The Impact of Budget Deficits on Inflation in Zambia

Maio Bulawayo¹, Francis Chibwe² & Venkatesh Seshamani³

Abstract

Despite the vast amount of research and received literature on the impact of budget deficits on inflation, the last word has not been spoken on the theme. Is there a significant causal relationship between budget deficits and inflation? In many developing countries especially in sub-Saharan African countries this question has not been adequately investigated through rigorous research. And yet, in many of these countries where inflation has often proved to be an intractable issue, it is important for policy makers to know how risky it would be to finance public programmes through deficit spending beyond certain limits. This paper examines the role of budget deficits as a contributor to inflation in Zambia where hardly any previous work has been done in recent years in addressing this question. An econometric analysis has been done using the AutoRegressive Distributed Lag (ARDL) approach. The analysis shows that while there are significant short-run impacts of deficits on inflation, no significant long-run relationship exists.

Keywords: budget deficit, inflation, Zambia, ARDL

1. Introduction

One of the tenets of macroeconomics is that budget deficits are a significant cause of inflation, with the caveat, however, that theory does not support this proposition unconditionally. According to Sharp and Flenniken (1978), inflations are too complicated phenomena to be explained by a single variable such as budget deficits. Sill (2005) argues that whether deficits lead to inflation depends on the extent to which a country’s monetary policy is independent. Some others (e.g. Ishaq, 2015) say that it depends on the independence of the central bank. Ross (2018) imposes the following conditionality: Even though the long-term macroeconomic impacts of fiscal deficits are subject to debate, there is far less debate about certain immediate, short-term consequences. However, these consequences depend on the nature of the deficit.

Many more of the above kind of conditions are discussed in other works which we shall bring out in the next section. As a rule, the transmission mechanism from deficits to inflation can be thought to operate in two ways. One, a government can try to counteract the fiscal deficit by raising taxes which will push up costs of production and producers may in turn pass on these additional costs to consumers by raising prices, thus resulting in cost-push inflation from the supply side of the economy. Two, a government may try to cover the deficit through seigniorage by printing money, thereby raising the level of money supply which in turn can raise aggregate demand and prices. This is demand-pull inflation based on the well-known Fisher equation of the Quantity Theory of Money. This sequential route of increases in budget deficit leading to increases in money supply leading in turn to increases in inflation emphasises the notion of fiscal dominance immanent in the seminal paper of Sargent and Wallace (1981).

However, a plethora of empirical studies have not established any conclusive and consistent evidence of this relationship. Several pieces of research based largely on standard time series and panel data econometrics have thrown up different results.

¹Lecturer in Economics, University of Zambia  
²Economist, Zambia Rural Electrification Authority  
³Professor of Economics, University of Zambia
Much seems to depend on the spatial-temporal regions involved, levels of development, the time perspective, the prevailing macroeconomic scenario, institutional factors and the quantitative models and techniques used in the research. As a typical illustration, one may cite the now oft-quoted study by Catao and Terrones (2005) that modelled inflation as non-linearly related to fiscal deficits through the inflation tax base and estimated this relationship as intrinsically dynamic, using panel techniques that explicitly distinguished between short- and long-run effects of fiscal deficits. The results of the study spanning 107 countries over 1960-2001 showed a strong positive association between deficits and inflation among high-inflation and developing country groups, but not among low-inflation advanced economies.

Many studies in individual countries also come up with disparate relationships that are circumscribed by various kinds of conditionality. Again, we describe such studies in the section on literature review that follows. Our motivation to undertake this study is twofold. One, from a policy perspective, the attainment of macroeconomic stability and growth in any given country requires a clear understanding of this relationship between deficits and inflation. Two, not many empirical studies of this relationship have been conducted in individual countries of sub-Saharan Africa. And, apart from heuristic statements made about the causal relationship between budget deficits and inflation, no rigorous analytical study exists for Zambia. Further, in recent periods, the high budget deficits have been a matter of great concern among policy makers and Zambian economic observers.

