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The Impact Of Exchange Rate On Debt In The Gambia: A Non-Linear Autoregressive Distributed Lag Model

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Abstract:

This study investigates the relationship between exchange rate fluctuations and debt sustainability in The Gambia. Unstable currency rate remains a major problem to countries' economy especially external debt which The Gambia is faced with. To achieve the objective of this study, we employed non-linear autoregressive distributed lag (NARDL) model to explore both short-term and long-term effect. Our study revealed that exchange rate volatility was found to significantly influence The Gambia's external debt dynamics, particularly through the reduction of the Gambian Dalasi (GMD) against major currencies, which raises the cost of servicing foreign-denominated debt and strains fiscal resources. The study reveals that a 1% depreciation of GMD increases external debt by 6.6% in the short run, underlining the immediate impact of currency fluctuations on debt accumulation. This research highlights that exchange rate volatility can undermine investor confidence and escalate borrowing costs, and exacerbates debt challenges. In terms of policy recommendations, the study emphasizes the importance of robust debt sustainability analysis (DSA), effective currency management, and export-driven growth to mitigate the adverse effects of

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exchange rate fluctuations. The findings provide valuable insights for policymakers in The Gambia, suggesting strategies to improve fiscal resilience and manage exchange rate-induced economic risk.

INTRODUCTION

Exchange rates play a crucial role in shaping a country's economic trajectory, influencing debt accumulation and management. Exchange rate fluctuations can significantly impact macroeconomic stability, debt sustainability, and overall economic performance. Depreciation of the domestic currency raises the cost of servicing foreign-denominated debt, thereby increasing the debt burden. Conversely, currency appreciation may reduce debt servicing costs but can undermine export competitiveness, potentially affecting economic growth. To analyze this complex relationship, sophisticated econometric models like the Non-linear Autoregressive Distributed Lag (NARDL) model are often employed. The NARDL model captures the asymmetrical effects of exchange rate movements on debt dynamics, accounting for threshold effects and non-linear responses. This approach provides valuable insights into both short-term fluctuations and long-term trends, helping policymakers develop strategies to manage exchange rate volatility and its implications for debt sustainability.

In the context of The Gambia, exchange rate fluctuations present significant challenges for managing national debt. A depreciating Gambian Dalasi (GMD) against major currencies, such as the US Dollar and Euro, increases the cost of servicing external debt, straining fiscal resources and limiting the government's capacity to fund critical development projects. Persistent depreciation also raises the cost of imports, worsening trade deficits if export revenues do not grow proportionately, and contributing to higher external debt levels. Besides, exchange rate volatility undermines investor confidence in The Gambia's economy. Sudden depreciation or fluctuations in the Dalasi increase perceived risks for foreign investors, which can lead to higher borrowing costs for the government when issuing sovereign debt. If left unchecked, these elevated borrowing costs may accelerate debt accumulation and compromise fiscal sustainability.

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Therefore, this study examines the intricate relationship between exchange rate movements and debt sustainability in The Gambia, using the NARDL model to provide empirical insights as its main focal objective. However, to inform policymakers about strategies to enhance fiscal resilience and manage the economic risks associated with exchange rate volatility, the study empirically examines the short-term and long-term effects of exchange rate fluctuations on national debt.

This study is guided by the hypotheses which are formulated in a null form as follow:

- **Hypothesis 1**: There exists no significant short-term impact of exchange rate fluctuations on national debt.
- **Hypothesis 2**: The long-term impact of exchange rate fluctuations on national **3.**

METHODS

Empirical research on the impact of exchange rates on national debt utilizes various econometric approaches, including panel data analysis, time series analysis, and case studies. Panel data analysis is widely used to compare the effects of exchange rate fluctuations across different countries (Chinn & Meredith, 2004; Kose et al., 2021). Time series models, such as ARDL, examine both short-term and long-term impacts, providing valuable insights into how exchange rate changes influence debt dynamics over time (Bahmani-Oskooee & Hegerty, 2007; Lippi & Forni, 2020). Case studies focus on specific country contexts, shedding light on the unique factors that influence the exchange rate-debt relationship (Bexley et al., 2022; Mendoza & Ostry, 2021).

