# Policy Rule-based Stress Tests of Monetary Integration and Single Monetary Policy in the West African Monetary Zone

**by**

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## Abstract

In the West African sub region, the second monetary zone known as the West African Monetary Zone (WAMZ) was launched in 2002. Membership of the WAMZ is currently made up of The Gambia, Ghana, Guinea, Liberia Nigeria and Sierra Leone. This paper carried out monetary policy rule based stress test to examine an aspect of the feasibility test of this second monetary union by assessing the ease of monetary integration of the proposed currency zone as well as the adequacy of single monetary policy for national stability of the six member countries that are expected to lose their respective monetary independence on the commencement of the monetary union and the institution of a common central bank which would make single monetary policy for the proposed monetary union. The two monetary policy rules (the McCallum monetary base growth rule and the Taylor nominal interest rate rule) employed this study generated the counterfactual interest rates and monetary growth rates at national and union levels. Relevant annual secondary data were sourced from various databases spanning over the 25-year period between 1990 and 2014. Findings produce evidence to suggest that Nigeria is strongly likely to be the crucial major determinant of the single monetray policy stance within the future currency union. However, these two monetary policy rules principally generated varied results. The estimated counterfactual Taylor rule nominal interest rates suggests that Ghana, Guinea and Nigeria have the prospects of coming together to form a sustainable currency union on the long run. While the inferences from the alternative McCallum rule base money growth estimations, is that The Gambia, Liberia, Nigeria and Sierra Leone would be able to form a sustainable monetary integration and operates conveniently within a common monetary policy that would adequately ensure the achievement of national stability. The most crucial evidences given by the two monetary policy rule stress test results are about the suggestions of the order in which the six WAMZ countries would be at ease in joining the proposed monetary union. For the Taylor rule counterfactual nominal interest rate, Nigeria is at the fore front, followed (in the order) by Ghana, Guinea, Liberia, The Gambia and Sierra Leone. The evidences from McCallum rule counterfactual base money growth monetary stress estimations also shows Nigeria at top of the ladder, followed (in the order) by Liberia, Sierra Leone, The Gambia, Ghana and Guinea. One common finding from this monetary policy rules stress tests suggests that Nigeria is solely guarenteed to find the monetary integration easy as well the single monetary policy adequate for its national stability.

## 1.1 Introduction

The Treaty of the Economic Community of West African States (ECOWAS) was revised in 1993. The aim of the revised treaty was to accelerate the economic integration process and strengthen political cooperation. It has a long term objective of establishing an economic and monetary union between all member countries. This ECOWAS revised objectives caused the formation in 2000 the second monetary zone (apart from the UEMOA) when five countries (The Gambia, Ghana, Guinea, Nigeria and Sierra Leone) signed the Accra Declaration that established the West African Monetary Zone (WAMZ). Eventually, on 20 April, 2002, the WAMZ as the second monetary zone was launched. Membership of the WAMZ was made up of The Gambia, Ghana, Guinea, Nigeria and Sierra Leone. The WAMZ formally came into existence on 15 December, 2000 when the five countries signed the Articles of Agreement of the zone. The thinking was that the successful launching of the WAMZ would aid the merger with the CFA zone to usher in the ECOWAS single currency, the *eco*. The objective of the WAMZ is to establish a monetary union that will be characterised by a common central bank and a single currency, *the eco*, to replace the existing five national currencies. Liberia later joined the WAMZ.

Members of the West African Monetary Zone that decided to participate in the monetary zone will eventually abandon their national currencies; lose the control of their respective national monetary policies and fix their nominal exchange rates in relation to each other. From that date, the WAMZ member countries will neither be able to change short term interest rates nor change exchange rates (price of their currencies). They will no more be able to determine the quantity of money within their respective economies. As alternative to exchange rate, for countries in this category, only factor mobility (capital mobility and labour mobility) and wage flexibility will remain the main adjustment mechanisms. The loss of the ability of a member of a monetary union (like WAMZ countries) to operate national

monetary and exchange rate policies independently in the presence of asymmetric shocks will be a cost of monetary union to these countries. However, the West African Monetary Zone will be an optimum currency area if the benefits that the six member countries will receive for joining the monetary union will outstrip or outweigh the costs of being in the union. The key concern for the proposed monetary cooperation within the WAMZ is the uniformity in inflation and output growth dynamics and the responses of these macroeconomic indicators to shocks and whether this will affect member countries in the same manner. Therefore if a WAMZ member country has large asymmetric (country-specific) shock and there is no appropriate adjustment mechanism, such country should not join the common currency area; and if this apply to a group of countries planning to go into monetary union, it is not advisable for such group of countries to create a common currency union. This is because of the cost of maintaining a fixed exchange rate which would outweigh the benefits of such fixed exchange regime.

It is against this background that this paper aims at testing an aspect of the feasibility of the West African Monetary Zone as currency union by examining the perspective of the ease of monetary integration of the proposed currency zone as well as the adequacy of single monetary policy for national stability of the six member countries who would lose their respective monetary independence on the commencement of the monetary union and the institution of a common central bank which would make single monetary policy for the proposed monetary union. The assesments are performed with the application of two monetary policy rules, the McCallum monetary base growth rule and the Taylor nominal interest rate rule) to estimate the levels and indicators of monetary policy stress tests of the WAMZ member countries. Therefore, the research questions to be answered by this paper is about the extent to which future common interest rate and common monetary growth within

the WAMZ as a monetary union would meet the desires of the member nations and achieve national stabilisation purposes in these countries.

### 2.1 Theoretical Frameworks of the Monetary Policy Rules

From the era of Gold Standard to recent past, one can conclude that there is a long history of monetary rules. Many academics and economists have come up with various rules considered 'operational' for monetary policy. Many of these rules are characterised by complexities. Friedman's K% rule (proposing the keeping of money growth to a fixed percentage at every period) is an example of a popular simple rule.

Nevertheless, it is a matter of principles that an optimal monetary policy rule should critically depend on the relationships between macroeconomic indicators as the relationship between monetary policy instruments and economic outcomes. Practically, there have been lack of clear understanding of these relationships and there are difficulties in identifying policy rules that are robust in eliminating the necessity for discretion in monetary policy decision making. Lately, many developed and developing economies have resuscitated simple monetary rules that guide discretion. There have been suggestions made by many economists, of rules that adjust monetary policy instrument in reaction to observed deviation of policy objectives from targets or the desired trend. The monetary base rule suggested by Bennett T. McCallum (1988) and the nominal interest rate rule proposed by John B. Taylor (1993) belong to the class of such monetary rules. Many regard the McCallum monetary rule as an alternative to the Taylor rule. This paper applies these two monetary policy rules in the stress tests of the WAMZ member countries in assessing the adequacy of single monetary policy for these countries as well as examining the ease of monetary integration of the proposed currency union.

In setting monetary policy instrument, the Taylor rule (TR) and the McCallum rule (MR) are similar fundamentally, but have some technical differences. As policy instrument, it is short term interest rate in the Taylor rule while base money is the instrument in the McCallum rule. Both monetary rules give room for feedback. The TR feeds back from the deviations in the right hand side of the equation (inflation deviations and output gaps) suggesting that whenever inflation is above its target and output above the trend, there would be monetary policy which is tighter than what should be in the 'neutral stance'; and the deviations are otherwise when monetary policy are easier than what should be when the posture is 'neutral'. This, in economic terms is perceived as "leaning against the wind."[1] The feedback goes on to illustrate that the appropriate monetary policy is not in any way static. For instance, according to the TR, if inflation rate changes occur, there will be also be changes in the appropriate level of policy instrument, because if nominal interest rate is left unchanged when inflation rate rises, this would amount to the loosening of monetary policy. For the MR, the feedback is from deviations in nominal income from a target path assumed (Stuart, 1996).

This paper applies these two monetary policy rules in the stress tests of the WAMZ member countries in assessing the adequacy of single monetary policy for these countries as well as examining the ease of monetary integration of the proposed currency union.

## 2. 2 The Taylor Interest Rate Rule of Monetary Policy

For the past few decades, the change from discretional policies to rule-based policies and the delegation of authority to independent central bank have been the observed crucial tendencies in the conduct of monetary policy. Consequently, modern central banking embraces the adoption of interest rate arrangement in which short term interest rates would serve as the

[1] 'Leaning against the wind' in this respect is a term that qualifies a countercyclical monetary policy in which the monetary authorities act to keep the inflationary boom down or boost the economic growth during recession.

monetary policy instrument. Many understand the monetary policy rules to be interest rate rule that, in monetary policy transmission mechanism, links interest rate (which serves as the main policy instrument) with some other variables considered by the monetary authorities while making necessary adjustments of policy instruments. Inflation is usually the final target of the policy. It is a monetary economic practice that monetary policy is uncontroversially set by the central bank. In the process, the central bank (hereinafter referred to as the CB) analyses the economy and thereafter consider how best to set the policy instrument it has.[2] In doing so, the CB acts in accordance with the dictates of the current economy and also in consideration of its assessment of the effects of the overall level of demand in the economy and how demand is linked with the ultimate policy target. A widely accepted rule in this respect is known as 'Taylor Rule'.

