Wah Academia Journal of Social Sciences
Volume 4, Issue 1, Jun 2025, pp. 652-674
ISSN – E 2958-8731 P 2958-8723
https://doi.org/10.63954/WAJSS.4.1.34.2025

Government Revenue, Expenditure, and Public Debt in Mali: Empirical Evidence and Policy Implications

Tidiane Guindo[1]

Abstract

This study examines the relationship between government revenue, expenditure, and public debt in Mali (2000–2024) using a Vector Error Correction Model (VECM). The Johansen cointegration test confirms a long-term equilibrium, highlighting structural fiscal imbalances. Results show that expenditure negatively impacts revenue (-1.3017 elasticity), indicating that excessive spending weakens revenue mobilization. Public debt has no significant effect on revenue, suggesting inefficiencies in debt-financed policies. In the short run, expenditure adjusts significantly to disequilibrium (ECT = 0.6998, p = 0.001), while revenue and debt remain unresponsive. Furthermore, Granger causality tests, based on the Toda-Yamamoto approach confirms a bidirectional relationship between government revenue and expenditure, supporting both the tax-spend and spend-tax hypotheses. Additionally, there is supporting evidence that public debt is Granger-caused by both revenue and expenditure, indicating that fiscal deficits in Mali are primarily financed through borrowing. These findings stress the need for fiscal reforms in Mali, focusing on tax efficiency, prudent expenditure, and sustainable debt management to prevent macroeconomic instability.

Keywords: Fiscal sustainability, Revenue-expenditure nexus, Public debt dynamics, Mali

Introduction

Characterized by agriculture, extractive industries, and reliance on external aid, Mali's economic framework is heavily contingent upon gold mining, rendering it vulnerable to global price volatilities (Mainguy, 2011; Drakenberg, 2010). The expansion of artisanal and small-scale mining (ASM) further complicates fiscal governance, as the sector's predominantly informal nature hinders effective revenue

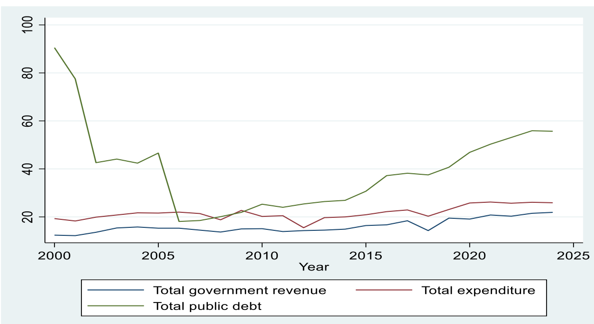
[1] Department of Economics, Andalas University, Limau Manis, Pauh, Padang City, West Sumatra - Indonesia

collection (Traoré et al.; World Bank, 2023). Consequently, revenue mobilization is constrained by a fiscal policy encumbered by a limited tax base and a pervasive informal economy (Haavik & Cissé, 2024; Bah, 2024). Institutional and structural impediments inhibit sector formalization (Simba et al., 2023), despite promising strides in tax reform and digital revenue collection, which necessitate enhanced institutional backing (Mansour & Keen, 2009; Cogneau & Mo, 2024).

Mali grapples with a complex fiscal dichotomy: pursuing immediate developmental imperatives while ensuring long-term sustainability. Investment in social infrastructure is critically necessary yet curtailed by budget earmarking, endemic insecurity, and escalating military expenditures (Herrera & Ouedraogo, 2018; Guindo & Hak, 2024, ICG, 2024). In this precarious context, the increasing reliance on debt-financed public spending for development and deficit management heightens the risk of fiscal destabilization if not judiciously managed (Atingi-Ego et al., 2021; Shah et al., 2024). While strategically deployed debt can catalyze growth, rising global interest rates and commodity price fluctuations threaten sustainable fiscal management (AfDB, 2023, Nurjihadi & Guindo, 2024). Effective debt management, transparent governance, and access to concessional financing are imperative for maintaining fiscal stability (World Bank, 2023). Moreover, the adverse impacts of climate change exacerbate fiscal vulnerabilities, undermining agricultural productivity and exacerbating food insecurity (FAO, 2012). The fiscal burden of climate adaptation intensifies pressure on national resources, underscoring the need for substantial international support (AfDB, 2023).

Figure 1.

The composition of public debt, government expenditure and revenue in Mali 2000-2024 (as % of GDP)



Source: Author

This (**Error! Reference source not found.**) represents the trends in Total Government Revenue, Total Expenditures, and Total Public Debt in Mali over a 25-year period from 2000 to 2025. These trends tell us much about the fiscal and economic landscape in Mali, both progressing and with problems. Government revenue growth was modest, spurred on by agriculture, gold mining, and tax collection. Additionally, it is very vulnerable to external shocks (Staatz et al. 2011; Drakenberg 2010). After 2010, tax reforms coupled with mining expansion increased revenue collection, but the tax base continued to be narrow (Mainguy 2011; Thomas 2010). Meanwhile, expenditures grew at an increasing rate, with investments in infrastructure, social services, and security operations, often overtaking revenues, leaving deficits (Blimpo & Harding 2013; Maïga et al. 2021). In terms of public debt, it notably rose after 2010, being predominantly externally financed, bringing into question sustainability due to Mali's fragile revenue capacity (Atingi-Ego et al. 2021; Maddah et al. 2024). This debt accumulation endangers the priority public investment programs and increases fiscal vulnerability.

Review of the Literature

❖ Theoritical Literature

Public debt, government expenditure, and revenue are at the center of public finance debates based upon differing theoretical perspectives. The tax smoothing theory (Barro 1979) argues that taxpayers sustain stable rates by borrowing during periods of increasing government expenditure to smooth out economic distortions. The displacement effect (Peacock & Wiseman 1961) contradicts this view, arguing that government expenditure increases in times of crises, leading to higher taxes and a sustained public debt rate. This puts the former hypothesis into the framework of the very same spending-led fiscal expansion that supports the spend-tax hypothesis.

