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Relative Effectiveness of Monetary and Fiscal Policies on Output Stabilization in Developing Countries: Evidence from Rwanda

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Abstract

The aim of this study was to explain the relative effectiveness of monetary and fiscal policies in explaining output in Rwanda. The study used a sample of quarterly data for the period 1996-2014. Applying a recursive VAR, the study used 12 variables, including 5 endogenous and 7exogenous variables to the benchmark model and other two specifications were attempted to capture the true contribution of monetary and fiscal policies to variations in nominal output. Obtained results using impulse responses and variance decomposition provide evidence that monetary policy is more effective than fiscal policy in explaining changes in nominal output in Rwanda. In addition, monetary policy explains better output when the VAR model contains domestic exogenous variables than when they are not included, suggesting the relevance of including domestic exogenous variables in VAR specification of monetary and fiscal policies effectiveness on economic variables. Another suggestion is that in order to achieve higher growth, the government of Rwanda should rely more on monetary policy as compared to fiscal policy.

Keywords: monetary and fiscal policies, output stabilization, domestic shocks, developing countries, Rwanda

1. Introduction

Monetary and fiscal policies are the main tools that policy makers use in an attempt to influence the level of economic activity. If recession occurs, two principles sets of tools can be used by policy makers to affect aggregate economic activity: *fiscal policy*, the control of government spending and taxes and *monetary policy*, the control of interest rates or the money supply (Mishkin, 2012). While empirical studies using monetarist models suggest that monetary actions have a greater impact on economic activities of the developed countries (Anderson & Jordan, 1968; Senbet, 2011; Bruce & Tricia, 2002), studies using structural models suggest that fiscal actions appear to have a dominant influence on economic activity in these countries (Darrat et al., 2014; Galí et al., 2007). The differences in the results of various studies suggest that none of the policies can be thought of as superior to the other, and their relative effectiveness depends on the prevailing economic and political conditions.

In May 2012, Rwanda aimed at becoming a middle income country by year 2020 with a corresponding GDP per capita of $1240 from $644 in 2012, a target that requires a sustained average GDP growth of 11.5% (Republic of Rwanda, 2013). After the 1994 Genocide, the economy experienced a high growth rate relative to other Sub Sahara economies. This trend has however reversed with an average annual growth rate of 9.2% between 1996 and 2000; 7.2% in the period 2001-2005; 8.2% between 2006 and 2009, and 6.9% in the period 2010-2013 (Note 1). This trend illustrates the volatility of growth which could be attributed to resource scarcity, size of the country and being a landlocked country. Consequently, the government's vision 2020 strategy may not be realized.

The main goal of this paper is therefore to evaluate the relative effectiveness of monetary and fiscal policies in explaining changes in output. Previous studies that have attempted to assess the relative effectiveness of both policies on output in developing countries, have mainly controlled for foreign exogenous shocks but have neglected domestic exogenous variables such as the influence of weather on agricultural output, variability in aid, United Nations (UN) payments, and expenditures related to war. The variability in the domestic shocks has affected the Rwandan economy over time. For instance, the agricultural sector is the backbone of the economy,

accounting for 39 percent of GDP, 80 percent of employment, 63 percent of foreign exchange earnings and 90 percent of the country's food needs (World Bank, 2013). When the rains fail, agriculture production declines and hence economic growth (Enseign & Bertrand, 2011; BNR, 2003; AfDB, 2008; Kanimba, 2008; AfDB, 2014), and high inflation pressures (Kanimba, 2008).

While the government has effectively used aid for development, the country remains vulnerable to fluctuations in aid flows, affecting both long-term and short-term planning (Abbott & Rwirahira, 2012; Baingana, 2011; AfDB, 2014). The amount of aid is usually less than that promised, while delays observed in disbursements affect government planning.

The period following a civil war is generally characterized by two main challenges, economic recovery and avoiding renewed conflict. Nonetheless, nearly 40 percent of post-war countries return to civil war within a decade (Collier et al., 2008). After the civil Rwandan war between 1990-1994, Rwanda came into wars -first and second- against the Democratic Republic of Congo (DRC) between 1996-1997 and 1998-2002 respectively. In addition, during the period 1996-2001 an organized insurgency based in the DRC based its operations in the areas considered as the breadbasket of Rwanda, thereby curtailing agricultural production.

In the past ten years, Rwanda has become an important contributor to UN, and Africa Union (AU) peace keeping mission. Reimbursements from the UN to the government for peacekeeping contributions account for a significant proportion of the defense budget. However, delays in the disbursements impacted fiscal targets negatively including government expenditure, and the exchange rate (Beswick & Marco, 2014). Consistent with the research problem, the paper seeks to address the following research question; should the government rely more on monetary policy as compared to fiscal policy or vice-versa, so as to achieve higher output?

