Long Run Money Superneutrality Evaluation of the Relevance of Money in Africa: An ARDL Approach

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by

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Abstracts

Neutrality of money holds that the real economy is not affected by the level of the money supply level. Superneutrality of money as a property stronger than neutrality of money connotes that the rate of money supply growth has no effect on real variables. The hypothesis of money superneutrality is about what the long run relationship between money supply growth and growth in real output and changes in price levels and what these suggest for the use of monetary aggregates in the conduct of monetary policy. This paper assesses the validity of the hypothesis of money superneutrality in the long run by gathering empirical evidence for 50 African economies within five (5) monetary and economic blocs of Africa (EAC, ECCAS, ECOWAS, AMU/MENA, and SADC), including Djibouti and Ethiopia. This study determines if money supply growth is influential across economies in Africa. The autoregressive distributed lag (ARDL) bound testing cointegration approach developed by Pesaran et al (2001) was employed to test money superneutrality in this study. Relevant time series annual data of money supply growth, and real GDP growth and inflation spanning over a period of 42 years between 1980 and 2022 were sourced and applied for 53 African countries under the study. Findings and results generated from the ARDL estimation results produced evidence to suggest that money is not superneutral in monetary policy outcomes and implementation virtually all the economies of Africa evaluated, from both perspectives of the influence of money supply growth on real output and on inflation. However, it is necessary to state that the assessments of the influence of money supply growth on inflation rate yield establish the relevance of money across African economies.

1. Background and Introduction

One of the many ways through which the effectiveness of monetary policies could be measured is to check the neutrality of money and superneutrality of money in the economy, and a basic issue in macroeconomics is the possible link between nominal variables (measured in monetary terms) and real variables. A fundamental issue here is whether money has real influence or effects.

There was the evolution of two prominent views on the neutrality (and superneutrality of money: (i) Keynesian view; and (ii) Monetarist view. However, it si relevant to consider the classical theory that preceded these two schools of thought. The view of the classical macroeconomic theorists as developed between the late 19th Century and 20th Century is that monetary policy does not play long run roles in determining real economic activities. Although, their views are that there might be short-run minor effects of monetary policy on economic activity, but they posited that money has direct influence only on prices in the long-run. This view of the influence of money only on price is the 'quantity theory of money. Consequently, it could be agreed that the consensus of the short-run and long-run effects of monetary policy emanated from the proponents of the quantity theory of money, as presented by Irving Fisher.

The view of the Classical theorists is that money and monetary policy played no long run role in the determination of economic activities. Tobin formally brought to the Keynesian views on the long run effects to the limelight as he suggested that economic activity (particularly, real interest rates) is jointly determined in the long run by monetary policy and economic fundamentals. This is contrary to the views within the Classical school of thought.

The Monetarists, rather than reacting to the position of the Keynesians directly, they gave a view that served as underpin for empirical works by Philip in 1958 when he investigated the relationship between nominal variables and real variables. The Monetarists therefore applied the theoretical framework to explain that changes in real economic activity as induced by monetary policy would be short-lived. Friedman and Phelps explained the views of the Keynesians through two assumptions: (i) the nature of monetary policy – where increases in the money supply would cause interest rate increase (monetary surprises); and (ii) responses of economic decision makers to the

effects of monetary policy (monetary surprises) is always accompanied by money illusion, a failure of households and firms to notice increase in the price level, but show interest in increases in prices of that are of special interest to them, as they mistakenly took increase in nominal prices to be increases in real prices of goods affected. These errors of belief lead to various wrong economic decisions; and due to this, money surprises created by monetary policy can influence real economic activities. With his Liquidity Effect Theory which is based on the position that the short run decision made by households and firms are propelled by money illusion, Friedman restated the quantity theory of money by highlighting that monetary policy change would be superneutral in the long run and would have to real effects.

Nevertheless, the Keynesians and the Monetarists have a consensus that in the short run, a higher money growth rate correlates with: (a) higher inflation rate; (b) lower real interest rate; and (c) increase in economic activity. The acceptance by the Keynesians, of the position of the Monetarists on the long run superneutrality of money is seen by many economists as a 'rigorous scientific synthesis' of the two theories. The Neoclassical economists (Lucas (1972), Sargent and Wallace (1976) extended the arguments of the Monetarists (Friedman and Phelps) against the Keynesian theory. Lucas in an article, was of the view that: (a) money is superneutral in the long run; (b) the real effects of monetary policy in the short run are limited, even when prices are accelerated. Mistakenly, Keynesians mistakenly took 'rational expectations' as implying long-run superneutrality.

In spite of the view raised by the various school of thoughts, there are propositions and arguments that it has not been strongly established unequivocally that monetary policy does not have long run effect and that the possibility is strong that monetary policy has huge, long run effect that this should draw the attention of policy makers and economist. This forms the background for this assessment of superneutrality of money within the context of monetary policy stance in Africa.

2. Money Neutrality and Money Super neutrality

Monetary neutrality as a concept of classical economics, generally suggests that within an economy, changes in a nominal variable (like money supply) do not impact a real variable (like real GDP and employment). There are two hypotheses that explain the real variable - nominal variable relationship which specify that in the long run: (i) permanent change

in the level of money supply has no effect on the level of real variable (this is money neutrality hypothesis); (ii) a permanent change in the growth rate of money supply does not influence the level of real variables (this is money super-neutrality hypothesis). The generally accepted of the two hypotheses is the long run money neutrality (LMN) proposition; and the reason for this acceptance is that apart from standing as a core feature of a huge number of economic models, LMN is the yardstick for monetary policy effectiveness measurement.

Over the decades and centuries, across nations and economies with varied monetary and fiscal policies, literature have been able to establish the monetarists argument in favour of the significance of monetary aggregate in strategising the control of inflation through the robust empirical estimations of low frequency or long run association of money growth and inflation. Going by the dictum of Milton Friedman which states that 'inflation is always and every time a monetary phenomenon' (Friedman, 1963). The underlying view of the quantity theory of money that portrays money as the determinant of inflation rate, then, it is appears obvious that inflation control (maintenance of price stability) is a major objective of a central bank. The popular thinking (right from elementary levels) is that a monetary policy that aims at inflation control should bother itself with how modest rate of money supply growth can be maintained. Though, many academic and policymakers are of the view that money does not play a role in the conduct of monetary policy, many schools of thoughts however disagree with this issue of 'de-emphasising 'money growth as a criterion for assessing how sound a monetary policy. A bothering question is if monetary policy decisions can be based on the models of monetary policy transmission mechanism which fail to take cognisance of the monetary aggregate. [1]

The fundamental principles of 'neutrality of money' (as an economic theory), cast doubts over the theoretical coherence of the 'money-less' monetary policy models (which apparently lacks consistency with the fundamentals of money neutrality'. Woodford (2008) stresses that a model that makes reference to money neutrality (or which leaves the general price level to be indeterminate) should be applied in predicting the consequences of alternative policies for inflation. Monetary economists hold the belief that injections of money into an economy have certain implications because such change

[1] The ECB, the common central bank of the EMU always asserts prominent and significant roles of growth in money supply within the context of the formulation and of monetary policy strategy.

in money stock will only change nominal wages and price without any reflection of such change in real output, real wages and real interest rates. The effect of the injection of money into the macro economy is neutral on the long run because most macroeconomic decisions emanate from real factors within the economy; and consequently, there would be no change in economic decisions made because the real variables are unchanged. This is why neutrality of money is a postulation that a change in the stock of money within an economy, affects just only nominal variables, with no such effect on real variables that are inflation-adjusted. Therefore, what money neutrality idea imply is that the central bank does not affect the real economy (size of the GDP, employment, real investment and real consumption) by printing money; and that any increase in money supply would be negated by a proportional rise in price and wages. This is an assumption underlying some macroeconomic theories and models (like the classical model, neo classical model, real business cycle theory).[2]

According to the 'classical dichotomy', there are different powers having different effects on nominal and real variables, thus causing money supply to affect only nominal variables. When the velocity of money is constant while the capacity to supply good constrains the velocity of activity, money supply changes will cause price changes.[3] New classical economists posit that even in the short term, perfectly anticipated monetary policy cannot affect activity, thus supporting the classical concept of long run money neutrality. As a long- run proposition, the classical dichotomy was basic to the views of many pre-Keynesian economists (regarding money as a veil) as well as the new classical macroeconomic theories. Based on the argument that prices are sticky, the classical dichotomy was rejected by the Keynesians and the monetarists. Their thinking was that prices fail to adjust in the short run, so that money supply increase will cause aggregate demand to rise and thereby altering real macroeconomic variables. The view in classical economics and neoclassical economics tends towards the notion that as monetary factors (and not real factors) wholly determine nominal variables, real factors (not monetary

[2] These theories and models show that money is neutral and has no effect on real variables within the economy.
[3]This led Friedman to conclude that "inflation is always and everywhere a monetary phenomenon."

factors) purely determine real variables in the economy. Though, Keynesian and monetarist economists rejected this position.[4]

As a concept stronger that money neutrality, superneutrality concept outdoes money neutrality concept. Some economists hold the belief that money superneutrality is a tool of long-term design of an economy. Money is superneutral when permanent changes in the growth rate of money supply have no real effects on the long run level of real out and other real economic variables other than on real money balances. The postulation of macroeconomic theory at its foundation level is that the implication of money neutrality is that exogenous permanent changes in the growth rate of money supply money growth rate will only influence nominal economic variables. The evaluation of the economic impact of inflation essentially assesses the long run superneutrality of money hypothesis as a conjecture that enjoys broad support amongst many macroeconomists.

Woodford (2007) points out what the long run relationship between money growth and prices implies for monetary policy conduct. Firstly, with the existence of the well-established empirical relationship, 'money-less' models of inflation are impliedly incorrect. Secondly, the long run money-price relationship provides the basis for the argument on the desirability of a money-growth target. Thirdly, with the cointegration of money growth and inflation rate, one would not need further information in order to forecast average inflation rate over some sufficiently long future horizon since one would already possess the knowledge of what the average rate of money growth will be over such time horizon. These justify the significance of this study on money superneutrality in Africa while providing answers to the question on if money supply growth is relevant within the continent of Africa.

3. **Data and Methods**

For a detailed investigation of long run superneutrality money neutrality (LMN) and due to the evidence that monetary superneutrality tests are sensitive to the underlying monetary aggregates, M2 money was applied for money supply. Given the developing nature of the economy of African countries in which a high proportion of base money does not pass through the formal banking system, there is justification in laying greater

[4]This rejection is based on prices sticky prices arguments: if prices fail to adjust in the short run, an increase in the money supply raises aggregate demand and thus alters real macroeconomic variables (Oxford Dictionary Quick reference)

emphasis on results generated for the assessment of cointegrating relationships between real output growth and M2 in the African economies evaluated. The real variables are real output as proxy by real GDP and inflation as measured by GDP deflator. Annual data were collected for the 50-member countries five (5) African monetary and economic blocs (EAC, ECCAS, ECOWAS, AMU/MENA, and SADC), including Djibouti and Ethiopia for the purpose of this study span over the period of 42 years between 1980 and 2022. Due to lack of complete dataset, Eretria, Somalia, Sudan and South Sudan were dropped from the assessments.

The autoregressive distributed lag (ARDL) bound testing approach developed by Pesaran et al (2001) was employed to test money neutrality and money superneutrality here. As opposed to the traditional Engle-Granger and Johansen cointegration approaches, the ARDL bound testing cointegration method is very rare in the investigation of neutrality of money. While attention was paid to the integration and cointegration properties of the variables and consequently, unit root tests of the variables was performed in order to assess the stationary properties of the variables. Since the long run relationships between the money supply and real output (for neutrality assessments) and money supply growth, real out growth and inflation (for superneutrality tests) depend on the integration order of each variable, the Augmented Dickey-Fuller GLS (ADF) and Phillips-Perron (PP) unit roots tests were applied so as to establish that none of the variables is I(2) and thus avoid spurious results. The assumption of bound test is that variable employed in the estimation are I(0) or I(1). This therefore makes the Pesaran F-statistics based on I(2) variables to be invalid. ARDL bounds test cointegration procedure will enable the empirical analysis of long run relationship and dynamic interactions between variables of interest. This is a procedure developed by Pesaran, Shin and Smith (2001). These pretests of variables for the order of integration were performed to trend and/or intercept or none of trend and intercept as appropriate. To determine the inclusion of trend, intercept or none of both, each variable was regressed on constant and trend, using the OLS estimation method. From the results of the OLS estimations, any of constant and trend that was statistically significant at 5% level of significant were included when running the unit roots tests. The Schwarz Criteria (SC) was applied for the automatic lag selection in the ADF tests while for the PP tests, the Newey-West Bandwidth Selection was used for the bandwidth automatic selection and the Bartlett Kernel spectral

estimation method was applied. ARDL bound tests were performed at 5% level of significance with intercept and trend on the condition that they were statistically significant at 5% level of significance, otherwise they were restricted. There was automatic lag length selection by the Akaike Information Criterion (AIC) in which the maximum lag was set at 4 for both dependent and independent variables being estimated. The post-estimation residual diagnostic tests for normality, serial correlation and heteroscedasticity were carried out at 5% level of significance, with Jarque-Bera (JB) test for normality, Breusch-Godfrey LM tests for autocorrelation and Breusch-Pagan-Godfrey tests for heteroscedasticity.

An ARDL regression model, in its basic form, is stated as:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \cdots + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \cdots \alpha_q x_{t-q} + \varepsilon_t \qquad 1$$

The lag lengths of both the dependent and independent variables should be carefully determined. In the ARDL modeling, the x terms on the right hand side of the equation is usually referred to as 'q' while the autoregressive lag length of the dependent is usually called 'p'. The most common method of determining the lag lengths in the ARDL process is by information criteria (AIC or BIC). Specifically here, the first stage in the ARDL process in the estimation of money neutrality and superneutrality is to establish if long run relationships exists by applying the unrestricted error correct model (UECM) representation of the ARDL (p,q) thus:

$$\Delta\pi y_t = \alpha_0 + \beta_1 y_{t-1} + \beta_2 lnM_{t-1} + \sum_{i=1}^{p} \delta_i \, \Delta\pi y_{t-i} + \sum_{j=1}^{q} \gamma_i \, \Delta lnM_{t-j} + \varepsilon_t \qquad 2$$

Where α_0 is the constant, β_1 and β_2 are long-run relationships parameters, δ_i and γ_i are the short run relationships parameters, Δ is the difference operator and ε_t is the white noise term. Biased coefficient estimates will result when an ARDL model is estimated by ordinary least (OLS) square method. The OLS will also be an *inconsistent* estimator because of the influence of lagged values of the dependent variable as regressors, if the disturbance term, ε_t, is autocorrelated. This is a reason for the general introduction of instrumental variables in the application of an ARDL models. The model is "autoregressive" because of the part explanations of the dependent variable by its own lagged value; and contains a "distributed lag" component with the successive lags of the explanatory variables on the right-hand side of the model. Researchers can efficiently

apply the method whether or not the regressors in the model are purely I (0). In this ARDL process, the null hypothesis in Equation 2 above is expressed as: $H_0 = \beta_1 = \beta_2 = 0$ indicating 'no long run relationship' against the alternative hypothesis:$H_0 \neq \beta_1 \neq \beta_2 \neq 0$, using the F-test. The F-test which has a non-standard distribution is applied on lagged values of the variables in the process of determining the existence of long run relationship among the variables. The F-test is conditional upon: (i) if the variables in the ARDL model are I(0) or I(1); (ii) the number of explanatory variables; (iii) if the ARDL model contains an intercept and/or a trend.

