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Original Article

Fiscal and Monetary Drivers of Public Debt in Uganda: Evidence from an Autoregressive Distributed Lag Framework

Paul Kimono[1], *Jonah Ibanda*[1], *Geoffrey Mubiinzi*[1*] & *Oscar Ayebazibwe*[1]

[1] Uganda Martyrs University, P. O. Box 5498, Kampala, Uganda.
* Author for Correspondence ORCID ID; https://orcid.org/0000-0001-7315-9387; Email: gmubiinzi@umu.ac.ug

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Public debt, Government expenditure, Government revenue, Exchange rate, Economic growth, Military expenditure, ARDL, Uganda.

ABSTRACT

Uganda's public debt has risen markedly after the debt relief of the 2000s, increasing concern about the fiscal and macroeconomic forces sustaining renewed accumulation. This study examined the short-run and long-run relationships between public debt and government expenditure, government revenue, real gross domestic product growth, and the Uganda shilling-United States dollar exchange rate over 2000–2024. Military expenditure was evaluated in a supplementary specification because it is a component of total government expenditure. The study used secondary annual macroeconomic data from the International Monetary Fund, World Bank, and Stockholm International Peace Research Institute. The annual series were converted to quarterly frequency using the EViews frequency-conversion procedure, log-transformed where appropriate, and analysed using the autoregressive distributed lag bounds-testing and error-correction framework. The main-model bounds statistic of 21.793 confirmed cointegration. In the long run, government expenditure was positively associated with public debt (7.788, $p < .001$), whereas government revenue (-12.853, $p = .024$) and economic growth (-0.493, $p = .011$) were negatively associated with debt. Exchange-rate depreciation had a positive effect that was significant at the 10% level (5.192, $p = .067$). In the short run, expenditure and depreciation increased debt, revenue reduced it, and growth was statistically insignificant. The supplementary model also confirmed cointegration ($F = 32.928$); military expenditure had a positive but weak long-run association with debt (0.018, $p = .095$), while revenue remained debt-reducing and depreciation debt-increasing. Residual and stability tests supported model adequacy. The findings indicate that Uganda's debt dynamics reflect the interaction of expenditure pressure, limited domestic revenue, growth performance, and foreign-currency valuation risk. Sustainable debt management therefore requires coordinated expenditure control, revenue mobilisation, growth-enhancing investment, and active management of exchange-rate exposure.

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INTRODUCTION

Public debt is an essential instrument for financing public investment, smoothing temporary fiscal shocks, and supporting macroeconomic stabilisation. Its developmental value nevertheless depends on the cost, maturity, currency composition, and productivity of the expenditure that borrowing finances. Debt becomes a source of vulnerability when the stock and debt-service burden rise faster than the revenue base and the economy's capacity to generate domestic and foreign exchange. These risks are especially important in low-income economies where tax capacity is limited, development needs are large, and external debt exposes the budget to exchange-rate valuation effects (Escolano, 2010; International Monetary Fund [IMF] & World Bank, 2018; Reis, 2022).

Uganda provides a particularly important case. The country was an early beneficiary of the Heavily Indebted Poor Countries Initiative and the Multilateral Debt Relief Initiative, which sharply reduced external obligations and created fiscal space for poverty-reducing expenditure. Public debt subsequently reaccumulated as government expanded infrastructure and other development programmes, while domestic financing became a larger component of the portfolio. At the end of December 2024, central-government debt was reported at US$29.06 billion, approximately UGX 106.97 trillion and 52.1% of gross domestic product (GDP). Domestic and external debt represented 25.6% and 26.5% of GDP, respectively, and interest payments were equivalent to approximately 4.1% of GDP (Ministry of Finance, Planning and Economic Development [MoFPED], 2025).

The increase in debt reflects more than the arithmetic accumulation of annual budget deficits. Government expenditure raises borrowing requirements when it exceeds revenue and grants, but its eventual debt effect depends on whether it expands productive capacity and the tax base. Revenue affects both the need to borrow and the government's ability to service existing obligations. Real GDP growth changes the denominator of the debt ratio and influences the revenue base, while exchange-rate depreciation revalues foreign-currency liabilities in domestic-currency terms. Stock-flow adjustments, arrears, contingent liabilities, and refinancing conditions further mediate the relationship between fiscal flows and the recorded debt stock (Acosta-Ormaechea, 2020; Anaya & Pienkowski, 2015; Weber, 2012).

Existing evidence identifies fiscal balances, revenue performance, growth, exchange rates, and expenditure composition as important determinants of public debt, although the strength and direction of individual effects vary across countries and methods. African panel studies find that stronger tax revenue and GDP performance generally reduce debt, while fiscal deficits, exchange-rate movements, public investment, and military expenditure may raise it (Appiah-Kubi et al., 2022; Nagou et al., 2021). Country studies

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using autoregressive distributed lag (ARDL) models show that government spending and fiscal imbalances contribute to public debt in Tanzania and Ghana (Musah, 2023; Ngasamiaku & Ngong'ho, 2022). Uganda-specific work has emphasised primary balances, interest-growth conditions, and exchange-rate effects, but has not consistently separated the revenue and expenditure sides of the budget or examined military expenditure through a distinct expenditure-composition specification (Kijjambu et al., 2023).