2. Literature review

There is indeed a vast amount of research that has been conducted on this theme over several decades. Here we provide a fair sample of studies undertaken more recently. Given the specific focus of our paper on the impact of deficits on inflation, one can see from the table below that these studies fall into three broad groups:

- Those that suggest a significant impact of budget deficits on inflation;
- Those that suggest that inflation impacts on budget deficits but not the other way round;
- Those that find no relationship between the two.

In the following table, we provide relevant details of our sample studies.
### Table 1: Selected studies of the impact of budget deficits on inflation

| Author(s), year | Country/countries covered | Period       | Methodology               | Result                                                                 |
|-----------------|----------------------------|--------------|---------------------------|------------------------------------------------------------------------|
| Bakara et al, 2014 | Nigeria                   | 1975-2012    | ECM                      | Statistically significant impact                                        |
| Catao & Terrones, 2005 | 107 countries           | 1960-2001    | Dynamic Panel techniques  | Strong impact only in high-inflation, developing countries             |
| Datta & Upadhyay, 2011 | Indonesia               | 1971-1999    | VAR, VECM                | Inflation causes deficit, not the other way round                       |
| Erkan & Cetinkaya, 2014 | Turkey                  | 1987-2013    | VAR                      | Positive significant impact in high-inflation period and no causality in low-inflation period. |
| Ishaq, 2015      | 11 Asian countries       | 1981-2010    | GMM                      | Deficits are inflationary, particularly strong where financial markets are not fully developed and central banks are not independent. |
| Jalil et al, 2014 | Pakistan                 | 1972-2012    | ARDL                     | Deficit is a major determinant of inflation.                            |
| Khumalo, J., 2013 | South Africa             | 1981-2012    | VAR, Impulse Response function | Deficit positively contributes to inflation.                             |
| Khundrakpam & Pattanaik, 2010 | India               | 1953-2009    | ARDL                     | Deficit could pose medium-term risk to future inflation path.           |
| Lin & Chu, 2013  | 91 countries             | 1960-2006    | DPQR                     | Strong impact of deficits in high-inflation episodes and weak impact in low-inflation episodes |
| Lozano, 2014     | Columbia                 | 1955-2007    | ECM                      | Statistically significant impact                                        |
| Lwang & Maweije, 2014 | Uganda                 | 1999-2011    | VAR, VECM                | Inflation impact on deficit, not the other way round.                  |
| Makochekanwa, 2010 | Zimbabwe                | 1980-2005    | Johansen Cointegration   | Significant inflationary impact of deficits.                            |
| Narayan et al, 2014 | Fiji                   | 1970-2004    | Bounds Testing approach  | Deficit Granger-causes inflation only in the long run.                 |
| Samirka, 2014    | Turkey                   | 1980-2013    | Johansen Cointegration   | No impact                                                              |
| Solomon & Wet, 2004 | Tanzania                | 1967-2001    | ECM                      | Significant impact                                                      |
| Vieira, 2000     | 6 European Union countries | 1950-1996    | ARDL                     | No impact                                                              |
| Zonuzi et al, 2011 | Iran                    | 1990-2007    | Bounds Testing, GARCH    | Strong impact of budget deficit and volatility of budget deficit on inflation |

Source: Authors’ compilation

Abbreviations used in Table 1:

- ECM: Error Correction Model
- VAR: Vector Auto Regression
- VECM: Vector Error Correction Model
- ARDL: Auto Regressive Distributed Lag
- DPQR: Dynamic Panel Quantile Regression
- GMM: Generalized Method of Moments
- GARCH: Generalized Auto Regressive Conditional Heteroskedasticity

Apart from the many caveats we have already alluded to earlier that are reflected in the results of the various studies listed in Table 1, some broad inferences can be made:
• The adverse effects of budget deficits on inflation are largely a phenomenon of the developing countries. Deficits seldom lead to inflation in advanced/developed countries.
• There is a starting point handicap. The impact of budget deficits is greater in a country that is already facing high inflation as compared to a country where prevailing inflation is low.
• Budget deficits may not be the only factor that contributes to inflation.
• Institutional factors such as the autonomy of the central bank and the independence of monetary policy can influence the impact of budget deficits on inflation.