The spend-tax hypothesis postulates, with the support of Barro's 1974 Ricardian equivalence, a direct relationship of causation between government spending, revenues, and debts, asserting that a government may either subject itself to taxation or borrow money: the two acts are interchangeable. The revenue-spend hypothesis (Friedman, 1978; Buchanan and Wagner, 1977) contradicts this, asserting that tax revenues are a predecessor to government spending with the latter increasing as taxes go up or down: higher taxes will fuel government expenditures while tax cuts create an illusion that actually causes spending to jump. Both hypotheses recognize a link between revenues and expenditures but differ in the proposed causality domains: the spend-tax sees spending as the cause while the revenue-spend sees taxation as the source.

A contrasting theory on public finance, Lerner's functional finance (1943), holds that the regulatory interest of economic stability shall receive precedence over expenditure and taxation to an extent. The tenets of classical theory would be against contracting debts. Smith (1937) saw public debt as a terrible detriment, while Mill (1979) found it a good, as the interest being paid on sufficiently settled foreign wealth, is able to divert investment expenditures into the real domestic economy.

In contrast to classical views on public debt, Keynesian theory (1936) postulates that increasing government expenditure and cutting taxes will spur economic growth, especially in times of recession. Thus, contrary to Keynesianism, the revenue-spend hypothesis (Friedman 1978) argues that spending depends on revenue collection. In Mali, Keynesian principles are pertinent, as fiscal expansion usually gives way to debt accumulation, which lends itself to the displacement effect. However, in the face of fiscal constraints, the revenue-spend hypothesis considers revenue generation as a predecessor to expenditures, attaching competitiveness. Their presence seemingly illustrates the contrast among theorists rowing in one river of thought concerning dynamics of fiscal policies in developing countries.

Empirical Literature

The relationship between government revenue, expenditure, and public debt has been widely examined with mixed findings. Iiyambo and Kaulihowa (2020) found borrowing drives spending in Namibia, supporting the tax-spend hypothesis—similar to findings in Kenya (Kiminyei, 2014), Nigeria (Uguru, 2016), and Jordan (Alawneh, 2017). Others highlight factors like corruption (Del Monte & Pennacchio, 2020), fiscal transparency (Roth et al., 2022), and weak tax systems (Mose et al., 2024). Debt-growth dynamics vary across contexts (Butkus et al., 2021; Berkeley et al., 2022; Alhamdany et al., 2025). While some support investment-led spending (Awoyemi, 2020; Bahaa, 2021), others emphasize institutional reforms (Menguy, 2024; Spyrakis & Kotsios, 2021). Given limited evidence for Mali, this study addresses the gap by analyzing its fiscal dynamics.

Methodology

❖ Research Design

This methodology employs a quantitative approach utilizing the Vector Error Correction Method (VECM) to analyze the phenomena of government revenue, expenditure, and public debt in Mali for the period of 2000 to 2024. This period guarantees the reliability of data from institutions such as the IMF and World Bank and corresponds with some of the key fiscal reforms and economic developments in Mali. Further, it evaluates the impacts of recent shocks and resilience of Mali's economy, thereby giving optimum insights into fiscal policy and financial stability.

❖ Model Specification and Data Sources

The study employs a multiple linear regression approach, adapting the methodology of Abdulrasheed (2017), with public debt as an additional explanatory variable. This inclusion aligns with Favero and Giavazzi (2007), who emphasized the importance of public debt in policy analyses.

The inclusion of public debt is justified as government revenue alone is often inadequate to finance government expenditure. Public debt affects fiscal policy through interest payments, debt servicing, and principal repayments, making it a critical factor in understanding the dynamics of government fiscal sustainability.

Thus, the functional relationship among the variables is specified as:

$$GVTRV_t = f(GVTEX_t\ , PD_t)$$

Transforming variables into natural logarithms enhances model estimation by addressing heteroskedasticity, ensuring stationarity, and enabling elasticity interpretation. It stabilizes variance, maintains consistent statistical properties over time, and allows coefficients to reflect percentage changes, improving robustness and interpretability.

The log-linear regression model is specified as follows:

$$\mathrm{Ln}(GVTRV_t) = \alpha + \beta_1 \ln(GVTEX_t) + \beta_2 \ln(PD_t) + \varepsilon_t$$

The model examines the relationship between government revenue($GVTRV_t$), expenditure($GVTEX_t$), and public debt(PD_t) over 2000–2024 using World Bank and IMF data. $GVTRV_t$ is the dependent variable, reflecting government income, while $GVTEX_t$ and PD_t represent spending and borrowing? The intercept (α) indicates baseline revenue, and coefficients β_1 and β_2 measure revenue elasticity concerning expenditure and debt. The error term (ε_t) captures unobserved factors. This framework analyzes fiscal dynamics without relying on original data sources, ensuring consistency across periods.

Estimation Techniques

The study applied the Classical Linear Regression Model (CLRM) with Ordinary Least Square estimation, augmented with descriptive statistics and time-series tests such as unit root and cointegration tests. Then, the appropriate model was determined. Short-run and long-run relationships among public debt, government revenue, and expenditure were captured with a Vector Error Correction Model (VECM), which was further subjected to Granger causality tests for the directional relationships. Data analysis was conducted using Stata.

Stationary and Unit Root Tests

A time series is stationary if its mean and variance remain constant (Gujarati, 2004). To prevent spurious results, stationarity was tested using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both tests check for unit roots, with the null hypothesis assuming non-stationarity. Variables were tested at levels and first differences, and if integrated of order one [I(1)], cointegration analysis followed.