This study examines the fiscal and monetary drivers of public debt in Uganda from 2000 to 2024. Public debt is modelled as a function of total general government expenditure, general government revenue, real GDP growth, and the Uganda shilling per United States dollar exchange rate. A supplementary model replaces aggregate expenditure with military expenditure to avoid entering an expenditure component and its aggregate simultaneously. The study contributes by treating public debt as the dependent variable, distinguishing the separate fiscal channels of revenue and expenditure, estimating short-run and long-run dynamics in a country-specific framework, and examining military expenditure in a separate supplementary specification. The results inform fiscal policy, debt management, growth strategy, and foreign-exchange risk management.

LITERATURE REVIEW

Public-debt accumulation is governed by an accounting structure, but the observed path of debt also reflects behavioral, political, and macroeconomic responses. The literature therefore combines debt-dynamics identities with theories of fiscal choice and empirical evidence on revenue, expenditure, growth, exchange rates, and expenditure composition. This section first develops the theoretical channels that motivate the model and then reviews the empirical evidence relevant to Uganda.

Theoretical Literature

Intertemporal Government Budget Constraint and Public-Debt Dynamics

The intertemporal government budget constraint provides the principal analytical foundation. It states that current expenditure, interest obligations, and debt repayment must ultimately be financed through current or future revenue, asset sales, monetary financing, or additional borrowing. In a one-period nominal representation, the end-period debt stock equals inherited debt plus interest on that stock, the primary financing gap, and stock-flow adjustments:

$$B_t = (1 + i_t)B_{t-1} + G_t - T_t + SFA_t$$

Where B_t is nominal public debt at the end of period t, i_t is the effective nominal interest rate, G_t is primary government expenditure, T_t is government revenue and grants, and SFA_t denotes valuation changes and other stock-flow adjustments. The identity separates debt, which is a stock, from the fiscal deficit, which is a flow. Debt may therefore rise even when the contemporaneous deficit is modest because exchange-rate valuation, recognition of arrears, assumption of guaranteed liabilities, or differences between cash financing and recorded expenditure can alter the stock (Escolano, 2010; Weber, 2012).

Scaling the identity by nominal GDP produces the standard debt-ratio relationship. In a simplified real formulation, the inherited debt ratio is affected by the effective real interest rate, real economic growth, the primary balance, and stock-flow adjustments:

$$d_t = \left(\frac{1 + r_t}{1 + g_t}\right) d_{t-1} - pb_t + sfa_t$$

Where d_t is public debt as a share of GDP, r_t is the effective real interest rate, g_t is real GDP growth, pb_t is the primary balance expressed positively for a surplus, and sfa_t is the stock-flow

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adjustment ratio. The interest-growth differential determines how rapidly inherited debt compounds relative to the economy's repayment base. When growth exceeds the effective interest rate, a given debt ratio is easier to stabilise; when the interest rate exceeds growth, a stronger primary balance is required. Revenue and expenditure therefore enter through the primary balance, while growth affects both the denominator and the capacity to generate future revenue (Bohn, 1998; Escolano, 2010; Reis, 2022).

A substantial foreign-currency share introduces an additional monetary channel. Depreciation raises the domestic-currency value of external principal and interest even where no new loan is contracted. A stylised currency-adjusted representation is:

$$d_t = \left(\frac{1+r_t}{1+g_t}\right)(1+\alpha_{t-1}\Delta e_t)d_{t-1} - pb_t + sfa_t \quad (3)$$

Where α_{t-1} is the foreign-currency share of inherited debt and Δe_t is the proportional depreciation of the domestic currency. The valuation effect becomes larger as the foreign-currency share rises. This mechanism is particularly relevant to Uganda because external obligations remain material and are serviced from a fiscal base denominated largely in Uganda shillings (Acosta-Ormaechea, 2020; MoFPED, 2025).

Tax-Smoothing Theory of Public Debt

Tax-smoothing theory treats borrowing as an instrument for distributing the distortionary cost of taxation across time. Where the marginal economic cost of taxation rises with the tax rate, government can avoid abrupt tax changes by borrowing during temporary expenditure surges or revenue shortfalls and repaying when the disturbance recedes (Barro, 1979). The theory predicts debt accumulation after wars, recessions, disasters, or other temporary shocks, but it does not justify permanent borrowing to finance a structural gap. A persistent expenditure-revenue imbalance ultimately requires higher permanent revenue, lower expenditure, or a combination of both. In the Ugandan setting, this distinction is important because infrastructure programmes and crisis responses may justify temporary financing, whereas recurrent expenditure commitments without a corresponding revenue base create continuing debt pressure.

Keynesian and Functional-Finance Perspectives

Keynesian and functional-finance perspectives provide a macroeconomic rationale for countercyclical deficits. During a downturn, debt-financed expenditure can support aggregate demand, employment, and public services when private spending is weak. The initial debt increase may be partly reversed if the intervention raises output and revenue sufficiently. The net long-run effect of expenditure is therefore conditional on its multiplier, productivity, financing terms, and timing. Productive infrastructure can expand future output and exports, while inefficient projects or rigid recurrent commitments may increase debt without strengthening repayment capacity. This perspective explains why the expected direct expenditure coefficient is positive but why its eventual effect cannot be evaluated independently of growth and revenue performance (Anaya & Pienkowski, 2015; Patel & Peralta-Alva, 2024).

Political-Economy Perspectives and Theoretical Synthesis

Political-economy theories explain why fiscal deficits may persist after the original shock has passed. Governments may value the immediate political benefits of expenditure while shifting part of the cost to future taxpayers. Electoral uncertainty, fragmented expenditure claims, weak commitment mechanisms, and disagreement between current and future administrations can therefore produce debt beyond the level implied

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by tax smoothing (Alesina & Tabellini, 1990; Persson & Svensson, 1989). These mechanisms are difficult to identify directly in a short annual series, but they help interpret persistent expenditure pressure and delayed fiscal adjustment.

