



Debt Dynamics and Economic Growth in Pakistan

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Abstract: This paper estimates the impact of unanticipated public debt shocks on economic growth in Pakistan using a forecast-error identification strategy. Exploiting deviations of realized debt outcomes from contemporaneous IMF forecasts for the period 1994–2025, the analysis finds that a 1 percentage point increase in the public debt reduces real GDP by about 0.21 percent in the subsequent year. Extending the analysis to allow for nonlinearities, a debt threshold of 57 percent of GDP is identified, beyond which debt exerts a drag on growth. The findings highlight the macroeconomic costs of fiscal surprises and persistently high debt-to-GDP ratios, underscoring the need for a credible medium-term fiscal reform strategy.

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1. Introduction

Public debt dynamics are central to macroeconomic policymaking, as the level, composition, and evolution of public debt shape medium-term growth prospects and exposure to macroeconomic shocks. In Pakistan, concerns over debt sustainability have intensified amid persistent fiscal imbalances, a narrow tax base, and excessive reliance on bank borrowing to meet financing needs. The resulting accumulation of public debt has amplified fiscal rigidities through higher debt-servicing costs, thereby constraining policy space for development spending and affecting economic growth.

These concerns are reflected in Pakistan's public debt trends, underscoring the persistence and scale of debt accumulation. Pakistan's public debt-to-GDP ratio has remained elevated over the past five years, averaging around 75 percent and rising by nearly 1.4 percent of GDP per year since its trough in 2007. These outcomes partly reflect repeated slippages from planned fiscal targets, which have reinforced concerns about medium-term fiscal and debt sustainability. In this context, two questions naturally arise: first, how does output respond when fiscal balances deviate from budget targets; and second, is there a level of public debt beyond which economic growth tends to weaken?

The link between public debt and economic growth operates through offsetting channels. Public borrowing can support economic activity when it finances productive investments. However, as debt rises, higher debt-servicing costs reduce fiscal flexibility, crowd out priority spending, and weaken growth prospects. In Pakistan, debt-servicing obligations have increased sharply in the past few years, leaving development expenditures broadly stagnant at around 2 percent of GDP. Elevated debt levels also increase the likelihood of distortionary fiscal adjustments, including tax-rate increases and in-year budgetary measures that are likely to have a negative impact on growth.

High public debt can also affect growth through financial crowding out. Over the past few years, nearly two-thirds of the fiscal deficit has been financed by the domestic banking system. The government's excessive reliance on bank financing, combined with banks' preference for risk-free

sovereign securities, has constrained the supply of credit to the private sector, potentially dampening private investment and overall economic growth.

Against this background, this paper examines the empirical relationship between public debt and economic growth in Pakistan. The analysis pursues two complementary objectives. First, it assesses the short-to medium-term output response to deviations of the fiscal balance from budget targets. Second, it estimates whether a public debt threshold exists beyond which economic growth tends to weaken. By integrating fiscal dynamics with nonlinear debt effects in a single empirical framework, the paper offers a comprehensive assessment of the macroeconomic consequences of elevated public debt for Pakistan.

The empirical results suggest that positive public debt shocks have a contractionary effect on growth. Specifically, a one percentage point increase in public debt lowers real GDP by about 0.21 percent. The study also identifies a debt threshold of around 57 percent of GDP, beyond which growth is negatively affected. While this threshold provides a useful reference point, it is important to note that Pakistan's public debt has remained well above it for an extended period. This persistently high debt level reflects a structural drag on growth rather than a temporary deviation from equilibrium.

Accordingly, the estimated debt threshold is best interpreted as a long-run sustainability benchmark rather than a near-term target. Policy efforts should therefore prioritize a medium-term fiscal strategy aimed at putting public debt on a downward path, thereby reducing the debt-servicing burden and supporting economic growth.

The remainder of the paper is organized as follows: Section II reviews the literature; Section III outlines the analytical framework; Section IV describes the data and estimation; Section V presents robustness checks; and Section VI concludes.

2. Review of Literature

The relationship between public debt and economic growth has been widely examined in both theoretical and empirical literature. Early theoretical contributions highlight the competing mechanisms through which public borrowing influences economic activity. While debt-financed

spending may support growth by funding productive public investment or smoothing cyclical fluctuations, high and persistent debt can give rise to debt-overhang effects by increasing expected future taxation, elevating sovereign risk premia, and crowding out private investment, thereby dampening growth.