Recent findings emphasize several key policy recommendations for managing exchange rate volatility and its impact on debt. Exchange rate stability remains crucial, with studies by Aizenman and Lee (2022) and Clarida and Waldman (2021) highlighting the role of central banks in managing currency volatility to protect debt sustainability. Debt management strategies, such as diversifying debt portfolios and employing hedging techniques, are vital for mitigating exchange rate risks and ensuring fiscal health (Reinhart & Rogoff, 2021; Panizza et al., 2020). Additionally, structural reforms, such as promoting economic diversification and export-led growth,

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are essential for reducing reliance on foreign borrowing and mitigating the adverse effects of exchange rate fluctuations (Rodrik, 2021; Hausmann & Panizza, 2022).

Overall, the literature underscores the importance of comprehensive strategies for maintaining fiscal stability and ensuring debt sustainability. Effective exchange rate management, prudent debt practices, and structural reforms are essential for countries to navigate the challenges posed by exchange rate volatility and external debt accumulation.

3.1 Model Specification

In this study we specify our log-linear form, functional model as follows:

$$lnED_t = \beta_0 + \beta_1 lnEXR_{1t} + \beta_2 lnFD_{2t} + \beta_3 lnTOT_{3t} + \varepsilon_t$$
$$(+) \qquad (-) \qquad (-)$$

Where:

ED is External Debt measured in million dollars

EXR *is the nominal exchange rate*

FD *is the consolidated fiscal deficit (in million dollars)*

TOT *Represent the terms of trade between the domestic economy and the rest of the world (2000-01 = 100)*

All variables are reported in logarithmic form, with the theoretically expected signs of the variables indicated in parentheses.

3.2 Vector Error Correction Model (VECM)

According to Engle and Granger (1987) if two series are co-integrated of order one, *i.e.* I(1), then there must exists VECM representation in order to govern joint behavior of the series of the dynamic system. In VECM specification, short run as well as long run adjustments are made. VECM also provides information about the causal factors that may affect variables. Pre-requisites for the application of VECM are that all variables should be integrated of order 1 and there exists at least one co-

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integrating relationship among the variables. VECM specification in case of our model related to determinants of foreign debt is as follows.

$$\Delta \ln ED_{1t} = \beta_{10} + \sum_{i=1}^{p} \beta_{11,i} \Delta \ln ED_{1.t-i} + \sum_{i=1}^{p} \beta_{12,i} \Delta \ln EXR_{2,t-i} + \sum_{i=1}^{p} \beta_{13,i} \Delta \ln FD_{3,t-i} + \sum_{i=1}^{p} \beta_{14,i} \Delta \ln TOT_{4,t-i} + \beta_1 ECT_{t-1} + \varepsilon_{1t} \quad \text{..... (1)}$$

$$\Delta \ln \left(\frac{EXR_{2t}}{} \right) = \beta_{20} + \sum_{i=1}^{p} \beta_{21,i} \Delta \ln ED_{1.t-i} + \sum_{i=1}^{p} \beta_{22,i} \Delta \ln EXR_{2,t-i} + \sum_{i=1}^{p} \beta_{23,i} \Delta \ln FD_{3,t-i} + \sum_{i=1}^{p} \beta_{24,i} \Delta \ln TOT_{4,t-i} + \beta_2 ECT_{t-1} + \varepsilon_{2t} \quad \text{.....(2)}$$

$$\Delta \ln FD_{3t} = \beta_{30} + \sum_{i=1}^{p} \beta_{31,i} \Delta \ln ED_{1.t-i} + \sum_{i=1}^{p} \beta_{32,i} \Delta \ln EXR_{2,t-i} + \sum_{i=1}^{p} \beta_{33,i} \Delta \ln FD_{3,t-i} + \sum_{i=1}^{p} \beta_{34,i} \Delta \ln TOT_{4,t-i} + \beta_3 ECT_{t-1} + \varepsilon_{3t} \quad \text{.....(3)}$$

$$\Delta \ln \left(\frac{TOT_{4t}}{} \right) = \beta_{40} + \sum_{i=1}^{p} \beta_{41,i} \Delta \ln ED_{1.t-i} + \sum_{i=1}^{p} \beta_{42,i} \Delta \ln EXR_{2,t-i} + \sum_{i=1}^{p} \beta_{43,i} \Delta \ln FD_{3,t-i} + \sum_{i=1}^{p}$$

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$$\Delta \ln TOT_{4,t} = \alpha_{44,i} + \sum_{i=1} \beta_{4i} \Delta \ln TOT_{4,t-i} + \sum_{i=1} \gamma_{4i} \Delta ECT_{t-1} + \varepsilon_{4t} \quad \ldots\ldots\ldots\ldots (4)$$

Where

"Δ" is the first difference operator, "P" is the lag length, and "ECT_{t-1}" is the lagged error correction term. The term ECT_{t-1} shows degree of disequilibrium levels of the variables in the previous period. Thus above specification of the VECM states that change in a variable depends on other variables, on its own past values as well as on the degree of disequilibrium among the variables. The term ECT_{t-1} should be negative and statistically significant in order to have stable long run equilibrium path.

