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Working Paper 23/2019
August 2019

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SOVEREIGN DEBT AND ECONOMIC GROWTH IN ZIMBABWE: A MULTIVARIATE CAUSAL LINKAGE

Talknice Saungweme[1] and Nicholas M. Odhiambo

Abstract

This paper examines the causal linkage between public debt and economic growth, and between public debt service and economic growth in Zimbabwe for the period from 1970 to 2017. The purpose of the study is to provide empirical evidence to the question "do high public debt or public debt service levels promote or reduce economic growth in Zimbabwe?" To avoid the omission-of-variable bias, fiscal balance and savings are used as intermittent variables, thereby creating a multivariate Granger-causality model. The study employs the autoregressive distributed lag (ARDL) bounds testing approach. Empirical findings indicate that there is short-run unidirectional causal flow from economic growth to public debt in Zimbabwe. Further, the study results reveal that there is no causal link between public debt service and economic growth, irrespective of whether the causality is estimated in the short run or long run. Therefore, the paper concludes that the sovereign debt overhang in Zimbabwe is mostly a result of low economic growth.

Keywords: Zimbabwe, Granger-causality, economic growth, public debt, public debt service ARDL

JEL Classification : H62, H63, O47

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1. Introduction

The debate on the policy question "do high public debt or public debt service levels promote or reduce economic growth?" has been ongoing for some time and the empirical evidence has been inconclusive. Much of the empirical evidence on this subject implicitly appears to support the hypothesis that high public debt and public debt service reduce economic growth (see, among others, Huang et al., 2018; Gómez-Puig and Sosvilla-Rivero, 2018; Ahlborn and Schweickert, 2016; Afonso and Jalles, 2015; Eberhardt and Presbitero, 2015; Soydan and Bedir, 2015; Teles and Mussolini, 2014). However, there is also theoretical reasoning and empirical evidence suggesting that public debt is likely to accumulate when economic growth is low (see, for example, Kobayashi, 2015; Reinhart et al., 2012). The raised arguments are that low economic growth narrows the tax revenue base of the government, forcing it to borrow, locally and abroad. It is also hypothesised in the literature that in periods of prolonged recessions, government borrowing can be an effective tool to stimulate economic growth (see, for example, DeLong and Summers, 2012; Cerra and Saxene, 2008).

Parallel arguments by Panizza and Presbitero (2014) state that the existence of correlations between public debt and economic growth, and between public debt service and economic growth do not certainly infer causation (see also Puente-Ajovín and Sanso-Navarro, 2015). These divergent views on the causal links between public debt and economic growth and between public debt service and economic growth make the causal effect analysis an empirical problem.

Therefore, the aim of this paper is to extend the debate on the subject to Zimbabwe. Zimbabwe is an interesting country of analysis for a number of reasons. The country's sovereign debt stocks and associated repayment obligations are startling, and the general economic performance has been weak since the late 1990s (see Ministry of Finance "MOF", 2018; African Development Bank "AfDB", 2018a; 2018b; World Bank, 2018). Despite the government's intended purpose to improve public financial management practices, and to reduce its domestic and foreign debt arrears, the country has remained in severe debt distress, and the pace of economic growth continue to be subdued (AfDB, 2018b; International Monetary Fund, 2017).

Nonetheless, to the best of our knowledge, the causal relationship between public debt and economic growth, on the one hand, and between public debt service and economic growth, on the other hand,

in Zimbabwe has not been empirically determined. Against this background, this study seeks to examine the causal relationships between public debt and economic growth, and between public debt service and economic growth in Zimbabwe during the period from 1970 to 2017.

This study contributes to the existing literature on the public debt-economic growth debate in four main ways. First, unlike most previous studies on the subject that focussed only on the causal link between public debt and economic growth, this study extends the causality analysis to public debt service and economic growth as well (see Donayre and Taivan, 2018; Gómez-Puig and Sosvilla Rivero, 2015; Kobayashi, 2015).

Second, with regard to modelling, the study employs a multivariate causality model, which has been confirmed to perform better than the bivariate model. The traditional bivariate model used in previous studies is known to suffer from omission-variable-bias (see, for example, Gómez-Puig and Sosvilla Rivero, 2015), while the multivariate Granger-causality approach has the advantage of eliminating spurious correlations and also increasing the general validity of the causation test (Lutkepohl, 1982).

Third, unlike most past studies on the subject which make inferences based on cross-sectional Granger-causality tests, this study conducts causal tests for a specific country, Zimbabwe (see Donayre and Taivan, 2017; Panizza and Presbitero, 2014). The chosen approach in this study has the advantage of capturing country-specific factors.

