IDENTIFYING NIGERIA'S NATURAL RATE OF UNEMPLOYMENT: PRELIMINARY EVIDENCE FROM THE AUGMENTED PHILLIPS RELATION

Aderoju Oyefusi & **Nosakhare Arodoye**
Department of Economics, University of Benin

Abstract
Concern and anxiety over the rising level of unemployment in Nigeria, especially among the youths, have mounted over the last decade. This concern will be misplaced, however, if we do not know the country's "natural" rate of unemployment. This paper attempts to identify Nigeria's "natural" unemployment rate and its evolution over time using the framework of the expectation-augmented Phillips relation and based on estimated parameters by the International monetary Fund (IMF) and historical data from the IMF and the National Bureau of Statistics (NBS). The results show that the rate may have risen significantly over time. This has implications for our understanding of the Nigerian labour market and the unemployment situation, the role and limit of macroeconomic policies, and the prospects of long-term growth in the country. While it is too early to make categorical statements on the reasons for the sharp increases in the "natural" unemployment rate, the paper draws attention to the possible influences of a strong social insurance around family networks (in particular, remittance inflows) and income from illicit "businesses" on the willingness to participate in the labour market at existing wage levels, and the likely impact of price increases arising from the unregulated nature of the country's product market. The paper concludes with the need for a more rigorous study of the labour market and the dynamics of change over the past twenty to thirty years.

Keywords: Natural rate of unemployment, NAIRU, Phillips Relation, Nigeria

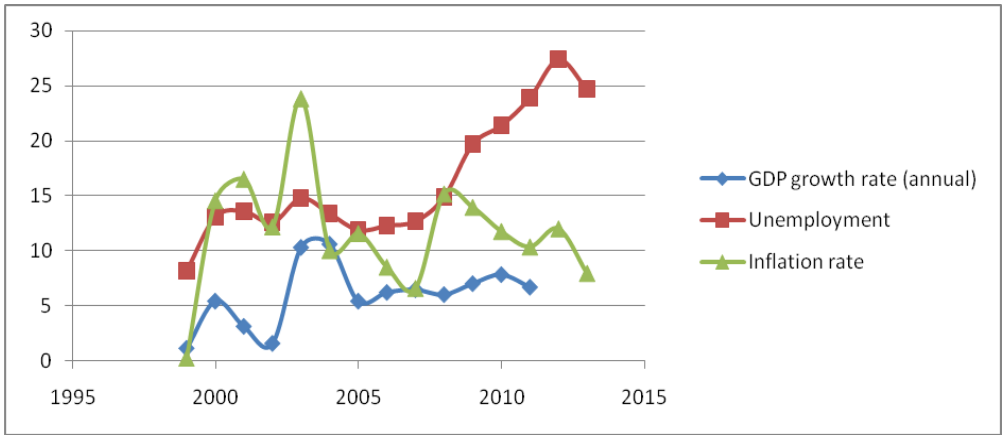
Introduction

Over the past decade, there has been heightened concern about the high level of unemployment in Nigeria (Garba & Garba, 2013; Okojie, 2013; Ozugbalu & Ogwumike 2013; Diejomaoh, 2013; Iyoha, Adamu, & Bello, 2013). From 8.2 percent in 1999, the unemployment rate rose to 21.4 percent in 2010 and 24.7 percent in 2013 (National Bureau of Statistics, 2014; see Figure 1), one of the highest rates in Sub-Saharan Africa.[1] The situation is compounded by the fact that the nation had witnessed robust growth over the period with an average growth rate of 6.80 percent between 2002 and 2011 (World Development Indicators, WDI, 2014, see also Figure 1). In addition, as illustrated in Figure 1, the inflation rate has been highly volatile, and only recently began to trend downward. The anxiety generated by rising

[1] The average unemployment rate for Sub-Saharan Africa in 2013 was 7.65 percent (World Development Indicators, 2014).

unemployment, especially among the youths, is not unexpected. A high unemployment rate imposes economic and social costs on society and may lead to instability. The misery is compounded when unemployment combines with high or rising inflation. However, these fears may also be misplaced if we do not know the "natural" rate of unemployment (Friedman, 1968; Phelps, 1968). The received wisdom in the field of economics is that unemployment becomes worrisome only when the rate rises above its "natural" level.

Figure 1: Unemployment, Inflation, and GDP growth rate in Nigeria (1999-2013)



Sources: NBS (2014), WDI (2014), IMF (2014)

Using the framework of the expectation-augmented Phillips relation, estimated parameters from the International Monetary Fund (IMF, 2008) and historical data from the IMF and the National Bureau of Statistics (NBS), we provide some preliminary investigation of the "natural" unemployment rate for Nigeria. The results show that the rate may have risen sharply over the last two to three decades. This has implications for our understanding of the Nigerian labour market, the unemployment situation, the role and limit of monetary and fiscal policies and the prospects of long-term growth. The remaining part of the paper runs as follows. In section 2, we discuss the existing theoretical and empirical literature on the natural rate of unemployment, its importance and implications for government policy and show how this article contributes to the academic and policy discourse. Section 3 presents the theoretical framework for the use of the Phillips relation in estimating the natural rate of unemployment. Section 4 contains the empirical analyses and results for Nigeria while section 5 draws some policy implications of the findings and makes recommendations on the way forward.