The evaluation of the estimated value of *F*-statistic were in line with the critical values tabulated in Table CI (iii) of Pesaran *et al.* (2001). Two bounds of critical values are generated here as benchmarks for the integration orders of the variables. The upper bounds values are for the I(1) variables, while the lower bounds values are for the I(0) variables. Cointegration exists if the computed F statistic exceeds the upper critical value. F-statistics below the lower critical value bound indicate that there is no cointegration. The test is inconclusive when the F-statistic fall in-between the two bounds of critical values. This study applies the bound-test small sample size critical value computed by Narayan (2005) rather than the Pesaran and Pesaran (1997) critical values which were computed for large samples sizes of 500 to 1,000 observations. After the long run relationships are established through the bound tests, at the second stage is the estimation of the estimation of the long run and short run coefficients of cointegration. If the null hypothesis of no cointegration is rejected (that is the cointegration of the variables is ascertained), the long run relationship between the variables would be estimated by setting the error correction component of Equation 2 equal to zero to derive the long run effects by normalising β_2 on β_1. Diagnostic test for serial correlation, normality and heteroscedasticity and parameter stability were performed via CUSUM, CUSUMSQ and other tests on the error correction representation of the ARDL model.

The derivative equation applied in this money superneutrality evaluation are expressed below:

$$\%\Delta y_t = f\%\Delta m_t \quad 3$$

and

$$\pi_t = f\%\Delta m_t \quad 4$$

where $\%\Delta y_t$ is the real GDP growth, and m is the money supply, π is inflation and is $\%\Delta m$ money supply growth, all at period t. The investigation of money superneutrality through the estimations of the relationship between inflation, real output growth and money supply aggregates, explicitly specified in the estimable functions in Equations 5 and 6.

and the following two equations for the money superneutrality tests:

$$\pi_t = \alpha + \beta m g_t + \varepsilon_t \quad 5$$

$$yg_t = \alpha + \beta m g_t + \varepsilon_t \quad 6$$

where: yg_t is output growth rate at time t, and mg_t is money growth rate at time t. It is very likely that the estimates of these 'St. Louis Equations' equations may yield results that will provide evidence of non-neutrality of money, for instance, when a strong association between higher growth in money supply and higher output growth would be established, because of the positive estimated parameter.[5] As solution to this problem it is therefore necessary to apply a model that will find solution to possible endogenous explanatory variables. This entails the introduction of instrumental variables which makes ARDL model is more appropriate.

The augmented ARDL model expressed by Pesaran et al (2001) takes to take the following general form:

$$y_t = \alpha_0 + \sum_{t=1}^{k} \beta_i x_{it} + \varepsilon_t \quad 7$$

where y_t is the dependent variable, α_0 is the constant term and x_{it} is the independent variable and ε_t is the disturbance term. In terms of the lagged levels and difference, we can obtain the unrestricted error correction version of (for instance) an ARDL (1,1) model as:

Super-neutrality with respect to real output growth:

$$\Delta yg_t = \alpha_o + \sum_{t=1}^{k} \beta_1 \Delta yg_{t-1} + \sum_{t=1}^{k} \beta_2 \Delta m_{t-i} + \gamma_1 yg_{t-1} + \gamma_2 m_{t-1} + \varepsilon_t \quad 8$$

Super-neutrality with respect to changes in inflation rates:

$$\Delta \pi_t = \alpha_o + \sum_{t=1}^{k} \beta_3 \Delta \pi_{t-1} + \sum_{t=1}^{k} \beta_4 \Delta m_{t-i} + \gamma_3 \pi_{t-1} + \gamma_4 m_{t-1} + \varepsilon_t \quad 9$$

All the variables are as defined. β and γ are the parameters of interest to be estimated. The first part of each equation with β_1, β_2, β_3, and β_4 represent short run dynamics while the second part with γ_1, γ_2 , γ_3, and γ_4 representing the long run relationships. Δ is the

[5] This method was used in the 60s by the St. Louis Fed economists Leonall C. Andersen and Jerry Jordan.

first difference operator and ε_t is the 'while noise error term'. Evaluation made in this study was limited to money neutrality tests in respect of real output and money superneutrality tests regarding inflation and real output growth. Thus, the tests of null hypotheses (as against alternative hypotheses) of no long run relationships are:

For Equation 8 – $H_0 = \gamma_1 = \gamma_2 = 0$ – (no long run relation)

For Equation 9 – $H_0 = \gamma_3 = \gamma_4 = 0$ – (no long run relation).

4. Results and Findings

The results of the unit roots tests and the decision on the order of integration of the variables employed (money supply growth and GDP growth and Inflation), reflecting the ADF and PP unit roots test outcomes are as expressed in Table 1 below:

Table 1: Results of the ADF and PP Unit Roots Tests of Variables

East African Community (EAC)

Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Burundi	I(0)	I(0)	I(0)
Democratic Rep. of Congo	I(0)	I(0)	I(0)
Kenya	I(0)	I(0)	I(0)
Rwanda,	I(0)	I(0)	I(0)
Tanzania	I(0)	I(0)	I(0)
Uganda	I(1)	I(0)	I(1)

Economic Community of Central African States (ECCAS)

Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Cameroon	I(0)	I(0)	I(0)
Central Republic of Africa	I(0)	I(0)	I(0)
Chad	I(0)	I(0)	I(0)
Republic of Congo	I(0)	I(0)	I(0)
Equatorial Guinea	I(0)	I(0)	I(0)
Gabon	I(0)	I(0)	I(0)
Sao Tome and Principe	I(0)	I(0)	I(0)

Economic Community of West African States (ECOWAS)

Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Benin	I(0)	I(0)	I(0)
Burkina Faso	I(0)	I(0)	I(0)
Cabo Verde	I(0)	I(0)	I(0)
Cote d'Ivoire	I(1)	I(0)	I(0)
Gambia	I(0)	I(0)	I(0)
Ghana	I(0)	I(0)	I(0)
Guinea,	I(0)	I(0)	I(0)
Guinea-Bissau	I(0)	I(0)	I(1)
Liberia	I(0)	I(0)	I(0)
Mali	I(0)	I(0)	I(0)
Niger	I(0)	I(0)	I(0)
Nigeria	I(0)	I(0)	I(0)
Senegal	I(0)	I(0)	I(0)
Sierra Leone	I(0)	I(0)	I(0)
Togo	I(0)	I(0)	I(0)

Arab Maghreb Union (AMU) and North African Countries in MENA			
Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Algeria	I(0)	I(0)	I(0)
Egypt	I(0)	I(0)	I(0)
Libya	I(0)	I(0)	I(0)
Mauritania	I(0)	I(0)	I(0)
Morocco	I(0)	I(0)	I(0)
Tunisia	I(0)	I(0)	I(0)

South African Development Community (SADC)			
Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Angola	I(0)	I(0)	I(0)
Botswana	I(0)	I(0)	I(0)
Comoros	I(0)	I(0)	I(0)
Eswatini (Swaziland)	I(0)	I(0)	I(0)
Lesotho	I(0)	I(0)	I(0)
Madagascar	I(0)	I(0)	I(0)
Malawi	I(0)	I(0)	I(0)
Mauritius	I(0)	I(0)	I(0)
Mozambique	I(0)	I(0)	I(0)
Namibia	I(0)	I(0)	I(0)
Seychelles	I(0)	I(0)	I(0)
South Africa	I(0)	I(0)	I(0)
Zambia	I(1)	I(0)	I(1)
Zimbabwe.	I(0)	I(0)	I(0)

Other African Countries			
Country	*Inflation GDP Deflator*	*GDP Growth*	*Money Supply Growth*
Djibouti	I(0)	I(0)	I(0)
Ethiopia	I(0)	I(0)	I(0)

Source: Author's Estimation and EViews 12 Output

All the variables pretested have similar integration of I(0), except for Cote D'Ivoire' inflation at I(1). Because none of the variable is integrated to the order of two I(2), there was the conviction towards the appropriateness of the use of the ARDL method in estimating the superneutrality of money in the African countries.

The results of the ARDL bounds tests of money superneutrality test of cointegration relationship between GDP growth rates and money supply growth rates in the African economies in the 50 African economies assessed are exhibited in Table 2 below. The results show the automatically selected ARDL model ran for each country and bound test F-statistics generated respectively. It is evident from the results that there are long run equilibrium relationships between money supply growth and real GDP growth (real output growth) in 43 of the 50 African countries (apart from Cameroon, Sao Tome and Principe, Guines Bissau, Mali, Niger, Mauritania, Zambia while the test for Morocco is 'inconclusive'. By implications, the bounds test F-statistics of the countries exhibiting this long run relationships exceed the upper bound at 5% level of significance and so we cannot accept the null hypothesis of no cointegration (and long-run relationships)

between real output growth and money supply growth in these African countries. These results imply that for most of the African countries, the money supply growth affect output growth, thus portraying influence of money supply growth on output growth.

Table 2: Results of ARDL Bounds Tests of Superneutrality of Money
Real Output and Money Supply Growth:

East African Community (EAC)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Burundi	1, 0	12.15270	There is long run equilibrium relationship
Democratic Rep. of Congo	4, 2	5.641799	There is long run equilibrium relationship
Kenya	1, 2	11.49009	There is long run equilibrium relationship
Rwanda,	3, 2	16.80021	There is long run equilibrium relationship
Tanzania	3, 0	10.73936	There is long run equilibrium relationship
Uganda	1, 0	13.08092	There is long run equilibrium relationship

Economic Community of Central African States (ECCAS)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Cameroon	4, 0	2.743244	There is no long run equilibrium relationship
Central Republic of Africa	1, 0	22.18174	There is long run equilibrium relationship
Chad	1, 0	12.06149	There is long run equilibrium relationship
Republic of Congo	1, 0	4.871369	There is long run equilibrium relationship
Equatorial Guinea	1, 4	14.70999	There is long run equilibrium relationship
Gabon	1, 0	18.87898	There is long run equilibrium relationship
Sao Tome and Principe	2, 0	3.504652	There is no long run equilibrium relationship

Economic Community of West African States (ECOWAS)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Benin	1, 1	33.83956	There is long run equilibrium relationship
Burkina Faso	1, 4	37.83362	There is long run equilibrium relationship
Cabo Verde	1, 0	6.874384	There is long run equilibrium relationship
Cote d'Ivoire	1, 0	5.257674	There is long run equilibrium relationship
Gambia	1, 4	26.75190	There is long run equilibrium relationship
Ghana	1, 2	12.84364	There is long run equilibrium relationship
Guinea,	1, 3	10.30900	There is long run equilibrium relationship
Guinea-Bissau	4, 0	1.348283	There is no long run equilibrium relationship
Liberia	1, 0	6.765520	There is long run equilibrium relationship
Mali	4, 0	3.474256	There is no long run equilibrium relationship
Niger	3, 2	2.048182	There is no long run equilibrium relationship
Nigeria	1, 2	13.49092	There is long run equilibrium relationship
Senegal	2, 0	12.39208	There is long run equilibrium relationship
Sierra Leone	1, 0	5.831781	There is long run equilibrium relationship
Togo	2, 0	17.75199	There is long run equilibrium relationship

Arab Maghreb Union (AMU) and North African Countries in MENA

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Algeria	1, 3	12.23425	There is long run equilibrium relationship
Egypt	1, 0	7.016215	There is long run equilibrium relationship
Libya	4, 1	22.77395	There is long run equilibrium relationship
Mauritania	2, 0	2.619235	There is no long run equilibrium relationship
Morocco	4, 1	3.426439	Inconclusive
Tunisia	1, 0	17.56156	There is long run equilibrium relationship

South African Development Community (SADC)			
Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Angola	1, 3	11.16291	There is long run equilibrium relationship
Botswana	1, 0	19.72382	There is long run equilibrium relationship
Comoros	4, 3	14.61637	There is long run equilibrium relationship
Eswatini (Swaziland)	1, 1	10.06698	There is long run equilibrium relationship
Lesotho	3, 3	5.240868	There is long run equilibrium relationship
Madagascar	1, 0	24.83861	There is long run equilibrium relationship
Malawi	2, 0	6.796613	There is long run equilibrium relationship
Mauritius	2, 0	16.96678	There is long run equilibrium relationship
Mozambique	3, 4	12.80773	There is long run equilibrium relationship
Namibia	1, 4	7.159385	There is long run equilibrium relationship
Seychelles	2, 3	15.98434	There is long run equilibrium relationship
South Africa	1, 0	20.16497	There is long run equilibrium relationship
Zambia	3, 0	0.776030	There is no long run equilibrium relationship
Zimbabwe.	1, 0	17.34129	There is long run equilibrium relationship
Other African Countries			
Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Djibouti	1, 0	15.23054	There is long run equilibrium relationship
Ethiopia	4, 0	5.636858	There is long run equilibrium relationship

Source: Author's Estimation and EViews 12 Output

Table 3 below reflects the long run cointegration coefficients as well as the short run cointegration coefficients tested at 5% level of significance for the assessment of money superneutrality within the context of the influence of money supply growth on real output growth on inflation rates in the 50 African economies.

Table 3: Coefficients of Long Run Relationship and Error Correction Regression in the ARDL Bounds Tests of Superneutrality of Money

Dependent Variable: Real Output:

East African Community (EAC)		
Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Burundi	0.1122*	-0.6355*
Democratic Rep. of Congo	0.0898*	-0.8916*
Kenya	-0.1289	-0.7381*
Rwanda,	0.8550*	-0.0760*
Tanzania	-0.0356	-0.4633*
Uganda	-0.024	-0.8405*
Economic Community of Central African States (ECCAS)		
Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Cameroon	0.0205	-0.6157*
Central Republic of Africa	0.0546	-1.0486
Chad	-0.0144	-0.7015*
Republic of Congo	0.0738	-0.4103*
Equatorial Guinea	0.3403*	-0.9927*
Gabon	0.1269*	-0.9012*
Sao Tome and Principe	-0.0369	-0.5030*
Economic Community of West African States (ECOWAS)		
Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Benin	0.0731*	-1.2731*
Burkina Faso	0.3935*	-1.2926*
Cabo Verde	0.0860	-0.5258*

Cote d'Ivoire	0.0488	-0.5774*
Gambia	-0.0708	-1.3017*
Ghana	-0.0915	-0.6815*
Guinea	-0.0614	-0.7389*
Guinea-Bissau	0.0299	-0.3542
Liberia	0.0053	-0.5410*
Mali	0.4851	-0.6032*
Niger	0.1050	-0.5854*
Nigeria	0.1576*	-0.6413*
Senegal	0.0114	-1.0667
Sierra Leone	0.0094	-0.4622*
Togo	0.3323*	-0.6571*

Arab Maghreb Union (AMU) and North African Countries in MENA

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Algeria	0.1465*	-0.7671*
Egypt	0.0508	-0.5121*
Libya	0.2002*	-3.5781*
Mauritania	-0.0302	-0.3738*
Morocco	0.3065*	-0.6912*
Tunisia	0.0275	-0.9598*

South African Development Community (SADC)

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Angola	-0.0184	-0.8915*
Botswana	0.0206	-1.0268*
Comoros	0.0458	-2.3386*
Eswatini (Swaziland)	0.0653	-0.6824*
Lesotho	0.4719*	-0.7012*
Madagascar	0.0476	-1.2428*
Malawi	0.1063*	-0.7721*
Mauritius	0.0302	-1.3398*
Mozambique	0.2453*	-0.7472*
Namibia	0.1724*	-0.6530*
Seychelles	-0.3744*	-0.9016*
South Africa	0.1245*	-0.9380*
Zambia	-0.1403	-0.0700
Zimbabwe.	-0.0153	-1.0108*

Other African Countries

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Short Run Coefficient)*
Djibouti	0.1310*	-1.0540*
Ethiopia	0.3311*	-1.5957*

Source: Author's Estimation and EViews 12 Output

From the estimation results in Table 3 above, for the long run coefficients of money supply growth, 15 countries' results are significant at 5% level of significance. Kenya, Tanzania, Uganda, Chad, Sao Tome and Principe, The Gambia, Ghana, Guinea, Mauritania, Angola, Seychelles, Zambia and Zimbabwe exhibiting negative coefficients which are not statistically significant at 5%, depicting inverse relationships between real GDP growth and money supply growth in these countries. All the coefficients of the short run error correction model coefficients are negative and statistically significant at 5% level of significance (except for Guinea Bissau, Senegal and Zambia). Usually, the short run

coefficient should be negative and should be more than 1; but the output yielded by Central Republic of Africa, Benin, Burkina Fasi, The Gambia, Senegal, Libya, Botswana, Madagascar, Mauritius, Zimbabwe, Djibouti and Ethiopia are more than 1. This is a coefficient that indicates the speed of adjustment from short run to the long run in case there is any disequilibrium in the system. Data set for these countries and other factors could be investigated further in order to determine the reason behind this.

