Searching for the Relative Potency of Monetary and Fiscal Policies in Selected African Countries: A Panel Data Approach to St. Louis Equation

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Abstract

With the aid of the St. Louis equation, this study applies panel data technique to real variables of some selected African countries with extended data from 1970 − 2012. The outcomes support both Keynesian and monetarist positive policy assertions. The monetary base and government expenditure are viable instruments to stabilize output. The study, as well, finds that utilizing the monetary base as a policy tool is more potent than using government expenditure. This is in line with the predictions of Milton Friedman and Schwartz (1963) and other advocates of the St. Louis equation. Therefore, in order to attain higher output growth, these economies should rely more on monetary policy as compared with fiscal policy.

I.   Introduction

Governments are preoccupied with the responsibility of economic management which is fundamental to the management of the macroeconomic variables such as output, inflation, money supply, employment, aggregate demand, exchange rate and interest rate which are essential variables that influence the growth path and development of every economy. Hence, transmute into the welfare level of the citizens. Economic management is an amalgam of two complementary tools namely: monetary policy and fiscal policy.

Monetary policy is the process by which the monetary authority of a country controls the supply of money, often targeting a rate of interest for the purpose of promoting economic growth and stability. It can either be expansionary or contractionary, where an expansionary policy increases the total supply of money in the economy more rapidly than usual, and contractionary policy expands the money supply more slowly than usual or even shrinks it. Empirical researches show that in order to make accurate assessment of the magnitude, timing and duration of monetary policy, the policymakers need to understand the mechanisms through which monetary policy affects the economy. Mishkin (1995), points out that the monetary transmission mechanisms include the interest rate channel, the exchange rate channel, the asset price channel and the credit channel.

The monetary authority influences interest rates by expanding or contracting the monetary base, which consists of currency in circulation and banks' reserves on deposit at the central bank. The primary way that the central bank can affect the monetary base is by open market operation or sales and purchases of second hand government debt, or by changing the reserve requirement. If the central bank wishes to lower interest rates, it purchases government debt, thereby increasing the amount of cash in circulation or crediting banks' reserve accounts. Alternatively, it can lower the interest rate on discounts or overdrafts (loans to banks secured by suitable collateral, specified by the central bank). If the interest rate on such transactions is sufficiently low, commercial banks can borrow from the central bank to meet reserve requirements and use the additional liquidity to expand their balance sheets, increasing the credit available to the economy. Lowering reserve requirements has a similar effect, freeing up funds for banks to increase loans or buy other profitable assets. A central bank can only operate a truly independent monetary policy when the exchange rate is floating. If the exchange rate is pegged or managed in

any way, the central bank will have to purchase or sell foreign exchange. These transactions in foreign exchange will have an effect on the monetary base analogous to open market purchases and sales of government debt; if the central bank buys foreign exchange, the monetary base expands, and vice versa. But even in the case of a pure floating exchange rate, central banks and monetary authorities can at best "lean against the wind" in a world where capital is mobile.

Fiscal policy is a policy instrument that relies on public revenue and public expenditure management to produce the desired effect in an economy. This implies the manipulation of government expenditure, or taxes, or both for the purpose of influencing the level of economic activity, inflation and economic growth. (Amacher and Ulbrich, 1986). Fiscal policy can be neutral fiscal policy (when an economy is in equilibrium), government spending is fully funded by tax revenue and overall the budget outcome has a neutral effect on the level of economic activities. Expansionary fiscal policy which occur when government spending exceeding tax revenue, and contractionary fiscal policy i.e. when government spending is lower than tax revenue, and is usually undertaken to pay down government debt. The two main instruments of fiscal policy are changes in the level and composition of taxation and government spending in various sectors. These changes affect the macroeconomic variables such as: aggregate demand and the level of economic activity, income distribution, the pattern of resource allocation within the government sector and relative to the private sector.

With the great depression in the 21st century, the Keynesian economists led by John Maynard Keynes was of the opinion that lower aggregate expenditures in the economy contributed to a massive decline in income and to employment that was well below the average which made the economy to reached equilibrium at low levels of economic activity and high unemployment. Therefore, to keep people fully employed, governments have to run deficits when the economy is slowing, as the private sector would not invest enough to keep production at the normal level and bring the economy out of recession. Keynesian economists called on governments during times of economic crisis to pick up the slack by increasing government spending and/or cutting taxes, (Klein L.R. 1947). Also, the Monetarist, including Milton Friedman, argue that the Great Depression was mainly caused by monetary contraction, the consequence of poor policy-making by the American Federal Reserve System and continued crisis in the banking system, (Krugman, Paul 2007). In this view, the Federal Reserve, by not acting, allowed the money supply as

measured by the M2 to shrink by one-third from 1929–1933, thereby transforming a normal recession into the Great Depression. Friedman argued that the downward turn in the economy, starting with the stock market crash, would have been just another recession (Bernanke, B.S. 2000).

