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ARTICLE

Public Debt, Corruption Control and Economic Development in Ecowas Countries

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Abstract
This paper examines the effects of public debt on economic development when mediating with corruption control in the ECOWAS states. This paper's primary goal is to evaluate if corruption control moderates the effect of domestic debt on real GDP in ECOWAS countries, empirically evaluate that impact and offer appropriate policy recommendations. This paper uses secondary panel data from the World Development Indicators (WDI), African Development Bank (AfDB), and World Governance Indicators (WGI) spanning the period 1996-2022 for ECOWAS members' states. This study used real gross domestic product (GDP) and domestic debt as explained and explanatory variables, respectively, while corruption control serves as the moderating variable. The PARDL result shows that that there is evidence of both short and long-run symmetric relationship between domestic debt and real GDP with and without corruption control. However, the effect is better pronounced when corruption is controlled. Comparatively, domestic debt has positive and negative nexus with real GDP in the short- and long-run, respectively, while corruption control maintains a significant positive association in the short- and long-run. Finally, the study concluded by underscoring the pivotal role of domestic debts on real GDP in ECOWAS countries by further control of corruption is necessary for strengthening economic development.

Keywords: Domestic debt, Panel ARDL, corruption control, economic development**.**

JEL Classification: D73, F63, H63, C23

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1. Introduction

The escalation of public debt in various countries, particularly in the aftermath of the global financial crisis, has prompted significant debate regarding its implications for long-term economic growth (**Aladejare, 2022a**). This paper delves into the nexus between public debt, corruption, and economic development within the Economic Community of West African States (ECOWAS). While acknowledging the role of the financial crisis in exacerbating the debt problem, attention is also directed towards underlying structural issues that perpetuate high levels of debt (**Dar & Amirkhalkhali, 2014**). Public debt is recognized as a critical measure of a nation's financial stability, often arising from a shortfall in tax revenues necessitating borrowing to meet public spending requirements

(**Hilton, 2021**). However, while borrowing can be a necessary tool for economic development, its accumulation must be carefully managed to avoid adverse effects on growth.

Economic theory posits that borrowing, when done at reasonable rates, can foster economic growth, particularly in developing countries like those within ECOWAS (**Aqeeq & Chamadia, 2023**). The utilization of borrowed funds for productive investments, along with macroeconomic stability, is crucial for ensuring positive outcomes and poverty reduction (**Egbetunde, 2012**). Nonetheless, the heavy burden of external debt faced by many ECOWAS nations poses challenges in fulfilling financial commitments and can impede progress (**Aladejare, 2023**). Recent borrowings from entities such as the Exim Bank of China have contributed to the region's rising external debt, emphasizing the need for prudent debt management strategies (**DMO, AFDB, 2022**). Corruption emerges as a significant impediment to economic development within ECOWAS countries, exacerbating the debt burden and hindering progress in critical sectors (**Appiah et al., 2019**). High levels of poverty, unemployment, and income inequality underscore the limited impact of borrowed funds in addressing socioeconomic challenges (**AFDB, 2020**). Moreover, corruption undermines transparency, good governance, and efficient resource utilization, thereby thwarting efforts to achieve sustainable development (**Chiyemura et al., 2022**). Addressing these challenges necessitates comprehensive policies that promote transparency, accountability, and effective governance to mitigate the detrimental effects of corruption on economic stability and progress (**OECD, 2020**).

The interplay between public debt, corruption, and economic development within ECOWAS presents complex challenges that demand thorough investigation (**Okwara & Egbu, 2019**). While existing literature has explored these elements individually, there remains a gap in research that comprehensively examines their interconnectedness, particularly within the ECOWAS context (**Seyram et al., 2019**). Bridging this gap is crucial for informing policymakers and scholars about the multifaceted dynamics shaping economic development in the region. By understanding how corruption mediates the relationship between public debt and economic development, policymakers can devise effective strategies to promote sustainable growth and mitigate the adverse effects of corruption on socioeconomic progress in ECOWAS countries (**Tarawallie & Jalloh, 2021**).

Following this section, we structure the rest of the paper as follows. Section 2 provides the literature review for the study while Section 3 explains the methodology applied for economic fundamentals and nominal exchange rate nexus, as we present the dynamic heterogenous panel data model and the discussion of results. Section 5 however concludes the paper.