The theories are complementary. Debt dynamics identifies the accounting channels; tax smoothing explains temporary borrowing; Keynesian reasoning explains stabilisation and productive investment; and political economy explains the persistence and composition of deficits. Together, they predict that higher government expenditure and currency depreciation will generally increase debt, while stronger revenue and sustained real growth will generally reduce it. Military expenditure is expected to have a non-negative direct fiscal effect when financed by borrowing, although its net coefficient may be moderated by expenditure substitution, security benefits, or the relatively small share of defence spending in total expenditure.

Empirical Literature

Government Revenue, Expenditure, and Public Debt

Evidence from Africa generally supports a debt-reducing revenue channel. Appiah-Kubi et al. (2022), using a panel of 47 African countries and dynamic estimators, report that stronger tax revenue is associated with lower public debt. Gnangnon (2021) similarly shows that revenue instability and the design of tax reform influence public-debt instability in developing countries, with the effect mediated by trade openness and the reliability of public receipts. These studies indicate that the size and stability of the revenue base matter, but their cross-country coefficients average across different tax structures, grant dependence, institutions, and debt portfolios. A country-specific model is therefore required to establish whether Uganda's general government revenue has a stable short-run and long-run association with debt.

The expenditure evidence is more consistently positive in its direct fiscal effect. Ngasamiaku and Ngong'ho (2022) apply an ARDL model to Tanzania for 1970-2019 and find that government spending increases public debt in the short run. Musah (2023) reports that fiscal and macroeconomic variables jointly explain Ghana's debt accumulation, with government expenditure and budgetary conditions entering a cointegrated debt relationship. At the broader African level, Nagou et al. (2021) use Bayesian model averaging and identify fiscal deficits, military expenditure, interest rates, exchange rates, and debt service among the robust drivers of debt accumulation. The findings suggest that expenditure pressure is important, although its magnitude depends on whether spending is recurrent or capital, whether it is financed domestically or externally, and whether it generates future revenue.

Recent Ugandan evidence also points to two-way fiscal interactions. Wadada et al. (2026) find that revenue, debt, exports, and economic activity are long-run determinants of government expenditure. Their dependent variable is expenditure rather than public debt, but the result is important because it indicates potential feedback: borrowing can expand expenditure, while expenditure can create subsequent borrowing requirements. The present study retains debt as the dependent variable and separates revenue from expenditure so that fiscal capacity and fiscal use are estimated independently.

Economic Growth, Exchange Rates, and Public Debt

Economic growth generally reduces the debt ratio through denominator and fiscal-capacity effects, although empirical results vary with the sample and identification strategy. Bittencourt (2015) finds that stronger growth reduces government and external debt in young South American democracies. Patel and Peralta-Alva (2024), using a structural vector autoregression for 17 advanced economies, conclude that GDP-growth shocks and their macroeconomic comovements account for a substantial share of annual debt-ratio

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variation, exceeding the contribution of discretionary fiscal-policy shocks. For Africa, Okoth and Sekmen (2026) report a negative growth-debt relationship for the overall panel and for several individual economies, underscoring the importance of country heterogeneity. These findings support inclusion of real GDP growth, while cautioning that contemporaneous growth may also respond to debt-financed expenditure and fiscal adjustment.

Exchange-rate effects are especially important in economies with foreign-currency liabilities. Acosta-Ormaechea (2020) demonstrates that intra-year exchange-rate movements can create material debt changes through valuation effects. Awan et al. (2015), using an ARDL model for Pakistan, find that nominal depreciation and fiscal deficits increase external debt. Nagou et al. (2021) identify the exchange rate as a robust public-debt driver across African countries, while Okoth and Sekmen (2026) find positive exchange-rate effects in several African economies but also document country-specific differences. Uganda-specific analysis by Kijjambu et al. (2023) associates the real effective exchange rate, primary balance, and real interest rate with debt sustainability. The present model uses Uganda shillings per United States dollar, so a positive coefficient indicates that depreciation is associated with a higher domestic-currency debt burden.

Military Expenditure and Public Debt

Military expenditure represents a specific form of expenditure pressure. Dunne et al. (2004) find that military expenditure contributes to debt in small industrialising economies, although the effect depends on financing structures and country characteristics. Ahmed (2012), using dynamic panel data for 25 Sub-Saharan African countries, reports that military expenditure increases external debt while stronger real output reduces the burden. Nagou et al. (2021) also identify military expenditure as a robust African debt driver. These studies justify examining defence spending, but including it jointly with total expenditure would place an aggregate and one of its components in the same small model. The supplementary specification therefore replaces total expenditure with military expenditure.

Research Gap and Contribution

The literature leaves four related gaps. First, much of the evidence is cross-country, whereas debt dynamics are shaped by country-specific revenue capacity, creditor composition, institutions, and exchange-rate exposure. Second, several studies examine the effect of debt on growth rather than the fiscal and monetary determinants of debt. Third, Uganda-specific evidence commonly uses the primary balance or debt-sustainability decompositions and therefore does not separately identify the revenue and expenditure sides of the budget. Fourth, military expenditure is often omitted or entered without addressing its overlap with aggregate expenditure. This study addresses these gaps through a parsimonious Uganda-specific ARDL model for 2000–2024 that separates government revenue from total expenditure, incorporates real GDP growth and the nominal exchange rate, and estimates military expenditure through a supplementary expenditure-composition model.

