How sustainable are fiscal budgets in the Kingdom of Swaziland?

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HOW SUSTAINABLE ARE FISCAL BUDGETS IN THE KINGDOM OF SWAZILAND?

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ABSTRACT: The recently experienced Swazi fiscal crisis of 2011 has facilitated the need for an academic probe into the sustainability of fiscal budgets in the Kingdom. Against the absence of empirical evidence evaluating the sustainability of Swazi fiscal budget, our study fills the hiatus by econometrically evaluating the sustainability of the fiscal budget of the Swazi economy between 1999 and 2016. Our empirical study depends on a combination of linear and asymmetric unit root and cointegration empirical procedures to attain this objective. In reviewing the obtained results, the evidence obtained from the linear econometric frameworks is inconclusive whereas the results from the more vigorous asymmetric models point to the unsustainability of Swazi fiscal budget over both the short and long-run. Important policy implications for Swazi fiscal policymakers are drawn from the analysis.

Keywords: Fiscal budget, Fiscal Crisis, Swaziland, SACU, KSS nonlinear unit root test, Fourier function, nonlinear autoregressive distributive lag model.

JEL Classification Code: C12; C13; C32; C51; H61; H62.

1 INTRODUCTION

The Kingdom of Swaziland is a small, landlocked monarchy situated in the South East parts of the African continent and is host to a population of under 1.4 million people. Geographically, the country measures 17,364 km^2 (6,704mi^2) in landscape and is completely surrounded by South Africa to the Northern parts (Hhohho district), Western parts (Manzini district), Southern parts (Shiselweni district) yet share borders with the Southern province of Mozambique on the Eastern parts (Lubombo district). Economically, Swaziland is heavily dependent on South Africa, particularly in the area of trade activity, in which together with Namibia, Botswana and Lesotho operate under the Southern African Customs Union (SACU) Free Trade Area (FTA) agreements. Part of the stipulations of these FTA agreements are that revenues collected and deposited into a common pool from trade receipts are distributed amongst the member states using a revenue sharing formula. What facilitates the ease of trade transaction amongst the countries is that they share borders with South Africa hence warranting much flexibility in free movement of capital and labour. Moreover, with the exception of Botswana, the remaining SACU members operate under a Common Monetary Area (CMA) which significantly reduces transactions costs in exchanging currency across borders.

The Swazi Kingdom was hit by a severe budget crisis in 2011 which saw the local budget deficit almost double from 7% of GDP to 13% of GDP between the fiscal years of 2009/10 and 2011/12, whilst increasing debt levels from 12.5% of GDP to 17% of GDP between the same periods (Mafusire, 2015). The budget crisis is alluded to the massive downturn in Southern African Customs Union (SACU) revenues which plummeted from 24% of GDP in 2008/09 to 9.7% of GDP in 2010/11. The sharp declines in SACU revenues were very problematic for Swazi policymakers as these revenues constitute a major portion of fiscal collections which are specifically used to finance the Kingdom's large public wage bill. Further given limited access to other financing options, the Swazi government faced a serious liquidity shortage which threatened the solvency of the fiscal budget. According to a 2012 technical report compiled by the United Nations, the main transmission channels of the crisis into the Swazi economy were via i) reduced social services delivery ii) weakened labour markets, and

iii) vulnerable credit markets. In turn, the deeper social repercussions of the crisis included i) layoffs and wage cuts ii) social expenditure cuts iii) poor access to health care and education service iv) decreased quality and quantity of nutritional intake v) increased school dropouts and crime rates (United Nations, 2012).

As a result of it's severity, the Swazi budget crisis of 2010-2011 attracted much required assistance from the international community, more especially from the International Monetary Fund (IMF), who have worked hand-in-hand with Swazi domestic authorities to pave a way towards increased budget sustainability. As part and parcel of these collaborations, a number of academics from the African Research Department of the IMF (see Mongardini et al. (2011) and Basdevant et al. (2011, 2013)) have produced a series of research papers on the effects of the budget crisis on the Swazi economy. Collectively, the aforementioned research case studies carry two common themes. Firstly, the influence of monetary policy in stabilizing the economy is greatly hindered due to the affiliation of the Swazi economy to the Common Monetary Area (CMA) agreements. Under these agreements, the Swazi Lilangeni currency is pegged of equal value onto the South Africa Rand, all at the expense of independent conduct of domestic monetary policy. Secondly, with the failure of the proposed IMF staff monitoring programme (SMP) in meeting the requirements to obtain a letter of comfort directed at securing external funding from international institutions such as the African Development Bank (AFDB), the most immediate concerns of the Swazi government should be with implementing deep fiscal structural reforms.

Against these developments, a fundamentally important empirical question which can be raised is whether the Swazi fiscal budget is sustainable or not? After conducting a rigorous review of the available literature, we observe that no previous research has attempted to empirically address this question for the case of Swaziland. Another important question which can be posed is 'what course of action should Swazi fiscal authorities embark on towards attaining improved budget sustainability over both long and the short-run?' Should the government focus on expanding the fiscal budget or should it rather concentrate on contracting the budget? Unfortunately, symmetric econometric models, which assume that both increases and decreases in the fiscal budget adjustments have similar magnitude effects on sustainability over the steady state, fail to appropriately address this issue. Therefore, our study contributes to the paradigm by examining the sustainability of the Swazi fiscal budget using symmetric and asymmetric unit root testing procedures and cointegration methods applied to time series data collected between 1999 and 2016. In particular, preliminary evidence on the sustainability of the fiscal budget is provided by the conventional symmetric ADF and DF-GLS unit root tests which is supplemented with a cointegration analysis using the symmetric autoregressive distributive lag (ARDL) model of Pesaran et al. (2001). A comparative analysis is thereafter provided by the asymmetric unit root testing procedure of Kapetanios et al. (2003) which is augmented with a Fourier function as well as by the nonlinear autoregressive distributive lag (N-ARDL) model of Shin et al. (2014). Given the robustness of our empirical strategy in examining the sustainability of the Swazi budget, we believe that our empirical study could provide useful ramifications for Swazi fiscal authorities.

Having provided a background to the research, the remainder of the study is presented as follows. The following section provides an overview of the Swazi economy and the 2011 fiscal crisis. The third section presents a brief review of the associated empirical literature. Section four presents our methodology which constitutes of our theoretical framework, the unit root testing framework as well as the cointegration frameworks used in our empirical study. Section five presents the data and empirical results whilst section six concludes the paper in the form of policy implications.

2 A SNAPSHOT OF THE SWAZI ECONOMY AND THE FISCAL CRISIS

In order to reasonably appreciate the severity of the fiscal budget crisis on the Swazi nation, it is imperative that one first possess an economic background to the Kingdom. It is well documented that over the last decade or so, the Swazi economy has been growing at a sluggish two percent growth rate which is described as being amongst the lowest in the SSA region (Mongardini et al., 2011). In addition, the unemployment rate has averaged about 29 percent and it is believed that over 69 percent of the population lives below the poverty line of one dollar a day (Masuku and Limb, 2016). Per capita income was estimated at US$3,000, the economy ranks 148 out of 187 on the United Nations Human Poverty Index and the country's Gini coefficient of 0.51 is one of the highest in the world (Woods, 2015). From a health perspective, the country boasts one of the highest HIV prevalence rates globally, which has been labelled as an epidemic and according to the World Bank statistics, the life expectancy of Swazi citizens is approximately 49 years (Brixiova et al., 2013).