Cointegration Test

Once the unit root tests results confirmed the non-stationarity of variables at levels, cointegration analysis was considered, which implies the existence of long-run equilibrium relationship among the variables that have been incorporated in a model (Gujarati, 2004).

Johansen cointegration

The trace and maximum eigen value Johansen tests were used. The null hypothesis is rejected if the probability value (p-value) under both trace and maximum eigenvalue tests are less than 5% (0.05) significance level and the statistics for both tests are greater than the critical value at 5% level of significance, concluding that the variables are cointegrated. The optimal lag length was also determined based on the model with the lowest Akaike Information Criterion (AIC) or Schwarz Information Criterion (SC) values.

Vector Error Correction Model (Vecm)

The study establishes a Vector Error Correction Model-VECM as applied to a log transformed level of government revenue, expenditure, and public debt as required by the cointegration framework of Engle and Granger (1987). Indeed, the Johansen Cointegration Test (1988, 1991) reveals that these variables exhibit a long-run equilibrium and thus, allows a VECM instead of first-differencing in order not to lose the long-term relationships induced by the underlying model. This vector autoregression with cointegration constraints is expected to capture short-term dynamics as well as long-run adjustments and, of course, the speed of reversion to equilibrium so determined by the error correction term.

The VECM equation takes the form:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \Gamma_i \, \Delta Y_{t-i} + \Pi Y_{t-i} + \varepsilon_t$$

Y_t is the Vector of log-transformed level values of the dependent variables (government revenue, government expenditure, public debt)? ΔY_t First differences of the variables, capturing short-run adjustments. α represents Vector of constant terms (intercepts). While this $\sum_{i=1}^{p} \Gamma_i \, \Delta Y_{t-i}$ captures the short-run dynamics, showing how past changes in revenue, expenditure, and debt influence current values. ΠY_{t-i} includes the error correction term (ECT), which measures how the system adjusts back to long-run equilibrium. ε_t Vector of white noise error terms, representing unexplained variations. The Error Correction Term (ECT) is analyzed to determine the speed at which fiscal disequilibria adjust toward long-run equilibrium.

Granger Causality Tests

In this study, the Chow test (Chi-square) in the Vector Error Correction Model has been used to determine causality among revenues, expenditures, and debts. The Granger causality test establishes relationships in time series data, whereas VECM modifies Granger causality by allowing the possibility of the variables being cointegrated and answer short- and long-term dynamics. Wald's test evaluates the significance of coefficients in testing for Granger causality, similar to the modified test of Toda and Yamamoto (1995), which resolves issues with integration orders.

To test whether government revenue Granger-causes government expenditure, we estimate:

$$GVTEX_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \gamma_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \delta_i \, PD_{t-i} + \varepsilon_t$$

This equation tests whether past values of government revenue (GVTRV) influence government expenditure (GVTEX). Here, GVTEX_t represents government expenditure at time t. while α_0 is the constant term. The sum $\sum_{i=1}^{p} \beta_i \, GVTEX_{t-i}$ reflects how previous government spending influences current expenditure, suggesting that spending patterns may follow historical trends. Similarly, $\sum_{i=1}^{p} \gamma_i \, GVTEX_{t-i}$ captures the impact of past revenue on present expenditure. If the coefficients γ_i are statistically significant, it indicates that past revenue plays a role in shaping government spending, aligning with the tax-spend hypothesis—the idea that governments first collect revenue before determining expenditure levels. Additionally, $\sum_{i=1}^{p} \delta_i \, PD_{t-i}$ accounts for the influence of past public debt on current spending. ε_t is the error term, accounting for factors not included in the model.

If the null hypothesis $H_0 : \gamma_1 = \gamma_2 = \ldots = \gamma_P = 0$ is rejected, it implies that government revenue Granger-causes government expenditure, meaning tax revenues strongly influence government spending decisions.

To test whether government expenditure Granger-causes government revenue, we estimate:

$$GVTRV_t = \alpha_1 + \sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \theta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \omega_i \, PD_{t-i} + \varepsilon_t$$

This equation investigates the reverse relationship: Does government expenditure influence government revenue? Here, GVTRV_t represents government revenue at time t. While α_1 is the constant term. The sum $\sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i}$ captures the role of past revenue levels on current revenue, ensuring that past fiscal policies and trends are accounted for. Similarly, $\sum_{i=1}^{p} \theta_i \, GVTEX_{t-i}$ measures the effect of past government spending on current revenue. If the coefficients θ_i are statistically significant, it indicates that government spending affects future revenue, supporting the spend-tax hypothesis—where governments spend first and then adjust taxes accordingly to finance expenditure. Additionally, $\sum_{i=1}^{p} \omega_i \, PD_{t-i}$ reflects the role of public debt in shaping revenue collection efforts. ε_t represents the error term.

If the null hypothesis H_0: $\theta_1 = \theta_2 = \ldots = \theta_P = 0$ is rejected, government expenditure Granger-causes government revenue, suggesting that tax policies respond to changes in government spending rather than the other way around.

To test whether public debt Granger-causes government revenue, we estimate:

$$GVTRV_t = \alpha_2 + \sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \tau_i \, PD_{t-i} + \sum_{i=1}^{p} \psi_i \, GVTEX_{t-i} + \varepsilon_t$$

This equation examines whether past levels of public debt impact government revenue collection. Here, $GVTRV_t$ represents government revenue at time t. While α_2 is the constant term. The sum $\sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i}$ accounts for the role of past revenue on current revenue. Similarly, $\sum_{i=1}^{p} \tau_i \, PD_{t-i}$ captures the effect of past debt levels on revenue collection efforts. If the coefficients τ_i are statistically significant, it implies that increasing public debt influences government revenue generation, possibly due to higher taxation imposed to service debt. Additionally, $\sum_{i=1}^{p} \psi_i \, GVTEXP_{t-i}$ controls for the impact of past government expenditure on current revenue. ε_t represents the error term.

