POLAC INTERNATIONAL JOURNAL OF ECONS & MGT SCIENCE (PIJEMS)
DEPARTMENT OF ECONOMICS & MANAGEMENT SCIENCE
NIGERIA POLICE ACADEMY, WUDIL-KANO

PUBLIC DEBT AND CAPITAL FORMATION IN NIGERIA AND GHANA: A COMPARATIVE ANALYSIS

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Abstract

This study investigates the impact of public debt on Gross Fixed Capital Formation (GFCF) in Nigeria and Ghana, providing a comparative analysis of how foreign debt shapes capital formation and economic growth in both countries. Using timeseries data and the ARDL modeling technique, the findings reveal that public debt positively influences GFCF in both countries, with a stronger effect in Ghana. In Ghana, national savings contribute positively to capital formation, while in Nigeria, the impact is weak and negative, highlighting disparities in savings mobilization and utilization. Interest and exchange rates exert a more significant influence in Nigeria, though with mixed effects, whereas Ghana demonstrates a more stable macroeconomic relationship. The results underscore the critical role of public debt in driving investment, especially in Ghana, and confirm the presence of effective error-correction mechanisms in both countries. Ghana's model also shows higher explanatory power, suggesting a better alignment between its economic variables and capital formation. Based on these insights, the study recommends that Nigeria prioritize the efficient use of public debt, enhance savings mobilization, and work toward exchange rate stability. For Ghana, the focus should be on strategic allocation of debt to development projects, boosting national savings, and maintaining macro-stability to attract investment. Future research should delve into sector-specific effects, the role of governance, and conduct regional comparisons to inform broader strategies for capital formation across Africa.

Keywords: Public Debt, Capital Formation, Nigeria, Ghana

1. Introduction

Public debt and its implications for capital formation remain central to economic policy debates in developing countries, particularly in Sub-Saharan Africa. In Nigeria and Ghana, this relationship is crucial due to its effects on economic growth, investment, and infrastructure development. Over the years, both nations have adjusted their fiscal and debt strategies in response to internal and external pressures. This study examines the impact of foreign debt on capital formation in Nigeria and Ghana, with specific interest in why foreign debt seems to influence capital formation more significantly in Ghana than in Nigeria (Olaoye, 2023).

Historically, public debt has been used in both countries to finance infrastructure and stimulate growth. However, excessive borrowing has often led to debt overhang, reducing investment in productive sectors and weakening capital formation (Abille & Mpuure, 2020; Olaoye, 2023). Nigeria's debt grew sharply from the 1980s through the 2000s, culminating in a crisis due to heavy reliance on external borrowing (IMF, 2021). More recently, domestic debt has dominated, with external debt rising to over 46.41% of GDP by 2023 (CBN, 2023). This increasing burden, often diverting funds from capital projects, has raised concerns about a crowding-out effect on public investment (Ajakaiye et al., 2014).

Ghana followed a somewhat similar path. Low debt levels before the 1980s increased due to economic mismanagement and commodity price shocks. The Structural Adjustment Program of the 1980s led to increased external borrowing (Aryeetey & Baah-

Boateng, 2007). By 2020, Ghana's debt-to-GDP ratio had peaked above 70%, leading to participation in the HIPC initiative (Asravor et al., 2023). Though efforts at restructuring have been made, rising debt 84.90% of GDP by 2023 (Bank of Ghana, 2023) has strained fiscal space and crowded out private investment (UNCTAD, 2022).

Comparing both countries reveals key differences. Ghana's HIPC relief temporarily eased debt pressure and boosted investment (Ajakaiye & Ngalawa, 2010), while Nigeria's domestic borrowing has not translated into similar gains (Akolgo, 2023). Capital formation in both countries has averaged below 27% of GDP over the past two decades, below the threshold needed for sustainable growth (Hernandez-Cata, 2000; Abdullahi et al., 2016; Muhammad et al., 2023; Olaoye, 2023).

Thus, rising debt servicing costs in both nations have hindered critical investments in infrastructure, education, and healthcare. The effectiveness of foreign debt in fostering capital formation remains debatable. Ghana's recent fiscal improvements offer lessons for Nigeria, which still struggles with debt sustainability (Olaoye, 2023). The broader question remains: can public debt be leveraged without undermining capital formation?

