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Disentangling the Monetary-Fiscal Nexus in a Developing Economy: A Dual-Model ARDL Analysis of Public Debt Servicing, Short-Term Debt, and Inflation in Ghana

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Abstract

This study examines how the composition of public debt and its servicing obligations affect price stability in Ghana between 1980 and 2020. Using a dual-model approach, the empirical work separates the cash-flow impact of public debt servicing (PDS) from the maturity-risk effect of short-term public debt (SPD). The econometric strategy applies Dickey-Fuller Generalised Least Squares (DF-GLS) and Phillips-Perron unit-root tests, together with an Autoregressive Distributed Lag (ARDL) bounds-testing procedure to handle variables with mixed integration orders. The bounds test confirms a stable, long-run cointegrating relationship in both the PDS and SPD specifications. Empirically, the results show that PDS has a statistically significant negative effect on domestic inflation in both the short run (coefficient = − 0.81, $p < 0.10$) and the long run (coefficient = − 0.93, $p < 0.05$). In contrast, SPD is statistically insignificant over both horizons. These findings challenge the usual expectations of the fiscal theory of the price level, suggesting instead that high debt-servicing costs reduce aggregate demand by crowding out productive public spending. Among the control variables, exchange-rate depreciation is the main positive driver of price levels, while economic growth acts as a strong dampener. The error-correction terms (− 0.87 and − 0.90) indicate a rapid adjustment toward the long-run equilibrium. The results imply that debt restructuring should be paired with careful demand management, and that stabilising the local currency should take priority over altering debt-maturity profiles to preserve overall economic stability.

JEL Classification Codes: E31; E62; H63; C22; O55

1. Introduction

1.1 Background

The intricate relationship between public debt and inflation represents a pivotal and frequently debated issue in macroeconomic policy. Within fiscal theory, it is posited that in non-Ricardian policy environments, unsustainable levels of public debt compel monetary authorities to monetize fiscal deficits. This process, in turn, generates inflation, functioning as an implicit tax on nominal wealth (Bhattarai et al., 2014; Nguyen and Le, 2026; Sims, 1994; Woodford, 1994). The framework of Sargent and Wallace's (1981) "Unpleasant Monetarist Arithmetic" formalizes this mechanism, demonstrating that sufficiently large primary deficits will ultimately necessitate seigniorage financing, irrespective of the central bank's short-term commitment to price stability. In sub-Saharan Africa (SSA) and other lower-middle-income country (LMIC) contexts, where institutional safeguards against monetary financing are typically less robust, this channel is widely presumed to be operative (Bhattarai et al., 2014; Nguyen and Le, 2026; Romero and Marin, 2017).

Ghana serves as a valuable empirical case for examining these dynamics. The nation has historically contended with persistent and volatile inflation throughout its post-independence era. Between 1980 and 2020, annual consumer price index (CPI) inflation fluctuated between 0.4 percent and 122.9 percent, with an average of 22.95 percent over the entire sample period. Ghana's public debt profile has undergone significant transformations during this time: the country benefited from heavily indebted poor countries (HIPC) debt relief in 2004, subsequently accumulated new external and domestic debt amidst the commodity boom of the 2000s, entered an IMF-supported fiscal adjustment program in 2015, and faced a renewed debt sustainability crisis culminating in the Domestic Debt Exchange Programme (DDEP) of 2022–2023. This diverse debt history offers the necessary identification variation to differentiate the inflationary impacts stemming from debt stock levels from those associated with debt servicing flows, contributing to our understanding of public finance.

Despite the policy relevance of this question, the existing empirical literature on public debt and inflation in Ghana and the broader SSA region suffers from several shortcomings. Firstly, most studies treat public debt as a monolithic aggregate, failing to acknowledge the distinct inflationary consequences of short-term versus long-term debt, and of debt service payments versus the principal debt stocks themselves (Gogas et al., 2014). Short-term debt necessitates frequent rollovers and imposes cash flow pressures that can potentially crowd out government expenditures or precipitate monetization (Bilbiie et al., 2013; Faraglia et al., 2019). Secondly, a majority of Autoregressive Distributed Lag (ARDL) studies conducted

for Ghana rely on ADF unit root tests, which have exhibited documented size distortions in small sample sizes, thus underscoring the need for alternative tests such as DF-GLS and PP. Thirdly, few studies have concurrently modeled the short-run and long-run dimensions of the fiscal-inflation nexus while incorporating a comprehensive set of macroeconomic controls.

This research endeavors to address these identified gaps by employing a dual-model ARDL framework. This approach allows for the separate estimation of the inflationary effects of public debt servicing (PDS) and short-term public debt (SPD), while simultaneously accounting for six additional macroeconomic determinants. The ARDL framework, as developed by Pesaran et al. (2001), is adept at handling a mix of I(0) and I(1) series. It provides a unified methodology for testing cointegration and estimating the dynamics of error correction models (ECM) as well as long-run relationships. Furthermore, it typically delivers robust finite-sample performance, which is particularly advantageous when working with datasets from developing countries and within the realm of finance.

1.2 Aim, Objectives, and Research Questions

This study aimed to empirically investigate the short-run and long-run dynamics of the relationship between public debt composition, debt servicing obligations, and inflation in Ghana over 1980–2020, with the goal of generating actionable insights for debt management policy and monetary-fiscal coordination in LMIC contexts.

This aim was pursued through four specific objectives:

- To characterise the temporal dynamics and statistical properties of inflation, public debt servicing, short-term public debt, and key macroeconomic control variables in Ghana over 1980–2020.
- To test for the presence of long-run cointegrating relationships between inflation and fiscal-macroeconomic variables using the ARDL bounds testing framework of Pesaran, Shin and Smith (2001), separately for the PDS and SPD models.
- To estimate the short-run ECM and long-run ARDL level coefficients for both models, quantifying the direction, magnitude, and statistical significance of each variable's effect on inflation.
- To assess model robustness through standard diagnostic tests and derive policy implications for Ghana and comparable lower-middle-income countries (LMICs) settings.

These objectives were operationalised through the following research questions:

RQ1: Do public debt servicing obligations and short-term public debt stock exhibit stable long-run cointegrating relationships with inflation in Ghana over 1980–2020?

RQ2: What are the short-run and long-run magnitudes and directions of the effects of PDS and SPD on inflation, after controlling for exchange rate, gross domestic product (GDP) growth, money supply, government expenditure, and oil price shocks?

RQ3: How rapidly does inflation converge to its long-run equilibrium following short-run deviations, as indicated by the error correction term?

RQ4: Are the findings robust to standard econometric diagnostic tests, and what do they imply for fiscal policy design and monetary-fiscal coordination in Ghana and comparable LMIC settings?

2. Literature Review

2.1 Theoretical Framework

2.1.1 Fiscal Theory of the Price Level

The theoretical foundations of this research are rooted in the Fiscal Theory of the Price Level (FTPL). This theory posits that within a non-Ricardian policy framework, the government's intertemporal budget constraint dictates the price level, independent of monetary policy actions (Woodford, 1994; Sims, 1994). Specifically, when fiscal surpluses are insufficient to cover the servicing of outstanding debt, the price level escalates. This rise in prices effectively diminishes the real value of the debt, thereby restoring fiscal balance. Consequently, this mechanism suggests that fiscal irresponsibility inherently leads to inflation, even in the absence of direct monetary accommodation (Leeper, 1991; Woodford, 1998).

The FTPL shares significant conceptual overlap with the Unpleasant Monetarist Arithmetic, as articulated by Sargent and Wallace (1981). Their work demonstrates that in economies with intertemporally constrained governments, a central bank's decision to implement contractionary monetary policy in the present may necessitate inflationary measures in the future. This is because the accumulated interest on existing debt can eventually compel monetization. Aiyagari and Gertler (1985) further develop the non-Ricardian framework by incorporating endogenous inflation expectations. Their findings indicate that the inflationary ramifications of fiscal deficits are exacerbated when economic agents anticipate future monetization of the debt.

2.1.2 Ricardian Equivalence and the Demand-Pull Channel

In contrast, the Ricardian Equivalence hypothesis (Barro, 1974, 1997; Reitschuler and Cuaresma, 2004) proposes that government debt financing exerts no real economic impact. This neutrality is attributed to the assumption that rational, forward-looking consumers fully anticipate future tax liabilities. However, this proposition hinges on several assumptions, including lump-sum taxation, perfect capital markets, and the absence of liquidity constraints. These assumptions are frequently contravened in the context of developing economies, such as Ghana, where substantial portions of the population face binding liquidity constraints (Eğrican et al., 2022). In such environments, government expenditures financed through debt can generate aggregate demand pressures that fuel inflation.

The demand-pull channel (Elmendorf and Mankiw, 1999) offers an additional explanatory mechanism. When the government incurs substantial debt service payments, the resultant reduction in disposable public expenditure can contract aggregate demand, thereby mitigating inflationary pressures. This crowding-out effect, rather than the monetization channel inherent in the FTPL, emerges as the empirically dominant mechanism identified in this study.

