Evaluating the Relative Impact of Monetary and Fiscal Policy in Nigeria using the St. Louis Equation

Michael Adebayo Ajayi[1], Olufemi Adewale Aluko[2]

Abstract: The controversy existing on the efficacy of monetary and fiscal policy to influence the economy is unending. This study evaluates the relative impact of monetary and fiscal policy in Nigeria from 1986 to 2014 using a modified St. Louis equation. Employing the Ordinary Least Squares estimation method, this study reveals that growth in money supply and export have a positive and significant effect on growth in output of the economy while growth in government expenditure has a negative and insignificant effect. This study provides evidence that monetary policy has a greater growth-stimulating effect on the economy than fiscal policy. It recommends that monetary policy rather than fiscal policy should be relied upon by the Nigerian government as an economic stabilisation tool.

Keywords: Monetary policy; Fiscal policy; St. Louis equation; Nigeria

JEL Classification Numbers: E52; E62

1. Introduction

Monetary policy is mainly concerned with interest rate management and control of money supply in the economy. Fiscal policy on the other hand refers to how government influences economic output through its expenditure and taxation policy. Monetary and fiscal policy are tools that government implement to stabilise the economy and promote economic growth. Failure to implement either monetary or fiscal policy appropriately may lead to increase in inflation and limited economic performance.

Monetary and fiscal policy are the two commonly used macroeconomic tools to influence the economy. The relative impact of monetary and fiscal policy on the economy is a controversial issue among economists. The classical economists (monetarists) are of the opinion that it is only monetary policy that can influence the economy whilst fiscal policy would be ineffective. They argue that the

[1] PhD, Department of Finance, University of Ilorin, Address: P.M.B 1515, Ilorin, Nigeria, Tel.: +2348033963850, E-mail: maajayi@unilorin.edu.ng.
[2] M.Sc., Department of Finance, University of Ilorin, Address: P.M.B 1515, Ilorin, Nigeria, Tel.: +2348037357830, Corresponding author: olufemiadewale6@gmail.com.

economy is self-regulating, hence there is no need for government intervention in the economy. They believe in the ability of the economy to achieve full employment through its own internal mechanisms (Olofin & Salisu, 2014). The notions of the classical economists failed to prevent the Great Depression of 1930s from occurring and this led to the emergence of the Keynesian economists. The Keynesian economists led by John Maynard Keynes suggested that there is need for government intervention in the economy. They see aggregate demand as a key driver of economic growth and argue that government can stimulate aggregate demand by increasing its expenditure in the economy. They see fiscal policy as being largely effective on the economy while monetary policy would be ineffectual. In contrast to both the classical and Keynesian economists, the real business cycle theory suggests that both monetary and fiscal policy are not capable of influencing the economy.

In most countries, monetary policy has been instrumental in the implementation of fiscal policy because monetary authorities are often responsible for financing budget deficits (Laurens & de la Piedra, 1998). Lambertini and Rovelli (2003) argue that monetary and fiscal authorities may not have the same motivation and goals but their policy choices have a crucial impact on aggregate demand in the economy. According to Adefeso and Mobolaji (2010), monetary and fiscal policy are inseparable in macroeconomic management. Therefore, government need to strike a balance by finding an appropriate mix of these policies so that the influence of one on the economy does not neutralise the desired outcome of the other. The influence of monetary and fiscal policy on the economy tend to differ as government implement both policies simultaneously.

The earliest effort to resolve the monetary-fiscal policy debate can be traced to Andersen and Jordan (1968) which developed a model referred to as the Andersen-Jordan (A-J) equation or, as it widely referred to as the St. Louis equation to examine the relative impact of monetary and fiscal policy in the stabilisation of the United States economy. The equation is an estimated relationship (using the Almon lag procedure) between changes in gross national product and changes in money supply and high-employment Federal expenditures (Carlson, 1978). According to Batten and Thorton (1986), the major critiques of the A-J equation are omission of relevant exogenous variables, simultaneous equation bias and failure to identify appropriate measures of monetary and fiscal policy. Other critiques include heteroskedasticity problem, endogeneity problem and the use of the Almon lag procedure. Over the years, the St. Louis equation has witnessed empirical modifications and has been widely used to determine the relative influence of monetary and fiscal policy in both developed and developing economies.