MATERIALS AND METHODS

Research Design, Data and Variable Measurement

The study adopted a longitudinal macroeconomic time-series design covering Uganda from 2000 to 2024. The dependent variable was general government gross debt as a percentage of GDP. The main explanatory variables were total general government expenditure and general government revenue, both expressed as percentages of GDP; annual real GDP growth; and the period-average exchange rate measured as Uganda shillings per United States dollar, so that an increase denotes depreciation. Military expenditure, expressed as a percentage of GDP, was used only in the supplementary model. Fiscal and debt data were obtained from IMF-based databases, GDP growth

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and exchange-rate data from the World Development Indicators, and military expenditure from the Stockholm International Peace Research Institute (SIPRI) database (IMF, 2024; SIPRI, 2025; World Bank, 2024).

Table 1: Definition, Measurement and Expected Relationship of the Study Variables

Variable	Symbol	Measurement	Principal source	Expected debt relationship
Public debt	LNPD	Log of general government gross debt (% of GDP)	IMF WEO; MoFPED	Dependent variable
Government expenditure	LNGEXP	Log of total general government expenditure (% of GDP)	IMF WEO	Positive
Government revenue	LNGREV	Log of general government revenue (% of GDP)	IMF WEO	Negative
GDP growth	LNGDPG	Log of positive-domain-adjusted real GDP growth rate	World Bank WDI	Negative
Exchange rate	LNEXR	Log of period-average UGX per US dollar	World Bank WDI	Positive
Military expenditure	LNMEXP	Log of military expenditure (% of GDP)	SIPRI	Positive/weak

Note. *An increase in LNEXR represents depreciation of the Uganda shilling. Military expenditure replaces aggregate expenditure in the supplementary model.*

The source series contained 25 annual observations. For dynamic estimation, the annual series were converted to quarterly frequency using the EViews frequency-conversion procedure, producing 100 observations from 2000Q1 to 2024Q4 before lag adjustment. The converted series were used for ARDL estimation. Public debt, expenditure, revenue, the exchange rate, and military expenditure were transformed into natural logarithms to reduce scale differences and stabilise variance. GDP growth included a negative annual observation; a positive-domain adjustment was therefore applied before logarithmic transformation, denoted $GDPG*$. The transformations were $LNPD = ln(PD)$, $LNGEXP = ln(GEXP)$, $LNGREV = ln(GREV)$, $LNEXR = ln(EXR)$, $LNMEXP = ln(MEXP)$, and $LNGDPG = ln(GDPG*)$.

Model Specification

The main log-linear specification separated the two sides of the government budget:

$$LNPD_t = \beta_0 + \beta_1 LNGEXP_t + \beta_2 LNGREV_t + \beta_3 LNGDPG_t + \beta_4 LNEXR_t + \varepsilon_t \quad (4)$$

The expected signs were $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$, and $\beta_4 > 0$. Military expenditure was not entered together with total expenditure because it is a component of that aggregate. The supplementary specification was:

$$LNPD_t = \gamma_0 + \gamma_1 LNMEXP_t + \gamma_2 LNGREV_t + \gamma_3 LNGDPG_t + \gamma_4 LNEXR_t + \nu_t \quad (5)$$

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The ARDL representation allowed current public debt to depend on its own lags and current and lagged values of the explanatory variables:

$$LNPD_t = c_0 + \sum_{i=1}^{p} \phi_i \, LNPD_{t-i} + \sum_{j=1}^{4} \sum_{i=0}^{q_j} \theta_{ji} \, Z_{j,t-i} + u_t \quad (6)$$

Where $Z = \{LNGEXP, LNGREV, LNGDPG, LNEXR\}$ for the main model and $Z = \{LNMEXP, LNGREV, LNGDPG, LNEXR\}$ for the supplementary model. The ARDL method is appropriate when regressors are a mixture of $I(0)$ and $I(1)$, provided no variable is $I(2)$, and it estimates short-run dynamics and a long-run equilibrium within one framework (Pesaran et al., 2001). The unrestricted error-correction form used for the bounds test was:

$$\Delta LNPD_t = a_0 + \lambda LNPD_{t-1} + \sum_{j=1}^{4} \delta_j \, Z_{j,t-1} + \sum_{i=1}^{p-1} \varphi_i \, \Delta LNPD_{t-i} + \sum_{j=1}^{4} \sum_{i=0}^{q_j-1} \theta_{ji} \, \Delta Z_{j,t-i} + e_t \quad (7)$$

The null hypothesis of no level relationship was $H0: \lambda = \delta_1 = \ldots = \delta_4 = 0$. This joint F-test imposed five zero restrictions on the lagged level terms (the lagged dependent variable and four regressors). Cointegration was established when the calculated F-statistic exceeded the upper critical bound. After cointegration, the parsimonious error-correction model was estimated as:

$$\Delta LNPD_t = \omega_0 + \sum_{i=1}^{p-1} \omega_i \, \Delta LNPD_{t-i} + \sum_{j=1}^{4} \sum_{i=0}^{q_j-1} \pi_{ji} \, \Delta Z_{j,t-i} + \psi ECM_{t-1} + e_t \quad (8)$$

A negative and statistically significant psi indicates convergence to long-run equilibrium; its absolute value measures the proportion of disequilibrium corrected per period.

