Zambia Social Science Journal

Volume 6
Number 1 *2015/2016*

Article 5

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We establish the causality between government revenue and government expenditure using Granger causality tests within the Vector Auto-Regressive (VAR) framework. The estimated VAR model includes gross domestic product, exchange rate and Treasury Bill rates. Granger causality tests found unidirectional causality running from government expenditure to revenue. This work is founded in economic theory of public choice and the underlying causality of budget deficits. Knowledge of the revenue spending nexus will shed more light on the nature of the intertemporal relationship between government revenue and government spending and help shape the political economy of fiscal policies.

The results are augmented by forecast error variance decompositions which suggest that a one standard deviation shock to government expenditure will only explain about 15% variation in government revenue. The absence of social crises may explain the weak relationship indicated by forecast error variance. The spend-and-tax hypothesis is based on the premise of large-scale social disturbance, crises, or war, which make it easier for a political system to decide how much to spend and then adjust tax revenues. In the context of Zambia, these results may indicate that the political system makes spending decisions in the midst of peace and gets to adjust revenue policy to finance the budget deficit.

Zambia must emphasise policies that control or place limitations on government spending to effectively manage budget deficits. Policymakers, politicians, and civil society will have to prepare themselves and the general public on the importance of bringing the government budget in balance.

Keywords
revenue, expenditure, Granger causality, vector auto-regressive, Zambia, causality between government revenue and expenditure: empirical evidence from Zambia

1.0 Introduction

The Zambian government and the International Monetary Fund (IMF) have been in discussion over a possible IMF support programme for Zambia. The discussion comes after Zambia acquired a series of Eurobonds at a commercial rate to plug the budget deficits arising from spending stress for the government budget and is compounded by the delay in implementing cost-reflective pricing of petroleum and electricity (IMF, 2015).

The debt dynamics in Zambia closely track the performance of copper prices on the international market. The fall in copper prices in the 1970s brought about a corresponding decline in government revenue and led to an accumulation of substantial external debt during the 1970s through to the 1990s (Weeks and McKinley, 2006). During this period the government also depended on revenues from the mines to build hospitals and schools, general infrastructure development, and provide subsidies on production and consumption of food.

Fiscal deficits averaged 12.3% of gross domestic product (GDP) in the 1970s, 13.8% in 1980s, and 6% in the 1990s (Whitworth, 2012). By 30 September 1987, mounting debts and defaults on debt servicing forced the IMF to declare Zambia ineligible to use the general resources of the Fund (IMF, 1988). In 1990, Zambia held elections and multiparty democracy was ushered in from a one-party dispensation. With a change in the nation's leadership and upon negotiation with the IMF, the country was permitted to use the Fund's financial resources and loans were issued out to Zambia.

Zambia adopted radical structural reforms of the economy in which many state-owned enterprises were sold to become privately owned entities in 1992. These reforms were seen as part of the financing agreement with the IMF and World Bank. The performance of most of the privatised companies followed the standard privatisation curve: poor performance before privatisation, rebounding two to three years after privatisation and declining sharply thereafter (Serlemitsos and Fusco, 2003). The Zambian government was hesitant in privatising strategic institutions in the energy, telecommunications, financial and mining sectors. The losses from these state-owned enterprises, together with preparations for the 2001 general elections, and Organisation for African Unity (OAU) summit's exceptional expenditures created serious budget problems for the government (AFDB/OECD, 2003).

In 1999, the international financial institutions replaced structural adjustment programmes with Poverty Reduction Strategy Papers (PRSPs). The PRSPs involved three-year development plans with details of macroeconomic policies, government spending targets and social development programmes. This was meant to entrench ownership in the development process by all stakeholders such as government, civil society organisations, the church, and business. The international financial institutions then evaluated the PRSPs as part of the process of reaching the completion point of Heavily Indebted Poor Countries (HIPC). Debt relief would be granted by the international financial institutions to countries deemed to have performed to the set standards in the PRSPs. The resources freed from debt relief were to be used to support poverty reduction strategies. In 2005, Zambia was deemed to have made satisfactory

progress, and the IMF and World Bank offered US$ 3.90 billion in debt service relief. The remainder of the debt from multilateral and bilateral creditors was also expected to be reduced by the respective institutions/entities to provide their share of assistance required under the HIPC initiative (IMF, 2005).

This paper proceeds as follows: section 2 discusses the motivation for the paper; section 3 reviews the literature; section 4 presents the model and methodology; section 5 explains results, and section 6 concludes.