Public debt can support capital formation but only when matched with robust economic growth and prudent fiscal management. Otherwise, excessive borrowing may erode fiscal space and displace private investment. This comparative study aims to shed light on how foreign debt affects capital formation in Nigeria and Ghana, contributing to literature and offering insights for policymakers.

The study is valuable for policymakers, investors, and researchers. Nigeria and Ghana, with similar resource-based economies and development challenges, offer a unique basis for cross-country analysis. Differences in their debt strategies provide a framework to evaluate what works. Ghana's fiscal reforms present potential lessons for Nigeria. The findings also extend relevance to West Africa's development discourse and fill a gap in literature by jointly analyzing both countries' debt-capital formation dynamics.

2. Literature Review

2.1 Empirical Review

Numerous empirical studies across different countries have examined the complex relationship between public debt, capital formation, and economic growth, yielding mixed but insightful outcomes.

Foreign studies indicate that while external debt can initially promote investment and growth, excessive borrowing often results in debt overhang, crowding-out effects, and reduced fiscal space for productive expenditures. For instance, Abuzaid (2011) found that external borrowing enhanced investment and growth in Egypt, Morocco, and Tunisia. Conversely, Georgiev (2012) and Dinca and Dinca (2013) showed that high debt levels in European and post-communist countries curtailed capital formation by increasing debt servicing costs. In Sub-Saharan Africa, Ejigayehu (2013) found that debt servicing crowded out investment rather than causing debt overhang. Tchereni et al. (2013) observed no significant link in Malawi, while Panizza and Presbitero (2014) reported a negative relationship in OECD countries. In Pakistan, Zaman and Arslan (2014) noted positive GDP growth from external debt but a decline in investment. Studies by AL-Refai (2015) and Eberhardt and Presbitero (2015) reiterated debt's adverse long-term effects on growth. Mukhtarkhan (2021) stressed the role of debt composition in resource-based economies like Kazakhstan and Russia, and Olaoye (2023) revealed that debt relief programs in SSA had marginal growth impacts due to corruption and a shift from concessional to market-based financing.

In Nigeria, findings are varied. Shehu and Aliyu (2014) found external debt positively impacted growth from 1970 to 2010 when used productively. However, Babatunde et al. (2016) identified a debt-to-GDP threshold of 73.70%, beyond which debt becomes harmful. Olasode and Babatunde (2016) reported a declining positive impact of external debt over time. Odubuasi et al. (2018) highlighted that capital expenditure drives growth more than debt servicing. Orji (2018) and Festus & Saibu (2019) supported the debt overhang hypothesis, showing that excessive debt discourages investment. Efuntade et al. (2020) stressed the importance of a balanced debt mix,

while Yusuf and Mohd (2021) found external debt aided short-term growth but harmed long-term prospects. Oyadeyi et al. (2024), using threshold ARDL, concluded that while domestic debt is sustainable, external debt becomes growth-impairing beyond certain limits. These studies collectively underscore that debt's impact depends on type, scale, and usage.

In Ghana, the literature underscores the importance of strategic debt and investment policies. Antwi et al. (2013) highlighted how investment promotion acts boosted capital formation via FDI. Owusu-Nantwi and Erickson (2016) observed that moderate debt levels stimulate growth, but excessive debt is detrimental. Asafo and Matuka (2019) revealed that while external debt can aid short-term growth, long-term overdependence undermines it. Abille et al. (2020) showed that fiscal incentives attract FDI, which in turn spurs industrial growth. The country has used external borrowing to finance productive sectors like mining, fostering capital formation through technology and skills transfer. Unlike Nigeria, Ghana places greater emphasis on ensuring debt funds are strategically deployed toward high-return investments, contributing to more sustainable growth.

In summary, these empirical studies reveal that while debt particularly external debt can support capital formation and growth, its benefits are conditional. The sustainability of debt, its composition, the existence of debt thresholds, and the effectiveness of governance and policy frameworks play critical roles. The comparative experiences of Nigeria and Ghana emphasize the need for prudent borrowing, strategic investment of borrowed funds, and efficient debt management to ensure that debt serves as a catalyst rather than a constraint to economic development.