Table 1: Economic Forecast: ECOWAS (real GDP growth; per cent)

Countries	2022	2023*	2024*
Benin	6.0	6.0	5.9
Burkina Faso	2.5	4.9	5.9
Cabo Verde	10.5	4.4	5.4
Cote d'Ivoire	6.7	6.2	6.6
The Gambia	4.4	5.6	6.3
Ghana	3.2	1.6	2.9
Guinea	4.3	5.6	5.7
Guinea Bissau	3.5	4.5	5.0
Liberia	4.8	4.3	5.5
Mali	3.7	5.0	5.1
Niger	11.1	6.1	13.0
Nigeria	3.3	3.2	3.0
Senegal	4.7	8.3	10.6
Sierra Leone	2.8	3.1	4.8
Togo	5.4	5.5	5.7

**Projection*

Source: Authors' compilation

2. Literature Review

The pursuit of economic growth stands out as a fundamental macroeconomic goal for nations globally, given its pivotal role in fostering economic development. Without sustained economic growth, achieving meaningful progress becomes improbable. Economic growth, predominantly understood in quantitative terms, denotes an increase in GDP or GDP per capita over a specific period, usually a year, adjusted for inflation. **Griffin and Maddison (1970)** and **Jhingan (2011)** characterize economic growth as a sustained and quantitative upsurge in a nation's per capita income, concomitant with expansions in the labour force, consumption, capital, and trade volume. **Zhattau (2013)** underscores economic growth as the bedrock for heightened prosperity. In contrast, economic development, a more subjective notion than economic growth, eludes quantification and measurement. Factors such as quality enhancement, risk mitigation, innovation, and entrepreneurship drive The Table presents economic forecasts for ECOWAS countries, focusing on real GDP growth rates for the years 2022, 2023, and projections for 2024. Real GDP growth rates serve as indicators of economic performance and provide insights into the trajectory of economic development within each country.

Interpreting the table alongside the discussion on economic growth, it becomes evident that there is variability in growth rates among ECOWAS countries. For instance, some countries like Cabo Verde and Senegal exhibit relatively high growth rates, with Cabo Verde showing a substantial growth rate of 10.5% in 2022. This suggests robust economic activity and potential opportunities for prosperity in these nations. Conversely, other countries such as Ghana and Nigeria experience lower growth rates, reflecting challenges or constraints in their economies.

High levels of corruption can hinder economic growth by distorting market mechanisms, deterring foreign investment, and undermining public trust in institutions (**Appiah et al., 2019**). Therefore, countries with lower growth rates may also be grappling with corruption-related issues that impede their economic potential.

Furthermore, the variability in growth rates across ECOWAS countries underscores the need for tailored policy responses. Countries with high growth rates may need to focus on sustaining momentum and ensuring inclusive growth, while those with lower growth rates may need to address underlying structural issues such as corruption, inefficient governance, or inadequate infrastructure (**Fagerberg et al., 2013**).

In conclusion, the economic forecasts presented in the table provide valuable insights into the economic outlook for ECOWAS countries. However, to fully understand and address the challenges and opportunities presented by these forecasts, it is essential to consider factors such as corruption, governance, and structural reforms in crafting effective policies for sustainable economic development.

economic growth. Market dynamics and macroeconomic conditions significantly influence economic growth, with a focus on microeconomic aspects such as business opportunities and input quality. Additionally, economic growth is influenced by institutions, social capital, labour and capital mobility, as well as income and wealth equality (**Song et al., 2021**).

Corruption manifests in various forms and is shaped by economic, political, administrative, social, and cultural factors (**Appiah et al., 2019**). Scholars and policymakers have increasingly recognized the nuanced and multifaceted nature of corruption, particularly as it encompasses the misuse of public office for personal gain (**Kaufmann et al., 2019**). Corruption detrimentally impacts economic growth, political stability, and social cohesion.