Review of Theoretical and Empirical Literature

The concept of a "natural rate of unemployment" is attributable to Friedman (1968) and Phelps (1968). It is understood to mean the rate of unemployment that

guarantees equilibrium in the labour market (that equalizes the demand for labour with supply at the existing wage rate). The concept has also been defined as the "structural rate of unemployment" (the unemployment rate that prevails as a result of the underlying structure of the economy and institutional arrangements in the labour market) and the "non-accelerating inflation rate of unemployment" (NAIRU) (Blanchard, 2009. p193). The phrase, NAIRU, was first introduced by Modigliani & Papademos (1975)[2]. While some economists consider the two concepts synonymous (since both relate to the sum of frictional and structural unemployment) (Gordon, 1997; Cross, 1995; Ball & Mankiw, 2002), others believe they are not interchangeable (Chang, 1997; Espinosa-Vega & Russell, 1997). In this regard, NAIRU is generally thought to be an empirical macroeconomic relation between inflation and unemployment, the unemployment rate that balances the "inflation-increasing effects of excess demand markets" with the "inflation-decreasing impacts of the excess-supply markets". In contrast, the natural rate of unemployment is associated with "Walrasian equilibrium" in the labour market (Tobin, 1997, p.8) and depends on the microeconomic features of the market.[3] In spite of this, many maintain that the two concepts serve the same purpose in terms of their roles as economic indicators and their relevance to policy. Claar (2002), in fact, argue that "the overall inflation-forecasting utility of the natural rate of unemployment relative to the NAIRU is not very different" (see also Pošta, 2008).

Both the natural rate of unemployment and the NAIRU are associated with the Phillips relation or curve[4]. The original formulation of the Phillips curve predicts an inverse relationship between the inflation rate and the unemployment rate, and the possibility of a trade-off between the two. In its more recent form (the expectation-augmented version), it consists of an inverse relationship between changes in the inflation rate and the deviation of the unemployment rate from its "natural" level. Most economists believe that a trade-off between inflation and unemployment is possible only in the short run. In the medium run[5], unemployment settles at its natural

---

[2] In their formulation, Modigliani and Papademos (1975) talked about a NIRU (Noninflationary Rate of Unemployment) rather than NAIRU.

[3] There is no universally-agreed definition of the natural rate of unemployment or consensus as to the meaning. Rogerson (1997) lists up to 12 different definitions.

[4] The "Phillips relation" is associated with A. W. Phillips who in 1958 first noted a clear and inverse relationship between the inflation and unemployment rates based on data for the United Kingdom covering the period 1861 to 1957. In 1960, Paul Samuelson and Robert Solow found the same relation for the United States using data for the period 1900-1960 (see Blanchard, 2009, p.185).

[5] It is popular in economic discuss to distinguish between the "short-run" and the "long-run". In the "short-run", some factors are assumed fixed, while in the "long-run" all factors are assumed variable. In the classical macroeconomic context, while the economy may be unstable over the "short run" experiencing fluctuations in the level of economic activities, it

rate, which is determined essentially by structural factors in the economy. In contrast, the inflation rate corresponding to the "natural" rate of unemployment is determined by the growth rate of money supply, and hence is a function of monetary policy (Friedman, 1968; Phelps, 1968; Modigliani and Papademos, 1975). Thus while the Phillips curve may be downward-sloping in the short-run, it tends to be vertical in the medium-run.

Associated with the above, are the concepts of a short-term NAIRU (ST-NAIRU) and the "medium-term equilibrium rate of unemployment" (Turner, Boone, Giorno, Meacci, Rae & Richardson, 2001)[6]. While the two capture the same underlying notion of "an unemployment rate associated with stable inflation", they differ in their time horizons. The ST-NAIRU is that unemployment rate that allows the inflation rate to remain the same in the next period, "the unemployment interval under which it holds that neither inflationary nor disinflationary pressures are present in the markets". In contrast, the medium-run equilibrium rate of unemployment is that which obtains "once the NAIRU has fully adjusted to all supply and policy influences or shocks, including permanent ones" (ibid) [7]. It shows the rate of capacity utilization that is "sustainable", being associated with "reasonably stable inflation" over the medium term. The ST-NAIRU tends to be more volatile; often buffeted by supply shocks, inflationary expectations and inertia and influenced by the level and rate of change of the actual unemployment rate while the medium-term equilibrium rate of unemployment, relates to a "medium-term steady state" (ibid)[8]. Thus while the two

---

often adjusts to its "potential" level over the "long run". Thus macroeconomic variables tend to find their "natural" level in the "long run". However, in recent times, there has been a modification to this traditional view. While it is common to still find this two-fold classification in many macroeconomic textbooks, it is now believed that what was once labeled as the "long-run" is better called the "medium-run". From the viewpoint of macroeconomics, the concept of the "long-run" is reserved for the time period long enough for the economy to move from one "natural" or "potential" equilibrium level to another.

[6] The authors talked about a "long-term equilibrium rate of unemployment" but we chose to use the "medium-term" consistent with the observation made in the preceding footnote.

[7] We can distinguish between permanent and temporary shocks. The latter are expected to "revert to zero" or wear out over the horizon of "one to two years" while permanent shocks leave long-lasting effects and often alter the medium-run equilibrium condition (Turner et al, 2001; Blanchard, 2009, chapter 7).

