co-integration test such as Engle-Granger and Johansen co-integration test suitable when the series are all integrated at order one (I(1)) (Dimitrios, 2006; Pesaran *et al.*, 2001), and the bounds test is suitable for mixed order of intergration, that is, I(0) and I(1). However, due to the break observed in the model, Gregory Hanson co-integration method is introduced to the bound test through the inclusion of a dummy variable to capture the observed breaks Hansen (2001), Gregory and Hansen (1996) and Perron (2006).

DV_t =Dummy Variable for structural breaks

$$\text{Break} = \begin{cases} 1, \text{period after the breakpoint} \\ 0, \text{period before the break point} \end{cases}$$

To detect the break date the study employs the Sequential Bai-Perron method (Bai and Perron, 1998). Details of the estimation results are provided in Appendix 1 while the results of the modified ADF test are presented in Table 4.4.

Table-4.4. Result of the Modified ADF Unit Root Test

Unit Roots with Structural Breaks (Modified ADF Test)							
Variable	**Level**			**First Difference**			
	Break Date	***T. stat***	***Pvalue***	***Break Date***	***T.stat***	***Pvalue***	***I(d)***
LP	1992	-3.929853[eb]	0.4165	1995	-7.850919 [ea]	< 0.01	I(1)
FC	1989	-6.809629***[ea]	< 0.01		……………………‡		I(0)
CI	2009	-2.831937[bd]	0.7720	2014	-4.731606***[bd]	< 0.0221	I(1)
DsGap	1995	-2.423126[bd]	<0.9212	2008Q3	-7.840096***[ea]	< 0.01	I(1)
ERP	1999	-5.966709***[ea]	< 0.01		……………………‡		I(0)
CONC	1998	-5.054038[ea]	0.0695	2000	-13.05290***[ea]	< 0.01	I(1)
CAP	2009	-6.106210***[ea]	< 0.01		……………………‡		I(0)

Source: computation from output of Eview 9
Note: *, ** and *** imply significance at 10%, 5% and 1% respectively. 'a' implies break point test equation with constant and trend, 'b' implies break point test equation with constant only, and 'c' implies break point test equation with trend only. 'd' implies trend specification with intercept only, 'e' trend specification with intercept and trend.

The result of the ADF unit root reveal that except FC (finance cost), ERP (effective rate of protection) and CAP (production capacity) significant at levels, other variables are stationary after first difference, justifying the use of ARDL technique for the regression estimates.

4.3. The Bounds Co-integration Test Result

Table 4.5 shows the result of Bounds co-integration test to check if there exists a long-run equilibrium relationship between the series in the models. For the estimated model, the sequential Bai-Perron method was used to detect the break date in the model and a break of 1992 was detected. This necessitated the inclusion of the dummy variable (DV) in the model. Moreover, since the F-statistic is greater than the upper bound (I1) critical value at 10% level of significance, thus it can be concluded that a long-run equilibrium relationship is exist in the model. This indicates that the trend of the mean difference of the variable is constant in the long run; as a result they do not diverge. In other words the linear combination of these variables in the long run is stationary, thus the long run estimates are as well seen as very significant.

Table-4.5. Result of Bounds Co-integration Test

Model: $LP = f(FC, ERP, DsGap, CAP, CI, CONC, DV)$		
F-stat	4.448509	
Critical Values		
Significance levels	I0 Bound	I1 Bound
10%	2.03	3.13
5%	2.32	3.5
2.5%	2.6	3.84
1%	2.96	4.26

Source: Author's Computation

The regression results are presented in Table 4.6. The results comprise the short-run and the long run ARDL estimates and the vital statistics of the model. The ARDL model (1, 0, 0, 0, 1, 0, 2, 1), are selected automatically for the model through the ARDL estimation technique after using lag length of 2 for the model.