As is the case with many Sub-Saharan Africa (SSA) economies, a number of public enterprises have been established in key sectors of the Swazi economy in order to spearhead development and provide a variety of goods and services (Dlamini, 2003). In particular, a special development fund organization, Tibiyo Taka Ngwane, which holds a significant portion of the nation's wealth, provides much of the infrastructure, such as urban water supply, electricity, telecommunications and postal services, rail and air transport and the agro-industrial services (Dlamini, 2005). In addition, Tibiyo uses its generated investment income as resources to purchase large equity stakes (usually 50% interest) in the most significant foreign investment ventures into the Kingdom which is inclusive of asbestos, casinos, construction, food and meat processing, hotels, banks, insurance, sugar and other agribusiness, mines and timber (Debly, 2014). From a trade perspective, textiles and sugar processing form a major bulk of the Kingdom's exports to international destinations such as the United States (US) and the European Union (EU) and consequentially account for a majority of Swaziland's government revenue from SACU receipts.

Due to the dominance of state ownership of factors of production with government being the largest employer of labour, a majority of ordinary Swazi citizens have to earn a living by either engaging in small and medium enterprise opportunities or work directly in the public sector (Humayun and Adelopo, 2012). This has resulted in a very large public wage bill in Swaziland which is reported to be the highest worldwide, averaging 50% of total fiscal revenues and 17% of GDP between 2010 and 2011, and is primarily financed through revenues collected from the SACU common revenue pool (CRP) (United Nations, 2012). In 2002, there was a change in the revenue sharing formula which had been criticized on the premise of reflecting colonialist ideologies of South Africa's previous Apartheid regime. The new agreement sought to encompass i) democratization and the creation of new governing institutional structures ii) trade liberalization and regulation as well as iii) a new revenue sharing formula for the SACU-CRP funds (Gibbs, 2002). Initially, trade revenues generated under the new agreements were exceptionally favourable towards smaller SACU countries (Botswana, Lesotho and Swaziland) especially between the fiscal period of 2004/5 and 2007/8, in which Swaziland's share in revenues amounted to 39.4% of total government income and also 26.7% of GDP in 2006/07. In a twist of events, Swaziland's share in SACU revenues plummeted from 20.4% of GDP in 2009/10 to 9.5% of GDP in 2010/11 (United Nations, 2012) and this has being mainly attributed to the Lehman bankruptcy which sparked the global financial crisis of 2008, the global recessionary period of 2009 as well as the European sovereign debt crisis of 2010. By 2011 the external current account deficit reached approximately 18% of GDP, the international reserves had depleted to a meagre R4,5 billion (under $500 million) and this had crippled government service delivery for many state departments (Simelane, 2014). In response to the looming fiscal liquidity crunch facing Swaziland, the local government attempted to finance it's fiscal budget by drawing deposits at the Central Bank, engaging in significant domestic borrowing and accumulating of significant domestic payment arrears, and this set course of action only worsened the economic situation in Swaziland (Simelane, 2016).

In running out of options, the government sought to obtain R600 million from the African Development Bank (AFDB) and due to the perceived, unfavourable credibility of the Swazi government in repaying back this loan, the AFDB requested a letter of comfort from the IMF. A team of delegates, led by Dr. Joannes Mongardini, was then dispatched by the IMF and this advisory team recommended that the Swazi government embark on a fiscal adjustment roadmap (FAR) whose aim was to restore domestic fiscal sustainability over the short-to-medium term and to institute deeper structural fiscal reforms as a long-term development objective. As part of this policy programme, the staff monitoring programme (SMP) was introduced through a series of fiscal reforms which were implemented in attempt to consolidate the deteriorating budget. On the revenues side of the budget, there was an increase levy on gasoline and fuel; a proposed increase in excise duties on alcohol and cigarettes; an increase in sales tax and the introduction of the value added tax (VAT), all which were forecasted to bring in significant revenue collections to fiscal authorities. On the expenditure side, there was a decision taken to stop all new budget commitments, except for health and education items, as well as significant cuts to the public wage bill. Overall, there was an encompassing fiscal mandate to reduce the threshold ceiling of the domestic debt from 40% of GDP to 25% of GDP (United Nations, 2012).

However, in 2012, the IMF abruptly ended its collaborations with the Swazi government and withdrew its advisory team, claiming that it was unable to support the government proposed reform agenda because it did not go far enough in addressing deeper socio-political structural reforms (Wood, 2015). In particular, the IMF explicitly expressed serious concerns over Tibiyo's tax exempt status, of which if taxed, the institution would be largest contributors of tax payments to the country's revenues collections (Debly, 2014). The Swazi government did not take too kindly to these political-based recommendations and requested the IMF to stop meddling in the country's affairs. Subsequently, the Swazi fiscal budget did improve in 2012, and yet has since deteriorated to levels worse than experienced in 2010/2011, reaching 1over 16% of GDP in the most recent fiscal year of 2016/17 (Mafusire, 2015). Much of the recent dismal fiscal performance comes courtesy of the El-Nino induced drought of 2015 and according to a 2016 report published by the Deputy Prime Minister's office, Swaziland drought assessment rainfall decreased by over 50% with the agribusiness suffering significant losses in sugarcane, maize and vegetation production and this has had spillover effects into households via increased food deficits. The Swazi government has since launched the long-term National Emergency Response, Mitigation, and Adaptation Plan (NERMAP) which has developed a contingency response plans for i) agriculture and food security ii) education iii) water and sanitation iv) health and nutrition sector v) social protection vi) storm damages and vii) co-ordination of drought mitigation and adaptation plan, as well as vii) storm damages response, all of which has already set the government budget back by R345 363 948 (approximately US$29 033 503) (United Nations, 2016).

3 REVIEW OF ASSOCIATED LITERATURE

There has been a considerable large volume of previous empirical literature which has examined the sustainability of fiscal budgets for European economies (Owoye (1995), Koren and Stiassny (1998), Garcia and Henin (1999), Afonso and Rault (2009), Lau and Baharumshah (2009), Holmes et al. (2010), Cuestas and Staehr (2013) and Bolat (2014)), Latin American countries (Baffes and Shah (1994), Ewing and Payne (1998) and Cheng (1999)), Asian economies (Karim et al. (2006), Mehrara et al. (2011) and Magazzino (2014)) and other African countries (Carneiro et al. (2005), Eita and Mbazima (2008), Ghartey (2010) and Baharumshah et al. (2016)). Collectively, these studies produce a wide range of differing empirical results mainly due to differences in the measure of the fiscal budget, different econometric methodologies applied, differing time spans covered as well as differing country-specific dynamics.

In categorizing these studies, it is most convenient to broadly segregate them into two groups. Firstly, there are studies which rely on testing the integration properties of the balanced budget (Cunado et al. (2004), Lau and Baharumshah (2009), Holmes et al. (2010) and Liu et al. (2014)). The intuition behind these studies is that government's budget is deemed sustainable if the series is found to be stationary since a shock to the budget will eventually revert the variable back to it's steady state equilibrium. This evidence is supported by Cunado et al. (2004) for the US and Holmes et al. (2010) for EU economies. Conversely, the fiscal budget is considered unsustainable if the time series is found to contain a unit root since this implies a shock to the budget permanently deviates from it's steady-state equilibrium such that it's predictability does not tend to an average value. This evidence of a non-stationary fiscal budget process is supported by Lau and Baharumshah (2009) for 10 Asian countries and Liu et al. (2014) for China's provinces.