[8] Temporary supply shocks may lead to one-off changes in the inflation rate without affecting the medium-term equilibrium unemployment rate, while permanent shocks lead to ongoing inflation and may generate permanent changes in the equilibrium rate. In addition, supply shocks may alter the fundamental relationship defined by the Phillips curve. For example, the sharp increases in oil prices between 1973 and 1975 (a negative supply shock) led to a combination of higher inflation and unemployment (stagflation) and permanent increases in the inflation and unemployment rates **(**Blanchard, 2009, p.173-177**)**.

may differ in the short run, the "expectation-augmented Phillips relation" can be used to generate the same value for the "natural" rate of unemployment and the NAIRU over the medium run when inflationary expectations are met (Pošta, 2008). In addition, it is believed that the "medium-term equilibrium rate of unemployment" is more difficult to quantify or empirically estimate because of difficulties in identifying and separating the effects of permanent supply shocks. It is also assumed to be less relevant to monetary and fiscal policies (though important for structural policies), especially when the NAIRU adjusts slowly to the medium-run equilibrium. On the other hand the ST-NAIRU is easier to empirically determine and "play clearly defined roles in macroeconomic analysis and policy assessments" (Turner *et al*, 2001).

Most recent empirical discourse on the Phillips relation adopts what has come to be called the "triangle model". The model goes beyond the narrow focus on demand shocks and incorporates the role of supply shocks in shaping the inflation-unemployment relationship (Gordon, 2013). Apart from providing a solid explanation to the stagflation experience of the 1970s and the apparent collapse of the conventional Phillips curve (Gordon, 1977), the model has been used to predict the rapid fall in the inflation rate in the US during 1981-86 period despite a low "sacrifice ratio" (Gordon & King, 1982), the low rate of inflation of the late 1990s despite rapid increases in demand and declining unemployment, and the absence of a reduction in the inflation rate between 2008 and 2013 despite rising unemployment (the "missing deflation" phenomenon: see Gordon, 2013). It has also been used to analyze the increase in the unemployment rate in Europe from 2 percent before 1972 to more than 8 percent after 1985 despite a stable inflation rate (see Blanchard & Summers, 1986).

Rapid changes in the unemployment rate also have implications for the Phillips relation. Turner et al (2001) argue that recent movements in the unemployment rate may be just as important as the level, such that a rapidly falling rate of unemployment may create a "speed limit" effect on inflation (that is, accelerate the inflation rate) even at high levels of unemployment. In addition, an upward-trending ST-NAIRU or a persistent increase in the unemployment rate may be an indication of a rise in the medium-term equilibrium rate of unemployment (Setterfield, Gordon & Osberg, 1992). For example, the rise in the unemployment rate in Europe between 1972 and 1985 is believed to have led to an increase in the medium-run unemployment (Gordon, 2013). Demographic changes, such as an increasingly youthful or a shrinking workforce; unexpected and rapid decline in productivity, and labor market policy changes could also lead to an increase in the "natural" rate of unemployment (Labonte, 2004).

In concluding this section, we note that while there is a general consensus that knowledge of the NAIRU is of great value to government, policy makers and economic agents, there is no known attempt to empirically investigate this in relation

to Nigeria[9]. The only known robust model of the Phillips relation for the Nigerian economy was developed by staffs of the International Monetary Fund (IMF) in 2008 but the analyses fell short of identifying, estimating or predicting the NAIRU. The Central Bank of Nigeria undertakes inflation-targeting and shows differences between target and actual inflation rates but it is not clear whether there is an underlying utilization of the concept of a NAIRU. In this paper, we attempt to identify the ST-NAIRU for Nigeria from historical data on inflation and unemployment and based on estimated parameters from the model developed by the IMF (IMF, 2008). This is taken up after discussing the theoretical framework for such analysis in the next section.

Theoretical Framework and Model[10]

The prevailing wage rate in the society is influenced by existing institutional factors, the unemployment rate and people's expectation about the price level. The institutional or structural factors include the presence, scale and depth of labour unionization, unemployment insurance, minimum wage legislations and other labour/employment protection policies. These related factors, which can be represented in a "catch-all" variable (c) are assumed to be positively related to nominal wages (the presence of generous unemployment benefits, minimum wages, employment protection laws and strong unions, individually and collectively make it more difficult for firms to lay off workers and for prospective workers to accept lower wages). There is also a positive and equi-proportional relationship between the expected price level and nominal wages (when workers expect the price level to rise, for example, they bargain for a compensating increase in nominal wages). But the rate of unemployment is inversely related to the wage rate (higher unemployment makes workers willing to accept lower wages). Given the above, we can write the wage-setting behavioural equation of workers and firms as

$$W = P^e G\,(u, c) \qquad (1)$$
$$\quad\; - \;\; +$$

where W is the nominal wage rate, P^e is the expected price level, u is the unemployment rate and the signs under the bracket indicate the theoretical relationship between each variable and W. Since institutional factors change slowly, c may be assumed to be fairly constant, especially in the short run.

[9]There have been attempts to estimate the NAIRU/"natural" rate of unemployment for many other countries and regions (see for example, Turner et al, 2001 for OECD countries; Gerlach-Kristen, 2004 for Hong Kong; Côté & Hostland, 1996 for Canada, and Mehrara, Sargolzaei, & Ahmadi, 2012 for Iran). The World Bank compiles annual data on the long-term unemployment rate for various countries but this does not include Nigeria and most sub-Saharan African countries (see WDI, 2014).

[10] This section is based on Blanchard (2009, chapters 6, 7 & 8).