Post-estimation diagnostic tests were performed for the ARDL estimation of the relationships between real GDP growth rates and money supply growth in Africa. The results of the tests for normality, serial correlation and heteroscedasticity are as displayed in Table 4 below:

Table 4: Results of Post ARDL -estimation Diagnostic Tests of Monetary Superneutrality

Dependent Variable: Real Output Growth:

East African Community (EAC)			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Burundi	0.8934 (0.64)	0.0755 (0.93)	1.6737 (0.20)
Democratic Rep. of Congo	3.0723 (0.21)	0.1094 (090)	0.4470 (0.86)
Kenya	0.4345 (0.80)	0.4252 (0.66)	0.1840 (0.94)
Rwanda,	333.5437 (0.00)	0.3198 (0.70)	0.9025 (0.50)
Tanzania	1.5966 (0.45)	3.7511 (0.03)	0.7595(0.56)
Uganda	13.5953 (0.00)	3.1680 (0.05)	0.5013 (0.61)

Economic Community of Central African States (ECCAS)			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Cameroon	2.0399 (0.36)	1.2628 (0.30)	0.4841 (0.78)
Central Republic of Africa	723.4224 (0.00)	0.9906 (0.38)	0.1281 (0.88)
Chad	71.4033 (0.00)	0.5963 (0.56)	1.4692 (0.24)
Republic of Congo	2.3551 (0.31)	0.5230 (0.57)	0.3689 (0.69)
Equatorial Guinea	2.5882 (0.27)	0.1972 (0.82)	1.6208 (0.17)
Gabon	10.4779 (0.00)	0.4863 (0.62)	5.9417 (0.00)
Sao Tome and Principe	3.7037 (0.16)	0.6708 (0.52)	1.1361 (0.36)

Economic Community of West African States (ECOWAS)			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Benin	1.6679 (0.43)	0.2030 (0.82)	1.5310 (0.22)
Burkina Faso	1.3747 (0.50)	0.9666 (0.40)	0.9884 (0.45)
Cabo Verde	61.2553 (0.00)	2.1772 (0.13)	0.8324 (0.44)
Cote d'Ivoire	7.4554(0.02)	0.7857 (0.46)	1.3504 (0.27)
Gambia	0.1389 (0.93)	2.4323 (0.11)	1.6738 (0.17)
Ghana	6.2530 (0.04)	0.4804 (0.62)	3.6208 (0.01)
Guinea	0.6252 (0.73)	6.9090 (0.00)	0.6185 (0.69)
Guinea-Bissau	205.8706 (0.00)	1.2646 (0.23)	0.1263 (0.98)
Liberia	401. 7871 (0.00)	0.1972 (0.82)	0.1273 (0.88)
Mali	35.2137 (0.00)	4.4551 (0.02)	0.9795 (0.44)
Niger	51.7489 (0.00)	3.4245 (0.04)	1.2925 (0.29)
Nigeria	2.8514 (0.24)	0.1721 (0.84)	0.6449 (0.63)
Senegal	1.6720 (0.43)	5.1521 (0.01)	1.1774 (0.33)
Sierra Leone	3.6722 (0.16)	0.5507 (0.58)	1.9261 (0.16)
Togo	5.3205 (0.07)	0.2525 (0.78)	3.0608 (0.040)

Arab Maghreb Union (AMU) and North African Countries in MENA			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Algeria	4.0719 (0.13)	1.553 (0.22)	1.5355 (0.20)
Egypt	38.8619 (0.00)	2.5038 (0.09)	1.1211 (0.34)
Libya	18.6400 (0.00)	0.2206 (0.80)	0.6488 (0.69)
Mauritania	1.1805 (0.55)	0.1724 (0.84)	0.7966(0.50)
Morocco	18.2008 (0.00)	0.9004 (0.42)	0.6108 (0.72)
Tunisia	57.0468 (0.00)	0.8212 (0.45)	0.1176 (0.89)
South African Development Community (SADC)			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Angola	1.0834 (0.58)	0.7837 (0.47)	1.0614 (0.42)
Botswana	58.2137 (0.00)	0.6073 (0.55)	0.3330 (0.80)
Comoros	0.9731 (0.61)	2.2457 (0.13)	1.1633 (0.36)
Eswatini (Swaziland)	177.0575 (0.00)	0.0728 (0.93)	0.7063 (0.55)
Lesotho	4.2368 (0.12)	0.0776 (0.92)	0.5570 (0.78)
Madagascar	14.1909 (0.00)	1.5604 (0.22)	2.1031 (0.14)
Malawi	9.3655 (0.01)	0.1774 (0.84)	5.9781 (0.00)
Mauritius	515.7270 (0.00)	2.2969 (0.12)	0.5228 (0.72)
Mozambique	3.211 (0.20)	0.1465 (0.86)	1.8005 (0.12)
Namibia	4.0489 (0.13)	0.6914 (0.51)	0.6914 (0.51)
Seychelles	4.3309 (0.11)	1.3638 (0.27)	0.3476 (0.91)
South Africa	16.9049 (0.00)	0.0260 (0.97)	1.3533 (0.27)
Zambia	2.3940 (0.30)	1.7316 (0.20)	4.2203 (0.00)
Zimbabwe.	509.4709 (0.00)	0.1684 (0.85)	0.1691 (0.92)

Other African Countries			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Djibouti	0.0641 (0.96)	1.1037 (0.34)	0.3927 (0.68)
Ethiopia	131.0826 (0.00)	0.4768 (0.63)	0.058 (0.99)

Source: Author's Estimation and EViews 12 Output

For the 50 African countries assessed, the tests for normality (Jarque-Bera tests) to check the goodness of fit of the data sets if they are normally distributed yielded positive figures but with mixed results of the probability values showing many of the results greater than the 5% significance level which implies that the error terms suffer problems of normality. Apart from data for Tanzania, Uganda, Guinea, Mali, Senegal and Egypt that reflect autocorrelation, there are no issue of serial correction for all other 44 countries as yielded by the Breusch-Godfrey Serial Correlation LM Tests conducted as these countries' autocorrelation tests p-value are greater than the 5% level of significance. The null hypothesis of Breusch-Pagan-Godfrey heteroskedasticity test states that no heteroskedasticity exist in the ARDL model estimations. The results of the heteroskedasticity diagnostic tests in Table 4 above reveal that model estimations for most of the African countries (apart from Gabon, Ghana, Malawi and Zambia) produced probability values that are greater than 5% significance level with the implications that

we cannot reject the null hypothesis of no heteroscedasticity the ARDL model estimations for these countries and therefore conclude that their model have equal variance.

Table 5: Results of ARDL Bounds Tests of Superneutrality of Money
(Inflation and Money Supply Growth)

East African Community (EAC)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Burundi	1,1	15.95128	There is long run equilibrium relationship
Democratic Rep. of Congo	1, 1	13.65259	There is long run equilibrium relationship
Kenya	4, 1	6.657433	There is long run equilibrium relationship
Rwanda,	1, 1	10.60714	There is long run equilibrium relationship
Tanzania	1, 2	18.49049	There is long run equilibrium relationship
Uganda	1, 3	14.79043	There is long run equilibrium relationship

Economic Community of Central African States (ECCAS)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Cameroon	1, 0	15.51639	There is long run equilibrium relationship
Central Republic of Africa	3, 1	16.96563	There is long run equilibrium relationship
Chad	2, 0	25.53238	There is long run equilibrium relationship
Republic of Congo	3, 0	32.48583	There is long run equilibrium relationship
Equatorial Guinea	2, 0	21.58090	There is long run equilibrium relationship
Gabon	4, 2	8.164756	There is long run equilibrium relationship
Sao Tome and Principe	1, 0	6.804271	There is long run equilibrium relationship

Economic Community of West African States (ECOWAS)

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Benin	1, 0	22.24638	There is long run equilibrium relationship
Burkina Faso	1, 0	13.02178	There is long run equilibrium relationship
Cabo Verde	1, 0	50.48269	There is long run equilibrium relationship
Cote d'Ivoire	2, 0	7.524420	There is long run equilibrium relationship
Gambia	1, 4	16.80998	There is long run equilibrium relationship
Ghana	1, 0	23.36150	There is long run equilibrium relationship
Guinea,	4, 0	22.30973	There is long run equilibrium relationship
Guinea-Bissau	3, 3	10.80703	There is long run equilibrium relationship
Liberia	1, 0	10.63953	There is long run equilibrium relationship
Mali	1, 0	11.78341	There is long run equilibrium relationship
Niger	2, 0	15.86971	There is long run equilibrium relationship
Nigeria	1, 0	23.29456	There is long run equilibrium relationship
Senegal	1, 0	19.19518	There is long run equilibrium relationship
Sierra Leone	1, 3	15.01444	There is long run equilibrium relationship
Togo	1, 0	45.58096	There is long run equilibrium relationship

Arab Maghreb Union (AMU) and North African Countries in MENA

Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Algeria	1, 1	7.128445	There is long run equilibrium relationship
Egypt	1, 0	7.630500	There is long run equilibrium relationship
Libya	2, 0	0.541139	There is no long run equilibrium relationship
Mauritania	1, 0	22.82455	There is long run equilibrium relationship
Morocco	1, 0	52.24365	There is long run equilibrium relationship
Tunisia	1, 0	9.103198	There is long run equilibrium relationship

South African Development Community (SADC)			
Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Angola	1, 4	18.70182	There is long run equilibrium relationship
Botswana	3, 0	10.93979	There is long run equilibrium relationship
Comoros	3, 2	12.13559	There is long run equilibrium relationship
Eswatini (Swaziland)	2, 0	10.66098	There is long run equilibrium relationship
Lesotho	1, 2	30.61043	There is long run equilibrium relationship
Madagascar	2, 0	9.917751	There is long run equilibrium relationship
Malawi	1, 2	17.90239	There is long run equilibrium relationship
Mauritius	1, 0	22.64624	There is long run equilibrium relationship
Mozambique	1, 1	6.650261	There is long run equilibrium relationship
Namibia	3, 0	16.80581	There is long run equilibrium relationship
Seychelles	1, 4	13.24048	There is long run equilibrium relationship
South Africa	2, 3	1.195320	There is long run equilibrium relationship
Zambia	4, 0	8.541907	There is long run equilibrium relationship
Zimbabwe.	3, 0	34.51917	There is long run equilibrium relationship
Other African Countries			
Country	*Selected ARDL Model*	*Bounds Test F-statistics*	*Implications (at 5% Level of Significance)*
Djibouti	1, 0	17.28269	There is long run equilibrium relationship
Ethiopia	1, 0	8.727168	There is long run equilibrium relationship

Source: Author's Estimation and EViews 12 Output

The results of the ARDL bounds tests of money superneutrality test of cointegration relationship between Inflation rates and money supply growth rates in the African economies in the 50 African economies assessed are exhibited in Table 5 above. The results show the automatically selected ARDL model ran for each country and bound test F-statistics generated respectively. It is evident from the results that there are long run equilibrium relationships between money supply growth and inflation rates in 49 of the 50 African countries (apart from Libya). By implications, the bounds test F-statistics of the countries exhibiting this long run relationships exceed the upper bound at 5% level of significance and so we cannot accept the null hypothesis of no cointegration (and long-run relationships) between inflation rates and money supply growth rates in these African countries. These results imply that for most of the African countries, the money supply growth affect inflation rates and changes bin the price levels thus portraying influence of money supply growth on inflation rates.

Table 6 below reflects the long run cointegration coefficient as well as the short run cointegration coefficients tested at 5% level of significance for the assessment of money superneutrality within the context of the influence of money supply growth on inflation rates in the 50 African economies.

Table 6: Coefficients of Long Run Relationship and Error Correction Regression in the ARDL Bounds Tests of Superneutrality of Money

Dependent Variable: ***Inflation:***

East African Community (EAC)

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Burundi	0.5783*	-0.7863*
Democratic Rep. of Congo	12.8026	-0.8603*
Kenya	0.5900*	-0.7706*
Rwanda	0.0112	-0.6836*
Tanzania	-0.6906*	-1.1568*
Uganda	1.0146*	-0.8349*

Economic Community of Central African States (ECCAS)

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Cameroon	-0.0257	-0.9157*
Central Republic of Africa	0.4740*	-0.8000*
Chad	0.2948*	-1.3360*
Republic of Congo	0.4614*	-1.4381*
Equatorial Guinea	0.1815*	-1.1835*
Gabon	0.2659	-1.3321*
Sao Tome and Principe	0.2272	-0.4714*

Economic Community of West African States (ECOWAS)

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Benin	0.3401*	-1.0118*
Burkina Faso	-0.0418	-0.7634*
Cabo Verde	0.2130*	-1.2909*
Cote d'Ivoire	0.5783*	-0.5163*
Gambia	0.7556*	-0.9961*
Ghana	0.0087	-1.1146*
Guinea	0.6464*	-1.1774*
Guinea-Bissau	0.3169*	-0.8731*
Liberia	-0.0070	-0.7501*
Mali	0.2574*	-0.7574*
Niger	-0.0910	-1.2688*
Nigeria	-0.0764	-1.0940*
Senegal	0.3200*	-0.7351*
Sierra Leone	1.0906*	-0.8679*
Togo	0.2471*	-1.1392*

Arab Maghreb Union (AMU) and North African Countries in MENA

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Algeria	-0.1378	-0.4978*
Egypt	0.0437	-0.7519*
Libya	-0.2245	-0.2702
Mauritania	-0.0567	-1.0176*
Morocco	-0.0783	-0.9030*
Tunisia	0.0414	-0.5679*

South African Development Community (SADC)

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Angola	0.7425*	-1.0288*
Botswana	0.0227	-1.1472*
Comoros	0.0293	-1.4791*
Eswatini (Swaziland)	0.1850	-0.8973*
Lesotho	-0.0097	-1.1897*
Madagascar	0.0647	-0.7337*
Malawi	0.8358*	-0.9274*

Mauritius	-0.0090	-0.8158*
Mozambique	1.1161*	-0.3712*
Namibia	0.0478	-1.4647*
Seychelles	-0.3440	-0.7399*
South Africa	0.3556	-0.0824
Zambia	0.3192	-0.4352*
Zimbabwe.	0.4688*	-1.5035*

Other African Countries

Country	*Money Supply Growth (Long Run Coefficient)*	*Error Correction Model (Cointegration Coefficient)*
Djibouti	-0.0014	-1.0033*
Ethiopia	0.4104*	-0.8671*

Source: Author's Estimation and EViews 12 Output

From the estimation results in Table 3 above, for the long run coefficients of money supply growth, 23 countries' results are significant at 5% level of significance. Tanzania, Cameroon, Burkina Faso, Liberia, Niger, Nigeria, Algeria, Libya, Mauritania, Morocco, Lesotho, Mauritius, Seychelles and Djibouti exhibiting negative coefficients, all of which are not statistically significant at 5% (except for Tanzania), depicting inverse relationships between real GDP growth and money supply growth in these countries. All the coefficients of the short run error correction model coefficients are negative and statistically significant at 5% level of significance (except for Libya and South Africa). Usually, the short run coefficient should be negative and should be more than 1; but the output yielded by Tanzania, Chad, Republic of Congo, Equatorial Guinea, Gabon, Benin, Cabo Verde, Ghana, Guinea, Niger, Nigeria, Togo, Mauritania, Angola, Botswana, Comoros, Lesotho, Namibia, Zimbabwe and Djibouti are more than 1. This is a coefficient that indicates the speed of adjustment from short run to the long run in case there is any disequilibrium in the system. Again, the data set for these countries and other factors could be investigated further in order to determine the reason behind this.