2. Motivation for the paper

In recent years, budget deficits have become chronic. Many countries the world over have to deal with huge budget deficits, i.e., Portugal, United States of America, Greece, etc. Zambia is no exception. Budget deficits have been rising, despite the government commitment to reduce them in the past few years (Ministry of Finance, 2014). To finance spending, the government has been contracting both domestic and foreign debts.

The execution of the government budget has its problems such as wasteful expenditure, un-vouched expenditure, and unaccounted for revenue.s (Auditor General, 2015). Systems put in place to promote accountability of budget execution have not been satisfactorily implemented. The spending arrears rose to an estimated 10 billion Zambian kwacha by 2015. These arrears arose due to late payments to road contractors, pensions, and electricity imports. Provision for public participation in budget preparation exists, however the significant part of this participation only begins after the annual budget has been presented to parliament, leaving little scope to influence the budgetary outcome (CSPR, 2010). Fiscal discipline is vital to improve and sustain macroeconomic stability. Reduction in borrowing to finance fiscal deficit may lead to private sector investments rising, since lower interest rates are associated with a higher quantity of project proposals that qualify for implementation, which raises endogenous investment spending (Aisen and Hauner, 2008). It also helps reduce vulnerabilities of unexpected shocks to the economy. Large persistent budget deficits over time may lead to loss of credibility in policy making (The World Bank, 2004).

It is therefore important to understand the relationship between revenue and expenditure to enable one devise a strategy for reducing fiscal deficits. Should government achieve this through raising revenue or reducing expenditures? The Granger non-causality test can be used to pick out any underlying relationship that may exist between government revenue and spending in explaining budget deficits. Knowledge of the underlying relationship can help design appropriate policy responses in managing budget deficits.

3.0 Theoretical Literature Review

How budget deficits happen has generated considerable debate in scholarly literature. Friedman's (1978) tax-and-spend hypothesis suggests that increases in tax revenues lead to increases in government spending and therefore worsening budget deficits. Small interest groups each lobbying for spending to benefit its members lead to a budget deficit. Correcting budget deficits would require placing a limit on government revenues, as that would reduce the appetite for increasing government spending thereby bringing spending in line with revenues.

The spend-and-tax hypothesis is premised on a growing divergence between desirable public spending and the limits of the taxation system. Large-scale social disturbances make it easier for governments to run budget deficits and raise tax revenues to new levels initially thought impossible without resistance (Peacock and Wiseman, 1961). There is a likelihood that governments will spend-and-tax, engaging in deficit financing, increasing state activity during a period of crisis or social disturbance. Spending rises enable governments to raise and sustain higher tax revenues without much ado.

The fiscal synchronisation hypothesis suggests that it is the size of the mean income relative to the median income of the decisive voter that determines the tax rate and therefore the size of the budget (Meltzer and Richard, 1981). In this model, individuals are utility maximisers, and it depends on incomes and leisure. If the decisive voter's median income lies below the mean income, there is an incentive for the median voter to choose candidates who favour a rise in taxes which favours redistribution which raises his utility. If the median income is higher relative to mean income, it provides an incentive for the median decisive voter to choose candidates who favour a lowering of taxes which lowers redistribution and raises his utility. Government spending and revenues are simultaneously synchronised by the median decisive voter's actions. The fiscal synchronisation hypothesis suggests that causality between government spending and revenue is bidirectional (Elhiraika et al, 2015).

The institutional separation hypothesis is premised on the theory that there is no causality running between government revenue and spending. The distinction between the allocation and taxation functions of the government creates separate institutions (Baghestani and McNown, 1994). The separation of institutions making revenue and spending decisions is influenced by their divergent interests and agendas (Hoover and Sheffrin, 1992).

3.1 Empirical Literature Review

Mupimpila et al (2015) used a Vector Error Correction (VEC) model on quarterly data to test for causality between government tax revenue and government

expenditure for Botswana. Variables employed included trade openness, per capita GDP and the interest rates. Findings suggest that past values of government tax revenues have a negative sign and significantly affect government expenditure. The results indicate that a fall in tax revenues will cause a rise in government expenditure supporting the fiscal illusion hypothesis. Past values of expenditure were also found to affect expenditure significantly. The error correction term was found to be significant and had the right negative sign.

Nyamongo et al (2007) using monthly data from October 1994 to June 2007 estimated an Error Correction Model to test for the relationship between government revenue and government expenditure in South Africa. They found significant error correction terms that indicated the existence of a long-run relationship between government expenditure and government revenue. The Granger causality evidence supported the existence of long-run bidirectional causality between government revenue and expenditure. However, the findings suggest a lack of short-run causality between the variables. The impulse response functions results indicate that government expenditure has a positive effect on itself and causes a permanent effect on revenue. A positive shock of one standard deviation to government revenue would have a positive permanent effect on government revenue and it has a permanent effect on government expenditure.