The level of prices in the economy is determined by firms' price-setting behavior. Firms are assumed to set prices by adding a mark-up over cost. If we ignore the cost of capital and assume that a unit of labour can produce a unit of output, in competitive environments, the cost of a unit of output will equal the cost of a unit of labour, which is the same as the nominal wage rate, *W*. Thus the price-setting behavior of firms can be represented in the equation

$$P = W+\beta W = (1 + \beta) W \qquad (2)$$

where P is the nominal price level and β is the mark-up on cost. The size of β will depend on existing market structure and may therefore be assumed to be fairly constant in the short run.

If the actual price level in the economy is the same as the expected price level ($P=P^e$), a situation that is believed to hold only in the medium run, we can rewrite (1) as

$$W = P\,G\,(u, c) = W/P = G\,(u, c) \qquad (3)$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad - \;\; +$$

where W/P is the real wage rate. Equation (3) expresses the real wage rate as an inverse function of the unemployment rate for given institutional factors in the labour market.

The price-setting relation (2) can also be slightly modified in terms of the real wage rate as follows

$$W/P = 1/(1 + \beta) \qquad (4)$$

Since c and β are assumed constant, the only *variable* influencing the real wage rate in (3) and (4) is the unemployment rate (u). In addition, there is a unique rate of unemployment (u^*) that will guarantee equality between the real wage determined by the wage-setting behavior of workers and firms and the price-setting behaviour of firms (equations (3) and (4). This unemployment rate is the natural or structural rate of unemployment.

There are a few things to note about u^*. First, it is associated with the medium run since it is based on equality of the actual and expected price levels. Economists believe that while the actual or prevailing unemployment rate (u) may differ from u^* in the short run, implying some disequilibria in the labour market, the rate always tends toward the "natural" level over the medium run. Secondly, and as evident from the prevailing discussion, u^* is not naturally endowed; rather, it is determined by structural factors in the society. Consequently, the rate will vary across societies (economies). Thirdly, the natural rate of unemployment does not remain the same forever. Though it tends to be stable over relatively short periods, it changes with variations in institutional arrangements and labour market dynamics. In other words, the natural rate of unemployment not only varies across space but across time. Fourthly, associated with u^* is a natural or potential level of output (Y^*). When unemployment is at its natural level, available workers are all engaged and the

economy is operating at full potential, given existing complementary factors (capital, other non-labour resources, and production technology).

While we know that there is a "natural rate of unemployment, it is difficult to observe u^* in practice. The Phillips relation (curve) gives us another view of u^* that may be more easily observed. The original form of the relationship may be stated as

$$\pi_t = (\beta + c) - \delta u_t \quad (\delta > 0) \tag{5}$$

where π is the inflation rate and t denotes current time. Equation (5) shows that there is an inverse relationship between the inflation rate and the unemployment rate for given β and c. A higher lower of unemployment can only be attained at the price of a higher rate of inflation. Countries could trade off some unemployment for higher prices and vice versa. The expectation-augmented version of the Phillips relation is derived from equilibrium conditions in the labour market. Given equations (1) and (2), the substitution of the latter into the former yields

$$P = (1 + \beta)\, P^e\, G\,(u, c) = P^e\,(1 + \beta)\, G\,(u, c) \tag{6}$$

$G\,(u, c)$ is a general function showing the roles that the unemployment rate (u) and the catch-all variable (c) play in nominal wage determination. We can assume a linear form of the function as follows

$$G\,(u, c) = 1 - \delta u + c \tag{7}$$

The intercept term in (7) (that is, the unit 1) ensures that the nominal wage rate is non-negative while the parameter δ shows to what extent changes in the unemployment rate translate to changes in nominal wages. Substitution of (7) into (6) yields

$$P = P^e\,(1 + \beta)\,(1 - \delta u + c) \tag{8}$$

Equation (8) gives the actual price level as a function of the expected price level and the unemployment rate for given β and c. This can be expressed as a relation between the actual and expected rate of inflation as follows

$$\pi = \pi^e + (\beta + c) - \delta u \tag{9}$$[11]

where π^e is the expected rate of inflation. If we add time subscripts to (9), we will have

$$\pi_t = \pi_t^e + (\beta + c) - \alpha u_t \tag{10}$$

The difference between (5) and (9) is the presence of expected inflation in the latter. In the initial formulation of the Phillip relation, the price level was assumed to remain fairly constant, so that expectation about inflation (π_t^e) was zero. However, the

[11] For a formal derivation of (9) from (8), see Blanchard (2009, p. 203).

general increases in the price level in the 1970s led to a change in peoples' expectation about inflation. The assumption of a zero inflation rate was no longer tenable and expectation of a positive inflation rate became the norm. The issue was no longer whether we should expect prices to rise, but by what magnitude? Thus, the focus shifted from the inflation rate to changes in the inflation rate.