If the null hypothesis $H_0 : \tau_1 = \tau_2 = \ldots = \tau_P = 0$ is rejected, it suggests that public debt Granger-causes government revenue, meaning that growing debt influences tax revenue collection, possibly due to fiscal adjustments such as higher tax rates or improved collection efficiency.

To test whether public debt Granger-causes government expenditure, we estimate:

$$GVTEX_t = \alpha_3 + \sum_{i=1}^{p} \beta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \sigma_i \, PD_{t-i} + \sum_{i=1}^{p} \rho_i \, GVTRV_{t-i} + \varepsilon_t$$

This equation examines whether past debt accumulation influences government spending decisions. Here, $GVTEX_t$ represents government expenditure at time t. While α_3 is the constant term. The sum $\sum_{i=1}^{p} \beta_i \, GVTEX_{t-i}$ captures the role of past expenditure on current expenditure, ensuring fiscal trends are considered. Similarly, $\sum_{i=1}^{p} \sigma_i \, PD_{t-i}$ measures the impact of past debt levels on government spending. If the coefficients σ_i are statistically significant, it suggests that higher debt levels drive increased government spending, possibly due to interest payments or expansionary fiscal policies fueled by borrowing. Additionally, $\sum_{i=1}^{p} \rho_i \, GVTRV_{t-i}$

controls for the influence of past government revenue on expenditure. ε_t represents the error term.

If the null hypothesis $H_0 : \sigma_1 = \sigma_2 = \ldots = \sigma_P = 0$ is rejected, it implies that public debt Granger-causes government expenditure, meaning that rising debt levels directly influence how much the government spends.

Model Diagnostics

To ensure model robustness, diagnostic tests are conducted: the Autocorrelation Test (Lagrange Multiplier) checks for serial correlation, the Heteroskedasticity Test (White's Test) assesses error variance stability, and the Normality Test (Jarque-Bera) verifies residual normality. These tests confirm whether assumptions hold or differ across models.

Empirical Results and Discussions

Descriptive Statistics

The Table 1 provides descriptive statistics for government revenue (GVTRV), expenditure (GVTEX) and public debt (PD) in emphasizing the main trends in fiscal management for Mali. Expenditure, on average (3.0679) exceeds revenue (2.7707), suggesting fiscal imbalances and deficit accumulation (3.5955). Public debt is the most volatile (SD=0.4308), proving that it fluctuates in any analysis. This usually occurs where policies are weak, or there is an external shock. Revenue, debt, and expenditures are generally positively skewed, although expenditures are slightly negatively skewed. Based on the findings of the Jarque-Bera test, they confirm an approximate normality, hence are fit for econometric modeling. Therefore, these findings speak well with effective debt and fiscal policies that would close up structural deficits.

Table 1 Descriptive Statistics

Statistic	(GOVTRV)	(GOVTEX)	(PD)
Mean	2.7707	3.0679	3.5955
Median (50%)	2.7279	3.0634	3.642
Maximum	3.0865	3.2658	4.5054
Minimum	2.5014	2.740	2.8959

Standard Deviation	0.1677	0.1263	0.4308
Skewness	0.4969	-0.2268	0.1281
Kurtosis	2.2176	3.2465	2.3241
Jarque-Bera	1.667	0.2777	0.5442
Probability	0.4346	0.8704	0.7618
Sum	69.2675	76.6975	89.8875
Observations (n)	25	25	25

Source: Author's compilation

Stationarity Test

The unit root tests (ADF and PP) were conducted at levels and first differences. A variable is I (1) if it becomes stationary after first differencing, I (2) if differenced twice, and I (0) if stationary at levels. The null hypothesis of a unit root is rejected when the p-value is below 0.05 or when t-statistics exceed critical values. Results confirm that all variables (ΔLn (GVTRV), NM(GVTEX), and NM(DEBT)) are I (1), ensuring compatibility for cointegration analysis and VECM estimation.

Table 2 Unit root test results at levels-ADF and PP

Variable	ΔLn(GVTRV)	ΔLn(GVTEX)	ΔLn(DEBT)
Deterministic Terms	Intercept & Trend	Intercept & Trend	Intercept & Trend
ADF Test Statistic	-7.69	-7.218	-5.383
5% Critical Value	-3.600	-3.600	-3.600
P-Value	0.0000	0.0000	0.0000
PP Test Statistic	-7.731	-7.463	-5.457
5% Critical Value	-3.600	-3.600	-3.600
P-Value	0.0000	0.0000	0.0000
Order of Integration	I(1)	I(1)	I(1)

Source: Author's compilation and data analysis using Stata.

Cointegration Test

❖ The Johansen Cointegration Test

The Johansen cointegration test was conducted after determining the optimal lag length (AIC = 1). The trace and maximum eigenvalue tests confirm cointegration, rejecting the null hypothesis of no cointegration. This indicates a long-run relationship among public debt, government expenditure, and government revenue over the study period.

Table 3 Lag Length Selection Criteria

Sample: 2004 thru 2024 | Number of Observations = 21

Criterion	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4
Log-Likelihood (LL)	39.023	56.6702	61.8427	65.6075	78.7578
Likelihood Ratio (LR)	-	35.294	10.345	7.5296	26.301*
Degrees of Freedom (df)	-	9	9	9	9
P-Value	-	0.000	0.323	0.582	0.002
Final Prediction Error (FPE)	6.5e-06	2.9e-06*	4.4e-06	8.7e-06	8.5e-06
AIC	-3.43077	-4.2543*	-3.88978	-3.39119	-3.78645
HQIC	-3.39838	-4.12477*	-3.66309	-3.06735	-3.36546
SBIC	-3.28155	-3.65743*	-2.84526	-1.89902	-1.84663

** optimal lag*
Endogenous: log_TotalGovernmentRevenue log_TotalExpenditure
Exogenous: _cons

Source: Author.