Estimation and Diagnostic Strategy

Analysis proceeded in six stages. First, means, medians, ranges, standard deviations, trend graphs, Pearson correlations, and Jarque-Bera statistics were examined. Second, centred variance inflation factors (VIFs) assessed linear dependence among regressors. Third, Augmented Dickey-Fuller tests established whether each series was I(0) or I(1). Fourth, lag-order criteria guided the maximum dynamic structure. Fifth, the ARDL F-bounds tests, long-run coefficients, and error-correction models were estimated for the main and supplementary specifications. Finally, model adequacy was evaluated using the Breusch-Godfrey serial-correlation test, residual normality, heteroskedasticity testing, the Ramsey RESET test, and cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) stability tests. Statistical significance was assessed at 1%, 5%, and 10%, with results at the 10% level reported separately.

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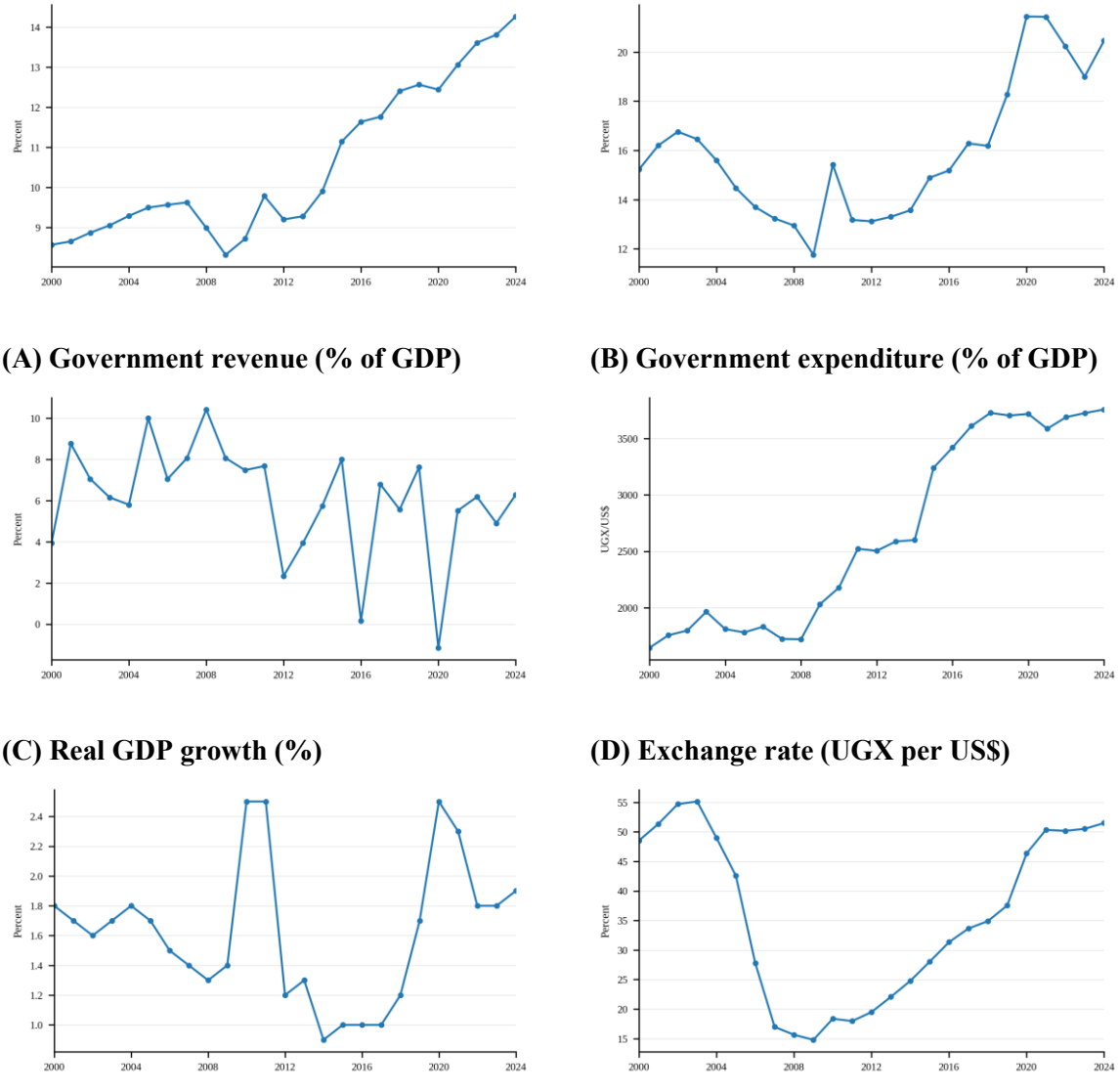
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RESULTS

Descriptive Patterns

Figure 1 and Table 2 provide a coherent descriptive account of Uganda's fiscal and debt trajectory. Government revenue rose gradually over most of the period and accelerated after the mid-2010s, whereas expenditure declined during part of the 2000s before increasing sharply in the later years. The resulting expenditure-revenue gap indicates a persistent financing requirement. Real GDP growth was comparatively volatile, including pronounced slowdowns, while the Uganda shilling depreciated substantially over the period despite temporary episodes of appreciation and stability. Military expenditure fluctuated within a narrower range than the other variables. Public debt fell steeply after the debt-relief period, reached its minimum of 14.793% of GDP in 2009, and then increased persistently to 51.493% of GDP in 2024.