In Nigeria, few studies have employed the St. Louis equation among which are Ajayi (1974), Aigbokhan (1985), Asogu (1998) and Adefeso and Mobolaji (2010). This study attempts to give further evidence on the relative impact of monetary and

fiscal policy in Nigeria using the St. Louis equation. The remainder of this study is as follows: Section 2 provides the literature review, Section 3 centres on the methodology, Section 4 presents the empirical results and Section 5 offers the conclusion.

2. Literature Review

2.1. Prior Studies on Developed and Developing Countries

Andersen and Jordan (1968) specified nominal gross national product as dependent on monetary policy and fiscal policy and found that monetary policy significantly affect the US economy while fiscal policy did not. de Leeuw and Kalchbrenner (1969) criticised Andersen and Jordan's use of money supply and government expenditure to proxy for monetary and fiscal policy respectively. In their study, high employment receipts adjusted for inflation was used to measure fiscal policy while monetary base adjusted for changes in reserve requirements and the adjusted monetary base minus currency in circulation were used to measure monetary policy. The study found both fiscal and monetary policy to be statistically significant on United States, thus contradicting Andersen and Jordan's finding of fiscal policy being irrelevant.

Carlson (1978) estimated the St. Louis equation using the percentage changes in the variables rather than the first difference form used in the A-J equation and still found that fiscal policy does not play a significant role in economic stabilisation. Hafer (1982) observed that once the growth of money is considered, the impact of fiscal policy is inconsequential. Batten and Hafer (1983) criticised the A-J equation for not capturing international trade, hence they included export. Using a sample of 6 developed economies, the study is consistent with Andersen and Jordan (1968) for all the economies.

Batten and Thorton (1986) reaffirmed the findings of Andersen and Jordan and found no evidence to support its critics. Chowdhury (1986) found that fiscal policy affects economic activities in Bangladesh more than monetary policy. In a study of 5 African countries, Bynoe (1994) discovered that monetary policy exert greater effect on these countries than fiscal policy.

Jayaraman (2001) showed that fiscal policy failed to produce a growth-stimulating impact on the economic growth of 4 South Pacific Island countries. Dahalan and Jayaraman (2006) found that fiscal policy is more influential than monetary policy on the economy of Fiji. Contrary to Chowdhury (1986), Rahman (2009) observed that monetary policy plays a greater role than fiscal policy in enhancing the economic growth of Bangladesh. Belliveau (2011) found that monetary policy is more effective than fiscal policy in the United States. Also, the study supported the

notion that monetary and fiscal policy have the ability to influence output and economic stability.

Topcu and Kuloglu (2012) revealed that monetary policy exert a significant positive influence on the Turkish economy in the short run. Conversely, in the long run, no significant impact was observed for monetary and fiscal policy. Moayedi (2013) observed that fiscal policy stimulated growth more than monetary policy in Iran. Adeniji and Evans (2013) found evidence to show that monetary and fiscal policy have been effective in stabilising the economy of 8 African countries. The study also revealed that monetary policy provide greater economic benefits than fiscal policy.

2.2. Prior Studies on Nigeria

Ajayi (1974) employed the Andersen and Jordan's equation and found that monetary policy facilitates economic activities than fiscal policy. On the contrary, Aigbokhan (1985) discovered that fiscal policy is more advantageous in promoting economic activities than monetary policy. Asogu (1998) discovered that money supply is statistically significant while government expenditure and export are not statistically significant, thus suggesting that monetary policy is effective on the economy while fiscal policy is not.

Ajisafe and Folorunso (2002) evaluated the efficacy of monetary and fiscal policies on the economy and revealed that monetary policy has greater impact on the economy than fiscal policy. Adefeso and Mobolaji (2010) examined the efficacy of fiscal and monetary policies on economic growth. The results showed that monetary policy is more beneficial to the economy than fiscal policy.

Aigheyisi (2011) found the economy is influenced by monetary policy than fiscal policy. Sanni, Amusa and Agbeyangi (2012) revealed that monetary policy is more effective on the economy than fiscal policy. Iyeli, Uda and Akpan (2012) discovered that the influence of monetary policy dominates fiscal policy in the economy.