Table 4 Johansen Cointegration Test Results

Null Hypothesis (H_0)	Trace Statistic	5% Critical Value	Decision
No cointegration (r = 0)	34.2756	29.68	Reject H_0 (Cointegration Exists)

At most 1 cointegration ($r \leq 1$)	11.5894	15.41	Fail to Reject H_0
At most 2 cointegration ($r \leq 2$)	0.3816	3.76	Fail to Reject H_0

Null Hypothesis (H_0)	**Max Eigenvalue Statistic**	**5% Critical Value**	**Decision**
No cointegration ($r = 0$)	22.6862	20.97	Reject H_0 (Cointegration Exists)
At most 2 cointegration ($r \leq 1$)	11.2078	14.07	Fail to Reject H_0
At most 2 cointegration ($r \leq 2$)	0.3816	3.76	Fail to Reject H_0

Source: Author.

❖ Vector Error Correction

Table 5 Vector Error Correction Model (VECM)

1. **Error Correction Term (ECT)**

Dependent Variable	**ECT Coefficient**	**Std. Error**	**z-Statistic**	**P-Value**	**Adjustment Speed**
ΔLn(GVTRV) (Government Revenue)	-0.1505	0.2324	-0.65	0.517	Not significant
ΔLn(GVTEX) (Government Expenditure)	0.6998	0.2028	3.45	0.001	Significant, adjusts to equilibrium
ΔLn(DEBT) (Public Debt)	0.5669	0.5701	0.99	0.320	Not significant

Source: Author.

2. Long-Run Cointegrating Relationship

Variable	Coefficient	Std. Error	z-Statistic	P-Value	Significance
Ln(GVTEX) (Government Expenditure)	-1.3017	0.1291	-10.08	0.000	Significant
Ln(DEBT) (Public Debt)	-0.0100	0.0368	-0.27	0.785	Not significant
Constant	1.2539	-	-	-	-

Source: Author.

The Johansen normalization restriction estimates the long-run equilibrium relationship as:

$$Ln(GVTR) = 1.3017 \ln(GVTEX) + 0.0100 \ln(DEBT) - 1.2539$$

3. Short-Run Dynamics (Chi² Tests)

Equation	R^2 (Goodness of Fit)	Chi^2 (P-Value)	Short-Run Significance
ΔLn(GVTRV) (Revenue)	0.0732	0.4195	No significant short-run effects
ΔLn(GVTEX) (Expenditure)	0.3598	0.0021	Significant short-run effects
ΔLn(DEBT) (Public Debt)	0.0496	0.5632	No significant short-run effects

Source: Author.

The R^2 values and Chi-square statistics measure how well short-run changes in revenue, expenditure, and debt explain each other.

The Vector Error Correcting Model (VECM), lagged by 1, is aptly specified, with an AIC value of -3.9767. The absence of autocorrelation confirmed by the LM test (p >

0.05) is further evidence of the model's statistical validity. Analysis indicates that government revenue, expenditure, and public debt maintain a long-run cointegrating relationship with one another, consistent with Arestis et al.'s (2004) and Baharumshah et al.'s (2017) findings. Government spending significantly reduces revenue (-1.3017, p = 0.000), in support of Fatás and Mihov (2003) on the fiscal burden of such excessive expenditures. However, public debt holds no significant revenue contribution (-0.0100, p = 0.785), affirming Reinhart and Rogoff's (2010) findings that debt does not usually result in growth for the fiscal. Expenditure adjusts to fiscal imbalances (ECT = 0.6998, p = 0.001), while revenue and debt remain unresponsive, mirroring Afonso and Jalles (2013) spending-driven adaptations. Short-run instability is also caused by these expenditures, per Claeys et al. (2012). It is posited that inefficient revenue mobilization or deficit financing is likely to be the source of the negative expenditure-revenue link (Gupta et al. 2005). Public debt has no impact, indicating poor allocation (Cecchetti et al. 2011). As indicated by Gemmell et al. (2011), structural factors shape fiscal outcomes.

- **Granger Causality**

A Granger causality test using the Wald test within a VECM framework examined short-run causal links among government revenue, expenditure, and debt. Three hypotheses were tested: (1) whether expenditure and debt influence revenue, (2) whether revenue and debt drive spending, and (3) whether revenue and spending affect debt levels. The test assessed the predictive significance of past values, revealing fiscal interdependencies.

Table 6 Granger Causality Test Results (Wald Test in VECM)

Null Hypothesis (H_0)	Chi^2 Statistic	P-Value	Decision (5% level)	Interpretation
Government revenue is not Granger-caused by expenditure & debt	34.62	0.0000	Reject H_0	Expenditure & debt Granger-cause revenue

Government expenditure is not Granger-caused by revenue & debt	34.62	0.0000	Reject H_0	Revenue & debt Granger-cause expenditure
Public debt is not Granger-caused by revenue & expenditure	34.62	0.0000	Reject H_0	Revenue & expenditure Granger-cause debt

Source: Author

There is a two-way relationship between government revenue and expenditure, which may imply both tax-spend and spend-tax hypthoses, according to Granger causality results. This agrees with Yashobanta (2012), who emphasized fiscal interdependence in India; these outcomes also show that Granger causes public debt by both revenues and expenditures. Hence, fiscal deficits in Mali are mainly financed through borrowings. This finding agrees with Eberhardt and Presbitero (2015) and Chudik et al. (2017), which warn about the dangers of borrowing in low-income economies. Revenue and expenditure dependence show that there is reactive fiscal policy in Mali-the same is also observed by Ugwuanyi et al. (2017) in sub-Saharan Africa. Given the reliance on borrowing, effective debt management is crucial to avoid sustainability risks, as underscored by Gunduz (2017).