2.1 Theoretical Issue

This study is grounded in the theories of **Solow (1956)** and **Chenery (1967)**, pivotal in understanding economic growth and productivity. These theories emphasize labor productivity and technological advancements as key drivers of economic development, moving beyond earlier models focused solely on capital accumulation. **Chenery and Strout (1966)** introduced the two-gap approach to economic development, which identifies foreign exchange and savings gaps as separate constraints in achieving desired growth rates in less developed countries (LDCs). They argue that external finance, such as grants or debt, can bridge these gaps to reach target growth rates. A key assumption is that these gaps are independent and unequal in magnitude, with one dominating over the other at any given time in any less developed country (**Todaro & Smith, 2004**). Assuming a fundamental Keynesian macroeconomic identity in which the aggregate output equals the aggregate expenditure $(Y = AE)$ such that

$$Y = C + I + (X - M) \quad (1)$$

where: Y = national income; C= consumption; I= investment (or domestic capital formation); X = exports; and M = imports. By subtracting C from both sides, the resulting equation is: $Y - C = I + (X - M)$, where $(Y - C) = S$ (domestic savings). Thus, these two constitute two separate constraints, and eliminating one does not eliminate the other since it is assumed that domestic

investment can be financed through domestic savings and capital inflows (F), where: $F = M - X$ the equation may be presented as

$$F = I - S(or\ I{=}F{+}S) \quad (2)$$

Thus, savings may be too small to permit the level of investment the country would otherwise undertake; hence, a *savings gap* exists. Similarly, exports may be too small to permit the level of imports required for efficient use of the economy's resources of the economy; thus, a *foreign exchange (or trade) gap* exists. The *two-gap* theory is adopted based on its relative importance in capital flow analysis.

It helps estimate the less-developed country's capital requirement for growth; in terms of how much capital can be generated within the economy and the requirement through foreign sources to achieve the target growth rate. In addition, it aids a proper understanding of the extent to which foreign resources are required to fill the savings and foreign exchange gaps to attain sustainable development. Also, the divergence between the two gaps highlights the role of external finance in economic development. If the *savings gap* exceeds the *foreign exchange gap,* it may be narrowed by the inflow of capital; and the foreign exchange gap between investment and savings will be bridged in the long-run; hence the *two-gap* model comes into play. Alternatively, if the *foreign exchange gap* exceeds the *savings gap*, external finance increases investment and economic growth.

Additionally, in order to examine the impact of corruption on economic growth, the augmented Solow Growth Model, propounded in 1956, has been adopted from the studies conducted by **Coupet Jr (2011)**, who modified the Solow model to incorporate the impact of corruption on the level of productivity in a country.

Assuming an economy that concentrates on the production of a single commodity with a given Neo-classical production function:

$$Y_t = K_t^{\alpha} H_t^{\beta} [A_t(\rho) L_t]^{1-\alpha-\beta} \quad (3)$$

where: where Y_t is the aggregate level of real income, K_t is the level of physical capital, H_t is the level of human capital, L_t is the amount of labour employed, A_t is the level of multifactor productivity, and ρ is the level of corruption in a country; such that $A'(\rho) < 0$ Supposing that $0 < \alpha < 1, 0 < \beta < 1, and\ \alpha{+}\beta{<}1$, the production function is assumed to exhibit a positive yet diminishing marginal returns to labour and capital:

$$\frac{dK}{dt} = S_k Y_t - \delta_k K_t \quad and \quad \frac{dH}{dt} = S_H Y_t - \delta_H H \quad (4)$$

Where S_H, S_k, δ_H and δ_k are exogenous parameters, which represent the shares of income that are allocated to human capital investment, physical investment, and depreciation rates of human and physical capital, respectively. Population is assumed exogenously determined and defined as $L_t = L_o e^{nt}$ so that the population growth is constant over time, i.e., $(dL/dt \big/ L_t = n^2$

Also, if At represents the economy's multifactor productivity, then:

$$A_t(\rho) = A_t e^{-\gamma\rho},\ where\ 0 \le \rho \le 1\ and\ A_t = A_o e^{gt} \quad (5)$$

Corruption is being incorporated into this model, which is assumed exogenous, and deteriorates input productivity. This deterioration may take various forms, ranging from the effects of externalities to the diminished quality of inputs. The firm who pays a bribe to a bureaucrat to avoid fines not only reduces its level of investment, but it may also impose externalities onto other firms. When a high government official makes an attempt to provide public goods by doing business with his unqualified cronies, this comes at the cost of reduced productivity in the private sector (**Tanzi & Davoodi, 1998**). Hence, the corruption parameters, ρ and γ, jointly the influence the effects of corruption on multifactor productivity. While, ρ alone measures of the economy's overall level of corruption, γ captures the sensitivity of corruption to the production function (**Coupet Jr, 2011**).