RESULTS AND DISCUSSION

4.1 Stationarity Results of The Variables

Optimal lag selection was conducted, and two lags were included in our model. When we applied the augmented dickey-fuller and Phillips Perron stationarity tests on our variables, none of the variables were found to be stationary at the level. Suggesting that the variables may exhibit some linear trends or seasonal breaks in the series and that variables were changing over time. When we took the first differences, all the variables such as external debt, exchange rates, fiscal deficit, and terms of trade were all stationary at their first differences.

Table 1

Variables	Augmented Dickey-Fuller	Phillip perron	Lags	AIC	BSIC	Order of Integration
External Debt	-2.893(0.000)*	-2.893(0.000)*	1	-0.22	-0.13	I(1)
Exchange Rates	-2.980(0.0138)*	-2.980(0.0153)*	2	8.17	8.77	I(1)

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Fiscal Deficit	-2.890(0.0059)*	-2.980(0.0071)*	1	4.71	4.85	I(1)
Terms of Trade	-2.978(0.000)*	-2.980(0.000)*	1	2.55	2.66	I(1)

NB: * indicates Significance at 5%

SHORT-RUN ARDL RESULTS

The R-squared of the ARDL model suggests that the independent variables explained the variation in external debt well. The short-run ARDL analysis revealed that the past values of exogenous variables have a strong, significant positive effect on external debt. The short-run results show that a one percent depreciation of the GMD increases external debt by 6.6 percent on the level and 5.0 percent on the lag value of exchange rate respectively, this result is statistically significant at both 5 percent and 10 percent significant levels. This shows that the depreciation of the domestic currency strongly responds to debt accumulation in the short run.

Table 2 Short Run Analysis

Dependent Variable: **lnExternal Debt**

Short Run Analysis

	Coefficients	t-value
Δ lnExternal Debt (L1)	0.72684	4.71
Δ Exchange Rate (L1)	0.05049	3.19
Δ lnFiscal Deficit	0.00061	0.56
Δ lnToT	0.00348	0.91

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Exchange rates have a significant positive effect on external debt, both in their past values and in the present. This suggests that a GMD depreciation significantly increases external debt accumulation in the short run.

The results suggest that the log of fiscal deficit and terms of trade indicate a negative relationship with the log of external debt, while the exchange rate is positively associated with the log of external debt.

Table 3: Correlation Matrix

	lnExternal Debt	Exchange Rate	lnFiscal Deficit	lnToT
lnExternal Debt	1			
Exchange Rate	0.97361096	1		
lnFiscal Deficit	-0.403023851	-0.617508596	1	
lnToT	-0.514386545	-0.595050148	0.457791237	1

COINTEGRATION RESULTS

The Johansen cointegration analysis suggests both trace statistics and eigenvalues. The trace statistics and the eigenvalues indicate the absence of cointegration relationships, leading to failure to reject the null hypothesis of no cointegration.

The Johansen test for cointegration revealed that no long-run relationship exists between the variables in our model. Since there was no cointegration among variables, we ran a vector autoregressive model (VAR), which also indicates the contemporaneous effect of exchange rates on external debt. This suggests that both the first and second lag of exchange rates affect external debt, and this result is significant at a 5 percent significance level.

Table 4 Johansen Co-integration

Hypothesized No. of CE(s)	Eigenvalues	Trace Statistics	5 % critical

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value			
0	.	43.4322	47.21
1	0.54076	19.3083	29.68
2	0.35990	5.4783	15.41
3	0.15807	0.1447	3.76
4	0.00466		

4.3 GRANGER CAUSALITY RESULTS

The presence of cointegration between time series may infer a Granger causality that is either unidirectional or bidirectional. The opposite, however, is not correct (Giles, 2011). According to Granger (1969), we can't depend entirely on correlation measurements when trying to understand the connection between multiple time series. This is because certain associations may be erroneous and insignificant, suggesting the existence of uncontrollable independent factors. More so, cointegration alone doesn't prove cause and effect between variables.

The null hypothesis is that lagged values of exchange rates do not Granger cause external debt. Our Granger causality results suggest that the lagged values of exchange rates Granger cause external debt with a probability of 0.001 less than a 5% significance level. However, the lagged values of external debt do not Granger cause exchange rates. Also, the lagged values of fiscal deficit and terms of trade do not Granger cause external debt. However, results suggest that the lagged values of fiscal deficit Granger cause exchange rates.

