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Capacity Utilization, Industrial Production Index and Dividend Payout Policy in Nigeria: An Autoregressive Distributed Lag (ARDL) Model Approach to Cointegration

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Abstract

The study apply the Autoregressive Distributed Lag (ARDL) Model approach to cointegration analysis and Error Correction Model (ECM) to examine the relationships between dividend payout policy, capacity utilization and the industrial production index for Nigeria. The cumulative sum of recursive residuals (CUSUM) and the Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) were used to test for structural stability of the model. The results from the ADF unit root tests indicate that the average dividend yield and the industrial production index are first difference stationary while capacity utilization is an I(0) variable. The ARDL bounds tests suggest that the average dividend yield, capacity utilization and the industrial production index series are cointegrated. The ECM also reveals that capacity utilization and the industrial production index have significant causative implications for dividend payout policy. The CUSUM and CUSUMSQ plots lie within the 5 per cent critical bound thus providing evidence that the parameters of the model do not suffer from any structural instability over the period of study. The analysis suggests that policies designed to increase the capacity utilization rate should be favourable for the dividend payout policy of firms in Nigeria. These might include government policies aimed at developing infrastructure, creating enabling environment for effective and profitable productive activities to grow as well as the ability to operate at optimal capacity as a sin-qua-non to achieving policy objectives by firms.

Keywords: Capacity Utilization, Industrial Production Index, Dividend Payout Policy

1. Introduction

Economic theory is prevalent with postulations that establish the importance of capacity utilization to production, price and returns to investment. The Kaleckian and Harrodian models of production, accumulation and income distribution as well as the Cambridge income distribution theory have shown that performance of firms is capacity utilization dependent (Skott (2008); Hein (2009)). Algebraically, the canonical Kaleckian model in Skott (2008) defines the profit rate as the product of the profit share, the utilization rate and the technical output-capital ratio while Schuttze (1963) asserts in his article "uses of capacity measures for economic analysis" that:

"there are three major economic variables which are directly affected by changes in the rate of capacity utilization: Investment, Prices and Productivity. In combination, the movement of prices and productivity affect the share of income going to profits, hence the share going to disposable personal income…."

In his "Financialisation, distribution, capital accumulation and productivity growth in a Post-Kaleckian model" Hein, (2009) observed that some authors (e.g. Boyer, 2000), have considered the possibility of a 'finance-led growth' regime in which shareholder value orientation has an overall positive impact on the rates of capacity utilization, profit and growth. However, Cordonnier (2006), have argued that a regime of 'profits without investment' might emerge with rising shareholder power which subordinates management's and workers' preference for (long-run) growth of the firm to shareholders' preference for (short term) profitability. In other words, increasing dividend payments restrict the availability of finance for firms' real investment projects. In this regime, rising interest or dividend payments of firms to shareholders are associated with increasing rates of profit and capacity utilization, but with a falling rate of capital accumulation. Some authors however have shown that a 'contractive' regime may arise; in which higher interest and dividend payments to shareholders have a restrictive effect on the rates of capacity utilization, profit and capital accumulation (Hein, 2010; Van Treeck, 2009b). However,, according to Hein (2009) considering the argument in favour of increasing shareholder power, this is surprising because the early orthodox proponents of shareholder value orientation had argued that increasing shareholder power would induce managers to make more efficient use of the funds at their disposal and thus reduce the inefficiencies inherent in the 'principal-agent' conflict of modern corporations (Jensen/Meckling, 1976). Therefore, increasing shareholder power and shareholder value orientation of management should have a positive effect on productivity growth and the firms' growth potential.

With so much economic theorizing on the relationship between Profit, Prices and Productivity, researchers have begun to measure the amount by which the actual profit of a multi-input, multi-output firm deviates from potential profit, and then to decompose this profit gap into components that are of practical use to managers. In particular, Hein (2009) asserts that the measurement of the contribution of unused capacity, along with measures of technical inefficiency, and allocative inefficiency in this profit gap are emphasized. See (Gold, 1973; Eilon, 1975, 1985; **Coelli** et al.2005).

Perhaps it is okay to state at this juncture that this study does not intend to join issues with the Kaleckians or the Harrodians neither are we drawn to the arguments of the Keynesian and Harrodian instability in capacity utilization exposition. Furthermore, whether capacity utilization is defined in engineering or economic terms, all have their relevance in this study.