The conventional multifactor productivity, A_t, is assumed exogenous and grows at rate g, thereby implying that: $dA_t \big/ d\rho < 0$, while $d^2 A_t / d\rho^2 > 0$. Therefore, in the absence of corruption (such that $\rho = 0$ =0), $A_t = A_t$; a positive (or negative) value of ρ results in corruption reducing (or improving) the multifactor productivity, since the value and sign of γ are instrumental in modeling the net effect of corruption on multifactor productivity

In line with the Two-Gap and the modified-Solow Growth theories, as well as existing studies, such as that of **Lamdsdorff (2005)**, **Eberhardt and Presbitero (2015)**, as well as **Leff (1964)**, the model is specified to test the empirical relationships between public debt, external and domestic debts, corruption practice

corruption control index and economic development indicators in the successive section.

2.2 Empirical Review

Ofurum and Fubara (2022) examined the effects of government borrowing on Nigeria's economy. The analysis employed Granger Causality, Autoregressive Distributed Lag, and Augmented Dickey-Fuller (ADF). The research found that neither external debt nor its servicing had a notable effect on Nigeria's real GDP or unemployment rates. The study concludes that the importance of natural resource utilization in the Nigerian economy should be considered, even though foreign debt servicing has a negative but negligible impact on real GDP.

Lotto and Mmari (2018) studied the impact of domestic debt on economic growth in Tanzania using OLS regression. They found an insignificant negative relationship between domestic debt and economic growth. Factors like increased domestic borrowing, lending patterns of financial institutions, and misallocation of borrowed funds may explain this. Control variables like inflation, gross capital formation, foreign direct investment, export, and government expenditure showed expected relationships with GDP growth, with exports having a significant positive impact. However, increased government spending funded by taxes or borrowing negatively affected GDP growth.

The effects of corruption on South Africa's democratic institutions and economic growth were studied by **Mlambo et al. (2019)**. The study's findings, based on qualitative data, indicate that corruption has a detrimental effect on Africa's economic growth and development. The study's data is considered to be outdated. The economic climate of the country, and the world at large, may have undergone significant shifts in the interim.

Azam (2021) investigated the impact of governance on economic growth. With data from 14 Latin America and Caribbean Countries, the study used autoregressive distributed lag (ARDL)/pooled mean group (P.M.G.) estimation methodology to analyse the data. The study finds that corruption has a negative impact on economic growth, while political stability and government effectiveness have positive effects in the long run. The results suggest that reducing corruption, improving government effectiveness, and maintaining political stability are crucial for promoting economic growth and enhancing social welfare through good governance.

Another study by **Alfada (2019)** examined the relationship between corruption and economic Growth in ASEAN Member Countries. The researcher employed Sample-splitting and threshold models and two-stage least squares (2SLS) estimator. The results of the estimation indicate that countries with corruption levels exceeding the second threshold of 80 experience a more substantial negative impact of corruption on economic growth. However, the study is limited by the choice of instrument. It also did not use post-estimation tests in the threshold model, including marginal effects and plots.

Osinubi et al. (2021) conducted a similar study to examine corruption's impact on Nigeria's tourism. They used the autoregressive distributed lag (ARDL) technique to analyse the data collected. The study found a negative impact of corruption on tourism in both the long and short run, with individual income and foreign direct investment also affecting tourism. These results support the "sanding the wheels" hypothesis.

Sloboda (2020) conducted an empirical study to discover what factors contribute to GDP growth in ECOWAS member states. ECOWAS economic growth was found to be significantly influenced by inflation, GDS, and TFP with panel unit root tests, panel cointegration tests, and dynamic panel data regression. The research shows that governments in ECOWAS countries can see positive changes in quality of life after adopting growth-friendly policies.

3 Methodology

3.1 Data and Sources

The secondary data sources are used in this study. The nature of the data is formed by pooling the cross-section and time series data composed of annual data on real GDP – a proxy for economic development – domestic debt and corruption control for the ECOWAS countries. The data spans from 1996 to 2022, and the selected ECOWAS countries include Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The data on rGDP, DD, and CCI are obtained from the World Development Indicators (WDI), African Development Bank (AfDB) and World Governance Indicators (WDI), respectively.