John Taylor, a Stanford economist developed the famous 'Taylor Rule' (hereinafter referred to as 'TR') for monetary policy in 1993. The monetary rule recommended that the US federal fund rate be adjusted in response to output gap and inflation gap.[3] The rule was meant to capture the major factors affecting the decision making and actions of the US monetary authority. The suggestion made by Taylor (1993) was that in setting monetary policy, a good rule should attempt at making the policy rate a positive function of output gap and inflation. Since Taylor came up with the rule, many monetary policy decisions in the modern world are based on TR which serves as benchmark for the paths of monetary policy and the way it should be conducted.[4] Taylor (1993) made historical account and analysis of monetary policy rules and concludes that the rule is useful in making practical decisions based on the fact that it characterises and evaluate past behaviour of monetary policy action by giving information on how optimal responses are generated towards changes in macroeconomic conditions. He

[2] This is usually the short term money market interest rates.
[3] Output gap is how GDP has deviated from its potential while inflation gap how inflation deviated from its desired rate.
[4] Though, many economists regard the rule as not comprehensive enough.

highlights further that in order to respond to changes in the price level or changes in real income, changes in the US Federal fund rates, it is necessary to have propelling good policy rules; stressing further he state that, given the fact that macroeconomic performances are revealed to be better when the policy rules describes the central bank's decision, such policy-based actions would be optimal.

Simply, Taylor Rule (TR) is a rule that states how the central bank's interest rate should be set. It is a rule that summarises the link between the level of short term interest rate on one hand and output and inflation on the other hand. It serves as a rule of thumb that formalises the intention of a policymaker to stabilise inflation and output (Taylor, 1993). In explaining the degree of influence of output and inflation gaps on the policy rate, overheating in the economy causes GDP to exceed its potential, leading to positive output gap which exerted upward pressure on inflation. To contain the inflation, the CB would raise the interest rate under its control as this would cool the economy down. If inflation is already high above its desired level, the CB would cause downward pressure on inflation by slowing down the economy.

The decision of the CB to set interest rate is based on the current economic situation and the TR serves as a useful general monetary policy framework within which decisions regarding interest rates are made. Typically, TR states that:

*nominal interest rate = (equilibrium nominal interest rate) +ψ .(inflation deviation from target) + δ . (output gap)*

Where δ and ψ are positive numbers (weights)

TR hypothesises that the CB should raise interest rates if the output gap is positive (when GDP is above its trend values) and when inflation is above its target.[5] Policy shifts in output and inflation as well as the inflation volatility and output volatility chosen by the policymaker are pronounced by the positive coefficients δ and ψ. The coefficients δ and ψ will be small if inflation is very sensitive to changes in interest rate. If volatilities of output and inflation are not tolerated, coefficients δ and ψ will respectively be large. A salient feature of the TR is that inflation gap coefficient should be positive and be equal to half (0.5). Therefore, an increase in inflation rate by 1% point would cause the target rate to rise by 1.5% points which implies that 1% point rise in inflation leads to real interest rate increase by 0.5%. This principle that the CB should increase the nominal interest rate more than the increase in inflation rate is the principle at the centre point of the TR which Mishkin (2010) sees as critical to the success of monetary policy. The TR principle is that on the average, inflation target is not achievable unless the long run inflation coefficient is 1; and given this it would be impossible for monetary policy to serve as nominal anchor because inflation would not be effectively tied down to a fixed value and the central bank would be 'leaning against the wind' only when inflation coefficient is more than 1.[6]

As advocated by the New Keynesian Economists, TR states that there should be an inflation target rate of the CB and that the interest rate should be adjusted according to the distance of inflation and output from their respective targets (King, 2012). Howells and Bains (2008) stress the need for the CB to carefully pay all attention to current inflation rate and how it relates its target and output gap. Highlighting the essence of TR, Blanchard (2009) reiterates the position of John Taylor that 'because the CB affects spending through interest rate, the

[5]There are many varieties of versions of the TR as many use the gap between expected future inflation and inflation target rather current inflation. For the purpose of smoothing out interest rate changes, some introduce lagged values of interest rates.

[6]This is according to Smith Jennifer. There is the natural one-for-one response of the nominal interest rate with inflation increase (Fisher Effect) and this makes the inflation coefficient to be exactly 1. This implies that the CB attempts not to slow down the movement of inflation.

CB should think directly in terms of choice of an interest rate rather than a rate of nominal money growth.' Blanchard further points out that the TR has generated a lot of interests from researchers and CBs and that more generally, the thinking of most policy makers has now shifted from nominal money growth to thinking about interest rate rules and from whatever happens to nominal money growth due to shifts of interests to nominal interest rate rules (as the TR) is increasingly seen as irrelevant by economists, financial markets and the CBs.

The popularity of TR has been increasing because: (i) it is clear and simple. Given the role of inflation rate and output gap in the model, TR provides a glaring link between the current policy rate and the current economic conditions. With TR, there is no need for a forecasting model as the observation of current inflation and the estimation of the current output gaps are enough for forecast purposes; (ii) TR well describes the behaviour of monetary policies in many countries.[7] Using a simple monetary policy rule like TR portends an advantage of accuracy in its goals and usefulness by specifying responses to inflation and output gaps and at the same time stabilising these variables. However, despite the merits of TR and how it guides monetary policymakers, Peerman and Smets (1999) spot that TR may not be robust to changes in the economic structure of the economy, stating that generally, the efficient feedback coefficient will be complicated functions of the preference of the monetary authority and also of the structural parameters of the model of the economy as for instance, changes in the efficient feedback coefficient emanate from changes in the monetary policy transmission mechanism.

Originally, Taylor Rule expresses the policy rate to be a function of the output gap and inflation gap. Whenever output exceeds its potential, this indicates inflationary pressures and

[7] Peersman and Smets (1999) report Clarida, Gali and Gertler (1998) to have shown how a version of TR with interest rate smoothing could explain short term interest rate in G3 countries and also how Gerlach and Schnabel (1999) got evidence that the description of the euro area average short term interest rates in the 1990s in line the TR recorded 0.5 coefficient on output gap and 1.5 coefficient for inflation.

the monetary authority should raise the policy rate in order to accommodate such pressure. Similarly, when inflation rates goes beyond its desire rate, the policymaker should increase the policy rate. TR was able to show that a simple reaction function in which the policy rate responded to movements in fundamental macroeconomic variables of inflation and output gap followed the observed path of the monetary authorities of the US in the late 1980s and up to early 1990s. In the model, Taylor assigned 0.5 to these macroeconomic variables (output gap and inflation). Therefore, TR as a reaction function reflects the reaction of the policy interest rate to shocks to inflation and output gap. The degree of co-movement of the TR implied rates between member countries of a monetary union is an indication of the degree of similarity of the aggregated shocks hitting these individual economies.

Since the announcement of the intention to form WAMZ 2000, the strategies of the monetary policies of the WAMZ's national economies were being propelled by the focus on achieving the stipulated 5% inflation convergence criterion as these countries were operating under the laid down primary and secondary convergence criteria which by implications are constraints on their paths towards being members of the WAMZ.

According to the benchmark TR, the monetary authority should set the short term interest rate in proportion to the output gap and the rate of inflation. The assumption of the baseline TR is that the CB sets the nominal short-term interest rate to be a function of the inflation and output gap. As a formula, TR was designed towards recommending how monetary authorities should set short term policy interest rates to achieve the short term objectives of stabilising the economy as well as the long run objective of moderating inflation. A general model of TR is:

$$i = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta(y_t - y_t^*) \quad 1$$

Where $r^*$ is the real' natural' interest rate;[8] $\pi_t$ is inflation rate; $\pi^*$is the target inflation rate; $y_t$ is output and $y_t^*$is the potential output. According to this rule in equation (1), the policy rate should rise if inflation rises above inflation target or if output (the real GDP) moves above the level of its target. In times of high inflation when employment is above the 'full employment' level, the policymaker should increase the policy rate; and reduce this policy rate when the situations are otherwise. This implies that the nominal policy rate$(i)$ will equal the sum of the long run equilibrium real interest rate ($r^*$) and target inflation ($\pi^*$). In Equation (1), if coefficients $\alpha$ and $\beta$ are large, aggressive responses to excess inflation and to economic booms should be put in place as monetary policy rule. A large $\alpha$ relative $\beta$ would specify that the CB would give more aggressive response to inflation than the level of economic activity. When $\beta = 0$, it indicates a situation of pure inflation targeting. Donrnbusch , Fischer and Startz (2011) point out that this rule is about monetary authority's manipulation of interest rate to stabilise output around potential and not simply about increasing output. If the nominal interest rate equals the real interest rate plus inflation, increase in nominal interest rate by more than the increase in inflation will, in line with the TR, increase real interest rate, thus 'cooling off the economy' as inflation increases.