Our purpose is to instigate corporate managers to a re-awakening of the importance of managing capacity utilization as it affects production, price and returns. This is because a generally agreed problem of manufacturing and other companies in Nigeria is low capacity utilization (Söderbom and Teal (2002)). Unfortunately, trends in dividend policy studies in Nigeria (Uzoaga and Alozienwa (1974), Inanga (1975, 1978), Soyode (1975), Oyejide (1976), Izedonmi and Eriki (1996), Adelagan (2003), Adesola and Okwong (2009), (Musa, 2009) and Okpara (2010)) show a neglect/ lack of attention to capacity utilization as a significant determinant of the dividend payout policy of firms in Nigeria.

Following the above introduction, the paper is organized as follows. Section two deals with review of related literature. Section 3 deals with our methodology while section four deals with data analysis. Finally, in section 5 we present our concluding comments.

2. Literature Review

2.1 Capacity Utilization

Johansen (1968) defined a primal notion of capacity, plant capacity, as the maximal amount of output that can be produced per unit of time with the existing plant and equipment without restrictions on the availability of variable inputs. The US Federal Reserve Board (FRB) and Institute for Supply Management (ISM) provide similar definitions of capacity Utilization as the "maximum level of production that an establishment could reasonably expect to attain under normal and realistic operating conditions fully utilizing the machinery, equipment and intangible resources in place" (Morin & Stevens, 2005).

Fare et al. (1989) build on Johansen's (1968) definition, that with unrestricted available variable factors of production, capacity is the maximum amount that can be produced per unit of time with existing plant and equipment. They develop a non-parametric linear programming model that allows observed inputs and outputs to proxy for the measure of capacity utilization. With their model, one can also measure technical change and productive (technical) efficiency change.

Anwar M. Shaikh and Jamee K. Moudud (2004) in their contribution to the Levy Economics Institute Working Paper Collection distinguish between "engineering capacity," which is the maximum sustained production possible over some interval, and "economic capacity," which is the *desired level* of output from given plant and equipment. For instance, it may be physically feasible to operate a plant for 20 hours per day 6 days a week, for a total of 120 hours per week of engineering capacity. But it may turn out that the potentially higher costs of second and third shifts make it most profitable to operate only a single 8-hour shift per day for five days a week, i.e. 40 hours per week. This is what defines economic capacity, the firm's benchmark level of output (Shaikh and Moudud (2004)). For a comprehensive analysis on the meaning and arguments about capacity utilization please see Hein, Lavoie and Treeck

(2011a) on Harrodian instability and the 'normal rate' of capacity utilization in Kaleckian models of distribution and growth – a survey.

2.2The Concept of Industrial Production Index and Capacity Utilization

Industrial Production Index is an economic report that measures changes in output for the industrial sector of the economy. The industrial sector includes manufacturing, mining, and utilities. Although these sectors contribute only a small portion of GDP (Gross Domestic Product), they are highly sensitive to interest rates and consumer demand. This makes Industrial Production Index an important tool for forecasting future GDP and economic performance. Industrial Production figures are also used by central banks to measure inflation, as high levels of industrial production can lead to uncontrolled levels of consumption and rapid inflation.

The industrial production data is used in conjunction with various industry capacity estimates to calculate capacity utilization ratios for each line of business, with a base year used as a benchmark level of 100%. The industrial production and capacity utilization figures usually reflect similar changes in overall economic activity. Their monthly, quarterly or yearly levels can be used to shade light on short-term rates of change and business cycle growth respectively.

Capacity utilization is a concept in economics which refers to the extent to which an enterprise or a nation actually uses its installed productive capacity. Thus, it refers to the relationship between actual output that 'is' produced with the installed equipment and the potential output which 'could' be produced with installed equipment, if capacity was fully used.

The implication of industrial production figures and capacity utilization for dividend policy decisions becomes obvious when it is realized that firms make projections on production, sales, earnings, expenditures and so on based on their installed capacity. It is expected that these projections including dividend payouts will vary according to the level of capacity utilization.

2.3 Nigeria in Context

Before going further, the following section delineates the environment in which firms in Nigeria operated during the period under study.