2.2Theoretical Framework

The Debt Overhang Hypothesis posits that a high level of public debt (PD) creates a situation where the government's debt burden discourages investment and capital formation (CF). This occurs because large amounts of public debt generate uncertainty, which diminishes investor confidence and reduces national savings (NS). Consequently, the higher debt levels lead to rising interest rates (IR) as the government competes for financial resources, which in turn exacerbates capital constraints. Moreover, public debt creates volatility in exchange rates (ER), further deterring investments and hindering capital formation. This interplay among the variables ultimately impedes sustainable economic growth, as it limits the resources available for productive investment and development.

3. Methodology

3.1 Model Specification

In light of the foregoing discussion and the debt overhang theory, an econometric model for capital formation is developed and mathematically specified as follows:

$$GFCF=f(PD,NS,IR,ER) \quad (1)$$

The model can be presented in an econometric form as follows:

$$GFCFt = \beta 0t + \beta 1PDt + \beta 2NSt + \beta 3IRt + \beta 4IERt + \varepsilon_t \quad (2)$$

Converted to log form we have:

$$GFCFt = \beta 0t + \beta 1\ln PDt + \beta 2\ln NSt + \beta 3IRt + \beta 4ERt + \varepsilon_t \quad (3)$$

Where:

GFCF = Gross fixed Capital Formation

PD = Public Debt

NS = National Savings

IR = Interest Rate

ER = Exchange Rate

Interest rates and exchange rates are not logged in the econometric models due to several key reasons. First, these variables can sometimes take on zero or negative values, making the logarithmic transformation undefined in those cases. Additionally, interpreting logged interest rates can be challenging, as their impact is often more meaningful in level terms rather than as elasticities. Interest rates and exchange rates are also sometimes stationary in their levels or have meaningful linear relationships that do not benefit from logging

3.2 Methods of Analysis

The ARDL approach was employed to estimate the study's model. A unit root test was conducted on all the variables to assess their stationarity. Additionally, the ARDL bounds co-integration test was applied to examine the long-run relationship between the variables. From Equation 3, the unrestricted error correction model, (ECM) for ARDL is specified below:

$$lnGFCF_t = \beta_{1t} + \sum_{i=0}^{k} \alpha_i \, ln\Delta UPD_{t-i} + \sum_{i=0}^{k} \beta_{1i} \, ln\Delta NS_{t-i} + \sum_{i=0}^{k} \chi_{1i} \, \Delta IR_{t-i} + \sum_{i=0}^{k} \delta_{1i} \, ln\Delta ER_{t-i} + \theta_1 lnGFCF + \theta_1 lnPD + \theta_1 lnNS + \theta_1 IR + \theta_1 ER + \mu_t \quad (4)$$

Where Δ is first difference operator and *k* is optimal lag length.

To test the long run cointegration relationship among the variables, the following hypotheses are stated:

H0: $\theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$ (No cointegration)

Ha: $\theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq 0$ (Cointegration exists)

The null hypothesis of no cointegration will be tested against the alternative using the F-test. Due to the small sample size of this study, the critical values provided by Narayan and Narayan (2005), which are based on small sample sizes ranging from 30 to 80, will be applied. The test utilizes asymptotic critical value bounds, which vary depending on whether the variables are I(0), I(1), or a mix of both. If the F-statistic exceeds the upper bound, the null hypothesis is rejected, indicating the presence of cointegration. If it falls below the lower bound, we fail to reject the null hypothesis, suggesting no cointegration. If the F-statistic falls between the bounds, the result is inconclusive. However, if a long-run relationship is found, the long-run (Equation 5) and short-run (Equation 6) models will be estimated simultaneously:

$$lnGFCF_t = \beta_{2t} + \sum_{i=0}^{k} \beta_{2i} \, lnPD_{t-i} + \sum_{i=0}^{k} \chi_{2i} \, lnNS_{t-i} + \sum_{i=0}^{k} \delta_{2i} \, lnIR_{t-i} + \sum_{i=0}^{k} \pi_{2i} \, lnER_{t-i} + \mu_{2t} \quad (5)$$

$$ln\Delta GFCF_t = \beta_{2t} + \sum_{i=0}^{k} \alpha_i \, ln\Delta GFCF_{t-i} + \sum_{i=0}^{k} \beta_{3i} \, ln\Delta PD_{t-i} + \sum_{i=0}^{k} \chi_{3i} \, ln\Delta NS_{t-i} + \sum_{i=0}^{k} \delta_{3i} \, \Delta IR_{t-i} + \sum_{i=0}^{k} \pi_{3i} \, \Delta ER_{t-i} + \lambda ECT_{t-1} \quad (6)$$