3. Methodology

Model

We formulate the model as:

\[ I_t = \beta_0 + \beta_1 I_{t-1} + \ldots + \beta_p I_{t-p} + \alpha_1 BD_t + \alpha_q BD_{t-q} + \delta_0 ER_t + \delta_1 ER_{t-1} + \ldots \]

Where \( I_t \) = inflation rate; \( BD_t \) = ratio of budget deficit to GDP; \( ER_t \) = official exchange rate; GDP = Gross Domestic Product in constant prices.

The explanatory variables have been chosen on the basis of received literature as well as a due consideration of what would be appropriate in the Zambian context. In several studies, some money supply variable such as broad money \( M_2 \) or an index of money supply indicators, is included. However, in a country like Zambia there is likely to be a high multicollinearity between the budget deficit and money supply. Hence we have dropped this variable.

We apply the ARDL (Auto Regressive Distributed Lag) / Bounds testing methodology developed by Pesaran et al (2001) to the estimation of econometric time series data.

The data used cover the period 1991 to 2016. We have chosen this period since economic liberalization began in 1991. This will enable us to reasonably assume that there is no major structural break during this period.

The analysis has been done using EViews, a package for conducting time series-oriented econometric analysis. The basic ARDL model would then be:

\[ I_t = \beta_0 + \beta_1 I_{t-1} + \ldots + \beta_p I_{t-p} + \alpha_1 BD_t + \alpha_q BD_{t-q} + \delta_0 ER_t + \delta_1 ER_{t-1} + \ldots + \delta_r ER_{t-r} + \gamma_0 GDP_t + \gamma_1 GDP_{t-1} + \ldots + \gamma_s GDP_{t-s} + \varepsilon_t(1) \]

It can be seen that Equation (1) has four variables: one dependent variable \( I \) and three explanatory variables \( BD, ER \) and \( GDP \) with lags \( p, q, r \) and \( s \) respectively.

The main advantages of using the ARDL approach (as opposed to the conventional cointegration method) are that it involves only a single equation, that it can be used with a mixture of \( I(0) \) and \( I(1) \) data and that different variables can be assigned different lag lengths. However, the ARDL cannot be used if any of the variables is \( I(2) \).

The ARDL methodology involves the following sequence of steps:

1. Make sure that none of the variables is \( I(2) \). This can be done by applying the ADF (Augmented Dickey-Fuller) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests;
2. Formulate an “unrestricted” or “conditional” ECM (Error Correction Model). It will take the form:

\[ \Delta I_t = \beta_0 + \beta_p \Delta I_{t-p} + \alpha_q \Delta BD_{t-q} + \delta_s \Delta ER_{t-s} + \gamma \Delta GDP_{t-s} + \theta_0 I_{t-1} + \theta_1 BD_{t-1} + \theta_2 ER_{t-1} + \theta_s GDP_{t-s} + \varepsilon_t \]

Equation (2) looks similar to a conventional ECM. The difference is that the lagged values in (2) have replaced the Error Correction Term, say \( z \) in the conventional model.
3. Select the appropriate values for the maximum lags. Several criteria are available but the Schwarz-Bayes Criterion (SBC) is generally preferred especially when the sample size is not very large.
4. A key assumption for the use of the ARDL is that there should be no serial correlation in the errors of equation (2). Hence once the appropriate version of equation (2) has been estimated, we use the Lagrange Multiplier (LM) test to check for this.
5. Since we have an autoregressive structure, we have to ensure that the model is dynamically stable. Dynamic stability can be tested using the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests originally suggested by Brown et al (1975). Despite the many drawbacks from which these tests are supposed to suffer, it has been shown by Caporale and Pittis (2010) that the two tests, especially the CUSUMSQ, perform well in an ARDL model which rules out serial correlation.
6. We now conduct the bounds testing. This is basically an F test of the null hypothesis \( H_0: \theta_0 = \theta_1 = \theta_2 = \theta_3 = 0 \) against the alternative that \( H_0 \) is not true. Pesaran et al (2001) provide the lower and upper bounds for the critical
values for the asymptotic distribution of $F$. If the observed value of $F$ is below the lower bound, the model is $I(0)$ and there is no cointegration. If the value is above the upper bound, the model is $I(1)$ and there is cointegration.