It is often assumed that people form expectations about inflation in an adaptive manner, so that

$$\pi_t^e = \gamma\pi_{t-1} \quad (0 < \gamma \leq 1) \tag{11}$$

If we assume for the time being that γ =1, we can rewrite (10) as

$$\pi_t - \pi_{t-1} = (\beta + c) - \delta u_t \tag{12}$$

Equation (12) is the "modified" or "expectation-augmented Phillips curve", a relation between the unemployment rate (u_t) and changes in the inflation rate ($\pi_t - \pi_{t-1}$) for given β and c. It is also called the "Accelarationist Phillips relation" (Blanchard, 2009, p. 191). Reductions in the unemployment rate accelerate (leads to positive changes in) the inflation rate and vice versa. However, in the medium run when the economy is operating at its "natural" level, expectations are fulfilled and changes in the inflation rate no longer lead to changes in the unemployment rate. The price level grows at a constant rate, implying a constant inflation rate. In symbols

$$u_t = u_t^*,\ Y_t = Y_t^*,\ P_t = P^e_t,\ \pi_t = \pi_t^e = \pi_{t-1}, \text{ and } \pi_t - \pi_{t-1} = 0 \tag{13}$$

Substituting these into equation (12) and solving for u^* yields

$$u^* = (\beta + c)/\delta \tag{14}$$

Equation (14) shows that the natural rate of unemployment (the medium-term unemployment rate) is a constant determined by some parameters in the economy (β, c and δ) and is outside the direct influence of monetary and fiscal policy. Macroeconomic policies and other forms of demand shock can influence u^* only as they affect β, c and/or α. A change in any or all of these parameters will lead to a change in the natural rate of unemployment.

Combining (13) and (14) gives

$$\pi_t - \pi_{t-1} = -\delta\,(u_t - u^*) \tag{15}$$

Equation (15) expresses the Phillips relations as one between the deviation of the unemployment rate from its "natural" level ($u_t - u^*$) and changes in the inflation rate ($\pi_t - \pi_{t-1}$). An unemployment rate above the "natural" level (($u_t - u^*$) > 0) implies a reduction in the inflation rate (($\pi_t < \pi_{t-1}$ so that ($\pi_t - \pi_{t-1}$) < 0) and vice versa. As a corollary, a constant inflation rate over the next period (($\pi_t = \pi_{t-1}$ so that ($\pi_t - \pi_{t-1}$) = 0)

implies that the prevailing unemployment rate is the natural rate of unemployment ($u_t = u^*$). Thus, the natural rate of unemployment u^* is also called the "non-accelerating inflation rate of unemployment" (NAIRU).

Associated with (15) is a "sacrifice ratio" derived as follows:

$$1/\delta = -(u_t - u^*)/(\pi_t - \pi_{t-1}) \quad (16)$$

This is the point years of excess unemployment needed to reduce the inflation rate permanently by one percentage point[12]. The ratio is independent of policy and solely determined by the parameter, δ. The higher the parameter's value, the lower the sacrifice ratio associated with reducing the inflation rate.
We can also express the sacrifice ratio in terms of the output gap ($Y^* - Y_t$) such that

$$1/\delta = -(Y^* - Y_t)/(\pi_t - \pi_{t-1}) \quad (17)$$

A higher δ implies that output does not respond as much to fluctuations in the price level, meaning that little will be lost in terms of output if the price level drops. Also, the greater the ability of firms or the number of firms that are able to adjust prices in every period, the larger the value of δ and the lower the change in output that will be associated with price changes. Our task in the next section will be to identify the "natural" rate of unemployment from historical data based on the relationship postulated in equation (15).

4. Empirical Analyses

The IMF's Forecasting and Policy Analysis System (FPAS) for Nigeria (IMF, 2008)[13] predicts inflation and assesses economic risks. Though, the model falls short of estimating Nigeria's natural rate of unemployment, it provides estimates for some parameters associated with the Phillips relation and the non-oil potential output level. Equation (18) presents the empirical model for the Phillips curve by the IMF based on the headline inflation.

---

[12] The concept is based on "Okun's law" (see Okun, 1966).

[13] The model, a calibration and modification of an earlier model developed by Berg, Karam, and Laxton (2006a, 2006b) and which has been applied to various countries, is designed to "support policy analysis in an inflation-targeting regime". It consists of four equations**:** an aggregate demand equation (IS curve), a price-setting equation (Phillips curve), an "uncovered interest parity condition for the exchange rate, with some allowance for backward-looking expectations"; and "a rule for setting the policy interest rate as a function of the output gap and expected inflation" (IMF, 2008). In the specification for Nigeria, the Phillips curve follows the triangular model and "relates inflation to past and expected inflation, the output gap, the exchange rate and the relative price of oil". However, it fails to capture other factors that act as shocks to output, especially agricultural output.

$$\pi_t = \alpha_{\pi ld}\pi 4_{t+4} + (1-\alpha_{\pi ld})\pi 4_{t-1} + \alpha_{ygap} ygap_{t-1} + \alpha_z (z_t - z_{t-1}) + \alpha_0 \pi_{rpoil,\,t} + \alpha_1 \pi_{rpoil,\,t-1} + \varepsilon_t^{\pi} \quad (18)$$

where π = cpi inflation, quarterly at annualized rate, percentage points
ygap = output gap, percentage points
$\pi 4t$ = four-quarter change in the CPI, annualized rate, percentage points
$\pi rpoil,t$ = hange in the relative price of oil, quarterly at annualized rate, percentage points
$\pi 4rpoil,t$ = four-quarter (moving average) change in the relative price of oil, percentage points
= log of the real exchange (an increase implies a depreciation)

The parameter $\alpha_{\pi ld}$ captures the effect of forward-looking behaviour in inflation expectations (a situation where agents form current expectation about inflation by forecasting future values rather than looking at the preceding rate). It is believed that a higher value "makes it more difficult for the monetary authorities to change inflationary patterns" or meet inflation targets. As a corollary, $(1-\alpha_{\pi ld})$ will express the effect of the backward- looking components in inflation formation (that is adaptive expectation). This is synonymous to γ in equation (11). The relationship between the output gap and inflation is expressed in α_{ygap}. It is equivalent to δ in equation (14) and (17). The parameter plays a role opposite in effect to the markup (β in equation 14). A higher δ, all else equal, implies a lower sacrifice ratio and a reduction in the natural rate of unemployment (u^*). But higher δ may also generate increases in the markup β which produces an opposite effect.[14] The coefficient α_z captures "the weight of imported goods in the CPI basket and the pass-through of foreign-currency prices (and hence the nominal exchange rate) on to the domestic-currency prices of imports" while α_0 and α_1 take care of "the weight of oil related products in the CPI basket and the pass-through to prices" (IMF, 2008).