The error correction term (ECT) in Equation 6 is defined as:

$$ECT_t = lnGFCF_t + \sum_{i=0}^{k} \beta_{4i} \, ln\Delta PD_{t-i} + \sum_{i=0}^{k} \chi_{4i} \, ln\Delta NS_{t-i} + \sum_{i=0}^{k} \delta_{4i} \, \Delta IR_{t-i} + \sum_{i=0}^{k} \pi_{4i} \, \Delta RT_{t-i} \quad (7)$$

The model will be tested in the context of Nigeria as well as Ghana.

3.3 Data and Sources

Annual time series data on capital formation (GFCF), public debt (PD), national savings (NS), interest rates (IR), and exchange rates (ER) from 1981 to 2022 were used for this analysis. The data were obtained from the World Development Indicators, the Central Bank of Nigeria, and the Bank of Ghana.

4. Results and Discussion

Table 1: Unit Root Test Using Augmented Dickey Fuller (ADF) Nigeria.

	ADF Test Statistics			
	Constant		Trend	
Variables	Level	First difference	Level	First Difference
$lnGFCF_t$	0.679 (0.840)	5.227 (0.000)***	2.997 (0.145)	5.247 (0.000)***
lnPD_t	1.832 (0.360)	6.417 (0.000)***	2.891 (0.175)	6.910 (0.000)***
lnNS_t	2.197 (0.478)	5.719 (0.000)***	4.631 (0.270)	5.344 (0.000)***
lnIR_t	2.344(0.163)	4.069 (0.085)*	2.243 (0.453)	5.876 (0.000) ***
lnER_t	2.833 (0.999)	4.069 (0.002)***	0.164 (0.996)	4.807 (0.002)***

***, ** and * Denotes 1%,5% and 10% significance level respectively.

The Augmented Dickey-Fuller (ADF) test results show that all variables lnGFCFt, lnPDt, lnNSt, lnIRt, and lnERt are non-stationary at their levels, as indicated by p-values above standard significance thresholds. However, after first differencing, all variables become stationary, with p-values below 1%, confirming they are integrated of order one, I(1). This validates the use of the ARDL econometric technique, which requires variables to be either I(0) or I(1), but not I(2).

Table 2: Unit Root Test Using Augmented Dickey Fuller (ADF) Ghana.

	ADF Test Statistics			
	Constant		Trend	
Variables	Level	First difference	Level	First Difference
$lnGFCF_t$	0.179 (0.967)	5.617 (0.000)***	1.760 (0.705)	5.557 (0.000)***
lnPD_t	-0.485 (0.883)	-6.235 (0.000)***	-1.773 (0.699)	-6.160 (0.000)***
lnNS_t	-1.731 (0.135)	-11.282 (0.000)***	-2.631 (0.270)	-11.120 (0.000)***
lnIR_t	-1.878 (0.338)	6.918 (0.000)***	2.177 (0.488)	6.914 (0.000) ***
lnER_t	2.375 (0.999)	5.691 (0.0020***	2.011 (0.999)	5.897 (0.000)***

***, ** and * Denotes 1%,5% and 10% significance level respectively.

Table 3: Bounds Test Result, Nigeria

				Bounds critical values [Unrestricted intercept & no trend]	
	F-stats	Lag	Level of significance	I(0)	I(1)
Model ($lnGFCF_t$,$lnPD_t$,$lnNS_t$,IR_t,ER_t)	**4.251**	1			
			10%	2.402	3.345
			5%	2.85	3.905
			1%	3.892	5.173

The ARDL Bounds Test from Table 3 reveals a significant long-run relationship among Gross Fixed Capital Formation, Public Debt, National Savings, Interest Rate, and Exchange Rate at the 10% and 5% **levels**, but not at the 1% level. This indicates that the variables are **cointegrated** and move together over time, justifying the use of long-run ARDL modeling to analyze their dynamics in the Nigerian context.