This paper is organized as follows. In the next section we review the related literature. Section 3 specifies the empirical model. Section 4 describes data and the measurements of the variables of interest. Section 5 presents the empirical results and explores a number of robustness checks. Conclusions, policy suggestions, and presentation of unresolved issues are provided in section 6.

2. Previous Evidence

During the era of Great Depression, fiscal policy was viewed as more effective on economic activity. De Leew and Kalchbrenner (1969), Schmidt and Waud (1973), Blinder and Solow (1974), present basic theoretical grounds for active fiscal policy. However, during the late sixties, the failure of 1968-surtax policy induced a new ground for monetarist contest. The argument was that fiscal policy has a very little effect on aggregate demand and monetary policy is more important- that an increase in government expenditure is fully offset by negative wealth and substitution effects on private investments, resulting in expansionary fiscal policy eventually lowering income by crowding out private investment (Gramlich, 1971).

The New Economic Consensus (NEC) sets monetary policy at the control of the economic activity. However, recent reconsideration of fiscal policy in the NEC framework arises from the worry to the existence of the zero-interest rate bound [e.g. Bernanke et al. (2004); (Krugman, 2005)]. Given that the short-term rate is the major policy switch under Central Bank control, when it reaches a nominal bound of zero, a liquidity trap *a la* Japan occurs, and no more economic incentive from monetary policy is achievable. In this context, fiscal policy should be adopted. As noted by Krugman (2005) fiscal policy is distortionary and inflationary, and hence important mostly in extreme deflationary period. In the short run, fiscal authorities may deviate from a balanced budget stance in order to deal with deep recessions, while in the long run fiscal discipline must be exercised by ensuring stable national debt in order to maintain the public confidence (Bernanke, 2003).

There are two schools of thought with regard to the effectiveness of macroeconomic stabilization policies. Monetarists believe that monetary policy is more powerful than fiscal policy in stabilizing the economy (Friedman & Meiselman, 1963; Anderson & Jordan, 1968; Carlson, 1978). On the flipside, Keynesian view led by Keynes (1964), De Leew and Kalchbrenner (1969), Schmidt and Waud (1973), Blinder and Solow (1974) provide basic theoretical propositions for the effectiveness of fiscal policy.

The evidence so far is mixed. Empirical literature shows a long-run strong relationship between money and prices are affected by monetary policy with a certain lags. Monetary aggregates or policy interest rates affect output in the short run but monetary policy is neutral in the long-run (See for example Rakić & Rađenović, 2013).

The empirical evidence supporting the traditional Keynesian view, finds that fiscal policy shocks have clear positive effects on output, consumption and/or employment (Dungey & Fry, 2007; Galí et al., 2007; Giordano et al., 2008; Romer & Romer, 2010; Okorie et al., 2017; Darrat et al., 2014; Mutuku & Koech, 2014). There are also contrasting findings showing that expansionary fiscal policy could generate adverse effects on some

macroeconomic variables as suggested by neo-classical theoretical predictions (Iyeli et al., 2012; Ramey, 2011; Afonso & Sousa, 2009; Habibour, 2009; Caldara & Camps, 2008; Perotti, 2007; Mountford & Uhlig, 2005).

With the exception of Buckle et al. (2007) (Note 2), Dungey and Fry (2007), and Jayaram (Note 3) (2002), none of the previous studies controlled for the possibility of exogenous effect of weather on growth. To avoid model misspecification, this study controls for a set of exogenous variables such as foreign aid, rain fall, war period (1996-2002) between Rwanda and DRC, and the UN payments. Contrary to Buckle et al. (2007), and Dungey and Fry (2007) who used the number of days of soil moisture deficit in each quarter, this study applies a different approach by using rain fall (Note 4) as estimated by the Rwanda Meteorology Agency. The number of days of soil moisture deficit is not available for the case of Rwanda.

3. Specification of the Benchmark Model

VAR methodology has been employed by various empirical studies on the effects of monetary and fiscal policies. Previous studies that have employed VAR framework include Bernanke and Blinder (1992), Bernanke and Mihov (1998), Blanchard and Perotti (2002), Uhlig (2005), Caldara and Kamps (2008). This study uses a recursive VAR model approach which constructs the error terms in each regression equation as uncorrelated with the error in the preceding equations. This is done by including some contemporaneous values as regressors. The results depend on the order of the variables: changing the order changes the VAR equations, coefficients, and residuals, and there are $n!$ recursive VARs representing all possible orderings. The estimated benchmark model is the reduced form of a structural VAR model comprising of the log of government spending (LNGEXP), the log of nominal GDP (LNGDP), the log of tax revenues (LTREV), the log of broad money (LM3) and the log of interbank rate (LINT) as a proxy for short-term interest rate.