3. Methodology

This study evaluates the relative impact of monetary and fiscal policy in Nigeria from 1986 to 2014. Data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (2014) edition. This study adopted a modified version of the St. Louis equation built by Batten and Hafer (1983) which specified nominal gross domestic product (GDP) as the endogenous variable and money supply (MS), government expenditure (GE) and export (EX) as the exogenous variables. Money supply and government expenditure represent the monetary and fiscal policy respectively. The growth rate series of the variables were used in the model for this

study. The growth rate represents the percentage change in the variables from the previous year. Using growth rate series, the equation would not be limited by heteroskedasticity problem unlike when the first difference series of the variables are used (Carlson, 1978). The model for this study is expressed as:

$$\Delta GDP_t = \beta_0 + \beta_1 \Delta MS_t + \beta_2 \Delta GE_t + \beta_3 \Delta EX_t + \mu_t \quad \ldots (1)$$

Where Δ denotes percentage change, ΔGDP_t is growth in nominal gross domestic product or output growth, β_0 is the intercept or constant parameter, $\beta_1, \beta_2, \beta_3$ are the coefficients of the growth in money supply, government expenditure and export respectively and μ_t is the stochastic term.

In choosing the optimal lag length for the model, this study relied on different lag length selection criteria. After setting the maximum lag length to be 4, a lag length of 0 was chosen by all the lag length selection criteria. Andersen and Jordan (1968) used the Almon lag technique to determine a lag length of 3 for each exogenous variables. Elliot (1975) showed that the findings of Andersen and Jordan were supported regardless of the lag length of the exogenous variables. Thus, it can be inferred from Elliot (1975) that a St. Louis equation with zero-lag structure would not yield incorrect estimates. Therefore, a lag length of 0 for the exogenous variables in this study seems appropriate.

The growth rate series of GDP, MS, GE and EX are stationary series, hence the equation was estimated using the Ordinary Least Square (OLS) estimation procedure and relevant diagnostics tests such as F-test, serial correlation LM test, heteroskedasticity test, variance inflation factors test, CUSUM and CUSUMQ tests and Ramsey RESET test were performed on the estimated model. In order to validate that the growth rate series of the variables are stationary, unit root test was performed. Table 1 presents the result of the Augmented Dickey-Fuller (ADF) unit root test performed on the growth rate series of the variables at level.

Table 1. ADF Unit Root Test

Variable	t-statistic	p-value
ΔGDP	-5.806802*[b]	0.0003
ΔMS	-3.567121***[b]	0.0537
ΔGE	-6.249882*[b]	0.0001
ΔEX	-6.126758*[a]	0.0000

Source: Authors' analysis

Notes: * and *** denote stationary at 1% and 10% significance level respectively and [a] and [b] indicate that test equation includes intercept only and intercept and trend respectively.

4. Empirical Results

4.1. Summary Statistics

Table 2. Summary Statistics Result

Statistic	**ΔGDP**	**ΔMS**	**ΔGE**	**ΔEX**
Mean	22.39508	23.01954	20.21038	24.16654
Median	16.22553	17.95961	21.82235	12.61810
Maximum	78.21597	44.58673	72.30303	152.8994
Minimum	-15.13644	6.540178	-30.14340	-50.16609
Standard Deviation	21.13525	10.86427	21.97898	42.72025
Skewness	0.914606	0.349203	0.114343	1.138089
Kurtosis	3.855503	1.870920	3.601164	4.702773
Jarque-Bera	4.927465***	2.129799	0.499882	9.763843*
Observations	29	29	29	29

Source: Authors' analysis

Note: * and *** indicate that null hypothesis of normal distribution is rejected of normal distribution at 1% and 10% significance level respectively.

From Table 2, it can be seen that all the series are positively skewed. The Kurtosis statistic of ΔGDP, ΔGE and ΔEX exceeds 3, thus implying that they have a fat-tailed distribution while ΔMS has a thin-tailed distribution because its Kurtosis statistic is less than 3. The Jarque-Bera statistic of ΔGDP and ΔEX indicates that they are not normally distributed while ΔMS and ΔGE are normally distributed.