Secondly, there are studies which rely on cointegration methods to examine the sustainability of the balance budget (see Baffes and Shah (1994), Owoye (1995), Ewing and Payne (1998), Koren and Stiassny (1998), Garcia and Henin (1999), Cheng (1999), Carneiro et al. (2005), Karim et al. (2006), Eita and Mbazima (2008), Afonso and Rault (2009), Ghartey (2010), Mehrara et al. (2011), Bolat (2014), Magazzino (2014) and Baharumshah et al. (2016)). According to this second group of studies, the fiscal budget is considered highly sustainable if the long-run elasticity between government revenues and spending is equal to unity. On the other hand, when the long-run revenue-spending elasticity is below unity, and particularly as it approaches zero, the fiscal budget is considered unsustainable, such that along such a steady-state path government is unable to finance its future spending items without running a Ponzi scheme of 'bubble' financing its expenditure by issuing debt to finance the deficits (Lau and Baharumshah, 2009).

However, a majority of these previous studies assume linearity in the evolution of the fiscal budget. According to Ewing et al. (2006), Paleologou (2013) and Phiri (2018), the proposition of linearity in fiscal sustainability may be flawed on the grounds of i) policymakers reacting differently to changes the budget deficit or surplus ii) the variation in taxpayers responses to changes in the effective tax rate of base iii) the closeness between the budget and the business cycle, in which the business cycle evolves in an asymmetric fashion. Consequentially, a handful of more recent conducted studies have assumed asymmetries in the budget sustainability by either employing nonlinear unit root testing procedures (see Arestis et al. (2004) for the US, Bajo-Rubio et al. (2004) for Spain, Chortareas et al. (2008) for Latin America and Caribbean countries and Ono (2008) for G7 countries) or nonlinear cointegration frameworks (Ewing et al. (2006) for the US, Payne et al. (2008) for Turkey, Zapf and Payne (2009) for the US, Saunoris and Payne (2010) for the UK, Young (2011) for the US, Apergis et al. (2012) for Greece, Paleologou (2013) for Sweden, Greece and Germany as well as Phiri (2018) for South Africa).

Nonetheless, the presented literature on the nonlinearity of fiscal budget sustainability, commonly suffer from two main empirical shortcomings. For starters, a majority of studies which employ nonlinear cointegration methods tend to rely on the momentum threshold autoregressive (MTAR) model of Enders and Siklos (2001) which assumes asymmetric in the equilibrium adjustment process and yet retains linearity in the levels relationship of the time series (Ewing et al. 92006), Payne et al. (2008), Zapf and Payne (2009), Saunoris and Payne (2010), Young (2011), Apergis et al. (2012), Paleologou (2013), Phiri (2018)). However, as conveniently noted by Athanasenas et al. (2014), these symmetric models may be simplifying the issue by account for asymmetries over the short-run yet ignoring possible asymmetries over the long-run steady state of the variables. Moreover, and to the best of our knowledge, no previous studies have applied both unit root and cointegration approaches, in a nonlinear context, to examining the sustainability of fiscal budgets. Conducting an empirical study of such nature would add vigour to the empirical analysis of the sustainability of fiscal budgets for the Swazi economy of which there currently exists no empirical evidence.

4 METHODOLOGY

4.1 Theoretical framework

From a modelling perspective, the sustainability of the fiscal budget can be evaluated through the following present value fiscal borrowing constraint:

$$EXP_t + (1 + r_t)\, BUD_t = REV_t + BUD_t \quad (1)$$

Where EXP_t is government expenditure, REV_t is government revenues, BUD_t is government debt whereas r_t is the real interest rate which is assumed to be stationary around it's mean, i_t. In recursively solving equation (1) for infinite future period's results in the following intertemporal budget constraint:

$$BUD_t = \sum_{s=1}^{\infty} \frac{REV_{t+s} - GOV_{t+s}}{\prod_{j=1}^{s}(1 + r_{t+j})} + \lim_{s \to \infty} \left(\frac{BUD_{t+s}}{1 + r_{t+s}} \right) \quad (2)$$

From equation (2), a sufficient and necessary condition for budget sustainability to hold is that the current value of outstanding government debt is equal to the present value of future budget surplus streams i.e.

$$\lim_{s\to\infty}\left(\frac{BUD_{t+s}}{1+r_{t+s}}\right) = 0 \qquad (3)$$

Empirical studies tend to test the limiting condition presented in equation (3), by either examining whether the fiscal budget evolves as a stationary, I(0) process, or whether government expenditures and revenues are cointegrated through the following steady-sttate regression:

$$REV_t = \alpha_0 + \beta EXP_t + e_t \qquad (4)$$

Where α_0 is regression intercept, e_t is a $N(0,\sigma^2)$ disturbance term and β the long-run regression coefficient which measures the sustainability of the fiscal budget. The rule of thumb is that the budget is highly sustainable if $\beta = 1$, and as β approaches zero, then government debts becomes increasing unsustainable such that the intertemporal budget constraint (3) is less likely to hold.

4.2 Unit root testing framework

Our first empirical approach to examining the fiscal sustainability in Swaziland, is to test for unit roots on the fiscal budget process. Note that from equation (4), one is able to express the fiscal budget as $BUD_t = REV_t - GOV_t$, which, in turn, can be further expressed the following autoregressive process:

$$BUD_t = \phi_i BUD_{t-1} + e_t \qquad (5)$$

An alternative and more convenient expression for equation (5) in testing for the presence of unit roots in the fiscal budget would be via the following Dickey-Fuller type regression:

$$\Delta BUD_t = \psi_i BUD_{t-1} + e_t \quad (6)$$

Where $\psi_i = \phi_i - 1$ and the unit root hypothesis is tested as H_0: $\psi_i = 0$ which is tested against the alternative hypothesis of a stationary time series (i.e. H_1: $\psi_i < 0$). The augmented version of the Dickey-Fuller test (i.e. ADF) includes lagged first difference variables which are used to correct for serial correlation i.e.

$$\Delta BUD_t = \psi_i BUD_{t-1} + \sum_{j=1}^{p} \rho_i \Delta BUD_{t-i} + e_t \quad (7)$$

The ADF tests statistic is computed as the t-statistic of the estimated regression (7) i.e.

$$t_{ADF} = \frac{\hat{\psi}}{S.E.(\hat{\psi})} \quad (8)$$

Where $\hat{\psi}$ is the estimated value of ψ and S.E.($\hat{\psi}$) is the standard error of $\hat{\psi}$. The unit root null hypothesis of can only be rejected if the computed test statistic is smaller than the critical values reported in McKinnon (1996). However, conventional linear unit root testing procedures have come under heavy criticism by authors such as Enders and Granger (1998) and Caner and Hansen (2001), who have argued that symmetric unit root testing frameworks sacrifice a considerable amount of testing power if the underlying data generating process of the time series is indeed nonlinear. One popular alternative which emerged in the literature, came about as courtesy of Kapetanios et al. (2003) who extended the DF testing procedure into the following exponential smooth transition autoregression (ESTAR) framework:

$$\Delta BUD_t = \psi_i BUD_{t-1} + [1-\exp(-\Phi y_{t-1}^2)] + \sum_{j=1}^{p} \rho_i \Delta BUD_{t-i} + e_t \quad (9)$$