The empirical evidence of policy reaction function estimation by Taylor (1993) suggests that empirical approximation of monetary policy is possible for setting interest rate through the simple rule which hypothesise that the policy rate$(i)$ should be above its long run level ($r^* + \pi^*$) when the actual inflation ($\pi_t$) is above the target inflation ($\pi^*$) and the economic output ($y_t$) is above its full employment level where output gap is positive. Thus, the specific model of TR (for the US) is:

$$i = 2 + \pi_t + 0.5\,X\,(\pi_t - \pi^*) + 0.5\,X(y_t - y_t^*) \qquad 2$$

[8] This corresponds with the interest rate when the economy is at equilibrium natural rate of unemployment or at the equivalent potential output ($y_t^*$)

In this original TR in equation (2), equal weight of 0.5 was apportioned to inflation and output gaps while, the inflation target ($\pi^*$) and the equilibrium real interest rate ($r^*$) were made to be 2% each. The rule is thus re-written as:

$$i = 2 + \pi_t + 0.5\,X\,(\pi_t - 2) + 0.5\,X(y_t - y_t^*) \quad 3$$

Thus, the parameterisation of the rule was:

$\pi^* = r^* = 2$

$\alpha = \beta = 0.5$

Equation (3) can therefore be re-written as:

$$i = 2 + 1.5\pi_t - 0.5\pi^* + 0.5\,X\,(y_t - y_t^*) \quad 4$$

This can transform to:

$$i = 1 + 1.5\pi_t + 0.5\,X(y_t - y_t^*) \quad 5$$

Equation (5) shows that in the original TR for the US, the constant was equal to 1 and that the estimated coefficient of inflation must be greater than 1. This shows that the TR recommends a 'leaning against the wind' policy in a way that the policy interest rate adjusts positively by a coefficient higher than one for inflation deviation and by a coefficient close for one to output (Taylor, 1999).

This paper adopts the WAMZ's inflation convergence criterion of 5% as the target inflation; and the mean real interest rate (for the six WAMZ countries,) of 7% over the period spanning 1990 to 2014 as the equilibrium real interest rate for six countries in the WAMZ-specific Taylor Rule. However, rather than simply choosing or fixing values of the coefficient of parameters of inflation and output gap (as done by Taylor), these coefficients of reaction functions of the WAMZ's CBs are econometrically estimated so as to capture the behaviour

and important elements of the monetary policy in these member countries of the proposed currency union. In this econometric estimation, the money market rate is the dependent variable while inflation deviation and output gaps are the independent variables. Table 2 shows the country-by-country estimated coefficients of inflation deviation from target and output gap respectively.

In describing the monetary policy of the WAMZ member countries, the country-by-country specific TR nominal interest rates are therefore expressed as:

$$\text{The Gambia: } iGM_t = 7 + \pi_t - 0.0\,X\,(\pi_t - \pi^*) + 34.5\,X(y_t - y_t^*) \quad (6)$$

$$\text{Ghana: } iGH_t = 7 + \pi_t + 0.3\,X\,(\pi_t - \pi^*) + 49.7\,X(y_t - y_t^*) \quad (7)$$

$$\text{Guinea: } iGU_t = 7 + \pi_t + 0.2\,X\,(\pi_t - \pi^*) + 119\,X(y_t - y_t^*) \quad (8)$$

$$\text{Liberia: } iLB_t = 7 + \pi_t - 0.1\,X\,(\pi_t - \pi^*) - 2\,X(y_t - y_t^*) \quad (9)$$

$$\text{Nigeria: } iNG_t = 7 + \pi_t + 0.0\,X\,(\pi_t - \pi^*) - 30.4\,X(y_t - y_t^*) \quad (10)$$

$$\text{Sierra Leone: } iSL_t = 7 + \pi_t + 0.4\,X\,(\pi_t - \pi^*) + 1.0\,X(y_t - y_t^*) \quad (11)$$

### 2.3 The McCallum Monetary Base Rule of Monetary Policy

McCallum (1987) stressed the principles necessary for the design of a monetary rule as: (i) the one that should be able to dictate the behaviour of a variable that can directly and accurately be controlled by the monetary authority. McCallum held the view that specifying the behaviour of some magnitude that is not itself controllable, such as the M1 measure of the money stock for instance, would be to leave task of rule design seriously incomplete; (ii) monetary rule should not rely essentially on the presumed absence of regulatory change and technical progress in the financial industry; (iii) the paths of both money stock and (nominal) interest rate are not important for their own sakes because they are only of relevance to the

extent that they are useful in facilitating good performance of output and inflation; (iv) a well-designed monetary rule. In qualitative terms, McCallum proposed a rule that reflects these four principles. At the starting point, there is the specification of a target path for nominal GDP characterised by even growth at a pre-specified rate that corresponds to the prevailing long term output growth average rate which is independent of monetary policy over an extended period. Therefore, keeping the growth in GDP at an appropriate value over a period should yield zero inflation (approximately) over such period. In addition, if the nominal GDP growth rate is prevented from fluctuating, swings of the real output from its trend paths would also be prevented. Though, on continuous basis, some fluctuations in output would still manifest, even when there is perfectly smooth growth path for nominal demand, probably, these would be as small as it can feasibly be obtained "due to lack of Phillips Curve model that could be relied upon". McCallum further advocated for the specification of operational mechanism that would keep the nominal growth rate close to the specified growth path by adopting a monetary base as monetary policy instrument, serving as a variable that can on regular basis be accurately set by the monetary authority operating within a political entity and economic environment of floating exchange rate system. This completes the rule which describes how big fluctuations of output are avoided by monetary authorities in applying base money as policy instrument. According to McCallum, the rule periodically adjusts the growth rate of base money. The base money would increase if nominal GDP is below its target path and vice versa. In its algebraic form, the McCallum monetary rule is stated as:

$$\Delta m_t = \Delta x^* - \Delta V_t^a + \lambda(\Delta x^* - \Delta x_{t-1}) \qquad 12$$

where is $\Delta m_t$ base money growth rate, $\Delta x^*$ is the nominal GDP growth rate target which is constant, estimated as the sum of long run average real GDP growth rate and inflation rate target, $\Delta V_t^a$ is the average base money velocity estimated by dividing base money by nominal

GDP, and $(\Delta x^* - \Delta x_{t-1})$ is the deviation of nominal growth rate. This base money growth rate rule is with the inflation targeting framework. Because $(\Delta x^* - \Delta x_{t-1})$ depicts pressure on inflation, an economy would display 'overheating' if the rate of GDP growth is higher than the rate of inflation target, prompting reduction in the base money growth. The McCallum rule is thus an automatic stabiliser. The growth rate of money base is the monetary policy instrument here.

The value of coefficient $(\lambda)$of has to be chosen and fixed in order to: (a) give adequate responsiveness of base money growth to departures of nominal GDP from its target path, and (b) to prevent the induction of dynamic instability that can cause 'too strong' feedback effects. Therefore, a carefully fixed coefficient $(\lambda)$ would give automatic adjustment to the money base and growth rates in a way that would on average, yield zero inflation in reaction to base 'velocity' alterations caused by regulatory or technical changes. For $\Delta V_t^a$ (average base velocity), McCallum used a four-year period, 4.5% for $\Delta x^*$ (the nominal GDP growth rate target) and assumed a value of 0.5 for $(\lambda)$, the coefficient of nominal growth rate deviations. In terms of aggregate demand, even with drastic changes in this form, increase in monetary base changes would make monetary policy to be expansionary, while on the other hand, there would be contractions when monetary policy changes decrease.

The McCallum monetary policy rule equation indicates that the growth of monetary base depends on three terms on the right hand side of Equation 12, that determine the monetary base growth. The first term is a constant which is the combination of the desire inflation plus the potential GDP growth. The second term, the monetary base velocity growth rate which assists in preventing the price level from drifts that may be caused by its response to money demand permanent shock. Under the assumption that monetary policy is neutral in the long run, if the growth rate of base money velocity is steady while the level of nominal GDP and

its targets are at par, inflation rate would be forced to its target by this monetary rule. The third term stabilises the properties of the McCallum rule. Whenever the nominal GDP deviates from target, monetary authorities are prompted to adjust the growth of monetary base.