Nigeria has the largest population in Africa, over 150million people and is among the fastest growing economies in Africa mainly due to growth in the oil sector. The non-oil sector, although still underdeveloped, has also shown strong performance over the past 9 years. However, at the microeconomic level the country has a challenging business environment. It has high poverty rates, limited access to finance, poor physical infrastructure and high corruption levels. According to the World Bank Business Competitiveness Index (BCI) (2007), Nigeria's level of competitiveness is declining and the country is less competitive relative to South Africa and Kenya. After a slight improvement in the overall BCI Index in 2005, both the quality of the national business environment and the competitiveness of company operations and strategy declined in 2007. Inadequate infrastructure particularly road networks and electricity supply, limited access to financing and high levels of corruption which undermines investor confidence were the key drivers of the decline in competitiveness.

However, efficacy of corporate boards and access to local equity market improved marginally over the period. Furthermore, political instability, corruption, and poor macroeconomic management, underwent substantial economic reform. On the social context, compared to its neighbors, Nigeria has lower human and social development indicators. 70% of the population lives below $1 a day and 92% of the population lives below $2 per day (EIU Country Profile, 2007, And UNDP Human Development Report, 2007-2008). The UNDP ranks Nigeria as a low human development country at 158 out of 177.

2.4 Dividend Yield (DY)

This is a financial ratio that shows how much a company pays out in dividends each year relative to its share price. In the absence of any capital gains, the dividend yield is the return on investment for a stock.

Dividend yield is calculated as: $\frac{annual\ dividend\ per\ share}{price\ per\ share}$ 1

Historically, a higher dividend yield has been considered to be desirable among many investors. A high dividend yield can be considered to be evidence that a stock is under priced while a low dividend yield can be considered evidence that the stock is overpriced. In contrast some investors may find a higher dividend yield unattractive, perhaps because it increases their tax bill.

3. Methodology

3.1 *Autoregressive Distributed Lag (ARDL) Model Approach to Cointegration*

To illustrate the ARDL modeling approach, the following simple model is considered:

$$y_t = \alpha + \beta x_t + \delta z_t + e_t \quad 2$$

where y_t, x_t and z_t are three different time series; e_t is a vector of stochastic error terms; and a and b are the parameters. For the above equation, the error correction version of the ARDL model is given by:

$$\Delta y = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta x_{t-1} + \sum_{i=1}^{p} \varepsilon_i \Delta z_{t-1} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \lambda_3 z_{t-1} + u_1 \quad 3$$

The first part of the equation above with b, d and e represents the short run dynamics of the model whereas the second part with λs represents the long run relationship. The null hypothesis of no cointegration in the long run relationship is defined by Ho: $\lambda_1 = \lambda_2 = \lambda_3 = 0$, is tested against the alternative of Ha: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$, by means of linear/non linear Wald tests of coefficient restriction. For more information on ARDL see Pesaran, M. H and Shin, Y (1999).

3.2 Model Specification

The relationship between capacity utilization, industrial production index and dividend payout policy is tested using the autoregressive distributed lag model.

The hypotheses are that:

1. There is no cointegration between capacity utilization and dividend payout policy of firms in Nigeria.
2. There is no cointegration between industrial production index and dividend payout policy of firms in Nigeria.

Functionally, Dividend yield= f (capacity utilization, industrial production index) …………4

Where:

Dividend Yield (DY) is the average dividend yield on the Nigerian stock exchange 1980 to 2008.

Capacity Utilization (CU) is the average capacity utilization in Nigeria 1980 to 2008.

Industrial Production Index (IPI) is the average industrial production index in Nigeria 1980 to 2008.

The data for this study was obtained mainly from the publications of Nigerian stock exchange (NSE), the Securities and Exchange Commission (SEC) and the Central Bank of Nigeria (CBN). See appendix A

Having expressed the functional relationship between the variables, the explicit function for estimation is given as follows:

$DY = \beta_0 + \beta_1 CU + \beta_2 IPI + E_i$ …………………………. ………………………….5

Where:

β_0, β_1 and β_2 are parameters to be estimated. E_i is the error term. The above equation (5) is subjected to dynamic estimation using the lagged structure of the variables. Thus,

$DY = \beta_0 + \beta_1 CU + \beta_2 IPI + \beta_3 DY_{t-1} + \beta_4 CU_{t-1} + \beta_5 IPI_{t-1} + E_t$ ……………….. ……..6

3.3 Diagnostic and Structural Stability Tests

To ascertain the goodness of fit of the ARDL model, the diagnostic test and the stability test are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). The null hypothesis of instability is rejected when the plots of the CUSUM and the CUSUMSQ stay within the 5 percent significance level. However, the model is unstable when the plots of the CUSUM and the CUSUMSQ move outside the 5 percent critical lines (Brown et al. (1975).

