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*Original Article*

# Investigating the Government Finance in Mali: Revenue, Expenditure, Debt and Policy Implications

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**Abstract:** This study explores the dynamic relationship between government revenue, expenditure, and public debt in Mali over the period 2000 to 2024, employing a Vector Error Correction Model (VECM) framework. The Johansen cointegration test confirms the existence of a long-term equilibrium relationship, reflecting underlying structural fiscal imbalances. The analysis reveals that government expenditure exerts a negative influence on revenue, suggesting that excessive spending hampers effective revenue mobilization. In contrast, public debt does not demonstrate a significant impact on revenue, indicating inefficiencies in the implementation of debt-financed policies. In the short run, expenditure adjusts significantly in response to deviations from the long-term equilibrium, while revenue and debt do not exhibit notable responsiveness. Moreover, Granger causality tests based on the Toda-Yamamoto approach reveal a bidirectional causality between revenue and expenditure, lending support to both the tax-spend and spend-tax hypotheses. The results also indicate that public debt is influenced by both revenue and expenditure, implying that fiscal deficits in Mali are predominantly financed through borrowing. These findings underscore the critical need for comprehensive fiscal reforms aimed at enhancing tax efficiency, ensuring prudent public spending, and promoting sustainable debt management to safeguard macroeconomic stability.

**Keywords:** Fiscal Sustainability; Tax Efficiency; Public Expenditure Management; Debt Management Strategy.



## 1. 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 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).

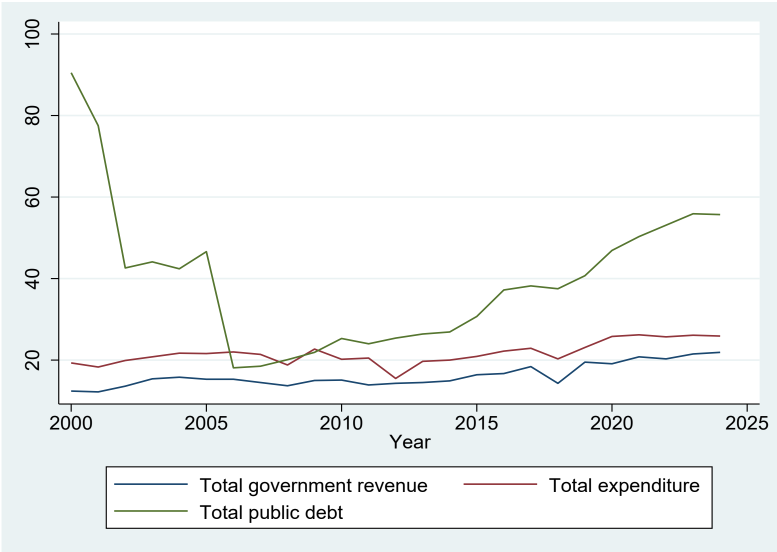


**Figure 1.** The composition of public debt, government expenditure and revenue in Mali 2000-2024 (as % of GDP)

Figure 1 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.

## 2. Literature Review

Debates surrounding public debt, government expenditure, and revenue remain central to public finance discourse, shaped by various theoretical perspectives. One prominent framework, the tax smoothing theory proposed by Barro (1979), suggests that governments may borrow during periods of heightened expenditure to maintain stable tax rates, thereby minimizing economic distortions over time. In contrast, the displacement effect theory, introduced by Peacock and Wiseman (1961), challenges this view by asserting that government spending tends to rise during periods of crisis, subsequently leading to higher taxes and sustained levels of public debt. This perspective aligns more closely with the spend-tax hypothesis, which emphasizes fiscal expansion driven by expenditure increases. The spend-tax hypothesis, drawing from Barro's (1974) Ricardian equivalence, posits a direct causal relationship between government spending, revenue, and borrowing. According to this view, borrowing and taxation are functionally equivalent mechanisms through which governments finance expenditures. Conversely, the revenue-spend hypothesis, supported by scholars such as Friedman (1978) and Buchanan and Wagner (1977), argues that tax revenue precedes spending. This theory holds that increases in tax revenue enable higher government expenditure, while tax cuts may generate the illusion of fiscal capacity, paradoxically leading to greater spending. Although both hypotheses acknowledge the interplay between revenue and expenditure, they differ fundamentally in their causality assumptions: the spend-tax hypothesis views expenditure as the driving force, whereas the revenue-spend hypothesis considers revenue as the initiator.