Last, this study uses the autoregressive distributed lag (ARDL) bounds testing procedure to assess the causal linkages between public debt and economic growth and between public debt service and economic growth. This approach yields unbiased long-run estimates and valid t-statistics even when some of the regressors are endogenous (Nyasha and Odhiambo, 2015).

The remaining part of the paper is organised as follows: Section 2 gives an overview of public debt – also known as sovereign debt, public debt service and economic growth analysis in Zimbabwe. Section 3 summarises the related literature on public debt, public debt service and economic growth. Section 4 presents the empirical model specification, the estimation technique and the analysis of empirical results, while the study conclusions are presented in Section 5.

2. Sovereign Debt, Sovereign Debt Service Developments and Economic Performance in Zimbabwe

The evolution of sovereign debt and public debt service commitments in Zimbabwe starts as far back as the 1980s (see Saungweme and Odhiambo, 2018). During this period, Zimbabwe had unlimited access to international lines of credit, both from the International Financial Institutions and from bilateral creditors (Bond, 2005). The weak domestic capital markets and narrow domestic revenue base constrained the government's finance options to foreign debt (Leo and Moss, 2009). By 1984, Zimbabwe was allocating a considerable proportion of its export earnings to cover foreign loans (Leo and Moss, 2009; Moss and Patrick, 2006).

Public debt developments in Zimbabwe worsened in the late 1990s when the country was put under economic sanctions due to the aggressive land reform program, as well as non-payment of protracted government debt arrears (AfDB, 2018b; IMF, 2005). In addition, economic growth prospects in Zimbabwe remained subdued since 2000 owing partly to restrictive monetary policy stance which raised the reserve requirements of financial institutions, leading to low credit provisions (IMF, 2014). Furthermore, the promulgation of exchange rate controls, on both capital and current transactions, as well as the aggressive implementation of the indigenisation policy in 2000 further depressed entrepreneurial activities and government revenue inflows in this country (AfDB, 2018a).

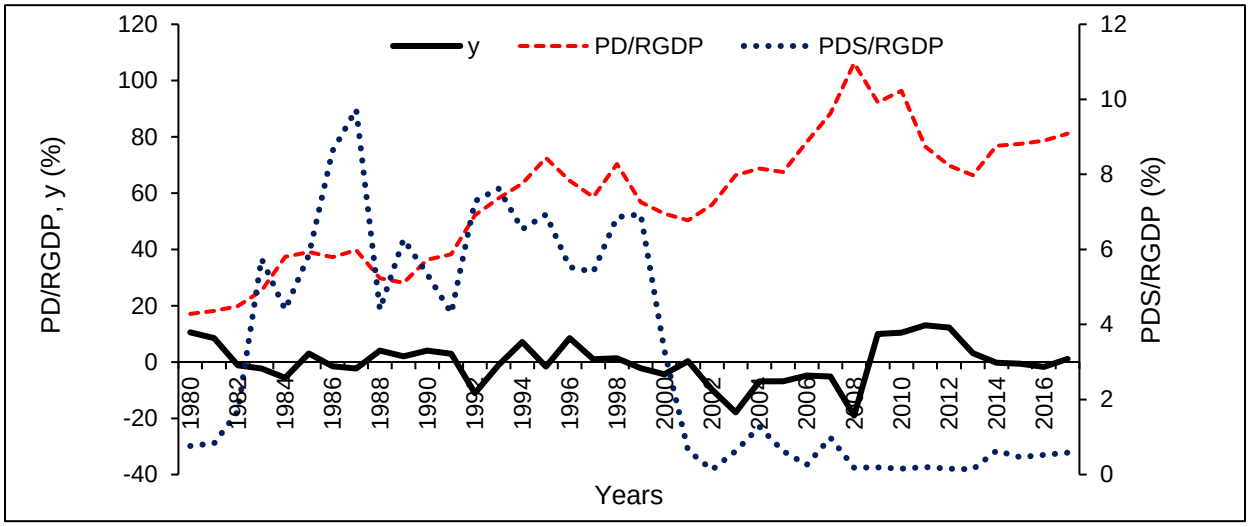
As a consequence, the Zimbabwean government, not only started to excessively overrun its budget but it also halted payments to the International Financial Institutions and other external creditors in 2000 (IMF, 2014; 2005). By 2006, total foreign public debt, principal and interest arrears, totalled US$3.0 billion, while by the end of 2009, foreign public debt had reached US$7.1 billion, which was approximately 140% of the country's gross domestic product (GDP), and 320% of annual export receipts (United Nations, 2010). In 2008, government debt service totalled around 270% of total central government revenues (IMF, 2009).

