

Analysis of Wamz's Economic Growth and Monetary Policy Using the Markov Switching Approach

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DOI: <https://doi.org/10.47772/IJRISS.2023.7411>

Received: 23 February 2023; Accepted: 21 March 2023; Published: 26 April 2023

ABSTRACT

This study investigates the impact of monetary policy shocks in two regimes of the business cycles (contractionary and expansion regimes) in 4 countries in the West African monetary zone (WAMZ). It employs the Markov switching model, using quarterly data for the period 1980Q1 to 2020Q4. Our findings show that the countries have common business cycles. In addition, the study offered enough evidence that the significant effects of the monetary instruments are significantly more potent in contractionary than expansionary regimes. Furthermore, on the aggregate, the zone appears to have an average business cycle ranging from 9.8 to 32.3 quarters, varying from country to country and comparatively shorter than the industrial countries. Hence, the designing of policies by the monetary authorities in this region should be tailored to shorten the duration of the contractionary period and must be meticulously formulated to avert the negative consequences of strict contractionary policy and ditto to expansionary policy.

Key Words: Monetary Policy, Business cycle, Economic growth, Markov Switching, WAMZ. JEL: C22; E32; E52.

INTRODUCTION

Over the years, business cycles have generally centered on the drive between expansion and recession phases (Burns and Mitchel, 1946). Specifically, since the Great Depression recognition has been of the asymmetric impact of the monetary policy on various macroeconomic variables. The recent global financial crisis has challenged economists on their ability to explicate monetary policy shocks and business cycle mechanisms and to proffer policy measures to the economic crises. Within the major research paradigms, considerable empirical efforts have been made both on the country-specific and regional cycles. However, little or no exploration has been made to unveil the relationship between monetary policy, business cycle fluctuations and economic growth in the member countries of the West African monetary zone.

Meanwhile, monetary policy has been ascribed to play significant roles in the business cycle fluctuations of an economy (Canova and De Nicolò, 2002) and economic growth (Famoroti and Adeleke, 2022).. However, this attribute generates further arguments that 'At what period of the business cycle are the monetary policy shocks are significantly more effective?' There are no consensus solutions to the questions. The findings of Allen and Robinson, (2015); Lo and Pigger, (2003); Dolado et al., (2005), among others, revealed that monetary policy shocks are more effective at recession regimes than at expansion regimes. Contrary to the opinions of Bodman, (2006); Berger and Vavra, (2015); Tenreyro and Twaites, (2016); Huber and Fisher, (2018) that monetary policy shocks are significantly more effective during an expansion regime than at recession. From another perspective, some existing literature was more exclusive concerning the business cycle and output growth effect in developed economies, with their contributions that the duration period of the business cycles is comparative to the developing economies (Bulir and Hannann, 2001 Agenor et al., 2000). These submissions, therefore, demand further empirical investigation particularly, in the context of

developing economies like The Gambia, Ghana, Nigeria and Serra Leone that constitute the West African monetary zone.

This is the typical study and a novelty in the economic literature of the zone to estimate and compare the impact of changes in monetary policy in the expansion (boom) versus contraction (Recession) regimes on output growth. This study, therefore, offers an investigation into the probability of stirring from one regime to the other) together with the estimation of the average duration of each regime in recent times.

Sequel to this introduction, Section 2 briefly epitomized the objectives of the study. Section 3 discusses the real business cycle. The literature review is contained in section 4. Also, the provides an outline of the methodology adopted for the estimation of the business cycles including the probability of the movements and duration. Section 5 documents our estimates and the implications. and Section 6 concludes.

OBJECTIVES OF THE STUDY

Given the preceding background, this study explores the efficacy of the monetary policy on growth under two regimes of the business cycle in WAMZ. Precisely, ascertaining whether the member countries of ECOWAS have similar business cycles, investigating the asymmetric effects of the monetary policy on economic growth across the business cycle in the countries within the region, and estimating the durability of each regime with the period covered by this study.

THE REAL BUSINESS CYCLE

There is considerable theoretical progress in the course of proffering solutions to the questions arising from the ability of economists to offer solutions to lingering economic crises. This includes among others the New Classical, which based their analysis of the business cycles on market clearing and the New Keynesians, which characterize variations of the business (see Dobrescu et al., 2012). Among the class of the new classical macroeconomic models, is the Real business-cycle (RBC) theory, which emphasizes that business-cycle fluctuations are accounted for by real (in contrast to nominal) shocks.

Earlier, monetary business cycle models developed by Austrian economist Mises, (1949) described the business cycle as a process that arises from the low-interest rates in credit expansion, leading to booming periods of businesses. This is possible because of the low cost of capital for investment into more profitable ventures. The economy expands with rising prices, leading to inadequate funds for the sustainability of their creative projects. Thus, unmanageable investments are invariably adjusted during the recession as credit tightening ensues. In furtherance to the construction of the monetary business cycle, Lucas, Jr (1972) (New Classical economists) explicated the shifting in the monetary policy and its impact on unemployment, production and inflation. The theory was based on the assumption of individuals possess more information on goods produced than those purchased. Lucas introduced money into the framework of the theory earlier developed by Paul Samuelson, (1958); the old pay for the goods consumed, while the young sell their goods with the intention of buying them when they grow old. This is a market-clearing process that is characterized by the neutrality of money. The injection of money into the economy leads to a rise in prices, which may arise due to monetary perturbation for the optimum aim of sustaining current output levels or due to a reduction in the number of producers for the optimum of increasing the output level.