The IMF's estimates for these parameters are presented in Table 1, which also contains estimates for the US economy (assumed to represent Nigeria's trading partners). The parameter values were based on "economic principles, the econometric evidence available, and an understanding of how the economy functions".

Table 1: Phillips Curve: Parameter estimates for Nigeria compared to the United States of America

Parameter	Lower range	Upper range	Nigeria	U.S.
Phillips curve				
$\alpha_{\pi ld}$	>0	1.00	0.10	0.20

[14] If a larger number of firms are able to adjust prices regularly, they may do so in the upward direction. In an unregulated environment, prices may be very flexible upward but sticky downward. This may allow for frequent increases in the mark-up.

α_{ygap}	0.25	0.50	0.40	0.30
α_z	...	...	0.20	
α_0	...	...	.074*(1/3)	.018*(1/3)
α_1	...	...	. 074*(1/3)	.018*(1/3)

Source: IMF (2008)

Substituting the estimated parameters into (18), we have

$$\pi_t = 0.1\pi 4_{t+4} + (0.9)\pi 4_{t-1} + 0.4ygap_{t-1} + 0.2(z_t - z_{t-1}) + 0.74\pi_{rpoil,\,t} + 0.74\pi_{rpoil,\,t-1} + \varepsilon_t^{\pi} \quad (19)$$

If we assume that the effects of all other factors are zero, or these factors remain unchanged (this is the same as assuming that the effect of all shocks that affect the Phillips relation have worn off), making use of equations (11) and (15), we may be able to derive the ST- NAIRU from equation (19) as follows

$$\pi_t - \gamma\pi_{t-1} = -\delta\,(u_t - u^*)\ ^{15} \quad (20)$$

Since $\gamma = 1 - \alpha_{\pi ld} = 1 - 0.1 = 0.9$

$$\pi_t - 0.9\pi_{t-1} = -\delta\,(u_t - u^*) \quad (21)$$

It follows that if $\pi_t = 0.9\,\pi_{t-1}$, then $\pi_t - 0.9\,\pi_{t-1} = 0$, and $u_t = u^*$. In addition, if we can find episodes from historical data where this condition is fulfilled, the accompanying unemployment rate may be identified as the ST-NAIRU. In addition, where these conditions are not exactly fulfilled, it will be possible to calculate the ST NAIRU (u^*) from available equations and estimated parameters. First, expressing (15) in terms of the output gap ($Y^* - Y_t$) and substituting the estimated parameter for $\alpha_{ygap} = \delta$, we have

$$\pi_t - 0.9\,\pi_{t-1} = -0.4\,(Y^* - Y_t) = -0.4\,(u_t - u^*) \quad (22)$$

and

$$u^* = \{(\pi_t - 0.9\,\pi_{t-1})/\,0.4\} - u_t \quad (23)$$

Our task in the remaining part of these analyses is to identify time periods when there was an absolute, or near-absolute, fulfillment of equation (21) and to use equation (23) to find the ST-NAIRU where applicable. This is based on historical data on inflation and unemployment for Nigeria covering the period 1981-2013 (see Appendix). The analyses and results are presented in Table 2.

We focused on periods where the percentage reduction in the inflation rate ($\pi_t - 0.9\pi_{t-1}$) is not more than twenty five (notice that the equality of π_t and $0.9\pi_{t-1}$ implies $\pi_t < \pi_{t-1}$ or a fall in the inflation rate by 10 percent). Five periods were identified

[15] Note that in the IMF estimate, $\pi 4t$ is the four-quarter change in the CPI, so that $\pi 4_{t-1}$ is the same as π_{t-1} when annual, rather than quarterly, data are used.

(columns 1 and 2, Table 2) but those with the closest margins are 1986-87, 2008-09 and 2010-11. Expectedly, the deviations of the actual unemployment rate from the estimated ST-NAIRU were smaller in these periods (column 6 of Table 2). In other words, the actual unemployment rates were very close to the "natural" rate of unemployment during the periods with margins typically less than one percentage point. Thus they yield more reliable estimates of u^* based on the predictions of the augmented Phillips relation. The results also reveal variations in the ST-NAIRU over time. From 6.42 percent in 1987, it rose significantly to 18.95 in 2009 and 23.31 in 2011 (column 4, Table 2). Thus, in a period of about two and a half decades, the ST-NAIRU had more than tripled indicating that the "natural" rate of unemployment may have risen significantly over the time period.