3.4 Error Correction Representation for The Ardl Model

The error correction model result indicates the speed of adjustment back to the long run equilibrium after a short run shock.

3.5 Unit Root Tests

It is necessary to test for unit root to ensure that all the variables satisfy the underlying assumption of the ARDL methodology before proceeding to the estimation stage.

With this in mind, we start the econometric analysis by analyzing the order of integration of the variables using Augmented Dickey and Fuller Unit Root Tests (ADF).

4.0 ESTIMATION RESULTS

From table 1, the results of the ADF unit root tests indicate that the average dividend yield and the industrial production index are first difference stationary while capacity utilization is an I(0) variable**.**

In table 2, the ARDL (2,0,1) estimated regression selected based on Akaike information criterion show that there is a positive and significant relationship between the immediate past dividend yield (dy(-1)) and dividend yield at time t at the 5% significant level with a coefficient of 0.421. The estimated equation also shows that Capacity Utilization (CU) has a positive and significant relationship with dividend yield at the 5% significant level.

Table 3 show that the selected ARDL (2, 0, 1) passes the standard diagnostic tests (serial correlation, functional form, normality and heteroscedasticity).

The results of estimated long run coefficients using the ARDL Approach in table 4 show that Capacity utilization affects positively and significantly the average dividend yield on the Nigeria stock exchange. The impact of Industrial production index on the average dividend yield on the Nigeria stock exchange is negative and significant at the 5 percent level.

Furthermore, the Wald test of restriction(s) imposed on parameters based on ARDL (2, 0, 1) regression of DY on: CU; IPI and C show that the hypothesis of no cointegration is rejected at the 5 percent level of significance with a Wald Statistic CHSQ(1) = 45.1124 and essentially zero probability [.000].See table5.

4.1 Error Correction Model (ECM)

The fact that the variables in our model are cointegrated provides support for the use of an error correction model mechanism (ECM) representation in order to investigate the short run dynamics. Estimation results, still based on the Akaike Information criterion, are presented in Table 6. The R^2 is 0.50225 suggesting that such error correction model fits the data well. More importantly, the error correction coefficient has the expected negative sign and is highly significant. This helps reinforce the finding of a long run relationship among the variables in the model. The results in Table 6 suggest that the immediate impact of changes in capacity utilization is positive and significant at the 5 per cent level. The impact of lagged dividend yield is positive but insignificant. Also, the impact of industrial production index is positive but insignificant.

The size (-.89420) of the coefficient of the error correction term (ECM (-1)) observed from the table 6 show that the estimated lagged error-correction term emerges as an important channel of influence. The statistically significant error-correction term confirms the existence of long run relationships between average dividend yield on the Nigerian stock exchange, capacity utilization and industrial production index. Again, the size (-.89420) of the coefficient of the error correction term (ecm (-1)) suggests a high speed of adjustment from the short run deviation to the long run equilibrium relationship. In other words, the series quickly adjusts to eliminate any deviations from the long run equilibrium relationships that they may share with each other. Specifically, the results show that capacity utilization and industrial production index have causal influence on average dividend yield on the Nigerian stock exchange through the significant error correction term.

4.2 Tests for Structural Stability

Figure 1 and Figure 2 below clearly indicates that both the CUSUM and CUSUMSQ plots lie within the 5 per cent critical bound thus providing evidence that the parameters of the model do not suffer from any structural instability over the period of study.

5.0 CONCLUSSIONS

This paper used the autoregressive distributed lag (ARDL) model approach to cointegration analysis, ADF unit root tests, ARDL bounds tests, both the CUSUM and CUSUMSQ stability tests and the ECM to examine the relationships between dividend payout policy, capacity utilization and the industrial production index for Nigeria.