In summary, the established cyclical progression of the macroeconomic variables conforms to the framework of the general equilibrium via the business cycle. Conversely, the Austrian model is on the postulation that the business cycle is in the form of an organized intertemporal disequilibrium. (see Dobrescu et.al., 2012).

The RBC is based on the philosophy that money plays a minor role in the business cycle and the agents in the business cycle are rational, responding mainly to real shocks, particularly technology. The model further assumes the existence of a perfect market. According to Mankiw, (2006), anticipated monetary policy does not have an impact on real variables like GDP, contrary to unexpected monetary policy, which affects the real variables. The theory assumes market clearing and flexible prices and wages in the long run of the RBC forms the bases of the model, which is objected to by the new Keynesians and the relevance of the theory is also debatable (Gottschalk, 2005). The new Keynesian models assume that prices and wages are temporarily rigid. In the model, the quantities adapt to external shocks in response to changes in monetary policy. Prices are set by monopolistic firms in the goods market, while households set the wages in the labour market. The model supports the neutrality of money in the long run but has an effect on output in the short run. However, this theory has been criticized on the ground of the absence of the role of money (Arestis and Sawyer, 2008).

LITERATURE REVIEW

From the theoretical point of view, the first class of theories is based on an imperfect credit market, where the asymmetric information that transpires between the lender and the borrower leads to agency costs at an increasing rate. The agency cost is a function of the borrower's net worth. That is the higher the net worth of a borrower the more the collateral assets. Bernanke and Gertler, (1989) further expatiated that the reliance on an external premium on the net worth of a borrower generates a financial mechanism known as 'financial accelerator'. Take for instance, when an economy is in boom period, the net worth of firms will naturally rise. This will eventually result to decrease in the external cost of financing such an economy. In return, it may reduce the effects of the initial shock. Order-wise, this propagation mechanism on monetary policy shock, is likely to be stronger during recession than during expansion regimes. At expansion regime, financial institutions can sufficiently finance themselves with retained earnings. Hence external financial premium is relatively low because of their strong balance sheets. Therefore, the effect of the monetary policy is limited on the premium. On the other hand, at recession regime, the firms/ financial institutions rely much on external finance, during which the external finance premium will be more susceptible to interest rate fluctuations. Hence, monetary policy may not be much effective on economic activity.

Another strand of the theory hypothesized that, with convex monetary aggregate supply, the monetary policy will have a tougher impact on the economy during recession. Complexity implies that the gradient of the supply curve steepens more at greater level of capacity utilization and low inflation. Subsequently, the monetary policy drive produces a stronger effect on output and weak effects on inflation during recession and vice versa at expansion (Peersman and Smets, 2001).

The study of Ka-Fu, (2000), was an attempt at examining the variability in the effects of monetary policy in U.S., using VAR. The study covers the period between 1959(1)- 1994(12) and the variables used are the Industrial production index, CPI, Non-borrowed reserves, Fed funds, and total Reserves. The result suggested that negative monetary policy shock is stronger. Also, there is short-run price stickiness and the existence of long-run neutrality. Lo and Piger, (2003); Dolado and Maria-Dolories, (2005) studied the monetary policy in the Euro area, using a cross-sectional Global Markov switching model. They submitted in their findings that Monetary policy actions have larger effects during the recession than expansion and there are larger effects of interest rates during the recession than expansion. More recently, Kutu and Ngalawa, (2017), carried out an investigation on the monetary policy and industrial output in BRICS countries, using a Markov Switching model. Their findings depict that Monetary policy has a significantly greater effect during recession than expansion. And that there is higher probability for the economies to move from a recession state to an expansion state than the reversal.

Contrary to the above views, other views in the economic literature observed in their empirical findings that

monetary policy instruments are more effective at expansion (Loose) regime rather than contractionary (Tight) regime. Bodman, (2006) studied the effect of monetary policy in Australia between the period 1972(1) and 2005(1). The author explores Cover, (1992) methodology and finds that unanticipated decrease in the interest rate leads to increase in GDP. While its increase does not significantly affect GDP. Similarly, Berger and Vavra, (2015) investigated US economy and find that monetary policy is more powerful at expansion shocks, since during boom durable expenses are more sensitive to policy shocks. This is further supported by Huber and Fischer, (2018), who employed Markov Switching factor augmented VAR (FAVAR) for US business cycle and monetary policy, with monthly data set spanning between 1959(1) to 2014(7). The authors also affirmed that the impact of monetary policy tools is more pronounced at expansion than in recession. Similarly, Tenregro and Thwaites, (2016) adopted Smooth Transition Local Projection Model (STLPM) for U.S. monetary data for 1969- 2007. Their result suggested that monetary policy is less powerful in recession, especially, on durable expenditure and business investment.