❖ **Diagnostic Test**

Table 7 Diagnostic tests for autocorrelation, heteroskedasticity, and Normality.

Diagnostic Test	Test Statistic	Degrees of Freedom (DF)	P-Value	Decision (5% level)	Conclusion
Autocorrelation (LM Test - Lag 1)	11.0798	9	0.2703	Fail to reject Ho	No autocorrelation

Autocorrelation (LM Test - Lag 2)	10.8783	9	0.2841	Fail to reject Ho	No autocorrelation
Heteroskedasticity (White Test)	8.04	9	0.5301	Fail to reject Ho	No heteroskedasticity
Normality (Total Test)	15.81	13	0.2595	Fail to reject Ho	Residuals are normally distributed
Normality (Skewness Test)	4.42	3	0.2200	Fail to reject Ho	No strong skewness
Normality (Kurtosis Test)	3.36	1	0.0670	Slightly rejects Ho	Possible excess kurtosis, but not severe

Source: Author

Conclusions and Recommendations

This study analyzes Mali's fiscal dynamics (2000–2024) using a Vector Error Correction Model (VECM) and Granger causality tests. Findings indicate a stable long-run relationship between revenue, expenditure, and debt, with inefficient tax collection and deficit financing undermining fiscal health. Government spending negatively impacts revenue (-1.3017 elasticity), and debt sustainability remains uncertain.

Short-term adjustments show expenditure responds quickly to imbalances, while revenue and debt remain sluggish. Policy recommendations focus on formalizing the informal sector, digitizing tax collection, optimizing key sectors (gold mining, telecom), and harmonizing WAEMU tax policies. Expenditure reforms emphasize productive investments, outcome-based budgeting, and reducing non-essential spending. Strengthened debt management, concessional borrowing, and fiscal rules are crucial for stability.

Additionally, integrating climate resilience into fiscal planning through environmental taxes and green financing will bolster sustainability. Comprehensive reforms in tax efficiency, spending rationalization, and debt control are essential for ensuring Mali's long-term fiscal stability and economic resilience.

Data Availability

The datasets used in this study are publicly available from the International Monetary Fund (IMF) and the World Bank databases. The data supporting the findings of this research can be accessed through the respective websites of these institutions. Additional details or processed data used in the analysis are available from the corresponding author upon reasonable request.

References

Abdulrasheed, B., 2017. Causality between government expenditure and revenue in Nigeria. Asian Journal of Economics and Empirical Research, 4(2), pp. 91-98. https://doi.org/10.20448/journal.501.2017.42.91.98

Achieng, W. J., 2012. The relationship between government budget deficit and domestic debt in Kenya. Master's Thesis. Nairobi: University of Nairobi.

AfDB. (2023). African Economic Outlook 2023: Debt Sustainability in Fragile States. African Development Bank.

Afonso, A., & Jalles, J. T. (2013). Growth and productivity: The role of government debt. International Review of Economics & Finance, 25, 384–407. https://doi.org/10.1016/j.iref.2012.07.004

Alhamdany, S. N., Alhamdany, M. N., Obed, M. K., & Alhamdany, S. N. (2025). The Impact of Public Government Spending on Public Debt in the Iraqi Economy. International Journal of Economics and Financial Issues, 15(2), 173-182.

Al Hayek, M. A. (2024). The role of public debt as a moderator in the relationship between revenues and capital expenditures of the Jordanian government.

Alawneh, A., 2017. The impact of public expenditure and public debt on taxes: A case study of Jordan. Accounting and Finance Research, 6(3), pp. 10-23. https://doi.org/10.5430/afr.v6n3p10

Arestis, P., Cipollini, A., & Fattouh, B. (2004). Threshold effects in the U.S. budget deficit. Economic Inquiry, 42(2), 214–222. https://doi.org/10.1093/ei/cbh055

Atingi-Ego, M., Timuno, S., & Makuve, T. (2021). Public debt accumulation in SSA: A looming debt crisis. Journal of African Economies, 30(Supplement_1), i103-i139.

Awoyemi, B. O. (2020). The responses of public debt to changes in government expenditure in Nigeria. African Journal of Economics and Sustainable Development, 3(2), 1-14.

Bah, M. (2024). Tax revenue mobilization and institutional quality in sub-Saharan Africa: An empirical investigation. African Development Review, 36(2), 201-221.

Bahaa, A. (2021). Public debt and government expenditure: Applied study on the palestinian environment. EuroMid Journal of Business and Tech-innovation (EJBTI), 96-115.

Baharumshah, A. Z., Lau, E., & Fountas, S. (2017). On the sustainability of current account deficits: Evidence from four ASEAN countries. Journal of Asian Economics, 18, 235–244. https://doi.org/10.1016/j.asieco.2006.10.002

Barro, R. J., (1979). On the determination of the public debt. Journal of Political Economy, 87(5), pp. 940-971

Bentour, E. M. (2022). The effects of public debt accumulation and business cycle on government spending multipliers. Applied Economics, 54(19), 2231-2256.

Blimpo, M. P., Harding, R., & Wantchekon, L. (2013). Public investment in rural infrastructure: Some political economy considerations. Journal of African Economies, 22(suppl_2), ii57-ii83.

Buchanan, J. M. and Wagner, R. W., 1977. Democracy in deficit. New York: Academic Press.