4.2. OLS Estimation

Table 3. OLS Regression Results

Variable	**Coefficient**	**p-value**
C	6.508933	0.4176
ΔMS	0.526744	0.0931***
ΔGE	-0.189447	0.2461
ΔEX	0.314052	0.0007*
Model diagnostics		
R^2	0.413538	——
F-statistic	5.876180	0.003517*
Breusch-Godfrey(1)	0.367526	0.5500
Breusch-Godfrey(2)	0.543989	0.5877
Breusch-Pagan-Godfrey	0.368446	0.7764
White	0.112327	0.9521
Ramsey RESET(^2)	0.048414	0.8277

Source: Authors' analysis

Notes: * and *** indicates statistically significant at 1% and 10% significance level respectively. Also, test statistic for Breusch-Godfrey serial correlation LM test, Breusch-Pagan-Godfrey and White heteroskedasticity tests and Ramsey RESET test follow F-distribution.

From Table 3, it can be inferred that growth in MS and EX are positively and significantly related to output growth while the growth in GE is negatively and not significantly related to output growth. The R^2 indicates that growth in MS, GE and EX account for approximately 41.4% change in the nominal GDP while the remaining 58.6% is explained by the stochastic term. The F-statistic shows that the model is statistically significant at 1% significance level. The Breusch-Godfrey serial correlation LM test indicates that the residuals in the model are serially independent at first and second order, thus confirming that the model is free from first and second order autocorrelation. The Breusch-Pagan-Godfrey and White (with no cross terms) heteroskedasticity tests indicate the residuals are independent and identically distributed since the null hypothesis of homoscedasticity is accepted. Using the squares of the fitted values, the F-statistic of the Ramsey RESET test is not statistically significant, thus the hypothesis that the model is correctly specified is accepted.

4.3.Variance Inflation Factors (VIF) Test

Variance inflation factors test was performed to check for multicollinearity. The presence of multicollinearity leads to parameters being inconsistent and having high standard errors which are capable of limiting the validity of the OLS estimation results. The rule of thumb is that if VIF of an exogenous variable is greater than 10, the variable is said to be highly collinear (Kleinbaum, Kupper & Muller, 1988). Table 4 presents the result of the VIF test.

Table 4. Variance Inflation Factors Test

Variable	VIF
ΔlnMS	1.025176
ΔlnGE	1.172751
ΔlnEX	1.146629

Source: Authors' analysis

From Table 4, it can be observed that there is no problem of multicollinearity. This implies that there is no strong linear relationship between the exogenous variables.

4.4. CUSUM and CUSUMQ Tests

The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of residuals (CUSUMQ) tests were performed to check whether the parameters in the model are stable.