The surfacing of domestic public debt in 2013 and the acquisition of new loans, mostly from China, aggravated the already precautious government debt position of Zimbabwe (AfDB, 2018b; IMF, 2017). Beginning in 2014, the government of Zimbabwe was actively participating in domestic capital markets, which exacerbated the scarcity of foreign exchange in this economy and also raised interest rates (IMF, 2017). More so, a combination of the rapid deterioration in world commodity

prices since end of 2015, rapid currency reforms, limited access to fresh capital and the perpetual decline in investor confidence have adversely impacted on the country's economic performance in recent years (MOF, 2018; World Bank, 2018; IMF, 2017). One of the implications of these adverse economic developments in Zimbabwe is the incapacity of the country to honour its debt commitments resulting in continual accumulation of debt arrears.

Recently, Zimbabwe's total public debt stock stood at US$14.7 billion in 2017, representing 81.2% of GDP, with US$7.1 billion in public domestic debt and $7.6 billion in foreign public debt (MOF, 2018: 33). As at August 2018, Zimbabwe's sovereign debt had soared to US$17.7 billion, with domestic and foreign public debt accounting for 54% and 46%, respectively (MOF, 2018: 33). The perennial government debt burden is compounded by the severe contraction in the country's export base as reflected by the negative annual growth rate of real GDP per capita, averaging -0.4% between 2014 and 2017 (World Bank, 2018). Figure 1 displays the public debt, public debt service and economic growth trends in Zimbabwe for the period 1980 – 2017. Public debt (PD) and public debt service (PDS) are both expressed as a percentage of real GDP, while economic growth is measured by the annual growth rate of real GDP per capita (y).

Figure 1: Sovereign Debt and Economic Growth Developments in Zimbabwe (1980-2017)



Source: World Bank (2018)

Whereas the relationship between public debt and economic growth seems to portray a negative correlation in Figure 1, the relationship is not clear between public debt service and economic growth. What is visible in Figure 1 is an upward trajectory of public debt from 2001, which is accompanied by depressed economic growth rates and subdued debt service payments. Among the significant economic challenges that characterise Zimbabwe since 2001 are high fiscal deficit, high public debt stocks and public debt service costs, rising inflation, domestic currency shortages, shrinking manufacturing sector – and rising informal sector, and an overvalued exchange rate which continue to undermine this economy's competitiveness (World Bank, 2018, AfDB, 2018, IMF, 2014; Leo and Moss, 2009).

In Figure 1, an upsurge in public debt over the 2013–17 period is evidence of increased fiscal imbalances on the back of declining revenues due to the slowdown in the global economy (MOF, 2018). These fiscal imbalances, which stood at 9.4% of GDP at the end of 2017, were financed mainly through increased issuance of treasury bills, and partly from new foreign borrowings (MOF, 2018). Part of the new government borrowings was used to make part payments to the old debts, mostly to the IMF arrears and to the domestic suppliers, hence the visible upward trend in PDS/RGDP ratio after 2013 (IMF, 2017).

3. A Review of Related Literature

Although a number of previous studies have analysed the relationship between public debt and economic growth, only a few studies have focused on the relationship between public debt service and economic growth – the latter has undergone limited investigation, and the literature is scanty.

Previous studies that specifically examined the direction of causality between public debt and economic growth include Donayre and Taivan (2017), Kobayashi and Shirai (2017), Owusu-Nantwi and Erickson (2016), Gómez-Puig and Sosvilla-Rivero (2015), Puente-Ajovín and Sanso-Navarro (2015), Woo and Kumar (2015), Panizza and Presbitero (2014), Reinhart et al. (2012), Reinhart and Rogoff (2010), Ferreira (2009), and Abbas and Christensen (2007). While a number of these studies have been conducted in developed countries, the same cannot be said regarding the coverage of developing countries.

The public debt-economic growth causality studies that were done in developed countries, using different samples and at different periods, have produced mixed evidence on the direction of causality between these two macroeconomic variables. Donayre and Taivan (2017) analysed the direction of causality between public debt and real economic growth in developed countries using a sample of 20 Organisation for Economic Co-operation and Development (OECD) countries for the period from 1970 to 2010. Their study findings reveal that the direction of causality is from low economic growth to high public debt in highly market-driven economies; and is either from low economic growth to high public debt or is bidirectional in more socialist states (Donayre and Taivan, 2017). The former results were also found by Woo and Kumar (2015) who used a sample of 24 OECD countries, and by Kobayashi (2015) who studied the public debt-economic growth relationship in Japan. The latter results are also supported by the findings of Ferreira (2009).

Furthermore, Puente-Ajovín and Sanso-Navarro (2015) and Panizza and Presbitero (2014) studied the direction of causality between public debt and economic growth in developed countries using panel samples of 16 OECD countries, and 17 OECD countries, respectively. Using Granger-causality tests, Puente-Ajovín and Sanso-Navarro (2015) found no evidence of causality between public debt and economic growth in studied economies. Similar results were confirmed by Panizza and Presbitero (2014) using an instrumental variable approach to control for reverse causality.