There are some basic characteristics of the McCallum monetary policy rule. First is the preference of nominal GDP over monetary aggregates (like M1 and M2) as the principal target variable of the monetary authority, since the nominal GDP exhibits correlation with real GDP and inflation. Furthermore, within the nominal GDP targeting system, the nominal GDP shows some traits that makes it in principle, to be a good guide in monetary policy decision making as monetary policy adjusts to offset aggregate demand disturbances and as it helps the monetary authority to strike the balance between the inflation and output growth stability objectives when the response to aggregate supply disturbances are to recognised. The preference of the nominal GDP over real GDP in this rule is borne out of the view that the monetary authorities can neither accurately control nor predict how the nominal GDP growth divides between inflation and real growth. The second element of the McCallum rule is the introduction of a constant growth target for nominal income instead of variation in target rate over the cycle. This is likely to remove unwanted fluctuations caused by policy surprises emanating from the pursuit of an optimal monetary policy decisions by the central bank. A principal feature of the McCallum rule is the use of monetary base (rather than nominal interest rate) as a monetary policy instrument. The argument brought forward by McCallum in this respect is that tightening or easing of the policy stance are ambiguous when the nominal interest rate is applied as monetary policy stance indicator. Because the monetary authority can control the monetary base variable with very high degree of accuracy, this monetary base policy rule is consequently regarded as 'desirably operational'.

Rather than simply choosing or fixing values of 0.5 for ($\lambda$),the coefficient of nominal GDP deviation as McCallum did, this coefficient for individual WAMZ countries were estimated econometrically so as to capture the actual behaviour of the related macroeconomics of the member countries of this proposed currency union. The 5% inflation target in the WAMZ's convergence criteria was applied. In consideration of these and the respective country's constant (the GDP growth rate target) and the base money velocity in describing the monetary policy of the WAMZ member countries, the country-by-country specific monetary base growth rates are therefore expressed as:

The Gambia: $\Delta mGM_t = 8.3 - \Delta V_t^a + \lambda(8.3 - \Delta x_{t-1})$ 13

Ghana: $\Delta mGH_t = 11.6 - \Delta V_t^a + \lambda(11.6 - \Delta x_{t-1})$ 14

Guinea: $\Delta mGU_t = 8.2 - \Delta V_t^a + \lambda(8.2 - \Delta x_{t-1})$ 15

Liberia: $\Delta mLB_t = 11.2 - \Delta V_t^a + \lambda(11.2 - \Delta x_{t-1})$ 16

Nigeria: $\Delta mNG_t = 10.8 - \Delta V_t^a + \lambda(10.8 - \Delta x_{t-1})$ 17

Sierra Leone: $\Delta mSL_t = 8.8 - \Delta V_t^a + \lambda(8.8 - \Delta x_{t-1})$ 18

### 3.1 Data and Methods

This paper covers the six countries in the WAMZ; and to achieve the aim of the study, all necessary data were collected for these countries from the databases of the Economic Intelligence Unit (EIU), the West African Monetary Authority (WAMA) and the IMF's International Financial Statistics (IFS). Owing to data collection constraints, these annual data spanning over the 25-year period between 1990 and 2014 are for real GDP, nominal GDP, inflation (GDP deflator), real interest rates, base money (M1) and base money (M1) annual growth.

The actual real output data is taken as the real GDP (constant) seasonally adjusted in US dollars at 2006 price, expressed in logarithmic form. Potential output is determined by fitting a time trend to actual output. Inflation rate is taken as the year-on-year changes in inflation calculated with the GDP deflator. The inflation target of 5% (as prescribed for all the WAMZ countries as a primary convergence criterion) is adopted as inflation target for all and thereof, deviations of the actual inflation rates from this inflation target are calculated for each member country of the zone. The money market rates of individual central bank are employed as the policy nominal interest rate. For each country, real interest rate is estimated with lending rates adjusted for inflation which is measured by the GDP deflator. In the calculation of the output gaps which is the deviation of real output from the potential output as a percentage of potential output, the Hodrick-Prescot (with lambda ($\lambda$) =100 for annual data) filter method was applied to filter the potential output (trend) from the real output. The velocity of the base money variable was constructed by dividing the nominal GDP by base money (M1) while the constant, the nominal GDP growth rate target is an addition of the WAMZ convergence criteria inflation target of 5% and average real GDP of each country over the 25 years covered by the study.

Apart from treading the path of the US by adapting the description of monetary policy as rule that depends upon developments in both inflation and output gaps as established by the Taylor Rule (TR), the European Central Bank (ECB), the common central bank of the European Monetary Union (EMU) as well, based its monetary policy strategy on the two pillars on which the TR rests. Money is accorded a prominent role in one of the pillars in which inflation as a monetary phenomenon, takes cognisance of the annual growth rate of money supply aggregates. Price development and price stability risk are what the second pillar depicts; and output gap is a macroeconomic indicator variable considered in this respect.

Using the two monetary policy rule (the Taylor Rule and the McCallum Rule) to estimate the optimal counterfactual paths of interest rate and money supply growth of the WAMZ member countries' central bank and the WAMZ that correspond with the macroeconomic fundamentals of the aggregates of these countries and the monetary zone as a currency union, I apply the following five-stage procedure to estimate the stress levels of member countries of the proposed currency union as well as testing the adequacy of a single monetary policy for these countries:

At the first stage, the annual short term counterfactual nominal interest rates, according to the TR specifications in Equations (6-11) are calculated for each WAMZ country. For the monetary base rule, the counterfactual base money growth rates, according to the McCallum monetary rule specifications in Equations (13-18) are equally estimated to the WAMZ countries at this stage.

At the second stage, averages of the estimated TR counterfactual nominal rates are calculated for each WAMZ country as well as averages of the estimated counterfactual monetary base growth in order to identify the potential members of the proposed currency union. The conjecture here is that countries exhibiting similar interest rate and similar monetary base growth rates would have the prospect of forming a sustainable currency union on the long run.

Because the WAMZ is yet to take off as monetary union with a common central bank, area-wide counterfactual nominal interest rates and counterfactual monetary base growth rates are calculated for the entire monetary zone in stage three. This is based on weighted average of WAMZ member countries' TR-estimated nominal interest rates as well as the weighted averages of base money growth rates. The weighted average takes care of the view that when members of a monetary union lose monetary independence, the setting of interest rates and

the determination of money supply growth for the monetary union are meant to serve the interest of countries that have high levels of influence on others. In this respect, this paper applies the 2014 current GDP(in US dollars) for each WAMZ member country as the indicator of weight. The area-wide counterfactual interest rate and area-wide money supply growth rate for the WAMZ as a proposed monetary union are therefore estimated with the following derived equation:

$$iWAMZ_t = \Sigma(W_C . i_{ct}) \quad 19$$

and

$$mWAMZ_t = \Sigma(W_C . m_{ct}) \quad 20$$

where $iWAMZ$ and $mWAMZ$ are the area-wide counterfactual interest rate and area-wide money supply growth respectively, for the WAMZ, $W_C$ is the weight of each WAMZ country, which is the country's GDP share of the total of the GDP of the six countries in the monetary zone, and $i$ is the estimated TR nominal interest rate for each member country (calculated in stage one), and $m$ is the monetary base growth rate (calculated in stage one).

At the fourth stage, the annual stress level for individual WAMZ country is estimated as the difference in the respective country's annual TR counterfactual nominal interest rate and the monetary zone's area-wide counterfactual nominal interest rate thus:

$$S_t = i_t - iWAMZ_t \quad 21$$

where $S_t$ is the WAMZ country specific stress level at time $t$;$i_t$ is the country's TR rate at time $t$ and $iWAMZ_t$ is the area-wide TR rate for the WAMZ at time $t$. Further annual stress levels for each member countries of the WAMZ are calculated as the difference in the respective country's annual monetary based growth rate and the monetary zone's area-wide monetary growth rate both estimated based on the McCallum monetary rule thus:

$$S_t = m_t - mWAMZ_t \quad (22)$$

where $m_t$ is the country's TR rate at time $t$ and $mWAMZ_t$ is the area-wide base money growth rate for the WAMZ at time $t$.

The lower the stress level displayed by a country, the closer such country's independently set interest rate/monetary base growth rate and proposed currency union's interest rate/monetary base growth rate, indicating the adequacy of a single monetary policy for the achievement of national stability in such member country. This indicates easy monetary integration which would be sustainable. On the contrary, if the stress level for is high, it depicts a wide difference between monetary base growth rate/the interest rate set independently by a country showing such high level of stress and the proposed currency union's area-wide interest rate/monetary base growth rate, with further implication of inadequacy of single monetary policy for such country as well as possible difficulty in monetary integration of the monetary zone and given the unsustainable posture of the monetary union. The difference between each country's independently set TR interest rate/McCallum's rule monetary base growth and the area-wide interest rate/McCallum's rule monetary base growth may either be positive or negative in value. For the TR counterfactual nominal interest rates assessment, a positive stress value indicates that the country showing this had monetary policy that is tight when compared with that of the proposed currency union, while a country exhibiting a comparatively more expansionary monetary policy would show negative stress. On the other hand, for the MC counterfactual base money growth evaluation, a positive stress value implies a monetary policy that is comparatively more expansionary in relation to the proposed currency union's monetary policy, while a negative stress value is an indication of a comparatively tight monetary policy.