Table-4.6. ARDL Estimates of the Model

Short Run Estimates	
Explanatory variable	LP_t
ε_{t-1}	-0.974768***(0.000)
ΔFC_t	-0.677902***(0.0003)
ΔFC_{t-1}	0.809885***(0.0003)
ΔERP_t	0.796101*(0.0774)
$\Delta DsGap_t$	-0.149094**(0.0159)
ΔCAP_t	-0.006852 (0.6204)
ΔCI_t	0.369165**(0.0294)
$\Delta CONC_t$	6.893427**(0.0119)
ΔDV_t	0.292620 (0.3172)
C	1.480678 (0.2394)
Long Run Estimates	
Explanatory variable	LP_t
FC_t	-1.735968***(0.0000)
ERP_t	0.792323*(0.0830)
$DsGap_t$	0.020378 (0.6371)
CAP_t	-0.006820 (0.6246)
CI_t	0.367413** (0.0173)
$CONC_t$	6.860715*** (0.0034)
DV_t	1.412136***(0.0000)
C	1.473651(0.2508)
R^2	0.996527
F-stat	502.1183 [0.000]
Ramsey RESET linearity test	0.159031 [0.6943]
Jarque-Bera normality test	0.090470 [0.955773]
Breusch-Godfrey serial correlation LM test	1.074557 [0.3613]
Breusch-Godfrey- Pegan heteroscedasticity test	1.341111 [0.2682]

Note: ***, **, * indicate the statistical significance of coefficients at 1%, 5% and 10% respectively; the values in parentheses and block brackets are, respectively, the standard errors and the probabilities; RESET implies Regression Error Specification Test.
Source: Author's Computation

Table 4.6 shows that the finance cost (FC) is reported to be a significant contributor to labour productivity at 1% level of significance in the short and long run. The impact coefficients are 0.131983 and -1.735968 in the short run and long run respectively. Also, the effective rate of protection (ERP) of the cement industry is observed to impact labour productivity positively and significantly in the short run and long run at 10% level of significance. In other words, there is a positive and significant relationship between ERP and LP in the short run and long run at 10% level of significance. The impact coefficients are 0.796101 and 0.792323, and with p-value less than 0.1, the impact coefficients are significant at 10% level. This suggests that the tariff structure and import prohibition in the cement industry positively impact increases in labour productivity.. Also, the demand and supply gap recorded an inverse and significant relationship with labour productivity in the short run alone. Conversely, installed capacity, CAP recorded insignificant impact on labour productivity in the cement sector in the short run and long run. The diagnostic tests indicate that other factors affecting not included in the model captured by the constant term recorded insignificant impact on labour productivity in the short run and long run on the average.

Furthermore, the 2-firm concentration index (CONC) is shown to exert a positive impact on labour productivity in the short and long run at 5% level. This implies that the more concentrated the industry is, the higher will be the productivity in the short and long run. This subsequently will have a positive effect on the economic performance of the cement industry on the average. Similarly, capital intensity (CI) is shown to record similar impact on labour productivity in the short run and long run. Overall, these findings show that market structure, proxied by the concentration ratio, CONC, and capital intensity, CI are important determinants of labour productivity of the cement sector both in the short run and long run.

Based on the results, the cement industry is not affected by sudden shifts in the short run, largely due to the huge capital requirements and the lengthy construction cycles of greenfield cement plants, amongst others. However, in the long run, structural breaks impact positively and significantly the model in the long run. This implies that the economic policy changes were material in the cement industry. Post-estimation tests suggest that the model is a good fit for the empirical data, and the estimated ARDL model does not suffer from wrong functional form, serial correlation in the residuals and non-constant residual variance.

Overall, the results indicate that beyond the government policy incentives, market structure is a key determinant of within-sector productivity movements. Specifically, beyond the trade incentive indexed by the effective rate of protection ERP, and the fiscal incentive indexed by financing costs FC, the market structure is a significant determinant of the increased productivity in the cement industry. The relative magnitude of the market structure index on the productivity improvements validate the importance of industry structure on industrial performance.

5. Conclusions

This study examined the determinants of increased production of a key industry in the Nigerian economy that contributes almost 1% of the nation's GDP and 10% of the entire manufacturing sector's output. The objective of the paper is to identify the importance of trade incentives to improvement of productivity in a large oligopolistic industry, with a view to understanding the nexus among trade policy incentives, market structure and productivity.