A distinct perspective is found in Lerner's (1943) functional finance theory, which advocates prioritizing macroeconomic stability over rigid adherence to balanced budgets or fixed expenditure-revenue relationships. Classical economic theorists, on the other hand, largely opposed public debt. For instance, Adam Smith (1937) regarded public debt as harmful, whereas John Stuart Mill (1979) perceived it as potentially beneficial if interest payments on foreign-held debt redirected investment into the domestic economy. Keynesian economics (Keynes, 1936) diverges from classical thought by promoting increased government spending and tax reductions as tools for stimulating economic growth, particularly during recessions. In contrast, the revenue-spend hypothesis, as articulated by Friedman (1978), maintains that government expenditure is constrained by revenue generation. In the context of Mali, Keynesian principles have often informed fiscal expansion policies, which in turn contribute to rising public debt—illustrative of the displacement effect. Nonetheless, under fiscal constraints, the revenue-spend hypothesis gains relevance by highlighting the primacy of revenue mobilization in determining expenditure levels. This divergence underscores ongoing theoretical tensions within public finance, particularly in the context of developing economies.

Empirical studies investigating the relationship between government revenue, expenditure, and public debt have yielded mixed results. For example, Iiyambo and Kaulihowa (2020) found that in Namibia, public borrowing drives government expenditure, supporting the spend-tax hypothesis. Similar patterns were observed in Kenya (Kiminyei, 2014), Nigeria (Uguru, 2016), and Jordan (Alawneh, 2017). Other studies emphasize structural factors influencing fiscal dynamics, such as corruption (Del Monte & Pennacchio, 2020), fiscal transparency (Roth et al., 2022), and weak tax administration systems (Mose et al., 2024). Debt-growth relationships are also found to vary significantly depending on contextual factors (Butkus et al., 2021; Berkeley et al., 2022; Alhamdany et al., 2025). While some researchers advocate for investment-led expenditure frameworks (Awoyemi, 2020; Bahaa, 2021), others underscore the need for institutional reforms (Menguy, 2024; Spyrakis & Kotsios, 2021). Given the paucity of country-specific evidence for Mali, this study seeks to fill that gap by exploring its unique fiscal dynamics.

## 3. Materials and Methods

### 3.1. Design of Study

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.

### 3.2. 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:

$$\text{Ln}(GVTRV_t) = \alpha + \beta_1 \ln(GVTEX_t) + \beta_2 \ln(PD_t) + \varepsilon_t, \quad (1)$$

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 $\beta_1$ and $\beta_2$ 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.

### 3.2.1. Model Estimation

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.

### 3.2.2. Data Stationary (Unit Root Test)

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.

## 3.3. Cointegration Analysis (Johansen)

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). 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.

## 3.4. 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:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \Gamma_i \, \Delta Y_{t-i} + \Pi Y_{t-i} + \varepsilon_t, \quad (2)$$

$Y_t$ is the Vector of log-transformed level values of the dependent variables (government revenue, government expenditure, public debt). $\Delta Y_t$ 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. $\Pi Y_{t-i}$ includes the error correction term (ECT), which measures how the system adjusts back to long-run equilibrium. $\varepsilon_t$ 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.

### 3.5. Granger Causality

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:

$$GVTEX_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \gamma_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \delta_i \, PD_{t-i} + \varepsilon_t, \quad (3)$$

This equation tests whether past values of government revenue (GVTRV) influence government expenditure (GVTEX). Here, $\mathrm{GVTEX}_t$ represents government expenditure at time t. while $\alpha_0$ 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 $\gamma_i$ 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. $\varepsilon_t$ is the error term, accounting for factors not included in the model. If the null hypothesis $\mathrm{H}_0 : \gamma_1 = \gamma_2 = ... = \gamma_P = 0$ 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:

$$GVTRV_t = \alpha_1 + \sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \theta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \omega_i \, PD_{t-i} + \varepsilon_t, \quad (4)$$

This equation investigates the reverse relationship: Does government expenditure influence government revenue? Here, $\mathrm{GVTRV}_t$ represents government revenue at time t. While $\alpha_1$ 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 $\theta_i$ 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. $\varepsilon_t$ represents the error term.