7. If the bounds test indicates there is cointegration, we can estimate the long-run equilibrium relationship between the variables. The long-run coefficients for the three explanatory variables BD, ER and GDP will be given as $\theta_1/\theta_0$, $\theta_2/\theta_0$ and $\theta_3/\theta_0$ respectively.

Data sources

Data on the inflation rate (measured as a percentage change in the consumer price index, CPI), the nominal exchange rate (measured in terms of Zambian Kwacha per US dollar, ZMW/US$) and the real GDP measured at 2010 constant US$ were all obtained from the World bank's World Development Indicators (WDI) database. Data on the budget deficit as a percentage of GDP were obtained from the International Monetary Fund’s World Economic Outlook (WEO) database.

4. Empirical Results

Unit Root Tests

Before estimating the ARDL, the ADF and KPSS tests were used to examine the stationary properties of the variables. These tests are necessitated by Perasan et al. (2001)’s view that estimating an ARDL model in which the variables have an order of integration of more than one gives spurious results. Table 2 summarises the results of the unit root tests. The results from the unit root tests indicate that the variables are either $I(0)$ or $I(1)$. Therefore, the ARDL approach can be applied without the risk of producing spurious results.

| Variable | ADF Test | KPSS Test |
|----------|----------|-----------|
|          | Level    | First Difference | Level    | First Difference |
|          | i        | i & t       | i        | i & t       | i        | i & t       |
| LNCPI    | -9.61*   | -9.89*      | -3.72    | -2.95      | 0.72     | 0.19*       | 0.55*     | 0.17*     |
| BD       | -6.56*   | -5.98*      | -7.88*   | -7.77*     | 0.39     | 0.15*       | 0.31      | 0.07      |
| LNER     | -7.39*   | -1.47       | 5.13*    | 3.75       | 0.66*    | 0.18*       | 0.45      | 0.19*     |
| LNGDP    | -3.31    | -1.40       | -0.66    | 0.83       | 0.73*    | 0.18*       | 0.41      | 0.19*     |

Note: i represents intercept and t represents trend. * implies stationarity at the 5% level of significance.

Lag Selection

The appropriate values for the maximum lags were identified using an unrestricted vector autoregressive (VAR) setup (see appendix 1). Table 3 summarises the optimal lag lengths selected by different information criteria. The Schwarz information criterion, which is preferred in small samples, was used to determine the optimal lag length for the unrestricted ECM. The optimal lag length selected by this criterion is one.

| Lag/IC | LogL | LR | FPE | AIC | SC | HQ |
|--------|------|----|-----|-----|----|----|
| 0      | -89.9| NA | 0.03| 7.83| 8.02| 7.88|
| 1      | 37.5 | 201.9| 0.000003| -1.46| -0.48*| -1.2|
| 2      | 62.6 | 31.3*| 0.000002*| -2.21*| -0.45| -1.75*|

Note: * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion.

Short-Run and Long-Run ARDL Model Results
The study proceeded to estimate an unrestricted or conditional error correction model (ECM) presented in equation (2); on the basis of one lag. Table 4 below presents the results of the unrestricted ECM.

Table 4: Unrestricted Error Correction Model

| Variable       | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------------|-------------|------------|-------------|--------|
| C              | -4.21288    | 5.93462    | -0.70988    | 0.4887 |
| D(LNCPI(-1))   | -0.10045    | 0.27693    | -0.36274    | 0.7219 |
| D(BD(-1))      | 0.008081*   | 0.00294    | 2.753242    | 0.0148 |
| D(LNER(-1))    | 0.078677    | 0.21224    | 0.370699    | 0.716  |
| D(LNGDP(-1))   | 0.612661    | 0.7126     | 0.859753    | 0.4035 |
| LNCPI(-1)      | -0.16426    | 0.22086    | -0.74374    | 0.4685 |
| BD(-1)         | -0.00074    | 0.00504    | -1.46829    | 0.1627 |
| LNER(-1)       | 0.001938    | 0.16774    | 0.011554    | 0.9909 |
| LNGDP(-1)      | 0.211369    | 0.28148    | 0.750915    | 0.4643 |

Note: * implies significance at the 5% level of significance. R-squared = 0.89; Adjusted R-squared = 0.83; F-Statistic = 15.4; Prob(F-statistic) = 0.0000.