Where under the null hypothesis, the fiscal budget follows a stationary process (i.e. H_0: $\Phi = 0$) whilst the alternative hypothesis is that the time series evolves as a stationary ESTAR model. Since the null hypothesis cannot be directly tested, then Kapetanios et al. (2003)

suggested that equation 9 can be re-parameterized using a first order Taylor series approximation. The following auxiliary unit root testing regression can be derived:

$$\Delta \text{BUD}_t = \delta_i BUD_{t-i}^3 + \sum_{j=1}^{p} \rho_i \Delta BUD_{t-i} + e_t \quad (10)$$

The null hypothesis of a linear unit root process can be now tested as H_0: $\delta_i = 0$ against the alternative of stationary ESTAR process (i.e. H_1: $\delta_i = 0$). In similarity to the conventional ADF test, the asymptotic critical value of the Kapetanios et al. (2003) unit root test is computed as:

$$t_{KSS} = \frac{\hat{\delta}}{S.E.(\hat{\delta})} \quad (11)$$

Since the t_{KSS} statistic does not follow an asymptotic standard normal distribution, Kapetanios et al. (2003) derive critical values for the test statistics for the test performed on raw time series, de-meaned data and de-trended data. One major shortcoming with the KSS unit root test is its inability to directly account for structural breaks in the regression. Of recent, there has been a growing consensus that a flexible Fourier form (FFF) approximation of unit root tests has good size and power properties in detecting a series of unknown smooth structural breaks (see Enders and Lee (2012) and Rodrigues and Taylor (2012)). Therefore, in augmenting the KSS unit root test using a single frequency Fourier function, the testing regression can be specified as:

$$\Delta \text{BUD}_t = \delta_i BUD_{t-i}^3 + \sum_{j=1}^{p} \rho_i \Delta BUD_{t-i} + a_i \sin\left(\frac{2\pi Kt}{T}\right) + b_i cos(\frac{2\pi Kt}{T}) + e_t, \quad t = 1,2,\ldots,T. \quad (12)$$

Where K is the singular approximated frequency selected for the approximation, whilst coefficients a and b measure the amplitude and displacement of the sinusoidal. Enders and Lee (2012) place emphasis on estimating a Fourier function with a singular frequency to avoid problems of over-fitting and loss of regression power. Moreover, Enders and Lee (2012) propose that regression (12) be estimated for all integer values of K which lie between the interval [1, 5] and selecting the estimation which produces the lowest sum of squared residuals (SSR).

4.3 *Cointegraton frameowrk*

Generally the literature tends to rely on traditional cointegration methods such as those presented by Engle and Granger (1987) and Johansen (1991) cointegration analysis (see Baffes and Shah (1994), and Ewing and Payne (1998)). However, it has become increasingly acknowledged that these method suffer from certain empirical shortcomings such as requiring mutual integration of the time series in the cointegration system. Henceforth, the ARDL model of Pesaran et al. (2001) has emerged as an attractive alternative in examining cointegration relations as the econometric framework does not require the variables to be integrated of similar order and can be estimated via a singular reduced form equation. In applying the ARDL model with lags (p,q) to our budget constraint, cointegration equation (#) can be re-specified as the following empirical regression:

$$\Delta REV_t = \alpha_0 + \sum_{j=1}^{n} \alpha_1 \, \Delta REV_{t-j} + \sum_{j=1}^{n} \alpha_1 \, \Delta EXP_{t-j} + \beta_1 REV_{t-1} + \beta_2 EXP_{t-1} + e_t \quad (13)$$

Where Δ denotes a first difference operator, α_1 and α_2 are the short-run coefficient parameters, β_2 is the long run regression coefficient which is normalized on β_1 and e_t is a normally distributed residual term. As a means of testing for cointegration effects Pesaran et al. (2001) develop an F-test which evaluates the joint significance of the long-run ARDL coefficients. Under the bounds test for cointegration, the null hypothesis of no ARDL cointegration effects is formulated as H_0: $\beta_1 = \beta_2 = 0$, and this is tested against the alternative of significant cointegration effects (i.e. H_1: $\beta_1 \neq \beta_2 \neq 0$). Pesaran et al. (2001) tabulate two sets of new critical values of the F-test which accommodate for stationary and difference stationary time series. The decision rule is that the 'no cointegration' null hypothesis can be only rejected if the computed F-statistic exceeds the upper bounds of the critical values. Conversely, if the F-statistic falls below the lower critical bound, then the null hypothesis cannot be rejected whereas if the F-statistic lies between the lower and upper critical bound values, then the evidence is inconclusive. Once cointegration effects are validated, then one can estimate the associated unrestricted error correction model (UECM):

$$\Delta REV_t = \alpha_0 + \sum_{j=1}^{n} \alpha_1 \Delta REV_{t-j} + \sum_{j=1}^{n} \alpha_1 \Delta EXP_{t-j} + \lambda ECT_{t-1} + u_t \quad (14)$$

Where ECT_{t-1} is the error correction term which measure the speed of adjustment back to steady-state equilibrium subsequent to a shock to the fiscal budget and $u_t \sim N(0, \sigma^2)$. However, equations # and # assume that the responses of the REV_t variable to changes in EXP_t. As previously discussed, this notion of linearity in the evolution of the fiscal budget is very restrictive. In order to circumvent this problem, we follow intuition provided by Shin et al. (2014), and decompose the EXP_t variable into positive and negative partial sum processes i.e. $EXP_t^+ = \sum_{j=1}^{i} \Delta EXP_j^+ = \sum_{j=1}^{i} \max(\Delta EXP_j, 0)$ and $EXP_t^- = \sum_{j=1}^{i} \Delta EXP_j^- = \sum_{j=1}^{i} \min(\Delta EXP_j, 0)$. Thereafter the N-ARDL (p, q) model can be expressed as the following nonlinear function:

$$\Delta REV_t = \sum_{j=1}^{p} \rho_i REV_{t-j} + \Phi_j^+ EXP_{t-j}^+ + \Phi_j^- EXP_{t-j}^- + \sum_{j=1}^{p-1} \lambda_i \Delta REV_{t-j} +$$
$$\sum_{j=0}^{q-1} (\alpha_j^+ \Delta EXP_{t-j}^+ + \alpha_j^- \Delta EXP_{t-j}^-) + \lambda ECT_{t-1} + \zeta_t \quad (15)$$

From regression (15), the long-run budgetary elasticities are calculated as $\beta^+ = -(\Phi^+/\rho)$ and $\beta^- = -(\Phi^-/\rho)$. Before estimating the empirical N-ARDL model we need to test for three empirical hypotheses as proposed by Shin et al. (2014). The first hypothesis is a test for N-ARDL cointegration effects which tests the null hypothesis of symmetric ARDL cointegration effects (i.e. H_{10}: $\rho = \Phi^+ = \Phi^-$) against the alternative of asymmetric ARDL effects (i.e. H_{11}: $\rho \neq \Phi^+ \neq \Phi^-$). The second pair of hypotheses is concerned with testing for long-run asymmetric effects in which the null hypothesis of symmetric long-run ARDL cointegration effects, H_{20}: $-(\Phi^+/\rho) = -(\Phi^-/\rho)$, is tested as which is tested against the alternative of asymmetric long-run

ARDL effects (i.e. H_{21}: $-(\Phi^{+}/\rho) \neq -(\Phi^{-}/\rho)$). The final pair of hypothesis tested focuses on validating short-run asymmetric effects, whereby the null hypothesis of symmetric short-run ARDL effects (i.e. $\sum_{i=0}^{q-1} \alpha_j^{+} = \sum_{i=0}^{q-1} \alpha_j^{-}$) is tested against the alternative of asymmetric short-run ARDL effects (i.e. $\sum_{i=0}^{q-1} \alpha_j^{+} \neq \sum_{i=0}^{q-1} \alpha_j^{-}$).