Figure 1: Trends in Public Debt and Selected Fiscal and Monetary Indicators in Uganda, 2000–2024



(A) Government revenue (% of GDP) **(B) Government expenditure (% of GDP)**

(C) Real GDP growth (%) **(D) Exchange rate (UGX per US$)**

(E) Military expenditure (% of GDP) **(F) Public debt (% of GDP)**

Note: *Annual observations from IMF-based fiscal databases, World Development Indicators, and SIPRI. The figure is arranged in a two-column by three-row layout.*

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Table 2 reinforces these patterns: public debt averaged 35.736% of GDP but had a large standard deviation of 14.290 percentage points, indicating considerable variation across the study period. Mean expenditure of 15.933% of GDP exceeded mean revenue of 10.563%, while GDP growth ranged from -1.150% to 10.428%. The Jarque-Bera probabilities exceeded .05 for every variable, so normality was not rejected at the 5% level, although GDP growth was comparatively close to the threshold. Public debt had a strong positive correlation with expenditure (r = 0.752), a moderate positive correlation with revenue (r = 0.389), weak positive correlations with the exchange rate (r = 0.210) and military expenditure (r = 0.310), and a weak negative correlation with growth (r = -0.172). The high correlations between revenue and the exchange rate (r = 0.923) and between expenditure and revenue (r = 0.782) signal possible shared trends and justify the subsequent multicollinearity assessment.

Table 2: Descriptive Statistics and Pearson Correlations

Statistic	PD	GEXP	GREV	GDPG	EXR	MEXP
Mean	35.736	15.933	10.563	6.097	2,665.255	1.620
Median	34.887	15.424	9.629	6.291	2,522.802	1.700
Maximum	55.139	21.445	14.264	10.428	3,757.300	2.500
Minimum	14.793	11.756	8.322	-1.150	1,644.475	0.900
Std. deviation	14.290	2.792	1.897	2.701	844.806	0.473
JB p-value	0.283	0.338	0.243	0.068	0.213	0.578

Panel B: Correlation matrix

Variable	PD	GEXP	GREV	GDPG	EXR	MEXP
PD	1.000	0.752	0.389	-0.172	0.210	0.310
GEXP	0.752	1.000	0.782	-0.323	0.665	0.489
GREV	0.389	0.782	1.000	-0.295	0.923	0.125
GDPG	-0.172	-0.323	-0.295	1.000	-0.424	-0.055
EXR	0.210	0.665	0.923	-0.424	1.000	0.029
MEXP	0.310	0.489	0.125	-0.055	0.029	1.000

Note. *N = 25 annual observations. PD = public debt; GEXP = government expenditure; GREV = government revenue; GDPG = real GDP growth; EXR = UGX per US dollar; MEXP = military expenditure.*

Preliminary Time-Series Tests

Table 3 establishes the integration properties and collinearity profile of the variables. $LNPD$, $LNGEXP$, $LNGREV$, and $LNEXR$ were non-stationary in levels but stationary after first differencing, and were therefore classified as $I(1)$. $LNGDPG$ and $LNMEXP$ were stationary in levels and classified as $I(0)$. Since none of the series was $I(2)$, the mixture of $I(0)$ and $I(1)$ variables satisfied the order-of-integration requirement for ARDL bounds testing.

Table 3: Unit-root and Multicollinearity Results

Series	ADF level (p-value)	ADF first difference (p-value)	Order	Main VIF	Supplementary VIF	Decision
LNPD	-1.888 (0.334)	-5.111 (<0.001)	I(1)	-	-	Use in ARDL
LNGEXP	-0.614 (0.862)	-4.815 (<0.001)	I(1)	3.038	-	Use in main model
LNGREV	-1.888 (0.914)	-3.341 (0.016)	I(1)	10.053	6.579	Interpret cautiously

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Series	ADF level (p-value)	ADF first difference (p-value)	Order	Main VIF	Supplementary VIF	Decision
LNGDPG	-5.178 (<0.001)	-10.079	I(0)	1.267	1.408	Use in both models
LNEXR	-0.844 (0.802)	-4.097 (0.002)	I(1)	7.136	6.966	Use; moderate VIF
LNMEXP	-3.072 (0.032)	-	I(0)	-	1.269	Use in supplementary model

Note. *ADF tests used two difference lags. Centred VIFs are reported because the regressions include intercepts.*

The variance inflation factors indicate that multicollinearity was concentrated mainly in government revenue and the exchange rate. In the main model, the VIF of 10.053 for LNGREV was marginally above the conventional threshold, while the VIF of 7.136 for LNEXR indicated moderate overlap. LNGEXP and LNGDPG had substantially lower VIFs of 3.038 and 1.267. In the supplementary model, all VIFs were below 7, with LNGREV and LNEXR remaining the largest. All variables were retained in line with the model specification.

Table 4: Lag-order Selection and ARDL Bounds Tests

Lag	LogL	LR	FPE	AIC	SC	HQ
0	152.643	NA	1.90e-09	-3.055	-2.895	-2.990
1	1,220.716	1,980.387	8.73e-19	-24.557	-23.435	-24.103
2	1,472.958	436.168*	9.73e-21*	-29.062*	-26.978*	-28.219*
3	1,483.632	17.124	1.69e-20	-28.534	-25.489	-27.303
4	1,504.811	31.326	2.39e-20	-28.225	-24.218	-26.606
Panel B: Bounds-test results						
Model	**F-statistic**	**10% I(1)**	**5% I(1)**	**1% I(1)**	**Decision**	
Main	21.793	3.52	4.01	5.06	Cointegration	
Supplementary	32.928	3.52	4.01	5.06	Cointegration	

Note. An asterisk identifies the criterion-selected lag. The bounds test used Pesaran et al. (2001), Table CI(iii), Case III (unrestricted intercept and no trend), with four regressors. The I(0)/I(1) bounds were 2.45/3.52 at 10%, 2.86/4.01 at 5%, and 3.74/5.06 at 1%. In both models, the F-statistic exceeds the 1% upper bound, rejecting the null of no level relationship.