If the null hypothesis $\mathrm{H}_0 : \theta_1 = \theta_2 = ... = \theta_P = 0$ 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:

$$GVTRV_t = \alpha_2 + \sum_{i=1}^{p} \lambda_i \, GVTRV_{t-i} + \sum_{i=1}^{p} \tau_i \, PD_{t-i} + \sum_{i=1}^{p} \psi_i \, GVTEX_{t-i} + \varepsilon_t, \quad (5)$$

This equation examines whether past levels of public debt impact government revenue collection. Here, $\mathrm{GVTRV}_t$ represents government revenue at time t. While $\alpha_2$ 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 $\tau_i$ 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. $\varepsilon_t$ represents the error term. If the null hypothesis $H_0 : \tau_1 = \tau_2 = ... = \tau_P = 0$ 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:

$$GVTEX_t = \alpha_3 + \sum_{i=1}^{p} \beta_i \, GVTEX_{t-i} + \sum_{i=1}^{p} \sigma_i \, PD_{t-i} + \sum_{i=1}^{p} \rho_i \, GVTRV_{t-i} + \varepsilon_t, \quad (6)$$

This equation examines whether past debt accumulation influences government spending decisions. Here, $\mathrm{GVTEX}_t$ represents government expenditure at time t. While $\alpha_3$ 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 $\sigma_i$ 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. $\varepsilon_t$ 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.

### 3.6. 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.

## 4. Results

### 4.1. Descriptive Statistics

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.

**Table 1.** Descriptive Statistics Analysis

| 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 |

The descriptive statistical analysis presented in Table 1 provides a comprehensive overview of three key variables: Government Revenue (GOVTRV), Government Expenditure (GOVTEX), and Public Development (PD), each based on 25 observations. Starting with Government Revenue (GOVTRV), the data reveals a mean value of 2.7707 and a median of 2.7279, indicating that the distribution of this variable is relatively symmetric, though slightly skewed to the right, as suggested by the positive skewness value of 0.4969. The standard deviation is 0.1677, showing moderate variability around the mean. The maximum and minimum values of GOVTRV are 3.0865 and 2.5014, respectively, which suggests a narrow range. The kurtosis value of 2.2176, being less than 3, indicates a distribution that is slightly platykurtic or flatter than the normal distribution. The Jarque-Bera test statistic is 1.667 with a probability of 0.4346, suggesting that the data does not significantly deviate from normality. For Government Expenditure (GOVTEX), the mean is 3.0679 and the median is 3.0634, which are very close, indicating a symmetric distribution. This is further supported by the slightly negative skewness of -0.2268. The standard deviation is 0.1263, showing low dispersion of values. The data ranges from 2.740 (minimum) to 3.2658 (maximum), reflecting a tighter spread than GOVTRV.

The kurtosis value of 3.2465 is slightly above 3, suggesting a distribution that is slightly leptokurtic, or more peaked than the normal distribution. The Jarque-Bera statistic is 0.2777 with a probability of 0.8704, strongly indicating normality in the distribution of this variable. Regarding Public Development (PD), this variable shows the highest mean value at 3.5955, with a median of 3.642, indicating that most values lie above the mean, supported by a small positive skewness of 0.1281. The standard deviation is 0.4308, which is relatively higher compared to the other variables, signifying greater variability. The PD values range broadly between 2.8959 and 4.5054, indicating a wide dispersion of data. The kurtosis value of 2.3241 again suggests a slightly flatter distribution than normal. The Jarque-Bera statistic is 0.5442 with a probability of 0.7618, confirming that the distribution of PD does not significantly differ from normality. Thus, all three variables exhibit near-normal distributions with slight variations in skewness and kurtosis. The descriptive statistics indicate that the datasets are well-behaved, with no major deviations from normality, making them suitable for further econometric or inferential statistical analyses.

### 4.2. Stationarity Test (Unit Root 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), ΔLn(GVTEX), and ΔLn(DEBT)) are I(1), ensuring compatibility for cointegration analysis and VECM estimation.