Table 4: ***Bounds Test Result, Ghana***

Model	F-stats	Lag	Level of significance	Bounds critical values [Unrestricted intercept & no trend] I(0)	I(1)
($lnGFCF_t$,$lnPD_t$,$lnNS_t$,IR_t,ER_t)	**14.103**	1			
			10%	2.461	3.461
			5%	2.947	4.088
			1%	4.093	5.532

ARDL Bounds Test from Table 4 confirms a strong long-run relationship among lnGFCFt, lnPDt, lnNSt, IRt, and ERt in Ghana, significant at the 10%, 5%, and 1% levels. This robust evidence of cointegration indicates the variables move together over time, supporting the use of long-run ARDL or error-correction models for further analysis.

Table 5: Estimated Long-run Coefficient Result, Nigeria

Dependent variable, $lnGFCF_t$		
Regressors	Coefficient	T-ratio (p values)
$LnPD_t$	0.290	3.901(0.001)
$LnNS_t$	-0.471	-2.947(0.053)
IR_t	-0.016	5.162(0.070)
ER_t	-0.001	4.231(0.004)
C	11.818	4.930(0.000)

***, ** and * Denotes 1%,5% and 10% significance level respectively.

The regression analysis reveals that public debt (LnPD) positively influences capital formation in Nigeria, supporting the view that well-managed external debt can drive growth by funding infrastructure and services (Shehu & Aliyu, 2014; Babatunde et al., 2016). However, the negative relationship between national savings (LnNS) and capital formation suggests that savings may not be effectively converted into investment, echoing concerns about poor utilization of domestic resources (Efuntade et al., 2020).

Additionally, both interest rates (IR) and exchange rates (ER) have negative impacts on capital formation, aligning with studies that highlight the dampening effects of high debt servicing costs and exchange rate volatility on investment and growth (Georgiev, 2012; Zaman & Arslan, 2014). These findings reflect the debt overhang effect, where rising debt levels crowd out private investment and reduce fiscal space (Panizza & Presbitero, 2014; Festus & Saibu, 2019).

Table 6: Estimated Long-run Coefficient Result, Ghana

Dependent variable, $lnGFCF_t$		
Regressors	Coefficient	T-ratio (p values)
$LnPD_t$	1.824	2.110(0.001)***
$LnNS_t$	0.752	1.947(0.093)*
IR_t	0.024	3.112(0.070)*
ER_t	0.150	2.421(0.004)**
C	-3.593	8.310(0.000)***

***, ** and * Denotes 1%,5% and 10% significance level respectively

The long-run model for Ghana shows that public debt (lnPD) significantly boosts capital formation (lnGFCF), with a strong coefficient of 1.824, indicating a much larger positive impact than in Nigeria. This supports earlier findings that well-managed external debt can drive growth through infrastructure investment (Shehu & Aliyu, 2014). National savings (lnNS) also positively influence capital formation in Ghana, contrasting with Nigeria's negative relationship, aligning with Efuntade et al. (2020), who warned that poorly managed domestic debt can hinder investment. Interest rates (IR) in Ghana have a marginally negative effect on capital formation, though less severe than in Nigeria, where their impact is more pronounced (Georgiev, 2012). Interestingly, exchange rates (ER) have a positive and significant effect in Ghana (coefficient = 0.150), suggesting that a stable exchange rate environment encourages investment. This contrasts with Nigeria, where exchange rates showed no significant effect.

Overall, these findings imply that Ghana's economic framework and debt management are more effective in translating public debt and macroeconomic stability into capital formation, compared to Nigeria (Babatunde et al., 2016).

Table 7: The Estimated Short-run Coefficient, Nigeria

Dependent Variable, $\Delta lnGFCF_t$		
Regressors	Coefficients	T-ratio (p value)
$\Delta lnGFCF_t$	0.189	0.816 (0.420)
$\Delta lnPD_t$	0.216	2.486 (0.005)**
$\Delta lnNS_t$	0.093	2.462 (0.003)**
ΔIR_t	0.014	1.492 (0.128)
ΔER_t	-0.155	-0.970 (0.656)
ECT_{t-1}	-0.541	-2.450 (0.004)***

***, ** and * Denotes 1%,5% and 10% significance level respectively.

From Table 7 the short run, public debt (lnPDt) and national savings (ΔlnNSt) significantly and positively affect gross fixed capital formation, indicating their importance in boosting short-term investments in Nigeria. Interest rates (ΔIRt) and exchange rates (ΔERt) have no significant effects in the short run. The significant and negative ECT suggests a robust adjustment mechanism, with the model correcting over half (54.1%) of any disequilibrium in each period, confirming the system's stability.