In order to make comparisons of monetary stress among the six WAMZ countries possible, stress indicators are constructed by estimating the root mean squared stress for each country under the two monetary rule respectively thus[9]:

$$iRMS = \sqrt{\frac{\sum_{t=1}^{T}(i_t - iWAMZ_t)^2}{T}} \quad 23$$

and

$$mRMS = \sqrt{\frac{\sum_{t=1}^{T}(i_t - mWAMZ)^2}{T}} \quad 24$$

where $iRMS$ and $mRMS$ are the stress indicator under the TR rule (depicting interest rate gaps) and McCallum rule (indicating base money growth gaps) respectively, and $T$ is the number of years.

### 4.1 Discussion of Findings

The country-by-country weight employed in this study as derived from the 2014 nominal GDP (in US dollars) is displayed in Table 1 below showing Nigeria as having the heaviest weight of 91.5% depicting crucial and landmark implications for the determination of the counterfactual and future monetary policy stance of the common central bank for proposed second currency union (the WAMZ) in the West African sub region. The Gambia has the lowest share of 0.001.

[9] As obtained in Moon and Poeck (2005)

**Table 1: WAMZ Countries' Weights (as derived from the 2014 Nominal (US dollars) GDP)**

| | *Gambia* | *Ghana* | *Guinea* | *Liberia* | *Nigeria* | *S/Leone* |
|---|---|---|---|---|---|---|
| ***Weight*** | 0.001 | 0.062 | 0.011 | 0.003 | 0.915 | 0.008 |

Source: EIU database and author's estimations

As stated earlier, with the loss of monetary independence by member states of a monetary union, the setting of policy interest rate and the determination of the money supply and money supply growth for the entire union would reflect the interests of countries demonstrating high degree of influences on other members; and in the case of the WAMZ, the weight displayed by Nigeria is heavy enough for the country to influence monetary policy decisions (including other decisions) within the proposed currency union. A diagrammatic representation of weights exhibited by each member country of the WAMZ is as shown in Figure 1 in the appendix.

For the results generated by this study to closely reflect the macroeconomic actual and developments within the monetary zone, the weight/coefficients of indicators in the equations applied in generating the Taylor rule (TR) interest rates (with and without interest rate smoothing) and the McCallum rule (MR) base money growth rates were econometrically generated through ordinary least square regressions of the related equations as displayed in Table 2 thus:

**Table 2: Econometric Derivation of Weights for Inflation Deviation and Output Gaps (TR) and Nominal Growth Deviation (McCallum)**

| ***Taylor Rule Rate (without interest rate smoothing)*** | | | | | | |
|---|---|---|---|---|---|---|
| | *Gambia* | *Ghana* | *Guinea* | *Liberia* | *Nigeria* | *S/Leone* |
| ***Inflation Deviation*** | -0.0 | 0.3 | 0.2 | -0.1 | 0.0 | 0.4 |
| ***Output Gap*** | 34.2 | 49.7 | 119 | -2 | -29.7 | 2.6 |
| ***Taylor Rule Rate (with interest rate smoothing)*** | | | | | | |
| ***Inflation Deviation*** | 0.0 | 0.3 | 0.2 | -0.0 | 0.0 | 0.3 |
| ***Output Gap*** | 32.6 | 60.9 | 134.5 | 0.5 | -22 | -8.6 |
| ***McCallum Rule Monetary Base Growth Rate*** | | | | | | |
| ***Growth Deviation*** | -0.1 | -0.9 | -1.6 | 0.2 | -0.2 | -0.4 |

Source: EIU and IMF databases and author's estimations and Eviews 7 Output

The highs and the lows of the averages and volatilities of the counterfactual TR interest rate and the MR monetary base growth rate for the WAMZ member countries and the area-wide rate for the WAMZ as a future monetary union are presented in Table 3.

**Table 3: Averages and Volatilities of the Counterfactual Monetary Rule Rates (1990-2014)**

| ***Taylor Rule Rate (without interest rate smoothing)*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** | ***WAMZ*** |
| ***TR Rate*** | 16.96 | 33.72 | 20.16 | 12.04 | 28.61 | 41.04 | 28.84 |
| ***Volatility*** | 26.39 | 13.52 | 11.86 | 7.02 | 28.17 | 43.50 | 26.27 |
| ***Taylor Rule Rate (with interest rate smoothing)*** | | | | | | | |
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** | ***WAMZ*** |
| ***TR Rate*** | 16.96 | 33.72 | 20.16 | 12.04 | 27.10 | 38.96 | 27.44 |
| ***Volatility*** | 26.38 | 13.53 | 11.83 | 7.47 | 25.57 | 40.34 | 23.88 |
| ***McCallum Rule Monetary Base Growth Rate*** | | | | | | | |
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** | ***WAMZ*** |
| ***TR Rate*** | -0.44 | 20.35 | 9.81 | 5.55 | 1.89 | 6.07 | 3.33 |
| ***Volatility*** | 5.44 | 7.45 | 17.66 | 4.44 | 5.48 | 12.13 | 5.18 |

Source: EIU and IMF databases and author's estimations

These averages and volatilities are over the 25-year period covered by this study. There are very close similarities in the results of averages and volatilities yielded under the TR interest rates estimations (with and without interest rate smoothing). Interestingly, Liberia shows the highest degree of stability (lowest volatility) in the three counterfactual monetary rule analyses. For the TR rates, The Gambia and Sierra Leone shows the highest level of volatility, while Guinea has the highest volatility in the MC base money growth estimates. Also on the average, Liberia has the lowest counterfactual TR interest rate of 12.04 while the lowest counterfactual growth rate of money base was recorded by the Gambia. However, further analyses of the deviations of country-by-country averages of the counterfactual interest rates and base money growth from the counterfactual area-wide rates are necessary in determining the case of monetary integration and the adequacy of single monetary rule for the member countries. For this purposes, the calculated deviations for each member country are estimated as exhibited in Table 4:

**Table 4: Deviations of Members' Averages and Volatilities of Counterfactual Monetary Rule Rates from Area-wide Counterfactual Monetary Rule Rates Averages and Volatilities (1990-2014)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ***Taylor Rule Rate (without interest rate smoothing)*** | | | | | | | |
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** | ***Threshold*** |
| ***TR Rate*** | -11.88 | 4.88 | -8.68 | -16.8 | -0.23 | 12.20 | ±8.5 |
| ***Volatility*** | 0.12 | -12.75 | -14.41 | -19.25 | 1.9 | 17.23 | ±11 |
| ***Taylor Rule Rate (with interest rate smoothing)*** | | | | | | | |
| ***TR Rate*** | -10.48 | 6.28 | -7.28 | -15.4 | -0.34 | 11.52 | ±9 |
| ***Volatility*** | 2.50 | -10.35 | -12.05 | -16.41 | 1.69 | 16.46 | ±9.9 |
| ***McCallum Rule Monetary Base Growth Rate*** | | | | | | | |
| ***TR Rate*** | -3.77 | 17.02 | 6.48 | 2.22 | -1.44 | 2.74 | ±5.6 |
| ***Volatility*** | 0.26 | 2.27 | 12.48 | -0.74 | 0.3 | 6.95 | ±3.83 |

Source: Author's estimations

The simple rule is that the bigger the margin reflected by these deviations in these rates, the more difficult it would be for the affected country to be part of a sustainable currency union as well as the more inadequate a single monetary policy would be for individual countries affected. Further to this, threshold levels (determined by the average of the absolute values of deviations) are established as shown in the last column in Table 4, and applied as appropriate. Employing these threshold levels in consideration of the estimated counterfactual TR nominal interest rate, Ghana, Guinea and Nigeria have the prospects of coming together to form a sustainable currency union on the long run. However, with the alternative MR base money growth estimations, The Gambia, Liberia, Nigeria and Sierra Leone would be able to form a sustainable monetary integration and operates conveniently within a common monetary policy that would adequately ensure the achievement of stability at national levels. Nevertheless, when the stability (volatility) of nominal interest rate as policy instruments is considered, The Gambia and Nigeria are the best candidates in the TR interest rate estimations while The Gambia, Ghana, Liberia and Nigeria are likely candidates of sustainable monetary integration as exhibited by the results of the McCallum monetary base growth rate estimation.

Information in Table 5 shows the results of the assessment of the extent to which each member country of the WAMZ adopted contractionary/expansionary monetary policies in relation to the area-wide counterfactual monetary policy over the period covered by this

study. The results were determined with the estimation of annual stress levels for each country in which information are provided on annual basis of monetary policy stance in these countries. The lower these annual values, the more adequate a common monetary policy would guarantee the achievement of national stabilisation goals of the affected countries.