Post-estimation diagnostic tests were performed for the ARDL estimation of the relationships between inflation and money supply growth in Africa. The results of the tests for normality, serial correlation and heteroscedasticity are as displayed in Table 7 below:

Table 7: Results of ARDL Post-estimation Diagnostic Tests of Monetary Superneutrality

Dependent Variable: ***Inflation:***

East African Community (EAC)

Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Burundi	1.9792 (0.37)	0.543871 (0.58)	0.9259 (0.44)
Democratic Rep. of Congo	974.5572 (0.00)	0.3475 (0.71)	1.3838 (0.26)
Kenya	38.2222 (0.00)	3.5144 (0.04)	1.4899 (0.21)
Rwanda	10.9093 (0.00)	1.0582 (0.36)	12.7366 (0.00)
Tanzania	34.1677 (0.00)	0.0792 (0.92)	4.3355 (0.00)
Uganda	86.7901 (0.00)	1.3746 (0.27)	0.8842 (0.50)

Economic Community of Central African States (ECCAS)

Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Cameroon	897. 7391 (0.00)	0.3923 (0.68)	0.8718 (0.43)
Central Republic of Africa	99.3688 (0.00)	0.8037 (0.46)	1.5005 (0.21)
Chad	4.2989 (0.12)	0.2267 (0.80)	0.6385 (0.60)
Republic of Congo	1.0807 (0.58)	0.3461 (0.71)	0.3452 (0.84)
Equatorial Guinea	1.3622 (0.51)	1.5563 (0.19)	0.7641 (0.52)
Gabon	0.5691 (0.75)	0.13897 (0.87)	0.9655 (0.47)
Sao Tome and Principe	8.0989 (0.01)	0.4515 (0.64)	2.0333 (0.14)

Economic Community of West African States (ECOWAS)

Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Benin	133.5828 (0.00)	0.1659 (085)	4.8279 (0.01)
Burkina Faso	7.0326 (0.03)	1.2669 (0.29)	0.5072 (061)
Cabo Verde	4.2294 (0.12)	0.6125 (0.55)	47.4021 (0.00)
Cote d'Ivoire	82.6970 (0.00)	0.2372 (0.79)	8.4651 (0.00)
Gambia	289.0555 (0.00)	0.4906 (0.62)	0.1018 (0.99)
Ghana	97.0268 (0.00)	0.9300 (0.40)	1.2617 (0.30)
Guinea,	41.4557 (0.00)	0.4254 (0.66)	4.5623 (0.00)
Guinea-Bissau	101.1572 (0.00)	1.4432 (0.25)	0.8675 (0.54)
Liberia	2.8452 (0.24)	0.4611 (0.63)	0.3392 (0.71)
Mali	53.0669 (0.00)	0.9904 (0.38)	5.0359 (0.01)
Niger	94.0127 (0.00)	0.5769 (0.56)	1.4507 (0.24)
Nigeria	738.5133 (0.00)	70.7815 (0.00)	2.5041 (0.07)
Senegal	176.9902 (0.00)	0.2846 (0.75)	8.5732 (0.00)
Sierra Leone	17.1099 (0.00)	0.4539 (0.64)	2.9901 (0.02)
Togo	27.7308 (0.00)	0.1790 (0.84)	4.3280 (0.01)

Arab Maghreb Union (AMU) and North African Countries in MENA

Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Algeria	7.8280 (0.02)	0.3606 (0.70)	1.1027 (0.36)
Egypt	17.0951 (0.00)	0.0991 (0.90)	2.6408 (0.08)
Libya	233.2959 (0.00)	0.2023 (0.81)	01.8183 (0.17)
Mauritania	110.0951 (0.00)	2.9997 (0.06)	0.6093 (0.55)
Morocco	7.9643 (0.02)	0.6231 (0.54)	0.3325 (0.80)
Tunisia	17.2249 (0.00)	1.5752 (0.22)	1.512 (0.23)

South African Development Community (SADC)

Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Angola	0.2716 (0.87)	0.9030 (0.42)	1.1365 (0.39)
Botswana	2.2236 (0.33)	1.5973 (0.21)	0.9657 (0.45)
Comoros	12.2191 (0.00)	0.8273 (0.45)	1.7261 (0.14)
Eswatini (Swaziland)	4.8774 (0.09)	0.3214 (0.73)	3.4432 (0.02)
Lesotho	0.1199 (0.94)	0.5657 (0.57)	1.0031 (0.43)
Madagascar	22.2994 (0.00)	3.1176 (0.06)	2.6605 (0.05)
Malawi	365.7554 (0.00)	0.1523 (0.85)	0.7762 (0.55)
Mauritius	14.2007 (0.00)	1.3500 (0.27)	0.7250 (0.54)
Mozambique	677.3786 (0.00)	1.4060 (0.26)	1.3795 (0.27)
Namibia	2.3260 (0.31)	0.7913 (0.46)	0.4021 (0.84)
Seychelles	3.9372 (0.14)	0.8568 (0.43)	3.6151 (0.01)
South Africa	0.7417 (0.69)	1.1626 (0.32)	2.0621 (0.09)
Zambia	7.4292 (0.02)	4.5074 (0.02)	3.316 (0.01)
Zimbabwe.	21.0306 (0.00)	0.0322 (0.97)	2.1271 (0.10)

Other African Countries			
Country	*Normality Test JB Statistics (p-value)*	*Breusch-Godfrey Serial Correlation LM Test F-Statistics (p-value)*	*Heteroskedasticity Test Breusch-Pagan-Godfrey F-Statistics (p-value)*
Djibouti	63.1089 (0.00)	0.7709 (0.47)	0.8876 (0.46)
Ethiopia	2.7642 (0.25)	0.0439 (0.96)	0.03767 (0.69)

Source: Author's Estimation and EViews 12 Output

For the 50 African countries assessed, the tests for normality (Jarque-Bera tests) to check the goodness of fit of the data sets if they are normally distributed yielded positive figures but with mixed results of the probability values showing many of the results greater than the 5% significance level which implies that the error terms suffer problems of normality. Apart from Kenya, Nigeria, Mauritania and Zambia that reflect autocorrelation, there are no issue of serial correction for all other 44 countries as yielded by the Breusch-Godfrey Serial Correlation LM Tests conducted as these countries' autocorrelation tests p-value are greater than the 5% level of significance. The null hypothesis of Breusch-Pagan-Godfrey heteroskedasticity test states that no heteroskedasticity exist in the ARDL model estimations. The results of the heteroskedasticity diagnostic tests in Table 7 above reveal that model estimations for most of the African countries produced probability values that are greater than 5% significance level with the implications that we cannot reject the null hypothesis of no heteroscedasticity the ARDL model estimations for these countries and therefore conclude that their model have equal variance. However, the following countries' estimations reflect heteroscedasticity issues: Rwanda, Tanzania, Benin, Cabo Verde, Guines. Mali, Nigeria, Senegal, Sierra Leone, Togo, Egypt, Eswatini, Seychelles, South Africa and Zambia.

The plots of model selection criteria for the output growth/money supply growth ARDL estimated models and inflation/money supply estimated ARDL models are exhibited in Appendix 1 showing the least as the appropriate model in each case. The plots of the residual stability cumulative sums (CUSUMS) and the cumulative sums of square (CUSUMS SQ) of the deviation of the value from targets at 5% significance levels are also displayed in Appendix 2. These give information about the stability of the estimated coefficients of the models in the long-run @ 5%. The plots reveal parameter instability (or otherwise) in the ARDL model estimations performed. Varied patterns of stability and instability were displayed by these plots.

5. Conclusions:

Neutrality of money holds that the real economy is not affected by the level of the money supply level. Superneutrality of money as a property stronger than neutrality of money connotes that the rate of money supply growth has no effect on real variables. The hypothesis of money superneutrality is about what the long run relationship between money supply growth and growth in real output and changes in price levels and what these suggest for the use of monetary aggregates in the conduct of monetary policy. In this research work, the validity of the hypothesis of money superneutrality in the long run was evaluated across 50 African economies within five (5) monetary and economic blocs of Africa (EAC, ECCAS, ECOWAS, AMU/MENA, and SADC), including Djibouti and Ethiopia. The autoregressive distributed lag (ARDL) bound testing cointegration approach developed by Pesaran et al (2001) was employed as econometric tools to estimate the long run equilibrium relationship and short run relationships between money supply growth and real output growth as well as money supply growth and inflation rates within the economies of the 50 African countries under the study that spans over a 42-year period between 1980 and 2022. Findings and results generated from the ARDL estimation results produced evidence to suggest that money is not superneutral in across virtually all the economies of Africa evaluated, from both perspectives of the influence of money supply growth on real output and on inflation., this leading to the conclusion that money is relevant and influential within African economies.

Thus, this research study is significant as it has provided useful answers to the question on if money is relevant in manipulating African economies. Results generated from this research efforts have the future consequences for monetary integration economic blocs of Africa and the African monetary integration project.

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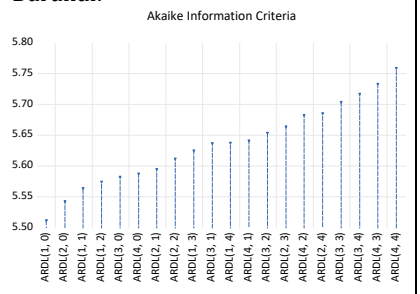
Appendix 1

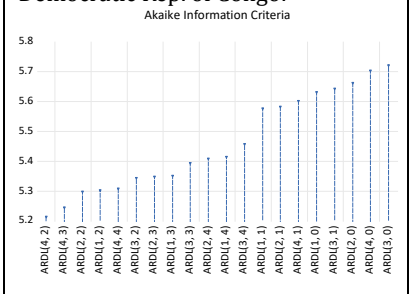
Figure1: Plots of Model Selection Criteria for Real Output Growth/Money Supply Growth ARDL Model

East African Community (EAC)

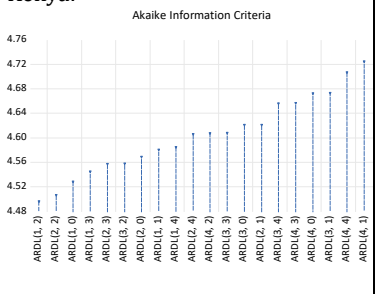
Burundi:



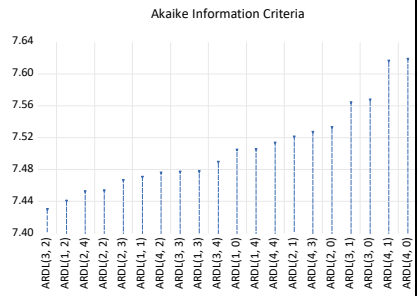
Democratic Rep. of Congo:



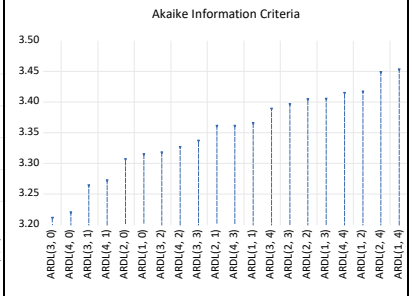
Kenya:



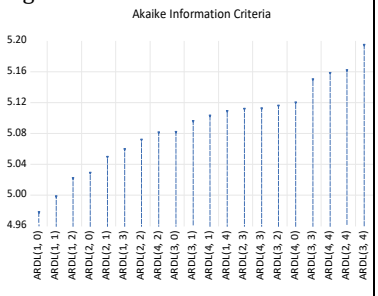
Rwanda:



Tanzania:

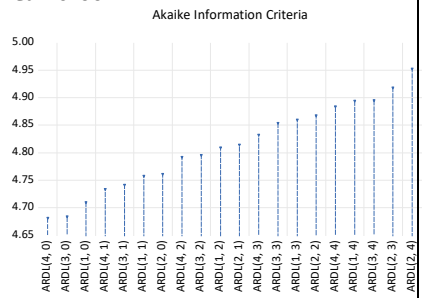


Uganda:

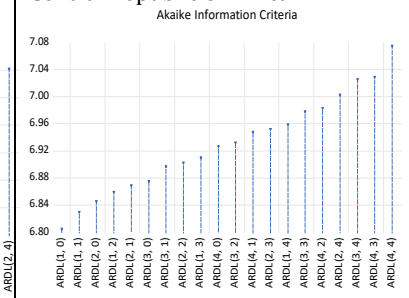


Economic Community of Central African States (ECCAS)

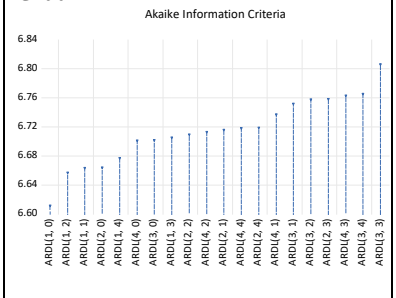
Cameroon:



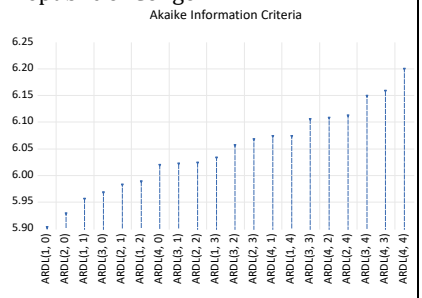
Central Republic of Africa:



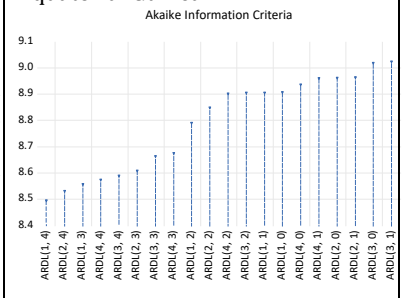
Chad:



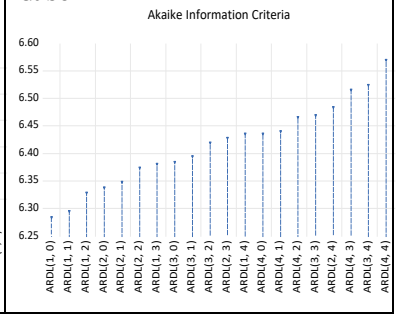
Republic of Congo:



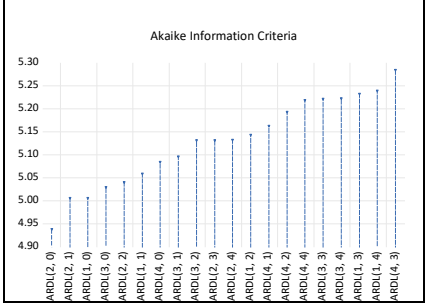
Equatorial Guinea:



Gabon:

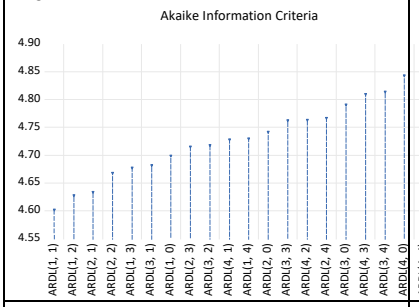


Sao Tome and Principe:

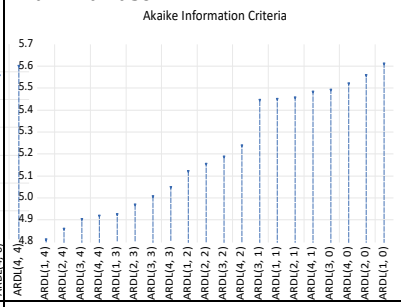


Economic Community of West African States (ECOWAS)