4.4 CUSUM AND CUSUM SQUARE TEST OF STABILITY

We utilize the CUSUM and CUSUM SQUARE of the recursive residuals to examine omitted variables bias and test for the stability of the model. Also, when we ran the eigenvalue stability condition, the results suggest that all our eigenvalues lie inside the unit circle, satisfying the stability condition.

Figure 1

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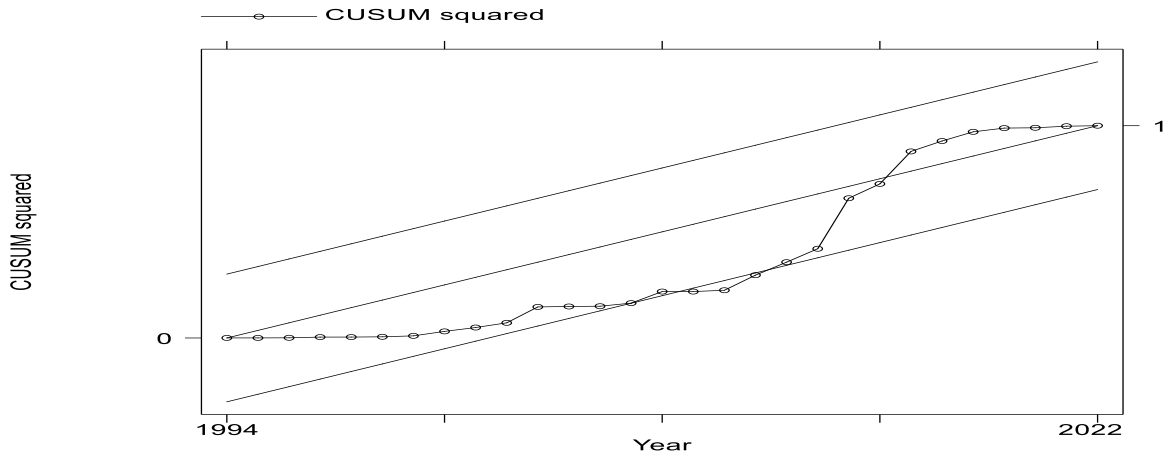

We use the LM test and the Breusch-Godfrey serial correlation to test for autocorrelation. The Jarque Bera test was deployed to test for the normality of the errors produced by the model. Furthermore, we examine heteroskedasticity using the Breusch Godfrey test. The Jaque Bera test for normality suggests that our model satisfied the normality condition and there was no serial correlation among our variables. The Durbin-Watson statistics show that there is no autocorrelation among the residuals and there no heteroskedasticity in the error term.

5. CONCLUSION AND POLICY PRESCRIPTIONS

The study makes a significant contribution by examining the important relationship between external debt, exchange rates, fiscal deficit, and terms of trade in The Gambia. The paper explores the role of exchange rate fluctuations in The Gambia's debt dynamics. The paper expands, addressing the gap in the literature with the introduction of fiscal deficit and terms of trade in our model using data spanning from 1992 to 2022. The stationary test revealed that all our variables were stationary after their first difference, using both the Augmented-Dickey Fuller and Phillip Perron unit root tests. Furthermore, a Johansen Co-integration test was conducted to check for long-run convergence. Results show that there was no long-run relationship among the variables under review. The ARDL short-run results show

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that a one percent depreciation of the GMD increases external debt by 6.6 percent on the level and 5 percent on the lag value of the exchange rate respectively, this was statistically significant at both the 5 percent and 10 percent level. This shows that the depreciation of the domestic currency strongly responds to debt accumulation in the short run. We further deployed a VAR model to confirm the results of the ARDL estimation, results suggest that both the first and second lag of exchange rates affect external debt and this result is significant at a 5 percent significance level.

Therefore, the study recommends that Policymakers must conduct effective debt sustainability analysis (DSA) to determine policies and the level of fiscal deficit that can sustain debt. A strong and comprehensive conceptual framework for assessing external debt sustainability needs to be developed. Policymakers must develop key metrics to assess reserve adequacy during short-term imbalances and develop a strategy to make macroeconomic adjustments sustainable and resilient over the short and medium term. Policies must be aimed at reducing debt to GDP ratio below 60 percent and discourage debt overhang. Finally, policymakers must aim at encouraging exports and discouraging imports to reduce the continuous depreciation of the domestic currency against foreign currencies.

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