Therefore, it can be deduced that economists all agree to both monetary and fiscal policies' ability to influence the pace of aggregate economic activities. However, the efficacy of both still remains widely debated and complicated as there exist a division (monetarists and Keynesians economists) among the economists as regards this assertion. The group that believes in monetary actions argued that monetary policy is more powerful than fiscal policy in achieving various economic goals. For example, Milton Friedman and Meiselman, (1963), Anderson and Jordan (1968), Carlson (1978) used the St. Louis equation to provide empirical evidence in favor of their stand. The other group led by Keynes (1964), followed by some noteworthy works, such as Leeuw et al. (1969), Schmidt and Waud (1973), Blinder and Solow (1974) provide basic theoretical and practical ground for the effectiveness of fiscal policy.

Hence, the objective of this paper is to empirically search for the relative potency of the monetary and fiscal policies in the selected African countries: a panel approach to Louis equation.

The rest of the paper is organized as follows: Section II summarizes the empirical review, while section III deals with model specification and methodology of the study. Section IV discusses estimation and empirical result. Section V concludes with a discussion of policy.

II.   Literature Review

The issue of the efficacy of monetary and fiscal policies has over the years twig up controversies among researchers based on varying findings. Some of these views are reviewed and presented below:

In respect of the relationship between money and output, a seminal paper by Milton Friedman and Schwartz (1963) is very important and influential. Their study, as mentioned by Walsh (1998), indicates that variation in the rate of money growth cause variations in real economic activity. However, some economists e.g., Benjamin Friedman and Kuttner (1992), Tobin (1970)

have challenged the prediction of Milton Friedman and Schwartz (1963). They argued that the causation from money to output, as claimed by Milton Friedman and Schwartz, might not be the case.

Benjamin Friedman and Kuttner (1992) re-examine the postwar evidence of significant relationship between money and income using time-series approach on extended data through the 1980s for the U.S. economy. The empirical findings do not indicate a close or credible relationship between money and income. Their paper, however, has one strong finding that the spread between the commercial paper and Treasury bill rate has very significant information about the movements in real income. In the concluding section of their paper, they express their concerned about the difficulty of using this spread as an intermediate policy target of the Federal Reserve System because of the continuously changing relationship between policy target and its outcome.

Gramlich (1971) summarizes some of the important papers on monetary-fiscal debate. He points out that a paper by Friedman and Meiselman (1963) predicts more stable and statistically significant relationship between output and money than that of output and autonomous spending. Paper of Anderson and Jordan (1968) uses various measures of monetary and fiscal policy actions and shows that monetary policy has greater, faster and more predictable impact on economic activities. Gramlich (1971) also reports the findings of some other papers from the antagonist side, such as, Ando and Modigliani (1965), DePrano and Mayer (1965) against the monetarist claim. His own study, however, indicates that both monetary and fiscal policy have impact on real economic activity with the indication that money matters greatly.

Benjamin Friedman (1977) uses the St. Louis equation in his paper and claims that the St. Louis equation now believes in" fiscal policy. In response of Benjamin Friedman's (1977) claim, Carlson (1978) re-estimates the St. Louis equation and argues that Benjamin Friedman's equation was suffering from the heteroscedasticity problem. The evidence from new and corrected estimation does not support Benjamin Friedman's claim that fiscal policy is more important than monetary policy. His findings suggest that only monetary policy has significant impact on economic activity and fiscal policy does not have any impact on real output.

Likewise, the outcome of developed countries, the empirical evidence for developing countries regarding the relative effectiveness of monetary and fiscal policies on economic activities is also mixed. Studies of Jayaraman (2002) for the South Pacific Island Countries, Masood and Ahmed

(1980) for Pakistan, Saqib and Yesmin (1987) for Pakistan and Upadhyaya (1991) for developing countries support the monetarists" view that monetary policy is important for economic activity. Some other studies on developing countries, such as Hussain (1982) for Pakistan, and Darrat (1984) for five Latin American countries find that fiscal policy is more effective than monetary policy in altering real output.

Using modified version of St. Louis equation, study of Latif and Chowdhury (1998) for Bangladesh found that fiscal policy is more effective over monetary policy in Bangladesh. This study uses the OLS technique based on the nominal data during 1974-1993 that suffers from all of the limitations indicated by Stein (1980) and Ahmed et al. (1984). They estimate six different equations of which 4 have only a single explanatory variable. One recent study on Bangladesh by Hasan (2001) based on the modified version of St. Louis equation predicts that both monetary as well as fiscal policies are important for economic growth. This study uses various econometric techniques based on nominal data during 1974-1996. The prediction of this paper, however, alters if real variable for income is used instead.