The structural (benchmark) model is specified as follows:

$$AY_t = B(L)LY_t + CX_t + e_t \tag{17}$$

where $Y_t = (GEXP_t, GDP_t, TREV_t, M_{3t},$ and $INT_t)$ is the vector of endogenous variables, A is a 5x5 matrix of coefficients capturing the contemporaneous relationship between the endogenous variables, L is the lag operator (with $LY_t = Y_{t-1}$), $B(L) = B_0 + B_1L + B_2L_2^2 + \ldots$ is a matrix polynomial in the lag operator, representing the lagged effects of the endogenous variables, C is a 5x7 matrix capturing the effects of the seven exogenous variables [foreign aid, rain fall, war, UN payments, US industrial product index, US Treasury bills rate, and World oil price], and $e_t = (e_{Gexpt}, e_{GDPt}, e_{Trevt}, e_{M3t},$ and $e_{Intt})'$ being the vector of structural innovations, with $E(e_t e_t') = \Sigma$, a diagonal matrix, and $E(e_t e_{t-j}') = 0$.

The estimated reduced-form VAR is given by:

$$Y_t = A^{-1}B(L)LY_t + A^{-1}CX_t + u_t \tag{18}$$

With $u_t = A^{-1}e_t$ is the vector of reduced-form residuals, where $E(u_t u_t') = \Omega = A^{-1}\Sigma A^{-1\prime}$, which is normally not diagonal. The reduced-form VAR yields an estimate of $A^{-1}B(L)$, as well as of u_t and Ω. Our main concern is the dynamic effects of an exogenous monetary policy and fiscal policy shocks on the nominal GDP. If we were able to know the elements of A, we could trace out the dynamic effects of an exogenous monetary and fiscal policy shocks on output (the impulse responses) by shocking the structural innovation of these policies in:

$$Y_t = A^{-1}B(L)LY_t + A^{-1}CX_t + A^{-1}e_t \tag{19}$$

and employ this equation to resolve for the present and all future values of Y_t. Unfortunately, we may not obtain an estimate of A by estimating the reduced-form VAR. However, some restrictions on those elements are provided. Ω is an observed 5x5 symmetric matrix. It thus contains fifteen distinct elements. By choice of units, one can set $\Sigma = I$, the identity matrix, and obtain $\Omega = A^{-1}A^{-1\prime}$.

Because Ω is symmetric, it contains fifteen distinct elements, and therefore, on the twenty five distinct elements of A, this equation provides fifteen independent (nonlinear) restrictions. We can therefore identify the remaining elements of A, by providing ten additional independent restrictions, and then compute the impulse responses. One approach is to assume that the contemporaneous interaction between the endogenous variables in the VAR is recursive. In this case, A becomes a lower-triangular matrix, and the ten additional restrictions would consist of zero restrictions on the diagonal elements of A. The recursive ordering (Note 5) $GEXP_t, GDP_t, TREV_t, M_{3t},$ and INT_t allows only the government spending to affect NGDP, and other variables in the system; NGDP to affect contemporaneously other variables in the system except government spending; Tax revenue cannot affect government spending and NGDP but can affect the broad money and interest rate contemporaneously; M_3 is contemporaneously affected by all other variables in the model except interest rate which is itself affected by all the variables in the model.

In order to investigate the relevance of using domestic exogenous variables, three VAR models (the benchmark model; specification 1, and specification 2) are estimated and results are compared. The benchmark model differs from other specifications in that in addition to endogenous variables, it uses domestic and foreign exogenous variables, while specification 1 uses only foreign exogenous variables; and specification 2 does not consider exogenous variables.

4. Data

This study uses quarterly data for nominal government spending (NGEXP), nominal net tax revenues (TREV), nominal GDP (NGDP), money stock (M3), and interbank rate (INT) from 1996Q1 to 2014Q4. Data for M3 and INT are obtained from the Central Bank of Rwanda (BNR), while NGEXP, TREV, NGDP, and Aid [Net Official Development Aid: NODA (for year 2014)] are obtained from the Ministry of finance and economic planning (Minecofin). Aid data from 1996-2013 was obtained from World Bank metadata. Data on rainfall were obtained from Rwanda Meteorology Agency on monthly basis, and were made quarterly by taking the monthly averages. Foreign exogenous variables include U.S. industrial production index (USIPI); the USA 90-Day Treasury Bills interest rate (USATB); the world oil prices (WOILP).

Nominal GDP is the Gross Domestic Product by Expenditure Approach and is generally computed by National Institute of Statistics of Rwanda (NISR); money supply M3 is computed by BNR and is currency in circulation outside banks plus demand, time deposits and foreign currency deposits at the commercial banks (deposits include both Rwanda franc and foreign-currency). The fiscal policy variables used in this study are government spending and tax revenues, and are defined in line with Blanchard and Perotti (2002). Government expenditure includes consumption (mainly compensation of employees and intermediate consumption), and government investment.