3.2 Model Specification

The study is premised on the objective of examining the mediating roles of corruption control on public debts on economic growth. In light of this, a regression model specification was specified to measure how corruption control mediates the effects of domestic debts on economic development – real GDP. The functional relationship for the role of corruption control in mediating the impact of domestic debt on real GDP

emanated from the work of **Udeh (2016)**, Fincke and **Greiner (2015)** and **Didia and Ayokunle (2020)** thus:

$$lrgdp = f(ldd, cci, ldd * cci)$$

Similarly, as stated under the objectives, the mediating role of the corruption index is also examined for the connection between domestic debt and real GDP. Hence, this model:

$$\Delta lrgdp_{it} = \partial_{9i} lrgdp_{i,t-1} + \theta_{9i} + \varphi_{9i} ldd_{i,t-1} + \delta_{9i} cci + \beta_{9i} ldd_{i,t-1} * cci_{i,t-1} + \sum_{j=1}^{r} \pi_{9ij} \Delta lrgdp_{i,t-j} + \sum_{j=0}^{s} \eta_{9ij} \Delta ldd_{i,t-j} + \sum_{j=0}^{t} \xi_{9ij} \Delta cci_{i,t-j} + \sum_{j=0}^{u} \zeta_{9ij} \Delta ldd_{i,t-j} * cci_{i,t-1} + \varepsilon_{9i} + \nu_{9it} \quad (6)$$

cci_{it} is the mediating variable which denotes the corruption control index for the individual country *i* over a specified period *t*.

θ_i is the member states-specific intercept.

Δ indicates the first difference operator.

ε_i is for the country-specific effects; and

ν_{it} connotes stochastic disturbance term.

Meanwhile, the short-run impact of the domestic debt, corruption control index, the interaction of domestic debt and corruption control index on real GDP are η_{2ij}, ξ and ζ, respectively. In addition, $-\varphi_{3i}/\partial_{3i}$, $-\delta_{3i}/\partial_{3i}$ and $-\beta_{3i}/\partial_{3i}$ measures the long-run effect of domestic debt, corruption control index, and the interaction of domestic debt and corruption control index on real GDP, respectively.

3.3. Estimation Method

Panel Autoregressive Distributed Lag was used in this research. Given the heterogeneous nature of the PARDL models, the assumption of homogeneity of slope parameters is often inappropriate, hence, the careful choice of estimation techniques. The PARDL (p,q) in error correction form is:

$$\Delta y_{it} = \theta_i \left[y_{i,t-1} - \vartheta_{0i} - \vartheta_{1i} x_{i,t-1} \right] + \sum_{j=1}^{p} \phi_{ij} \Delta y_{i,t-i} + \sum_{j=0}^{q} \delta_{ij} \Delta x_{i,t-j} + \mu_i + \upsilon_{it} \quad (7)$$

In a more compact form, the PARDL (p,q) can be specified as:

$$\Delta y_{it} = \theta_i \varepsilon_{i,t-1} + \sum_{j=1}^{p} \phi_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta x_{i,t-j} \mu_i + \upsilon_{it} \quad (8)$$

Where is the first difference operator, δ_{ij} measures the short-run relationship between the two variables, θ_i measures the speed of adjustment in the system which corrects for deviation of short-run dynamic to the long-run equilibrium

Since the ARDL specified here is expressed in panel form, the usual procedure of selecting optimal lag when using time series is not applicable. Technically, in the Panel ARDL, there are as many time series ARDL equations as the number of cross-sections. Thus, using any of the conventional model selection criteria, cross-sections may exhibit different optimal lags. Therefore, choosing the optimal lag combination for the Panel is usually computationally demanding. Given this, we consider PARDL (1,1) as follows:

$$\Delta y_{it} = \theta_i \left[y_{i,t-1} - \lambda_{0i} - \lambda_{1i} x_{i,t-1} \right] + \delta \Delta x_{it} + \mu_i + \upsilon_{it} \quad (9)$$

Where;

λ_{0i} *and* λ_{1i} captures the long run parameters and δ_i captures the short run. The evidence of long-run relationship if θ is significantly negative and satisfies the stationarity condition; otherwise, there is no long-run.