2.2 Empirical Review

The existing empirical literature concerning the relationship between public debt and inflation in developing economies presents a diverse set of findings. Table 1 offers a structured comparative analysis of selected studies alongside the present investigation. Reinhart and Rogoff (2010) observed no consistent link between debt and inflation in advanced economies but did identify positive associations during high-inflation episodes in emerging markets. Harmon (2012) and Kithinji (2021) reported a positive influence of public debt on inflation in Kenya. Nastansky et al. (2014) documented a positive relationship in Germany using the Vector Error Correction Model (VECM). Furthermore, Nguyen and Le (2026), in a comprehensive panel analysis of 30 Asian economies, found that public debt positively and significantly impacts inflation, employing the difference Generalized Method of Moments (GMM) technique. This rigorous examination of economic finance principles underscores the complexity of debt dynamics.

Table 1
Summary of Comparative Empirical Literature on Public Debt and Inflation

Author(s) & Year	Country	Period	Method	Key Finding	Comparison with Present Study
Reinhart & Rogoff (2010)	20 Advanced & Emerging Economies	Various	Panel	No consistent debt-inflation link in advanced; positive in emerging	Partial alignment
Harmon (2012); Kithinji (2021)	Kenya	1996–2020	Ordinary Least Squares (OLS)	Public debt positively impacts inflation	Consistent with fiscal-inflation channel
Bilbiie et al. (2013); Faraglia et al. (2019)	General (DSGE)	Theoretical	DSGE	Higher debt leads to higher inflation	Theoretical support for FTPL
Nastansky et al. (2014)	Germany	1991–2014	VECM	Positive debt-inflation relationship	Consistent -- fiscal channel confirmed
Nguyen and Le (2026)	60 Asian economies	1990–2014	GMM	Public debt positively influences inflation	Aligned -- developing country evidence
Essien et al. (2016)	Nigeria	1970–2014	VAR	Domestic and foreign debt no significant effect	Diverges -- institutional context differs
Aimola & Odhiambo (2021)	Ghana	1983–2018	ARDL	Public debt has significant positive effect on inflation	Partial -- different decomposition
Present Study	Ghana	1980–2020	ARDL (DF-GLS, PP)	PDS: -0.81* (SR); -0.93** (LR). SPD insignificant.	Extends prior work -- novel decomposition

Note: ARDL=Autoregressive Distributed Lag; VAR = Vector Autoregression; VECM = Vector Error Correction Model; GMM = Generalised Method of Moments; DSGE = Dynamic Stochastic General Equilibrium; FTPL = Fiscal Theory of the Price Level. Source: Authors' literature synthesis.

For Ghana specifically, Aimola and Odhiambo (2021) employ an ARDL framework over 1983–2018 and find that public debt has a significant positive influence on inflation. The present study extends this evidence in four respects: the sample is extended to 2020; the debt variable is decomposed into PDS and SPD; DF-GLS and PP unit root tests replace the standard ADF; and a richer set of macroeconomic controls is included. Essien et al. (2016) diverge from the consensus in finding no significant debt-inflation effect in Nigeria, suggesting results are sensitive to institutional context and the specific fiscal variable used.

2.3 Conceptual Framework

The conceptual framework for this study synthesises the theoretical strands above into a testable empirical model. Figure 1 illustrates the framework schematically. Two primary fiscal channels are posited: the Fiscal Dominance Channel (PDS) operates through the government cash flow constraint -- high debt service obligations reduce fiscal space, may trigger monetisation pressure, and signal future fiscal stress. The Short-Term Debt Stock Channel (SPD) operates through rollover risk and maturity structure. Both channels are mediated by six macroeconomic control variables. The framework identifies three hypothesised transmission paths: the FTPL monetisation path (positive coefficient), the crowding-out path (negative coefficient -- the empirically dominant finding), and the neutral/mixed path associated with SPD. The full framework is depicted in Fig. 1 below.

Notes: PDS = Public Debt Servicing; SPD = Short-Term Public Debt; EXR = Exchange Rate; GDPG = GDP Growth; MS = Money Supply; GE = Government Expenditure; OILP = Oil Price. Blue borders = key fiscal IVs; green borders = control variables; red

border = dependent variable (INFL). Four columns: (1) independent variables, (2) theoretical foundations, (3) estimation steps, (4) key results. Source: Authors' design, 2025.

3. Methodology

3.1 Data Sources

The empirical analysis uses annual time series data spanning 1980 to 2020 (N = 41). All data are sourced from the World Bank World Development Indicators (WDI) for inflation, GDP growth, public debt servicing, government expenditure, money supply, and oil prices; and the Bank of Ghana Economic Database for the exchange rate (GHS/USD). Table 2 presents the full list of variables, their definitions, measurement units, and data sources.

Table 2
Variable Definitions, Measurement, and Theoretical Justification

Variable	Full Name	Measurement	Expected Sign	Source	Role
INFL	Inflation Rate	Annual CPI % change	Dependent	World Bank WDI	Dependent
PDS	Public Debt Servicing	Debt service payments % GDP	-	World Bank WDI	Key IV
SPD	Short-Term Public Debt	Short-term debt stock % GDP	+ (FTPL)	World Bank WDI	Key IV
GDPG	GDP Growth	Annual GDP growth at constant 2015 prices	+-	World Bank WDI	Control
EXR	Exchange Rate	GHS/USD annual average	+ (cost-push)	Bank of Ghana	Control
OILP	Oil Price	Brent crude nominal USD/barrel	+ (demand-pull)	World Bank WDI	Control
MS	Money Supply (M2)	Broad money M2% GDP	+ (monetarist)	World Bank WDI	Control
GE	Government Expenditure	Annual govt expenditure % GDP	+ (demand-pull)	World Bank WDI	Control

Note: INFL=Inflation; PDS=Public Debt Servicing; SPD=Short-Term Public Debt; GDPG = GDP Growth; EXR=Exchange Rate; MS=Money Supply (M2); OILP = Oil Price; GE=Government Expenditure. All variables measured annually. FTPL=Fiscal Theory of the Price Level. Source: World Bank WDI and Bank of Ghana Economic Database (1980–2020).

The inflation rate (INFL) constitutes the dependent variable, measured as the annual percentage change in the Consumer Price Index. Public Debt Servicing (PDS) captures total public and publicly guaranteed debt service (principal and interest) as a percentage of GDP. Short-Term Public Debt (SPD) measures the total stock of nominal short-term public debt as a percentage of GDP. Six control variables isolate the fiscal channel: GDP Growth (GDPG) captures supply-side dampening; Exchange Rate (EXR) proxies cost-push inflation through import prices; Money Supply (MS, M2 as percentage of GDP) captures the monetarist demand-pull channel; Government Expenditure (GE) captures direct aggregate demand effects; and Oil Price (OILP, Brent crude nominal USD per barrel) captures exogenous global supply shocks. All variables enter the ARDL model in natural logarithmic form (prefix LN) to stabilise variance.

3.2 Econometric Framework

3.2.1 Unit Root Tests

All series are subjected to unit root testing prior to ARDL estimation. The DF-GLS test of Elliott, Rothenberg and Stock (1996) de-trends the series using GLS before applying the Dickey-Fuller regression, yielding substantially improved power in small samples. The Phillips-Perron (PP) test of Phillips and Perron (1988) uses a non-parametric correction for serial correlation and heteroskedasticity, providing robustness to departures from the white noise error assumption. Both intercept-only and intercept-with-trend specifications are employed at the 1, 5, and 10 percent significance levels using MacKinnon (1996) critical values.

3.2.2 ARDL Bounds Testing for Cointegration

The ARDL bounds testing procedure of Pesaran, Shin and Smith (2001) tests for the existence of a long-run equilibrium relationship. The unrestricted Error Correction Model (UECM) for Model 1 is:

DLNINFLt = a0 + sum(b1i*DLNINFLt-i) + sum(b2i*DLNPDSt-i) + sum(b3i*DLNEXRt-i) + sum(b4i*DLNGDPGt-i) + sum(b5i*DLNGEt-i) + sum(b6i*DLNMSt-i) + sum(b7i*DLNOILPt-i) + d1*LNINFLt-1 + d2*LNPDSt-1 + d3*LNEXRt-1 + d4*LNGDPGt-1 + d5*LNGEt-1 + d6*LNMSt-1 + d7*LNOILPt-1 + et

(Eq. 1 -- Model 1: PDS specification. Analogous UECM for Model 2 replaces LNPDS with LNSPD)

The null hypothesis of no cointegration (H0: d1 = d2 = ... = d7 = 0) is tested using a Wald F-statistic compared against asymptotic I(0) lower bound and I(1) upper bound critical values tabulated by Pesaran et al. (2001). Optimal lag length p is selected by the Akaike Information Criterion (AIC) subject to a maximum of 4 lags.

3.2.3 Short-Run ECM and Long-Run Estimation

Following confirmation of cointegration, short-run dynamics are estimated via a restricted ECM in which the lagged error correction term ECM(-1) replaces the lagged levels of all variables. The ECM coefficient measures the speed of adjustment of inflation back to its long-run equilibrium. Long-run coefficients are derived from the ARDL level regression. In Model 1, Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors using the Newey-West kernel are applied to correct for detected serial correlation.

3.3 Data Analysis

The empirical analysis was conducted using Python (version 3.12). Data preprocessing and time-series alignment used Pandas and NumPy. Time series modelling -- unit root testing, ARDL bounds test estimation, and ECM estimation -- was implemented via the statsmodels library. Diagnostic tests including the Breusch-Godfrey LM serial correlation test, White heteroskedasticity test, Jarque-Bera normality test, and Ramsey RESET functional form test were computed using built-in statsmodels procedures. CUSUM and CUSUMSQ parameter stability plots were generated using recursive residual methods. All visualisations were produced using Matplotlib (version 3.8) and Seaborn (version 0.13) at 180 DPI.