The revenue variable (TREV) is defined as total revenue (which includes tax and non-tax revenue) less interest payments and transfers (referred to as taxes or net taxes in this study). It is worth noting that only annual data for nominal GDP, TREV, NGEXP, and Aid were available for the period 1996-2014, and were transformed into quarterly in this study using the quadratic match sum approach. Nominal GDP is interpolated for the period 1996: Q1-2005: Q4, while for the period 2006: Q1 to 2014: Q4 data was obtained from the ministry of finance and economic planning (Minecofin) and was collected on quarterly basis by the National Institute of Statistics of Rwanda (NISR).

The data are expressed in natural logarithms (including the interbank rate) (Note 6) and are seasonally adjusted (except the interpolated ones) by Census X-12 approach. Dummy variable for war (war) between Rwanda and DRC takes the value of one during the period of wars (1996-2002) and zero otherwise, while the dummy for UN payments on peace keeping missions takes zero for the period before 2008, and one from 2008 to 2014. Moreover, given that domestic and foreign exogenous variables are likely to affect endogenous variables with a lag; exogenous variables enter the VAR model with 2 lags (Note 7).

5. Empirical Findings

5.1 Stationarity Test

The unit root tests are conducted on the equations describing the data generating process (DGP) of the series. Using Augmented Dickey-Fuller (ADF) test, Philips-Perron (PP), and Kwiatkowski-Philips-Schmidt-Shin (KPSS) tests, all endogenous variables of the model (lngexp, lngdp, ltrev, lm3, and lint), as well as exogenous variables (lnoda, lrf, lusipi, ltbusa, and lwoilp) are all non-stationary at level. Table 1 in Appendix indicates that the series are all integrated of order one [that is I-(1)].

5.2 Johansen Cointegration Test

Given that all the variables were found non-stationary at level, cointegration test was run to establish if a long-run relationship among the non-stationary variables exists. As shown in Table 2 in Appendix, Trace as well as Max-eigen value test indicates that variables are cointegrated at the 5% level.

5.3 Lag Order Selection

The lag order choice was made following the model that minimizes the functions of sequential modified LR test statistic, Akaike Information (AIC), Schwarz Bayesian (SC), Hannan-Quin (HQ), and Final Prediction Error (FPE) Information criteria. Before the lags for the endogenous variables are selected, we first fix exogenous variables to 2lags. Results in Table 3 in the Appendix show that the VAR models with 1 lag (by SC:-21.02, and HQ: -22.28), 5 lags (by LR: 67.53, and FPE: $3.81e^{-17}$), and 6 lags (by AIC:-24.22) are the best since they present the lowest computed values. We therefore have to choose between 1, 5, or 6 lags for one to determine the appropriate lag order for the model to be estimated.

The choice of the lag order was mainly based on the tests of stability of VAR, autocorrelation, and normality, but also given that the sample size used in this study, is not large so that the lag order that assures a parsimonious model is chosen. While the model with 6 lags was found unstable, the next step was to choose between 5 lags and 1 lag models. By taking into account that the sample had only 76 observations, 12 lagged endogenous and exogenous variables, the model with 1lag was adopted over the 5 lag model to ensure reasonable degrees of freedom.

5.4 Stability Test

The stability test results as presented in Figure 1 indicates that VAR model with 1 lag is stable, thus can be used for regression analysis. The modulus for all roots is less than1 and lie inside the unit circle.

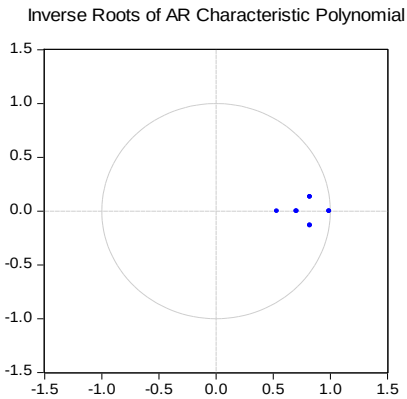

Figure 1. VAR stability test

5.5 Serial Correlation Test

Autocorrelation test was done using the multivariate LM test statistics for residual serial correlation up to 12 lags. The LM test results as depicted in Table 4 in the Appendix show absence of autocorrelation for the model with 1 lag.

5.6 Normality Test

The test for normality of residuals was one of the criteria for 1 lag VAR model to be chosen for analysis. Results in Table 5 in Appendix show that following Skewness criterion, the residuals of the VAR model in this study are normally distributed at 5% significance level.

6. Estimation Results and Discussions

In this section, we provide and discuss the recursive impulse responses and variance decomposition results with a focus of revealing monetary and fiscal policy effect on nominal output.