Gómez-Puig and Sosvilla-Rivero (2015) also tested the causal relationship between public debt and economic growth in developed countries using a sample of 11 central and peripheral countries of the European Economic and Monetary Union. The study utilised time-series data stretching from 1980 to 2013. The empirical evidence in this study is mixed. The results for Germany, Greece, Italy, Belgium and Spain show evidence that causality flows from public debt to economic growth. With respect to Finland and Ireland, the results show causality from economic growth to public debt, while in Austria and Portugal no causal relationship was confirmed.

Finally, Reinhart and Rogoff (2010) analysed the relationship between public debt and economic growth based on data from 44 developed and emerging countries over a period of 200 years. The authors concluded that for high levels of public debt, the evidence points to bidirectional causality, while for low levels of public debt no causality relationship was established.

Empirical studies in developing countries on the causal linkage between public debt and economic growth were done by, among others, Owusu-Nantwi and Erickson (2016) and Abbas and Christensen (2007). The results of Owusu-Nantwi and Erickson (2016), who studied Ghana; and those of Abbas and Christensen (2007), who used a panel of 93 developing countries, reveal that the direction of causal flow between public debt and economic growth is bidirectional.

Unlike the causal relationship between public debt and economic growth, studies that have tested for the causality between public debt service and economic growth in developing countries are scant, and the focus has been mainly on Asia and Latin American countries. Some of the studies that have explored the causal relationship between public debt service and economic growth include Jalles (2011), Karagol (2002), Ahmed et al. (2000), Afxentiou and Serletis (1996), Afxentiou (1993), and Amoatend and Amoako-Edu (1996).

Two of the studies found that public debt service Granger-causes economic growth. These are Karagol (2002) and Afxentiou (1993). Karagol (2002) studied the public debt service and economic growth causal relationship in Turkey using the vector autoregressive (VAR) models to perform all the econometric analysis. The variables of interest in the study were gross national product (GNP), foreign debt service, capital stock, labour force and human capital. The sample period was from 1950 to 1998. The results of Karagol (2002) show that there is a unidirectional causality from foreign public debt service to GNP.

Afxentiou (1993) used a panel of 20 developing countries to study the causal link between the annual growth rate of GNP, total public debt service/ GNP ratio, total public debt interest payments/GNP ratio, total public debt service/exports ratio, and total public debt interest payments/exports ratio. The results of Afxentiou (1993) show that there is a unidirectional causality from public debt service to growth rate of GNP.

The empirical findings of Jalles (2011), Ahmed et al. (2000), and Afxentiou and Serletis (1996) show no evidence of a causal link between public debt service and economic growth in studied economies. More specifically, Ahmed et al., (2000) studied eight Asian countries using a Granger-causality framework. The variables of interest in this study were annual growth rate of GDP, foreign public

debt service and export revenue growth. The authors found no evidence supporting a causal relationship between studied variables.

Finally, Amoatend and Amoako-Edu (1996) studied 35 African countries, and the variables of interest were annual growth rate of GDP and foreign public debt service. The authors found that there was a two-way causality between foreign public debt service and annual growth rate of GDP.

The reviewed empirical studies in developed countries show that the scale is balanced between studies that support causality from economic growth to public debt and those that support causality from public debt to economic growth. However, studies in developing countries provided evidence supporting a bidirectional causality between public debt and economic growth. Overall, developed countries enjoyed more coverage than developing countries on this subject. Regarding causality between public debt service and economic growth, the empirical evidence is more inclined to the existence of no causal relationship between these variables.

4. Methodology and Analysis of Empirical Results

The empirical analysis in this study uses annual time-series data for the period from 1970 to 2017. The data for all regression variables in this study were taken from the World Bank World Development Indicators database (World Bank, 2018). The study utilises two multivariate Granger-causality models within an autoregressive distributed lag (ARDL) bounds testing framework to analyse the causality between public debt and economic growth, and between public debt service and economic growth, and two other control variables – fiscal balance and gross domestic savings.