Eita and Mbazima (2008) performed the Granger causality test on the Namibian government's revenue and expenditure using time series data running from 1977 to 2007. Unit root tests suggested that government revenue and expenditure were stationary in levels and Johansen test for cointegration suggested existence of two cointegration equations. Using Vector Auto Regression (VAR) they found the existence of Granger causality from government revenue to government expenditure. The study failed to reject the hypothesis of no Granger causality from expenditure to government revenue. The impulse response functions suggest that government revenue responds positively to shocks from itself and government expenditure, and that government expenditure responds positively to shocks from itself and government revenue.

Aladejare and Ani (2012) used a VAR model to test for causality between government expenditure and government revenue in Nigeria. Annual data ranging from 1961 to 2010 was used for the study. The findings of the VAR model suggest that past values of government expenditure have a significant impact on government expenditure. Results of impulse response function suggest that government expenditure responds positively to its own shock and government revenue shock. Government revenue responds positively to changes in its own shock and expenditure shocks.

Richter and Dimitrios (2013) employed a vector error correction model on annual data for Greece for the years 1833 to 2009 to test for causality between

government revenues and government expenditure. Real GDP was included in the model to capture how the macroeconomy affects the intertemporal relationship between government spending and government revenues. Richter and Dimitrios (2013) defined the Granger causality test by reading the joint F-test for the significance of joint lagged values. The study findings indicated the existence of causality running from government spending to government revenues in support of the spend-and-tax hypothesis.

Maynard and Guy (2009) used quarterly data for Barbados from 1985 to 2008 to analyse causality between government spending and government tax revenue. They included interest rate and real output proxied by the GDP in the specification of the model. The results from the multivariate model suggest that there exists a long-run relationship between government spending, revenue, interest rates and GDP. The findings from the Vector error correction model indicate that government spending Granger causes taxes. Furthermore, real GDP and interest rate were found to be insignificant in causing taxes. In relation to revenue, the findings suggest that only real GDP Granger causes government revenue.

Manage and Marlow (1986) tested for causality between federal expenditure and receipts for the USA. Using a VAR model they found that that revenue causes government spending, while government spending does not cause revenue. In the second specification using real variables of government expenditure and government revenue, they found that real revenue causes real government spending while real government spending does not cause real revenue. Using a third specification considering nominal government outlays minus interest payment on debt and nominal revenue they found bidirectional causality between government spending and government revenue.

Dalena and Magazzino (2012) use VAR and VEC Models to test for causality between government revenue and government spending. Three homogenous annual data sets were employed spanning the years 1862 to 1913, 1914 to 1946, and 1947 to 1993. The findings of the VEC model for the years spanning 1862 to 1913 suggest unidirectional long-run causality running from government revenue to government spending. The error correction terms in the specifications for the sub year categories were either not significant, or did not have the right negative sign, and therefore could not form the basis for analysis. The Granger causality test and the Toda and Yamamoto tests were performed and produced similar results. In the period between 1862 and 1913 causality ran from government revenue to government expenditure. Iin the period from 1914 to 1946 causality ran from government expenditure to government revenue. The period from 1947 to 1993 showed bidirectional causality between government revenue and government expenditure. The results for the entire period between 1862 and 1993 showed bidirectional causality between government revenue and government expenditure.

Fosano and Wang (2002) use an error correction model to test for Granger causality between government revenue and government expenditure for all the Gulf Cooperation Council (GCC) countries. The results from the error correction model show that Bahrain, United Arab Emirates, and Oman have unidirectional causality running from revenue to expenditure. Qatar, Saudi Arabia, and Kuwait have bidirectional causality between revenue and expenditure.

In this study, we extend the literature by employing country-specific data on Zambia. The data set is recent and much longer than the data traditionally used in most studies on African countries. This enables us to generate additional insights for analysis which will bring out characteristics specific to Zambia underlying causality which ordinarily would be missing if we used cross country methodologies.