How long does a regime last in a business cycle? In the recent empirical evidence show that the duration of a regime varies from region to region and from country to country. Rand and Tarp, (2002) investigated the business cycle in 15 developing countries using Bry Broschan procedure and document that countries in Latin America have a longer expansion period than at contraction, but the contrary is the case in Asian countries and North America countries. In the case of Sub-Saharan African countries, the authors could not ascertain the average period but appears to have a more durable period than the other two regions. Generally, the average duration of a business cycle range between 7.7 and 12.0 quarters, which is lesser than the industrial countries of between 24 and 32 quarters. Calderon and Fluentes, (2010) found that the average contraction period in a sample of 12 LAC is 3.5 quarters, similar to 8 East Asian Countries of 4.5 quarters and 12 OECD economies of 3.6 quarters. And their average expansion duration differs substantially. That is 16 quarters, 24 quarters, and 11 quarters, respectively. This is however different from the findings of Male, (2009), whose findings revealed that in developing countries, business cycles are not shorter than the developed nations and that output volatility, on average, doubles that of developed countries. Altug and Bildirici, (2010) employed a univariate Markov switching model to model the business cycle of 22 countries in both developed and developing countries. The cross-section permits the comparative analysis of the cyclical fluctuations between developed and developing economies. Their report documents the relevance of heterogeneity in the experience of individual countries. It is suggesting the appearance of an important global factor that induced the cyclical fluctuations in both developing and developed countries.

From the above economic literature, the consensus is that monetary policy shocks impact economic fluctuations, but the nature and the magnitude of the effect are still questionable. Also, the employment of a univariate model (e.g. Altug and Bildirici, 2010) which may not be sufficient for drawing general inferences. Therefore, this study attempts to bridge these gaps, by adopting a multivariate approach in its switching modeling. Specifically, the study investigates the policy shock effects at contractionary and expansionary phases of the business cycle, in the selected 4 countries in WAMZ of West Africa.

METHODOLOGY

Several economic literature used linear models such as moving average (MA), autoregressive (AR), and mixed autoregressive moving average (ARMA) models, which are not without their drawbacks. For instance, their weaknesses include, among others, the inability to measure asymmetry, volatility clustering, and amplitude dependence (Arora, 2011). Thus, for the past 2 decades, there is an increased knowledge of applying non-linear, parametric time series modelling for the economic analysis of the business cycle, including Smooth Transition Autoregressive models, and Threshold Autoregressive models. Most of these models are not without their limitations as some were limited to time series data, while some were based on linear models.

Thus, this study intends to bridge this gap and for better economic analysis, the study employs Markov

switching VAR model to estimate the trend cycles of a parametric non-linear model for the West African region, where there are limited studies. The use of parametric model like Markov switching VAR approach brings about the identification of different regimes and these regimes differ in relation to their average growth rates and /or their volatilities. Specially, we identified two regimes in these countries and investigated whether the selected economies operate under any similar business cycle(s) and ascertain the probability of stirring from one regime in the business cycle to another.

The model has been used by various authors for similar empirical analysis, including Peersman and Smets, (2005); Cologni and Manera, (2006); and Lange, (2018); among others. Meanwhile, the model employed in this study is similar to Kutu and Ngalawa, (2017) butwe extended the model to include two other independent macroeconomic variables, which are inflation rate and the exchange rate. This is due to their impact on the real GDP which is our dependent variable. Also, the inclusion of AR(1) to AR(4) in our model gives a more reliable economic estimates.

Model Specification

Following the framework of Markov Switching Model (MSM) of Peersman and Smets, (2001), on the effects of Monetary policy in seven countries in the Euro area, where the deviations of the output growth from its mean follow the order of the autoregressive process, as may be stated below:

Consider a regime model:

$$y_t = g(x_t, y_{t-1}, y_{t-p}, s_t, s_{t-1} \dots s_{t-p}) + \sigma_{st} \varepsilon_t \text{-----(1)}$$

$$\varepsilon_t \sim \text{iid } N(0,1).$$

Where $g(\cdot)$ is a conditional mean function, $y_t = \text{Scalar}$

$x_t = \text{KX1}$ vector of observed (exogenous variable)

$s_t \in (0,1, \dots N-1)$ an integer valued state variable

For a regime switching auto regression

$$y_t = \mu_{st} + \phi_1 (y_{t-1} - \mu_{st-1}) + \phi_2 (y_{t-2} - \mu_{st-2}) + \dots + \phi_p (y_{t-p} - \mu_{st-p}) + \sigma_{st} \varepsilon_t \text{---(2)}$$

$$y_t - \mu_{st} = \phi_1 (y_{t-1} - \mu_{st-1}) + \phi_2 (y_{t-2} - \mu_{st-2}) + \dots + \phi_p (y_{t-p} - \mu_{st-p}) + \sigma_{st} \varepsilon_t \text{---(3)}$$