Butkus, M., Cibulskiene, D., Garsviene, L., & Seputiene, J. (2021). The heterogeneous public debt–growth relationship: The role of the expenditure multiplier. Sustainability, 13(9), 4602.

Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). The real effects of debt. BIS Working Papers, No. 352. https://www.bis.org/publ/work352.htm

Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2013). Debt, inflation and growth: robust estimation of long-run effects in dynamic panel data models. Cafe research paper, (13.23).

Claeys, P., Moreno, R., & Suriñach, J. (2012). Debt, interest rates, and integration of financial markets. Economic Modelling, 29(1), 48-59.

Cogneau, D., & Mo, Z. (2024). Enforcing Colonial Rule: Blood Tax and Head Tax in French West Africa.

Drakenberg, O. (2010). Mining in Mali–A background note for the Swedish International Development Cooperation Agency. Environmental Economics Paper.

Del Monte, A., & Pennacchio, L. (2020). Corruption, government expenditure and public debt in OECD countries. Comparative economic studies, 62, 739-771.

Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. Journal of International Economics, 97(1), 45–58. https://doi.org/10.1016/j.jinteco.2015.04.005

Eita, J. H. and Mbazima, D., 2008. The causal relationship between government revenue and expenditure in Namibia. Journal of Economic and Financial Sciences, 2(2), pp. 175-186. https://doi.org/10.4102/jef.v2i2.353

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica, 55(2), 251–276. https://doi.org/10.2307/1913236

Elyasi, Y., and Rahimi, M., 2012. The Causality between government revenue and government expenditure in Iran. International Journal of Economic Sciences and Applied Research, 5(1), pp. 129-145. https://doi.org/10.2139/ssrn.1977987

FAO. (2012). Potential impacts of climate change on food security in Mali.

Fatás, A., & Mihov, I. (2003). The case for restricting fiscal policy discretion. Quarterly Journal of Economics, 118(4), 1419–1447. https://doi.org/10.1162/003355303322552838

Favero, C. and Giavazzi, F., (2007). Debt and the effects of fiscal policy. NBER Working paper, No. 12822.

Friedman, M., (1978). The Limitations of Tax Limitations. Policy Review, (5), pp. 7-14.

Guindo, T., & Hak, M. B. U. (2024). Assessing the effectiveness of agricultural policies on development: A systematic literature review from diverse countries. In E3S Web of Conferences (Vol. 475, p. 04001). EDP Sciences.

Gujarati, D., 2004. Basic econometrics. London: McGraw Hill.

Gemmell, N., Kneller, R., & Sanz, I. (2011). The timing and persistence of fiscal policy impacts on growth: evidence from OECD countries. The Economic Journal, 121(550), F33-F58.

Gunduz, Y. B. (2017). Debt Sustainability in Low-Income Countries: Policies, Institutions, or Shocks?. International Monetary Fund

Gupta, A. (2024). THE IMPACT OF GOVERNMENT EXPENDITURE ON GOVERNMENT DEBT FOR G20 ECONOMIES.

Haavik, V., & Cissé, A. W. (2024). Taxing the informal sector: Coping with Coercion in Bamako, Mali. Development Policy Review, 42(4), e12775.

Herrera, S., & Ouedraogo, A. (2018). Efficiency of public spending in education, health, and infrastructure: An international benchmarking exercise. World Bank Policy Research Working Paper, (8586).

ICG. (2024). A Splinter in the Sahel: Can the Divorce with ECOWAS Be Averted?

Ighodaro, C. A. and Oriakhi, D. E., 2010. Does the relationship between government expenditure and economic growth follow Wagner" s law in Nigeria. Annals of University of Petrosani Economics, 10(2), pp. 185-198.

Iiyambo, H., & Kaulihowa, T. (2020). An assessment of the relationship between public debt, government expenditure and revenue in Namibia. Public sector economics, 44(3), 331-353.

Iiyambo, H. T. (2019). An investigation of the relationship between public debt, government expenditure and revenue in Namibia (Doctoral dissertation, University of Namibia).

Jibir, A., & Aluthge, C. (2019). Modelling the determinants of government expenditure in Nigeria. Cogent Economics & Finance.

Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control, 12(2–3), 231–254. https://doi.org/10.1016/0165-1889(88)90041-3

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica, 59(6), 1551–1580. https://doi.org/10.2307/2938278

Kanano, A. G., 2006. Determinants of public expenditure growth in Kenya. Master's Thesis. Nairobi: University of Nairobi.

Keynes, J. M., 1936. The general theory of employment, interest and money. New York: Cambridge University Press.

Kiminyei, F. K., 2014. Public debt, tax revenue and government expenditure in Kenya: 1960- 2012. Master of Economics Thesis. Nairobi: University of Nairobi.

Lerner, A. P., (1943). Functional finance and the federal debt. Social Research, 10(1), pp. 38-51.

Le Van, C., Nguyen-Van, P., Barbier-Gauchard, A., & Le, D. A. (2019). Government expenditure, external and domestic public debt, and economic growth. Journal of Public Economic Theory, 21(1), 116-134.

Luković, S. and Grbić, M., 2014. The causal relationship between government revenue and expenditure in Serbia. Economic themes, 52(2), pp. 127-138. https://doi.org/10.1515/ethemes-2014-0009

Maddah, L., Sherry, H., & Zeaiter, H. (2024). Economic and Political Determinants of Sovereign Default and IMF Credit Use: A Robustness Assessment Post 2010. Economies, 12(7), 181.

Mah, G. [et al.], 2013. The impact of government expenditure on the Greek government debt: An econometric analysis. Mediterranean Journal of Social Sciences, 4(3), pp. 323 330. https://doi.org/10.5901/mjss.2013.v4n3p323

Mainguy, C. (2011). Natural resources and development: The gold sector in Mali. Resources Policy, 36(2), 123-131.