The ARDL results indicate that market structure, trade protection, and financing subsidies are identified drivers of labour productivity. The magnitude of the estimation results indicate that the concentrated market structure in the oligopolistic cement industry had greater impact on within-sector productivity in the review period than the trade incentive *ERP* and the fiscal policy incentive The success of the policy incentives in driving productivity improvements have therefore been aided significantly by the market structure, raising questions as to whether the application of similar trade and fiscal policy incentives in a less concentrated industry would be as impactful in driving within-sector productivity.

Two key deductions emerge from this study. The first is the significant impact of the oligopolistic market structure on factor productivity, affirming the results of earlier studies such as Syverson (2004) and Polemis and Stengos (2015). However, the magnitude of significance of the market structure in the Nigerian cement industry masks other variables. Several explanations may be proffered for the overwhelming significance of market structure on productivity in this study. Notable is the peculiarity of the long-standing oligopoly in the Nigerian cement industry with a 2-firm concentration ratio of above 0.55 since 1980 rising to 0.85 in 2015. This influence of the concentration ratio is supported by the agglomeration externalities critical in boosting productivity in capital-intensive industries such as cement (Groot *et al.*, 2005). The second key deduction is that the effectiveness of trade and fiscal policy incentives, such as import prohibition and direct subsidies, as the key driver of within-sector productivity in a developing country may be enhanced or limited by the producer concentration ratio in the specific industry. Even if these incentives work in less concentrated industries, the allocative efficiency of such incentives would still need to be tested. Given the huge costs of these trade and fiscal incentives estimated at over 3% of the federal budget, these incentives are increasingly subject to a constrained fiscal policy space due to alternative demands on government revenues (FMITI, 2015). Coupled with the inherent abuse in the use of such fiscal instruments, it is dubitable as to whether the use of these trade policy incentives can be sustainable beyond a few industries and beyond the short-term (Modebe *et al.*, 2014).

Overall, this paper provides an industry-level perspective to the effectiveness of trade and fiscal policy incentives in stimulating industrial productivity in an oligopolistic industry in a developing country. Similar industry studies in sectors with alternative market structures may be beneficial in helping policy makers understand whether the effectiveness of these incentives would apply under different market contexts.

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Appendix-1. Estimation Results

CAP

Null Hypothesis: CAP has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2007				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 3 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.301105	0.0745
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: CAP has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2009				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.106210	< 0.01
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

ONC

Null Hypothesis: CN has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1999				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 1 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			0.592325	> 0.99
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p- values

Null Hypothesis: CN has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 1998				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 1 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.054038	0.0695
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

First Difference

Null Hypothesis: D(CN) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2000				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.324403	< 0.01
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(CN) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Lag Length: 4 (Automatic - based on Schwarz information criterion,				
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

CI

Null Hypothesis: CI has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2009				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.831937	0.7720
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: CI has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2008				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.826823	0.9808
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

First Difference

Null Hypothesis: D (CI) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2014				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.731606	0.0221
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang(1993) asymptotic one-sided p-values.

Null Hypothesis: D(CI) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2002				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.103244	0.0613
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Dsgap

Null Hypothesis: DSGAP has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1995				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 2 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.423126	0.9212
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: DSGAP has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 2000				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.463344	> 0.99
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

First difference

Null Hypothesis: D(DSGAP) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2009				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.243533	< 0.01
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(DSGAP) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 1998				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.840096	< 0.01
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

ERp

Null Hypothesis: ERP has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Lag Length: 4 (Automatic - based on Schwarz information criterion,				
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: ERP has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 1999				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion,				
maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.966709	< 0.01
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptoticone-sided p-values. LP

Null Hypothesis: LLP has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1989				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion,				
maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.430798	0.9195
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: LLP has a unit root
Trend Specification: Trend and intercept
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1992				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion,				
maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.929853	0.4165
Test critical values:	1% level		-5.347598	
	5% level		-4.859812	
	10% level		-4.607324	

*Vogelsang (1993) asymptotic one-sided p-values.

First difference

Null Hypothesis: D(LLP) has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 2010				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.216779	< 0.01
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Null Hypothesis: D(LLP) has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 1995				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.850919	< 0.01
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

FC

Null Hypothesis: FC has a unit root
Trend Specification: Intercept only
Break Specification: Intercept only
Break Type: Innovational outlier

Break Date: 1989				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.464277	< 0.01
Test critical values:	1% level		-4.949133	
	5% level		-4.443649	
	10% level		-4.193627	

*Vogelsang (1993) asymptoticone-sided p-values.

