International Journal of Economics and Management Sciences
Vol. 2, No. 8, 2013, pp. 01-13

MANAGEMENT JOURNALS
managementjournals.org

THE IMPACT OF UNEMPLOYMENT RATE ON PRODUCTIVITY GROWTH IN NIGERIA: An Error Correction Modeling Approach

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ABSTRACT

This paper examined the relationship between unemployment rate and productivity growth in Nigeria for the period 1986 to 2010. The study utilized co-integration and error correction model approach. Although the unit root tests showed that the variables were integrated of different orders, the Johansen co-integration result showed that the variables were co-integrated. The regression estimate based on the short run and long run models showed that unemployment rate has an insignificant influence on productivity growth in Nigeria over the study period. Based on these findings, this study recommended that there is still the need for government to take urgent steps against the rising unemployment rate, because unemployment is a major impediment to social progress and results in waste of trained manpower.

1.0 INTRODUCTION

Over the years there had been several discourse about the nexus between productivity growth and unemployment rate in developing, underdeveloped and developed economies ever since the onset of the classical economists. Economists, policy makers and government agencies have debated whether or not productivity growth which may emanate from technical progress can enhance unemployment? However, most economists are of the view that long run technical progress and growth as resulted to a rising standard of living in advanced economies. While others are of the view that technical progress and productivity growth have contributed to unemployment which has been much more controversial especially in the developing countries which Nigeria is inclusive.

The aforementioned controversy had found its root from the empirical study of Okuns (1962) which buttressed on the nexus of productivity and employment. His study revealed that if there is an association between employments and output then, there is the tendency that such relationship may change over time due to changing growth rate of productivity. Hence, this gives room to examine the level of change way of considering the time frame of the change that takes place between productivity and employment from either the short run or long run perspective as observed by Tobin (1993), Kalder (1985) and Solow (1997).

Furthermore, in the recent times the evaluation of Real Business Cycle (RBC) models has thrown more light in terms of significance of the link between productivity and employment. This is relevant because the RBC stipulates that technology shock are the driving force of business cycles and are predicted to be positively related, thus, making the study of the effect of productivity growth on unemployment an important issue as opined by Khemraj (2006). Although unemployment rate in any country is a function of population growth, demographic shifts, varying labour market participation and so on. However one might want to erroneously presume that the demand side of labour, employment offered by firms among others is the most driving force of unemployment rate. That is why this current study would not do any bad by following up on this line of

thinking. Hence this current study focuses on the link between unemployment and productivity growth via time – frame using error correction modeling approach in order to buttress the study of Laudmann (2004) which stipulated that the nature of the mechanism that links unemployment and growth should be taking into account. Sequel to this, it is important to also take account of the usefulness of these changes in productivity growth because their effect on productivity growth may be contradictory with respect to their time frame which among others includes; short, medium and long run as a function of the accompanying effects of changes in productivity growth as can be depicted in the case of the sequences of job creation as observed by Laudmann (2004) and Walsh (2004).

The aforementioned can be deduced from a typical operation of a labour market who is naturally vested with such responsible to create for firms and workers through its unions as a result of interaction at different time horizons, thereby ensuring that both the time horizon of economic decisions couple with the strength and direction of relationship among labour market variable vis-à-vis wages prices and unemployment among others are likely to change across time scales as opined by Gallegati *et al* (2009, 2011) thereby buttressing that the long run effect of the ascribed technological decision which is informed by technical innovation may be different from short run effects. This is because in the short run, new technology is likely to reduce labour thereby adding to the problem of unemployment as was visible in Europe since the 1990. On the other hand, it could be pinpointed that the advent of new technology in the long run, which in turn replaces labour increases productivity thereby making firms and the economy at large to be more competitive. However, there is the likelihood that the foregoing may reduce unemployment and thus increase employment.

The above mentioned relationships especially that of the medium and long run relationship between productivity growth and unemployment have been generally analyzed in the empirical literatures by means of examining aggregate data especially with the use of time series data with respect to the rate of growth of labour productivity was very volatile whose implications in terms of the movement of the other supply-side variables are difficult to interpret particularly in the short-run. Hence, the focal point of this current research is to examine the nexus between unemployment and productivity in the short and long run respectively.

Hence, the objective of this paper is to re-examine and provide evidence on the nature of relationship between labour productivity on a scale-by-scale basis for the Nigeria economy because this may assist to isolate some key relationships over different time scales thereby providing some information about the challenging theoretical frameworks and also the conduct of monetary policy in an economy.

The current paper proceeds as follows, section 2 of the paper presents and briefly reviews relevant literatures and theories which have provided possible causal links between productivity and unemployment the next section presents the research methodology that is to be adopted by the study, while section 4 provides discussion and interpretation of empirical result. Section 5 summarizes the main results and presents the conclusions.

