Empirical Test of Okun's Law in Nigeria

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Abstract: The paper estimates the Okun's coefficient, and checks the validity of Okun's law in Nigeria, using the time series annual data during the period 1980-2008. Engle granger co-integration test and Fully Modified OLS were employed. The empirical evidences show that there is positive coefficient in the Regression, implying that Okun's law interpretation is not applicable to Nigeria. It was recommended that government and policy makers should employ economic policies that are more oriented to structural changes and reform in labor market.

Keywords: Okun's Coefficient, Okun's Law, Engle granger co-integration, Fully Modified OLS, Regression.
JEL Classification: E24, O50

1 Introduction

Unemployment is an important issue in developing economies. High unemployment means that labor resources are not being used efficiently. Hence, full employment should be a major macroeconomic goal of any government because it maximizes output.

Nowadays unemployment is a prominent matter in the world. Every year thousands of students have passed out from educational and vocational institutions, therefore it is one of the key responsibilities of every modern state to provide job opportunities to all passed out graduates along with unskilled labor but it seems most of the states have failed to fulfill this responsibilities. A majority of the passed out graduates and unskilled labor remain unemployed in various countries, Nigeria inclusive.

Unemployment is seen as a great problem to global economic development. In recent years, both developed and developing countries have witnessed this problem, though the developed countries have been curtailing the rate of their unemployment. However, in developing countries, especially in Africa, unemployment has been on a continuously accelerating rise in the economy, culminating in reduction of household income and living standards and concomitant rise in the level and incidence of poverty (Kareem 2006).

Okun (1962) summarized the relationship of growth and unemployment in a statistical relationship, which was later labeled Okun's law. It has been discussed and updated by much economic research. This law states that the relationship of growth to unemployment reduction (employment increase) is not one to one. Okun in 1962 postulated that there is only a weak relationship between growth and the reduction of unemployment. He postulated that a1 percent increase in the growth rate above the trend rate of growth (or the growth in potential output) would lead only to 0.3 percent in the reduction of unemployment. Reversing the causality, a 1 percent increase in unemployment will mean roughly more than 3 percent loss in GDP growth. This relationship implies that the rate of GDP growth must be equal to its potential growth just to keep the unemployment rate constant. To reduce unemployment, therefore, the rate of GDP growth must be above the growth rate of potential output.

Okun's law is important for both theoretical and empirical reasons. From a theoretical point of view, Okun's law, which is rooted in old and new Keynesianism is, along with the Phillips curve, a key element to derive the aggregate supply curve; from an empirical perspective, "*Okun's coefficient is a useful "rule of thumb" in forecasting and policy –making*" (Harris & Silverstone,
2001, cited in Villaverde and Maza, 2008 p.

2), Okun's law (Okun, 1962, 1970), simply postulates the existence of a negative empirical link between changes in the unemployment rate and changes in real output.

Several economists have followed Okun (1962) by testing the relationship between unemployment and output to obtain estimates for Okun's coefficient. The list includes, *inter alia*, Hamada (2011), Zaleha et al. (2007), Geidenhuys and Marinkov (2007), Noor, Nor and Judhiana (2007), Turturean (2008), Kreishan (2011) and Arewa and Nwakanma(2012) which are single country studies. Likewise, some studies have introduced a regional dimension in the analysis of the relationship between output and unemployment: Freeman (2000, 2001), Lee (2000), Harris & Silverstone (2001), Soègner and Stiassny (2002), Christopoulos (2004), Perman and Tavera (2004),Adanu (2005), Dritsaki & Dritsakis **(**2009), and Pierdzioch, Ruike and Stadtmann (2009), Moazzami and Dadgostar (2009), are among the most relevant contributions.

Although, there are other studies on the relationship between Unemployment and growth in Nigeria, but to the best of Authors' knowledge those that use Gap model to estimate the Okun's coefficient is limited. Therefore, this paper intends to offer a thorough estimate of Okun's coefficient for Nigeria, using the Gap Model.

The unemployment and output gaps are generated using the Hodrick–Prescott (HP) filter detrending technique. We conducted unit roots using the Augmented Dickey – Fuller test (ADF test) and Kwiatkowski, Phillips, Schmidt, and Shin's test (KPSS test) to avoid spurious Regression. We performed Engle-Granger Cointegration Test and we estimated the cointegrating equations using the fully modified OLS to obtain the long-run elasticities. This study is important from the point of view of the implementation of sound and efficient economic policies.