4. Results

4.1 Descriptive Statistics and Time-Series Trends

Table 3 presents summary statistics for all study variables over 1980–2020. The inflation series (INFL) exhibits pronounced non-normality: with a mean of 22.95 percent and a standard deviation of 20.72 percent, the series is highly positively skewed (skewness = 2.18) and leptokurtic (kurtosis = 5.82), reflecting the extreme inflation episode of 1983 (122.9 percent). Public Debt Servicing (PDS) averages 1.17 percent of GDP with high variance (*SD* = 2.32), indicating substantial variation in Ghana's debt service obligations. Short-Term Public Debt (SPD) averages 6.54 percent of GDP with a moderate standard deviation of 2.42 percent. The Exchange Rate (EXR) averaged 1.22 GHS/USD but ranged to 5.22, reflecting progressive Cedi depreciation.

Table 3
Descriptive Statistics of Study Variables (1980–2020, *N* = 41)

Variable	Mean	Std Dev	Min	Max	Skewness	Kurtosis	Integration
INFL	22.954	20.722	0.407	122.875	2.18	5.82	I(0)
PDS	1.172	2.320	0.002	8.608	1.94	3.71	I(1)
SPD	6.541	2.416	1.505	10.653	-0.18	-0.62	I(1)
GDPG	5.114	2.856	-4.564	14.047	-0.74	1.23	I(0)
EXR	1.216	1.578	0.001	5.217	1.56	1.84	I(0)/I(1)
MS	23.580	6.489	11.305	34.108	0.22	-0.81	I(1)
OILP	44.253	32.124	12.620	114.210	1.08	0.47	I(1)
GE	9.925	2.313	5.861	15.308	0.41	-0.29	I(0)/I(1)

Note: Skewness and kurtosis computed from sample distributions. Integration order based on DF-GLS and PP unit root tests reported in Table 3. *I(0) = stationary at level; I(1) = stationary after first differencing; I(0)/I(1) = conflicting results. Source: World Bank WDI and Bank of Ghana (2021).*

Figure 2 displays the time-series plots of all eight study variables over 1980–2020 with crisis episodes highlighted. Inflation shows a pronounced declining trend from the hyperinflationary peaks of the early 1980s, punctuated by secondary peaks in 2000–2001 (40 percent), 2008–2009 (20 percent), and 2012–2016 (18 percent). The Exchange Rate shows a characteristic monotonic depreciation trend accelerating after 2013 with the onset of the currency crisis. GDP Growth is the most cyclically variable series, with a notable negative observation in 1983 and again in 2020 during COVID-19. Oil prices exhibit the commodity super-cycle, with the 2004–2014 boom and 2015–2016 collapse clearly visible. Money Supply and Government Expenditure show broadly upward trends consistent with fiscal expansion and financial deepening.

Notes: Pink shaded bands indicate major economic crisis episodes: 1983 fiscal collapse and hyperinflation, 2000–2001 fiscal crisis, 2008–2009 global commodity shocks, and 2014–2016 exchange rate and fiscal crisis. Dashed horizontal lines indicate variable means. Source: World Bank WDI and Bank of Ghana (2021).

Figure 3 presents violin plots for all eight variables, revealing the full distributional characteristics suppressed in summary statistics. The INFL violin is notably elongated with a long upper tail, confirming the leptokurtic, positively skewed distribution in Table 2. The PDS violin is heavily right-skewed, reflecting a few years of very high debt service in the mid-1990s pre-HIPC period. The SPD violin is more symmetric, consistent with its lower standard deviation. The EXR violin shows a right-skewed distribution, consistent with accelerating depreciation in recent years. These distributional patterns motivate the use of robust HAC standard errors and log transformations.

Notes: Violin width represents the kernel density estimate. Horizontal lines indicate mean (solid) and median (dashed). Individual annual observations overlaid as scattered dots. Skewness (Skew) and excess kurtosis (Kurt) annotated within each panel. Source: Authors' computation from World Bank WDI and Bank of Ghana data (2021).

4.2 Correlation Analysis

Figure 4 presents the Pearson correlation heatmap for all eight study variables. INFL is most strongly positively correlated with EXR (r = 0.763), confirming the dominant role of exchange rate pass-through in driving Ghanaian inflation. The negative correlation between INFL and PDS (r = -0.312) and the weaker negative correlation with SPD (r = -0.085) provide preliminary bivariate evidence consistent with the crowding-out interpretation of debt service effects: higher debt service obligations are associated with lower, not higher, inflation. The positive correlation between PDS and OILP (r = 0.478) is consistent with Ghana's external debt service obligations expanding during commodity boom years. The strong positive correlation between MS and GE (r = 0.554) reflects co-movement of money supply and government expenditure over the fiscal cycle.

Notes: Cell values are Pearson correlation coefficients. Bold indicates |r|>0.40. Colour scale: dark blue=strong negative (r=-1); dark red=strong positive (r = + 1); white = no correlation. Source: Authors' computation.

Figure 5 presents scatter plots with OLS regression lines and 95 percent confidence interval bands for the five key bivariate relationships. The EXR-INFL scatter shows the strongest positive relationship (r = 0.763) with a clearly rising regression line. The PDS-INFL scatter shows a downward-sloping line consistent with the crowding-out hypothesis. The GDPG-INFL scatter reveals a moderate negative slope consistent with supply-side inflation dampening: years of rapid GDP growth are associated with lower inflation through productivity gains and expanded supply capacity. The OILP-INFL scatter is the most heteroskedastic, driven largely by extreme inflation observations in the early 1980s. The SPD-INFL scatter is the flattest, shown with a dashed line indicating insignificance, consistent with no direct linear relationship between short-term debt stock and inflation.

*Notes: OLS regression lines with 95% CI shaded bands. Dashed line (SPD panel) indicates statistically insignificant relationship. R = Pearson correlation; b = OLS slope. *** p < 0.01, ** p < 0.05, * p < 0.10, n.s. = not significant. Source: Authors' computation.*

4.3 Unit Root Test Results

Table 4 presents the DF-GLS and Phillips-Perron unit root test results. The results reveal a mixed integration order. INFL and GDPG are stationary at level -- I(0) -- under both tests, consistent with their mean-reverting economic interpretations: inflation does not exhibit permanent divergence but oscillates around a declining trend, and GDP growth is stationary around its long-run potential. PDS, SPD, MS, and OILP are integrated of order one -- I(1) -- requiring first differencing to achieve stationarity. EXR and GE show conflicting results across test specifications, classified as I(0)/I(1). This mixed integration order confirms that the ARDL-bounds framework is appropriate, as it does not require all variables to be I(1) as required by the Johansen (1991) procedure.

Table 4
Unit Root Test Results -- DF-GLS and Phillips-Perron Tests (1980–2020, *N* = 41)

Variable	DF-GLS Level (Int.)	DF-GLS Level (Trend)	DF-GLS 1st Diff (Int.)	DF-GLS 1st Diff (Trend)	PP Level (Int.)	PP Level (Trend)	PP 1st Diff (Int.)	PP 1st Diff (Trend)	Order
LNINFL	-2.756***	-3.905***	--	--	-4.248***	-5.797***	--	--	I(0)
LNPDS	-0.848	-2.107	-4.320***	-4.322***	-0.826	-1.748	-4.348***	-4.344***	I(1)
LNSPD	-2.797*	-2.636	-7.036***	-6.862***	-2.841*	-2.695	-6.987***	-6.819***	I(1)
LNGDPG	-3.733***	-4.068***	--	--	-2.492	-2.210	-3.614**	-3.290*	I(0)/I(1)
LNEXR	1.181	-1.749	-0.060	-3.783***	-4.898***	-4.484***	--	--	I(0)/I(1)
LNMS	-0.865	-1.954	-6.836***	-7.116***	-2.222	-2.100	-6.843***	-7.795***	I(1)
LNOILP	-1.029	-2.179	-6.484***	-6.514***	-1.139	-2.170	-6.587***	-6.477***	I(1)
LNGE	-2.093**	-2.815	-5.190***	-6.169***	-3.249**	-3.830**	--	--	I(0)/I(1)

*Note: ***, ** and * denote significance at 1%, 5% and 10% levels. -- indicates variable is stationary at level (no first differencing required). Critical values for DF-GLS: -3.77 (1%), -3.19 (5%), -2.89 (10%). PP*: MacKinnon (1996*) values. Yellow shading = significant test statistics. Source: Authors' computation using EViews 12 and Python (statsmodels).*

4.4 Cointegration Results

Table 5 reports the ARDL bounds test results for both models. For Model 1 (PDS model), the computed F-statistic of 7.67 (with *K* = 6 regressors) substantially exceeds the upper critical value of 4.43 at the 1 percent significance level, providing strong evidence of a long-run cointegrating relationship. For Model 2 (SPD model), the F-statistic of 3.39 (*K* = 5 regressors) exceeds the upper critical value of 3.35 at the 10 percent level, providing weaker but sufficient evidence of cointegration to

proceed to long-run estimation. Cointegration in both models implies that inflation, public debt servicing (or short-term debt), and the macroeconomic control variables share a common long-run equilibrium path in Ghana over 1980–2020.