2.0. REVIEW OF LITERATURES, THEORETICAL FOUNDATION AND EMPIRICAL REVIEW

2.1. Review of Related Literatures

There has been an increasing coverage of empirical studies concerning the relationship between productivity growth and unemployment in both developing and developed economies as opined by Blanchflower and Oswarld (1994); Blanchard and Katz (1999) and Bell *et.al.*,(2002). Hence, the justification why productivity and unemployment nexus within the labour markets has received a relevant amount of attention in the economic literature. For instance, Basu *et. al.*,(2006) and others, finds that there is a negative correlation of employment and productivity growth on employment via hours worked by using a VAR methodology. Although this paper aims to focus on the nexus of productivity growth and unemployment as it may be. In the same vein, Gordon (1997) in his study pinpointed that there is a link between productivity and unemployment which presumes a time frame especially when it is looked at from the long run perspective. His study was carried out in U.S. and Europe where he identified categorically that, a greater productivity growth was experienced in Europe which is measured by output / hour for the time period of 1979-1994 where it was detected that there appear to be correlation between productivity and a higher rate of unemployment in Europe as the case may be. Gordon further buttress the fact that, the change of wages and the wage share resulting from wage setting shocks though accompanied by a high growth rate of productivity could also cause a decline in the demand for labour as observed by Evan (1992).

Sequel to the above, Tobin (1993) stipulated that there is a short run technology shocks which may induce a negative effect on employment and positive effect on unemployment which was buttressed by Francis and Ramey (2005). Despite the foregoing, it would not be out of context for one to agree that productivity shocks may lead to a persistent employment effect thereby reducing unemployment in the long run No wonder, (Meyer,

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2001, Ball and Moffilt 2001, Mankiw and Reis 2003) in their research are sort of consistent with the change:" hypothesis which is synonymous to time variation. However, a crucial assumption of this recent research is that workers estimates of productivity growth adjust gradually to true productivity growth. Hence, as a result pinpoints that there is a negative correlation between natural rate and the change in productivity growth rather than between the natural rate and the level of productivity growth. Furthermore, Brain (1984) and Meyer (2001) put forth that workers base their wage claims on a real-time estimate of the productivity trend as a way buttressing on the work of Laudmann (2004) who in his work pinpointed that the nature of the mechanism linking unemployment and productivity growth should be taking into account probably by using a scale by scale approach or time lag. Though, Ball and Moffitt (2011) suggested that workers real wage targets depend on aspirations, that is, a weighted average of past real wages.

In Mortensen and Pissarides (1998) view, productivity growth increases the value of a worker to the firm by means of gearing the creations of job vacancies which turn, causes unemployment to decline and otherwise known as the *capitalization effect*. On the other hands, they put forth the fact that higher productivity growth has the potentials to be accomplices by structural change. This is because old jobs are destroyed and replaced by new ones. Hence, referred to as the "***creative destruction effect***" The result of the aforementioned is that productivity acceleration would shorten employment duration and at the end raise natural rate of unemployment. Although the identified correlation would be as a result of the linkage between productivity growth and unemployment this is largely a function of the relative size of the above mentioned effects.

According to Alexander (1993) and Wakeford (2004) there exist a rising increase in productivity which impact on employment positively via its contribution to higher output signifying an increasing demand for labour hence reducing the unemployment rate all things being equal. In (Adam 2002; Lee, 2000; Schnabel, 2002)opinion,a drop in the unemployment rate is expectedly required to induce an increase in the labour participation rate, via hours worked and productivity thereby resulting to an increase in output at large.

On the contrary, Uhlig (2006) pointed out that all the correlation between productivity growth and unemployment are positive, less volatile and more persistent such that this correlation varies with the span of time under consideration. Thereby, buttressing that technical progress and growth in gross domestic production (GDP) are certainly not harming employment and over most periods creates and kept employment. Looking at this from another direction, Coher, Dickers and Pogen (2001) suggest that the new economy features production processes that put a greater emphasis on general rather than specific skills which as a result make workers to become more interchangeable in order to enhance easy to match workers and jobs which in turn reduce unemployment. In the same vein, Grubb, Jackman and Layard (1982) and Braun (1984) put forth an explanation that the link between unemployment and productivity rest on what he describe as "wage aspirations" which adjust slowly to shift in productivity growth. Though, the concept of wage aspirations is a departure from the neoclassical theory of the labour market, but it builds on research by psychologists and industries relations specialists.

2.2 Theoretical Foundation

Over the years, numerous theoretical hypotheses/theories have been offered to explain the linkage between productivity growth and unemployment in both developing and developed economies. Due to the contentious debate as to whether or not real business cycle actually accounts for the nexus between unemployment and productivity growth or not. Hence, this current study would highlight and briefly discuss few of such theories which among others includes; the Veblen theory of unemployment, job Search-matching theory, theory of low-frequency movement via asymmetric real wage rigidities etc.

2.2.1 The Search Theory of Unemployment

This theory was put forth by Terry (1998) who believes that workers have different skills requirements. Hence, workers need to find well-paying, desirable jobs, while firms need to find the most productive workers. According to Terry (1998) neither firms nor workers have all the information they need about the options available to them as a result, they must engage in search since, search is costly and time consuming hence; both firms and workers must use some of their resources to find a good match.