The coefficients $\beta_p$, $\alpha_q$, $\delta_r$ and $\gamma_s$ in equation (2) capture the short-run dynamics. From Table 4 above, our results show that a widening of the budget deficit increases inflation in the short-run. This conclusion is on account of the positive and significant relationship between the budget deficit and inflation. Specifically, a one percentage point increase in the budget deficit increases the CPI by 0.08%, ceteris paribus. In the short-run, however, the exchange rate and real GDP growth were found to have no significant impact on inflation. A key assumption made about the error terms in equation (2) is that there is no serial correlation among them. To tests whether this assumption is satisfied, the Breusch-Godfrey (BG) or Langrange Multiplier (LM) test was performed. The null hypothesis for this test is that the error terms are not serially correlated. The test statistic for this test is the product of the number of observations (N) and the coefficient of determination ($R^2$) of the test regression equation which, asymptotically, follows a chi-squared distribution. The null hypothesis is rejected if the p-value of the test statistic is less than the conventional 5% level of significance (Asteriou and Hall, 2007, p.145). This study found a p-value of 0.5252 or 52.52% (see appendix 2).

Therefore, the null hypothesis is not rejected; implying that the ‘no serial correlation’ assumption is sustained. The estimated model was also tested for dynamic stability. For this purpose, two related tests were used: the Cumulative Sum (CUSUM) and Cumulative Sum Squares (CUSUMSQ) tests. Figures 1 and 2 below show the results of the two tests. For both tests, the null hypothesis is that the model is dynamically stable. It is rejected if the trend line lies outside the bounds at 5% level of significance. From the figure below, it is clear that trend line largely lies inside the bounds. Therefore, the null hypothesis that the model is dynamically stable is not rejected.

Figure 1: Cumulative Sum (CUSUM) Stability Test
To determine the existence of a significant long-run relationship among our variables of interest, bounds testing was used. Thenull hypothesis for the bounds testing is that the coefficients of the variables capturing the long-run dynamics in equation (2), $\theta_0$, $\theta_1$, $\theta_2$ and $\theta_3$ are all simultaneously equal to zero. This implies that there is no long-run or cointegrating relationships among the variables. The alternative hypothesis is that these coefficients are not all equal to zero; implying the existence of a long-run relationship among the variables.

The null hypothesis is rejected if the $F$-statistic for the test is greater than Pesaran et al’s (2001) upper critical value; implying cointegration among the variables. On the other hand, we fail to reject the null hypothesis if the $F$-statistic is less than the lower critical value; otherwise, the test is inconclusive. Table 5 shows the bounds testing implemented using Wald’s test for linear restrictions.

| Upper Limit | 5.07 |
|-------------|------|
| Lower Limit | 4.01 |

| F-Statistic | 2.419075 |

From the above table, the $F$-statistic is clearly less than the lower limit. It can, therefore, be concluded that there exists no significant long-run relationship among the variables.

5. Conclusion

Studies on the impact of budget deficits on inflation do not yield uniform results. To the contrary, the results for different countries vary a lot ranging from highly significant impacts to no impacts. The budget deficit-inflation nexus is influenced by several factors some of which are economic, some institutional and some policy decision. In Zambia, budget deficits seem to have a significant impact on inflation in the short run but not in the long run. This is not a typical result since in a large number of studies, budget deficits and inflation are known to be cointegrated. There are of course a few studies that do conclude that there is no long-run relationship of budget deficit to inflation. One is the paper by Samirka (2014) that we have described in the literature review section that found no long-term relationship. There are also some others. For example, Mukhtar and Zakaria (2010) infer this for Pakistan on the basis of an econometric analysis using quarterly data for the period 1960 – 2007. It is also interesting that another paper published a few years later (Jalil, et al 2014, see Table 1) asserts that a strong long-run relationship exists in Pakistan! A similar result is obtained by Abubakar et al, (2014) in the case of Nigeria. Again, Kebo (2016) concluded that budget deficits are not inflationary in the West African Economic and Monetary Union (WAEMU) countries.