5 DATA AND EMPIRICAL RESULTS

5.1 *Empirical data*

The data used in our study consists of three time series variables namely i) total government expenditure expressed as a ratio of GDP (i.e. EXP_t) ii) total revenues collection expressed as a ratio of GDP (i.e. REV_t) and iii) the balanced budget (i.e. BUD_t) which is computed as the difference between REV_t and EXP_t (i.e. $BUD_t = REV_t - EXP_t$). All empirical time series data have been collected on annual basis from 1999 to 2016 and this sample size 17 observations is relatively small for estimation purposes. Therefore all our time series have been interpolated from yearly into quarterly data using the Centripetal Catmull-Rom spline method hence yielding a total of 68 observations (i.e. 1999:q1 – 2016:q4) which is reasonable for empirical use. The basic descriptive statistics of the time series variables are reported in Table 1 below.

Table 1: Descriptive statistics of time series variables

	REV_t	EXP_t	BUD_t
Mean	18.18	23.16	-4.97
Standard deviation	2.62	5.13	4.75
J-B	0.84	1.47	0.18
p-value	0.66	0.48	0.91
Observations	68	68	68

5.2 *Conventional unit root test results*

Before estimating our nonlinear models, we provide some preliminary evidence from conventional unit root and ARDL cointegration analysis. Table 2 presents the results of the ADF, PP and DF-GLS unit root tests as performed with i) an intercept and ii) a trend on the time series data. The lag length for the ADF and DF-GLS was selected by specifying a maximum of 6 lags and trimming these lags down until the AIC, SC and HQ information criterion are minimized in the estimated test regression. As can be easily observed from Table 2, the conducted analysis produces a variety of mixed results. For starters, when the ADF and PP tests are performed on the REV variable, with either an intercept a trend, we find that the unit root null hypothesis cannot be rejected for the series in its levels and yet manages to significantly do so in its first differences, even though the significance of rejection differs at critical levels. Nevertheless, when the more powerful DF-GLS test is performed on the levels of the REV time series, the unit root null hypothesis cannot be rejected whether the test is performed with an intercept or with a trend.

Concerning the EXP variable, the ADF tests fails to reject the unit root hypothesis in both the levels and the first differences of the series regardless of whether the test is performed with an intercept or a trend. However, when the PP tests are used, either with an intercept or trend, the EXP variable rejects the unit root null hypothesis and yet fails to do so in the first differences at all critical levels. When the DF-GLS is then performed with an intercept on the EXP series, the unit root hypothesis is rejected at a 5 percent critical level. Conversely, when a trend is included in the test, the unit root hypothesis is rejected in both the levels and first differences of the series.

Lastly, the results of the unit root tests performed on the BUD variable are of particular significance for our study. To recall, evidence of a unit root in the fiscal budget is an empirical indication of unsustainability in the budget whereas stationary implies sustainability of government's budget. When the ADF test is performed with either an intercept or a trend, we find that the Swazi budget is levels stationary at 5 percent and 10 percent critical levels, respectively. On the other hand, when the PP test is applied with an intercept, the budget is found to be stationary in it's levels at a 5 percent critical level whereas when a trend is included in the test, the unit root hypothesis cannot be rejected in both levels and first differences. Finally, when the DF-GLS test is performed on the BUD time series, with either an intercept or a trend, the unit root hypothesis is rejected at all critical levels. The overall inconclusiveness of the unit root tests for the fiscal budget warrants further deliberation into the time series integration properties for the Swazi fiscal budget.

Table 2: Conventional unit root test results

Unit root test	REV	EXP	BUD
ADF (intercept)	-2.23	-1.32	-3.28**
	(-3.86)**	(-2.43)	(-3.32)**
ADF (trend)	-2.64	-2.32	-3.29
	(-3.66)*	(-2.33)	(-3.85)**
PP (intercept)	-2.23	-1.51	-2.52
	(-4.19)***	(-6.21)***	(-3.23)**
PP (trend)	-2.76	-1.05	-2.43
	(-4.45)**	(-5.79)***	(-3.11)
DF-GLS (intercept)	-2.29**	-1.88*	-3.40***
	(-3.57)***	(-3.46)***	(-3.41)***
DF-GLS (trend)	-3.07*	-2.02)	-3.41**
	(-3.86)***	(-2.53)	(3.49)**

Note: "***", "**", "*" represent the 1%, 5% and 10% significance levels, respectively.

5.3 *Baseline ARDL estimates*

One of the most encouraging inferences drawn from our preliminary unit root tests is that it presents very little evidence attesting to the time series being integrated of an order I(2) or higher. This observation provides sufficient evidence to permit us to utilize the ARDL framework in examining the sustainability of the Swazi fiscal budget. As previously discussed, this can be achieved by modelling long-run and short-run cointegration relations between fiscal revenues and expenditures. However, prior to estimating the ARDL model, we perform the bounds test for cointegration and report the empirical results of this exercise in Table 3.

Table 3: Bounds test for cointegration

Test statistic	Value	K
F-statistic	4.0863	1

Critical value bounds Significance	I(0) bound	I(1) bound
10%	3.02	3.51
5%	3.62	4.16
1%	4.94	5.58

In order to choose our appropriate ARDL (p,q) model, we set a maximum of 4 lags on both the dependent and independent variable (i.e. p=4, q=4) and trim down to lags in order obtain the regression which minimizes the information criterion. Based on the minimization of both the AIC and SC information criterion, the selected model is an ARDL (1, 0), which we once again attribute to the short length of data utilized in our study. The F-statistic of the ARDL bounds test for cointegration produces a value of 4.09 and this statistic exceeds the upper bound of the 1(0), 5 percent critical level. Against this evidence of ARDL cointegration, we proceed to present the long-run and short-run regression estimates along with their associated diagnostic tests which are reported in Table 4.

Table 4: ARDL estimates (ARDL(1,0))

Variable	Coefficient	Standard deviation	t-statistics	Probability
Panel A: Long-run estimates				
Rev	0.9704	0.3041	3.1909	0.0188**
Panel B: Short-run estimates				
ΔRev	0.7961	0.4500	1.7690	0.0987*
ect(-1)	-0.5922	0.2385	-2.4830	0.0263**
Panel C: Diagnostic tests				
J-B	0.0823			0.9597
S-C	2.2593			0.1470
B-P-G	0.0544			0.8189
RESET	0.5964			0.5612

Note: "***", "**", "*" represent the 1%, 5% and 10% significance levels, respectively.