On the part of workers, it is assumed that they only search when they are unemployed. Hence, they are faced with an uncertain environment as firm do on their part. When a worker gets a job wage offer, for instance, he/she must decide whether to accept it or continue searching for a better offer because accepting such offer means foregoing the chance of a higher wage offer later; while continuing the search means losing the wages he/she would have earned if she had accepted the offer and started working. The wage at which the worker is

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indifferent between continuing the search and accepting the current job is called the *reservation wage* as a result the workers accept all job offers above the wage and turn down all offers below it.

Sequel to the above when a search is successful, that is when there is a match between the needs of the workers and the firm. The worker leaves unemployment. Hence, the theory pinpointed that, the wage offered by the firm is directly related to the workers' productivity all things being equal. .Suppose, that there is an economy-wide increase in productivity that workers are not aware of. Then, there is the tendency that such higher productivity can make it more attractive for the firm to increase employment by allowing it to do so by increasing the wage it offers to workers. This in turn increases the likelihood that the average worker will find an acceptable job offer and reduces the time she is likely to spend searching. Thus, the unemployment rate will decline in response to the increase in productivity.

Furthermore, the search theory of unemployment is a way in which improvement in technology could have a long lasting effect on the rate of unemployment if it leads to permanent increase in the rate at which searching firms and workers find the right match. The foregoing further buttressed the study of Gomme (1998)which suggested that the internet has made this possible because firms now routinely post vacancies on the internet, so that workers can look for jobs in multiple locations at almost no cost.

2.2.2 The Theory of Real Business Cycles

This theory contents that the growth of productivity of input which revolutionizes technology is the main sources of employment and unemployment that is, if the growth of output increases more than the growth of inputs, which makes the total factor productivity or the Solow's residual to receive increasing attention.For instance, if total factor productivity is not growing then firms and economies become inefficient. This therefore, follows that reallocation of labour and capital cannot be achieved and that labour and capital will be used in less profitable opportunities.Hence, the rate of unemployment will riseaccording to (Chatterjee, 1995 and 1999)

As a matter of fact, many factors are likely to be responsible for the slowdown in the total factor productivity (TFP). Hence, technology may not be an improving factor of the production of goods and services while workers skills are not being enhanced. Once there is no invention in a firm and nation at large and there is continuous increase in the prices of imported goods. This in turn pinpointsa tendency for the TFPto be stagnant, such that, the co-movements in other importantvariables are likely to be equally slowdown,henceleading to fall in productivity growth.

2.2.3 Veblen's theory of unemployment

Veblen's analysis of unemployment is grounded in his theory of the business cyclewhich can be explained by revenue and cost of production. Vining (1939-1964) contends that the concept of effective demand is implied in Veblen's statement that the difficulty of over production is a question of prices and earnings that is, "The difficulty is that not enough of a product can bedisposed of a fair prices to warrant the running of the mills at their full capacity and fair prices, according to Veblen (1904-217).

2.2.4 The Theory of real wage rigidities

This theory is used to explain how the labour market dynamics is at business cycle frequencies as observed by Shimer (2005), Hall (2005); Gertler and Trigari (2009); Blanchard and Gali (2010) where they show that real wage rigidities are relevance in accounting for a number of stylized facts including; the high volatility of employment and vacancies as well as the low volatility of real wages. The theoryfurther emphasized that, real rigidities can also account for unemployment dynamics at low frequencies and therefore providing rationale that there is an empiricalrelationship between long run unemployment, long run productivity and its vacancies. The foregoing therefore conforms to the proposed theory of the low frequency movement by Purpaolo, Luca and Paolo (2010).

2.2.5 Theory of effective demand

This theory was developed by Malthus, Marx Veblen, and Keynes (1936) where they considered unemployment as an involuntary phenomenon. Keynesthought that unemployment was basically cyclical, generated by the deficiency of aggregate demand in his opinion, capitalists hire workers and invest such labour to produce – output when the expectations about the economy and profits are favourable or optimistic. To him, if expectations about the future are supported by the economic reality, investments will be increasing such that employment will continue to rise until the equilibrium condition is reached. This equilibriumis however obtained by the intersection of aggregate demand and supply – the point of effective demand will and may be less than the full employment equilibrium; such that if expectation about the future of the economy is not favourable, the capitalists will reduce investment thereby making unemployment to rise. Hence, equilibrium is

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achieved where unemployment exists. This unemployment is due to the deficiency of aggregate demand particularly investment expenditure.

Having reviewed the above theories, the standpoint of this current study is based on the Keynesian and Veblen's theory which believes that unemployment is typically cyclical that emanates from the deficiency of aggregate demand from a capitalist point of view who hires and invest in workers with the aim of producing output which in turn reduces unemployment and induce productivity in the long run all things being equal.