So, the Zambian result is not all that exceptional. All the same, further analysis is warranted to enable us understand the reasons for the seeming absence of a long-run relationship between budget deficits and inflation in Zambia. Notwithstanding the results of our study, it would be hazardous at this stage to infer for policy that large budget deficits are not a source of worry in Zambia as a factor that can tell on inflation in the long run.
The significant short-run inflationary impacts in Zambia justify the concerns that have been expressed about the persistent high fiscal deficits the country has been experiencing in recent years, averaging over 6% between 2013 and 2017 (See Data in Appendix 3 and Republic of Zambia, 2017). Containing inflation in the face of such high deficits can turn out to be an increasingly challenging task in the future and decision makers must take due cognizance of this risk and place fiscal consolidation on top of the policy agenda, especially in the prevailing scenario where economic growth rates since 2015 have slumped to half of their previous medium-term average.

References

Abubakar, M., Aliero, H. M. and Umaru, A. D. (2014): An empirical analysis on the relationship between fiscal deficit and inflation in Nigeria, Annals of “Dunarea de Jos” University of Galati, 20(2): 67-74.
Asteriou, D. and Hall, S. (2007). Applied Econometrics: A Modern Approach. Revised Edition. New York: Palgrave Macmillan.
Bakre, I. A. O., Adesanya, O. A., and Bolarinwa, S. A. (2014): Empirical Investigation between Budget Deficit, Inflation and Money Supply in Nigeria, European Journal of Business and Social Sciences, 2(12): 120-134.
Brown, R. L., Durbin J. and Evans, J. M. (1975): Techniques for Testing the Constancy of Regression Relationships over Time, Journal of the Royal Statistical Society, Series B, 149- 162.
Caporale, G.M. and Pittis, N. (2004): Robustness of CUSUM and CUSUM-of-Squares Tests to Serial Correlation, Endogeneity and Lack of Structural Variance: Some Monte Carlo Evidence, Economics Series 157, Institute for Advanced Studies, Vienna.
Catao, L. and Terrones, M. E. (2005): Fiscal Deficits and Inflation, Journal of Monetary Economics, 52: 529-554.
Datta, K. and Mukhopadhyay, C. K. (2011): Relationship between Budget Deficit and Inflation: An Econometric Study of Indonesia, International Journal of Economic Issues, 4(2): 293-308.
Erkam, S. and Chetinkaya, M. (2014): Budget Deficits and Inflation: Evidence from Turkey, The Macrotrend Review, 3(8): 12-22.
Ishaq, T. and Mohsin, H. M. (2015): Deficits and Inflation: Are Monetary and Financial Institutions Worthy to Consider or Not?, Borsa Istanbul Review, 15(3): 180-191.
Jalil, A., Tariq, R. and Bibi, N. (2014): Fiscal Deficit and Inflation: New Evidences from Pakistan Using a Bounds Testing Approach, Economic Modelling, 34: 120-126.
Keho, Y. (2016): Budget Deficits, Money Supply and Price Level in West Africa, Journal of Economic and Financial Studies, 4(5): 1-8.
Khumalo, J. (2013): Budget Deficit – Inflation Nexus in South Africa, VAR Analysis, Mediterranean Journal of Social Sciences, 4(14): 725-734.
Khundrakpam, J.K. and Pattanaik, S. (2010): Fiscal Stimulus and Potential Inflationary Risks: An Empirical Assessment of Fiscal Deficit and Inflation Relationship in India, Journal of Economic Integration, 25(4): 703-721.
Lin, H-Y and Chu, H-P (2013): Are Fiscal Deficits Inflationary? Journal of International Money and Finance, 32 (C): 214-233.
Lozano, I. (2009): Budget Deficit, Money Growth and Inflation: Evidence from Columbian Case, Money Affairs, 22(1): 65-95.
Lwanga, M. M. and Maweje, J. (2014): Macroeconomic Effects of Budget Deficits in Uganda: A VAR-VECM Approach, EPRC Research Series number 11, 25 pages.
Makochekanwa, A. (2010): The Impact of a Budget Deficit on Inflation in Zimbabwe, Munich Personal RePEc Archive, Paper No. 24227: 1-22.
Mukhtar, T. and Zakaria, M. (2010): Budget Deficit, Money Supply and Inflation: the Case of Pakistan, Privredna Katarina i Economski Politika, 122.
Narayan, P.K., Narayan, S. and Prasad, A. D. (2006): Modelling the Relationship between Budget Deficits, Money Supply and Inflation in Fiji, Pacific Economic Bulletin, 21(2): 103-116.
Pesaran, H., Shin, Y. and Smith, R. (2001). Bounds Testing Approach to the Analysis of Level Relationship. Journal of Applied Econometrics, 16(3): 289-326.
Republic of Zambia (2017): 2018 Budget Address, Lusaka.
Ross, S. (2018): Reading the Effects of Fiscal Deficits on an Economy, Investopedia, March 20, 2018.
Samirkas, M. (2014): Effects of Budget Deficits on Inflation, Economic Growth and Interest Rates: Applications of Turkey in 1980-2013 Period, Journal of Economics and Development Studies, 2(4): 203-210.
Appendices