The results from the ADF unit root tests indicate that the average dividend yield and the industrial production index are first difference stationary while capacity utilization is an I(0) variable. The ARDL estimated regression show that there is a positive and significant relationship between the immediate past dividend yield (dy(-1)) and dividend yield at time t at the 5% significant level with a coefficient of 0.421. The estimated equation also shows that Capacity Utilization (CU) has a positive and significant relationship with dividend yield at the 5% significant level. The results from the ARDL bounds tests suggest that the average dividend yield, capacity utilization and the industrial production index series are cointegrated. This finding indicates that dividend yield, capacity utilization and the industrial production index have long run equilibrium relationship. The results from the ECM reveal that capacity utilization and the industrial production index have significant causative implications for dividend payout policy. This finding is consistent with the neo-classical income distribution and economic growth theory as shown in Shuttze (1963), and Skott(2009). Tests for Structural Stability clearly indicate that both the CUSUM and CUSUMSQ plots lie within the 5 per cent critical bound thus providing evidence that the parameters of the model do not suffer from any structural instability over the period of study.

The analysis suggests that policies designed to increase the capacity utilization rate should be favourable for the dividend payout policy of firms in Nigeria. These might include policies aimed at developing infrastructure, creating enabling environment for effective and profitable productive activities to grow by government as well as the ability to operate at optimal capacity as a sin-qua-non to achieving policy objectives by firms.

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TABLE 1: ADF UNIT ROOT TEST

VARIABLES	STATIONARITY	ADF statistic	McKinnon critical values
Dividend yield (dy)	1(1)	-4.762453	5% level -2.998064 10% level -2.638752
Capacity utilization (cu)	1(0)	-3.879231	5% level -2.998064 10% level -2.638752
Industrial production index (ipi)	1(1)	-5.554027	5% level -2.998064 10% level -2.638752

Table 2: Autoregressive Distributed Lag Estimates

Dependent variable is DY

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
DY(-1)	.42100	.19205	2.1921[.040]
DY(-2)	-.31520	.19013	-1.6578[.112]
CU	.095970	.035716	2.6870[.014]
IPI	.0026262	.029139	.090124[.929]
IPI(-1)	-.069357	.032369	-2.1427[.044]
C	12.8550	3.1096	4.1340[.000]

****

R-Squared .66236; F-stat. F (5, 21) 8.2392[.000]; DW-statistic 2.1330

Table 3 Diagnostic Tests

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1) = .80434[.370]	F (1, 20) = .61410[.442]
B: Functional Form	CHSQ (1) = 3.8317[.059]	F (1, 20) = 3.3077[.084]
C: Normality	CHSQ (2) = .16967[.919]	Not applicable
D: Heteroscedasticity	CHSQ (1) = .30286[.582]	F (1, 25) = .28361[.599]

Table 4: Estimated Long Run Coefficients using the ARDL Approach

Dependent variable is DY

Regressor	Coefficient	Standard Error	T-Ratio[Prob.]
CU	.10732	.033235	3.2292[.004]
IPI	-.074626	.017200	-4.3386[.000]
C	14.3760	2.1679	6.6313[.000]

Table 5: Bounds Tests for the Existence of Cointegration

Wald-statistics	5% Critical values (unrestricted intercept and no trend).	
	I (0)	I (1)
45.1124	3.79	4.85

Table 6: Estimates of the Error Correction Representation

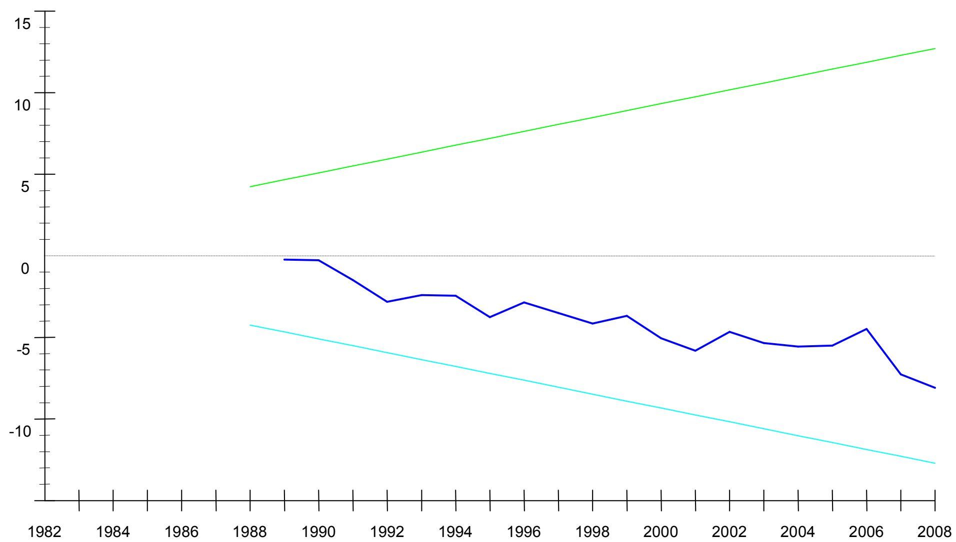
Error Correction Representation for the Selected ARDL Model