2.3 Empirical Review

As a matter of fact, many researchers have attempted to investigate the nexus between unemployment and productivity growth in both developing and developed economies. For instance, Strauss and Wohar (2004) in their study established that long run relationship exist between real wages and productivity at the industry level for a group of U.S manufacturing industries over the period of 1956-1996and that increase in productivity in an elastic form are associated with a less than unity increase in real wage in the U.S. Again, Meghan (2002) in his study of several industrialized countries opines that efficiency of wages was being paid in Canada, Italy and the United Kingdom. While in contrast, Sweden, U.S and France depicted a no efficiency wage settings, couple with a negligible wages and productivity feedback measures.

Another study carried out by Ho and Yap (2001) show that both the long-run and short-run dynamics of wage formation in the Malaysian manufacturing industry from which four sub-sectors of the industry were selected using the Engle-Granger test. The results posited a positive long run relationship between labour productivity and real wage. On the other hand, Gali (1999) used a VAR technique to gauge the effect of productivity on unemployment which in turn confirms that technology shock has a significant effect on productivity growth.

In the same vein, Francis and Ramey (2004) and Basu *et al* (2006) established a negative correlation between employment and productivity growth as much as an account of both demand and supply shocks affects output. Again, Blackhard and Quah (1989) employed maximum likelihood (ML) and structured VAR to estimate the weight of short and long run effects of productivity on unemployment. However, the latter was used to estimate the long-run restriction attributable to them. The results presume that, in the long run, non-technology shocks cannot exert a permanent effect on productivity. According to Gordon (1997), the nexus between productivity and unemployment is directly treated from the long run perspective. Gordon's study shows that a wage setting shock can create a positive correlation between the level of unemployment and the level of productivity.

(Adamu, 2000; Lee 2000; Schnabel 2002) using VAR technique depicted that there is a long run relationship between unemployment and its lagged values and the deviations of actual from potential output. Inconsonance with the above, (Ramsey and Lampart 1998 and Gallegaiti *et al* 2009) using discrete market transform (DWT) and least square regression observed that, a visual aspect of the long run components which indicates an anti – phase relationship between the variables with productivity slightly leading the unemployment rate.Millea (2002) reports empirical evidence about the bi-directional relationship between wages and productivity, in particular considering the nature of the wage setting process in different countries. The empirical evidence of this paper – as well as that of a more in-depth study for Germany (Fuess and Millea 2006) – his study can be interpreted in the light of efficiency wages, i.e. explaining productivity as resulting from particular wage levels, for given characteristics of the labour market (e.g. the total level of unemployment). It shows that the effects of productivity on wages differ substantially between the six countries of the analysis, but there is evidence for conventional wage bargaining following productivity in most countries with the exception of the US. The authors interpret this in the light of union coverage, with the US having the smallest share of workers covered by collective bargaining. At the same time, the study shows the evidence for efficiency wages being strongest in the US, Canada and Italy, the countries with the shortest duration of unemployment benefits

Most studies find increasing evidence that wages have grown below productivity in the last 30 years and discuss this finding in the light of increasing income inequality and not as is typically found in the European debate. (See Gross 2010) with regard to relative changes in a country's competitive position.

Mishel and Shierholz (2011) describe a widening gap between growth rates of productivity and wages (and labour compensation, including bonus payments). Labour compensation growth was particularly low in the private sector, while the growth of average wages was particularly weak for college educated public sector workers.

Harrison (2009) reports a similar divergence between the growth of real earnings and productivity in the US and Canada, but this result is obtained largely from rising earnings inequality (i.e. increases in the top one per cent

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of the income distribution alongside stagnant or falling income shares elsewhere). There are also, however, important measurement issues affecting the observed decline in labour earnings, e.g. when taking account of the depreciation of fixed assets, which has increased as a result of adoption of new technologies, and which has tended to push the labour share downwards.

Fleck, Glaser and Sprague (2011) provide further evidence on a widening wage-productivity gap, which began in the mid- 1970s. However, they note that this may also result, in part, from the measures of labour productivity not having been adjusted for compositional changes in the workforce, and from the choice of different price indices to adjust for inflation.

Lopez-Villavicencio and Silva (2010) analyze a macroeconomic panel of OECD countries between 1985 and 2007 interestingly findings depicts that wage increases have exceeded productivity growth for permanent workers, while the opposite is true for temporary workers, in line with their lower bargaining power. Given the great inter-country variation of the share of temporary workers, this may be an important reason for explaining why the existence and size of the wage-productivity gap varies between countries.

3.0. RESEARCH METHODOLOGY

3.1. Data and Sources

This study used annual data to examine the nexus between domestic oil price and macroeconomic variables in Nigeria between 1986 and 2010. Yearly data on gross domestic product (y), capital stock (cap), government expenditure (gxp) and inflation rate (ifr)are collected from the Central Bank of Nigeria (CBN) statistical bulletin. Also, yearly data on unemployment (uem) rate is collected from the National Bureau of Statistics (NBS) while labour force (lab) is obtained from the World development indicator (WDI) of the World Bank. Variables including economic growth, capital stock, government expenditure and labour force were transformed into logarithms form while inflation rate and unemployment rate were analyzed in their level form.