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

| Deterministic Terms | ΔLn(GVTRV) | ΔLn(GVTEX) | ΔLn(DEBT) |
|---|---|---|---|
| | 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) |

Table 2 presents the results of the unit root tests conducted at level for three variables: the first-differenced natural logarithms of Government Revenue (ΔLn(GVTRV)), Government Expenditure (ΔLn(GVTEX)), and Debt (ΔLn(DEBT)). The tests used are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), both incorporating an intercept and trend to account for deterministic components in the data. The ADF test statistics for all three variables are highly negative: -7.69 for ΔLn(GVTRV), -7.218 for ΔLn(GVTEX), and -5.383 for ΔLn(DEBT). These values are substantially lower than the 5% critical value of -3.600, indicating strong evidence against the null hypothesis of a unit root, and thus supporting stationarity. The corresponding p-values for all three variables are 0.0000, further confirming the rejection of the null hypothesis at conventional significance levels. Similarly, the PP test statistics yield consistent results: -7.731 for ΔLn(GVTRV), -7.463 for ΔLn(GVTEX), and -5.457 for ΔLn(DEBT), all of which again fall well below the 5% critical value of -3.600. The p-values for the PP tests are also 0.0000 across the board, reinforcing the robustness of the results from the ADF test. These findings collectively indicate that each variable becomes stationary after first differencing, and hence, all three—government revenue, government expenditure, and debt—are integrated of order one, or I(1). This stationarity at first difference is a critical prerequisite for further econometric procedures such as cointegration analysis or Vector Error Correction Models (VECM), ensuring that spurious regression issues are avoided.

### 4.3. Cointegration (Johansen)

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.** Result of 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 |

| Criterion | Lag 0 | Lag 1 | Lag 2 | Lag 3 | Lag 4 |
|---|---|---|---|---|---|
| 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 |

Note: * Optimal Lag, Endogenous: Log Total Government Revenue, Log Total Expenditure, Exogenous: _cons

Table 3 presents the results of lag length selection criteria for a Vector Autoregressive (VAR) model using annual data from 2004 to 2024, with a total of 21 observations. The model includes the logarithms of total government revenue and total government expenditure as endogenous variables, with a constant term as an exogenous regressor. Several standard selection criteria are employed to determine the optimal lag length, including the Log-Likelihood (LL), Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC). Across these criteria, lag 1 is consistently identified as the optimal lag length. The LL increases with each additional lag, peaking at lag 4, which suggests improved model fit; however, LL alone does not account for model complexity. The LR test reveals that moving from lag 0 to lag 1 significantly improves the model (LR = 35.294, p = 0.000), while further increases in lag length do not yield statistically significant improvements, except at lag 4 (p = 0.002). Even so, the addition of higher lags may lead to overfitting, particularly given the limited sample size. The FPE reaches its minimum value at lag 1 (2.9e-06), indicating the best forecast accuracy among the alternatives. Similarly, the information criteria—AIC, HQIC, and SBIC—all attain their lowest values at lag 1, reinforcing the conclusion that this lag offers the most appropriate balance between model fit and complexity. Therefore, based on statistical significance, predictive accuracy, and model parsimony, lag 1 is selected as the optimal lag length for the VAR model.

**Table 4.** Result of Johansen Cointegration

| 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 | 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 $H_0$ |

Table 4 presents the results of the Johansen cointegration test, which assesses the long-run equilibrium relationship among the variables in the model—specifically, the log of total government revenue, total government expenditure, and debt. The test is conducted using both the Trace Statistic and the Maximum Eigenvalue Statistic, each tested against their respective 5% critical values to determine the number of cointegrating relationships. Based on the Trace Statistic, the null hypothesis of no cointegration (r = 0) is rejected, as the computed trace statistic is 34.2756, which exceeds the 5% critical value of 29.68. This indicates the presence of at least one cointegrating relationship, suggesting that the variables share a long-run equilibrium relationship. However, the null hypotheses of at most one ($r \leq 1$) and at most two ($r \leq 2$) cointegrating vectors cannot be rejected, as their trace statistics are 11.5894 and 0.3816, respectively—both of which fall below their corresponding critical values of 15.41 and 3.76. This implies that only one cointegrating relationship exists among the variables.