II.   Model Specification and Methodology

The St. Louis equation has gotten considerable attention from policymakers. As formulated by Andersen and Jordan, the St. Louis equation is:

$$\Delta Y_t = c_0 + m_t \Delta M_{t-i} + g_t \Delta G_{t-i} + z_t \Delta Z_{t-i} \qquad\qquad (1)$$

Where,

Y = the growth rate of nominal GNP;

M = the growth rate of money;

G = the growth rate of full-employment government expenditures;

ΔZ = the growth rate of remaining variables that affect output

m and g are regression coefficients of money and government expenditure.

In this study, interest rate is added along with the three existing variables in the St. Louis equation, namely, real government expenditure as proxy for fiscal policy, real money supply

(M2) as proxy for monetary policy and real GDP as proxy for real output growth to take care of the omitted variable bias.

This study has thereby addressed some of the criticism of St Louis equation such as omitted variable, methodology and finally, the criticism by Schmidt and Waud (1973) who argued that the constrained Almon lag procedure imposed on the St. Louis equation for estimation purposes may lead to biased and inconsistent estimates and to invalid tests.

Our model, therefore, in line with Younus (2012), contains the following variables:

1. Real Government Expenditure (EXPENDITURE),

2. Real Money (MONEY),

3. Real Interest Rate (INTEREST) and

4. Real GDP (GDP).

The model can be specified as follows:

$$\text{LOG} (\Delta\text{GDP}) = f (\text{LOG } \Delta\text{MONEY, LOG } \Delta\text{EXPENDITURE, } \Delta\text{INTEREST}) \qquad (2)$$

$$\text{LOG}\Delta\text{GDP} = \Upsilon_0 + \Upsilon_1\text{LOG } \Delta\text{MONEY} + \Upsilon_2 \text{ LOG } \Delta\text{EXPENDITURE} + \Upsilon_3 \Delta\text{INTEREST} + \mathcal{E}_t$$

The a priori expectations are: Υ_1 and $\Upsilon_2 > 0$ and $\Upsilon_3 < 0$. This implies that MONEY and EXPENDITURE has a positive relationship with GDP. INTEREST has a negative relationship with GDP.

Annual data for real government consumption, real money supply, real interest rate and real GDP growth are used in this study. All of the series are in log form, except the real interest rate. The source of the data is the World Development Indicators. We first picked all the countries in SSA, then proceeded to eliminate countries whose data were not up to date. As a result, the final sample set consists of a balanced panel of 8 countries from SSA from 1970 - 2012. The selected countries are: South Africa, Nigeria, Niger, Cote Divoire, Malawi, Togo, Tanzania and Madagascar.

The analytical technique employed in this study is panel data. Panel data(also known as longitudinal or cross- sectional time-series data) is most suitable for this study because panel data allows controlling for unobservable heterogeneity through individual country effect. Panel data allows controlling for variables one cannot observe or measure like cultural factors or difference in business practices across countries; or variables that change over time but not across entities.The regression model can take the form of the Fixed Effects Model, Random Effects Model and the Pooled Ordinarily Least Square model in order to establish the fittest regression with the highest explanatory power, which is mostfitting to the data set employed in the study (Greene, 2003).

Because of the various methods of panel data analysis, the question of which is the most suitable method arises. For that reason, a means of choosing the most appropriate method among the different approaches especially between the Fixed Effects Model and Random Effect Model is needed. The test that has been employed by most empirical studies to choose the most suitable method is the Hausman Chi-square (Judge et al., 2007). The Hausman specification test is the conventional test of whether the fixed or random effects model should be chosen. The question is whether there is significant correlation between the unobserved unit of observation specific random effects and the regressors. If no such correlation exists, then the Random Effects Model may be more suitable. Conversely, when such a correlation exists, the Fixed Effects Model would be more appropriate.

IV.   Estimation and Empirical Results

4.1   Unit Root Tests

The literature suggests the impropriety of the use of panel least squares technique without a unit root test. The reason is some of the variables maybe non-stationary at level, thus signifying the likelihood for spurious regressions. Therefore, before estimating the panel least square, we examine unit root properties in the variables. We consider pooling the panel data for testing the unit root hypothesis. The potency of the panel-based unit root test is dramatically higher, compared to using a separate unit root test for each individual time series (Levin, 2002).