The regime switching can be reduced to:

$$y_t = x_t' \beta_{st} + \sigma_{st} \varepsilon_t \text{-----(4)}$$

Like Bazzi et al., (2017) the Markov process with time varying transition probability:

$$\phi_{ij,t} = \phi_r (s_t = i | s_{t-1} = j, Z_t) \text{-----(5)}$$

The disturbance term is independent of the latent variables at leads and lags

$$E(\varepsilon_t \Omega_{i,t+r}) = 0, \forall t, i, \Gamma. \text{ And } \forall t, i, \Gamma \neq 0 \text{-----(6)}$$

s_t is contemporaneously correlated with ε_t

If the joint probability between ε_t and $\Omega_{i,t}$ is bivariate:

$$\begin{bmatrix} \Omega_{i,t} \\ \varepsilon_t \end{bmatrix} \sim N \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \phi_i \\ \phi_i & 1 \end{bmatrix}, \quad i = 1, 2 \dots N - 1$$

The endogenous switching is being controlled by ϕ_i parameters, $i=1 \dots N-1$

Transition probability

Then the transition probabilities shall be in the form:

$$f(\Omega_{1,t}, \Omega_{2,t} \dots I \varepsilon_t) = f_1(\Omega_1, I \varepsilon_t) f_2(\Omega_2, I \varepsilon_t) \dots f_{N-1}(\Omega_{N-1,t}, I \varepsilon_t) \dots \dots \dots (7)$$

Where $\Omega_{1,t} I \varepsilon_t \sim N(\varphi_i \varepsilon_t \sqrt{1 - \varphi_i^2})$

Generally, the matrix of the transposition probabilities is

$$\varphi = \begin{bmatrix} \varphi_{00} & \varphi_{01i} & \dots & \varphi_{0N-2} \\ \varphi_{10} & \varphi_{11} & \ddots & \varphi_{1N-1} \\ \vdots & \vdots & \vdots & \vdots \\ \varphi_{N-10} & \varphi_{N-11} & \dots & \varphi_{N-1N-1} \end{bmatrix} \dots \dots \dots (8)$$

At Recession: $\varphi_{00} = \varphi [s_{t+1} = 0 | s_t = 0] = \frac{\exp(\phi_0)}{1 + \exp(\phi_0)}$

At Expansion: $\varphi_{11} = \varphi [s_{t+1} = 1 | s_t = 1] = \frac{\exp(\phi_1)}{1 + \exp(\phi_1)}$

The economic interpretation is as follows: At Recession, the probability will be φ_{00} , which implies that the series would be at state 0 (i.e. Recession) at time t and would remain at same 0 at time t+1. φ_{01} implies that the series would be at state 0 at the time t and transit to state 1 (i.e. Expansion) at time t+1. φ_{10} depicts that the series is at state 1 at time t and transit to state 0 at time t+1. φ_{11} Means that the series is at state 1 at time t and remains at the same 1 at time t+1.

Average Duration of a Regime

In line with Peersman and Smets (2005) for the estimation of each country i the equation will be as stated below in a reduced form:

$$y_{it} = (\alpha_{i0} \varphi_{0,t} + \alpha_{i1} \varphi_{1,t}) + \phi_{i,1} y_{i,t-1} + \phi_{i,2} y_{i,t-2} + (1 - \phi_{i,1} - \phi_{i,2}) (\beta_{i,0} p_{0,t-1} MP_{t-1} + \beta_{i,1} \varphi_{1,t-1} MP_{t-1}) \varepsilon_{i,t} \dots \dots \dots (7)$$

Where denotes the real output growth rate per annum

I = individual selected country i

MP_t = Policy indicator

$\varphi_{0,t}$ = Probability at recession

$\varphi_{1,t}$ = Probability at expansion

Hence $\varphi_{0,t} + \varphi_{1,t} = 1$

Following Subagyo et al., (2016), in this study we estimated the Markov Switching model by employing the growth rate means switching with error that follows a regime invariant AR(4). It is assumed in the model that the error variance is common during the regime. We used the real GDP as the leading indicator and other four monetary policy tools as predictors.

To investigate the business cycles in an observed data set, it is imperative to segregate the cyclical components from the trends. Regression or filtering are commonly used for the decomposition of the observed data into trends and cycles. Indeed, there are various approaches to identify the business cycle, which can be grouped into three broad methods. First, the classical method for the identification of the contraction and expansion of economic activity and the determination of the turning points (Burns and Mitchell, 1946). Second, the deviation method with statistical filters like HP filters, used to produce new stochastic variable from the cyclical component of the original trended series. (Hodrick and Prescott, 1997). Third, model-based methods like SVAR analysis, (Du Plessis et al., 2007), Markov switching, for the identification of the economic cycle, based on theoretical priors.

However, this study employs Hodrick-Prescott (HP) filter to decompose the observed macroeconomic variables into trend and cycle for clearer economic analysis. It is a macroeconomic tool used to extract the components in trend from a time series as it gives room for the smoothness of the parameters of the model. The application of HP filter estimation has become a paradigm in various economic analysis of a business cycle. It has been a subject of significant discussion and commendation in the context of business cycle estimation. It has not only been the most widely used detrending method in macroeconomics, but also offers a simplified solution to the basic need in economic policy formulation and monitoring (Kaisser and Maravall, 2002).