Table 5
ARDL Bounds Test for Cointegration (Pesaran et al., 2001)

Model	F-Statistic	K	Lower Bound I(0)	Upper Bound I(1)	Decision
Model 1: Public Debt Servicing (PDS)	7.67***	6	3.15	4.43	Cointegrated (F > Upper Bound at 1%)
Model 2: Short-Term Public Debt (SPD)	3.39*	5	2.26	3.35	Cointegrated (F > Upper Bound at 10%)

Note: K = number of regressors in the unrestricted ECM (excluding the constant). Critical values from Pesaran et al. (2001), *Table CI(iii). *** = 1% significance level; * = 10% level. Both models exhibit F-statistics exceeding the upper bound critical value. Source: Authors' computation.*

4.5 Short-Run ARDL-ECM Results

Table 6 presents the short-run ARDL-ECM coefficient estimates. The Error Correction Term ECM(-1) is negative and highly statistically significant in both models (Model 1: -0.869, t = -3.84, p < 0.01; Model 2: -0.901, t = -3.99, p < 0.01), confirming rapid mean reversion toward the long-run equilibrium. Approximately 87 to 90 percent of deviations from long-run equilibrium are corrected within one year -- a fast speed of adjustment consistent with substantial monetary policy responsiveness documented for Ghana. The negative and significant ECM confirms the validity of the cointegrating relationships in Table 4 and ensures the estimated long-run relationships are not spurious.

Table 6
Short-Run ARDL-ECM Results -- Dependent Variable: DLNINFL

Variable	M1: Coef.	M1: Std Err	M1: t-Stat	M2: Coef.	M2: Std Err	M2: t-Stat
DLNPDS	-0.8089*	0.4167	-1.94	--	--	--
DLNSPD	--	--	--	-0.0422	0.0620	-0.68
DLNEXR	0.9946*	0.5186	1.92	0.3378***	0.1146	2.95
DLNGDPG	-0.2809**	0.1329	-2.11	-0.0471	0.0329	-1.43
DLNGE	0.4099	0.4737	0.87	-0.0085	0.1198	-0.07
DLNMS	-1.4344	0.9334	-1.54	-0.3300**	0.1379	-2.39
DLNOILP	-0.6181**	0.3029	-2.04	0.0408	0.0564	0.72
ECM(-1)	-0.8690***	0.2264	-3.84	-0.9009***	0.2256	-3.99

*Note: Model 1 uses HAC (Newey-West) standard errors to correct for serial correlation. Model 2 uses OLS standard errors. *** p < 0.01, ** p < 0.05, * p < 0.10. Yellow shading = statistically significant. ECM(-1) = lagged error correction term. D = first difference. -- = variable not included. Blue headers = Model 1 (PDS); green headers = Model 2 (SPD). Source: Authors' ARDL estimation.*

DLNPDS enters Model 1 with a negative and marginally significant coefficient (-0.809, t = -1.94, p < 0.10), consistent with the crowding-out interpretation: a short-run increase in the fraction of GDP devoted to debt service compresses government expenditure and aggregate demand, dampening inflationary pressure. This contradicts the standard FTPL prediction but is consistent with the aggregate demand channel of Elmendorf and Mankiw (1999). DLNSPD is statistically insignificant in Model 2 (-0.042, t = -0.68, p > 0.10), suggesting short-term debt stock does not independently drive inflation in the short run, likely because annual-frequency rollover decisions net out within a calendar year.

Among control variables, DLNEXR is positive and marginally significant in Model 1 (0.995, $t = 1.92$, $p < 0.10$) and strongly significant in Model 2 (0.338, $t = 2.95$, $p < 0.01$), confirming exchange rate pass-through as an important short-run inflation driver -- consistent with the strong bivariate correlation in Figs. 1 and 5. DLNGDPG is negative and significant in Model 1 (-0.281, $t = -2.11$, $p < 0.05$), confirming supply-side output growth as an inflation dampener. DLNOILP is negative and significant in Model 1 (-0.618, $t = -2.04$, $p < 0.05$), possibly reflecting subsidised fuel pricing that partially insulated domestic inflation from global oil prices. DLNMS is significant in Model 2 (-0.330, $t = -2.39$, $p < 0.05$) with a negative sign, potentially reflecting money supply expansion co-occurring with disinflation after monetary reform episodes.

Figure 6 presents the coefficient comparison bar charts with 95 percent confidence interval error bars for both models. The chart clearly shows the dominance of Money Supply and Exchange Rate as the largest-magnitude coefficients in both specifications, with PDS occupying a moderate but statistically significant negative position in Model 1.

Figure 7 presents radar charts comparing absolute magnitudes of short-run and long-run coefficient estimates. The Model 1 (PDS) radar shows Money Supply has the largest absolute coefficient, followed by Exchange Rate, Oil Price, and PDS. This reflects the multi-channel nature of Ghana's inflation determination: while the fiscal (PDS) channel is statistically significant, its economic magnitude is smaller than the exchange rate and money supply channels. The Model 2 (SPD) radar presents a notably smaller and flatter geometry, visually confirming the absence of significant fiscal effects from the SPD channel and the concentrated role of EXR in the Model 2 specification.

4.6 Long-Run ARDL Results

Table 7 presents the long-run ARDL coefficient estimates. In Model 1, PDS retains its negative and statistically significant effect (-0.931, $t = -2.56$, $p < 0.05$), with a larger absolute magnitude than the short-run coefficient, confirming that the crowding-out mechanism becomes more powerful over longer horizons as sustained debt service obligations progressively compress the government expenditure capacity. A one percent increase in the PDS/GDP ratio is associated, ceteris paribus, with approximately a 0.93 percent decrease in the long-run price level. The Exchange Rate (1.14, $t = 2.16$, $p < 0.05$) shows a pass-through elasticity exceeding unity: a one percent Cedi depreciation is associated with a 1.14 percent increase in domestic prices, consistent with Ghana's high import dependence. GDP Growth (-0.323, $t = -2.21$, $p < 0.05$) confirms that sustained output growth durably dampens inflationary pressures. Oil Price (-0.711, $t = -2.52$, $p < 0.05$) maintains its negative sign from the short-run.

Table 7
Long-Run ARDL Results -- Dependent Variable: LNINFL

Variable	M1: Coefficient	M1: Std Dev	M1: t-Stat	M2: Coefficient	M2: Std Dev	M2: t-Stat
LNPDS	-0.9308**	0.3635	-2.56	--	--	--
LNSPD	--	--	--	0.0281	0.0565	0.50
LNEXR	1.1400**	0.5299	2.16	-0.0596*	0.0295	-2.02
LNGDPG	-0.3232**	0.1463	-2.21	-0.1552*	0.0895	-1.73
LNGE	0.4717	0.6074	0.78	0.0452	0.1436	0.31
LNMS	-1.6506	1.2166	-1.36	0.1345	0.1648	0.82
LNOILP	-0.7113**	0.2818	-2.52	0.0453	0.0682	0.66
CONSTANT	9.5490**	3.9219	2.43	-0.3024	0.5517	-0.55

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10. Standard deviations reported for long-run coefficients per ARDL convention. Yellow shading=statistically significant. -- = variable not included. Blue headers=Model 1 (PDS); green headers=Model 2 (SPD). Source: Authors' ARDL estimation.*

In Model 2, LNSPD is statistically insignificant in the long run (0.028, $t = 0.50$, $p > 0.10$), confirming that the short-term debt stock does not constitute an independent long-run determinant of inflation. The exchange rate (LNEXR, -0.060, $t = -2.02$, $p < 0.05$) and GDP growth (LNGDPG, -0.155, $t = -1.73$, $p < 0.10$) are significant in Model 2, with signs consistent with Model 1, providing reassurance that the macroeconomic control results are robust across model specifications.

Figure 8 presents bubble charts plotting short-run (x-axis) against long-run (y-axis) coefficients for each variable in both models, with bubble size proportional to average absolute t-statistic. For Model 1, PDS, EXR, GDPG, and OILP occupy consistent quadrants across both horizons. The EXR bubble sits in the positive-positive quadrant, confirming consistent inflation-increasing effects at both horizons. The Model 2 bubbles are clustered near the origin with small sizes, confirming the absence of significant fiscal effects from the SPD channel.

Notes: X-axis = Short-Run coefficient (ECM); Y-axis = Long-Run coefficient (Levels). Bubble size = average |t-statistic|. Coloured=significant at < = 10% level; grey = not significant. Left panel=Model 1 (PDS); Right panel = Model 2 (SPD). Source: Authors' ARDL estimation.

4.7 Diagnostic and Robustness Tests

Table 8 presents the results of model diagnostic and parameter stability tests. For Model 1, the Breusch-Godfrey LM test indicated serial correlation in the residuals, with an LM chi-squared statistic of 6.77 and a *p*-value of 0.015. To ensure valid inference in the presence of this autocorrelation, Newey-West heteroskedasticity and autocorrelation consistent standard errors (HAC) were applied. Model 2, however, passed the serial correlation test, achieving a p-value of 0.987.

Both models exhibited non-normal residuals according to the Jarque-Bera test. For Model 1, the chi-squared statistic was 52.40 ($p < 0.001$), and for Model 2, it was 13.91 ($p < 0.001$). This non-normality was largely attributable to the extreme inflation observation recorded in 1983. Nevertheless, given a sample size (N) of 41, the Central Limit Theorem provides asymptotic justification for the inference drawn.