The Maximum Eigenvalue Statistic provides consistent results. The null hypothesis of no cointegration (r = 0) is again rejected, with a test statistic of 22.6862 exceeding the critical value of 20.97, reaffirming the existence of one cointegrating vector. However, the hypotheses of at most one cointegration ($r \leq 1$) and at most two cointegration ($r \leq 2$) are not rejected, as their test statistics—11.2078 and 0.3816, respectively—are below the critical thresholds of 14.07 and 3.76. Thus, both the trace and maximum eigenvalue tests confirm the existence of a single cointegrating relationship among the three variables. This finding implies that despite short-term fluctuations, government revenue, expenditure, and debt move together in the long run, maintaining a stable equilibrium relationship. This result provides a solid basis for employing models such as the Vector Error Correction Model (VECM) to explore both the short-run dynamics and long-term relationships among the variables.

## 4.4. Vector Error Correction Model (VECM)

**Table 5.** Result of Error Correction Term (ECT) using Vector Error Correction Model (VECM*)*

| Dependent Variable | ECT Coefficient | Std. Error | z-Statistic | P-Value | Decision |
|---|---|---|---|---|---|
| ΔLn(GVTRV) (Government Revenue) | -0.1505 | 0.2324 | -0.65 | 0.517 | No |
| ΔLn(GVTEX) (Government Expenditure) | 0.6998 | 0.2028 | 3.45 | 0.001 | Yes |
| ΔLn(DEBT) (Public Debt) | 0.5669 | 0.5701 | 0.99 | 0.320 | No |

Table 5 presents the results of the Error Correction Term (ECT) estimation from the Vector Error Correction Model (VECM), which captures the short-run dynamics and adjustment process toward long-run equilibrium for the variables: log of government revenue (ΔLn(GVTRV)), log of government expenditure (ΔLn(GVTEX)), and log of public debt (ΔLn(DEBT)). The ECT coefficient indicates the speed at which each dependent variable adjusts to deviations from the long-run equilibrium identified in the Johansen cointegration test. A statistically significant and appropriately signed ECT coefficient confirms that the variable contributes to correcting disequilibrium in the long term. For government revenue (ΔLn(GVTRV)), the ECT coefficient is -0.1505 with a p-value of 0.517, which is not statistically significant. This suggests that government revenue does not play a significant role in adjusting back to the long-run equilibrium when deviations occur. In other words, revenue does not respond meaningfully in the short run to correct disequilibrium.

In contrast, government expenditure (ΔLn(GVTEX)) shows a positive and statistically significant ECT coefficient of 0.6998, with a p-value of 0.001. This implies that government expenditure is actively and significantly adjusting to restore the long-run equilibrium, playing a crucial role in correcting imbalances. The positive sign, while unusual in some contexts, may indicate a dynamic where increased past disequilibria (e.g., deficits or spending gaps) lead to increased short-run spending as part of fiscal response or inertia. As for public debt (ΔLn(DEBT)), the ECT coefficient is 0.5669, but it is not statistically significant (p-value = 0.320). This result indicates that debt does not significantly contribute to the correction mechanism in the short run and does not respond actively to deviations from long-run equilibrium conditions. Thus, among the three variables, only government expenditure exhibits a significant error correction mechanism, indicating its central role in adjusting short-run deviations and maintaining the long-run relationship with revenue and debt. Government revenue and public debt, on the other hand, do not significantly respond to disequilibria in the short term, suggesting asymmetric adjustment dynamics within the fiscal system.

**Table 6.** Result of Long-Run Cointegrating Relationship

| Variable | Coefficient | Std. Error | z-Statistic | P-Value | Decision |
|---|---|---|---|---|---|
| Ln(GVTEX) (Government Expenditure) | -1.3017 | 0.1291 | -10.08 | 0.000 | Yes |
| Ln(DEBT) (Public Debt) | -0.0100 | 0.0368 | -0.27 | 0.785 | No |
| Constant | 1.2539 | - | - | - | - |

Table 6 presents the estimated long-run cointegrating relationship among the variables in the model, specifically examining the effects of government expenditure (Ln(GVTEX)) and public debt (Ln(DEBT)) on government revenue (Ln(GVTRV)) within a cointegration framework. This long-run equation reflects the equilibrium path that these variables tend to follow over time. The coefficient for government expenditure is -1.3017, with a standard error of 0.1291 and a z-statistic of -10.08, which is highly significant at the 1% level (p-value = 0.000). This strong statistical significance suggests that government expenditure has a substantial and negative long-run relationship with government revenue. In practical terms, a 1%

increase in government expenditure is associated with a 1.30% decrease in government revenue in the long run, implying a possible fiscal imbalance or inefficiency in expenditure allocation, where increased spending does not translate into higher revenue generation.