Originally, the detrending estimate from the optimization problem is as follows: $y_t = r_t + c_t$

$$\text{Min } (r_t) \Sigma(y_t - r_t)^2 + \lambda \Sigma(r_t - 2r_t - r_{t-1})^2$$

Where: r_t and c_t represent the trend and cyclical component, respectively.

Relative to the function of our data period, the appropriate frequency power for the smoothing of the parameters (λ) is put at 1600, being a quarterly data set.

THE DATA, SCOPE, AND VARIABLES

This study used quarterly data for the period 1980q1 – 2020q4, covering Gambia, Ghana, Nigeria, and Sierra Leone (WAMZ). These countries were selected based on the availability of data. We considered the major advantages of using quarterly data, which among others, include its ability to provide a cross-sectional information at the business cycle frequency. The variables are defined as follow: To capture the classical features of the business cycle, we employed the Real GDP as a proxy for economic growth, which is the leading indicator. Interest Rate representing the policy indicator of the respective central banks.

Money supply represents the Broad money of each country. It is another prime monetary policy of the Central Bank. Other variables are exchange rate and inflation rate. These data were sourced from International Financial Statistics (IFS) and World development indicators (WDI).

RESULTS AND DISCUSSIONS

Business cycles and trends estimates.

The National Bureau of Economic Statistics (NBER) while extending the works of Burns and Mitchell, (1946), on the business turning points, identified four Phases of business cycle, expansion, contraction, trough and peak. However, this study is restricted to only two phases, which is expansion and contraction. Thus, following Sims and Zha, (2006), with focus on expansion and contraction phases, we de-trended the RDGP of the West African countries, using the Hodrick-Prescott (HP) filtering method for the detection of the cyclical elements of the economic activity of the countries under study to determine whether these countries share a comparable business cycle.

As shown in Figure 1, comparatively, the MSM reveals that the WAMZ have similar business cycles. The estimates demonstrate that these countries' business cycles are characterized by two distinct growth phases: a recession regime and an expansion growth regime, which is opposed to some countries with three growth rate phases of recession regime, moderate growth regime and high growth regime (see Medhioub, 2015).

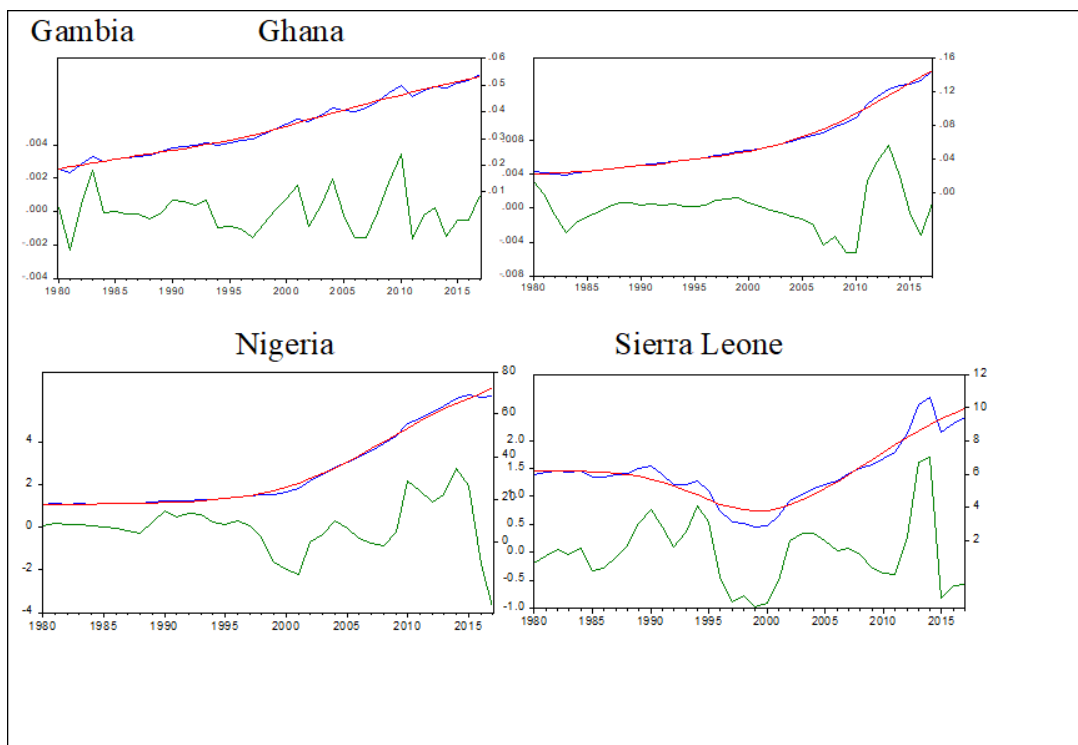


Figure 1: Business cycles and Trends in WAMZ

Source: Author's computation from estimates

A visual outlook of the graphs suggests that the countries appear to have similar trends and business cycles, though with varying degrees of volatilities. This result is similar to Kutu and Ngalawa, (2017) in BRICS countries having common business cycles. Also, the effects of the great depression of 2008 and the commodity price fall of 2014 are captured in the cycles. The occurrence of high volatility of the cycle in these countries demonstrates the prevailing high inflation rate.