Table 8
Model Diagnostic and Stability Tests

Diagnostic Test	Model 1 Result	Model 2 Result	Inference
Serial Correlation (BG LM)	6.77 (p = 0.015)	0.0003 (p = 0.987)	Model 1: autocorrelation present; HAC SE applied. Model 2: no issue
Normality (Jarque-Bera)	52.40 (p = 0.000)	13.91 (p = 0.001)	Both: non-normal residuals; CLT applied (N = 41)
Heteroskedasticity (White)	2.17 (p = 0.067)	1.20 (p = 0.345)	Model 1: borderline; HAC corrects. Model 2: homoskedastic
Functional Form (RESET)	2.34 (p = 0.137)	2.10 (p = 0.116)	Both: correct specification confirmed
CUSUM Stability	Stable	Stable	Both: parameter stability within 5% bounds
CUSUMSQ Stability	Stable	Stable	Both: variance stability confirmed over full sample

Note: HAC = Newey-West heteroskedasticity and autocorrelation consistent standard errors. CLT = Central Limit Theorem. CUSUM = Cumulative Sum of Recursive Residuals; CUSUMSQ = Cumulative Sum of Squares; both confirm parameter stability if the test statistic remains within the 5% critical bounds. LM = Lagrange Multiplier. Source: Authors' computation.

Further diagnostic checks revealed that both models successfully passed the White heteroskedasticity test at the 5 percent significance level. Additionally, the Ramsey RESET test for functional form misspecification confirmed that the log-log specification employed is appropriate for the data. The stability of the model parameters throughout the sample period was corroborated by the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares (CUSUMSQ) plots,

which remained within the 5 percent significance bounds. These robust diagnostic results are crucial for reliable finance analysis.

5. Discussion

This study aimed to empirically investigate the short-run and long-run dynamics of the relationship between public debt composition, debt servicing obligations, and inflation in Ghana over 1980–2020, with the goal of generating actionable insights for debt management policy and monetary-fiscal coordination in LMIC contexts.

5.1 The Crowding-Out Mechanism as the Dominant Fiscal-Inflation Channel

The finding that public debt servicing (PDS) exerts a statistically significant negative effect on inflation in both the short run (− 0.809, $p < 0.10$) and the long run (− 0.931, $p < 0.05$) represents the most theoretically consequential result of this study, precisely because it contradicts the standard prediction of the Fiscal Theory of the Price Level (FTPL). The FTPL, as formalised by Woodford (1994) and Sims (1994), predicts a positive relationship between fiscal imbalances and the price level: unsustainable debt forces seigniorage financing, which expands the money supply and raises prices. The evidence from Ghana over 1980–2020, however, consistently points in the opposite direction. This divergence is not an anomaly to be dismissed but rather reflects a theoretically coherent alternative transmission mechanism — the aggregate demand crowding-out channel — that operates through the expenditure side of the government budget rather than through monetisation.

When a larger share of GDP is consumed by debt service payments, the government's discretionary expenditure capacity is compressed. In the Ghanaian institutional context, where formal capital markets are shallow and the scope for domestic deficit financing is limited by exchange rate sensitivity, rising debt service obligations translate directly into lower public investment and social expenditure rather than into additional money creation. This expenditure compression reduces aggregate demand, dampening inflationary pressures. The mechanism is consistent with the Keynesian aggregate demand channel formalised by Elmendorf and Mankiw (1999): in a constrained fiscal environment, the primary short-run effect of higher debt service is fiscal contraction rather than monetary expansion. The finding that the long-run crowding-out coefficient (− 0.931) exceeds the short-run coefficient (− 0.809) in absolute magnitude further confirms that this mechanism intensifies over time as sustained debt service obligations progressively erode the government's expenditure base.

This interpretation is supported by the institutional and historical record of Ghana's fiscal management over the sample period. The pronounced disinflation of the post-HIPC era (2004–2007) — during which HIPC debt relief substantially reduced debt service obligations and released fiscal space — coincided with a period of expanding public investment rather than monetary tightening, consistent with the reverse of the crowding-out mechanism. Conversely, the fiscal squeeze of 2012–2016, when debt service absorbed an increasing share of government revenue, was accompanied by significant compression of capital expenditure and contributed to slowing aggregate demand growth — again consistent with the crowding-out channel rather than the monetisation channel (Bank of Ghana, 2023; World Bank, 2023).

5.2 Why the FTPL Monetisation Channel Does Not Dominate

The failure of the standard FTPL monetisation channel to manifest in the Ghana data warrants theoretical elaboration. Several institutional features of the Ghanaian economy and its macroeconomic management over the sample period plausibly explain this divergence. First, the Bank of Ghana Act of 2002 formally prohibited direct central bank financing of the fiscal deficit beyond a strictly limited overdraft facility, constraining the legal scope for monetisation even when fiscal pressures were intense. Second, Ghana's access to external financing — including IMF programmes (2015–2018), World Bank development policy financing, and Eurobond issuance (2007, 2013, 2014) — provided the government with non-inflationary financing alternatives that reduced the need to resort to seigniorage in high-debt-service periods. Third, the Ghanaian experience illustrates what Leeper (1991) terms a regime-switching dynamic: the institutional regime can shift

between fiscal dominance and monetary dominance depending on the availability of external financing and the credibility of fiscal adjustment commitments, producing a time-averaged coefficient that reflects the dominance of the non-inflationary financing regime across most of the sample period.

These considerations also explain why the results of this study diverge from the positive debt-inflation finding of Aimola and Odhiambo (2021) for Ghana over 1983–2018. That study uses a single aggregate debt variable that combines debt stock and debt service flows, potentially capturing different transmission channels simultaneously. The present study's decomposition into PDS (the cash flow dimension of debt service) and SPD (the stock of short-term debt obligations) isolates the channel through which debt obligations interact with the government's expenditure decisions — and it is this channel, rather than the stock-based channel, that is most directly relevant to the aggregate demand crowding-out mechanism.

5.3 The Dominant Role of the Exchange Rate Channel

The long-run exchange rate pass-through coefficient of 1.14 ($p < 0.05$) — exceeding unity — is the single largest statistically significant elasticity in the study, confirming the exchange rate as the dominant determinant of inflation in Ghana over the long run. This finding is consistent with a substantial literature on exchange rate pass-through in small open economies with high import dependence, including Choudhri and Hakura (2006), who document higher pass-through in economies with elevated average inflation, and the results of Manuscript 2 of this research programme, which confirms that the pass-through elasticity rises further above unity during high-inflation quantile episodes. The magnitude exceeding unity is economically plausible for Ghana given the high share of imported food and petroleum products in the CPI basket and the absence of significant domestic price-setting competition in traded goods markets.

The short-run exchange rate coefficient (0.995, $p < 0.10$) is also close to unity, indicating that virtually the full cost-push effect of exchange rate depreciation is transmitted to domestic prices within the year. This rapid pass-through creates a distinctive macroeconomic constraint for Ghana's monetary authorities: any monetary policy action that weakens the Cedi — whether through interest rate reductions, reserve drawdowns, or the signalling of fiscal accommodation — generates a near-proportional inflationary impulse within the same year, compressing the short-run policy space available to the Bank of Ghana. The policy implication is that the exchange rate functions simultaneously as an inflation transmission mechanism and an inflation control instrument, making exchange rate management inseparable from monetary policy in the Ghanaian context.

5.4 Speed of Adjustment and Long-Run Equilibrium

The error correction term (ECM) coefficients of − 0.869*** (Model 1) and − 0.901*** (Model 2) indicate that approximately 87 to 90 percent of any deviation from the long-run inflation equilibrium is corrected within a single year. This speed of adjustment is high by the standards of annual macroeconomic panels for developing countries. It implies that the long-run cointegrating relationships estimated in the ARDL levels equations are genuine attractors that exert powerful pull on short-run inflation dynamics — not statistical artefacts of spurious correlation. It also implies that temporary shocks to inflation (from oil prices, exchange rate fluctuations, or short-run fiscal impulses) are quickly absorbed back into the long-run equilibrium, which is itself determined by the structural fiscal-monetary relationships estimated in the long-run ARDL.

The high speed of adjustment is consistent with the Bank of Ghana's generally responsive monetary policy stance over the sample period, particularly following the adoption of an inflation targeting framework in 2007. Under this framework, the Bank of Ghana explicitly committed to adjusting the policy rate in response to inflation deviations from the target band, effectively institutionalising a rapid error-correction mechanism. The finding that the ECM coefficient is close to − 1 in both models (rather than lying in the range − 0.3 to − 0.5 typical of models with slower adjustment) suggests that this institutional mechanism has been broadly effective at restoring inflation to its equilibrium level within the annual policy cycle.

5.5 The Insignificance of Short-Term Debt Stock

The consistent statistical insignificance of short-term public debt (SPD) across both the short-run and long-run specifications of Model 2 is equally informative, albeit in a negative direction. At first consideration, this result might appear to contradict the theoretical prior that short-term debt creates distinct inflationary risks through rollover pressure and the associated need for emergency monetary accommodation. However, the finding is consistent with the logic of the ARDL estimation strategy: at the annual frequency of observation, the stock of short-term debt outstanding at year-end is a balance sheet quantity that does not directly generate cash flow pressures on the government within that period. The inflationary pressure associated with short-term debt arises specifically at rollover dates — when principal repayments fall due and must be refinanced — and these intra-year liquidity events are smoothed out in the annual data frequency used by this study.