The equation (3.24) can be estimated with the Mean Group (MG) estimator of **Pesaran and Smith (1995)** and the Pooled Mean Group (PMG) estimator of **Pesaran et al. (1997,1999)**. The MG estimator allows for variations in all the relevant parameters across the groups both in the long-run and short-run, making the MG parameters unweighted means of the individual coefficient. The MG estimator computes the coefficient as:

$$\theta = N^{-1} \sum_{i=1}^{N} \theta_i \quad (10)$$

$$\delta = N^{-1} \sum_{i=1}^{N} \delta_i \quad (11)$$

Hence, the null and alternative hypotheses for testing for co-integration in the model can be give as:

$$H_0 : \theta_i = 0;\ H_i : \theta_i < 0$$

The PMG estimator on the other side only allows the intercept and short-run coefficients to differ across the groups but constrains the long-run coefficients to be

equal. Therefore, the null and alternative hypotheses for co-integration in this case can be given as:

$$H_0 : \theta_i = \theta = 0;\ H_i : \theta_i = \theta < 0$$

The MG estimator fits separate models for each cross-section units and therefore allows the intercepts, slope (short and long run) coefficients, and error variances to differ across groups.

The PMG estimator allows the intercept, short-run coefficients, and error variances to differ across the groups like the MG estimator but constrains the long-run coefficients to be equal across groups. The difference between MG and PMG is that the both allows differences across the groups except the long run coefficients which the former allows to vary across units. While the MG estimator relies on estimating N time-series regressions and averaging the coefficients, whereas the PMG estimator relies on a combination of pooling and averaging of coefficients. Finally, The Hausman test assists us to choose between the two alternative estimators, where PMG is the restricted model under the null. MG is the unrestricted under the alternative. Hence, the statistical significance of the Hausman test indicates that MG is preferred, otherwise, the PMG is preferred.

4 Results and Analysis

4.1 Panel unit root test results

As a prerequisite for macro panels with large T, we subject the relevant variables to a panel unit root test. The dynamic heterogeneous panel data model – the preferred model in this study – is usually considered where non-stationarity is a concern. We consider both the stationarity test – Hadri, 2000 LM test – and the nonstationary tests – **Harris & Tzavalis, 1999; Breitung, 2000; Levin, Lin & Chu (LLC), 2002; Im, Pesarab & Shin (IPS), 1997** and ADF Fisher tests. The unit root test results as shown in Table 2 for Harris & Tzavalis (rho), LLC, Breitung and ADF Fisher are mixed – [I(0) and I(1)] – while IPS and Pesaran CD tests are integrated of order zero[I(0)], with Breitung test integrated of order one [I(1)]. Since the underlying framework for estimation allows for the combination of both I(0) and I(1), in so far as the level of stationarity does not exceed I(1); the mixed order of integration for certain variables in the model is not expected to bias our estimates.

Table 2: Panel Unit Root Tests

Test Method	*lrgdp*	*ldd*	*cci*
Null Hypothesis: Unit Root with common process			
Harris-Tzavalis [rho]	-31.1115***[b]	-4.0550***[a]	-2.4898***[a]
Breitung [t-stat.]	-8.3078***[b]	-1.3131*[a]	-3.2718***[a]
LLC [t*]	-9.0139***[b]	-1.6172*[a]	-8.7016***[b]
Null Hypothesis: Unit Root with Individual process			
IPS (*W Stat*)	-9.2398***[b]	-11.3914***[b]	-10.0800***[b]
ADF Fisher [Chi-square]	-0.5064	3.7191***[b]	5.9462***[b]
Null Hypothesis: Unit Root with cross-sectional dependence			
Pesaran CD test [z[t-bar]]	-2.578***[b]	-2.281**[a]	-2.487***[b]
Null hypothesis: No unit root with common unit root process			
Hadri [Z-stat.]	0.9804[b]	-2.1662[b]	0.3098[b]
Number of Cross-Sections	18	18	18
Number of Periods	192	192	192
Total Number of Observations	3456	3456	3456

Source: Authors' compilation

Note: a and b denote stationarity at level and first difference, respectively, while ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

4.2 Linear Panel Coefficient Estimates

We first estimated the PARDL model with the MG, PMG and DFE estimators and then subjected the results from these estimators to the Hausman test. The PMG estimator was the efficient estimator under the null, while the MG estimator was the efficient estimator under the alternative hypothesis. Our Hausman test results substantially support the PMG estimator as the efficient estimator for modelling the asymmetric association among the variables. Hence, only the results obtained from the preferred estimator are reported and discussed in this study.