Table 2: Calculating the ST-NAIRU from historical data based on estimated Phillips Relation

Year (Y_t - Y_{t-1})	Percentage change in Inflation rate (π_{t-1} - π_t)/ π_{t-1}	π_t - 0.9 π_{t-1}	u^*	u_t	(u_t - u^*)
1986-87	**-0.1175**	**-0.232**	**6.42**	**7.0**	**0.58**
2006-07	-0.2275	-1.0840	9.99	12.7	2.71
2008-09	**-0.0801**	**0.3018**	**18.95**	**19.70**	**0.75**
2009-10	-0.1573	-0.7995	19.40	21.4	2.0
2010-11	**-0.1200**	**-0.2343**	**23.31**	**23.9**	**0.59**

Source: Authors' Calculations based on IMF (2008, 2014) and NBS (2014)

Policy Implications, Conclusion and Recommendations

In this paper, we have attempted to identify the "natural" rate of unemployment for Nigeria using the concept of the NAIRU and based on estimated parameters by the IMF and data from both the IMF and the NBS. Our results show that the rate may have risen significantly over the years. This has implications for our understanding of the present unemployment situation in the country, the use of policy to achieve changes and the prospects of long-run growth. For example, if the unemployment rate is high because the natural rate is itself high, little may be achieved in terms of trading off unemployment for a higher inflation rate by use of expenditure-targeting monetary and fiscal policy (demand-side policies). In addition, a frequently changing NAIRU will complicate policy formation (Ball and Mankiw 2002; Gordon 1997, 1998) while a sustained increase in the natural rate of unemployment compromises long-term growth.

What factors may have led to the upward swing in the "natural" rate of unemployment in Nigeria? At this stage, we can only hypothesize. As far as the country is concerned, nothing appears to have changed much in relation to the catch-all variable (*c*) as traditionally defined. Unemployment benefits remain non-existent,

union power even weaker, while rules guiding employment and severance are hardly called into force. However, the presence and enduring nature of a strong social insurance around family networks may be playing a role. In this context, we may need to take a closer look at remittance inflow and its likely effect on the willingness to participate in the labour market at existing wage levels. Another unexplored or overlooked factor may be the growing influence of income from participation in some illicit activities, such as oil bunkering, ransom kidnaps and election-related/political violence (three forms of criminal activities that have become the bane of the Nigerian society). A steady flow of income from one or more of these sources may have had the same effect on willingness to engage in legitimate employment as do remittances.

However, it would appear that a more formidable force driving the increase in the "natural" unemployment rate may be the growing power of business firms as reflected in their ability to change the prices of goods and services in response to perceived and real supply shocks. Nigeria lacks any effective price control/regulation mechanism while antitrust legislations are virtually lacking. Collusion and cartelization exist in virtually all segments of production and marketing, even among artisans and informal traders. Thus, consumers are left at the mercy of cartels that fix and enforce prices at will. Adding to this is the high cost of doing business in the country, a result of the nation's huge infrastructural gap. In sum, frequent and steady increases in the mark-up over labour cost may have been partly, or even largely, responsible for the sharp increases in the natural rate of unemployment in the country.

As with other efforts to estimate the "natural" rate of unemployment, this analysis is limited in scope and depth and may also not have yielded precise estimates, though it gives a good and reliable lead. Going forward, there is the need to take a closer and detailed look at the Nigerian labour market to understand the changes that have taken place over the last two and a half decades, the dynamics of change, and the forces driving recent developments. This may promote a more robust analysis and one that combines macroeconomic theory with microeconomic foundations.

References

Ball, L. & Mankiw, N. G. (2002). The NAIRU in Theory and Practice. *Journal of Economic Perspectives*, 16(4),415-436.

Berg, A., Karam, P., & Laxton, D. (2006). A Practical Model-Based Approach to Monetary Policy Analysis–Overview. *IMF Working Paper, Washington: International Monetary Fund.*

Blanchard, O. J. (2009). *Macroeconomics*, fifth edition: New Jersey: Pearson Prentice Hall

Blanchard, O. J. & Summers, L.H. (1986). Hysteresis and the European Unemployment Problem. In *NBER Macroeconomics Annual*,(1),15-90

Chang, R. (1997). Is low Employment inflationary? *Economic Review (Federal Reserve Bank of Atlanta)*, 82 (1), 4-13.

Claar, V. V. (2002). Is the NAIRU More Useful in Forecasting Inflation than the Natural Rate of Unemployment? *MPRA Paper* 14257, available online at http://mpra.ub.uni-muenchen.de/14257/

Côté, D. & Hostland, D. (1996). An Econometric Examination of the Trend Unemployment Rate in Canada, *Bank of Canada Working Paper 7.*

Cross, R. (1995). Is the Natural Rate Hypothesis Consistent with Hysteresis? In R. Cross, ed., *The Natural Rate of Unemployment: Reflections on 25 years of the Hypothesis*: Cambridge: Cambridge University Press.

Diejomaoh, V. P. (2013). Accelerating Youth Employment Creation in Nigeria: The Challenge of sustained Implementation. *The Nigerian Journal of Economic and Social Studies*, 55(1), 127-141.

Espinoza-Vega, M.A. & Russell, S. (1997). History and Theory of the NAIRU: A Critical Review. *Economic Review (Federal Reserve Bank of Atlanta)*, 82 (2), 4-5.

Garba, A. P. & Garba, P.K. (2013). The Jobless Young and Poor in Nigeria: The Key Questions and the Possible Answers. *The Nigerian Journal of Economic and Social Studies*, 55(1),1-35.

Gerlach-Kristen, P. (2004). Estimating the Natural Rate of Unemployment in Hong Kong, Mimeo, HIEBS, University of Hong Kong. 1 -73. Available at: http://www.hiebs.hku.hk/working_paper_updates/pdf/ wp1085.pdf. 1- 13.