Table 4 shows that the likelihood-ratio statistic, final prediction error, Akaike information criterion, Schwarz criterion, and Hannan-Quinn criterion all selected two lags. Agreement across the criteria supports the two-lag specification. The bounds-test statistics were 21.793 for the main model and 32.928 for the supplementary model, both well above the 1% upper critical value of 5.06. The null hypothesis of no level relationship was therefore rejected for both specifications, providing a statistical basis for estimating and interpreting their long-run coefficients and error-correction terms.

Long-Run and Short-Run Estimates

Table 5 reports the estimated long-run, short-run, and adjustment effects. In the main model, the error-correction coefficient was negative and significant (-0.041, p = 0.029), indicating convergence toward equilibrium, although only about 4.15% of a deviation was corrected in each model period. Government expenditure was

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positively associated with public debt in both the long run (7.788, $p < 0.001$) and short run (1.170, $p < 0.001$), providing the strongest and most statistically precise positive effect in the model. Government revenue had significant negative coefficients in the long run (-12.853, $p = 0.024$) and short run (-1.360, $p = 0.007$), indicating that higher revenue was associated with a lower debt ratio after controlling for the other variables. The transformed GDP-growth measure was negative and significant in the long run (-0.493, $p = 0.011$), but its short-run coefficient was small and statistically insignificant (-0.025, $p = 0.283$). Exchange-rate depreciation had a positive long-run coefficient (5.192, $p = 0.067$), which provided weak evidence at the 10% level, and a positive short-run coefficient (0.691, $p = 0.008$), which was significant at the 1% level. In the supplementary model, the adjustment coefficient was also negative and significant (-0.026, $p = 0.001$), implying a slower correction of approximately 2.62% per period. Revenue remained negative and significant (-0.439, $p < 0.001$), while depreciation remained positive and significant (0.276, $p < 0.001$). Military expenditure was positive but weakly significant (0.018, $p = 0.095$), and GDP growth was statistically insignificant (0.003, $p = 0.553$). For LNEXR, a 1% increase in UGX per US dollar represents a 1% depreciation of the shilling. Across both specifications, depreciation increased debt while revenue reduced it.

Table 5: ARDL Long-Run, Short-Run and Supplementary-Model Estimates

Regressor	Main long run	p-value	Main short run	p-value	Supplementary long run	p-value
Adjustment term	-0.041471	0.029	-	-	-0.026209	0.001
Government expenditure	7.787533	<0.001	1.169774	<0.001	-	-
Government revenue	-12.852820	0.024	-1.360204	0.007	-0.438622	<0.001
GDP growth	-0.492830	0.011	-0.024858	0.283	0.002866	0.553
Exchange rate	5.192421	0.067	0.690804	0.008	0.275671	<0.001
Military expenditure	-	-	-	-	0.017915	0.095
Constant	-	-	-	-	-1.236932	<0.001

Note. *The main short-run entries are first-difference coefficients. A negative adjustment coefficient indicates convergence. p-values below .10 denote weak evidence; p-values below .05 denote conventional statistical significance.*

Model Adequacy and Stability

Table 6 shows that the estimated main model passed the reported residual and stability tests. The Breusch-Godfrey probabilities of 0.175 and 0.431 were above 0.05, so the null hypothesis of no residual serial correlation was not rejected. The Jarque-Bera probability of 0.669 indicated that the residual distribution did not depart significantly from normality. The heteroskedasticity-test probability of 0.647 supported constant residual variance, while the Ramsey RESET probability of .847 provided no evidence of functional-form misspecification. In addition, both the CUSUM and CUSUMSQ paths remained within the 5% critical boundaries, indicating stability in the estimated coefficients and residual variance over the sample. The diagnostic results supported the adequacy and stability of the estimated model.

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Table 6: Residual Diagnostic and Parameter-Stability Tests

Test	Statistic	p-value	Inference
Breusch-Godfrey LM (F)	1.949538	0.175	No serial correlation
Breusch-Godfrey LM (Obs. R-squared)	1.684894	0.431	No serial correlation
Jarque-Bera residual normality	0.803115	0.669	Residuals approximately normal
Heteroskedasticity F-test	0.841154	0.647	Constant residual variance
Ramsey RESET, F(2,21)	0.167885	0.847	No detected functional-form error
CUSUM	Within 5% bounds	-	Stable coefficients
CUSUMSQ	Within 5% bounds	-	Stable residual variance

Note. *The null hypotheses for the residual tests were not rejected at the 5% level.*

DISCUSSION

The results show that Uganda's public debt is jointly shaped by the expenditure, revenue, growth, and exchange-rate channels identified by the government budget constraint. The strong cointegration statistics indicate that these variables share persistent long-run relationships despite short-run variation. The negative adjustment terms in both models confirm convergence, but the small coefficients imply that debt shocks dissipate slowly. Persistence is consistent with the contractual nature of debt, the rigidity of expenditure commitments, and the time required for revenue and growth reforms to alter financing needs.

Government expenditure was the strongest positive fiscal correlate of public debt in the main specification. The long-run coefficient was positive and highly significant, and the short-run coefficient showed an immediate debt-increasing response. This pattern is consistent with the direct financing-gap mechanism: expenditure growth that is not matched by revenue creates a borrowing requirement. It accords with ARDL evidence from Tanzania and Ghana and with broader African findings that fiscal imbalance and government investment are important debt drivers (Appiah-Kubi et al., 2022; Musah, 2023; Ngasamiaku & Ngong'ho, 2022). The positive and significant coefficients in both the long run and short run identify expenditure pressure as a central feature of Uganda's debt dynamics.