6.1 Impulse Response Functions: Individual Effect of Monetary Variables on Nominal Output (Benchmark Model)

In order to trace out the effect of a one-time shock to one of the innovations on contemporary and future values of the endogenous variables, impulse response functions for the recursive VAR, ordered $\mathrm{LNGEXP_t}$, $\mathrm{LNGDP_t}$, $LTREV_t$, $\mathrm{LM3_t}$, $LINT_t$ were computed and plotted in Figure 2 of the benchmark model.

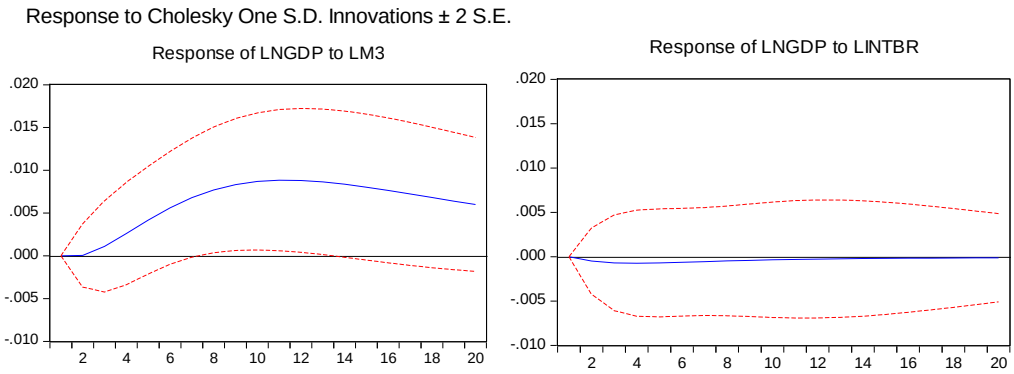

Figure 2. Effect of monetary variables on nominal GDP (Benchmark model)

It shows the effect of an unexpected 1percent increase in policy variable on output. Monetary policy through money stock exerts significant positive effect on output. The effect from money stock to nominal output is felt after the7th quarter with peak during the 9th quarter. The effect remains relatively high and significant up to 13th quarter, thereafter becomes insignificant but remains positive. These results are in harmony with monetary theory that, monetary policy can affect output in the short and medium term (Mishkin, 2012). These results also imply that expansionary monetary policy through money stock can be used to influence output in Rwanda, at least in the short and medium term. However, the interbank rate does not seem to exert any influence on nominal output.

6.2 Impulse Response Functions: Effect of Fiscal Policy Variables on Nominal GDP (Benchmark Model)

The effect of fiscal policy variables is shown in Figure 3.

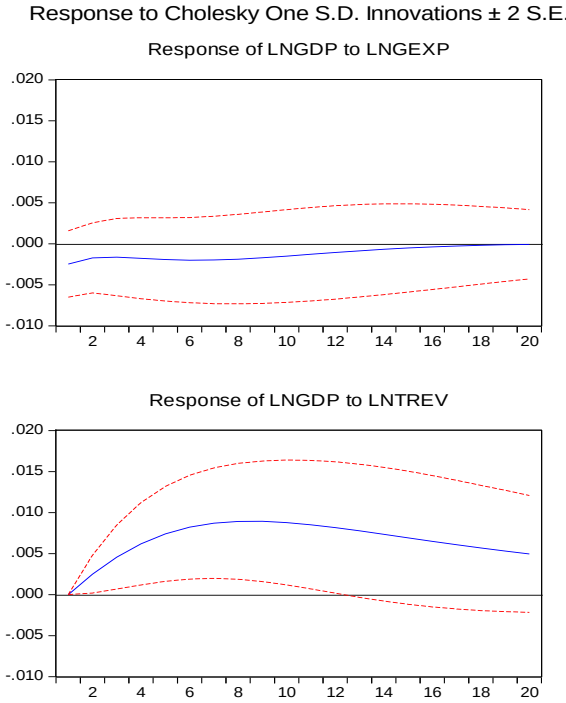

Figure 3. Effect of fiscal policy variables on nominal GDP (Benchmark model)

It shows that tax revenue positively affects the nominal output between the 2nd and 12th quarter before the effect becomes insignificant, though it remains positive in the subsequent period. The effect of TREV on output was expected to be negative. The positive effect of tax could be explained by a large portion of agricultural production that is exempted of tax. Thus actual tax data is not a representation of the entire economic activity at the macro level. On the other hand, the informal sector in Rwanda is relatively large which increases the untaxed segment of the economy. The positive effect of taxes on output was also obtained by Marcello and Issouf (2013), and Deak and Lenarcic (2011).