The long-run dynamics

The results from Table 3 show that in the long run, domestic debt exerted a negative and significant relationship with the dependent variable – RGDP –

during the study period across the countries studied. From the estimated model, as the countries' domestic debt (DD) decreases by 1 per cent, it brings about a 1.690 per cent increase in these countries' real GDP, *ceteris paribus.* Furthermore, the negative nexus between DD and rGDP is established to be statistically significant as revealed in Table 3, as the probability value is less than the 0.05 significant level. In the same vein, the introduction of the moderating variable – corruption control index (CCI) – in the model shows a positive and significant impact of the corruption control index on real GDP, as the corruption control is being strengthened with action, it brings about an 8.434% increase in the real gross domestic product (rGDP) of these countries, although significant at 5 %.

To address one of the cruxes of this study, the coefficient of the nonlinear models (DD*CCI) reveal that the interaction effect – DD*CCI – is statistically significant at the 5% levels. Furthermore, since the coefficient of DD is statistically significant, we must compute the net effects. Finally, there is a net effect of -2.34% for every 1% increase in domestic debt given the current average corruption control in ECOWAS countries studied

The net effect of domestic debt (DD) conditioned upon corruption control is computed as follows:

$$\frac{\partial rGDP}{\partial DD} = -1.690 + \left(1.108 \times \overline{CCI}\right)$$

$$\frac{\partial rGDP}{\partial DD} = -1.690 + \left(1.108 \times -0.59\right) = -1.690 - 0.654 = -2.344$$

These net effects show that appropriate and timely corruption control implementation could gear self-discipline among public servants of these ECOWAS countries, reducing the domestic debt by intensifying revenue collection and coverage net, which could lead to the availability of more funds that could be used to finance the budget and enhance real GDP

.

Table 3: Domestic Debt and Corruption Control on Economic Development in the Economic Community of West African States.

Variables	MG	PMG	DFE
δ^{ldd}	-0.0642**	0.248***	0.00365
	(0.0297)	(0.0356)	(0.00692)
δ^{cci}	0.458	3.514***	0.534
	(0.634)	(0.250)	(0.616)
$\delta^{ldd*cci}$	-0.0725	0.515***	-0.0876
	(0.0962)	(0.0371)	(0.0936)
Constant	0.686	0.0351*	1.710***
	(0.438)	(0.0195)	(0.270)
λ^{ldd}	0.291	-1.690***	0.0714
	(0.372)	(0.365)	(0.101)
λ^{cci}	-1.573	8.434***	2.471***
	(3.291)	(2.668)	(0.753)
$\lambda^{ldd*cci}$	0.297	1.108***	-0.301***
	(0.517)	(0.305)	(0.115)
γ^{ect}	-0.0642**	-0.190***	0.00365
	(0.0297)	(0.0257)	(0.00692)
Hausman Test (X_k^2)		1.46	23.22
		(0.7784)	(0.0034)
N	15	15	15
Observation (NT)	390	390	390

Source: Authors' compilation

Note: DD is domestic debt, CCI is corruption control index and DD*CCI is the interaction between domestic debt and the corruption control index. The values in parentheses are the standard errors. The $\lambda s'$ are for the long run, while the $\delta s'$ are for the short run. ***, ** & * imply significance at the 1%, 5% and 10% levels, respectively.

Short-run Dynamic

The existence of the speed of adjustment back to long-run equilibrium using the error correction term (ECT) to evaluate the statistical significance of short parameters as observed under the long run. For the error correction term (ECT), the speed of adjustment coefficient is negative and statistically significant as required $(ect_{t-1} = -0.190, p < 0.01)$. The coefficient of -0.190 indicates that about 19.0% of the short-run deviations from the long-run equilibrium is corrected annually. Alternatively, the adjusted is calculated by taking the inverse of the absolute value of the ECT to show how long it takes for the deviations from disequilibrium to return to equilibrium (**Pao & Tsai, 2010**). Therefore, the adjusted speed for this study is 5 years 2 months (i.e., $1/0.190$), which implies that it would take about 5 years and 2 months

for short-run deviations from the long-run to be corrected.