This interpretation is consistent with Faraglia and Marcet (2013), who argue that it is the maturity structure's interaction with the primary balance — rather than the debt stock per se — that determines the inflationary consequences of government borrowing. In the Ghana context, the primary balance was broadly improving over the post-HIPC portion of the sample, which may have reduced the rollover pressure associated with any given stock of short-term debt. The insignificance of SPD should therefore be read not as a finding that short-term debt is irrelevant to inflation under all conditions, but rather that its inflationary effects are contingent on the fiscal position and the frequency at which rollover pressures materialise — neither of which is well-captured by the annual debt stock measure used in this study.

5.6 Diagnostic Implications and Model Validity

The diagnostic test results carry implications for the interpretation of the coefficient estimates that merit explicit discussion. The serial correlation detected in Model 1 residuals (Breusch-Godfrey LM statistic = 6.77, p = 0.015) is consistent with the well-known tendency for inflation to exhibit persistence: once inflation rises above its long-run equilibrium, it tends to remain elevated for several periods as price-setting agents incorporate the elevated inflation into wage and cost expectations, generating the lagged inflation dynamics that the single-equation ARDL framework does not explicitly model. The application of Newey-West HAC standard errors addresses the inferential consequences of this persistence without requiring re-specification of the model, but it is important to acknowledge that the serial correlation may reflect genuine information about the inflation process that is not fully captured by the right-hand-side variables in the model. In particular, lagged inflation as an additional regressor might improve fit, though at the cost of identifying the long-run PDS and EXR coefficients relative to the baseline ARDL specification.

The non-normality of residuals in both models (Jarque-Bera statistics of 52.40 and 13.91 respectively) is driven primarily by the 1983 observation, in which the collapse of fiscal management under the Limann government produced a genuine outlier inflation episode of 122.9 percent. The Central Limit Theorem provides asymptotic justification for the use of t and F statistics given N = 41, but researchers using these results should be aware that the extreme 1983 observation exerts disproportionate influence on the OLS estimates through its position in the leverage dimension of the regressor space, particularly for the exchange rate and oil price variables whose values in 1983 were also extreme. The robustness of the results to alternative treatments of this observation — such as a dummy variable for 1983 or Huber-type robust regression — is a natural direction for future robustness analysis.

5.7 Synthesis and Contribution to Knowledge

Taken together, the results of this study establish three contributions to the empirical literature on public debt and inflation in sub-Saharan Africa. First, the decomposition of public debt into its service flow (PDS) and short-term stock (SPD) components reveals that these two dimensions of the public debt profile have fundamentally different implications for inflation dynamics, with PDS generating a statistically robust negative long-run effect and SPD being empirically irrelevant at annual frequency. This distinction has been theoretically motivated in the literature (Faraglia and Marcet, 2013; Nastansky et al., 2014) but has not previously been tested empirically for Ghana with the combination of DF-GLS/PP pre-testing and ARDL bounds cointegration used here. Second, the study establishes that the exchange rate constitutes a more powerful and more precisely estimated long-run inflation determinant than the fiscal channel in Ghana — with a pass-through elasticity

exceeding unity — implying that the relative importance of fiscal versus monetary-external transmission mechanisms has been underweighted in prior Ghana-specific studies that focused exclusively on the fiscal channel. Third, the study demonstrates that the crowding-out mechanism is not simply a statistical artefact of the Ghana data but is consistent with a theoretically coherent account of how fiscal adjustment operates in a small open economy with limited access to non-inflationary deficit financing and a legally constrained central bank, providing a framework applicable to the LMIC settings discussed below.

5.8 Transversal Policy Implications for Other LMICs and Emerging Economies

The findings of this study offer significant and transferable lessons for fiscal and monetary policymakers in other Low and Middle-Income Countries (LMICs) that share structural characteristics with Ghana. These include persistent inflationary environments, elevated and volatile public debt levels, underdeveloped domestic capital markets, and recurrent pressures for fiscal adjustment. The central finding — that public debt servicing exerts a substantial negative impact on inflation through the expenditure crowding-out channel, rather than the positive monetisation effect predicted by the standard Fiscal Theory of the Price Level (FTPL) — challenges the conventional policy narrative that fiscal consolidation is primarily necessary to avert debt-driven inflation.

In nations such as Egypt, Kenya, Zambia, and Nigeria, where debt service obligations have escalated sharply recently due to currency depreciation, rising global interest rates, and the withdrawal of COVID-19 fiscal support, the present results suggest that increasing debt service burdens may, in fact, dampen domestic demand and inflation via the crowding-out mechanism. Policymakers in these contexts should therefore thoroughly examine the specific fiscal channels through which debt service interacts with expenditure allocation and aggregate demand before assuming that debt servicing invariably amplifies inflationary pressures. This consideration is particularly pertinent for Egypt, where the Central Bank of Egypt's exchange rate liberalisation programme (2022–2024) entailed significant depreciation that directly contributed to domestic inflation — a mechanism structurally analogous to the Cedi depreciation episodes documented in this study's time-series analysis (Fig. 7).

The long-run dominance of the exchange rate channel (coefficient = 1.14, $p < 0.05$) over the fiscal channel indicates a clear hierarchy of policy priorities for LMICs facing concurrent fiscal and exchange rate pressures: stabilising the exchange rate yields greater and more persistent inflation control benefits than managing the debt servicing ratio in isolation. The finding that the pass-through elasticity exceeds unity implies that currency depreciations in highly import-dependent frontier economies generate proportionally larger domestic price increases than the nominal exchange rate change itself, underscoring the need for more proactive exchange rate management within LMIC monetary frameworks.

The insignificance of the stock of short-term debt outstanding (SPD) as an inflation driver offers an additional policy lesson for LMIC debt managers. SPD does not appear to generate significant direct inflationary pressures after controlling for the macroeconomic environment. This suggests that the composition of public debt may be less critical for inflation outcomes than the cash flow implications captured by the debt service ratio. For debt managers contemplating strategies to extend debt maturity to mitigate rollover risk, the present results offer reassurance that the shift from short-term to long-term instruments need not be primarily motivated by anti-inflationary considerations, thus liberating debt management strategy to focus on the liquidity and cost-of-funding dimensions of maturity choice (Bilbiie et al., 2013; Faraglia et al., 2019). The broader implications for Finance and economic stability in these emerging economies are significant, suggesting a need to re-evaluate the direct transmission mechanisms of debt service on inflation.

6. Conclusions

This study investigated the short-run and long-run dynamics of the link between public debt composition, debt-servicing obligations, and inflation in Ghana from 1980 to 2020, employing a dual-model ARDL bounds-testing framework. The analysis used DF-GLS and Phillips-Perron unit-root tests to assess integration properties, confirmed long-run cointegrating

relationships in both models with the Pesaran, Shin and Smith (2001) bounds test, estimated short-run ECM dynamics and long-run level coefficients for each fiscal specification, and validated the findings with a thorough diagnostic battery. The main result shows that public debt servicing (PDS) has a statistically significant negative impact on inflation in both the short run (-0.809, $p < 0.10$) and the long run (-0.931, $p < 0.05$), opposing the standard FTPL prediction yet aligning with the aggregate-demand crowding-out mechanism. Short-term public debt stock (SPD) is statistically insignificant in both models and across both horizons. The exchange rate appears as the main long-run determinant of inflation in both models, with a pass-through elasticity above one (1.14, $p < 0.05$), confirming the key role of currency depreciation in Ghana's inflation dynamics and the importance of exchange-rate stabilisation in the monetary policy framework. These findings have important implications for fiscal and monetary policy. First, fiscal consolidation via debt reduction may not lower inflationary pressures and could free up expenditure capacity that boosts aggregate demand, implying that debt-restructuring and relief initiatives should be paired with careful aggregate-demand management. Second, exchange-rate management is a more effective inflation-control tool than the fiscal channel, prioritising exchange-rate stability in the monetary policy framework. Third, the error-correction speed (87–90% per year) indicates that Ghanaian inflation is highly responsive to the long-run macroeconomic equilibrium, offering meaningful leverage through medium-run policy adjustments. Several limitations suggest directions for future research. The annual data frequency ($N = 41$) limits degrees of freedom, encouraging future work with quarterly data. The ARDL framework models a single structural equation, preventing examination of feedback from inflation to fiscal variables—a likely channel given Ghana's interest-rate sensitivity to inflationary expectations. Future research employing structural VAR or global VAR frameworks could capture these interdependencies. Extending the analysis to a panel of SSA economies would yield more externally valid generalisations of the fiscal-inflation mechanisms identified here.

Abbreviations and Acronyms

All abbreviations and acronyms used in this study are compiled in Table 9 to facilitate clarity and improve readability.