6.3 Variance Decomposition: Monetary and Fiscal Policy Effects on Nominal GDP

This study employs the error variance decomposition in order to investigate the relative magnitude of each random shock in affecting output in the VAR model. Table 6 in the Appendix shows that money stock is significant in explaining changes in nominal GDP, with a higher contribution of 32% occurring during the 20th quarter. However, interest rate does not seem to influence fluctuations in nominal output. With regard to fiscal variables effect on nominal GDP, it is apparent that government spending does not contribute in explaining fluctuations in nominal GDP. However, tax revenue tends to explain fluctuations over time and the effect is higher during the 20th quarter.

6.4 Comparison of Benchmark Model Results with Other Specifications

In order to test the robustness of the results, we perform some alternative regressions. Impulse responses results for specification 1 and 2 are presented in Figures 4 and 5 respectively.

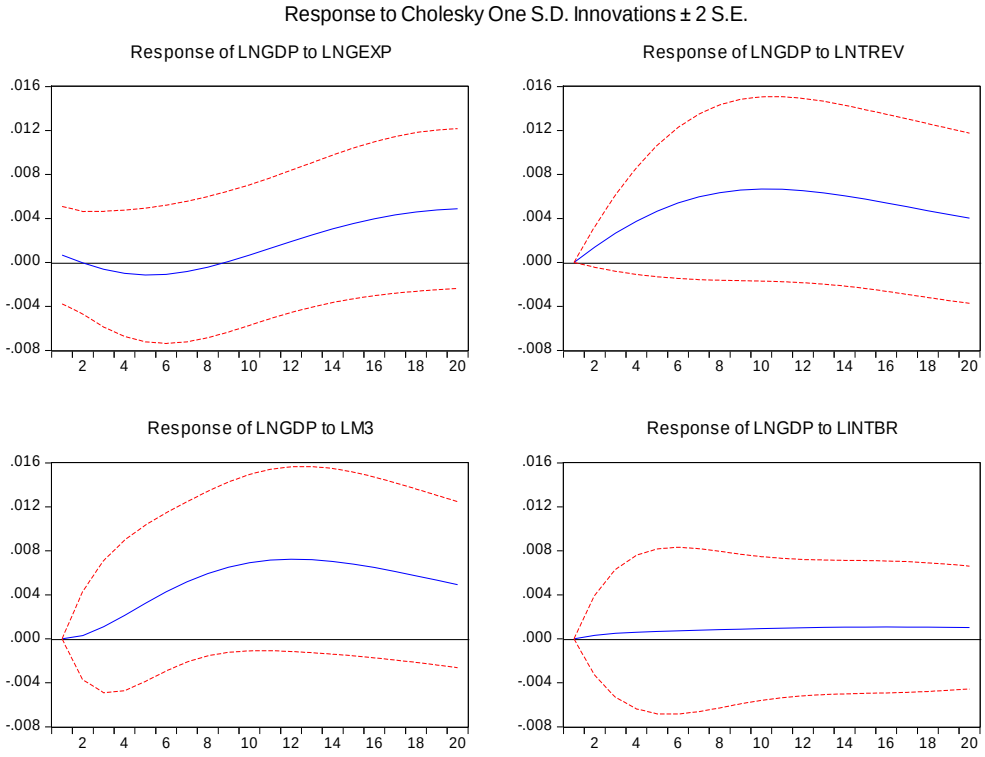

Figure 4. Effect of monetary and fiscal policy variables on nominal GDP (specification 1)