4.0 Methodology

Granger causality tests are performed in the framework of VAR and VEC models. If the variables are stationary, Granger causality can be analysed using the VAR framework. However, if the variables are integrated of order one I(1), the VEC model becomes an appropriate framework to use. The VAR treats endogenous variables in the system as functions of lagged values of all endogenous variables. They provide the advantage of being flexible and simple alternatives to the traditional multiple equation models which impose strong restrictions on the dynamic nature between macroeconomic variables (Sims, 1980). In a world of rational, forward-looking economic agents, no variable can be viewed as exogenous. The reduced form of VAR can model macroeconomic data informatively without imposing very strong restrictions. We represent the VAR model as;

$$Y_t = G_t Y_{t-1} + e_t \quad \text{...} (1)$$

Where;

$$Y_t = \begin{bmatrix} Y_{1,t} \\ Y_{2,t} \end{bmatrix},\ G_i = \begin{bmatrix} g_{11} \\ g_{12} \end{bmatrix},\ Y_{t-1} = \begin{bmatrix} Y_{1,t-1} \\ Y_{2,t-1} \end{bmatrix} \text{ and } e_t = \begin{bmatrix} e1.t \\ e2,t \end{bmatrix}$$

Y_t is a vector of endogenous variables, Y_{t-1} is a vector of variables representing past realisations of Y_t, G_i is a vector of constants and *et* is a (nx1) vector of white noise innovations, and are serially uncorrelated. The assumption about the error terms is that they can be contemporaneously correlated such that;

$$E(e_t, e_t') = \begin{bmatrix} \sigma^2_{e_1} & \sigma_{\varepsilon_1 \varepsilon_2} \\ \sigma_{\varepsilon_1 \varepsilon_2} & \sigma^2_{\varepsilon 2} \end{bmatrix} = \Omega \text{ where } \sigma_{e_1 e_2} \neq 0.$$

Ω is not assumed to be diagonal, i.e., the error terms of individual equations

can be contemporaneously correlated. Innovations must be correlated with their own lagged values and uncorrelated with all the right-hand variables of equations. However, the errors must be uncorrelated through time such that the variance-covariance matrix must equal;

$$E(e_t, e'_T = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, \text{ for } t \neq T$$

$$\text{Therefore, } E(e_t, e'_T) = \begin{cases} \Omega, \text{ if } t = T \\ 0 \text{ otherwise} \end{cases}$$

4.1 Econometric framework

The multivariate VAR model was specified such that government expenditure is Granger caused by its own lagged value(s), the lagged value(s) of government revenue, exchange rate, GDP and Treasury Bill rate in equation (2). Government revenue is also specified to be Granger-caused by its own lagged value(s) and lagged value(s) of government expenditure, exchange rate, GDP and Treasury Bill rate in the VAR model in equation (3). In the empirical literature, we build on the specification of Dalena and Magazzino, (2012) and Mupimpila et al, (2015) and augment it with exchange rate and Treasury Bill rate variables:

$$\text{Ln}GOVEXP_t = \vartheta_0 + \sum_{i=1}^{p} \alpha_i \text{Ln}GOVEXP_{t\text{-}i} + \sum_{i=1}^{p} \alpha_{2i} \text{Ln}GOV\text{REV}_{t\text{-}i} + \sum_{i=1}^{p} \alpha_{3i} \text{Ln}EXC_{t\text{-}i} + \sum_{i=1}^{p} \alpha_{4i} \text{Ln}GDP_{t\text{-}i} + \sum_{i=1}^{p} \alpha_{5i} \text{Ln}TBILL_{t\text{-}i} + \mu_t \quad \text{.......(2)}$$

$$\text{LnGOV}REV_t = \vartheta 1 + \sum_{i=1}^{p} ß_i \text{Ln}GOVEXP_{t\text{-}i} + \sum_{i=1}^{p} ß_{2i} \text{Ln}GOV\text{REV}_{t\text{-}i} + \sum_{i=1}^{p} ß_{3i} \text{Ln}EXC_{t\text{-}i} + \sum_{i=1}^{p} ß_{4i} \text{Ln}GDP_{t\text{-}i} + \sum_{i=1}^{p} ß_{5i} \text{Ln}TBILL_{t\text{-}i} + v_t \quad \text{.......(3)}$$

Where $\text{Ln}GOVEXP_t$ refers to the log of government expenditure, $\text{Ln}GOVREV_t$ refers to the log of government revenue, $\text{Ln}GOVEXP_{t-i}$ and $\text{Ln}GOVREV_{t-i}$ are lagged values of government expenditure and revenues respectively. $\text{Ln}EXC_{t-i}$,, $\text{Ln}GDP_{t-i}$ and $\text{Ln}TBILL_{t-i}$ and refer to the lagged values of exchange rate, gross domestic product and TreasuryBill rates. P refers to lag length to be used in VAR Model and μ_t and v_t are white noise error terms.