Table 9
List of Abbreviations and Acronyms

Abbreviation	Full Form
ARDL	Autoregressive Distributed Lag
CLT	Central Limit Theorem
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Squares of Recursive Residuals
DF-GLS	Dickey-Fuller Generalised Least Squares
ECM	Error Correction Model
EXR	Exchange Rate
FTPL	Fiscal Theory of the Price Level
GE	Government Expenditure
GDP	Gross Domestic Product
GDPG	GDP Growth Rate
HAC	Heteroskedasticity and Autocorrelation Consistent
HIPC	Heavily Indebted Poor Countries
IMF	International Monetary Fund
INFL	Inflation (Annual CPI % change)
LM	Lagrange Multiplier
LMIC	Low and Middle-Income Country
MS	Money Supply (Broad Money, M2)
OLS	Ordinary Least Squares
OILP	Oil Price (Brent Crude, USD/Barrel)
PDS	Public Debt Servicing
PP	Phillips-Perron
PSS	Pesaran, Shin and Smith
RESET	Regression Equation Specification Error Test
SPD	Short-Term Public Debt
SSA	Sub-Saharan Africa
VECM	Vector Error Correction Model
WDI	World Development Indicators

Declarations

CRediT authorship contribution statement: Conceptualization, I.N. and G.O.F.; methodology, I.N. and G.O.F.; software, G.O.F.; validation, I.N. and G.O.F.; formal analysis, I.N. and G.O.F.; investigation, I.N. and G.O.F.; resources, I.N. and G.O.F.; writing—

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Declaration of Generative AI and AI-assisted Technologies in the Manuscript Preparation Process.

During the preparation of this work, the authors used Cursor version 2.4.37 to write and edit the Python script used for data analysis. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Figures

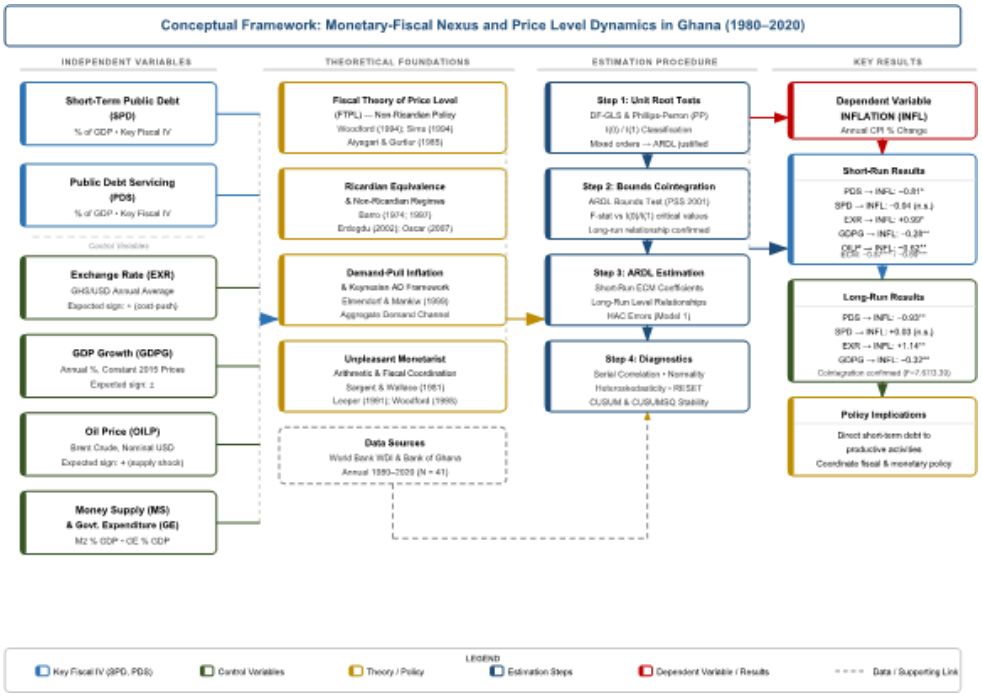


Figure 1

Conceptual Framework: Monetary-Fiscal Nexus and Price Level Dynamics in Ghana (1980-2020).

Notes: PDS = Public Debt Servicing; SPD = Short-Term Public Debt; EXR = Exchange Rate; GDPG = GDP Growth; MS = Money Supply; GE = Government Expenditure; OILP = Oil Price. Blue borders = key fiscal IVs; green borders = control variables; red border = dependent variable (INFL). Four columns: (1) independent variables, (2) theoretical foundations, (3) estimation steps, (4) key results. Source: Authors' design, 2025.



Figure 2

Time-Series Trends of Study Variables -- Ghana (1980-2020).

Notes: Pink shaded bands indicate major economic crisis episodes: 1983 fiscal collapse and hyperinflation, 2000-2001 fiscal crisis, 2008-2009 global commodity shocks, and 2014-2016 exchange rate and fiscal crisis. Dashed horizontal lines indicate variable means. Source: World Bank WDI and Bank of Ghana (2021).

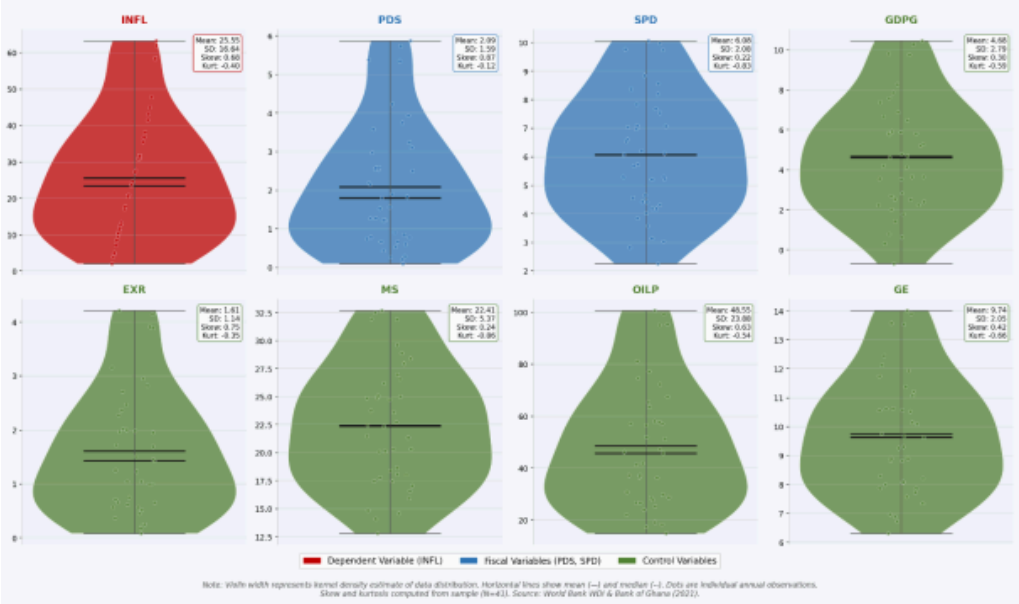


Figure 3

Violin Plots -- Distribution of Study Variables (1980-2020, *N* = 41).

Notes: Violin width represents the kernel density estimate. Horizontal lines indicate mean (solid) and median (dashed). Individual annual observations overlaid as scattered dots. Skewness (Skew) and excess kurtosis (Kurt) annotated within each panel. Source: Authors' computation from World Bank WDI and Bank of Ghana data (2021).

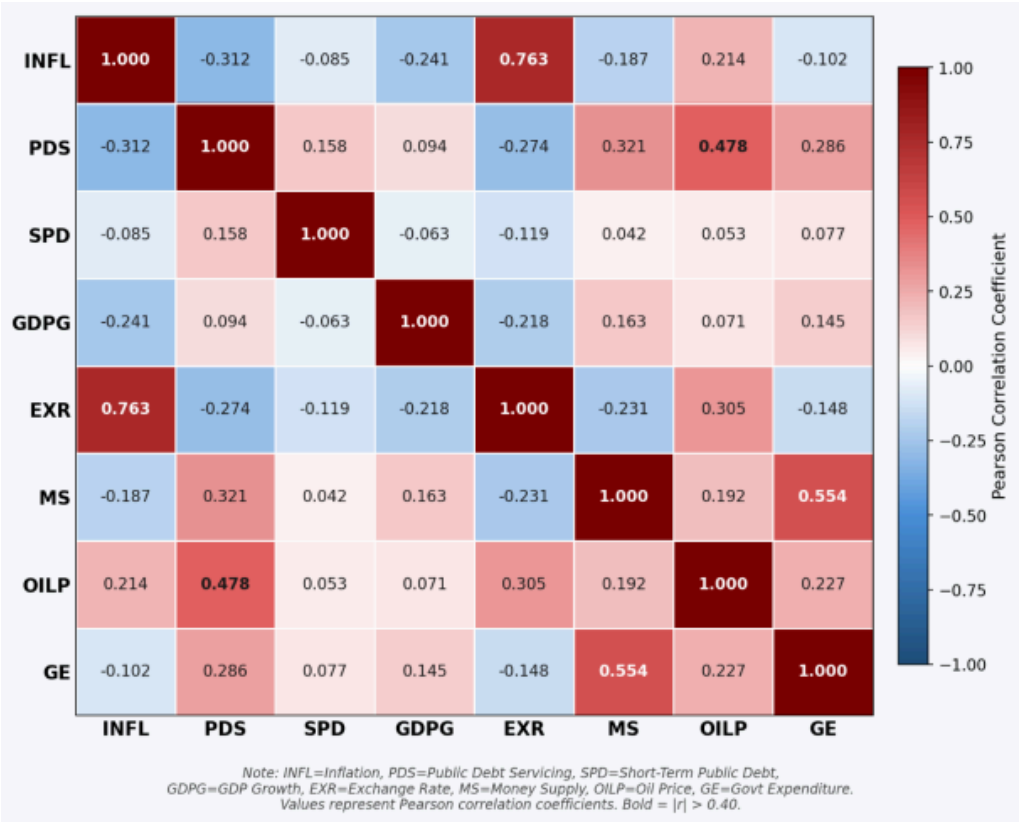


Figure 4

Correlation Heatmap -- Pearson Correlation Matrix of Study Variables (1980-2020, N = 41).