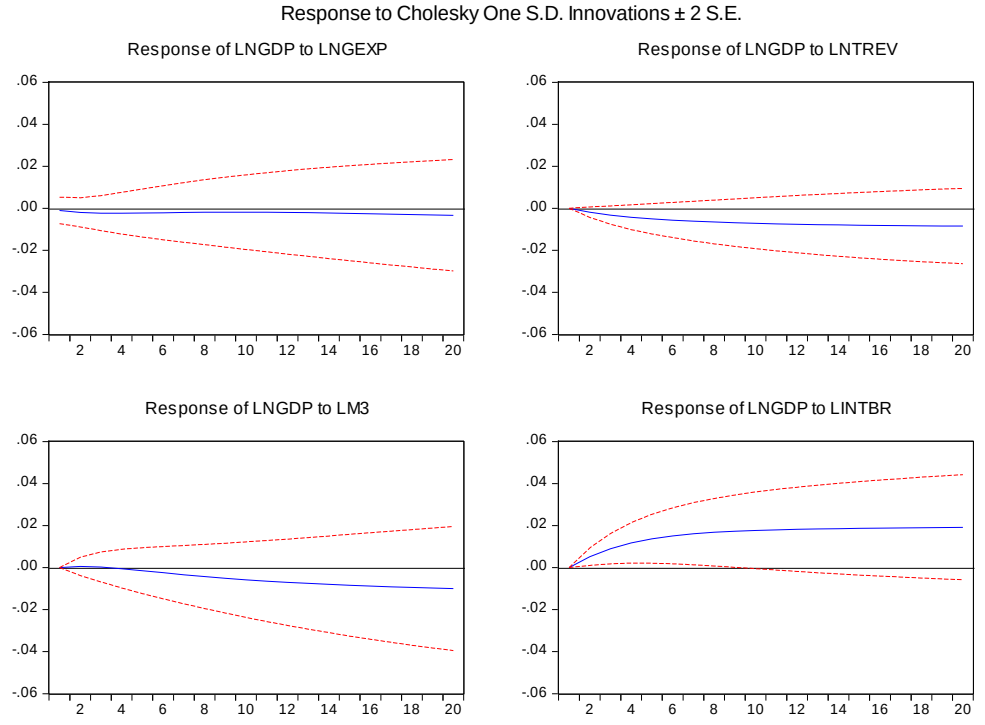

Figure 5. Effect of monetary and fiscal policy variables on nominal GDP (specification2)

The benchmark results significantly differ from both specification 1 (where only foreign shocks are controlled for) and specification 2 (where both domestic and foreign shocks are not controlled for) in that monetary policy in these specifications does not affect output, though it affects output in the benchmark model (where both the domestic and foreign shocks are controlled for). It is important to note that in specification 2, the interbank rate positively affects output, contrary to theoretical expectations. In light of these results, it is clear that the introduction of domestic exogenous variables improves the reliability of the results.

7. Conclusions

This study sought to establish whether monetary policy is more effective relative to fiscal policy in explaining changes in output in Rwanda. To achieve this objective, a recursive VAR model was estimated using quarterly data from 1996:Q1 to 2014: Q4. In order to correctly specify the estimated VAR model, domestic exogenous variables (rainfall, aid, UN payment, and war) in addition to foreign exogenous variables (US Industrial Product Index, US Treasury-Bills , and World oil product) were included. The results derived through impulse responses and variance decomposition support monetarists' views of the importance of monetary over fiscal policy. Monetary policy was found to exert large effect on output. Money stock has a significant positive effect on output in the short-term.

We also examined the relevance of domestic exogenous variables in the VAR specification. Using two alternative specifications, we found the inclusion of domestic exogenous variables as relevant in the VAR specification. Overall, monetary policy is effective in influencing movements in output in Rwanda, hence policy makers should rely more on monetary policy as compared to fiscal policy. Nevertheless, given the social impact of fiscal policy, the combination of both policies is worthwhile and should be explored.

One of the limitations of our study is the fact that the point estimates of the impulse responses are associated with wide confidence interval. We consider this to be attributed to the lack of large sample size, given that VAR is asymptotically efficient. Further research should therefore focus on the effectiveness of monetary and fiscal policy in explaining changes in output by including domestic exogenous variables (aid, rainfall, war among others), using a panel framework (for increased sample size) for sub-Saharan countries for they are affected by weather variability, aid variability, and wars.

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Notes

Note 1. Authors' calculations from World Bank (2015) Meta data.

Note 2. Buckle et al. (2007) demonstrated the relative importance of international and domestic shocks to the business cycle for a small and volatile open economy. The effect of domestic climate on the New Zealand business cycle was investigated and captured by the soil moisture deficit. Results showed that climate has been an important source of business cycles in New Zealand. Similarly, Dungey and Fry (2007) used the soil moisture

deficit to capture the effect of weather on the economy of New Zealand.

Note 3. Jayaraman (2002) took into consideration the effects of annual cyclones on growth in the four South Pacific island countries. This would reflect the need of consideration of the possibility of exogenous factors (natural) to affect economic activity, especially in low income countries with no means to counter their effects.

Note 4. Exenberger and Pandorfer (2011), Nastis et al (2012), Kumar and Sharma (2013), and Exenberger et al. (2014) used rain fall in their studies, as one of weather variables to estimate the effect of weather variability on agricultural production.

Note 5. The recursive ordering above is based on Caldara and Camp (2008); Mirdala (2009); Ravnik and Žilić (2010)

Note 6. The logarithm of interbank rate is given by lintbr ≡ log(1+intbr) in order to interpret the impulse responses to shocks to the policy rate as short run elasticities instead of semi-interest rate elasticities. Same approach is used for TBUSA.

Note 7. Exogenous variables are lagged by two periods corresponding to 6months taking into account that crops generally take 3 to 6months to get harvested.