The long-run regression coefficient reported in Panel A of Table 4 produces a value of 0.97 which is statistically significant at a 5 percent critical level. In realizing that this value is relatively close to unity, then we interpret this result to indicate a highly sustainable fiscal budget for Swazi policymakers. The 'close-to-unity' estimates obtained for the Swazi economy is a rather odd finding since they are in contrast to actual developments and furthermore they contrast those obtained by Ghartey (2010) for Kenya, Nigeria and South Africa which are countries similarly classified as middle-income SSA economies. We thus reserve this issue open for further empirical deliberation in the paper.

The short-run regressions coefficient which as reported in Panel B of Table 4 is also positive but of a lower magnitude estimate than it's long-run counterpart (i.e. 0.80) which is only significant at a 10 percent level. This later result implies that the Swazi budget is relatively unsustainable over the short-run. Furthermore, the error correction coefficient of -0.59 indicates that in the event of a shock to the fiscal budget, 59 percent of deviations are corrected in each period. Therefore disequilibriums are fully corrected within two periods or two years. Lastly, we observe that the diagnostic tests reported in Panel C of Table 4 fail to detect any evidence of serial correlation, heteroscedasticity and incorrect functional form. The CUSUM and CUSUMSQ plots in Figures 1 and 2, respectively, provide supplementary evidence on the stability of the estimated regression.

Figure 1: CUSUM plot for ARDL(1,0) model

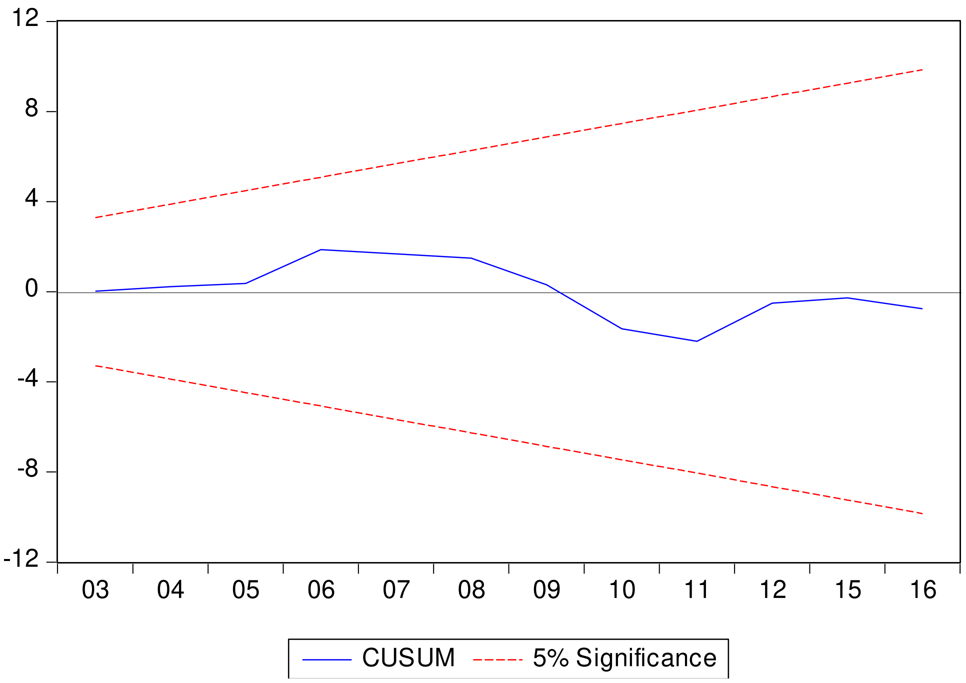
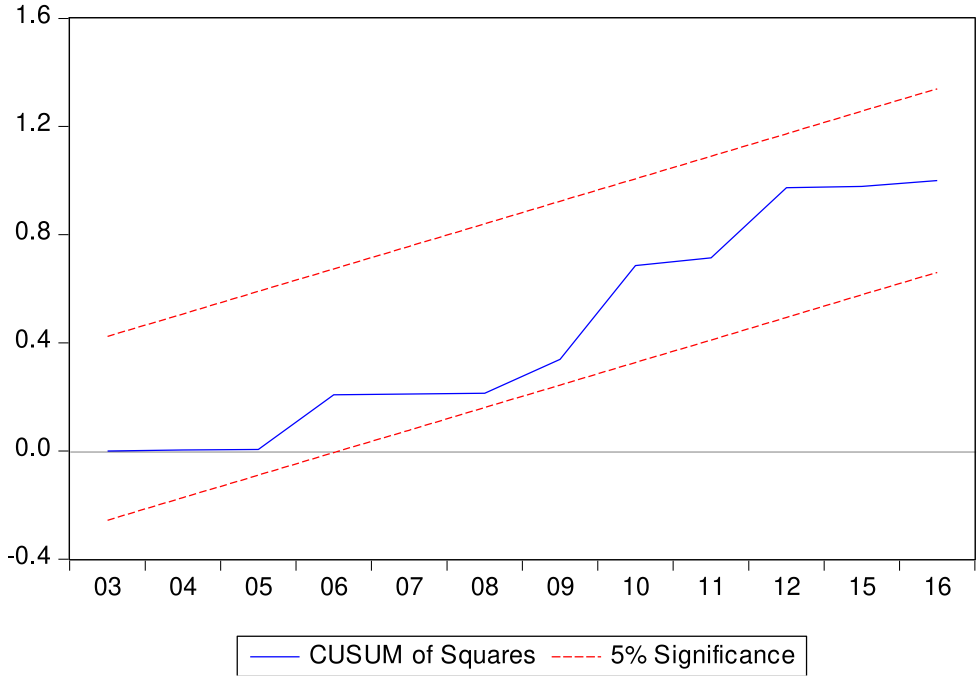


Figure 2: CUSUM of squares plot for ARDL(1,0) model



5.4 KSS unit root tests results

Having examined the sustainability of the Swazi fiscal budget from the perspective of linear econometric frameworks, we now present the results from the KSS unit root test. We firstly conduct the KSS test without a Fourier function and respectively report our empirical results on the raw and de-meaned time series in Panels A and B of Table 5. Since the KSS test is a nonlinear extension of the ADF test, the choice of correct lag is paramount in conducting the test properly. We perform the procedure using lags of 1 to 6, and thereafter base our choice of the test statistics upon the test regression which minimizes the AIC, SC and HQ information criterion. As can be observed from the reported findings, the optimal lag length of the performed tests is 1 for both raw and de-meaned time series and we consider this finding plausible on account of the length of the observed time series.

As can be observed from the reported findings in Table 5, the optimal lag length of the performed tests is 1 and we consider this finding plausible on account of the length of the observed time series. Further note that the produced obtained t-statistics of the tests on the Swazi budget in its levels fails to reject the unit root hypothesis when the test is applied to the raw data (-1.62) as well as on the de-meaned data (2.69) manage to reject the unit root hypothesis at a 10 percent critical level. On the other hand, once these series are transformed into first differences, the produced t-statistics exceeds the 1 percent critical level for both the raw data (-2.96) and the the de-meaned data (-4.43). However, in light of the inconclusiveness of these obtained results of the KSS unit root test on the raw and de-meaned data, we proceed to augment the unit root test with a Fourier function.