The first model (Model 1) investigates the causality between public debt and economic growth and has the following variables: public debt, economic growth, fiscal balance and savings. The second model (Model 2) tests the causal relationship between public debt service and economic growth and has the following variables: public debt service, economic growth, fiscal balance and savings. The system of ARDL-based cointegrating equations associated with the dynamic multivariate Granger-causality models used in this study can be expressed as follows:

ECM-based cointegration model: Public debt and economic growth (Model 1)

$$\Delta y_t = \phi_0 + \sum_{i=1}^{n} \phi_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \phi_{2i} \Delta PD_{t-i} + \sum_{i=0}^{n} \phi_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \phi_{4i} \Delta SAV_{t-i}$$

$$+ \phi_5 y_{t-1} + \phi_6 PD_{t-1} + \phi_7 FB_{t-1} + \phi_8 SAV_{t-1} + \varepsilon_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.1)$$

$$\Delta PD_t = \lambda_0 + \sum_{i=0}^{n} \lambda_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \lambda_{2i} \Delta PD_{t-i} + \sum_{i=0}^{n} \lambda_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \lambda_{4i} \Delta SAV_{t-i}$$

$$+ \lambda_5 y_{t-1} + \lambda_6 PD_{t-1} + \lambda_7 FB_{t-1} + \lambda_8 SAV_{t-1} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.2)$$

$$\Delta FB_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta PD_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta SAV_{t-i}$$

$$+ \beta_5 y_{t-1} + \beta_6 PD_{t-1} + \beta_7 FB_{t-1} + \beta_8 SAV_{t-1} + \varepsilon_{3t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.3)$$

$$\Delta SAV_t = \omega_0 + \sum_{i=0}^{n} \omega_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \omega_{2i} \Delta PD_{t-i} + \sum_{i=0}^{n} \omega_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \omega_{4i} \Delta SAV_{t-i}$$

$$+ \omega_5 y_{t-1} + \omega_6 PD_{t-1} + \omega_7 FB_{t-1} + \omega_8 SAV_{t-1} + \varepsilon_{4t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.4)$$

Where: y is annual growth rate of real GDP per-capita (a proxy for economic growth); PD is stock of public debt as a share of GDP (a proxy for public debt); FB is fiscal balance as a share of GDP (a proxy for fiscal balance); SAV is share of savings in GDP (a proxy for gross domestic savings); ϕ_0, λ_0, β_0 and ω_0 are respective constants; $\phi_1 - \phi_4$, $\lambda_1 - \lambda_4$, $\beta_1 - \beta_4$ and $\omega_1 - \omega_4$ are respective short-run coefficients; $\phi_5 - \phi_8, \lambda_5 - \lambda_8$, $\beta_5 - \beta_8$ and $\omega_5 - \omega_8$ are respective long-run coefficients; $\varepsilon_1 - \varepsilon_4$ are the white-noise error terms; Δ is the difference operator; n is the lag length; and t is the time period.

ECM-based Granger-causality model: Public debt and economic growth (Model 1)

Following Donayre and Taivan (2017), and based on the work of Pesaran and Shin (1999) and Pesaran et al. (2001), the ECM-based multivariate Granger-causality model in this study, for Model 1, is presented as:

$$\Delta y_t = \phi_0 + \sum_{i=1}^{n} \phi_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \phi_{2i} \Delta PD_{t-i} + \sum_{i=1}^{n} \phi_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \phi_{4i} \Delta SAV_{t-i} + \phi_9 ECM_{t-1} + \mu_{1t} \quad \ldots (1.5)$$

$$\Delta PD_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \lambda_{2i} \Delta PD_{t-i} + \sum_{i=1}^{n} \lambda_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \lambda_{4i} \Delta SAV_{t-i} + \lambda_9 ECM_{t-1} + \mu_{2t} \quad \ldots (1.6)$$

$$\Delta FB_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta PD_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta SAV_{t-i} + \beta_9 ECM_{t-1} + \mu_{3t} \quad \ldots (1.7)$$

$$\Delta SAV_t = \omega_0 + \sum_{i=1}^{n} \omega_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \omega_{2i} \Delta PD_{t-i} + \sum_{i=1}^{n} \omega_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \omega_{4i} \Delta SAV_{t-i} + \omega_9 ECM_{t-1} + \mu_{4t} \quad \ldots (1.8)$$

Where: ϕ_9, λ_9, β_9 and ω_9 are coefficients of ECM_{t-1}; ECM_{t-1} is the error correction term lagged one period; and all the other variables are as described in the cointegration model (Model 1).

ECM-based cointegration model: Public debt service and economic growth (Model 2)

$$\Delta y_t = \psi_0 + \sum_{i=1}^{n} \psi_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \psi_{2i} \Delta PDS_{t-i} + \sum_{i=0}^{n} \psi_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \psi_{4i} \Delta SAV_{t-i} + \psi_5 y_{t-1} + \psi_6 PDS_{t-1} + \psi_7 FB_{t-1} + \psi_8 SAV_{t-1} + \varepsilon_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.1)$$

$$\Delta PDS_t = \rho_0 + \sum_{i=0}^{n} \rho_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \rho_{2i} \Delta PDS_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \rho_{4i} \Delta SAV_{t-i} + \rho_5 y_{t-1} + \rho_6 PDS_{t-1} + \rho_7 FB_{t-1} + \rho_8 SAV_{t-1} + \varepsilon_{2t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.2)$$