3.2 Variable Measurement

Economic growth is measured by real gross domestic product (rgdp) which is calculated by deflating nominal gross domestic product by domestic consumer price index. Government expenditures *(gxp)* would be measured by the aggregation of the capital and recurrent expenditure of the government while capital stock is measured by the gross fixed capital formation. Labour force is measured by the total labour force as provided by the WDI while inflation rate (inf) is measured by the annual inflation rate.

3.3 Method of Analysis

To examine the relationship between unemployment rate and productivity growth in Nigeria, taking into cognizance other explanatory variables in equation (2), this study utilized theco-integration and Error-Correction Methodology (ECM). On the one hand, most economic variables are observed to be non-stationary (that is, the means and variances of these economic variables are not constant). Therefore, for valid estimation and inference, a set of non-stationary variables must be co-integrated, that is, a linear combination of these variables that is stationary must exist (see Wood, 1995; Nwachukwu and Odigie, 2009). On the other hand, the Error-Correction Methodology (ECM) enable us to integrate both short-run dynamic and long-run equilibrium models in a unified system while at the same time ensuring theoretical rigor and data coherence and consistency (Nwachukwu and Odigie, 2009).In applying this error correction mechanism the lag length on all the variables is set at two, to allow for sufficient degrees of freedom.

3.4 Model Specification

To examine the relationship between productivity growth and unemployment, the study specified a simple linear model as follows:

$$Y = \alpha_0 + \beta_1 UNEM + \varepsilon_t \quad \text{......} (1)$$

where$Y$ = productivity growth and *UNEM* is unemployment rate. Introducing other output influencing variables which includes labour force *(LAB)*, capital *(CAP)*, inflation rate *(IFR)*, and government expenditures*(GXP)*, equation (1) becomes:

$$Y = \alpha_0 + \beta_1 UEM_t + \beta_2 LAB_t + \beta_3 CAP_t + \beta_{4t} IFR + \beta_5 GXP_t + \varepsilon_t \quad \text{......} (2)$$

In order to estimate the short-run relationship among variables in equation (2), the corresponding error correction equation is estimated as:

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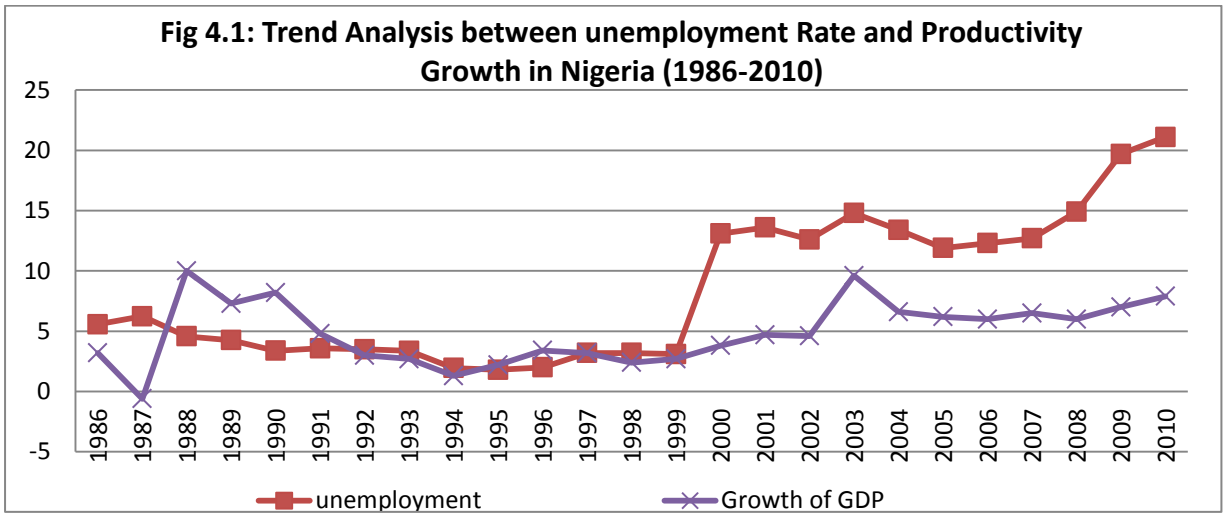
$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{2} \beta_1 \Delta Y_{t-i} + \sum_{i=1}^{2} \beta_2 \Delta UME_{t-i} + \sum_{i=1}^{2} \Delta\beta_3 LAB_{t-i} + \sum_{i=1}^{2} \Delta\beta_4 CAP_{t-i} + \sum_{i=1}^{2} \Delta\beta_5 IFR_{t-i}$$
$$+ \sum_{i=1}^{2} \beta_6 \Delta GXP_{t-i} + \psi ECM_{t-1} + \varepsilon_t \quad \text{.....(3)}$$

The ECM_{t-1} is the error correction term. The coefficient of the ECM_{t-1} measures the speed of adjustment towards the long run equilibrium

4.0 EMPIRICAL ANALYSIS

4.1 Trend Analysis of the Relationship between Unemployment Rate and Productivity Growth in Nigeria

Figure 4.1 illustrate a brief descriptive analysis of the relationship between unemployment rate and productivity growth in Nigeria over the periods 1986 to 2010. It is observed from the figure that no clear systematic relationship existed between the variables over the period. While there were some similar movements between unemployment rate and productivity growth over the periods 1991 to 1999 and 2002 to 2006,in the other periods both variables moved in opposite direction. Based on this evidence, it is difficult to conclude on the nature of the relationship between unemployment rate and productivity growth. Consequence to the inconclusive inference from the above trend analysis, next section presented the empirical analysis between these variables.