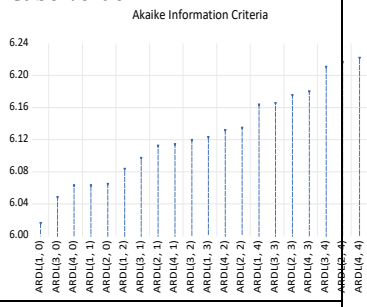
Benin:



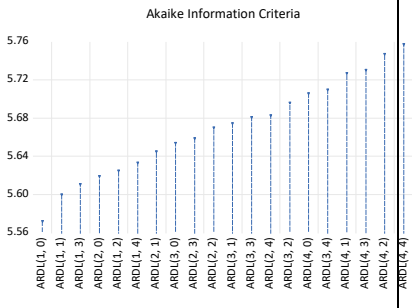
Burkina Faso:



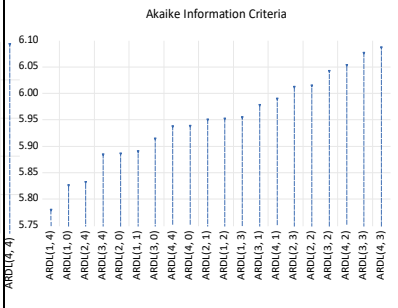
Cabo Verde:



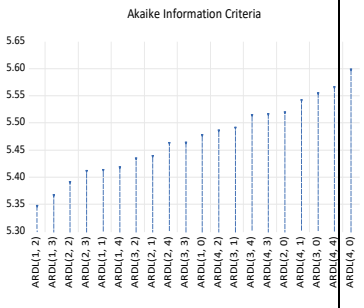
Cote d'Ivoire:



Gambia:



Ghana:



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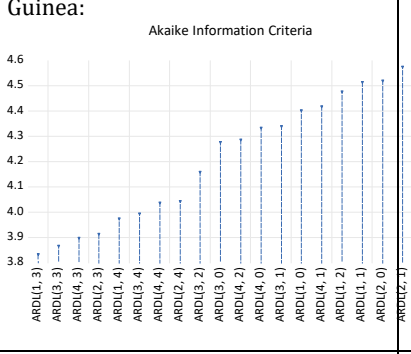
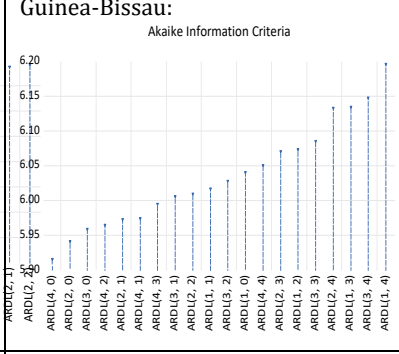
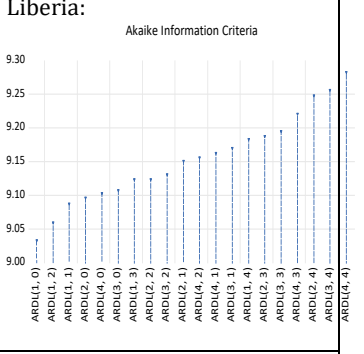


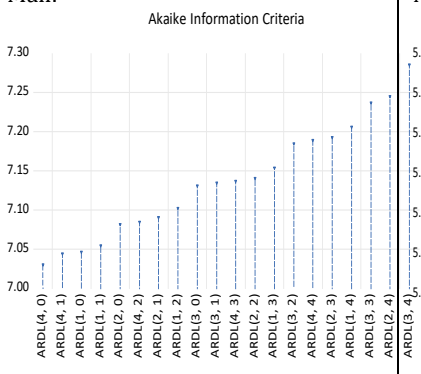
Guinea-Bissau:



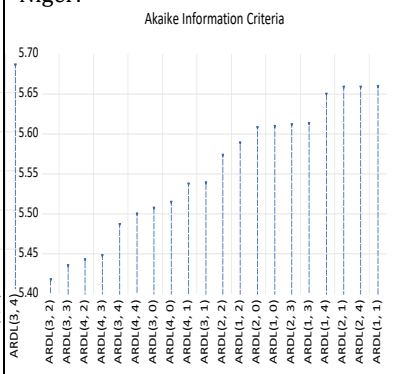
Liberia:



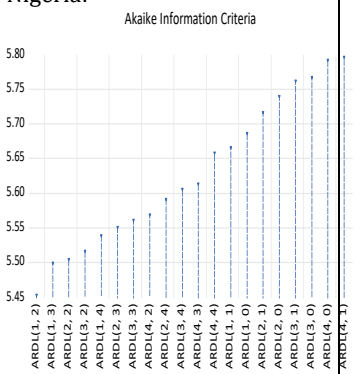
Mali:



Niger:



Nigeria:



Senegal:

Sierra Leone:

Togo:

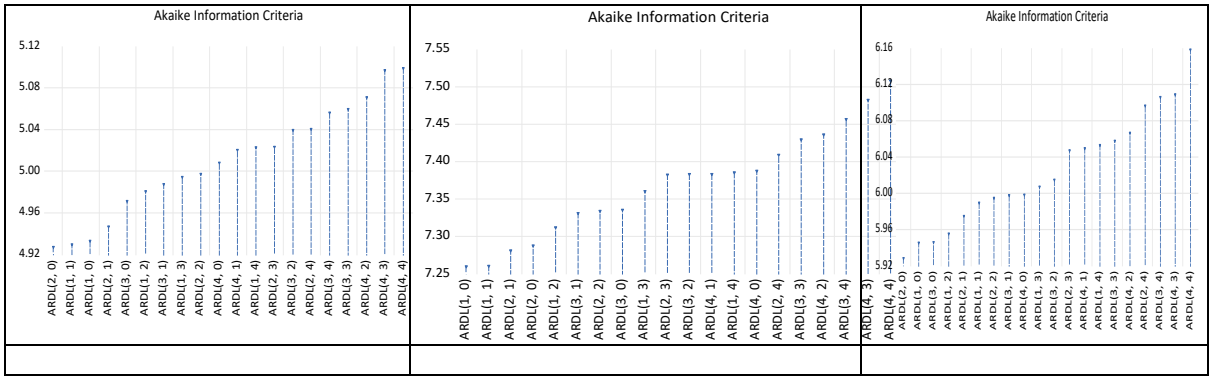
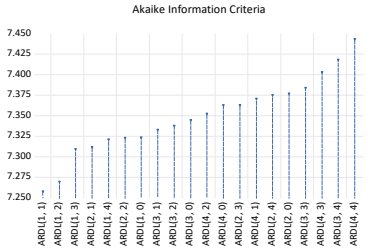


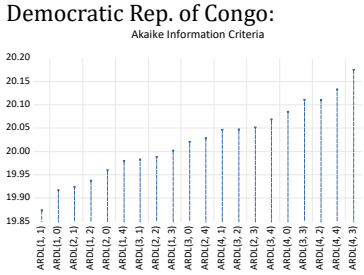
Figure2: Plots of Model Selection Criteria for Real Output Growth/Money Supply Growth ARDL Model

East African Community (EAC)

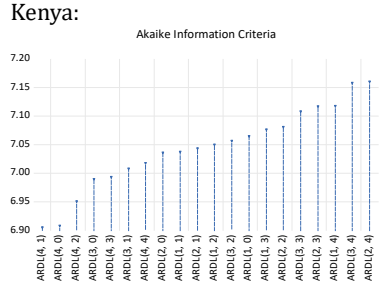
Burundi:



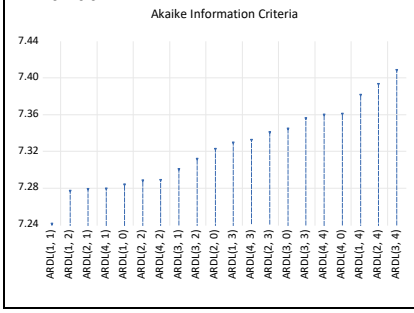
Democratic Rep. of Congo:



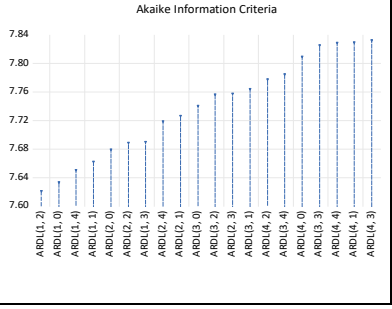
Kenya:



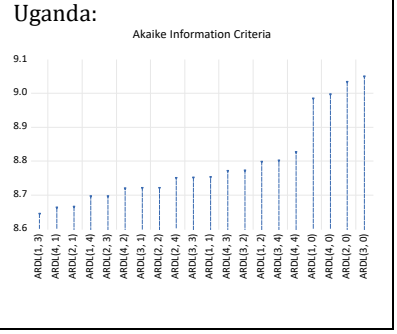
Rwanda:



Tanzania:

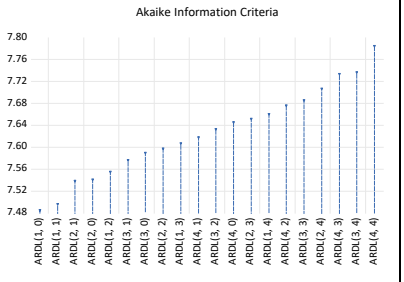


Uganda:

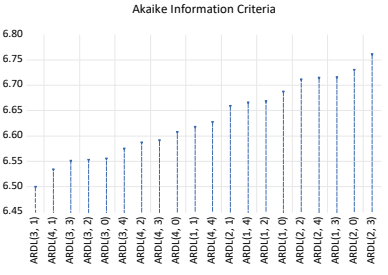


Economic Community of Central African States (ECCAS)

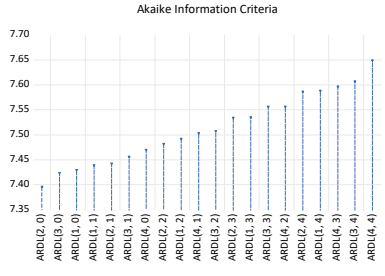
Cameroon:



Central Republic of Africa:



Chad:



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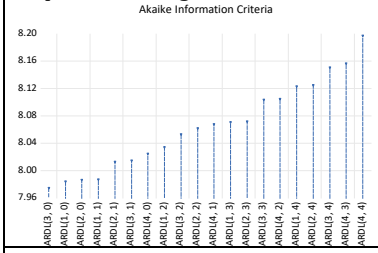

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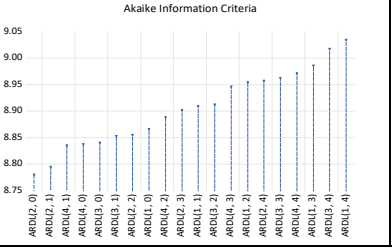

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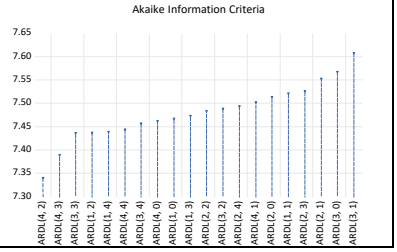
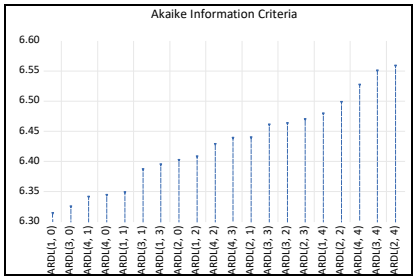
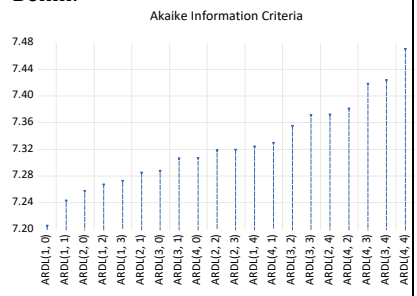
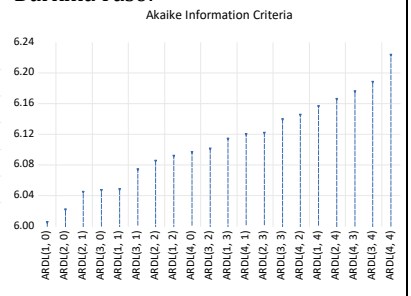
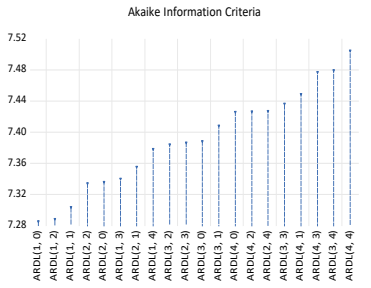
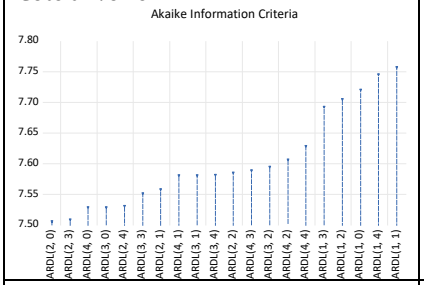
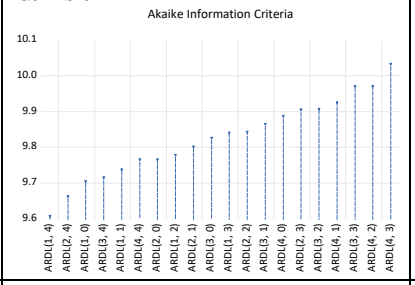
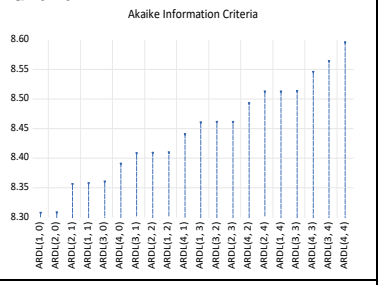
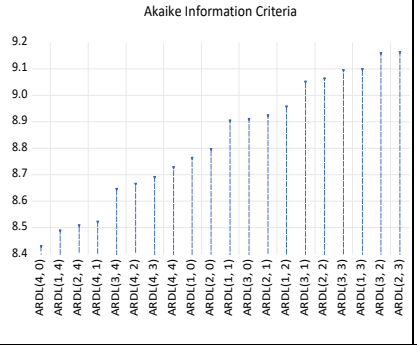
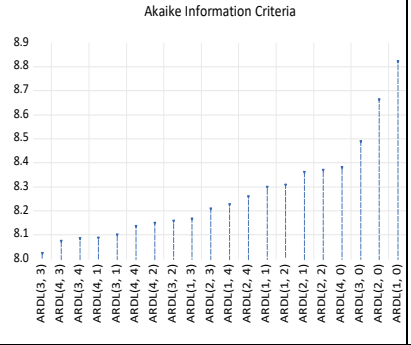
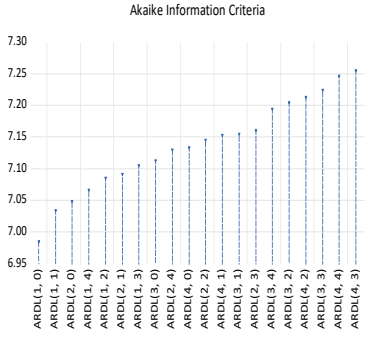
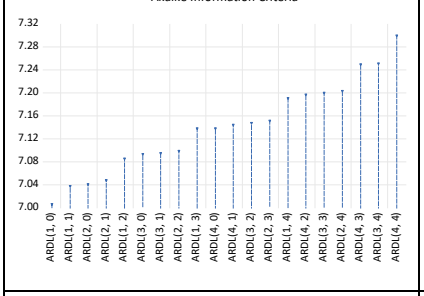
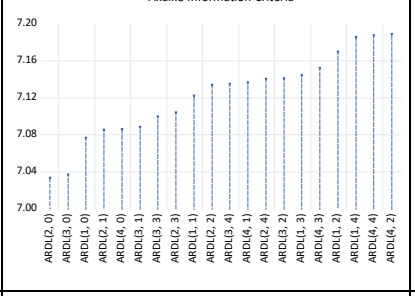
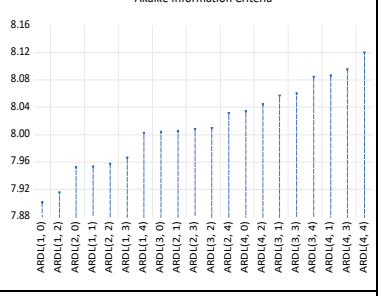
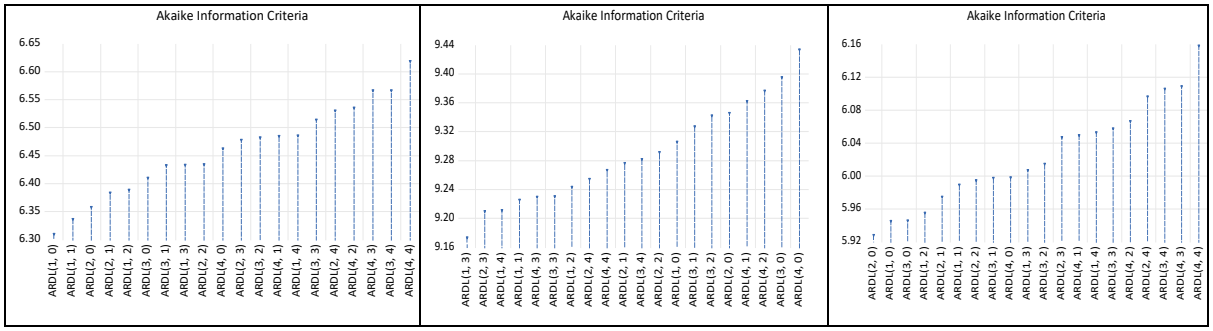