4.2 Data

The data was obtained from the African Development Bank Social and Economic data and the World Bank database. We make use of data whose data points are from 1980 to 2016. Table 1 describes in detail all the variables whose data are employed in our study for analysis.

4.3 Growth of real Government expenditure and revenue

The %age growth rate of real revenue and expenditure in Zambia is given for the selected years in Figure 1. Real government revenues and expenditure on average were falling from 1981 to 2004. In 2005 onwards we observe some positive growth until 2012. In 2013, real government revenue growth turned negative until 2016. On the other hand, real government expenditure turned negative in 2014 all through to 2016.

Table 1: Variable Description

Variable Name	**Units of Measurement**	**Variable Description**	**Expected Sign**
Real government revenue	United States dollar	Central government, total revenue, and grants deflated by CPI inflation.	(+)
Real government expenditures	United States dollar	Central government, total expenditure and net lending deflated by CPI inflation.	(+)
Exchange rate	Ratio	Local currency units relative to the U.S. dollar.	(+)
Gross domestic product	United States Dollar	Value of all goods and services produced in a particular period in Zambia	(+)
Treasury Bill rate	Rate percent	Policy variable on 90 day Treasury Bills	(-)

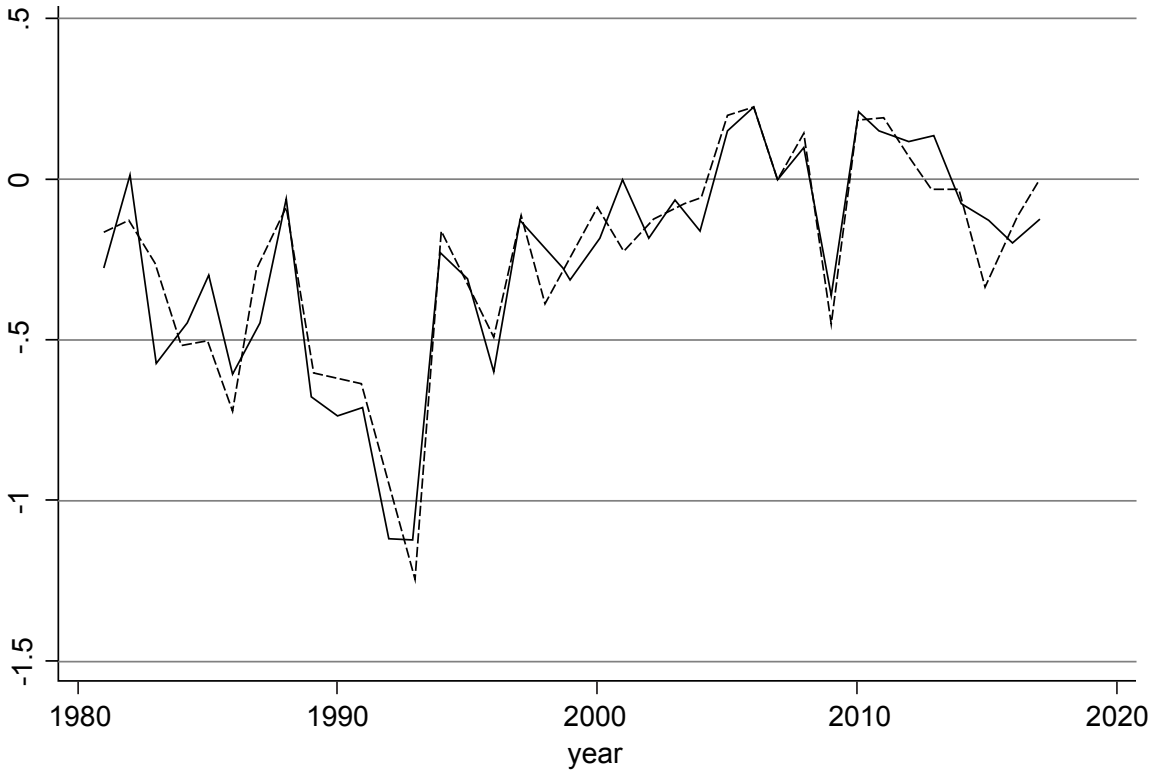


Figure 1: %age Growth of Real Government Expenditure and Revenue
Source: Author's computations.

4.4 Estimation Methods

4.4.1 Unit Root Test

A non-stationary series exhibits an infinite persistence of shocks to the auto-regressive process (Gujarati and Porter, 2009). We tested all the variables in our model for the presence of a unit root. If a time series is stationary after we take its first difference, then it is integrated of order one I(1) and if it is stationary after we take its second difference, then it is integrated of order two I(2). Theory of stationary stochastic processes suggests that economic variables are usually integrated of order one I(1) and rarely integrated of order greater than two (Kennedy, 2003).