Appendix 1

Table A1: Unrestricted Vector Autoregressive (VAR) Model

| Variable     | Coefficient | Std. Error | t-Statistic | Prob.   |
|--------------|-------------|------------|-------------|---------|
| C            | -4.212878   | 5.934615   | -0.709882   | 0.4887  |
| D(LNCPI(-1)) | -0.100454   | 0.276932   | -0.362741   | 0.7219  |
| D(BD(-1))    | 0.008081    | 0.002935   | 2.753242    | 0.0148  |
| D(LNER(-1))  | 0.078677    | 0.212239   | 0.370699    | 0.716   |
| D(LNGDP(-1)) | 0.612661    | 0.712601   | 0.859753    | 0.4035  |
| LNCPI(-1)    | -0.16426    | 0.220855   | 0.743742    | 0.4685  |
| BD(-1)       | -0.007401   | 0.005041   | 1.468288    | 0.1627  |
| LNER(-1)     | 0.001938    | 0.167741   | 0.011554    | 0.9909  |
| LNGDP(-1)    | 0.211369    | 0.281482   | 0.750915    | 0.4643  |
| R-squared    | 0.891463    | Mean dependent var | 0.208519 |
| Adjusted R-squared | 0.833576 | S.D. dependent var | 0.201492 |
| S.E. of regression | 0.082199 | Akaike info criterion | 1.879358 |
| Sum squared resid | 0.101349 | Schwarz criterion | 1.437588 |
| Log likelihood | 31.5523 | Hannan-Quinn criter. | 1.762156 |
| F-statistic  | 15.4002     | Durbin-Watson stat | 1.62822 |
| Prob(F-statistic) | 0.000006 |  |  |
### Appendix 2

**Table A2: Breusch-Godfrey LM Test for Serial Correlation**

| Breusch-Godfrey Serial Correlation LM Test: |  |
|---------------------------------|---|
| F-statistic                     | 0.239503 |
| Prob. F(1,14)                   | 0.6321   |
| Obs*R-squared                   | 0.403671 |
| Prob. Chi-Square(1)             | 0.5252   |

**Test Equation:**

- **Dependent Variable:** RESID
- **Method:** Least Squares
- **Date:** 01/06/18   **Time:** 17:22
- **Sample:** 1993 2016
- **Included observations:** 24
- **Presample missing value lagged residuals set to zero.**

| Variable     | Coefficient | Std. Error | t-Statistic | Prob.  |
|--------------|-------------|------------|-------------|--------|
| C            | -2.083091   | 7.430911   | -0.280328   | 0.7833 |
| D(LNCP(-1))  | -0.10453    | 0.35554    | -0.294004   | 0.7731 |
| D(BD(-1))    | -0.000256   | 0.003058   | -0.08389    | 0.9343 |
| D(LNER(-1))  | -0.016786   | 0.220516   | -0.07612    | 0.9404 |
| D(LNGDP(-1)) | -0.066659   | 0.743958   | -0.089601   | 0.9299 |
| LNCP(-1)     | -0.076775   | 0.275668   | -0.278504   | 0.7847 |
| BD(-1)       | 0.000605    | 0.005319   | 0.11365     | 0.9111 |
| LNER(-1)     | 0.040617    | 0.191122   | 0.212518    | 0.8348 |
| LNGDP(-1)    | 0.100605    | 0.354574   | 0.283734    | 0.7808 |
| RESID(-1)    | 0.236327    | 0.482901   | 0.489391    | 0.6321 |