Friedman, M. (1968). The Role of Monetary Policy. *American Economic Review Papers and Proceedings*, 58(1), 1-17.

Gordon, R. J. (1977). "Can the Inflation of the 1970s Be Explained?" *Brookings Papers on Economic Activity*, (1), 253-77.

_____ (1997). The Time-Varying NAIRU and its Implications for Economic Policy. *Journal of Economic Perspectives*, 11(1), 11-32.

_____ (1998). Foundations of the Godilocks Economy: Supply Shocks and the Time-Varying NAIRU. *Brookings Papers on Economic Activity*, (2), 297-346.

_____ (2013). The Phillips Curve Is Alive And Well: Inflation And The Nairu During The Slow Recovery. NBER Working Paper 19390, available at http://www.nber.org/papers/w19390

Gordon, R. J. & King, S. R. (1982). The Output Cost of Disinflation in Traditional and Vector Autoregressive Models," *Brookings Papers on Economic Activity*, (1). 205-42

International Monetary fund (IMF) (2008). *Nigeria: Selected Issues***,** *IMF Country Report No. 08/65 February 2008*, Washington D.C.: IMF.

_____ (2014). *World Economic Outlook*, Washington D. C.: IMF

Iyoha, M. A., Adamu, P. A., & Bello, S. M. (2013). Youth Employment and Poverty Reduction in Nigeria: An Econometric Investigation. *The Nigerian Journal of Economic and Social Studies*, 55(1): 73-101.

Labonte, M. (2004). A Changing Natural Rate of Unemployment: Policy Issues. Washington, DC: Congressional Research Service.

Mehrara, M., Sargolzaei, M., & Ahmadi, R. (2012). Estimation of Natural Rate of unemployment in Iran: an SVAR Approach, *International Journal of Business and Behavioral Sciences, 2(5).*

Modigliani, F. & Papademos, L. (1975). Targets for Monetary Policy in the Coming Year, *Brookings Paper on Economic Activity*, (1) 141-163.

National Bureau of Statistics, Nigeria (NBS) (2014). Report of National Stakeholders' Workshop on the Review on Definition and Methodology for Computing Unemployment Statistics in Nigeria held at Ayalla Hotel, Garki, Abuja, 8th –10th September. Available at

Okojie, C.E.E. (2013). The Jobless, Underemployed Young and Poor in Nigeria: The Gender Dimension. *The Nigerian Journal of Economic and Social Studies*, 55(1), 37-71.

Okun, A. (1966). The Gap between Actual and Potential Output. In Edmund S. Phelps, ed., *Problems of the Modern Economy*. New York: WW Norton & Co

Ozughalu, U. M. & Ogwumike, F. O. (2013). Impact of Employment Status and Nature of Employment of Household Head on Household Poverty Incidence in Nigeria. *The Nigerian Journal of Economic and Social Studies*, 55(1),103-125.

Phelps, E.S. (1968). Money, Wage Dynamics and Labour Market Equilibrium, *Journal of Political Economy*, 76 (4, part2), 678-711.

Pošta, V. (2008). The Nairu and The Natural Rate Of Unemployment – A Theoretical View, Ministry of Finance of The Czech Republic Research Study, Available at: www.mfcr.cz 1-18.

Rogerson, R. (1997). Theory ahead of Language in the Economics of Unemployment. *Journal of Economic Perspectives*, 11(1), 73-92.

Samuelson, Paul A. & Solow, R.M. (1960). "Analytical Aspects of Anti-inflation Policy." *American Economic Review Papers and Proceedings* 50 (May, no. 2), 177-94.

Setterfield, M.A., Gordon, D.V., & Osberg, L. (1992). Searching for a Will O'The Wisp: An empirical study of the NAIRU in Canada. *European Economic Review*, (36), 119-136.

Tobin, J. (1997). Supply Constraints on Employment and Output: NAIRU versus Natural Rate. *Cowles Foundation Discussion Paper*, 1150.

Turner, D., Boone, L., Giorno, C., Meacci, M., Rae, D., & Richardson, P. (2001), Estimating the Structural Rate of Unemployment for the OECD Countries. *OECD Economic Studies, 33*

World Bank (2014). World Development Indicators (WDI). Washington, D.C.: World Bank.

Appendix

Year	Inflation, end of period consumer prices (IMF 2014)	Unemployment rate (NBS 2014)
1981	17.312	3.9
1982	12.5	3.9
1983	33.333	3.9

1984	25	Na
1985	0	6.1
1986	13.333	5.3
1987	11.765	7
1988	39.474	5.3
1989	43.396	4
1990	2.632	3.5
1991	23.077	3.1
1992	48.958	3.4
1993	61.538	2.7
1994	76.623	2
1995	51.442	1.8
1996	14.314	3.8
1997	10.213	3.2
1998	11.913	3.2
1999	0.224	8.2
2000	14.527	13.1
2001	16.495	13.6
2002	12.169	12.6
2003	23.811	14.8
2004	10.008	13.4
2005	11.565	11.9
2006	8.5	12.3
2007	6.566	12.7
2008	15.148	14.9
2009	13.935	19.7
2010	11.742	21.4
2011	10.333	23.9
2012	11.984	27.4
2013	7.938	24.7
2014	7*	25.1
2015	7*	NA
2016	7*	NA
2017	7*	NA
2018	7*	NA
2019	7*	NA

* Estimates

Sources: IMF (2014) & NBS (2014).