Table 5: KSS unit root tests results without Fourier function

Panel A: Original data						
	Levels			1st differences		
Lag	t-statistic	AIC	SC	t-statistic	AIC	SC
1	**-1.62**	**6.21**	**6.31**	**-2.96*** **	**6.41**	**6.51**
2	-1.28	6.41	6.55	-3.05***	6.48	6.62
3	-0.82	6.60	6.79	-2.73**	6.71	6.88
4	-0.56	6.64	6.86	-2.16*	6.98	7.18
5	-0.15	6.58	6.82	-0.58	7.11	7.33
6	-0.13	6.94	7.19	-0.84	6.85	7.06

Panel B: De-meaned data						
	Levels			1st differences		
Lag	t-statistic	AIC	SC	t-statistic	AIC	SC
1	**-2.69***	**5.94**	**6.04**	**-4.43*** **	**6.01**	**6.10**
2	-2.32	6.14	6.28	-3.91***	6.22	6.36
3	-1.81	6.36	6.54	-3.44**	6.47	6.64
4	-0.75	6.57	6.79	-2.96**	6.68	6.88
5	-0.48	6.44	6.68	-1.89	6.64	6.85

6	-0.32	6.78	7.04	-1.86	6.29	6.50

Note: "***", "**", "*" represent the 1%, 5% and 10% significance levels, respectively. The critical values associated with KSS tests performed on the raw data are -2.82 (1%), -2.22(5%) and -1.92 (10%). The critical values associated with KSS tests performed on de-meaned data are -3.48 (1%), -2.93 (5%) and -2.66 (10%).

Table 6 reports the findings of the KSS unit root performed with a Fourier function on the levels and first differences of the budget series, with the results of the test on the raw data presented in Panel A and those for the de-meaned data are presented in Panel B. As previously discussed, it is important to for one to identify the optimal frequency, K*, selected for the Fourier approximation and as suggested by Enders and Lee (2012), a grid search must be performed using values of 1 to 5 for k, with the value which produces the lowest SSR being the optimal frequency, K*. As can be observed from Panel A in Table, we obtain optimal values of K* = 3 for the raw data in both levels and first differences, with the t-statistic of -1.27 obtained for the levels failing to reject the unit root null hypothesis at all critical levels whilst the t-statistic of -2.80 rejecting the unit root null hypothesis at a 5 percent significance level.

Concerning the results of the de-meaned data presented in Panel B of Table 6, the optimum frequency value is 2 for the time series in it's levels, of which the produced t-statistic of -0.30 fails to reject the unit root null hypothesis at all critical levels. Conversely, when the time series are differenced, the optimal frequency value becomes 3, and the t-statistic of -3.21 obtained for the first differences manages to reject the unit root hypothesis at a 5 percent level. We therefore, conclude that after controlling for both nonlinearity and unobserved smooth structural breaks, the Swazi fiscal budget contains at least one unit root in it's process and significant shocks to the budget, such as those leading to the crisis, are unlikely to return the budget back to it's steady-state equilibrium given the present status quo.

Table 6: KSS unit root test with Fourier function

Panel A: Original data				
	Levels		1st differences	
K	t-stat	SSR	t-stat	SSR
1	-1.71	345.41	-2.81**	397.80
2	-1.05	303.39	-3.16***	305.78
3	**-1.27**	**220.39**	**-2.80****	**273.34**
4	-1.65	332.06	-2.54**	391.49
5	-1.64	329.38	-2.45**	380.06
Panel B: De-meaned data				
	Levels		1st differences	
K				
1	-1.67	182.70	-4.99***	209.05
2	**-0.30**	**157.16**	-4.32***	186.46
3	-0.83	159.19	**-3.21****	**147.29**
4	-0.67	234.41	-2.39	149.52
5	-0.42	218.93	-1.07	151.25

Note: "***", "**", "*" represent the 1%, 5% and 10% significance levels, respectively. The critical values associated with KSS tests performed on the raw data are -2.82 (1%), -2.22(5%) and -1.92 (10%). The critical values associated with KSS tests performed on de-meaned data are -3.48 (1%), -2.93 (5%) and -2.66 (10%).

5.5 N-ARDL estimates

In this subsection of the paper, we provide the empirical analysis of the N-ARDL model. In setting a maximum lag length of 4, and trimming down the lags, the information criterion (i.e. AIC and SC criterion) mutually suggest a lag length of 1 on the dependent variable whilst maintaining a zero lag length for the independent variable hence yielding a N-ARDL (1, 0, 0) specification.

However, prior to that, we firstly present the results of asymmetric cointegration tests. To recall, there are three hypotheses which are tested namely i) tests for overall asymmetric ARDL cointegration effects ii) tests for long-run asymmetry effects iii) tests for short-run asymmetry effects. As shown in the reported results in Table 7, the null hypotheses of no N-ARDL cointegration effects, no long-run asymmetric effects and no short-run asymmetry effects are all significantly rejected since the produced test statistics of 7.13, 14.62, 5.13 and 22.75, all exceed their respective critical values.

Table 7: Symmetry tests for N-ARDL model

Test	Asymmetric ARDL effects	Long-run N-ARDL effects	Short-run N-ARDL effects
Null hypothesis	$\rho = \Phi^{+} = \Phi^{-}$	$-(\Phi^{+}/\rho) = -(\Phi^{-}/\rho)$	$\sum_{i=0}^{q-1} \alpha_j^{+} = \sum_{i=0}^{q-1} \alpha_j^{-}$
Test statistic	7.13	14.62	27.75
Critical values	Upper I(1) bound		Lower I(0) bound
10%	4.78		4.04
5%	5.73		4.94
1%	7.84		6.84

Note: All critical values are derived from Peseran et al. (2001) as suggested by Shin et al. (2014)

Table 8 presents the results of the long-run, short-run and the residual diagnostic tests on our estimated asymmetric cointegration regression. Panel A reports the long-run asymmetric regression coefficients. The estimate obtained for EXP+ variable is 0.57 whilst that for the EXP- variable is 0.85 and notably both coefficient estimates are statistically significant at a 5 percent critical level. By interpretation, these reported coefficients imply that a percentage increase in the contribution of government expenditure in GDP, only raises the share of revenues in GDP by 0.57 percent, whereas a percent decrease in public expenditure's share in GDP results in a 0.85 percent decrease in the revenues collection. However, we quick to point out that since both coefficient estimates are well below unity, then Swazi budget will remain unsustainable regardless of whether policymakers choose consolidate the budget by increasing expenditure through increased taxes or they opt to reduce expenditures. However, we note that the preferred course of action would be for Swazi policymakers to reduce expenditure items since the coefficient on the EXP- is of a higher value that on the counterpart EXP+ variable.

In turning to our short-run estimates, we find obtain a negative coefficient of -0.99 for the ΔREV- variable whereas a positive coefficient of 4.15 is obtained for the ΔREV- variable, and we note that both estimates are significant at all critical levels. By interpretation, this implies that over the short-run a 1 percent increase in government expenditure will decrease revenues by 0.99 percent whereas a 1 percent decrease public spending will also decrease revenues collected by 4.15 percent. We also find a highly significant error correction estimate of -0.95 which indicates that 95 percent of disequilibrium caused by exogenous shocks to the fiscal budget are corrected annually. Lastly, the diagnostic tests reported in Panel C of Table 8 indicate that the residuals extracted from the estimated N-ARDL model do not suffer from non-normality, serial correlation, heteroscedasticity or incorrect function form. The stability of our estimated model is further ensured by the CUSUM and CUSUMSQ plots presented in Figures 3 and 4, respectively.