The next section deals with the methodology employed in this paper. Empirical Analyses are presented in section three. Section four concludes the paper.

2 Methodologies

2.1 Model Specification

Generally, as suggested by Okun (1970), there are two standard model specifications of Okun's law, first is the 'First difference model' and second is the 'Gap model'. According to the first-difference model, the link between the natural log of real output (Y_t) and the natural log of unemployment rate (U_t) given as:

$$Y_t - Y_{t-1} = \propto + \beta(U_t - U_{t-1}) + \varepsilon_t \quad (1)$$

The second is "Gap model" as given as:

$$Y_t - Y_t^* = \propto + \beta(U_t - U_t^*) + \varepsilon_t \quad (2)$$

Where Y_t^* refers the log of potential output, U_t^* is the natural rate of unemployment. Where $\propto$ is the intercept, β $(\beta < 0)$ is Okun's coefficient computing that how much variation in the unemployment rate to changes in output, and ε_t is the disturbance term.

The Gap model has been chosen for further analysis of the okun's law, where the left-hand side

Represents the output gap and right-hand side represents the unemployment gap $(U_t - U_t^*)$. Thus, the difference between the observed and potential real GDP postulates the fluctuations in output. Similarly, the difference between the observed and natural rate of unemployment refers the cyclical rate of unemployment. It is obvious that the stationary or cointegration conditions of these gaps also have to be fulfilled.

A major problem with this model is that there are no observable data on Y^* and U^* so they have to be estimated, which means it is necessary to generate *y* and *u* trend series. To relatively overcome it, and in order to test for the robustness of the Okun's coefficients, we apply the Hodrick–Prescott (HP) filter detrending technique.

2.2 Data

We use annual data for the period 1980 to 2008 for Nigeria. Data used for Unemployment was obtained from Annual Abstract of Statistics, Various issues of the National Bureau of Statistics, while, the Real GDP was derived from the Central Bank of Nigeria's Statistical Bulletin, 2009.

2.3 Estimation Procedure

The analyses in this paper are carried out in four phases. First, the unemployment and output gaps are generated using the Hodrick–Prescott (HP) filter detrending technique. Second we conducted unit roots using the prominent tests namely: Augmented Dickey – Fuller test (ADF test) and Kwiatkowski, Phillips, Schmidt, and Shin's test (KPSS test), to avoid spurious Regression. Third, we perform Engle-Granger Cointagration Test. Four, we estimate the cointegrating equations from equation (2) using the fully modified OLS to obtain the long-run elasticities.

3 Empirical analyses

In the first step the unemployment and output gaps are generated using the Hodrick–Prescott (HP) filter detrending technique[1] **.** In the second step, the cyclical components of the unemployment and output series for the nation is plotted (see Fig. 1) showing that, as a general rule, the inverse relationship hypothesised by Okun seems not to hold.

3.1 Unit Root Test

The third step of the empirical analysis consists of performing unit root tests on the gaps of the unemployment and output series. For a robust analysis the Augmented Dickey-Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests were employed. According to the ADF test the series are stationary at first difference. The stationarity of the series is even more clearly established when the KPSS test is computed; in this case, all series prove to be *I* (1). This is presented in Table 1 below.

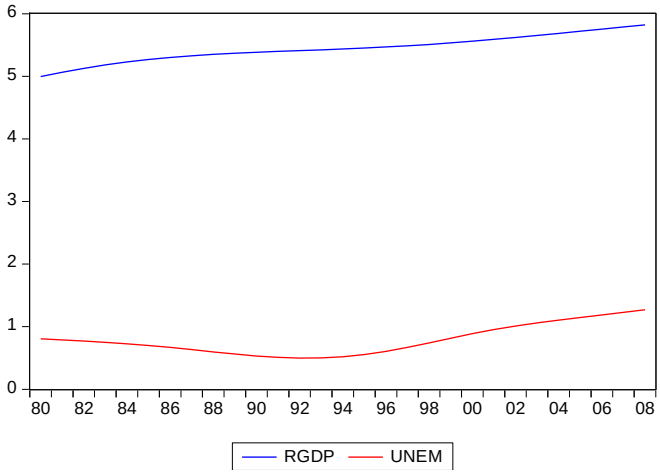

Figure 1. National differences in business cycles.