$$\Delta FB_t = \propto_0 + \sum_{i=0}^{n} \propto_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \propto_{2i} \Delta PDS_{t-i} + \sum_{i=1}^{n} \propto_{3i} \Delta FB_{t-i} + \sum_{i=0}^{n} \propto_{4i} \Delta SAV_{t-i} + \propto_5 y_{t-1} + \propto_6 PDS_{t-1} + \propto_7 FB_{t-1} + \propto_8 SAV_{t-1} + \varepsilon_{3t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.3)$$

$$\Delta SAV_t = \delta_0 + \sum_{i=0}^{n} \delta_{1i} \Delta y_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta PDS_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \delta_{4i} \Delta SAV_{t-i} + \delta_5 y_{t-1} + \delta_6 PDS_{t-1} + \delta_7 FB_{t-1} + \delta_8 SAV_{t-1} + \varepsilon_{4t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.4)$$

Where: y is annual growth rate of real GDP per-capita (a proxy for economic growth); PDS is stock of public debt service as a share of GDP (a proxy for public debt service); FB is fiscal balance as a share of GDP (a proxy for fiscal balance); SAV is share of savings in GDP (a proxy for gross domestic savings); ψ_0, ρ_0, $\propto_0$ and δ_0 are respective constants; $\psi_1 - \psi_4$, $\rho_1 - \rho_4$, $\propto_1 - \propto_4$ and $\delta_1 - \delta_4$ are respective short-run coefficients; $\psi_5 - \psi_8$, $\rho_5 - \rho_8$, $\propto_5 - \propto_8$ and $\delta_5 - \delta_8$ are respective long-run coefficients; $\varepsilon_1 - \varepsilon_4$ are the white-noise error terms; Δ is the difference operator; n is the lag length; and t is time period.

ECM-based Granger-causality model: Public debt service and economic growth (Model 2)

$$\Delta y_t = \psi_0 + \sum_{i=1}^{n} \psi_{1i}\Delta y_{t-i} + \sum_{i=1}^{n} \psi_{2i}\Delta PDS_{t-i} + \sum_{i=1}^{n} \psi_{3i}\Delta FB_{t-i} + \sum_{i=1}^{n} \psi_{4i}\Delta SAV_{t-i} + \psi_9 ECM_{t-1} + \mu_{1t} \ldots \ldots \ldots (2.5)$$

$$\Delta PDS_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i}\Delta y_{t-i} + \sum_{i=1}^{n} \rho_{2i}\Delta PDS_{t-i} + \sum_{i=1}^{n} \rho_{3i}\Delta FB_{t-i} + \sum_{i=1}^{n} \rho_{4i}\Delta SAV_{t-i} + \rho_9 ECM_{t-1} + \mu_{2t} \ldots \ldots \ldots (2.6)$$

$$\Delta FB_t = \propto_0 + \sum_{i=1}^{n} \propto_{1i} \Delta y_{t-i} + \sum_{i=1}^{n} \propto_{2i} \Delta PDS_{t-i} + \sum_{i=1}^{n} \propto_{3i} \Delta FB_{t-i} + \sum_{i=1}^{n} \propto_{4i} \Delta SAV_{t-i} + \propto_9 ECM_{t-1} + \mu_{3t} \ldots \ldots \ldots (2.7)$$

$$\Delta SAV_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i}\Delta y_{t-i} + \sum_{i=1}^{n} \delta_{2i}\Delta PDS_{t-i} + \sum_{i=1}^{n} \delta_{3i}\Delta FB_{t-i} + \sum_{i=1}^{n} \delta_{4i}\Delta SAV_{t-i} + \delta_9 ECM_{t-1} + \mu_{4t} \ldots \ldots \ldots (2.8)$$

Where ψ_9, ρ_9, $\propto_9$, and δ_9 are coefficients of ECM_{t-1}; ECM_{t-1} is the error correction term lagged one period; and all the other variables are as described in the cointegration model (Model 2).

The negative and significant coefficient of the ECM_{t-1} signifies the existence of a long-run causal relationship between the variables, and it also indicates convergence of the estimated system of variables in the models (Muyambiri and Odhiambo, 2018). The short-run causality is measured by the F-statistic on the explanatory variables, based on the Variable Deletion Test technique. The lagged error correction term (ECM_{t-1}) is integrated only in those equations where the series are cointegrated.

Analysis of Empirical Results

Unit Root

Since the ARDL procedure is applicable only when all regression variables are integrated of order zero [I(0)] or order one [I(1)], stationarity tests were performed to ascertain the order of integration in the series. For this purpose, the study used the Phillips-Perron (PP) and the Dickey-Fuller Generalised Least Square (DF-GLS) stationarity tests. The stationarity results are presented in Tables 1 (a) and 1(b).