Table 8: N-ARDL estimates

Variable	Coefficient	Standard error	t-statistics	Probability
Panel A: Long-run estimates				
Rev+	0.576531	0.072	7.942	0.0155
Rev-	0.852890	0.090	9.428	0.0111
Panel B: Short-run estimates				
ΔRev+	-0.9917813	0.0687202	-14.432165	0.0048
ΔRev-	4.15	0.2668673	15.556671	0.0041
ect(-1)	0.9578	0.05929	-16.1521	0.0038
Panel C: Diagnostic tests				
J-B	0.0159			0.9921
S-C	0.0465			0.9551
B-P-G	0.2716			0.9439
RESET	0.4082			0.7533

Note: “***”, “**”, “*” represent the 1%, 5% and 10% significance levels, respectively.

Figure 3: CUSUM plot for N-ARDL(1,0,0) model

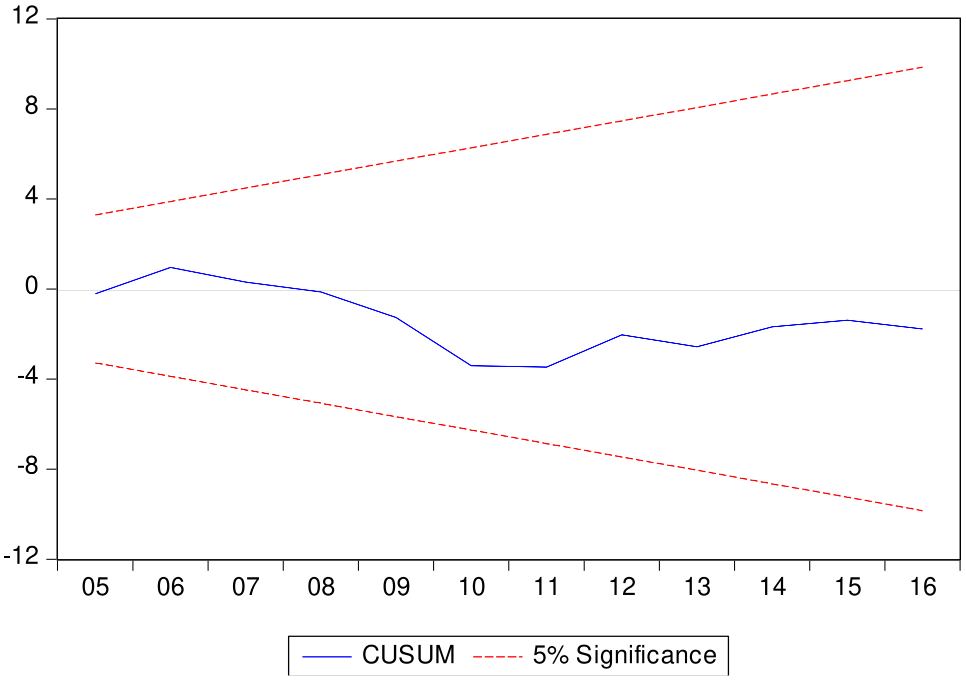
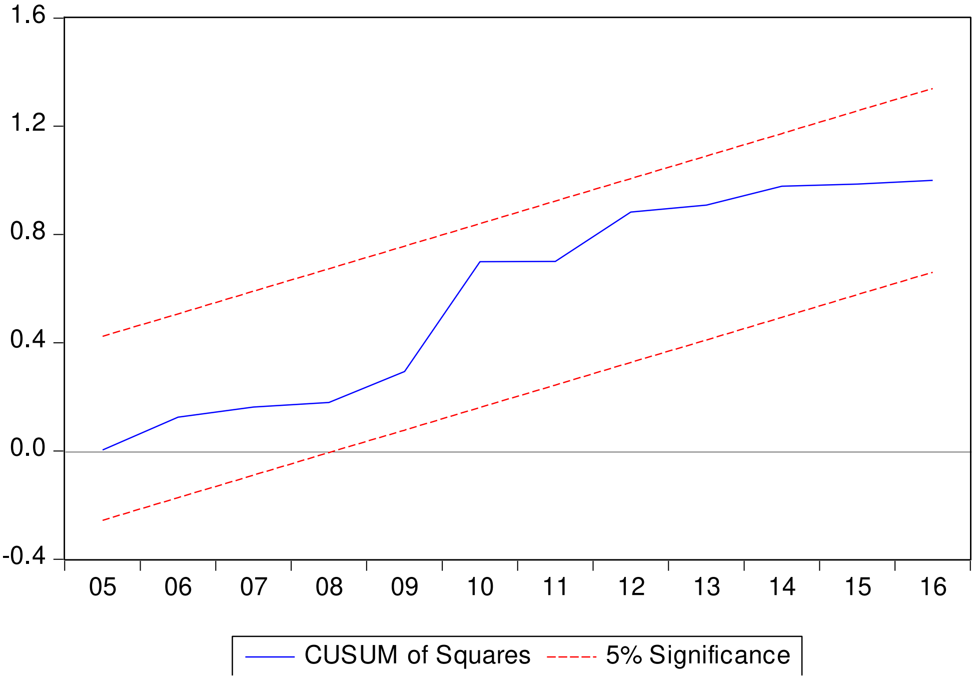


Figure 4: CUSUM of squares plot for N-ARDL(1,0,0) model



6 CONCLUSION

The Swazi budget crisis of 2011 has raised serious concerns over the sustainability of the Kingdom's fiscal budget. In this study we empirically examine the sustainability of the Swazi fiscal budget using annual data collected from 1999 to 2016. Our empirical analysis is conducted over two phases. In the first phase, we implement conventional unit roots on the fiscal budget and further estimate a long-run and short-run ARDL cointegration model of fiscal expenditures and revenues. The results of these preliminary analysis indicates stationarity in the fiscal budget whilst expenditures are found to be highly cointegrated with revenues. Collectively these results imply that Swazi authorities have a highly sustainable fiscal budget.

In the second phase of our empirical analysis, we rely on the nonlinear unit root testing procedure of Kapetanios et al. (2003) and the N-ARDL cointegration model of Shin et al. (2014) to re-assess the preliminary evidence. After controlling for asymmetries, we particularly find that the Swazi fiscal budget contains a unit root, a result which challenges the notion of a sustainable fiscal budget. Moreover, the N-ARDL further attests to the phenomenon of an unsustainability in the fiscal budget as the results confirm a rather weak cointegration relation between fiscal expenditures and revenues regardless of whether policymakers decide to reduce or increase the budget.

One common finding from our empirical analysis is that a reduction in fiscal budget appears to be the best course of action which Swazi policymakers should pursue given the current status quo of the Kingdom. However, the recent drought crisis has facilitated the need for increased government spending which can be either financed through higher public debt levels, increased taxation revenue, decreases in other public expenditure items or though international donations. According to our presented results pursuing the first two of these alternatives are sure to have undesirable effects on the short-and-long term sustainability of the fiscal budget whilst the third alternative will most likely lead to a more deteriorating social economy. The obvious way forward for Swazi policymakers out of their fiscal woes would be to implement deeper fiscal reforms as has been rightly advised by the international community.

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