Null Hypothesis: FC has a unit root
Trend Specification: Trend and intercept
Break Specification: Trend and intercept
Break Type: Innovational outlier

Break Date: 1989				
Break Selection: Minimize Dickey-Fuller t-statistic				
Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.809629	< 0.01
Test critical values:	1% level		-5.719131	
	5% level		-5.175710	
	10% level		-4.893950	

*Vogelsang (1993) asymptotic one-sided p-values.

Regression result and co-integration test
Estimating the break date using the multiple break point test
Break point date

Multiple breakpoint tests
Bai-Perron tests of L+1 vs. L sequentially determined breaks
Date: 03/21/19 Time: 16:55
Sample: 1980 2015
Included observations: 36
Breaking variables: C
Non-breaking variables: CAP CI CN DSGAP ERP FC
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwidth)

Sequential F-statistic determined breaks:			**1**
		Scaled	Critical
Break Test	F-statistic	F-statistic	Value**
0 vs. 1 *	20.87600	20.87600	8.58
1 vs. 2	1.311479	1.311479	10.13
* Significant at the 0.05 level.			
** Bai-Perron (Econometric Journal, 2003) critical values.			
Break dates:			
	Sequential	Repartition	
1	1992	1992	

Regression result

ARDL Cointegrating And Long Run Form
Dependent Variable: LLP
Selected Model: ARDL(1, 0, 0, 0, 1, 0, 2, 1)
Date: 03/21/19 Time: 20:57
Sample: 1980 2015
Included observations: 34

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CAP)	-0.006852	0.013630	-0.502735	0.6204
D(CI)	0.369165	0.158326	2.331670	0.0298
D(CN)	6.893427	2.504613	2.752293	0.0119
D(DSGAP)	-0.149094	0.056815	-2.624189	0.0159
D(ERP)	0.796101	0.428741	1.856832	0.0774
D(FC)	-0.677902	0.154118	-4.398579	0.0003
D(FC(-1))	0.809885	0.187030	4.330246	0.0003
D(DV)	0.292620	0.285581	1.024649	0.3172
CointEq(-1)	-0.974768	0.157818	-6.176532	0.0000
Cointeq = LLP - (-0.0068*CAP + 0.3674*CI + 6.8607*CN + 0.0204*DSGAP +				
0.7923*ERP -1.7360*FC + 1.4121*DV + 1.4737)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CAP	-0.006820	0.013733	-0.496600	0.6246
CI	0.367413	0.142192	2.583928	0.0173
CN	6.860715	2.081586	3.295908	0.0034
DSGAP	0.020378	0.042619	0.478144	0.6375
ERP	0.792323	0.436299	1.816011	0.0837
FC	-1.735968	0.172172	-10.082739	0.0000
DV	1.412136	0.152341	9.269569	0.0000
C	1.473651	1.247811	1.180989	0.2508

Dependent Variable: LLP
Method: ARDL
Date: 03/21/19 Time: 21:00
Sample (adjusted): 1982 2015

Included observations: 34 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (2 lags, automatic): CAP CI CN DSGAP ERP FC DV
Fixed regressors: C
Number of models evalulated: 4374
Selected Model: ARDL(1, 0, 0, 0, 1, 0, 2, 1)