Source: Authors computation

4.2 Unit Root Test

This study commenced it empirical analysis by testing the properties of the time series, used for analysis. The stationarity test on the variables was carried out using both the Augmented Dickey-Fuller (ADF) and the Philip-Perron tests and the results are presented in table 1. It was observed from the ADF test estimate on the left hand of table 1 that all the variables except aggregate government expenditure (lgxp) and labour force (llab) were integrated of order one. Government expenditure was integrated of order two while labour force was observed to be stationary at level, that is integrated of order one. The results of the ADF estimate was confirmed by the Philip-Perron test result, on the other column (right hand) of table 1.

Table 1: Unit Root Test Result

Augmented Dickey-Fuller (ADF) Test				Phillip-Perron (PP) Test		
Variables	Level	1st / 2nd Diff	Status	Level	1st /2nd Diff	Status
lcap	-1.8571	-4.7640*	I(1)	-1.9614	-4.7640*	I(1)
lgxp	-3.6805**	-	I(0)	-6.0484*	-	I(0)
llab	-0.9899	-4.3094*	I(2)	-0.0147	-4.3575*	I(2)
ly	0.4367	-3.1449**	I(1)	1.0666	-3.2496**	I(1)
ifr	-2.4425	-4.2396*	I(1)	-2.5251	-5.1899*	I(1)
uem	0.2196	-4.2336*	I(1)	0.1557	-4.2175*	I(1)

Note: *=1% and **=5% significance level.

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4.3 Co-integration Estimate

The co-integration estimate was carried out using the Johansen (1991) co-integration technique. This is a powerful co-integration test, particularly when a multivariate model is used and moreover, it is robust to various departures from normality in that it allows any of the six variables in the model to be used as the dependent variable while maintaining the same co-integration result (Nwachukwu and Odigie, 2009). The result of the co-integration estimate is presented in table 2 below.

Table 2: Summary of the Co-integration Estimate

Trace Test				Maximum Eigen value Test			
Null	alternative	Statistics	95% critical values	Null	alternative	Statistics	95% critical values
r=0	r≥1	202.126	95.754	r=0	r=1	79.367	40.076
r≤1	r≥2	122.759	69.818	r≤1	r=2	54.818	33.877
r≤2	r≥3	67.941	47.856	r≤2	r=3	30.040	27.584
r≤3	r≥4	37.901	29.797	r≤3	r=4	23.181	21.132
r≤4	r≥5	14.720	15.495	r≤4	r=5	10.897	14.265

Source: Author's Computation, 2011

From the above table, it was observed that the null hypothesis of no co-integration, for r=0, r≤1, r≤2, and r≤3 were rejected by both the trace statistics and the maximum eigen-value statistics. The statistical values of these tests were greater than their critical values.However, the null hypothesis of no co-integration that is r≤4 could not be rejected by the trace and maximum eigen-value statistics because their statistical values were less than their critical values. The implication of the co-integration estimate is that there are five co-integrating equations at 5% in the model.The long-run relationships (co-integrating equation) can be expressed as follows:

4.4 Long Run Estimate

$LY_t = -51.151 + 0.001UEM_t + 0.058LCAP_t - 0.232LGXP_t + 3.804LLAB_t + 0.001IFR_t + \varepsilon_t$

t: [0.199][1.986]*** [-2.619]** [4.137]* [1.090]

SE: (0.007) (0.029) (0.088) (0.881) (0.001)

Note: *, ** and *** implies 1% , 5% and 10% significance level respectively.

It is observed from the long run co-integration estimate above that unemployment rate had an insignificant effect on productivity growth in Nigeria. Although, this is contrary to a priori expectation, the result however is not surprising in the case of Nigeria. This is because, in recent time, the Nigeria economy has experienced a steady and progressive increase in unemployment rate which unfortunately has being accompanied by an increase in the productivitygrowth of the economy. The implication of this is that the productivitygrowth in the economy is insensitive to the unemployment condition in the economy. With respect to other explanatory variables, it was observed that capital stock and labour force had a significant-positive on productivity growth with coefficient values of 0.06 and 3.80 per cent respectively. The implication of this is that a one per cent increase in capital stock capital formation and labour force would positively stimulate productivitygrowth in the long run. It was also observed that inflation rate was insignificant while government expenditure was observed to have a negative effect on productivity growth.