Table 8: The Estimated Short-run Coefficient, Ghana

Dependent Variable, $\Delta lnGFCF_t$		
Regressors	Coefficients	T-ratio (p value)
$\Delta lnGFCF_t$	0.081	0.221 (0.720)
$\Delta lnPD_t$	0.314	3.986 (0.000)**
$\Delta lnNS_t$	0.113	2.932 (0.00)**
ΔIR	-0.021	-1.492 (0.128)
ΔER	0.013	0.771 (0.566)
ECT_{t-1}	-0.421	-6.450 (0.000)***

***, ** and * Denotes 1%,5% and 10% significance level respectively.

In Ghana's short-run model, public debt (ΔlnPDt) and national savings (ΔlnNSt) have significant positive effects on capital formation, with public debt having a stronger impact (0.314) than in Nigeria (0.216). Interest rates (ΔIR) and exchange rates (ΔER) have insignificant effects, though interest rates show a slight negative influence. The error correction term (ECT) is negative and significant, indicating that about 42.1% of disequilibrium is corrected each period. Compared to Nigeria, Ghana's public debt has a greater short-run effect, but Nigeria's model adjusts faster to long-run equilibrium (54.1% vs. 42.1%).

Table 9: Goodness fit of the Model, Nigeria

R-square	0.605
DW-statistics	1.680
Prob(F-statistic)	7.448 (0.000)***

The Nigerian model explains 60.5% of the variation in the dependent variable, indicating a fairly good fit. The F-statistic confirms model significance, while the Durbin-Watson statistic (1.5–2.5 range) suggests no first-order autocorrelation.

Table 10: Goodness fit of the Model, Ghana

R-square	0.796
DW-statistics	1.712
Prob(F-statistic)	8.222 (0.000)***

The Ghana model from Table 10 shows that the model is robust, with a strong fit (R2=0.796R^2 = 0.796R2=0.796) and statistically significant independent variables (p=0.000p = 0.000p=0.000). The absence of significant autocorrelation (DW=1.71) further validates the model's reliability.

Table 11: Diagnostic Test, Nigeria

Test Statistics	F Version
A. Serial Correlation	F(2,33) = 1.005 (0. 0.308)
B. Functional form	F(134) = 0.569 (0.574)
C. Normality	2.471 = (0.290)
D. Heteroskedasticity	F(1,38) = 1.165 (0.999)

Tables 11 and 12 show that both the Nigerian and Ghanaian models pass all key diagnostic tests, confirming their robustness and reliability. Each model shows no serial correlation, correct functional form, normally distributed residuals, and no heteroskedasticity, indicating they are well-specified and suitable for analysis.

Table 12: Diagnostic Test, Ghana

Test Statistics	F Version
A. Serial Correlation	F(2,19) = 1.090 (0. 0.356)
B. Functional form	F(1,28) = 1.138 (0.268)
C. Normality	4.525 = (0.104)
D. Heteroskedasticity	F(1,28) = 0.384 (0.540)

5. Conclusion and Recommendations

In conclusion, the analysis highlights key differences and similarities in the determinants of Gross Fixed Capital Formation (GFCF) in Nigeria and Ghana. Both countries exhibit significant long-run relationships among variables, with stronger evidence in Ghana. Public debt positively influences GFCF in both countries, but the effect is more pronounced in Ghana. National savings support capital formation in Ghana, while in Nigeria, their weak negative effect suggests inefficiencies in savings mobilization.

Interest and exchange rates have mixed effects in Nigeria but are more stable in Ghana. In the short run, public debt plays a central role in stimulating investment, again with stronger effects in Ghana. Both models have effective error correction mechanisms, though Nigeria adjusts more quickly to equilibrium. Ghana's model shows higher explanatory power, indicating a better fit for capturing GFCF dynamics.

These findings underscore structural and policy differences. For Nigeria, there is a need to improve public debt utilization and reform savings mobilization. Ghana should focus on efficient debt allocation, encouraging savings, and stabilizing exchange rates to support investment and growth.

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