4.4.2 Application of the VAR

Given that the unit root tests suggest that the variables are stationary in levels I(0), we make use of the VAR model. The model was specified in Log-Linear form as in Dalena and Magazzino(2012). Government expenditure is Granger-caused by its own lagged value(s) and the lagged value(s) of revenue. Government revenue is also specified to be Granger -caused by its own lagged value(s) and lagged value(s) of government expenditure in the VAR Model. The VAR model has the advantage of treating all variables as endogenous, and therefore becomes useful in detecting the flow of causality

between the variables. We followed the Lag selection criterion in using the lag length of one (1).

5.0 Results

The full results from estimating equations (2) and (3) are as presented in Table 2. The Granger causality test is presented in Table 2.1. The autocorrelation test suggests that there are no serial correlations in the residuals. All the roots of the companion matrix values lie within the unit circle, indicating a stable VAR system[1]. We also performed the augmented Dickey-Fuller test to check for unit root. The findings suggest that the variables do not suffer from a unit root in levels. Performing the Dickey-Fuller test at lag zero, we find the log of government revenue, log of government expenditure, log of GDP, and log of Treasury Bills to be stationary at 5% level of significance. The log of exchange rate was also found to be stationary in levels at 1% level of significance[2].

We found unidirectional causality which runs from government expenditure to government revenue in the Granger causality test. Treasury Bill rate was also found to Granger-cause government revenue and expenditure. The result findings suggested that exchange rate and GDP do not Granger-cause government revenue and government expenditure.

The estimated coefficients with the associated standard errors for the VAR are also given in Table 2 below. Our target model suggests that the lag of government expenditure has a positive effect on government revenue at 5% level of significance. The lag of government revenue was found to have no effect on government revenue. The lags of GDP and exchange rate were found to have no effect in influencing government revenue. However, Treasury Bill rate was found to have a significant and negative influence on revenue.

Table 2: VAR Results

DEPENDENT VARIABLE	GOVERNMENT REVENUE	GOVERNMENT EXPENDITURE
GOVREV (L1)	-0.16	-0.46
	(-0.55)	(-0.59)
GOVEXP (L1)	1.07	1.41
	(0.43)*	(0.46)*[3]
GDP (L1)	-0.20	-0.13
	(-0.32)	(-0.35)
EXCH RATE (L1)	-0.17	-0.08
	(-0.28)	(-0.30)
TBILL (L1)	-0.28	-0.28
	(0.08)**	(0.08)**[4]
Constant	5.93	3.83
	(-4.94)	(-5.28)

Source: Author's computations.

In the non-target model, we found a positive and significant relationship between the lag of government expenditure and government expenditure. The lag of government revenue was found to have no significant relationship with government revenue. The lags of GDP and exchange rate were found to be insignificant in influencing government revenue. The lag of Treasury Bills rate is found to be highly significant in influencing government expenditure.