The estimated short-run results from Table 3 show that domestic debt (DD) and its interaction with corruption control exerted a significant positive relationship with real GDP during the study period across the countries studied except corruption control (CCI) which has a significant positive relationship with real GDP. Furthermore, as the countries' domestic debt (DD) decreases by 1 per cent, it brings about a 0.248 per cent increase in the ECOWAS countries' real GDP, *ceteris paribus.* This negative association between DD and real GDP is established to be statistically significant as revealed in Table 2, with a probability value which is less than the 0.05 significant level. Also displayed in Table 2 is the positive effect of corruption control in ECOWAS countries on the real GDP, indicating that as corruption control increases in these countries, it brings a surge in rGDP, as a 1 % increase in CCI leads to a 3.514% increase in real GDP, *ceteris paribus*. The positive effect of CCI on real GDP was attested to be statistically significant at 5%, as the *p*-value is less than the significant level.

In the same vein, the introduction of the moderating variable – corruption control (CCI) – in the model shows a significant negative impact of corruption control on real GDP, as the governments of these ECOWAS countries strive to control corruption and corrupt practices, it brings about a 0.515 per cent increase in real gross domestic product of these countries.

The coefficient of the nonlinear variables (*DD*CCI*) in the short run reveals that the interaction effect is statistically significant at 5%levels. Furthermore, since the coefficient of domestic debt and its interaction are significant, the net effect is computed. When DD was not moderated with corruption control, it only brought about 0.248 % increase in real GDP, but when corruption was controlled, it brought about 0.515% increase in real GDP. The net effect of DD when corruption control is accounted for is 0.552%. This implies that there is a net effect of 0.552% increase in real GDP for every 1% increase in domestic debt given the current average corruption control in ECOWAS countries.

The net effect of DD conditioned upon CCI in the short run is computed as follows:

$$\frac{\partial rGDP}{\partial DD} = 0.248 + \left(0.515 \times \overline{CCI}\right)$$

$$\frac{\partial rGDP}{\partial DD} = 0.248 + \left(0.515 \times -0.59\right) = 0.248 + 0.304 = 0.552$$

4.3 Discussion of Findings

The RGDP-domestic debt nexus when corruption is controlled explicitly shows that there was the existence of short and long-run impact of domestic debt on real GDP without and with corruption control, hence it was concluded that domestic debt and corruption have a significant impact on real GDP, likewise they're interactive. It was further established that when corruption is controlled, domestic debt has more impact on real GDP. This view was in line with the submission of **Sinha (2022), Soh et al. (2021), Sharma and Mitra (2019), Benfratello et al., (2017), Lartey et al. (2018)** where they asserted and concluded empirically that corruption control affects public debt negative influence on economic development. It should be of note that these studies differ from the current study either in scope or methodology, but still concluded similarly.

Meanwhile, the estimated models' result depicts that domestic debt when corruption Is controlled significantly impacts real GDP as upheld **by Benfratello et al. (2017), Epaphra (2021), Liu et al. (2017), Runstler and Smith (2019), Omotor (2021), Owusu-Nantwi & Owusu-Nantwi (2023)**. Whereas, the studies of **Onafowora and Owoye (2019), Peter et al., (2021), Rafindadi and Musa (2019),** and **Ozekicioglu and Tülümce (2020)** found that sometimes corruption control has a minimal effect on domestic debt influence on economic development in countries where rule of law and other institutional quality are adhered to strictly. They argued that if corruption is controlled through some government institution and there is no willingness on the judiciary arm to properly convict or execute a severe penalty on any corrupt official, the aims might not be effectively achieved. However, few of them (**Philips & Perron, 2020; Sekrafi & Sghaier, 2018**) agreed that if corruption is strictly controlled to the barest minimum, domestic borrowings will be efferently and effectively managed and will not impede economic development as established in this current study.

5. Conclusion and Policy Recommendation

The study concluded that public debt and corruption affected economic development in ECOWAS. When corruption was moderated for, public debt enhanced economic development. The study highlights the significant impact of public debt on economic development when corruption is controlled across ECOWAS countries. Results from the PMG analysis reveal that when corruption control moderates' domestic debt influence, substantial impacts are observed across the same indicators, indicating the complex interplay between debt, corruption, and economic development in the region.

Considering these findings, several recommendations

are proposed to enhance economic development in ECOWAS countries. The study therefore recommended that savings and revenue mobilization should be improved to reduce debt and anti-corruption agencies should be further strengthened to reduce corruption. Efforts should also be directed towards addressing the rising levels of external indebtedness by exploring alternative sources of capital for investment and implementing stringent measures to combat corruption. Moreover, effective corruption control measures are crucial for mitigating the adverse effects of domestic debt on economic development, thereby fostering sustainable growth and productivity across the region.

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