4.5 Dynamic Error Correction Model

Consequent to the co-integration estimate reported on table 2, this study preceded to examine the dynamic short run relationship between productivity growth and unemployment rate in Nigeria as specified in equation (3). Before, estimating the equation (3), the stationarity property of the residual from the long run estimate was examined and the result is presented on table 3 below. Both the Augmented Dickey Fuller test (ADF) and the Phillip-Perron test revealed that the residual is integrated of order one at five per cent significant level.

Table 3: Residual Stationarity Test

Variable	Augmented Dickey Fuller Test	Phillip-Perron Test	Order of Integration
Resid	-3.1153**	-3.1176**	I(0)

Note: ** implies 5% significance level.

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Following the residual stationarity test, we over parameterized the first differenced form of the variables in equation (3) and used Schwarz Information Criteria to guide parsimonious reduction of the model. This helps to identify the main dynamic pattern in the model and to ensure that the dynamics of the model have not been constrained by inappropriate lag length specification (Amassoma et al, 2011).

With respect to the parsimonious regression estimate capturing the short run analysis, it is observed from table 4 that there are significant improvement in the parsimonious model of the over parameterized model (see appendix). The Adjust R-Square, F-stat, and the D.W improved significantly. The results further showed that the coefficient of the error-term for the ECM model is both statistically significant at one per cent and negative. The coefficient estimate of the error correction term of -0.67 implied that the model corrects its short run disequilibrium by about 67 per cent speed of adjustment in order to return to the long run equilibrium. Also, the negative sign of the error correction term indicates a move back towards equilibrium.

Apart from the above, the appropriateness of the model was further verified by carrying out various diagnostic tests on the residual of the ECM model; namely the histogram and normality test, the serial correlation LM test and the ARCH LM Test. The Jarque-Bera statistic from the histogram and normality test was insignificant (see appendix), implying that the residual from the error correction model is normally distributed. More so, both the serial correlation and ARCH LM tests confirmed that there is no serial correlation in the residuals of the ECM regression (see appendix). This is because the F-statistics of both tests were insignificant. This shows that there are no lagged forecast variances in the conditional variance equation. In other words, the errors are conditionally normally distributed, and can be used for inference (Nwachuwu and Odigie, 2009).Overall, the model could be considered to be reasonably specified based on its statistical significance and fitness.

In addition to the above and with respect to the coefficient of individual variables, it was observed that the co-efficient of the first lagged value of productivitygrowth was positive (0.1590) but significant while the co-efficient of the second lagged value of productivitygrowth was also positive (0.4592) and significant. The co-efficient of current unemployment rate was observed to be negative and insignificant while those of the first and second lagged values of unemployment rate were observed to be positive and also insignificant. In addition, the co-efficient of current capital stock was observed to be positive and insignificant while those of the first and second lagged values of capital stock were observed to be negative and significant. More so, co-efficient of current government expenditure was observed to be negative and significant while the coefficients of the second lagged values of government expenditure andlabour force were observed negative and significant. Finally, the co-efficient of current inflation rate was observed to be positive and insignificant while the coefficient of the second lagged value of inflation rate was also positive but significant.

With respect to the key variable of interest, it was noted that unemployment rate had no significant effect on productivitygrowth in the short which was similar to the result obtained in the long run regression estimate, although current unemployment rate had the correct expected sign (that is negative). The implication of this as pointed above is the productivitygrowth is insensitive to the unemployment conditions in Nigeria.

Table 4: Parsimonious Short Run Regression Estimate

Variables	Coefficient	Std. Error	t-Statistics	Probability
C	0.3605	0.0530	6.8025	0.0003
ECM(-1)	-0.6662	0.0737	-9.0379	0.0000
ΔLY(-1)	0.1590	0.0885	1.7957	0.1156
ΔLY(-2)	0.4592	0.1156	3.9714	0.0054
ΔUEM	-0.0024	0.0014	-1.7327	0.1267
ΔUEM(-1)	0.0017	0.0015	1.1230	0.2985
ΔUEM(-2)	0.0026	0.0019	1.3513	0.2187
ΔLCAP	0.0133	1.0119	1.1114	0.3031
ΔLCAP(-1)	-0.0270	0.0068	-3.9626	0.0054
ΔLCAP(-2)	-0.0314	0.0076	-4.1429	0.0043
ΔLGXP	-0.0684	0.0172	-3.9857	0.0053
ΔLGXP(-2)	-0.0774	0.0193	-4.0049	0.0052
ΔLLAB(-2)	-10.9534	1.6961	-6.4580	0.0003
ΔIFR	0.0004	0.0003	1.7229	0.1286
ΔIFR(-2)	0.0007	0.0002	3.9954	0.0052
Adjusted R^2	0.9503	***S.D dependent Var:***		0.0459
S.E of Regression	0.0102	***F-Statistic***		29.6942
D.W Stat	2.4322	***Prob. (F-Statistic)***		0.0001

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5. CONCLUSION AND POLICY RECOMMENDATION

This paper examined the relationshipbetween unemployment rate and productivity growth in Nigeria for the period between 1986 and 2010. The estimation results for both the long run and short run models revealed that unemployment rate has an insignificant influence on productivitygrowth which was contrary to a priori expectations. The outcome of the result could explain why the Nigerian government has placed little or no emphasis on the rising unemployment rate in Nigeria, since it does not affect the productivitygrowth of the economy. Based on these findings, this study recommended that there is still the need for government to take urgent steps against the rising unemployment rate, because unemployment is a major impediment to social progress and results in waste of trained manpower.