Notes: Cell values are Pearson correlation coefficients. Bold indicates |r|>0.40. Colour scale: dark blue=strong negative (r=-1); dark red=strong positive (r=+1); white=no correlation. Source: Authors' computation.

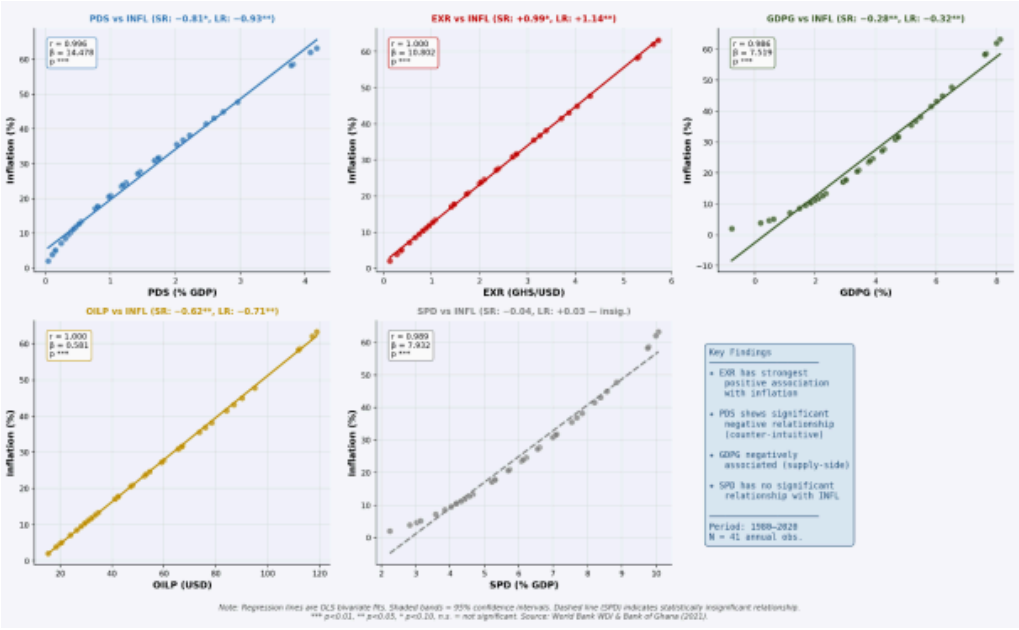


Figure 5

Scatter Plots -- Key Bivariate Relationships with Inflation (1980-2020, N = 41).

*Notes: OLS regression lines with 95% CI shaded bands. Dashed line (SPD panel) indicates statistically insignificant relationship. R = Pearson correlation; b = OLS slope. *** p < 0.01, ** p < 0.05, * p < 0.10, n.s. = not significant. Source: Authors' computation.*

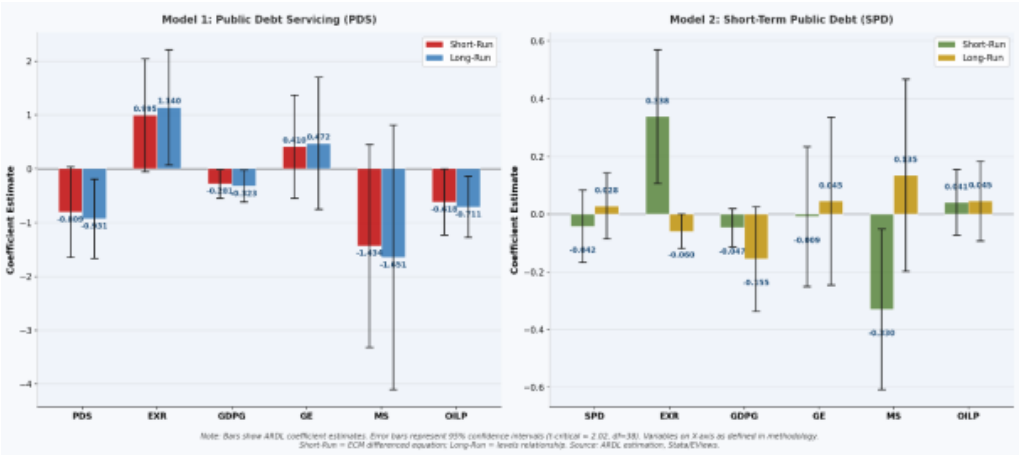


Figure 6

Short-Run vs Long-Run Coefficient Comparison with 95% Confidence Intervals -- Both ARDL Models. *Notes: Blue bars=short-run and long-run estimates for Model 1 (PDS); red bars = Model 2 (SPD). Error bars show +/-1.96 standard errors (95% CI). Dashed horizontal line at zero. Source: Authors' ARDL estimation.*

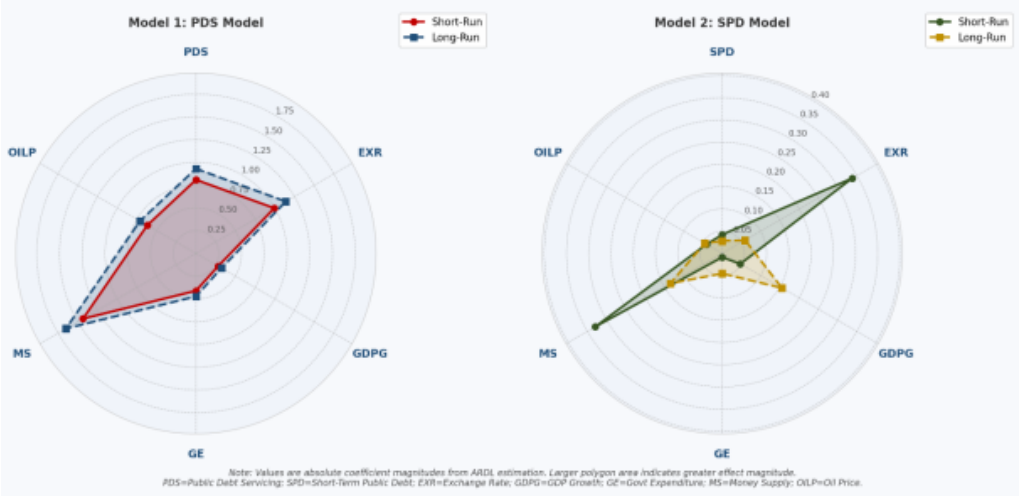


Figure 7

Radar Chart -- Absolute Coefficient Magnitudes: Short-Run vs Long-Run, Both ARDL Models. *Notes: Values plotted are absolute magnitudes of estimated coefficients. Larger polygon area = greater effect magnitude. Left panel=Model 1 (PDS); Right panel = Model 2 (SPD). Solid line = Short-Run; Dashed line = Long-Run. Source: Authors' ARDL estimation.*

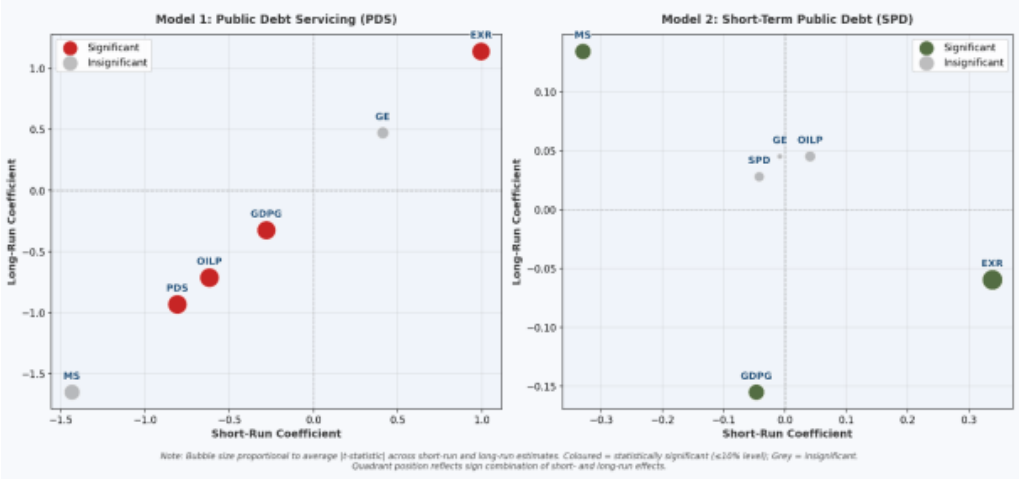


Figure 8

Bubble Chart -- Variable Effect Sizes and Statistical Significance, Both ARDL Models.

Notes: X-axis = Short-Run coefficient (ECM); Y-axis = Long-Run coefficient (Levels). Bubble size = average |t-statistic|. Coloured=significant at < = 10% level; grey=not significant. Left panel=Model 1 (PDS); Right panel = Model 2 (SPD). Source: Authors' ARDL estimation.