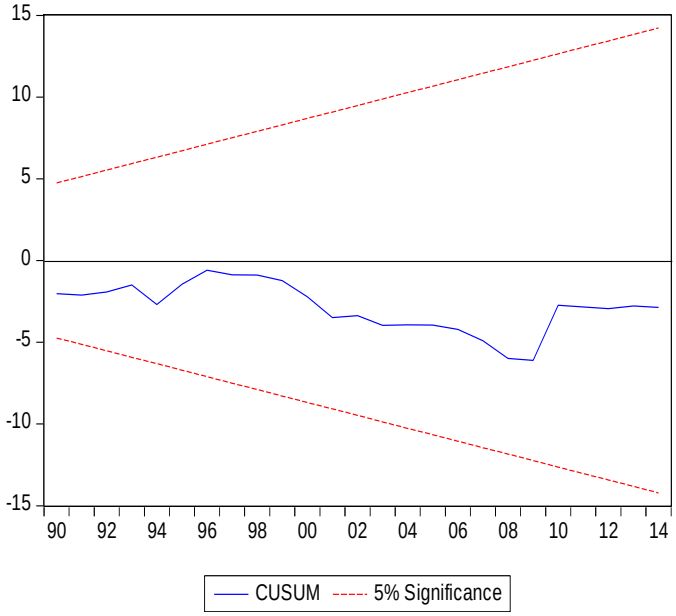

Figure 2. CUSUM Plot

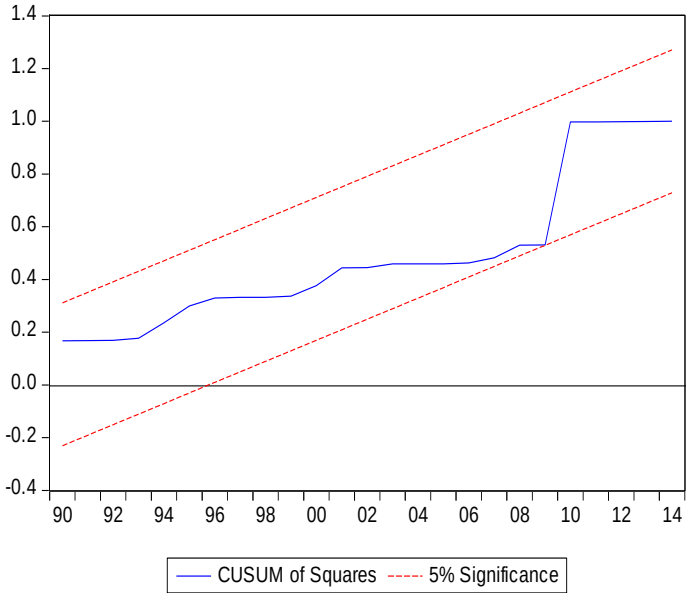

Figure 3. CUSUMQ Plot

It can be seen from Fig. 2 and 3 that the plots of CUSUM and CUSUMQ lie within the 5% critical bound, thus indicating that the parameters in the model are stable. This implies that the model is not affected by structural instability. The stability of

the model further confirms that the shift from military rule to civilian rule in 1999 did not cause structural break in macroeconomic management. To corroborate this assertion, the Chow Breakpoint test was performed. The null hypothesis for the test is that there is no break at the specified breakpoint. The specified breakpoint is 1999. Table 5 reports the result of the Chow Breakpoint test.

Table 5. Chow Breakpoint Test

F-statistic	p-value
1.304619	0.3005

Source: Authors' analysis

Table 5 shows that the F-statistic is not statistically significant, thus the null hypothesis is accepted. This implies that macroeconomic management during the military leadership is not significantly different from that of the democratic leadership. In other words, macroeconomic management remained the same during the period under review.

5. Conclusion

This study evaluated the relative impact of monetary and fiscal policy in Nigeria from 1986 to 2014 using a modified St. Louis equation developed by Batten and Hafer (1983). Following the stance of Carlson (1978), the growth series of the variables were used instead of their first difference form. The regression estimates showed that growth in money supply and export are positively and statistically significant on output growth while growth in government expenditure is negatively and not statistically significant related to output growth. The statistical significance of growth in export disregards the claim of Asogu (1998) and Adefeso and Mobolaji (1998) that export is redundant in the application of St. Louis equation to the Nigerian economy. The significant positive effect of growth in money supply on output growth suggests that the CBN has been effective in promoting economic growth and stabilising the economy. This study showed that monetary policy has a greater growth-stimulating effect on the economy than fiscal policy and this is in line with previous studies such as Ajayi (1974), Asogu (1998), Adefeso and Mobolaji (2010). It provides evidence to support the classical economists' (monetarists) argument that monetary policy would stabilise the economy while fiscal policy would be largely ineffectual. This study recommends that government should rely more on monetary policy in stabilising the economy.

6. References

Adefeso, H.A. & Mobolaji, H.I. (2010). The fiscal-monetary policy and economic growth in Nigeria: Further empirical evidence. *Pakistan Journal of Social Sciences*, 7(2), pp. 137-142.

Adeniji, S. & Evans, O. (2013). *Searching for the relative potency of monetary and fiscal policies in selected African countries: A panel data approach to St. Louis equation*. Retrieved from http://mpra.ub.uni-muenchen.de/52420/.

Aigbokhan, B.E. (1985). *The relative impact of monetary and fiscal action on economic activity: Evidences from developed and less developed countries*. Paisley: Department of Economics, Paisley College.

Aigheyisi, O.S. (2011). *Examining the relative effectiveness of monetary and fiscal policies in Nigeria: A cointegration and error correction approach*. Retrieved from http://dx.doi.org/10.2139/ssrn.1944585.

Ajayi, S.I. (1974). *An economic case study of the relative importance of monetary and fiscal policy in Nigeria.* Bangladesh Economic Review, 2, pp. 559-576.

Ajisafe, R.A. & Folorunso, B.A. (2002). The relative effectiveness of fiscal and monetary policy in macroeconomic management in Nigeria. *The African Economic and Business Review*, 3(1), pp. 23-40.