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APPENDIX

Over-parameterized Short Run Regression Estimate

Dependent Variable: DLRDGP
Method: Least Squares
Date: 08/23/12 Time: 04:15
Sample (adjusted): 1989 2010
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.372710	0.092461	4.030982	0.0274
ECM(-1)	-0.649976	0.193348	-3.361700	0.0437
DLY(-1)	0.138965	0.154986	0.896632	0.4360
DLY(-2)	0.355611	0.179714	1.978756	0.1422
DUEM	-0.002432	0.002579	-0.943092	0.4152
DUEM(-1)	0.002847	0.002536	1.122791	0.3433
DUEM(-2)	0.002880	0.003356	0.858270	0.4538
DLCAP	0.024105	0.019081	1.263291	0.2957
DLCAP(-1)	-0.023181	0.009999	-2.318452	0.1032
DLCAP(-2)	-0.033746	0.010486	-3.218227	0.0486
DLGXP	-0.084255	0.027152	-3.103065	0.0532
DLGXP(-1)	-0.033360	0.050276	-0.663530	0.5544
DLGXP(-2)	-0.091499	0.038215	-2.394314	0.0964
DLLAB	2.234185	3.182470	0.702029	0.5332
DLLAB(-1)	0.005062	3.147193	0.001609	0.9988
DLLAB(-2)	-12.92074	3.502915	-3.688567	0.0346
DIFR	0.000426	0.000629	0.676945	0.5470
DIFR(-1)	-9.71E-06	0.000322	-0.030145	0.9778
DIFR(-2)	0.000698	0.000235	2.974472	0.0589

R-squared	0.988257	Mean dependent var	0.057465
Adjusted R-squared	0.917796	S.D. dependent var	0.045935
S.E. of regression	0.013170	Akaike info criterion	-6.086891
Sum squared resid	0.000520	Schwarz criterion	-5.144627
Log likelihood	85.95580	Hannan-Quinn criter.	-5.864922
F-statistic	14.02574	Durbin-Watson stat	2.558855
Prob(F-statistic)	0.025434		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.054201	Prob. F(2,5)	0.4149
Obs*R-squared	6.525353	Prob. Chi-Square(2)	0.0383

Heteroskedasticity Test: ARCH

F-statistic	0.235441	Prob. F(1,22)	0.6323
Obs*R-squared	0.254125	Prob. Chi-Square(1)	0.6142

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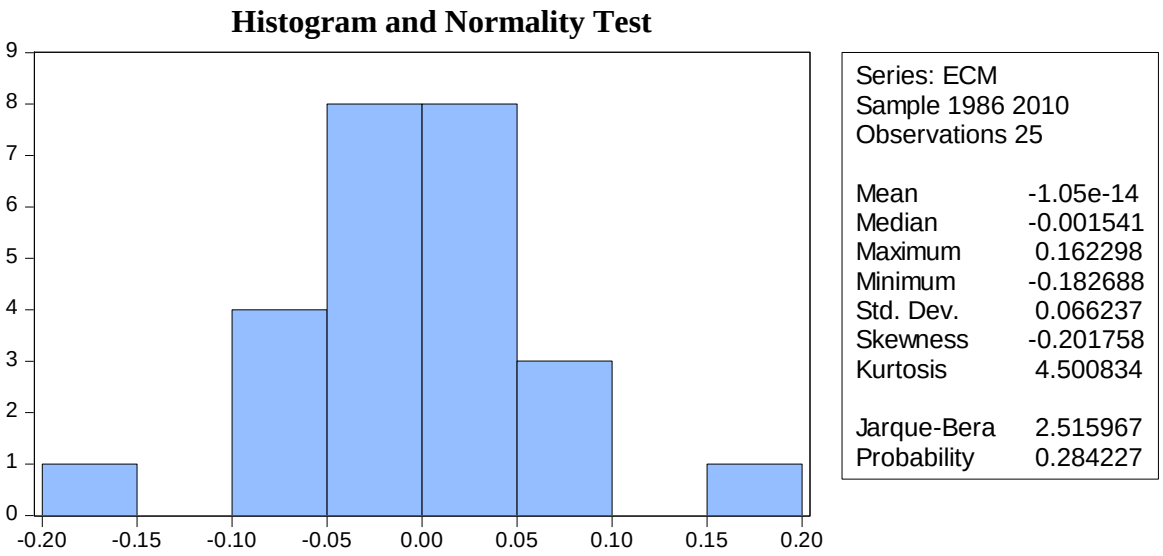

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