Dependent variable is dDY

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dDY1	.31520	.19013	1.6578[.112]
dCU	.095970	.035716	2.6870[.013]
dIPI	.0026262	.029139	.090124[.929]
dC	12.8550	3.1096	4.1340[.000]
ecm(-1)	-.89420	.21625	-4.1350[.000]

ecm = DY -.10732*CU + .074626*IPI -14.3760*C

R-Squared 0.50225; F-stat. F(4, 22) 5.2974[.004]; DW-statistic 2.1330



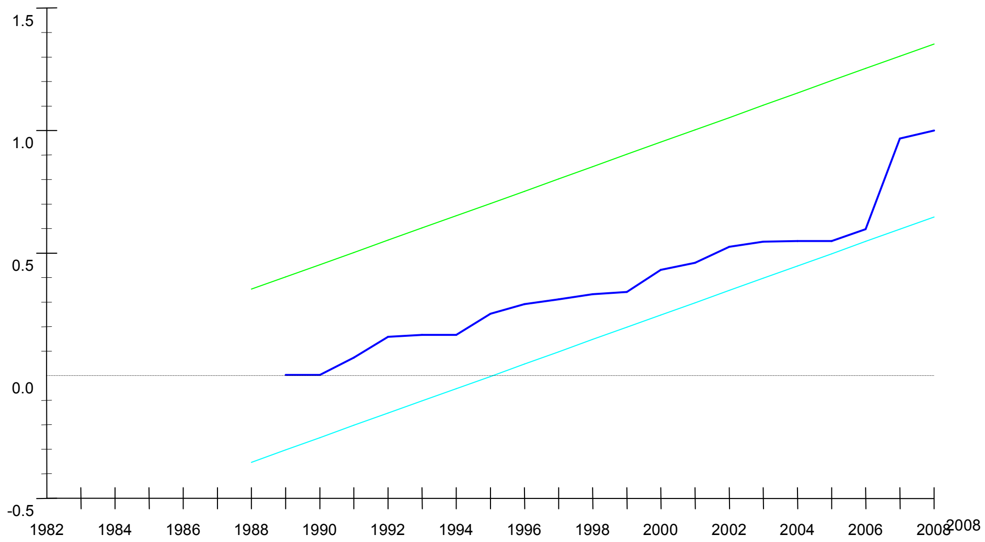


Figure 3: Plot of Cumulative Sum of Squares of Recursive Residuals.
The straight lines represent critical bounds at 5% significant level.

APPENDIX A

Table of Capacity Utilization (CU), Dividend Yield (DY) and Industrial Production Index (IPI)

YEAR	CU	DY	IPI
1980	70.1	11.5	110
1981	73.3	11.4	115.6
1982	63.6	11.8	122.9
1983	49.7	11.3	96.4
1984	43	10.4	91.6
1985	38.3	10.6	100
1986	38.8	9.6	103.5
1987	40.4	11.2	122.1
1988	42.4	10.7	108.8
1989	43.8	11.7	125
1990	40.3	12	130.6
1991	42	10.4	138.8
1992	38.1	7	136.2
1993	37.2	6.5	131.7
1994	30.4	8.4	129.2
1995	29.3	7.9	128.8
1996	32.5	9.6	132.5
1997	30.4	8.7	140.6
1998	32.4	6.6	133.9
1999	34.6	7.8	129.1

2000	36.1	7.5	138.9
2001	42.7	7.3	144.1
2002	54.9	10.8	145.2
2003	56.5	10.5	147
2004	55.7	9.7	151.2
2005	54.8	9.5	158.8
2006	53.3	10.6	166.8
2007	53.4	5.31	175.2
2008	53.5	4.4	184.7

Source: Central Bank of Nigeria(CBN) and Nigeria Securities and Exchange Commission (SEC)