Maïga, A., Bamba, A., Sy, B., Keita, G. H., Mouleye, I. S., & Diallo, M. (2021). Analysis of the effects of public expenditure on agricultural growth in Mali.

Mansour, M., & Keen, M. (2009). Revenue mobilization in sub-Saharan Africa: challenges from globalization.

Menguy, S. (2024). Limiting Public Expenditure to Ensure Public Debt Sustainability in the EMU. Public Finance Review, 52(1), 78-110.

Mill, J. S., (1979). Principles of Political Economy. Fairfield: Augustus M. Kelley.

Monamodi, N. E., & Choga, I. (2021). An Estimation of the Effect of Tax Revenue Collection on the Public Debt in South Africa. Review Pub Administration Manag, 9, 292.

Mose, N., Tanchev, S., & Fumey, M. (2024). Impact of Tax Revenue and Government Expenditure on Public Debt in Eastern Europe. Available at SSRN 5048821.

Nurjihadi, M., & Guindo, T. (2024). DETERMINANTS OF SMALLHOLDER FARMERS'FOOD SECURITY IN MALI AMIDST CLIMATE CHANGE. AGROTEKSOS, 34(1), 1-13.

Ogujiuba, K. and Abraham, T. W., 2012. Testing the relationship between government revenue and expenditure: Evidence from Nigeria. International Journal of Economics and Finance, 4(11), pp. 172-182. https://doi.org/10.5539/ijef.v4n11p172

Okafor, C. and Eiya, O., 2011. Determinants of growth in government expenditure: An empirical analysis of Nigeria. Research Journal of Business Management, 5(1), pp. 44-50. https://doi.org/10.3923/rjbm.2011.44.50

Oladokun, O. O., 2015. Causal relationship between public debts and public expenditure in Nigeria. International Journal of Management and Applied Science, 1(8), pp. 68-79.

Onyango, J. A. (2019). Nexus between public sector expenditure and public debt in Kenya (Doctoral dissertation, University of Nairobi).

Peacock, A. T. and Wiseman, J., (1961). The growth of public expenditure in the United Kingdom. London: Oxford University Press.

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a time of debt. American Economic Review, 100(2), 573–578. https://doi.org/10.1257/aer.100.2.573

Ribeiro, R. S., & Lima, G. T. (2019). Government expenditure ceiling and public debt dynamics in a demand-led macromodel. Journal of Post Keynesian Economics, 42(3), 363-389.

Roth, C., Settele, S., & Wohlfart, J. (2022). Beliefs about public debt and the demand for government spending. Journal of Econometrics, 231(1), 165-187.

Saungweme, T., 2013. Causality between government expenditures and revenues: The Zimbabwean case 1980-2004. International Journal of Economic Research, 4(6), pp. 28-40.

Simba, A., & Tajeddin, M. (2023). Enabling economic and social change in Sub-Saharan Africa: An informal economy perspective. Journal of Developmental Entrepreneurship, 28(03), 2350022.

Shah, S. S. A., Rafique, R., & Afridi, M. A. (2024). Empirical examination of public debt sustainability in African economies: A panel data analysis. Journal of Public Affairs, 24(1), e2896.

Smith, A., (1937). The Wealth of Nations. New York: Random House.

Spyrakis, V., & Kotsios, S. (2021). Public debt dynamics: the interaction with national income and fiscal policy. Journal of Economic Structures, 10(1), 8.

Staatz, J. K., & Boughton, V. (2011). Mali agricultural sector assessment. USAID/Mali, Bamako

Sutherland, A., (1997). Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy?. Journal of public economics, 65(2), pp. 147-162. https://doi.org/10.1016/s0047-2727(97)00027-3

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. Journal of Econometrics, 66(1–2), 225–250. https://doi.org/10.1016/0304-4076(94)01616-8

Thomas, M. S. (2010). Mining taxation: An application to Mali. International Monetary Fund.

Traoré, M., Hilson, G., & Hilson, A. (2024). Reimagining entrepreneurship in the artisanal and small-scale mining sector: Fresh insights from sub-Saharan Africa. Africa journal of management, 10(2), 176-207.

Uguru, L. C., 2016. The link between public debt and government expenditure pattern: The Nigeria experience. Journal of Business and Management, 18(1), pp. 37-41.

Ugwuanyi, U. B., & Ugwunta, O. D. (2017). Fiscal policy and economic growth: An examination of selected countries in Sub-Saharan Africa. International Journal of Academic Research in Accounting, Finance and Management Sciences, 7(1), 117-130.

Ukwueze, E. R., 2015. Determinants of the size of public expenditure in Nigeria. SAGE Open, pp. 1-8. https://doi.org/10.1177/2158244015621346

Yamin, I., Alzghoul, A., & Alsheikh, G. A. A. (2023). The influence of public debt on economic growth: A review of literature. International Journal of Professional Business Review: Int. J. Prof. Bus. Rev., 8(4), 3.

Yashobanta, Y. P. (2012). Causal link between central government revenue and expenditure: Evidence for India.

World Bank. (2023). Mali Economic Update: Special Chapter: Strengthening Financial Resilience of Pastoralists to Drought. World Bank Group.

Article Information:

Received	*8-Apr-2025*
Revised	28-May-2025
Accepted	1-Jun-2025
Published	15-Jun-2025

Declarations:

Author's Contribution:

- **Conceptualization, and intellectual revisions**
- **Data collection, interpretation, and drafting of manuscript**

- The author agrees to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

- **Conflict of Interest**: NIL

- **Funding Sources**: NIL

Correspondence:

Tidiane Guindo

guindotidiane62@gmail.com