Table 2.1: Granger Causality Test Results

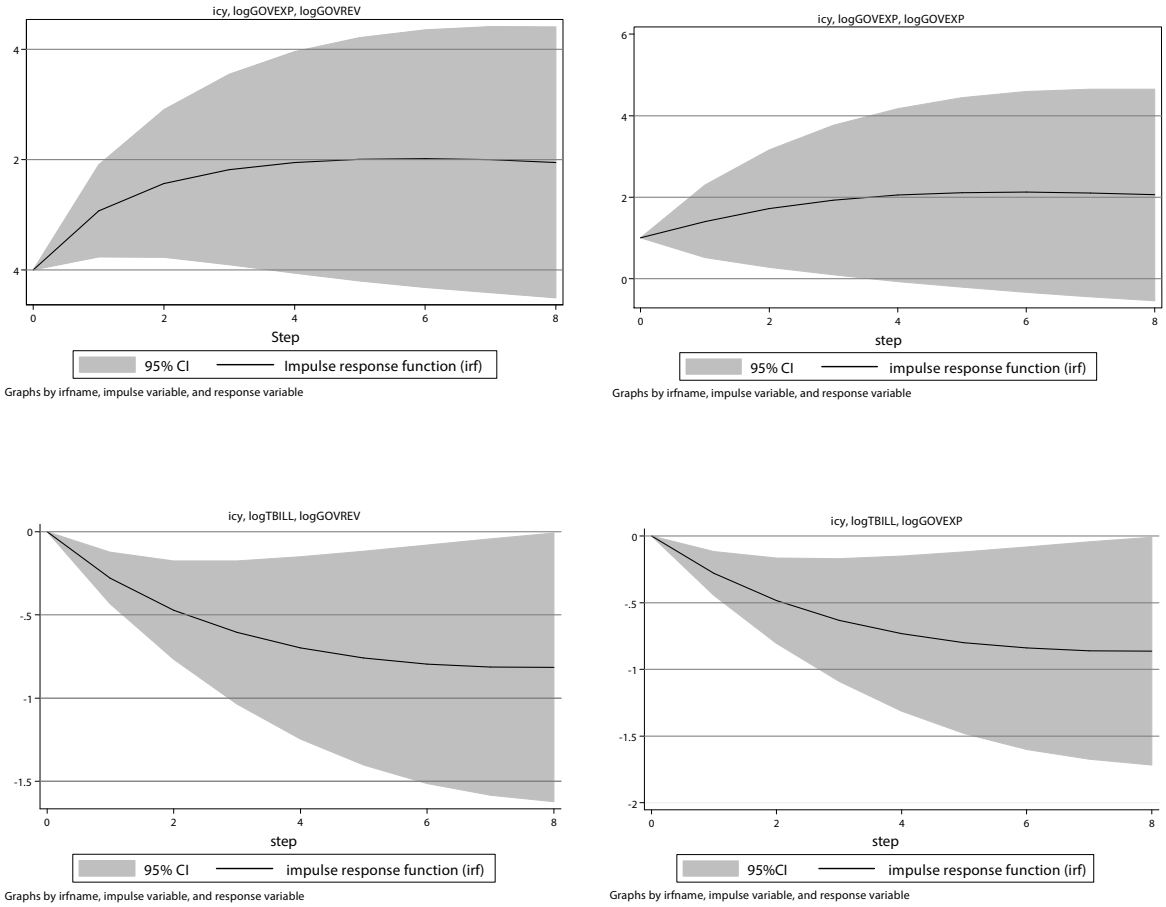
Equation	Excluded	Probability
GOVREV	GOVEXP	0.01*
GOVREV	GDP	0.53
GOVREV	EXCH RATE	0.54
GOVREV	TBILL	0.00**
GOVREV	ALL	0.00**
GOVEXP	GOVREV	0.44
GOVEXP	GDP	0.71
GOVEXP	EXCH RATE	0.80
GOVEXP	TBILL	0.00**
GOVEXP	ALL	0.00**

Source: Author's computations.

5.1 Impulse Response Functions Results

The results of the impulse response functions are reported in Figure 2. We direct our focus on impulse responses on variables that are found to be statistically significant in the VAR model. A one-unit shock to government expenditure raises government revenue in one year's time and permanently remains at that higher level, and a one-unit shock to government expenditure raises expenditure moderately and holds at that level throughout the eight-year forecast. A one-unit shock to Treasury Bills lowers government expenditure after about one year and continues falling throughout the forecast period. A one-unit shock to Treasury Bills reduces government revenue after about one year and continues falling throughout the forecast period.

Figure 2: Impulse Response Functions



Source: Author's computations.

5.2 Forecast Error Variance Decomposition

The full results of the Forecast Error Variance Decomposition (FEVD) are reported in Table 3. We direct our focus on the FEVD's on variables that are found

to be statistically significant in the VAR model. In the short-run, a one standard deviation shock to government expenditure accounts for approximately 6% variation in government revenue only after two years, and it rises to 15% in the long-run (8-year forecast). A one standard deviation shock to government expenditure explains approximately 15% to itself in the short-run and rises to about 17% in the long-run. A one standard deviation shock to Treasury Bill rate will raise government expenditure by 3% in the in the short-run (second year) and 15% in the long-run (eight-year forecast). A one standard deviation shock to Treasury Bill rate will raise government revenue by 3% in the short-run and by 15% in the long-run.

Table 3: Results of Forecast Error Variance Decomposition

	Impulse:	**Govtexp**	**Govtexp**	**TBill**	**TBILL**
Step	**Response:**	**GovtRev**	**GovtExp**	**GovtRev**	**GovtExp**
0		0	0	0	0
1		0	0.148331	0	0
2		0.060864	0.155597	0.029388	0.026392
3		0.10168	0.160711	0.061597	0.057683
4		0.124032	0.163643	0.08833	0.08472
5		0.136491	0.165142	0.109632	0.106619
6		0.143748	0.165773	0.126607	0.124166
7		0.148129	0.165873	0.14026	0.138288
8		0.150815	0.165633	0.151355	0.149746

Source: Author's computations.