Conversely, the coefficient for public debt is -0.0100, with a standard error of 0.0368 and a z-statistic of -0.27, which is not statistically significant (p-value = 0.785). This indicates that public debt does not have a meaningful long-run impact on government revenue within the context of this model. The lack of significance suggests that changes in public debt levels do not exert a predictable or stable influence on revenue performance over time, which may point to ineffective debt utilization or a disconnect between borrowing and revenue-generating activities. The constant term in the long-run relationship is estimated at 1.2539, capturing the baseline level of government revenue when both government expenditure and public debt are held constant. While the constant has no associated significance test in this context, it represents the fixed component of the long-run revenue function. Thus, the long-run cointegration results reveal that government expenditure significantly and negatively influences government revenue, highlighting potential structural imbalances in fiscal policy. Meanwhile, public debt shows not statistically significant long-run effect, suggesting a need to reassess the role and effectiveness of debt in supporting revenue mobilization. The Johansen normalization restriction estimates the long-run equilibrium relationship as:

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

**Table 7.** Result of Short-Run Dynamics (Chi-Square Tests)

| Equation | $R^2$ (Goodness of Fit) | $Chi^2$ (P-Value) | Decision |
|---|---|---|---|
| ΔLn(GVTRV) (Revenue) | 0.0732 | 0.4195 | No |
| ΔLn(GVTEX) (Expenditure) | 0.3598 | 0.0021 | Yes |
| ΔLn(DEBT) (Public Debt) | 0.0496 | 0.5632 | No |

Table 7 shows the result of Short-Run Dynamics (Chi-Square Tests). 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.

## 4.5. 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 8.** Result of Granger Causality (Wald Test in VECM)

| Null Hypothesis ($H_0$) | $Chi^2$ Statistic | P-Value | Decision |
|---|---|---|---|
| Government revenue is not Granger-caused by expenditure & debt | 34.62 | 0.0000 | Expenditure & debt Granger-cause revenue |

| Null Hypothesis ($H_0$) | Chi² Statistic | P-Value | Decision |
|---|---|---|---|
| Government expenditure is not Granger-caused by revenue & debt | 34.62 | 0.0000 | Revenue & debt Granger-cause expenditure |
| Public debt is not Granger-caused by revenue & expenditure | 34.62 | 0.0000 | Revenue & expenditure Granger-cause debt |

Table 8 shows the result of Granger Causality using Wald Test in VECM. 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 shows 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).

## 4.6. Model Diagnostics

**Table 9**. Result of Model Diagnostics

| Diagnostic Test | Test Statistic | df | P-Value | Decision |
|---|---|---|---|---|
| Autocorrelation (LM Test - Lag 1) | 11.0798 | 9 | 0.2703 | No autocorrelation |
| Autocorrelation (LM Test - Lag 2) | 10.8783 | 9 | 0.2841 | No autocorrelation |
| Heteroskedasticity (White Test) | 8.04 | 9 | 0.5301 | No heteroskedasticity |
| Normality (Total Test) | 15.81 | 13 | 0.2595 | Normally distributed |
| Normality (Skewness Test) | 4.42 | 3 | 0.2200 | No strong skewness |
| Normality (Kurtosis Test) | 3.36 | 1 | 0.0670 | Excess kurtosis acceptable |

Table 9 presents the results of a series of model diagnostic tests used to evaluate the adequacy and statistical soundness of the estimated Vector Error Correction Model (VECM). These diagnostics assess key assumptions such as the absence of autocorrelation, homoscedasticity, and normality of residuals, which are essential for ensuring reliable inferences from the model. The autocorrelation tests using the LM (Lagrange Multiplier) Test at lag 1 and lag 2 yield test statistics of 11.0798 and 10.8783 respectively, with degrees of freedom (df) of 9 and p-values of 0.2703 and 0.2841. Since both p-values exceed the conventional 5% significance level, the null hypothesis of no autocorrelation cannot be rejected at either lag. This indicates that the residuals of the model are free from serial correlation, confirming that the model is appropriately specified in terms of its dynamic structure.