**Table 5**

**Stances of Counterfactual Monetary Policies (in Percentages) (1990-2014)**

| ***Taylor Rule Rate (without interest rate smoothing)*** | | | | | | |
|---|---|---|---|---|---|---|
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** |
| ***Loose (%)*** | 76 | 32 | 40 | 76 | 56 | 32 |
| ***Tight (%)*** | 24 | 68 | 60 | 24 | 44 | 68 |
| ***Taylor Rule Rate (with interest rate smoothing)*** | | | | | | |
| ***Loose (%)*** | 76 | 32 | 44 | 72 | 72 | 32 |
| ***Tight (%)*** | 24 | 68 | 56 | 28 | 28 | 68 |
| ***McCallum Rule Monetary Base Growth Rate*** | | | | | | |
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** |
| ***Loose (%)*** | 56 | 100 | 54 | 83 | 64 | 76 |
| ***Tight (%)*** | 44 | 0 | 46 | 17 | 36 | 24 |

Source: Author's estimations

The Gambia, Liberia and Nigeria show high degree (over 50%) of expansionary (loose) monetary policies over the 25-year period for the TR interest rates. The MR base money growth shows all the WAMZ countries displaying loose monetary policies (over 50%) for the years covered by the study. Ghana exhibits the strongest of 100% in this regard.

The correlation analyses in Table 6 shows that the counterfactual TR nominal interest rates for Ghana, Nigeria and Sierra Leone are positively associated with the WAMZ's area-wide counterfactual nominal rate as Nigeria demonstrate the very positive correlation of 99%, followed by Ghana and Sierra Leone respectively.

**Table 6: Correlation of the Counterfactual Interest Rates and Monetary Growth WAMZ's Member with the Common Counterfactual Interest Rates and Money Growth Rates**

| ***Taylor Rule Rate (without interest rate smoothing)*** | | | | | | |
|---|---|---|---|---|---|---|
| | ***Gambia*** | ***Ghana*** | ***Guinea*** | ***Liberia*** | ***Nigeria*** | ***S/Leone*** |
| ***TR Rate*** | -0.02 | 0.54 | -0.04 | -0.14 | 0.99 | 0.20 |
| ***Taylor Rule Rate (with interest rate smoothing)*** | | | | | | |
| ***TR(S) Rate*** | -0.02 | 0.54 | -0.04 | -0.19 | 0.99 | 0.21 |
| ***McCallum Rule Monetary Base Growth Rate*** | | | | | | |
| ***McCal. Rate*** | -0.18 | 0.69 | -0.13 | 0.21 | 0.99 | 0.17 |

Source: Author's estimations and Eviews

For the MR counterfactual base money growth, The Gambia and Guinea maintain their negative association with the counterfactual area-wide base money growth while other WAMZ countries exhibit positive relationship as Nigeria again, shows the highest of 99%. What these suggest is that it is strongly likely that the single monetary policy for the WAMZ as a monetary union would be greatly influenced by Nigeria.[10] Figures 2-4 (in the appendix ) display annual stress levels in the WAMZ countries under the three counterfactual monetary policy instruments applied in this study.

Monetary Stress among the WAMZ countries assessed are better revealed by the results of the stress indicators computed by applying Equations 23 and 24 respectively for the TR rates and the MR base money growth rate as exhibited in Table 7:

**Table 7: Results of Estimated Monetary Policy Stress Indicators**

| ***1. Stress Indicators (Lowest to Highest): Taylor Nominal Interest Rate Rule*** | |
|---|---|
| ***WAMZ Country*** | ***Stress Indicator*** |
| *Nigeria* | 2.11 |
| *Ghana* | 22.23 |
| *Guinea* | 29.98 |
| *Liberia* | 32.29 |
| *The Gambia* | 38.71 |
| *Sierra Leone* | 46.78 |
| ***2. Stress Indicators (Lowest to Highest): Taylor Nominal Interest Rate Rule with Interest Smoothing*** | |
| *Nigeria* | 1.94 |
| *Ghana* | 20.69 |
| *Guinea* | 23.98 |
| *Liberia* | 30.03 |
| *The Gambia* | 36.69 |
| *Sierra Leone* | 43.16 |
| ***3. Stress Indicators (Lowest to Highest): McCallum Base Money Rule*** | |
| *Nigeria* | 1.31 |
| *Liberia* | 6.11 |
| *Sierra Leone* | 6.75 |
| *The Gambia* | 8.54 |
| *Ghana* | 18.32 |
| *Guinea* | 18.82 |

Source: Author's estimations

[10] As at 2014, Nigeria has over 91% of the total GDP of the entire WAMZ as a monetary zone.

The lower the stress indicator, the easier is the integration into the monetary union as a well the adequacy of the common monetary policy for national stability. In Table 7, Nigeria is on top of the ladder as the country that would find it most convenient to be part of the monetary integration of the WAMZ as well as finding the common currency more adequate in meeting her monetary policy objectives of stability. Nigeria is followed by Ghana and Guinea respectively in the results yielded by the TR nominal interest rate assessment, while Sierra Leone is at the base of the ranking. The evaluation of the McCallum (which also exhibits Nigeria at the top) reveals The Gambia, Ghana and Guinea as countries that may not find the single monetary policy adequate for the achievement of their respective national monetary policy goals. Graphical representations of the country-by-country stress indicators are presented in Figures 5-7 in the appendix.

### 5.1 Summary and Conclusions

This paper assesses an aspect of the feasibility of the second monetary union within the West African sub region, the West African Monetary Zone (WAMZ) by examining the perspective of the ease of monetary integration of the proposed currency zone as well as the adequacy of single monetary policy for national stability of the six member countries that would lose their respective monetary independence on the commencement of the monetary union and the institution of a common central bank which would make single monetary policy for the proposed monetary union. Two monetary policy rules (the McCallum monetary base growth rule and the Taylor nominal interest rate rule) are employed in this assessment towards estimating the levels and indicators of monetary policy stress tests of the WAMZ member countries. The research question answered by this paper centers around the extent to which future common interest rate and common monetary growth within the WAMZ as a monetary union would meet the desires of the member nations and achieve national stabilisation purposes in these countries.The study covers a period of 25 years between 1990 and 2014 and

relevant annual secondary data necessary for the analysis were collected from various reliable sources and analysed in line with the requirements and dictates of the models and equations employed. For my results to reflect some elements of the actual behaviour of the related macroeconomics of the member countries assessed, weights and coefficients necesary for estimations of these equations were generated through the model-dictated OLS econometric regressions.

From the analyses, there are evidence to suggest that Nigeria has an enormous influence over the other five members of the proposed currency union, given the size of her economy, and given this the country is strongly likely to be the crucial major determinant of the single monetray policy stance within the future currency union. National counterfactual TR nominal interest rates (with and without interest smoothing) and McCallum Rule base money growth as well as the area-wide rate for the WAMZ were estimated. Member countries deviations from these rate were also calculated and the determining thresholds estimate. The results generated from the two Taylor rates are close related.

However, these two monetary policy rules principally generated varied results. The estimated counterfactual TR nominal interest rates suggests that Ghana, Guinea and Nigeria have the prospects of coming together to form a sustainable currency union on the long run. While the inferences from the alternative MR base money growth estimations, is that The Gambia, Liberia, Nigeria and Sierra Leone would be able to form a sustainable monetary integration and operates conveniently within a common monetary policy that would adequately ensure the achievement of national stability. The evaluation of the stability of the counterfactual nominal interest rate as policy instruments reveals The Gambia and Nigeria as the best candidates while The Gambia, Ghana, Liberia and Nigeria are likely candidates of sustainable monetary integration as exhibited by the results of the monetary base growth rate estimation. The most crucial evidences given by the two monetary policy rule stress test results are about

the suggestions of  the order in which the six WAMZ countries would be at ease in joining the proposed monetary union. For the Taylor rule counterfactual nominal interest rate, Nigeria is at the fore front, followed (in the order) by Ghana, Guinea, Liberia, The Gambia and Sierra Leone. The evidences from McCallum rule counterfactual base money growth monetary stress estimations also shows Nigeria at top of the ladder, followed (in the order) by Liberia, Sierra Leone, The Gambia, Ghana and Guinea. One common finding from this monetary policy rules stress tests suggests that Nigeria is solely guarenteed to find the monetary integration easy as well the single monetary policy adequate for her national stability.