Appendix

Table 1. Stationarity tests results

Variable(specification)/ Test	ADF	PP	KPSS	Conclusion
LNGDP (Trend&Int)	-1.733	-1.896	0.153	LNGDP is I (1)
	-5.525***	-5.435***	0.100***	
LM3 (Trend & Int)	-1.718	-1.598	0.278	LM3 is I (1)
	-10.547***	-10.613***	0.071***	
LINTBR (No Trend, no Int)	-1.391	-1.396		LINTBR is I (1)
	-8.567***	-8.567***		
LNGEXP (Trend & Int)	-1.841	-1.855	0.241	LNGEXP is I (1)
	-2.169	-5.601***	0.045***	
LNTREV (Trend & Int)	-2.849	-3.15	0.158*	LNTREV is I (1)
	-4.951***	-5.014***	0.071***	

Note. Int=intercept; ADF=Augmented Dickey-Fuller; PP=Phillips-Perron; KPSS= Kwiatkowski-Phillips-Schmidt-Shin; (*), (**), and (***) =the series is stationary at 10%, 5%, and 1% respectively for ADF and PP, while stationary at 1%, 5%, and 10% for KPSS. I (1)= the series is integrated of order 1.

Table 2. Cointegration test for monetary and fiscal policies effects on NGDP

Sample (adjusted): 3 76
Included observations: 74 after adjustments
Trend assumption: Linear deterministic trend
Series: LNGEXP LNGDP LNTREV LM3 LINTBR
Exogenous series: LNODA(0TO-2) LRF(0TO-2) WAR UNP LUSIPI(0TO-2) LTBUSA(0TO-2) LWOILP(0TO-2)
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.415804	103.3624	69.81889	0
At most 1 *	0.337198	63.58591	47.85613	0.0009
At most 2 *	0.226698	33.15131	29.79707	0.0198
At most 3	0.129197	14.12694	15.49471	0.0795
At most 4 *	0.051208	3.889851	3.841466	0.0486

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.415804	39.77645	33.87687	0.0088
At most 1 *	0.337198	30.43459	27.58434	0.0209
At most 2	0.226698	19.02437	21.13162	0.0961
At most 3	0.129197	10.23709	14.2646	0.1968
At most 4 *	0.051208	3.889851	3.841466	0.0486

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 3. VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
1	873.948	474.4591	6.45E-17	-23.1128	-21.02491*	-22.28346*
5	1005.742	67.53475*	3.81e-17*	-24.0212	-18.72117	-21.91596
6	1037.779	29.29114	4.00E-17	-24.22226*	-18.1192	-21.79805

* indicates lag order selected by the criterion

Table 4. VAR serial correlation LM tests

Null Hypothesis: no serial correlation at lag order h Included observations: 75		
Lags	LM-Stat	Prob
1	30.90303	0.1922
2	22.18392	0.6251
3	25.59815	0.4293
4	87.19386	0
5	24.20193	0.5077
6	23.14483	0.5691
7	25.19598	0.4514
8	51.17194	0.0015
9	24.72356	0.4779
10	28.83039	0.2711
11	20.40572	0.7252
12	49.08882	0.0028
Probs from chi-square with 25 df.		

Table 5. VAR residuals normality test

Orthogonalization: Cholesky (Lutkepohl) Null Hypothesis: residuals are multivariate normal Included observations: 75				
Component	Skewness	Chi-sq	Df	Prob.
Joint		6.084457	5	0.29

Table 6. Variance decomposition: Monetary and fiscal policy effect on nominal GDP

Variance Decomposition of LNGEXP:						
Period	**S.E.**	**LNGEXP**	**LNGDP**	**LNTREV**	**LM3**	**LINTBR**
1	0.028	100	0	0	0	0
10	0.048	64.887	7.845	17.676	9.511	0.081
20	0.058	43.723	5.643	26.503	24.06	0.069

Variance Decomposition of LNGDP:						
Period	**S.E.**	**LNGEXP**	**LNGDP**	**LNTREV**	**LM3**	**LINTBR**
1	0.018	1.98	98.02	0	0	0
10	0.042	2.009	51.46	28.713	17.644	0.173
20	0.053096	1.398823	32.05629	34.26785	32.15504	0.121992
Variance Decomposition of LNTREV:						
Period	**S.E.**	**LNGEXP**	**LNGDP**	**LNTREV**	**LM3**	**LINTBR**
1	0.03	0.147	3.496	96.357	0	0
10	0.094	1.235	3.045	52.798	42.905	0.017
20	0.101	1.116	2.742	50.322	45.804	0.016
Variance Decomposition of LM3:						
Period	**S.E.**	**LNGEXP**	**LNGDP**	**LNTREV**	**LM3**	**LINTBR**
1	0.037	1.082	3.684	4.532	90.702	0
10	0.063	3.74	10.525	17.967	67.605	0.163
20	0.075	2.693	7.965	25.839	63.369	0.134
Variance Decomposition of LINTBR:						
Period	**S.E.**	**LNGEXP**	**LNGDP**	**LNTREV**	**LM3**	**LINTBR**
1	0.009	2.184	1.43	1.014	1.243	94.129
10	0.011	2.47	4.374	0.869	1.258	91.029
20	0.011	2.543	4.37	0.926	1.321	90.84
Cholesky Ordering: LNGEXP LNGDP LNTREV LM3 LINTBR						