Sao Tome and Principe:



Economic Community of West African States (ECOWAS)		
Benin: 	Burkina Faso: 	Cabo Verde: 
Cote d'Ivoire: 	Gambia: 	Ghana: 
Guinea: 	Guinea-Bissau: 	Liberia: 
Mali: 	Niger: 	Nigeria: 
Senegal:	Sierra Leone:	Togo:


Akaike Information Criteria
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6.55
6.50
6.45
6.40
6.35
6.30
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ARDL(1, 1)
ARDL(2, 0)
ARDL(2, 1)
ARDL(1, 2)
ARDL(3, 0)
ARDL(3, 1)
ARDL(1, 3)
ARDL(2, 2)
ARDL(4, 0)
ARDL(2, 3)
ARDL(3, 2)
ARDL(4, 1)
ARDL(1, 4)
ARDL(3, 3)
ARDL(2, 4)
ARDL(4, 2)
ARDL(4, 3)
ARDL(3, 4)
ARDL(4, 4)
Akaike Information Criteria
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9.40
9.36
9.32
9.28
9.24
9.20
9.16
ARDL(1, 3)
ARDL(2, 3)
ARDL(1, 4)
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ARDL(3, 3)
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ARDL(3, 2)
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Akaike Information Criteria
6.16
6.12
6.08
6.04
6.00
5.96
5.92
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ARDL(1, 0)
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ARDL(1, 2)
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ARDL(1, 1)
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ARDL(1, 4)
ARDL(3, 3)
ARDL(4, 2)
ARDL(2, 4)
ARDL(3, 4)
ARDL(4, 3)
ARDL(4, 4)

Appendix 2

Figure3: CUSUM Parameter Stability Charts for Real Output Growth/Money Supply Growth ARDL Model

East African Community (EAC)

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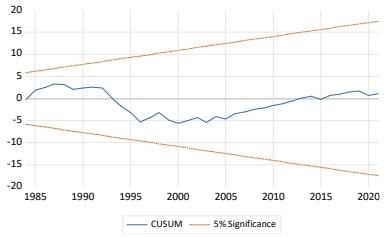
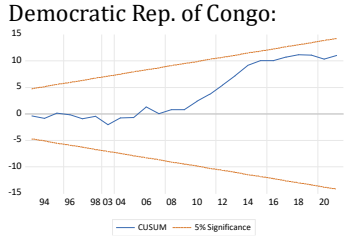
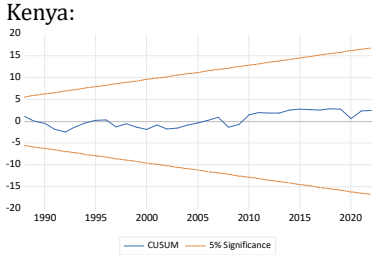


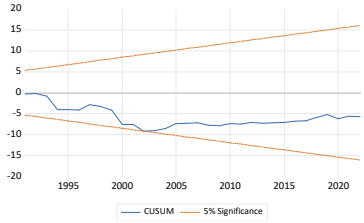
Democratic Rep. of Congo:



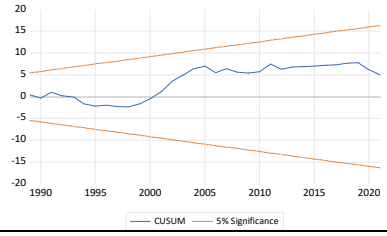
Kenya:



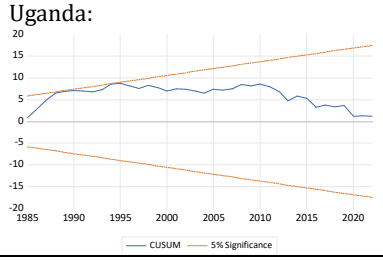
Rwanda:



Tanzania:

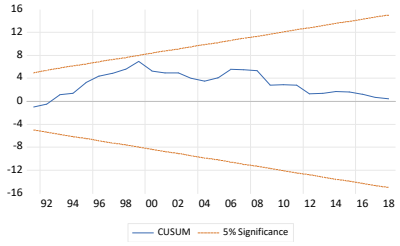


Uganda:

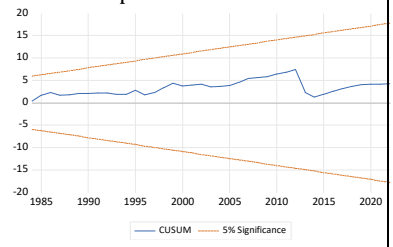


Economic Community of Central African States (ECCAS)

Cameroon:



Central Republic of Africa:



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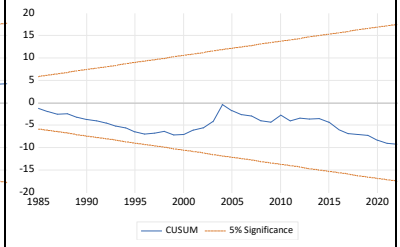
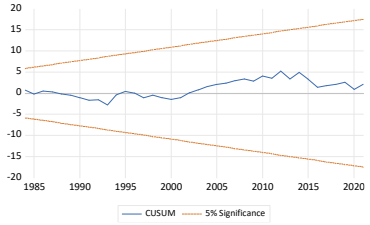
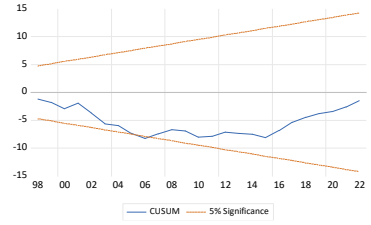


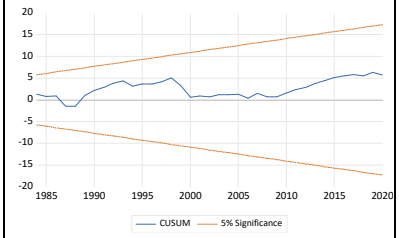
Republic of Congo:



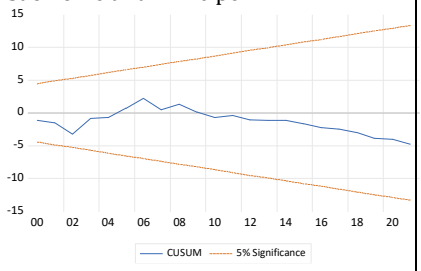
Equatorial Guinea:



Gabon:

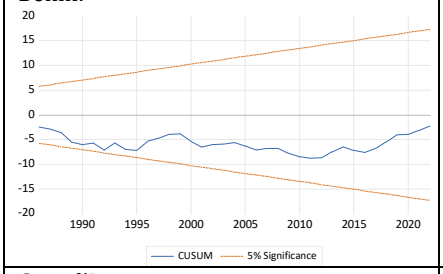


Sao Tome and Principe:

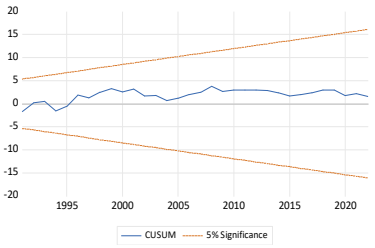


Economic Community of West African States (ECOWAS)

Benin:



Burkina Faso:



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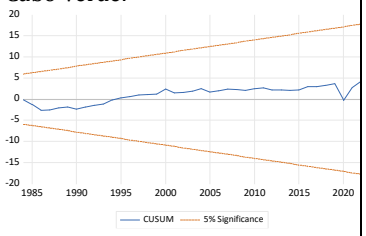
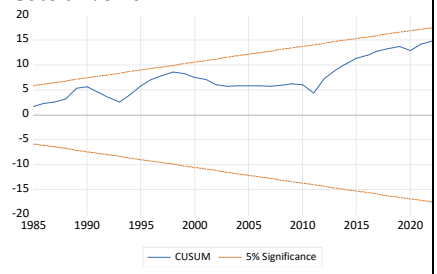
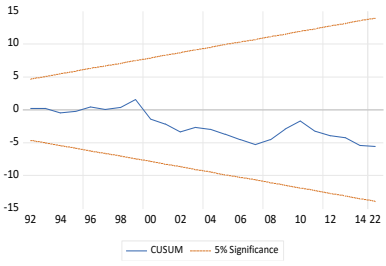


Cote d'Ivoire:



Gambia:



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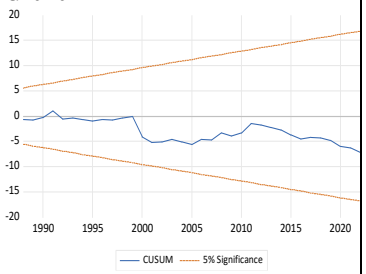

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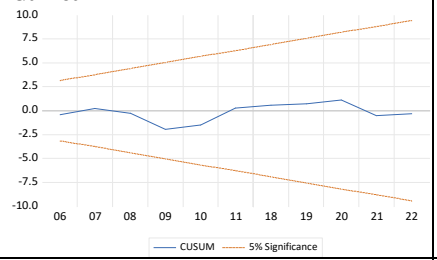
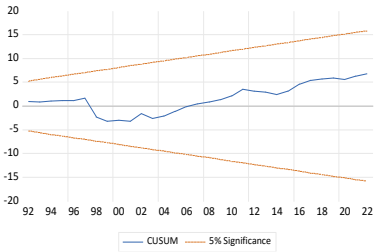


Guinea-Bissau:



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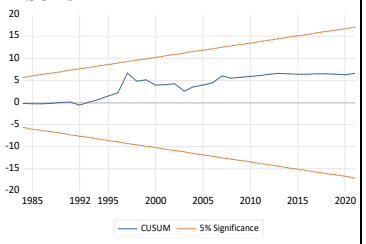

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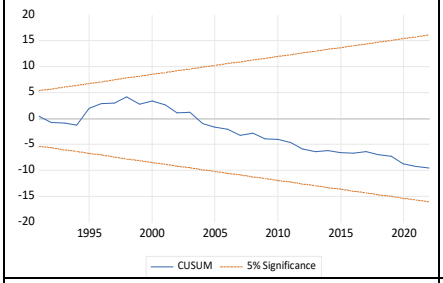

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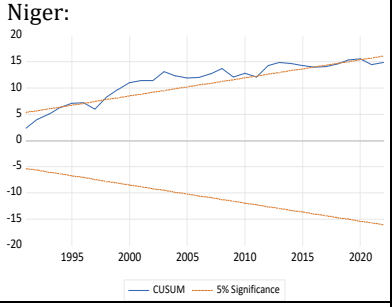
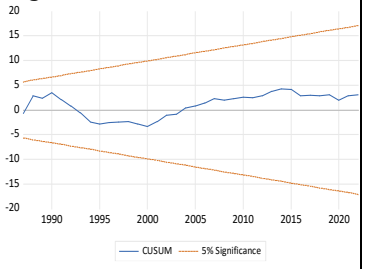
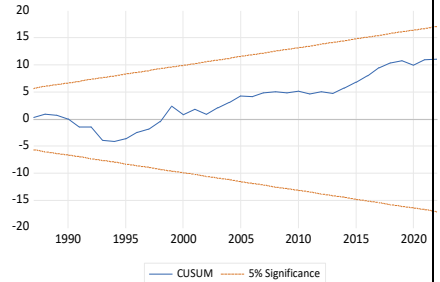


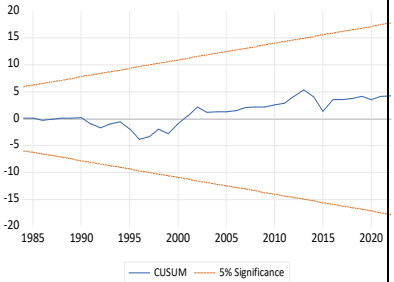
Nigeria:



Senegal:



Sierra Leone:



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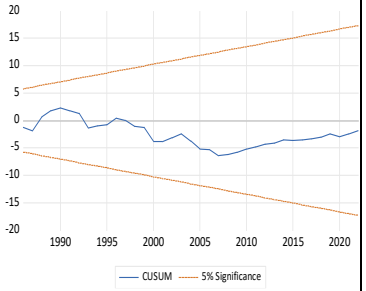
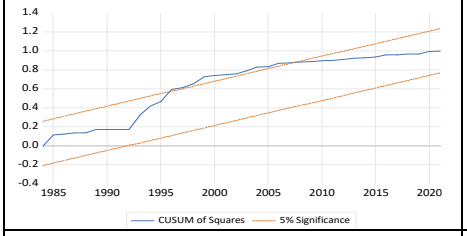


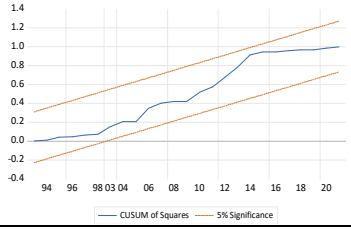
Figure 4: CUSUM Square Parameter Stability Charts for Real Output Growth/Money Supply Growth ARDL Model

East African Community (EAC)

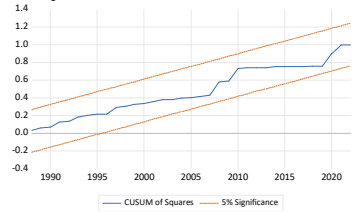
Burundi:



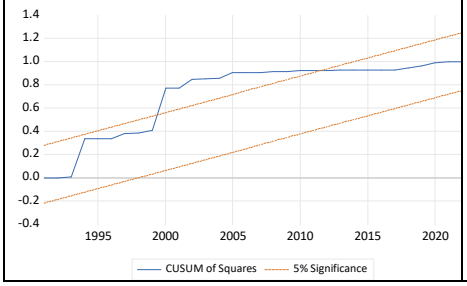
Democratic Rep. of Congo:



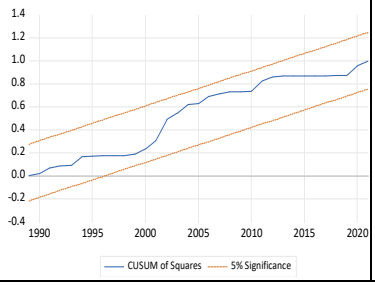
Kenya:



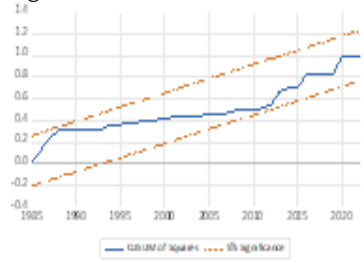
Rwanda:



Tanzania:

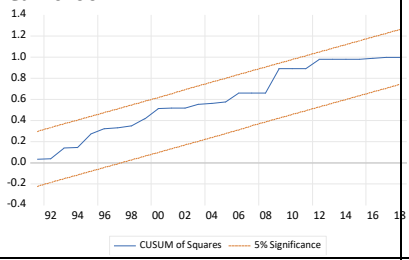


Uganda:

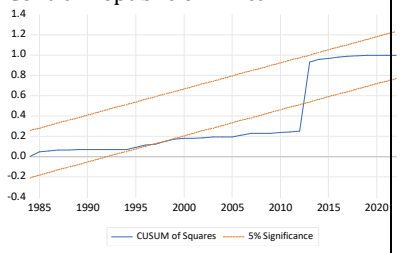


Economic Community of Central African States (ECCAS)

Cameroon:



Central Republic of Africa:



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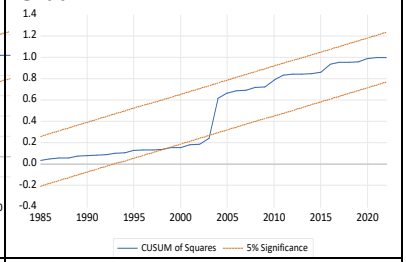
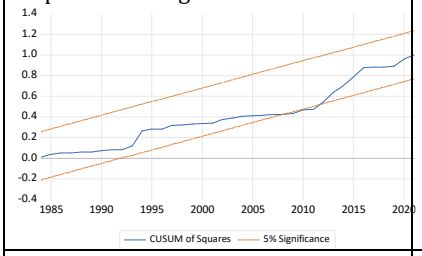
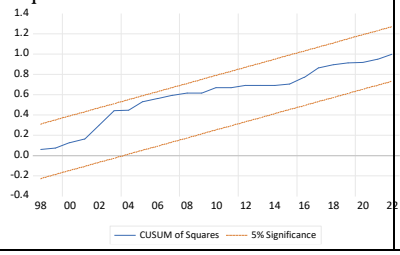


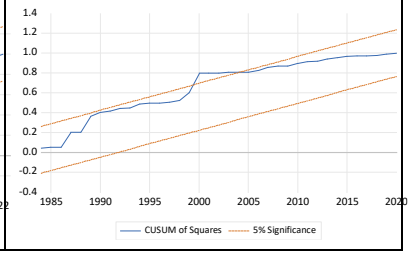
Republic of Congo:



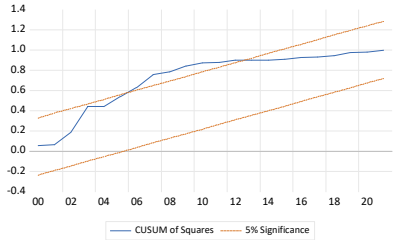
Equatorial Guinea:



Gabon:

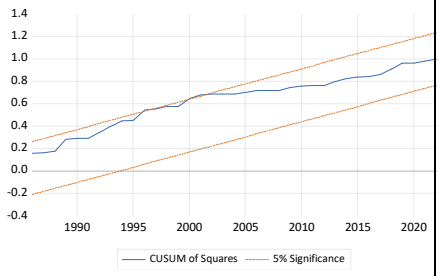


Sao Tome and Principe:

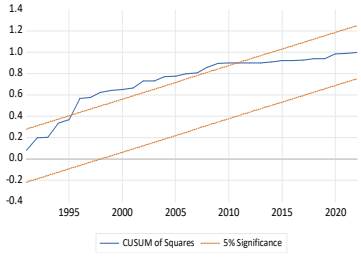


Economic Community of West African States (ECOWAS)

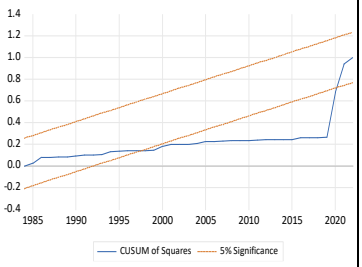
Benin:



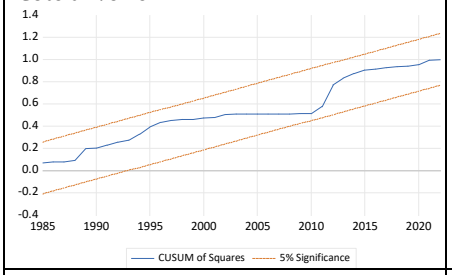
Burkina Faso:



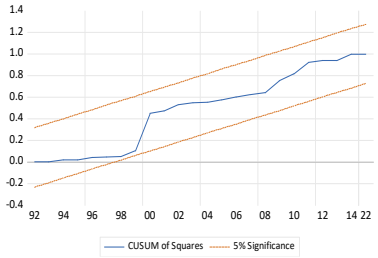
Cabo Verde:



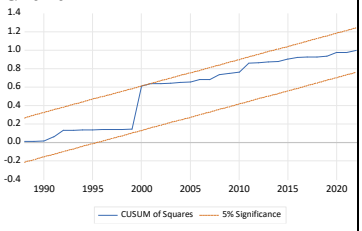
Cote d'Ivoire:



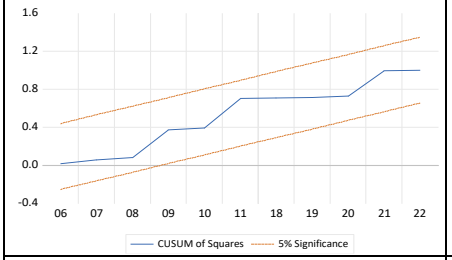
Gambia:



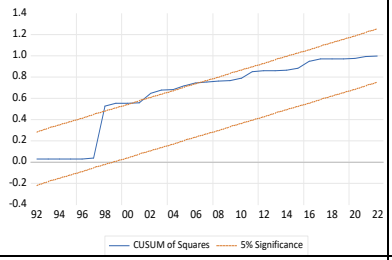
Ghana:



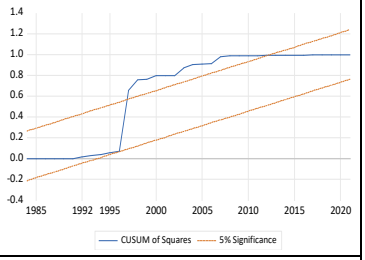
Guinea:



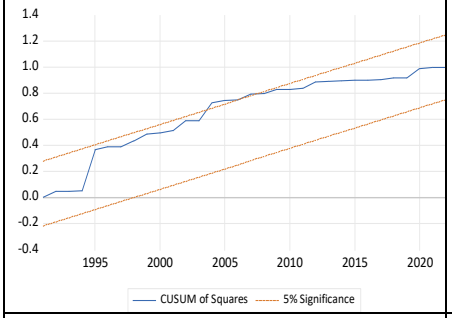
Guinea-Bissau:



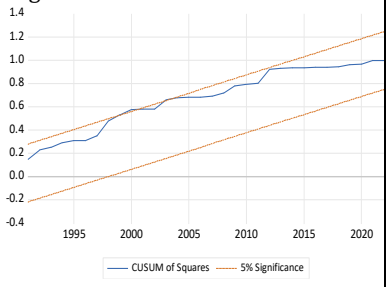
Liberia:



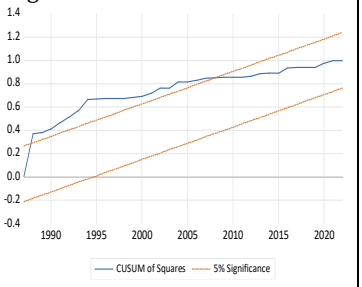
Mali:



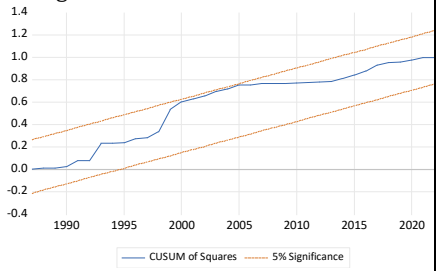
Niger:



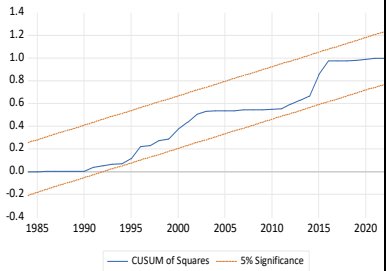
Nigeria:



Senegal:



Sierra Leone:



Togo:

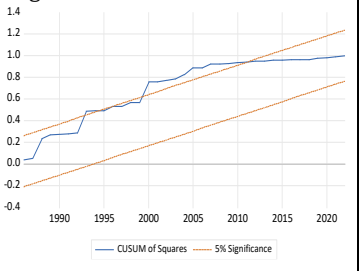
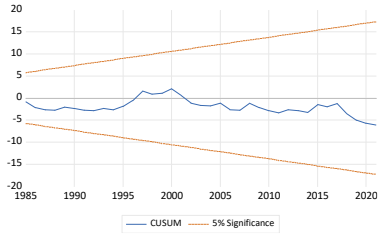


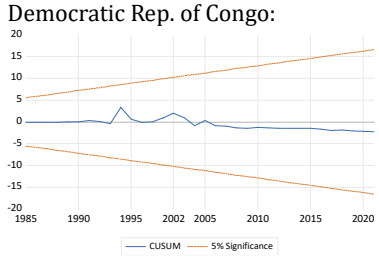
Figure 5: CUSUM Parameter Stability Charts for Inflation/Money Supply Growth ARDL Model

East African Community (EAC)

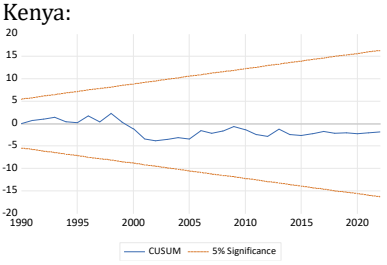
Burundi:



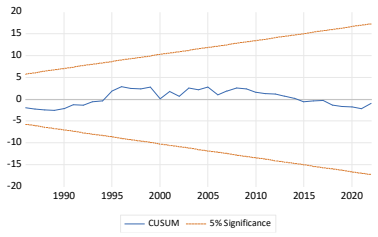
Democratic Rep. of Congo:



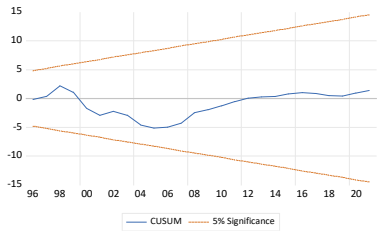
Kenya:



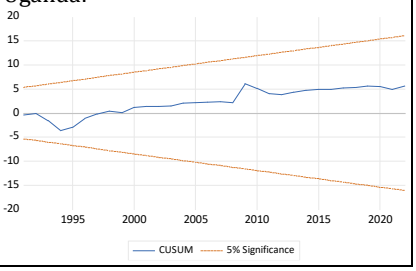
Rwanda:



Tanzania:

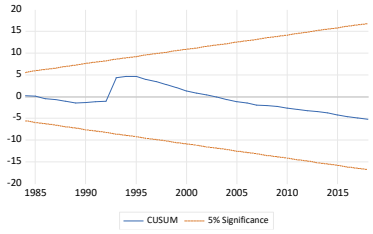


Uganda:

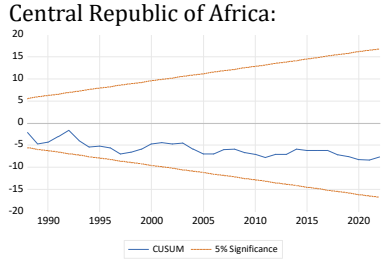


Economic Community of Central African States (ECCAS)

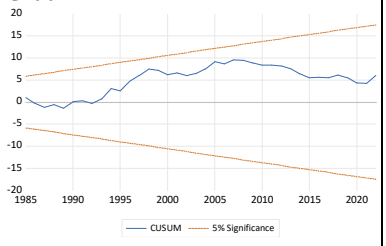
Cameroon:



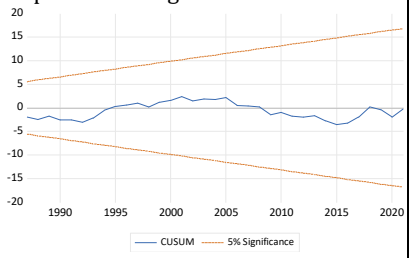
Central Republic of Africa:



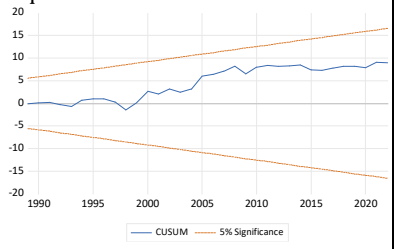
Chad:



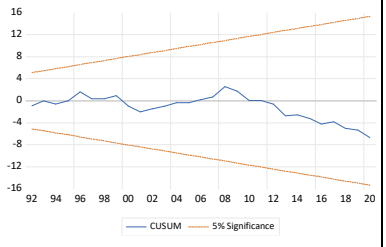
Republic of Congo:



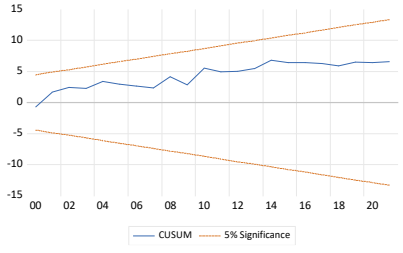
Equatorial Guinea:



Gabon:

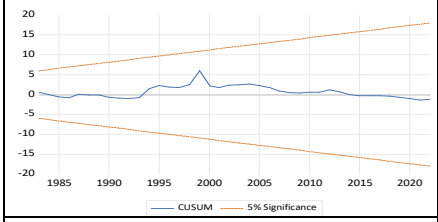


Sao Tome and Principe:

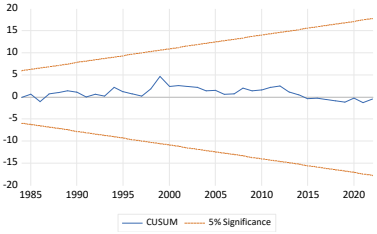


Economic Community of West African States (ECOWAS)

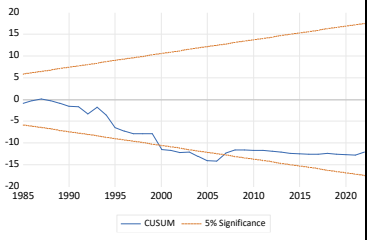
Benin:



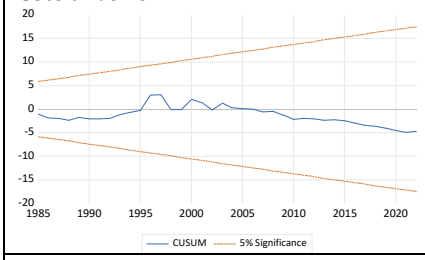
Burkina Faso:



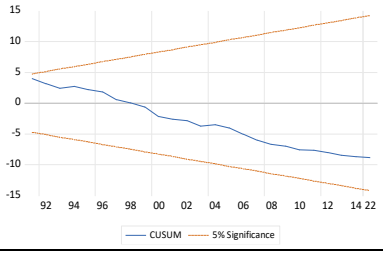
Cabo Verde:



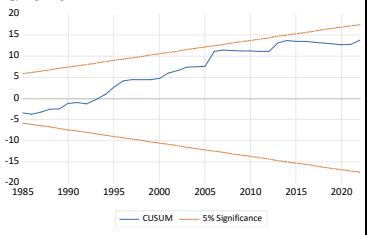
Cote d'Ivoire:



Gambia:



Ghana:



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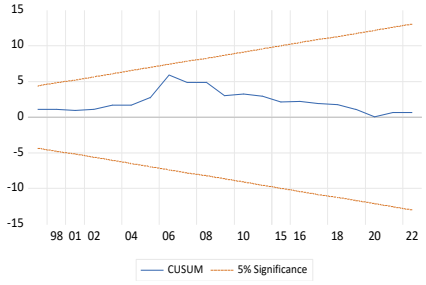
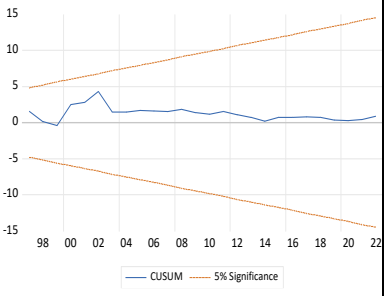
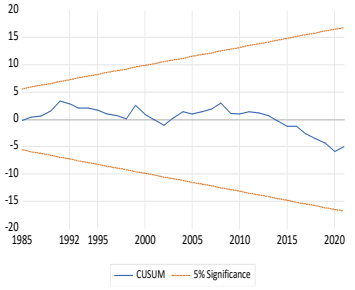


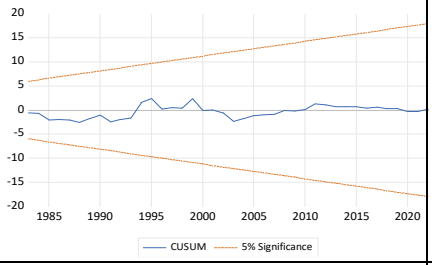
Guinea-Bissau:



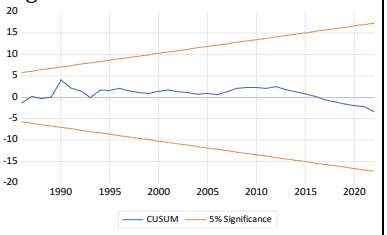
Liberia:



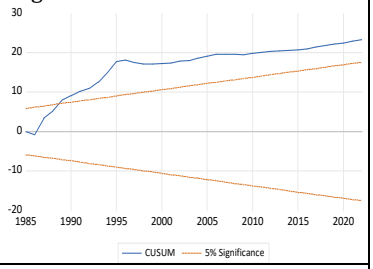
Mali:



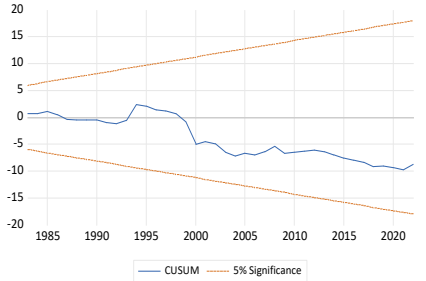
Niger:



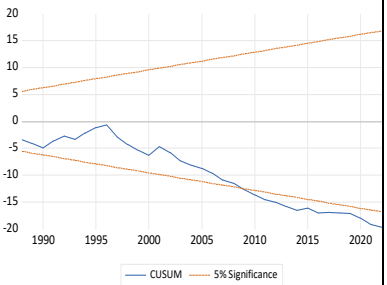
Nigeria:



Senegal:



Sierra Leone:



Togo:

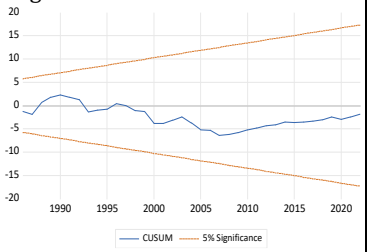
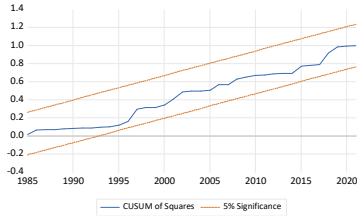


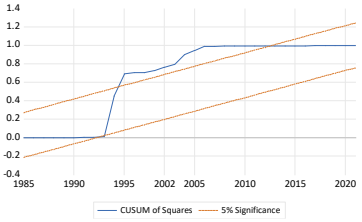
Figure 6: CUSUM Square Parameter Stability Charts for Inflation/Money Supply Growth ARDL Model

East African Community (EAC)

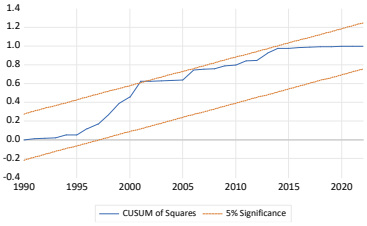
Burundi:



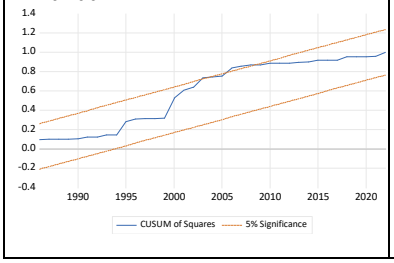
Democratic Rep. of Congo:



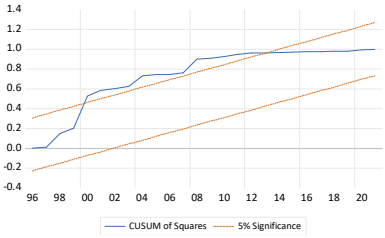
Kenya:



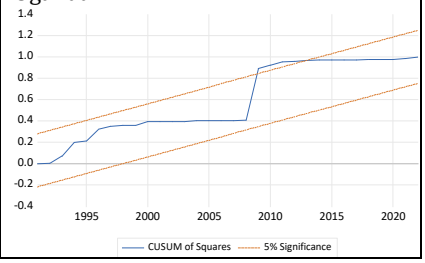
Rwanda:



Tanzania:

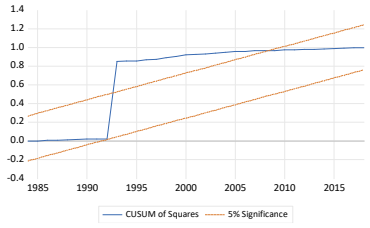


Uganda:

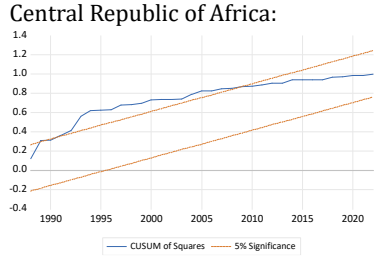


Economic Community of Central African States (ECCAS)

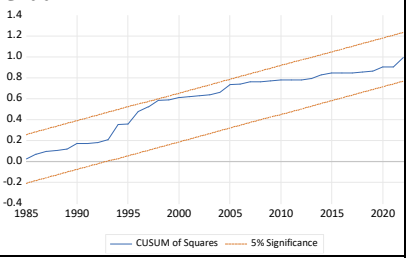
Cameroon:



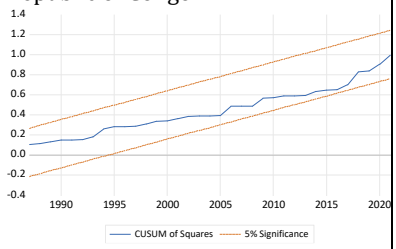
Central Republic of Africa:



Chad:



Republic of Congo:



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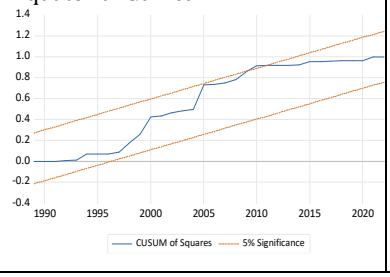

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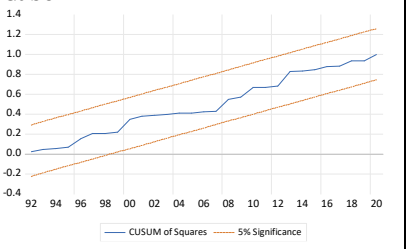
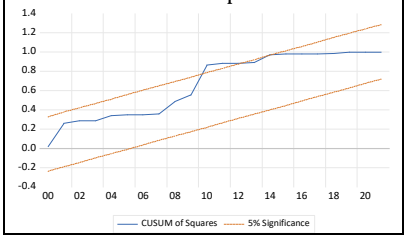
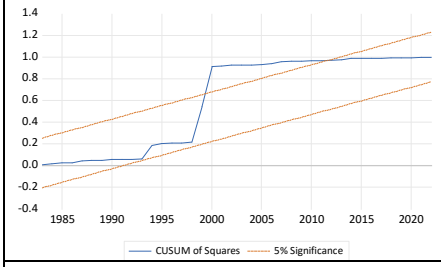


Sao Tome and Principe:

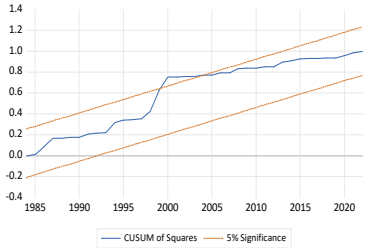


Economic Community of West African States (ECOWAS)

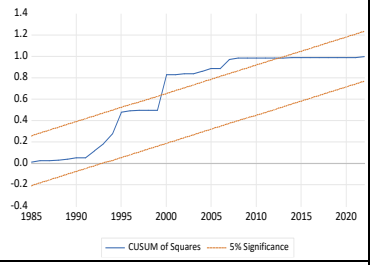
Benin:



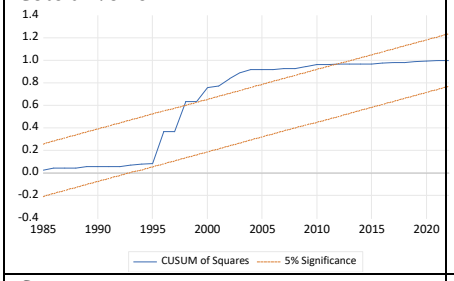
Burkina Faso:



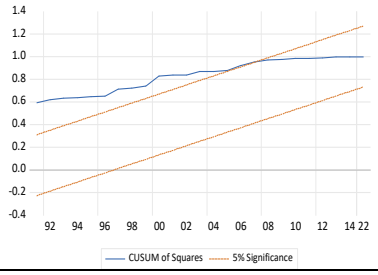
Cabo Verde:



Cote d'Ivoire:



Gambia:



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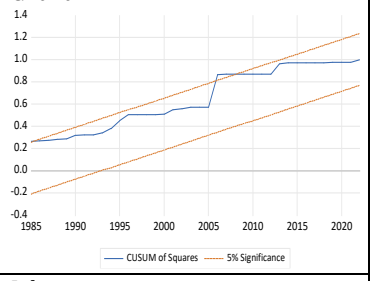

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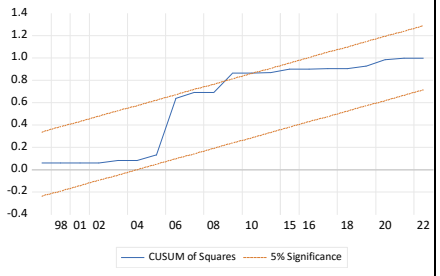
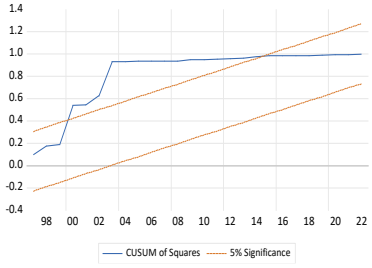
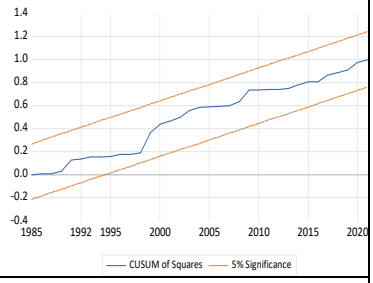


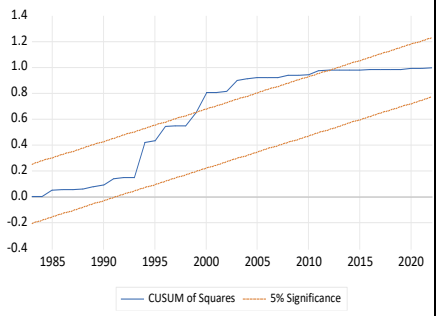
Guinea-Bissau:



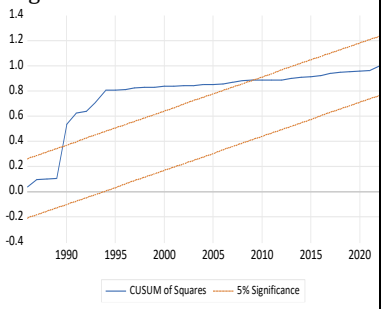
Liberia:



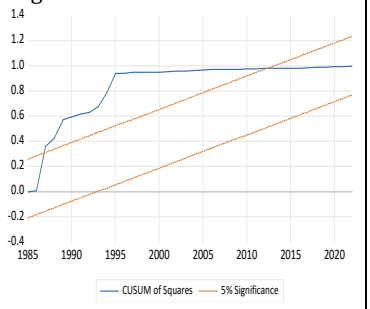
Mali:



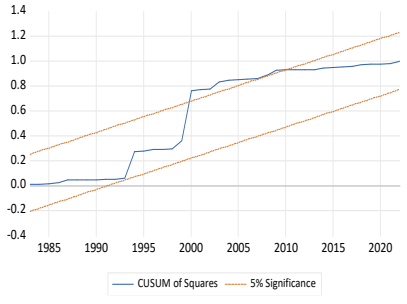
Niger:



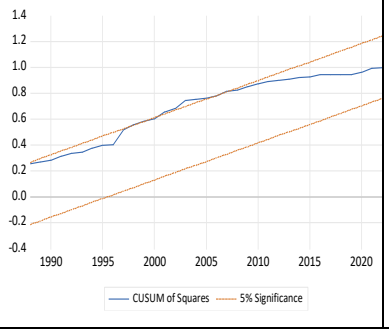
Nigeria:



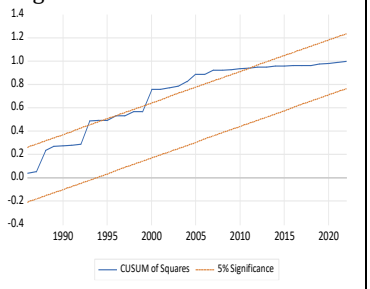
Senegal:



Sierra Leone:



Togo:



Appendix 3
African Countries and Economic/Monetary Blocs Covered

East African Community (EAC)
1. Burundi
2. Democratic Rep. of Congo
3. Kenya
4. Rwanda,
5. Tanzania
6. Uganda
Economic Community of Central African States (ECCAS)
1. Cameroon
2. Central Republic of Africa
3. Chad
4. Republic of Congo
5. Equatorial Guinea
6. Gabon
7. Sao Tome and Principe
Economic Community of West African States (ECOWAS)
1. Benin
2. Burkina Faso
3. Cabo Verde
4. Cote d'Ivoire
5. Gambia
6. Ghana
7. Guinea,
8. Guinea-Bissau
9. Liberia
10. Mali
11. Niger
12. Nigeria
13. Senegal
14. Sierra Leone
15. Togo
Arab Maghreb Union (AMU) and North African Countries in MENA
1. Algeria
2. Egypt
3. Libya
4. Mauritania
5. Morocco
6. Tunisia
South African Development Community (SADC)
1. Angola
2. Botswana
3. Comoros
4. Eswatini (Swaziland)
5. Lesotho
6. Madagascar
7. Malawi
8. Mauritius
9. Mozambique
10. Namibia
11. Seychelles
12. South Africa
13. Zambia
14. Zimbabwe.
Other African Countries
1. Djibouti
2. Ethiopia