Transition probability estimates.

The estimates of each of the countries in WAMZ economy are as presented in Table 1 showing the potency of monetary policy shocks at deferent regimes. It comprises the regime switching results with noteworthy features on the transition probability. The estimates reveal from each of the countries suggest that monetary policy shocks are more potent at contraction/recession (regime1) than at expansion/boom (regime 2). This is apparent in most of the probability values of each of the variables that are at significant level of <0.05 across the countries. This conforms with the findings of Lo and Piger, (2003); Dolado and Maria-Dolories, (2005), among others, where their evidence of monetary policy actions at recession, contrary to Bodman (2006).

Table 1: Regime switching

Gambia					Ghana				
Variable	Coefficient	Std. Error	z-Statistic	Prob.	Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1					Regime 1				
INF	-0.006797	0.003033	-2.240819	0.025	INF	-0.023035	0.002453	-9.390056	0
M2	0.000283	0.000134	2.110677	0.0348	M2	0.0018	0.000392	4.594276	0
INTR	0.000475	0.000524	0.906294	0.0048	INTR	0.000466	0.000966	0.482948	0.6291
EXCR	0.01124	0.001542	7.290925	0	EXCR	-0.030569	0.006959	-4.392462	0
LOG(SIGMA)	-3.301548	0.155638	-21.21301	0	LOG(SIGMA)	-2.592222	0.140947	-18.39153	0
Regime 2					Regime 2				
INF	-0.001546	0.000524	-2.948873	0.0032	INF	-0.009433	0.0004	-23.60827	0
M2	3.55E-05	9.36E-05	0.378697	0.0049	M2	-0.000408	0.000229	-1.782209	0.0747
INTR	-0.000304	0.000129	-2.356265	0.0185	INTR	0.002585	0.000855	3.023072	0.0025
EXCR	0.012612	0.001207	10.44705	0	EXCR	-0.007486	0.004924	-1.52042	0.1284
LOG(SIGMA)	-5.620981	0.082358	-68.25079	0	LOG(SIGMA)	-4.515536	0.080972	-55.76649	0
Nigeria					Sierra Leone				
Variable	Coefficient	Std. Error	z-Statistic	Prob.	Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1					Regime 1				
INF	-3.375594	0.260343	-12.96594	0	INF	0.007916	0.001538	5.148335	0
M2	-0.093864	0.009461	-9.921162	0	M2	0.003376	0.000468	7.21753	0
INTR	-0.677286	0.09833	-6.887906	0	INTR	-0.006998	0.002076	-3.371856	0.0007
EXCR	4.048907	0.466571	8.678012	0	EXCR	0.012865	0.005134	2.505848	0.0122
LOG(SIGMA)	2.690028	0.121216	22.19205	0	LOG(SIGMA)	-1.87045	0.16103	-11.61557	0

Regime 2					Regime 2				
INF	-0.07864	0.016041	-4.90252	0	INF	-2.98E-05	0.000249	-0.119966	0.0045
M2	0.013994	0.001948	7.183368	0	M2	-0.000184	0.000105	-1.753558	0.0025
INTR	-0.030737	0.017399	-1.766629	0.0373	INTR	-0.000223	0.000319	-0.699916	0.044
EXCR	-0.196332	0.092598	-2.120259	0.034	EXCR	0.005775	0.001442	4.006336	0.0001
LOG(SIGMA)	-1.82337	0.072063	-25.30236	0	LOG(SIGMA)	-4.966093	0.070915	-70.02844	0

Source: Authors computation from results

Transmission probability results

Table 2 shows the estimates of the transitioning effect of the monetary policy shock on economic growth in the business cycle of each country in the zone. That is the transition probabilities in Gambia, Ghana, Nigeria and Sierra Leone respectively. The results depict those variations of the channels of monetary policy involving the interest rates, broad money supply as well as inflation and exchange rates have significant impact on the growth.

Results for Gambia

This result for Gambia shows that the probability of being in the expansion regime is higher than the probability of being in recession. This is evident from the results in Table 2 which shows that the transition probabilities of settling in recession(contraction) period is 0.4537, which is lesser than the expansion probability of 0.874792. This implies that the Gambia economy stays more in expansion regime than recession regime. This is further rooted in the expectation duration of each regime.