Some schools of thought opine the Taylor nominal interest rate rule is superior to the MCCallum base money growth rule (which they believe is an alternative to the Taylor rule). From the point at which this research ends, the decisive question to answer by future research should pertain to the more superior and all embracing of the two monetary policy models employed by this study

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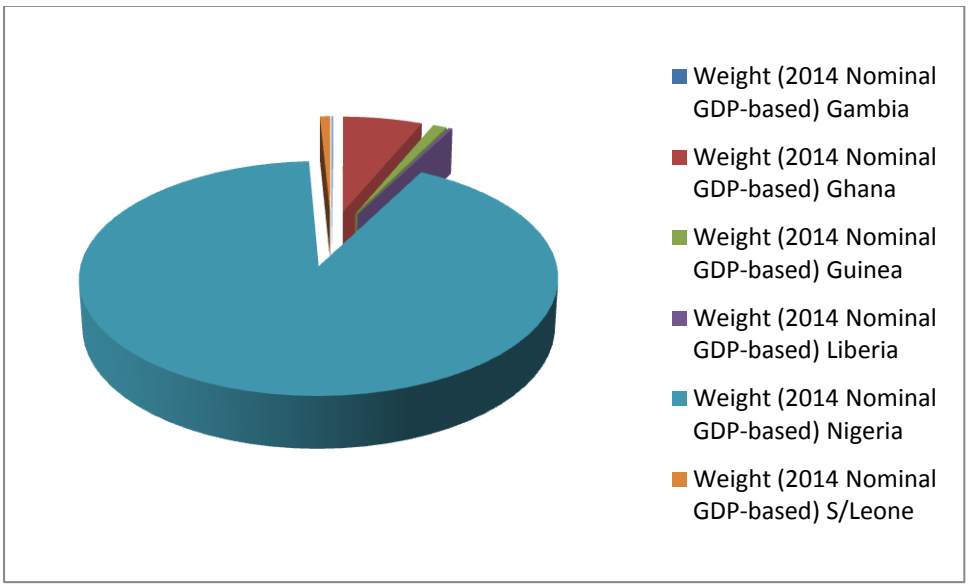
**APPENDIX 1**