Table 1   Panel unit root test for GDP (@ first difference)

Cross-

Method	Statistic	Prob.**	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.26218	0.0000	8	328
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.15229	0.0000	8	328
ADF - Fisher Chi-square	108.598	0.0000	8	328
PP - Fisher Chi-square	109.775	0.0000	8	328

Table 2   Panel unit root test for MONEY (@ first difference)

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-10.2600	0.0000	8	327
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.9112	0.0000	8	327
ADF - Fisher Chi-square	134.308	0.0000	8	327
PP - Fisher Chi-square	146.552	0.0000	8	328

Table 3   Panel unit root test for EXPENDITURE (@ first difference)

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-12.4409	0.0000	8	327
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-13.0081	0.0000	8	327
ADF - Fisher Chi-square	166.105	0.0000	8	327
PP - Fisher Chi-square	170.376	0.0000	8	328

Table 4   Panel unit root test for INTEREST (@ first difference)

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-16.4193	0.0000	8	326
Null: Unit root (assumes individual unit root process)				

Im, Pesaran and Shin W-stat	-14.6504	0.0000	8	326
ADF - Fisher Chi-square	189.681	0.0000	8	326
PP - Fisher Chi-square	183.613	0.0000	8	328

Each of the tables from Table 1-4 shows the results for four panel unit root tests. All four tests have a slightly different alternative hypothesis. The most popular panel unit root test follows from Levin–Lin–Chu (2002). The null hypothesis is that the series contains a unit root, and the alternative is that the series is stationary. The Levin–Lin–Chu test assumes a common autoregressive parameter for all panels; it restricts the coefficient around the lagged dependent variable to become constant across all units with the panel. We can see the Levin–Lin–Chu test confirms the all variables to be stationary at first difference.

For robustness we estimate the system root tests following Im, Pesaran and Shin W-stat (2003). The Im, Pesaran and Shin W-stat test is different from the Levin–Lin–Chu test because the Im, Pesaran and Shin W-stat test allows the coefficient on the autoregressive parameter to be heterogeneous across panels. The Im, Pesaran and Shin W-stat test has an alternative hypothesis that enables unit roots test for individual panels. As well, we report the ADF and PP Chi-Square. All the tests confirm that the variables are only stationary at first difference.

4.2   Hausman Test

Hausman Test involves comparison of two different estimators for the parameters of a panel data regression model. It is really a test of H_0: that random effects is consistent and efficient, versus H1: that random effects is inconsistent. If the Hausman test statistic is large, we use fixed effects. Otherwise we use random effects.

Table 5   Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	17.368758	3	0.0006

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
ΔMONEY	0.316054	0.378864	0.000243	0.0001
ΔEXPENDITURE	0.174617	0.199254	0.000040	0.0001
ΔINTEREST	-0.004591	-0.004475	0.000000	0.4175

As shown in Table 5, the Chi-Square Statistic is highly significant. Therefore, if we are to go by the Hausman's Chi-square statistics, the random effect result will be more reliable. Therefore, we use the random effects model in analyzing our panel data.

4.3   Random Effects Model

Table 6   Results of the Random Effects Model

Dependent Variable: ΔGDP
Method: Pooled EGLS (Cross-section random effects)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.050064	0.008615	5.811167	0.0000
ΔMONEY	0.378864	0.042726	8.867379	0.0000
ΔEXPENDITURE	0.199254	0.030826	6.463887	0.0000
ΔINTEREST	-0.004475	0.001810	-2.472385	0.0139
	Weighted Statistics			
R-squared	0.838521	Mean dependent var		0.135397
F-statistic	56.63517	Durbin-Watson stat		1.993423
Prob(F-statistic)	0.000000			

From the random effects model in Table 6, MONEY has significant positive relationship with GDP. This means that monetary policies in the selected countries have positive and significant impact on the economies. EXPENDITURE also has significant positive relationship with GDP. This means that fiscal policies in the selected countries have positive and significant impact on the economies.

From the t-statistic, it can be seen that monetary policy has greater impact than fiscal policies on the said economies. This is in line with Friedman and Meiselman (1963) who predicts more stable and statistically significant relationship between output and money than that of output and autonomous spending. It is, as well, in accord with Anderson and Jordan (1968) uses various measures of monetary and fiscal policy actions and shows that monetary policy has greater, faster and more predictable impact on economic activities.

From the random effects model, the R^2 is satisfactory at 83.9%. This indicates that more than 83% of the variations in GDP is explained by the variations in MONEY (proxy for monetary policy), EXPENDITRE (proxy for fiscal policy) and INTEREST (proxy for real interest rate). The F-statistics of 56.63517also indicates that the regression equation is significant. The DW statistics of 1.993423further indicates that the regression equation is free from the problem of autocorrelation. The implication of this is that the estimated equation can be relied upon in making valid inference about the relative potency of monetary and fiscal policies in African economies.

V   Conclusion

With the aid of the St. Louis equation, this study applies panel data technique on real variables of some selected African countries with extended data from 1970 – 2012. The results support both Keynesian and monetarist positive policy assertions. The monetary base and government expenditure are viable instruments to stabilize output. Moreover, this study suggests that utilizing the monetary base as a policy tool is more powerful than using government expenditure. This is in line with the predictions of Milton Friedman and Schwartz (1963) and other advocates of the St. Louis equation.Therefore, in order to attain higher output growth, these economies should rely more on monetary policy as compared with fiscal policy.

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