6.0 Discussion and Conclusion

The findings of the Granger causality tests suggest that causality is running from government expenditure to government revenue. These results are surprising given that spend-and-tax hypothesis is based on the premise of crises which is not the case for Zambia. These results are consistent with the findings of Richter and Dimitrios (2013) for Portugal. In the case of Dalena and Magazzino (2012), such results correspond to the interwar period in Italy's history. These results were puzzling; we sought to understand the strength of the causality running from government expenditure to government revenue. To do this, we augmented the Granger causality test with the forecast error variance decomposition.

The results of the forecast error variance decomposition suggest that a one standard deviation shock to government expenditure will explain about 6% variation in revenue in two years and will rise to 15% variation in spending in

eight years. These results suggest that the causality running from government expenditure to government revenue exists but is not so strong. What then could be explaining the forecast error variance results? The absence of social crises may explain the weak relationship indicated by forecast error variance. There has never been a social disturbance, or war, or epidemic of extreme proportions in Zambia. The spend-and-tax hypothesis is based on the premise of large-scale social disturbance, crises, or war which make it easier for the political system to decide how much to spend and then adjust tax revenues. In the context of Zambia, these results may indicate that the political system makes spending decisions in the midst of peace and gets to adjust revenue policy to finance the budget deficit. This may be partly explained by the various stakeholders' groupings who all lobby and expect to benefit from government expenditure (Bwalya et al, 2009). These findings are indicative rather than prescriptive for Zambia. Therefore, given that increases in government revenue are Granger-caused by increases in government expenditure, financing the budget deficit through raising revenues may not be the most appropriate tool to reduce budget deficits. Rather, efforts that lead to policies that control, or place limitations, on government spending must be emphasised. Policymakers, politicians, and civil society will have to prepare themselves and the public on the importance of bringing the government budget in balance. Perpetual budget deficits destabilize the macroeconomy in three ways: firstly, it raises the cost of borrowing in the economy; secondly, it limits resources available to the private sector for investment; and thirdly, persistent budget deficits can increase the national debt.

Endnotes

[1] See appendices A3 and A4

[2] See appendix A1

[3] Implies coefficient is significant at 5% level of significance

[4] Implies coefficient is significant at 1% level of significance

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APPENDICES

Appendix A1: Unit Root Test

Augmented Dickey-Fuller Test

Variable	Test Statistic	1% critical value	5% critical value
log of government revenue	-3.348	-3.675	-2.969
log of government expenditure	-3.496	-3.675	-2.969
Log of GDP	-3.151	-3.675	-2.969
Log of Treasury Bill rate	-2.045	-2.453	-1.696
Log of exchange rate	-3.865	-2.647	-1.950

Source: Author's computations

Appendix A2: Normality Test
Jarque-Bera Test

Equation	Chi2	Df	prob>Chi2
log of government revenue	0.083	2	0.95927
log of government expenditure	0.189	2	0.91002
Log of GDP	2.077	2	0.35404
Log of exchange rate	1.316	2	0.51796
Log of Treasury Bill rate	0.912	2	0.63367
ALL	4.577	10	0.91761

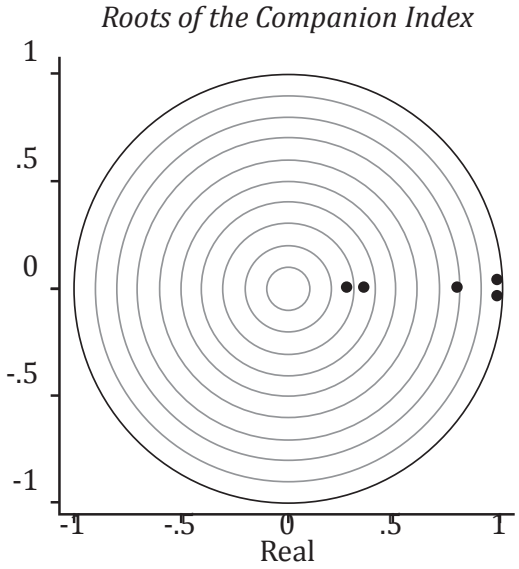
Source: Author's computations.

Appendix A3: Autocorrelation test
Lagrange-multiplier test

Lag	Chi2	Df	prob>chi2
1	24.4164	25	0.49543
2	26.7128	25	0.37038

Source: Author's computations.

Appendix A4: Stability of VAR System



Source: Author's computations.