Building on these theoretical insights, the empirical literature can be broadly grouped into two strands. The first strand focuses on threshold effects in the debt–growth relationship, positing that the adverse impact of debt on economic activity intensifies once debt exceeds a critical level. Reinhart and Rogoff (2010) report that growth weakens sharply when public debt rises above 90 percent of GDP, although subsequent work has questioned the robustness and precision of this numerical threshold. Related studies, including Caner et al. (2010) and Omotosho et al. (2016), also find statistically significant negative growth effects beyond country-specific debt thresholds. More recent panel studies, such as Eberhardt and Presbitero (2015), Égert (2015), and Chudik et al. (2017), show that estimated debt thresholds are sensitive to methodology, sample composition, and controls.

The second strand of empirical literature emphasizes debt dynamics rather than debt levels. Pescatori et al. (2014) argue that high debt is not necessarily harmful to growth if it follows a credible path of decline, while even moderate debt can affect growth when it is on an upward path. Subsequent work, including Abbas et al. (2021), reinforces this view by highlighting the importance of debt trajectories, fiscal credibility, and institutional quality in shaping growth outcomes. This perspective underscores the role of fiscal sustainability rather than a single numerical debt threshold in influencing macroeconomic performance.

While these strands of the literature document the association between public debt and growth, the recent literature increasingly emphasizes the need to disentangle causality. Examining unanticipated public debt shocks helps overcome this challenge by isolating unexpected fiscal developments that are plausibly exogenous to current economic conditions. This approach allows a clearer assessment of the impact of debt on output, particularly in economies subject to macroeconomic shocks.

Recent studies explicitly account for the endogeneity between public debt and economic activity. For instance, De Soyres, Kawai, and Wang (2022) used forecast errors to show that unanticipated increases in

public debt led to output losses, particularly in economies with weaker institutions and higher macroeconomic risk. Related recent studies, including Jordà, Schularick, and Taylor (2023), find that debt surges are associated with prolonged output costs, especially when accompanied by financial vulnerabilities.

At the country level, the evidence for Pakistan is broadly consistent with these cross-country findings. The existing literature generally documents a negative relationship between public debt and economic growth. Studies by Akram (2011), Mustafa (2012), and Zohaib (2020), using cointegration, ARDL, and other time-series techniques, find evidence of debt overhang and adverse growth effects, particularly for external debt. Other studies emphasize the role of rising domestic debt, bank-financed fiscal deficits, and increasing debt-servicing costs in constraining private investment and development spending.

Recent evidence addressing endogeneity between public debt and economic activity motivates a closer examination of debt shocks as a channel affecting economic growth in Pakistan. This paper contributes to the literature in two key respects. First, it applies the forecast-error-based identification strategy of De Soyres et al. (2022) to assess the causal impact of public debt shocks on output. Second, by combining this approach with a threshold regression framework, the paper assesses whether the growth effects of debt shocks vary systematically across debt regimes. By jointly identifying exogenous debt shocks and nonlinear debt dynamics, this paper extends the existing evidence by assessing how prolonged episodes of high public debt shape growth outcomes in Pakistan.

3. The Analytical Framework

To isolate the macroeconomic effects of fiscal volatility, this paper adopts a framework that distinguishes unexpected fiscal outcomes from normal debt accumulation. Fiscal slippages, measured by forecast errors, are assumed to represent unanticipated debt shocks. Conceptually, such shocks can have immediate adverse effects on output by tightening financing conditions, increasing sovereign risk premia, and necessitating abrupt fiscal adjustment. Persistently high public debt levels further amplify these effects by interacting with structural debt dependence, generating a pronounced drag on economic growth.