**Figure1: Weight (2014 Nominal GDP-estimated)**




Source: EIU database, author's estimations and Excel Output

**Figure 2**

**Figure 2: Annual Stress Levels of the WAMZ Countries (Taylor Rule without interest rate smoothing)**

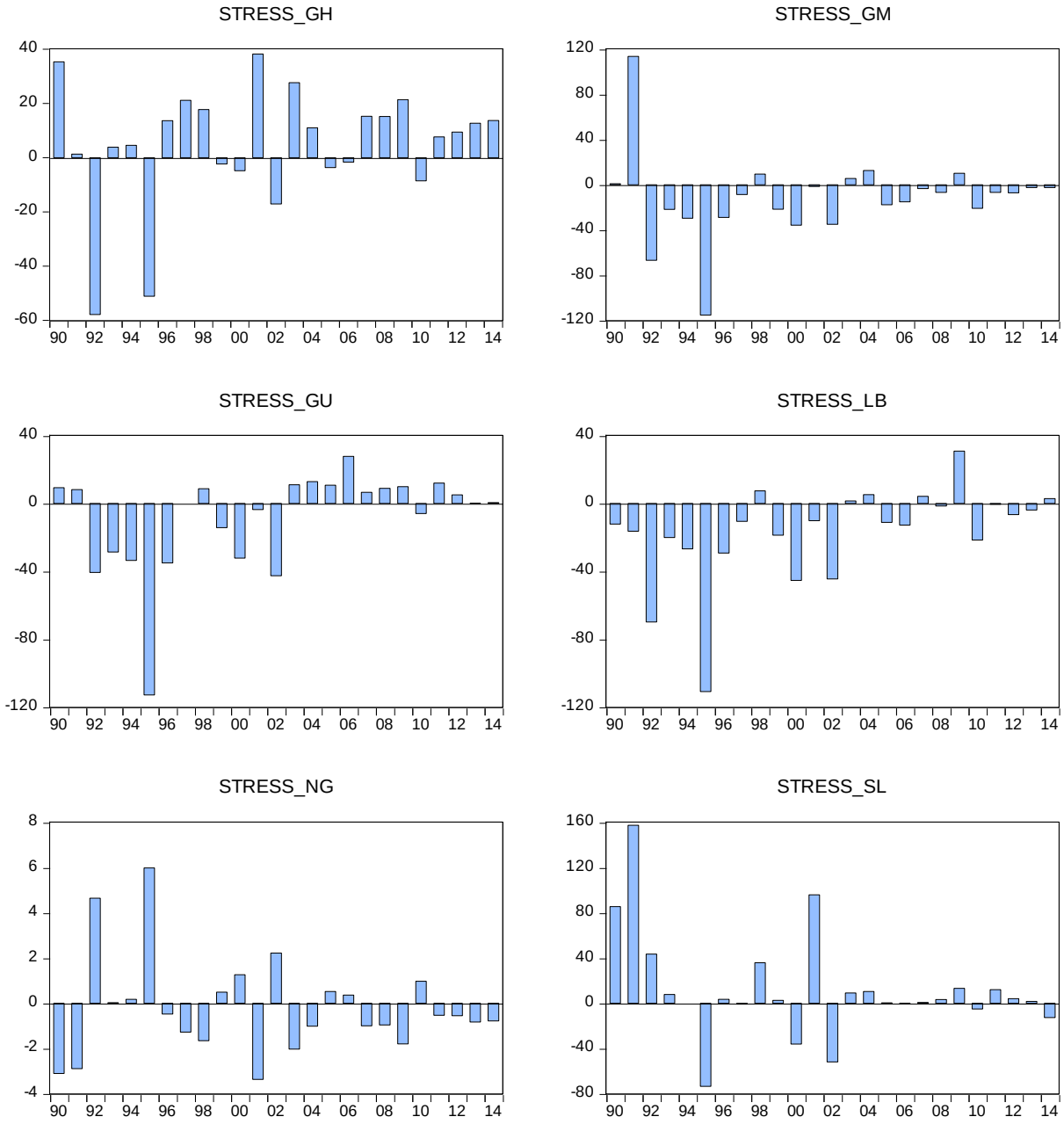


**Figure 3: Annual Stress Levels of the WAMZ Countries (Taylor Rule with interest rate smoothing)**

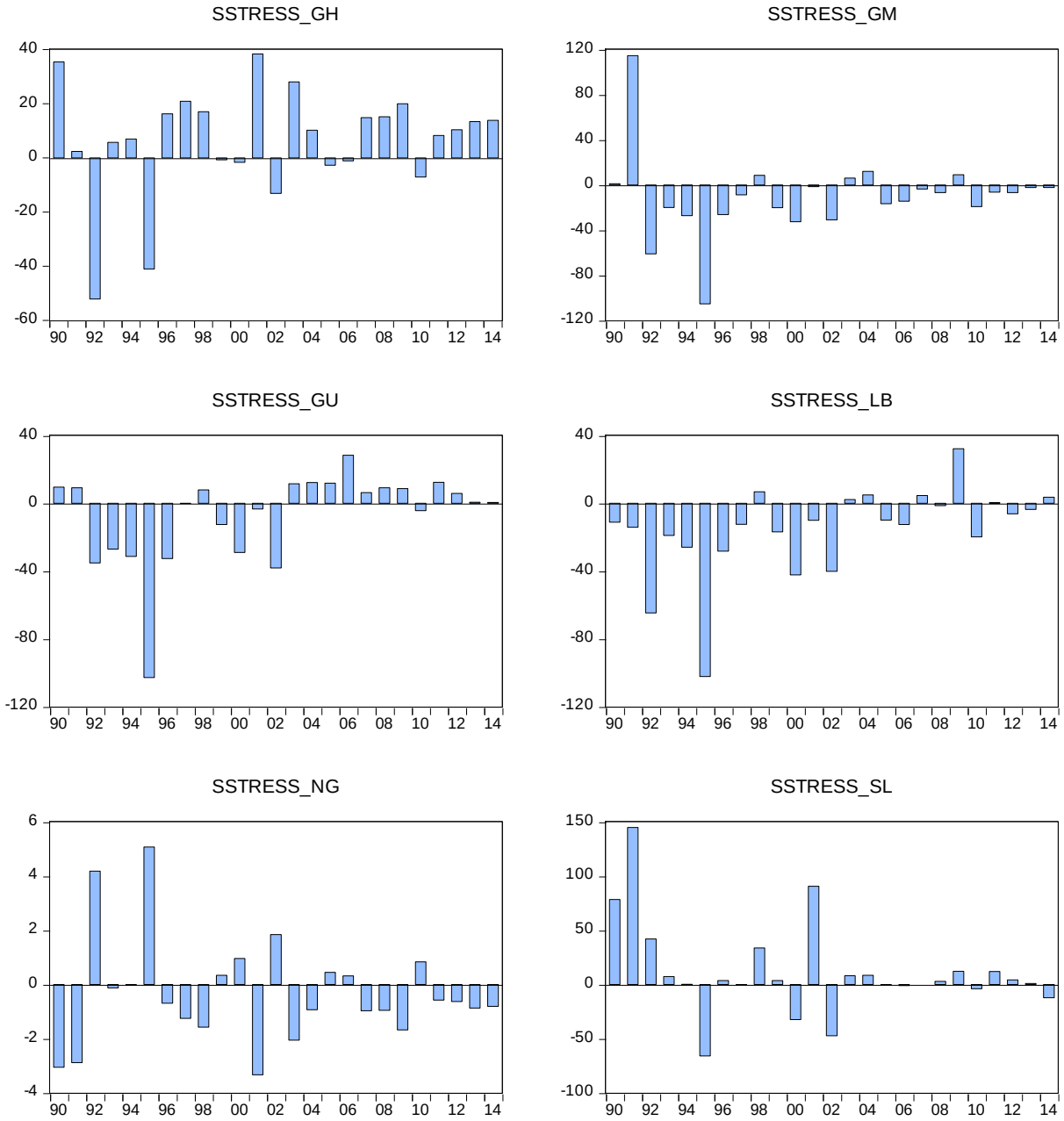


**Figure 4: Annual Stress Levels of the WAMZ Countries (McCallum Rule)**

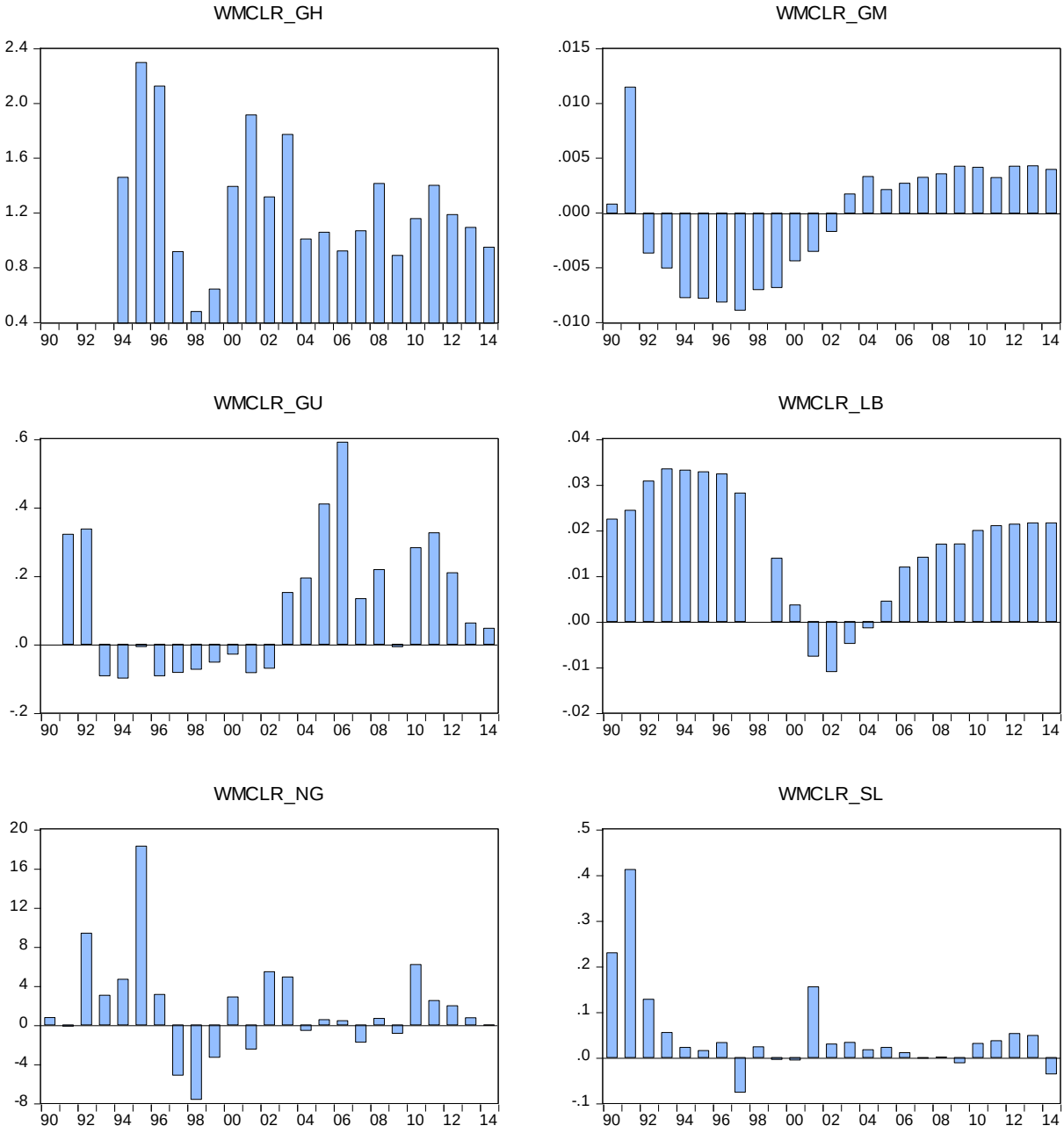


**Figure 5: Taylor Rule Based Monetary Policy Stress Indicators**

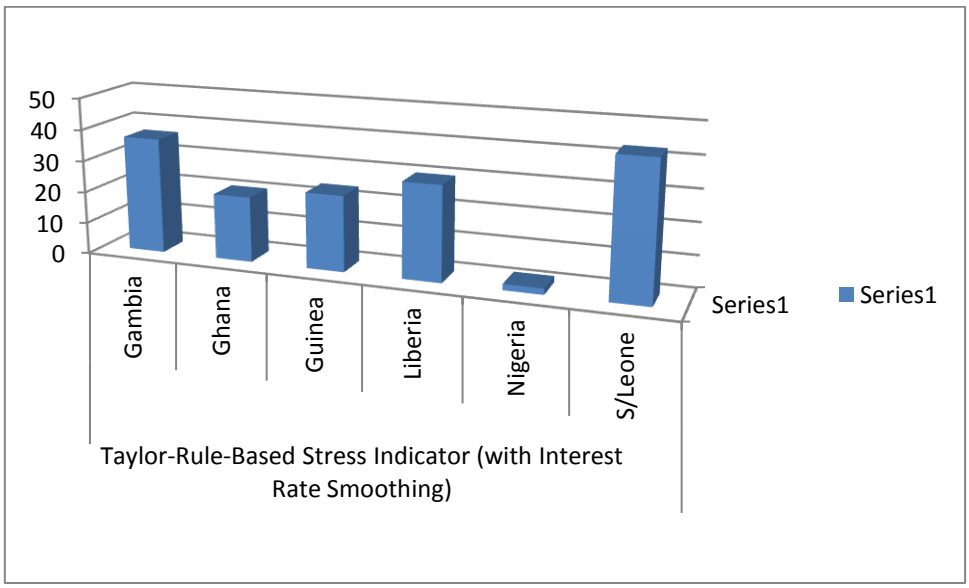



**Figure 6: Taylor Rule Based (with interest rate smoothing) Monetary Policy Stress Indicators**

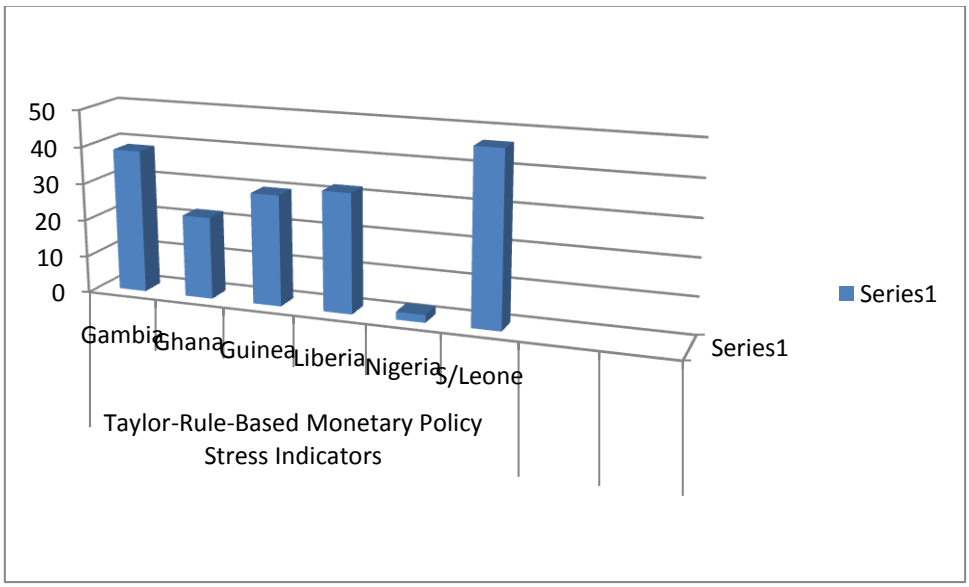


**Figure 7: McCallum Rule Based Monetary Policy Stress Indicators**