Table 2: Transition probabilities and expected durations

`GAMBIA			`GHANA		
Constant transition probabilities	Regime 1(t+1)	Regime 2(t+2)	Constant transition probabilities	Regime 1(t+1)	Regime 2(t+2)
1	0.453703	0.546297	1	0.749396	0.250604
2	0.125208	0.874792	2	0.066868	0.933132
Constant expected durations:			Constant expected durations:		
1	2		1	2	
1.830507	7.986704		3.990364	14.95494	
`NIGERIA			SIERRA LEONE		
Constant transition probabilities			Constant transition probabilities		
	Regime 1(t+1)	Regime 2(t+2)		Regime 1(t+1)	Regime 2(t+2)

1	0.887243	0.112757	1	0.766095	0.233905
2	0.042697	0.957303	2	0.046379	0.95362
Constant expected durations:			Constant expected durations:		
	1	2		1	2
	8.868661	23.42081		4.275246	21.56139

Source: Authors computation from estimates.

Results for Ghana

Also included in the estimates is Ghana economy, which illustrates the effects of the monetary policy shock on output growth in Ghana.(Table 2). There is a greater likelihood of being in regime 2 (Expansion) with a given the probability of 0.933132 as against the likelihood of being in regime 1(Recession) with the probability of 0.749396. This result is parallel to that of Gambia, which also suggests that there is probability of being in an expansion regime is higher than the probability of being in a recession.

Results for Nigeria

As is indicated in table 2, monetary policy in Nigeria has a significant impact on output growth both in at recession and expansion and there is a probability value of 0.957303 in regime 2_(t+2) as against that 0.887243in regime 1_(t+1), which implies that there is higher likelihood of staying in expansion than contraction regimes. This may not be unconnected with the higher output of the economy within the region, being an oil rich country.

Results for Sierra Leone

Also included in the estimate in Table 2is the significant impact of the monetary policy tools on output growth in Sierra Leone. It further indicates the possibility of remaining in regime 2 (expansion) is higher than the possibility of staying in regime 1 (recession). This is evident in the probability value of 0.953621 in regime 2, which is higher than that of 0.766095 in regime 1.

In general, the results in each of the countries in the zone (Gambia, Ghana, Nigeria, and Sierra Leone)suggest that there is higher probability of staying in regime 2 (expansion) than that of staying in regime 1 (Contraction/recession). Thus, economies persist longer in an expansion/boom regime than in a contraction/recession regime. This is further buttressed by their longer average duration period of expansion regime than the contraction regime. This is similar to Peersma and Smets, (2001); Male, (2010); Padayachee, (2010) and Kutu and Ngalawa, (2016), where average duration periods are higher during expansion regime than recession period.

The filtered regime probabilities

Figure 2indicates the filtered regime probabilities of the business cycles across all the countries in the WAMZ, showing series of contractions and expansion regimes in the economic activity of each country, with evidence of high volatility. The results corroborate the transmission probabilities of more expansion than contraction periods, while the policy instruments are more effective at recession than expansion regime. This is in concordance with the findings of Loaya and Hnatkovska, (2004) that estimate a high volatility rate in 40 developing countries.It further buttressed the transition probability results earlier analysed. Even though there are heterogeneous timing of the recession and contraction phases and turning points, however, the estimate depicts some relatively synchronous recessions and expansions as well as peaks and troughs. For instance there are generic periods of relatively long expansion in the early 80s to late

80s and 2010 -2012 to the period of high growth rate experienced in the West African countries (ADB, 2018). On the other hand, the recession periods 1991- 1993and 2009 are reflections of the global economic crisis and the recent commodity price fall of 2014.

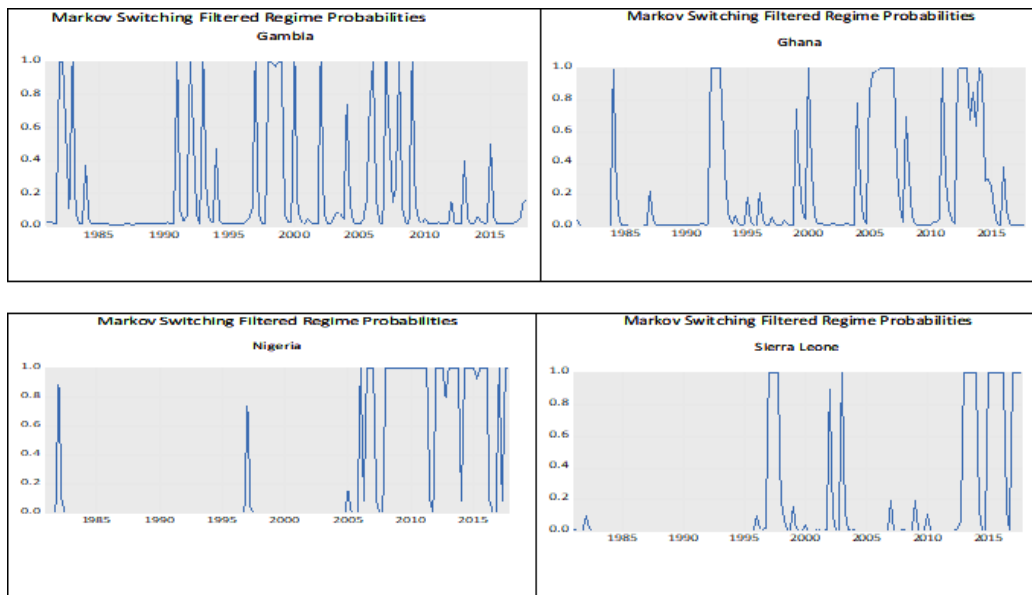


Figure 2: WAMZ Filtered Regime Probabilities

Source: Author’s computation from results

Expected Duration result estimates.