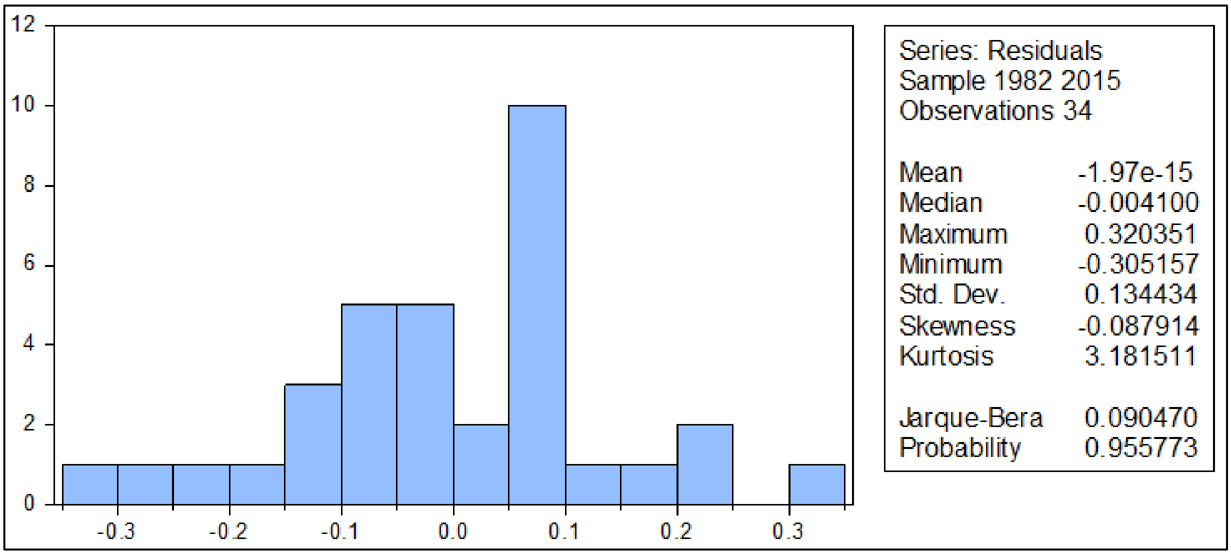
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LLP(-1)	-0.004768	0.157818	-0.030213	0.9762
CAP	-0.006852	0.013630	-0.502735	0.6204
CI	0.369165	0.158326	2.331670	0.0298
CN	6.893427	2.504613	2.752293	0.0119
DSGAP	-0.149094	0.056815	-2.624189	0.0159
DSGAP(-1)	0.169569	0.052948	3.202567	0.0043
ERP	0.796101	0.428741	1.856832	0.0774
FC	-0.677902	0.154118	-4.398579	0.0003
FC(-1)	-0.256458	0.165225	-1.552176	0.1356
FC(-2)	-0.809885	0.187030	-4.330246	0.0003
DV	0.292620	0.285581	1.024649	0.3172
DV(-1)	1.126249	0.337373	3.338289	0.0031
C	1.480678	1.222962	1.210731	0.2394
R-squared	0.996527	Mean dependent var		7.653777
Adjusted R-squared	0.994542	S.D. dependent var		2.281123
S.E. of regression	0.168522	Akaike info criterion		-0.440633
Sum squared resid	0.596393	Schwarz criterion		0.142975
Log likelihood	20.49076	Hannan-Quinn criter.		-0.241606
F-statistic	502.1183	Durbin-Watson stat		2.414910
Prob(F-statistic)	0.000000			

***Note:** p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 03/21/19 Time: 21:01
Sample: 1982 2015
Included observations: 34
Null Hypothesis: No long-run relationships exist

Test Statistic	**Value**	**k**		
F-statistic	4.448509	7		
Critical Value Bounds				
Significance	I0 Bound	I1 Bound		
10%	2.03	3.13		
5%	2.32	3.5		
2.5%	2.6	3.84		
1%	2.96	4.26		

Diagnstic test



Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.074557	Prob. F(2,19)	0.3613
Obs*R-squared	3.454986	Prob. Chi-Square(2)	0.1777

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.341111	Prob. F(12,21)	0.2682
Obs*R-squared	14.75126	Prob. Chi-Square(12)	0.2553
Scaled explained SS	6.138145	Prob. Chi-Square(12)	0.9090

Ramsey RESET Test
Equation: UNTITLED
Specification: LLP LLP(-1) CAP CI CN DSGAP DSGAP(-1) ERP FC FC(-1) FC(-2) DV DV(-1) C
Omitted Variables: Squares of fitted values

	Value	**df**	**Probability**
t-statistic	0.398787	20	0.6943
F-statistic	0.159031	(1, 20)	0.6943
F-test summary:			
	Sum of Sq.	df	Mean Squares
Test SSR	0.004705	1	0.004705
Restricted SSR	0.596393	21	0.028400
Unrestricted SSR	0.591688	20	0.029584