The White heteroskedasticity test produces a test statistic of 8.04 with 9 degrees of freedom and a p-value of 0.5301, again failing to reject the null hypothesis of homoscedasticity. This result suggests that the residuals exhibit constant variance, meaning there is no evidence of heteroskedasticity, which supports the reliability of the estimated standard errors and the overall robustness of the model. Regarding normality, the total test statistic is 15.81 with 13 degrees of freedom, and the corresponding p-value is 0.2595, indicating that the residuals are normally distributed overall. The Skewness test also supports this, with a statistic of 4.42, df = 3, and p-value of 0.2200, which implies the residuals do not exhibit significant skewness. However, the Kurtosis test shows a test statistic of 3.36 with 1 degree of freedom and a p-value of 0.0670, slightly below the 10% threshold. Although this suggests some presence of excess kurtosis, it is not severe enough to invalidate the assumption of normality, especially when considered alongside the skewness and overall tests. Thus, the diagnostic checks affirm that the model satisfies key statistical assumptions. There is no evidence of autocorrelation or heteroskedasticity, and the residuals are approximately normally distributed. These results enhance the credibility of the VECM estimations and support the robustness and validity of the model's findings.

## 5. Conclusions

This This study provides an in-depth analysis of Mali's fiscal dynamics over the period 2000 to 2024, utilizing a Vector Error Correction Model (VECM) and Granger causality tests to explore the interrelationships among government revenue, expenditure, and public debt. The findings reveal a stable long-run equilibrium among these fiscal variables yet highlight underlying inefficiencies—particularly in tax collection and deficit financing—that continue to undermine the country's fiscal health. The analysis shows that government expenditure exerts a significant negative effect on revenue generation, with an elasticity of -1.3017, suggesting that current spending patterns are fiscally unsustainable. Furthermore, Mali's debt sustainability remains uncertain, posing risks to macroeconomic stability. In the short term, public expenditure demonstrates a quicker adjustment to fiscal imbalances, whereas revenue and debt responses are comparatively sluggish, limiting the government's flexibility in responding to shocks. To address these challenges, the study proposes a multifaceted policy agenda. Enhancing tax collection by formalizing the informal sector and expanding digital tax infrastructure is essential for increasing revenue mobilization.

Targeted fiscal strategies should prioritize high-potential sectors such as gold mining and telecommunications while working towards the harmonization of tax frameworks within the West African Economic and Monetary Union (WAEMU) to promote regional consistency and efficiency. Expenditure-side reforms should focus on enhancing the productivity of public investment, adopting outcome-based budgeting practices, and reducing unproductive or non-essential expenditures. Strengthening debt management frameworks, prioritizing concessional financing, and implementing clear fiscal rules are also critical to safeguarding debt sustainability and maintaining fiscal discipline. Moreover, integrating climate resilience into fiscal policy—through the introduction of environmental taxes and the expansion of green financing mechanisms—will be pivotal for long-term economic and ecological sustainability. In conclusion, Mali's path to fiscal stability and economic resilience hinges on comprehensive reforms across tax administration, expenditure rationalization, and debt governance. A coordinated, strategic approach to these reforms will be instrumental in building a more robust, adaptive, and sustainable fiscal framework for the country's future.

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## 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

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. *Public and Municipal Finance*, *13*(2), 14-23.

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

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.

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, 4*(2), 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.

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

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

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

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), 129-145. https://doi.org/10.2139/ssrn.1977987

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

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.

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.

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.

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. *International Journal of Social Science and Economic Research, 9*(1), 117-121.

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

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.

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.

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.

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

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

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. *Asian Journal of Agricultural Extension, Economics & Sociology, 39*(7), 42-50

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

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.

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.

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.

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*(8), 1-22

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

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

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

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

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

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), 1-11

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