Table 1(a): PP Stationarity Test Results – All Variables

	Stationarity of all Variables in Levels		**Stationarity of all Variables in First Difference**	
Variable	*With Intercept*	*With Intercept and Trend*	*With Intercept*	*With Intercept and Trend*
y	-4.444***	-4.378***	-	-
PD	-1.077	-2.720	-6.577***	-6.516***
PDS	-1.735	-1.937	-7.166***	-7.264***
FB	-2.150	-2.126	-5.396***	-5.297***
SAV	-1.301	-2.973	-10.096***	-9.980***

*Note: *** denotes stationarity at the 1% significance level.*

Table 1(b): DF-GLS Stationarity Test Results – All Variables

	Stationarity of all Variables in Levels		**Stationarity of all Variables in First Difference**	
Variable	*With Intercept*	*With Intercept and Trend*	*With Intercept*	*With Intercept and Trend*
y	-3.656***	-4.201***	-	-
PD	-0.377	-2.614	-6.309***	-6.511***
PDS	-1.681*	-1.809	-	-7.316***
FB	-2.626***	-2.127	-	-5.482***
SAV	-0.879	-1.996	-9.737***	-9.954***

*Note: * and *** denote stationarity at the 10%, and 1% significance levels, respectively.*

As shown in Tables 1 (a) and (b), the stationarity results of variables are a mixture of those integrated of order zero and those integrated of order one – thus confirming the applicability of the ARDL cointegration technique. The study, therefore, proceeds to test the likelihood of cointegration among the variables using the ARDL bounds testing procedure.

Cointegration

The null hypothesis of no cointegration relationship in Model 1 and Model 2 is examined by performing a joint significance test on the lagged level variables. The results of the bounds F-statistic test for cointegration for both public debt and economic growth (Model 1), and public debt service and economic growth (Model 2) are reported in Table 2 [Panels A and B].

Table 2: Bounds test for cointegration – Models 1 and 2

Pane A: Model 1 – Public debt and economic growth

Dependent Variable	Function	F-statistic	Cointegration Status
y	F(y| PD, FB, SAV)	3.927*	Cointegrated
PD	F(PD| y, FB, SAV)	1.511	Not cointegrated
FB	F(FB| y, PD, SAV)	2.231	Not cointegrated
SAV	F(SAV| y, PD, FB)	1.037	Not cointegrated

Panel B: Model 2 – Public debt service and economic growth

Dependent Variable	Function	F-statistic	Cointegration Status
y	F(y| PDS, FB, SAV)	4.903**	Cointegrated
PDS	F(PDS| y, FB, SAV)	1.086	Not cointegrated
FB	F(FB| y, PDS, SAV)	2.266	Not cointegrated
SAV	F(SAV| y, PDS, FB)	0.867	Not cointegrated

Asymptotic critical values Pesaran *et al.* (2001: 300) Table CI(iii) Case III	**1%**		**5%**		**10%**	
	I(0)	***I(1)***	***I(0)***	***I(1)***	***I(0)***	***I(1)***
	4.29	5.61	3.23	4.35	2.72	3.77

*Note: ** and * denote statistical significance at 5% and 10%, respectively.*

The results of the F-statistic test in Table 2 [Panel A] for Model 1 reject the null hypothesis of no cointegration only when economic growth (y) is the dependent variable. Similarly, the results in Table 2 [Panel B] for Model 2 suggest that there exists a long-run relationship between public debt service, economic growth, fiscal balance and savings only when economic growth (y) is the dependent variable. The findings in Models 1 and 2 are confirmed by the respective F-statistics of each function against the asymptotic critical values.

ECM-based Granger-causality

Having established cointegration relationships between the variables in Model 1 and Model 2, the study proceeds to investigate the direction of causality between public debt and economic growth, and between public debt service and economic growth. The results of the Granger-causality tests are given in Tables 3(a) and 3(b).