Andersen, L.C. & Jordan, J.L. (1968). Monetary and fiscal actions: a test of their relative importance in economic stabilization. *Federal Reserve Bank of St. Louis Review*, pp. 29-44.

Asogu, J.O. (1998). An economic analysis of the relative potency of monetary and fiscal policy in Nigeria. *CBN Economic and Financial Review*, 36(2), pp. 30-63.

Batten, D.S. & Hafer, R.W. (1983). The relative impact of monetary and fiscal actions on economic activity: A cross-country comparison. *Federal Reserve Bank of St. Louis Review*, January, pp. 5-12.

Batten, D.S. & Thorton, D.L. (1986). The monetary-fiscal policy debate and the Andersen-Jordan equation. *Federal Reserve Bank of St. Louis Review*, October, pp. 9-17.

Belliveau, S. (2011). *A St. Louis equation to reassess the influence of macroeconomic-policy instruments*. Retrieved from https://mpra.ub.uni-muenchen.de/28839/.

Carlson, K.M. (1978). Does the St. Louis equation now believe in fiscal policy?. *Federal Reserve Bank of St. Louis Review*, 60, pp. 13-19.

Chowdhury, A.R. (1986). Monetary and fiscal impacts on economic activities in Bangladesh: A note. *The Bangladesh Development Studies*, 14(1), pp. 101-106.

Dahalan, J. & Jayaraman, T.K. (2006). Monetary and fiscal policies in Fiji: A test for effectiveness. *Pacific Economic Bulletin*, 21(2), pp. 94-102.

de Leeuw, F. & Kalchbrenner, J. (1969). *Monetary and fiscal actions: A test of their relative importance in economic stabilization – comment.* Federal Reserve Bank of St. Louis, April, pp. 6-11.

Elliot, J.W. (1975). The influence of monetary and fiscal actions on total spending. *Journal of Money, Credit and Banking*, 7, pp. 181-192.

Hafer, R.W. (1982). The role of fiscal policy in the St. Louis equation. *Federal Reserve Bank of St. Louis Review*, January, pp. 17-22.

Iyeli, I.I.; Uda, E.B. & Akpan, E. (2012). The relative effectiveness of monetary and fiscal policies in economic stabilization in a developing economy: An empirical evidence from Nigeria. *Annals of Humanities and Development Studies*, 3(1), pp. 87-138.

Jayaraman, T.K. (2001). Efficacy of fiscal and monetary policies in the South Pacific Island countries: Some empirical evidence. *The Indian Economic Journal*, 49(1), pp. 63-72.

Kleinbaum, D.G.; Kupper, L.L. & Muller, K.E. (1988). *Applied regression analysis and other multivariate methods*. 2nd Edition. Boston: PWS-Kent.

Laurens, B. & de la Piedra, E.G. (1998). Coordination of monetary and fiscal policies. *IMF Working Paper No. 98/25*. Washington D.C.: Monetary and Exchange Affairs Department, International Monetary Fund.

Lambertini, L. & Rovelli, R. (2003). *Monetary and fiscal policy coordination and macroeconomic stabilization. A theoretical analysis.* Retrieved from www.federalreserve.gov/events/conference/irfmp2003/pdf/Rovelli.pdf.

Moayedi, V. (2013). Reassessing the effect of fiscal and monetary policies in Iran: The St. Louis equation revisited. *Journal of Economic Development*, 38(4), pp. 123-141.

Olofin, S.O. & Salisu, A.A. (2014). *An introduction to macroeconomics*. 2nd Edition. Ibadan: Evans Brothers Limited.

Rahman, H. (2009). *Relative effectiveness of monetary and fiscal policies on output growth in Bangladesh: A VAR approach*. Retrieved from https://www.researchgate.net/publications/46476707.

Sanni, M.R.; Amusa, N.A. & Agbeyangi, B.A. (2012). Potency of monetary and fiscal policy instruments on economic activities of Nigeria (1960 – 2011). *Journal of African Macroeconomic Review*, 3(1), pp. 161-176.

Topcu, M. & Kuloglu, A. (2012). Total spending equation of St. Louis model: A causality analysis for Turkish economy. *Chinese Business Review*, 11(4), pp. 368-376.