In line with the submission of Burns and Mitchell (1946) that duration is a crucial step in the identification of business cycle in an economy, hence we estimated the expected duration of each phase of the business cycle in each country of the region as reported in table 3

In Gambia business cycle, the result reveals that the expected duration of staying in at contraction is 1.8 quarters where as to stay at expansion period is 7.9 quarters. This further buttressed the higher probability of the economy of Gambia transitioning from recession to boom. The Gambia constitutes the fourteenth largest economy in the ECOWAS region. As of 2018, The Gambia has a population of 2.28million with a growth rate of 2.9% in 2018. Due to thin natural resources, 3/4 of the population depends on agriculture, which contributes 1/3 of the GDP of the country and dominated by the production of groundnut. (see ADB, 2018; World Bank, 2018 and World Factbook, 2019).

The expected duration of the two regimes in Ghana is also similar to those obtained in Gambia. The results further suggest an average of 3.7 quarters and 14.9 quarters for contractionary and expansionary periods respectively. Ghana is a member of WAMZ and one of the major economic contributors to the ECOWAS economy. The country has a population of 29.77million and annual growth rate of 2.2% in the year 2018. The economy is driven mainly by oil sector, while agriculture led by cocoa, accounts for about 20% of the GDP.

In Nigeria the constant duration within the period of indicated an average period of 8.8 Quarters for contactory regime and 23.4 quarters for expansionary regime. This longer expansionary period of stay relative to other countries in the zone, may be due to the dominant volume of the economy. Nigeria is a member of WAMZ and the largest economy in ECOWAS and in Sub-Sahara African countries. The country, which majorly relies on oil revenue, contributes about 2/3 (70%) of the economy of West Africa and about 20% of the entire continent’s GDP. The population of the country was estimated at 195.89 million

people, with a growth rate of 2.6% in 2018 Nigeria is the largest economy in the zone and even in West African region, creating a robust market advantage

The estimates also include the probability of the length of each economic regime (Recession and expansion) in Serra Leone. It shows that the economy stays in recession for an average period of about 4.2 quarters, which is lesser than 21.5 quarters of staying at expansion period. Sierra Leone is a member of WAMZ and the eleventh largest economy in ECOWAS. In 2018, its population estimate was put at 7.65million people, with a growth rate of 2.4% and 50% of the work force are into subsistence farming. Ore mining has made the country to be susceptible to external shocks of international price variations. Thus, the poverty rate is about 52.9% of the population.

Succinctly put, in Table 3, in WAMZ the average contraction period ranges between 1.89 and 8.8 quarters. The results further suggest a contractionary average period of 4.7 quarters and expansionary average period of 17.0 quarters. The length of the business cycle ranges between 9.8 to 32.3 quarters, varying from country to country. This re-affirms the findings of Rands and Tarp, (2002) that business cycles in developing countries have a relatively shorter periods than the industrial countries, and are diverse across countries.

In addition, the analysis further documents that average duration period for recession period is 4.7 and 17.0 quarters at expansionary period.

Table3:Summary of transition Estimates

Sub-Region	Country	Contraction P(s(t) =1)	Expansion P(s(t) =2)	Avg length of cycle Business
WAMZ	Gambia	1.830507	7.986704	9.8
	Ghana	3.990364	14.95494	18.9
	Nigeria	8.868661	23.42081	32.3
	Sierra Leone	4.275246	21.56139	25.8
Avg-WAMZ		4.7	17.0	21.7

Source: Authors computation from results

From the result, Nigeria has greater probability of staying in expansion than in recession regime and this might have accounted for the significant proportion of the country’s economic growth. Similarly, these two countries are also better off with average length of business cycle being above the group average, while Gambia appears to be worse off than others within WAMZ countries, with the shortest phase of expansion and average business cycle duration.

CONCLUSION AND RECOMMENDATION

From the analysis of assessing the effectiveness of monetary policy in a two-phase business cycle regime, the result suggests monetary policy instruments are more potent during recession/contraction than at expansion/boom phase and the appearance of similar business cycles.

We therefore recommend that these countries can formulate similar monetary policies that can elongate the duration of the expansionary regime and shorten the recession regime, with due considerations to the phase

of the business cycle in each country. However, such policies must be taken with some considerations that the resultant consequences of stringent contractionary policy may not be pleasant, as it may work contrary to their expectations. For example, it may further lead to economic stagnation, increasing unemployment, currency depreciation, and hike in prices among others.

Finally, the analysis of study is restricted to the classical approach of the business cycle, according to Burns and Mitchell, (1946), with much emphasis on the relative expansion and contraction, consecutive periods (with duration) of the cycle, while the typical approach which deals with turning points (peaks and troughs) of the business cycle is a gap yet unfilled.

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