Table 3(a): Granger-causality Test Results – Public Debt and Economic Growth [Model 1]

Dependent Variable	**F-statistics [probability]**				ECT_{t-1} **[t-statistics]**
	Δy_t	ΔPD_t	ΔFB_t	ΔSAV_t	
Δy_t	-	0.088[0.916]	0.353 [0.705]	3.939*[0.061]	-0.699***[-5.954]
ΔPD_t	2.169*[0.083]	-	2.210*[0.080]	0.867[0.429]	-
ΔFB_t	1.932[0.173]	0.014[0.986]	-	2.667*[0.083]	-
ΔSAV_t	0.342[0.562]	1.277[0.291]	0.672[0.517]	-	-

*Note: * and *** denote statistical significance at 10% and 1% levels, respectively.*

Table 3(b): Granger-causality Test Results – Public Debt Service and Economic Growth [Model 2]

Dependent Variable	F-statistics [probability]				ECT_{t-1} [t-statistics]
	Δy_t	ΔPDS_t	ΔFB_t	ΔSAV_t	
Δy_t	-	1.343[0.274]	0.030[0.970]	2.286*[0.053]	-0.572***[-4.269]
ΔPDS_t	0.392[0.535]	-	0.258[0.774]	0.482[0.622]	-
ΔFB_t	1.320[0.258]	3.306**[0.048]	-	4.8754**[0.013]	-
ΔSAV_t	0.115[0.736]	2.756*[0.077]	0.029[0.971]	-	-

*Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.*

On the one hand, the Granger-causality results reported in Table 3(a) for Model 1 show the existence of short-run unidirectional causality from economic growth to public debt. This result is confirmed by the corresponding F-statistic of economic growth (Δyt) in the public debt (ΔPDt) function, which is statistically significant at the 10% level. This established causal flow in Zimbabwe is consistent with the view that low economic growth rates force the country to borrow excessively to finance the savings, fiscal and current account gaps. The outcome of this study is consistent with the findings in Donayre and Taivan (2017), Woo and Kumar (2015) and Kobayashi (2015).

The results of Model 1 further show that there is unidirectional causal flow from savings to economic growth in both the short run and the long run. The results also reveal that there is short-run unidirectional causal flow from fiscal balance to public debt – confirmed by the coefficient of ΔFBt in the ΔPDt function. Model 1 results further reveal the existence of short-run unidirectional causal flow from savings to fiscal balance, and no causality between fiscal balance and economic growth, and between savings and public debt.

On the other hand, the empirical results presented in Table 3(b) (Model 2) for public debt service, fiscal balance, savings and economic growth show that there is no causal link between public debt service and economic growth in both the short run and the long run. This finding is confirmed by the F-statistic of ΔPDSt in the economic growth (Δyt) function and that of Δyt in the public debt service (ΔPDSt) function, which are found to be both statistically insignificant. This result is consistent with

the findings in Gómez-Puig and Sosvilla-Rivero (2015), Puente-Ajovín and Sanso-Navarro (2015), Panizza and Presbitero (2014) and Jalles (2011).

Other results of Model 2 show the existence of short-run and long-run unidirectional causal flow from savings to economic growth. The results of Model 2 further show a distinct short-run unidirectional causality from public debt service to fiscal balance, and from savings to fiscal balance; confirmed by the coefficients of ΔPDS_t in the ΔFB_t function and ΔSAV_t in the ΔFB_t function, respectively. Furthermore, the results show that there is short-run unidirectional causality from public debt service to savings, and no causality between fiscal balance and economic growth.

In summary, the study findings imply that, in Zimbabwe, high public debt levels are a result of poor economic performance. The country has had an average economic growth rate of -0.1% for the period from 1970 to 2017 (World Bank, 2018). During the period 2000 – 2008, the country persistently recorded negative economic growth rates, averaging -8.3% (World Bank, 2018). More so, the country's poor economic performance since 2014, and the associated negative economic growth rates might have worsened the government debt position (MOF, 2018). The study further found no evidence supporting a causal link between public debt service and economic growth in Zimbabwe.

5. Conclusion

In this paper, the causal linkage between public debt and economic growth, and between public debt service and economic growth in Zimbabwe has been empirically investigated for the period from 1970 to 2017. Unlike most previous studies on the subject which make inferences based on cross-sectional Granger-causality tests, this study tested the causal linkages in Zimbabwe only in order to capture country-specific issues. The study used time-series data from 1970 to 2017, and it employed two models, namely, Model 1 and Model 2. Model 1 comprises of public debt, fiscal balance, gross domestic savings and economic growth, while Model 2 is composed of public debt service, fiscal balance, gross domestic savings and economic growth. Thus, the examination of the causal impact of public debt, public debt service and economic growth have been done within a multivariate causality setting, with fiscal balance and savings as intermittent variables. The advantages of a multivariate causality setting are that it addresses the problem of omission of variable bias, eliminates spurious correlations and also increases the general validity of the causation test.

Based on the ARDL cointegration procedure and the ECM-based Granger-causality tests, the results of this study show that there is short-run unidirectional Granger-causality flowing from economic growth to public debt in Zimbabwe. However, the results further found no empirical evidence supporting a causal link between public debt service and economic growth in the study country. This latter finding was found to apply both in the short run and in the long run. Based on these findings, the study recommends Zimbabwe to intensify the implementation of economic growth-enhancing policies and strategies in order to solve its perennial high public debt problem.

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