Government revenue had the expected negative relationship with public debt in the long run and short run, and the negative effect persisted in the supplementary specification. Higher revenue reduces the amount that must be financed through new borrowing and increases the resources available for debt service. The result is consistent with African panel evidence linking tax revenue to lower debt and with research showing that stable revenue systems reduce debt instability (Appiah-Kubi et al., 2022; Gnangnon, 2021). Revenue retained a negative coefficient across the main and supplementary specifications despite its high correlation with the exchange rate.

Real GDP growth reduced debt significantly in the main long-run model but not in the short run or the supplementary model. The main long-run finding is consistent with the denominator effect and with the expansion of taxable income that accompanies sustained growth. The absence of a short-run effect suggests that output growth does not immediately change debt commitments and financing needs. Its insignificance when aggregate expenditure is replaced by military expenditure also indicates specification sensitivity. This mixed pattern resembles Uganda-specific evidence that has found growth effects weaker than primary-balance and valuation channels (Kijjambu et al., 2023), while remaining consistent with cross-country evidence that sustained growth lowers debt over longer horizons (Bittencourt, 2015).

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Exchange-rate depreciation increased public debt in the short run and long run. The main-model long-run effect was weak at the 10% level, but the short-run effect and supplementary-model long-run effect were strongly significant. Because the exchange rate is measured as shillings per United States dollar, the positive coefficients represent the domestic-currency revaluation of foreign-currency obligations and higher shilling debt-service costs. This result is consistent with debt-decomposition evidence showing that exchange-rate movements can materially affect stock-flow adjustments (Acosta-Ormaechea, 2020; Weber, 2012). It also explains why debt sustainability can deteriorate even without an equivalent contemporaneous increase in primary expenditure.

Military expenditure had a positive but weakly significant long-run coefficient when it replaced total expenditure. The direction is consistent with evidence that security spending can add to debt when it is financed through borrowing, particularly where procurement involves imported equipment and foreign-currency contracts (Ahmed, 2012; Dunne et al., 2004; Nagou et al., 2021). Its small and weak coefficient indicates that military expenditure is not the dominant expenditure channel. Aggregate government expenditure, revenue, and exchange-rate movements provide stronger explanatory signals. The supplementary result points to a smaller role for military expenditure than for aggregate expenditure, revenue, and exchange-rate movements.

POLICY IMPLICATIONS

The estimates support a coordinated debt-management strategy rather than reliance on a single adjustment instrument. Expenditure plans should be anchored to realistic revenue projections and the medium-term debt strategy. Borrowing should prioritise projects with demonstrable productivity, export, and revenue effects, while recurrent commitments, delayed projects, supplementary budgets, and low-return expenditure should receive stronger scrutiny. Project appraisal should be followed by implementation monitoring and ex-post evaluation so that debt-financed assets contribute to repayment capacity.

Domestic revenue mobilisation should combine base broadening, improved compliance, digital administration, rationalisation of inefficient exemptions, and formalisation of productive activity. Revenue expansion is most sustainable when it grows with structural transformation rather than through repeated rate increases on a narrow tax base. Exchange-rate risk should be integrated into loan selection, currency composition, maturity management, and stress testing. Concessional financing remains valuable, but foreign-currency exposure should be assessed against export earnings and expected foreign-exchange availability. Military procurement should be planned within the medium-term expenditure framework and evaluated for financing structure, currency exposure, value for money, and opportunity cost.

LIMITATIONS

The study has four principal limitations. First, the source data cover 25 annual observations and were converted to quarterly frequency for estimation. Second, GDP growth required a positive-domain transformation before logarithmic estimation. Third, aggregate national data do not distinguish domestic from external debt, recurrent from capital expenditure, or concessional from commercial borrowing. Fourth, the ARDL specification focuses on selected fiscal and macroeconomic variables and excludes interest rates, inflation, grants, contingent liabilities, institutional quality, and public-investment efficiency. The findings relate to Uganda over 2000–2024 and the variables included in the model.

CONCLUSION

Uganda's public debt dynamics over 2000–2024 were associated with mutually reinforcing fiscal and monetary forces. Government expenditure

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increased public debt in both the short run and long run, while government revenue reduced it. Economic growth provided a debt-reducing long-run channel in the main model but did not produce a stable short-run or supplementary-model effect. Exchange-rate depreciation consistently raised the domestic debt burden, confirming the importance of foreign-currency valuation risk. Military expenditure had a positive but comparatively weak relationship with debt when assessed separately from aggregate expenditure. The results place fiscal capacity and expenditure control at the centre of debt management, while also showing that growth quality and currency exposure shape the sustainability of the debt path. A durable response requires disciplined and productive expenditure, stronger domestic revenue, investment that expands output and exports, and active management of the currency and maturity structure of the public debt portfolio.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

All listed authors contributed to the conception, interpretation, critical revision, and approval of the manuscript. Oscar Ayebazibwe conducted the underlying dissertation research and data analysis.

Data Availability

The study uses publicly available secondary data from the IMF World Economic Outlook Database, World Bank World Development Indicators, SIPRI Military Expenditure Database, and Uganda public debt reports. The annual source series, quarterly series used for estimation, and complete EViews output are available from the corresponding author on reasonable request.

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