| R-squared    | 0.01682     | Mean dependent var | 7.07E-16 |
| Adjusted R-squared | -0.615225 | S.D. dependent var | 0.066381 |
| S.E. of regression | 0.084365 | Akaike info criterion | -1.812987 |
| Sum squared resid  | 0.099645 | Schwarz criterion | -1.322132 |
| Log likelihood   | 0.026611 | Hannan-Quinn criter. | -1.682763 |
| F-statistic      | 0.999997 | Durbin-Watson stat | 1.737907 |
## Appendix 3

### Data

| Year | *Consumer Price Index* | **Budget Deficit (% of GDP)** | *Exchange Rate (ZMW/US$)* | *Real GDP (2010 Constant US$)* |
|------|------------------------|-------------------------------|---------------------------|-------------------------------|
| 1991 | 0.428632003            | -43                           | 0.06464                   | 8,385,212,483.00              |
| 1992 | 1.138903208            | -12                           | 0.172214                  | 8,240,070,980.00              |
| 1993 | 3.226649928            | -11                           | 0.452763                  | 8,800,171,187.00              |
| 1994 | 4.988443439            | -1                            | 0.669371                  | 8,041,117,529.00              |
| 1995 | 6.730886151            | -4                            | 0.864119                  | 8,274,122,491.00              |
| 1996 | 9.630087339            | -3                            | 1.2079                    | 8,788,652,644.00              |
| 1997 | 11.98163155            | -10                           | 1.314498                  | 9,123,852,515.00              |
| 1998 | 14.91215368            | -14                           | 1.862069                  | 9,088,657,606.00              |
| 1999 | 18.90677617            | -9.5                          | 2.388019                  | 9,511,297,430.00              |
| 2000 | 23.82828787            | 1.161                         | 3.110844                  | 9,881,983,407.00              |
| 2001 | 28.92605987            | -5.892                        | 3.610935                  | 10,407,395,447.00             |
| 2002 | 35.35729045            | -4.499                        | 4.398595                  | 10,876,354,172.00             |
| 2003 | 42.92430868            | -5.314                        | 4.733271                  | 11,631,714,140.00             |
| 2004 | 50.63685795            | -2.508                        | 4.778875                  | 12,449,702,237.00             |
| 2005 | 59.91577845            | -2.372                        | 4.463503                  | 13,350,512,768.00             |
| 2006 | 65.31992551            | 16.913                        | 3.603072                  | 14,405,696,504.00             |
| 2007 | 72.28129833            | -1.037                        | 4.002523                  | 15,608,923,120.00             |
| 2008 | 81.27712466            | -0.668                        | 3.745661                  | 16,822,344,541.00             |
| 2009 | 92.16440247            | -2.057                        | 5.046109                  | 18,373,423,318.00             |
| 2010 | 100                    | -2.432                        | 4.797137                  | 20,265,556,274.00             |
| 2011 | 106.4293968            | -1.783                        | 4.860666                  | 21,393,258,427.00             |
| 2012 | 113.4280872            | -2.832                        | 5.147253                  | 23,018,636,259.00             |
| 2013 | 121.3427317            | -6.151                        | 5.395887                  | 24,183,235,705.00             |
| 2014 | 130.8219706            | -5.705                        | 6.152816                  | 25,318,838,465.00             |
| 2015 | 144.0358986            | -9.338                        | 8.632356                  | 26,058,118,447.00             |
| 2016 | 169.7823203            | -5.781                        | 10.31305                  | 26,918,036,355.00             |

Sources: * World Bank World Development Indicators (WDI) database; ** International Monetary Fund (IMF) World Economic Outlook (WEO) database.