Table 1. Unit Root Test Result (At First difference)

Variables	ADF	KPSS	Order of Integration
RGDP	-3.687	10.577	I(1)
	(0.01)	*(0.00)*	
UNEM	-3.615	2.178	I(1)
	(0.01)	*(0.04)*	

Source: Authors' Computation.
Note: P values are in italics and brackets under ADF and KPSS

3.2 Cointegration test

The results of the Unit Root Test point out that the variables are integrated at same order (I(1)), the next step is to check if the long run relationship exists between the variables of interest. If the sequence of residuals from this regression is stationary, the variables are said to be co-integrated of order (1, 1). On the other hand, if these residuals are non-stationary, it is concluded that there is no long run equilibrium relationship or no cointegration lies between the output gap the and unemployment gap. It is of major importance to note that the critical values for the cointegration test (the ADF test on the residuals) are not the same as the standard critical values of the ADF test used for testing stationarity. In fact in order to have more robust conclusions regarding the evidence of cointegration, the critical values are more

[1] There are other detrending Techniques, but for simplicity we adopted this. Likewise the result of the detrending is not presented in this paper but available on request.

negative than the standard ADF ones (see Tables 1 and 2).

Table-2 summarizes the results of Co-integration analysis between output gap and Unemployment gap in Nigeria. Engle and Granger result identifies the existence of long run association, error term of both equations are stationary at level, which reflects the evidence of cointegration. Thus, the presence of co integration vector shows the existence of a long run equilibrium association between the variables.

Table 2. Engle and Granger Result

At Levels			
Coefficient	**P-Value**	**order of Integration**	**Decision**
-4.121	0.004	I(0)	Cointegrated

Source: Authors' Computation.

Having found the long-run relationship between the output gap and unemployment gap, in this context the aim is to estimate the long-run elasticities. They can be calculated through using Phillips and Hansen (1990) fully modified ordinary least squares (FMOLS) as presented in Table 3. It is apparent that the results did not meet apriori expectations because there is a positive relationship between unemployment and output growth. The Coefficient is 0.451, but it is significant at 1 percent level. Our results do not support the implications of Okun's Law in Nigeria, therefore, lack of economic growth does not explain the unemployment problem in Nigeria. The result is in line with Lal et al (2010) , arewa and Nwakanma (2012), likewise Kreishan (2011)

Table 3. Fully Modified OLS Result

Coefficient	T-**Value**	P-**Value**
0.451***	2.655	0.01

Source: Authors' Computation.
*Note: *, **, *** represent 10%, 5% and 1% levels of statistical significance respectively.*

4 Conclusion and policy implication

This study attempts to provide a robust empirical analysis of the relationship between RGDP and
Unemployment for Nigeria during the period (1980-2008). Further, the study provided an estimation of Okun's coefficient. Our empirical analysis consisted of Hodrick–Prescott (HP) filter detrending technique, Augmented Dickey-Fuller (ADF) and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS), Engle granger cointegration test and Fully modified OLS to estimate relationship between unemployment rate and economic growth. The results presented in this study, showed that the data series are stationary in their differences. Tests of cointegration revealed long-run association between unemployment and economic growth. On the other hand, the results support that unemployment and output are unrelated. Therefore, our findings suggest that Okun's law is not valid for Nigeria. It can be suggested that the lack of growth does not explain the unemployment problem in Nigeria.

Thus, our results have an important policy implication, the economic policies related to demand management would not have an important effect in reducing unemployment in Nigeria. However, economic policies more oriented to structural changes and reform in labor market would be more appropriate in the case of Nigeria. Aggregate supply policies would be more adequate; in these cases, tax and benefit system reforms aimed at increasing work incentives (e.g. reducing the tax wedge and the level of job security provisions on layoffs) and greater wage flexibility (based on a less centralised collective bargaining system and a better understanding between the parties involved in the wage bargaining process) might be pertinent (Arpegis, 2005; Maza & Villaverde, 2007).

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