Following De Soyres, Kawai, and Wang (2022), forecast errors are computed as the realized change in the public debt-to-GDP ratio, the change in the forecasted debt-to-actual GDP ratio, and the change implied by contemporaneous debt forecasts:

$$debt_t^{shock} = \left(\ln \frac{Debt_t^{actual}}{NGDP_t^{actual}} - \ln \frac{Debt_{t-1}^{actual}}{NGDP_{t-1}^{actual}} \right) - \left(\ln \frac{Debt_t^{forecast}}{NGDP_t^{forecast}} - \ln \frac{Debt_{t-1}^{actual}}{NGDP_{t-1}^{actual}} \right) \quad (1)$$

which simplifies to:

$$= \Delta \ln debt_t^{actual} - \Delta \ln debt_t^{forecast}$$

Once debt shocks are identified, their short- to medium-term effects on output are estimated using the following local-projection-type regression:

$$y_{t+k} - y_{t-1} = c + \beta debt_t^{shock} + \theta Z_t + \varepsilon_t \quad (2)$$

where y_t denotes real output, Z_t is a vector of control variables, and ε_t is the error term. Following the related literature, the control set includes the trade deficit and inflation, both important determinants of economic activity in Pakistan. The horizon k ranges from 0 to 3 years.

In the second stage of the analysis, the paper examines whether the growth effects of public debt vary across debt regimes. To this end, the framework proposed by Khan and Senhadji (2001) is used to estimate a public debt-to-GDP threshold for Pakistan. The following equation is estimated using a multistep ordinary least squares approach:

$$y_t = \alpha + \beta_1 d_t (Pd_t - Pd^*) + \beta_2 (1 - d_t) (Pd_t - Pd^*) + \theta Z_t + \varepsilon_t \quad (3)$$

where Pd_t denotes the public debt-to-GDP ratio at time t , and d^* is a candidate threshold value that is iterated over a grid to identify the optimal debt threshold. The indicator variable d_t is defined as:

$$d_t = \begin{cases} 1, & \text{if } Pd > d^* \\ 0, & \text{elsewhere} \end{cases}$$

In this specification, β_1 captures the marginal impact of public debt on output when the debt ratio exceeds the threshold, while β_2 captures the corresponding effect when debt remains below the threshold.

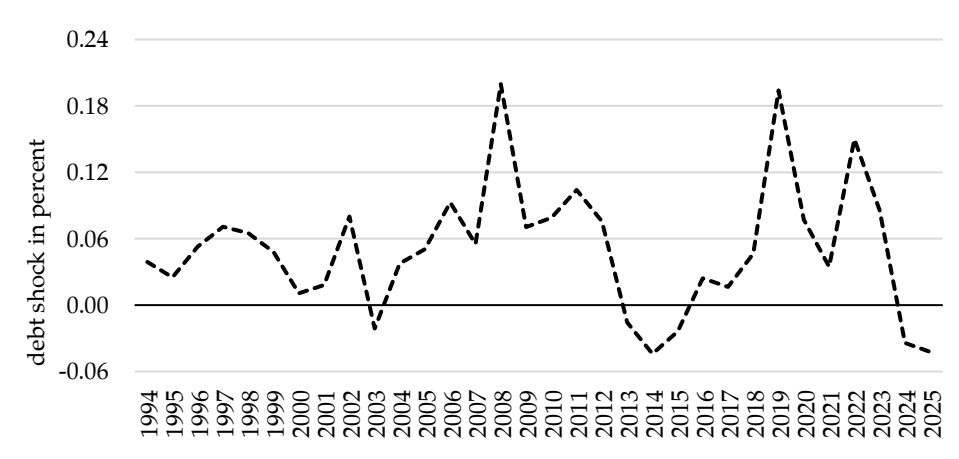
4. Data and Estimation

This section outlines the data sources, sample coverage, and empirical strategy used to evaluate the output effects of public debt shocks and to identify potential debt threshold effects in Pakistan. The analysis uses annual data from 1994 to 2025, primarily from the IMF's World Economic Outlook, Article IV consultation reports, and the Economic Survey of Pakistan. Detailed conceptual definitions, data sources, and the methodology for constructing forecast errors are provided in Appendix B.

To ensure consistency and comparability across the sample period, several measurement adjustments are applied to the data. First, both actual and forecast public debt are expressed relative to actual nominal GDP to isolate unexpected movements in public debt from mechanical effects caused by GDP forecast errors. Second, debt forecasts are drawn from the October vintages of the World Economic Outlook for the corresponding year to mitigate endogeneity concerns, as these projections incorporate information from annual budgets and announced policy measures.

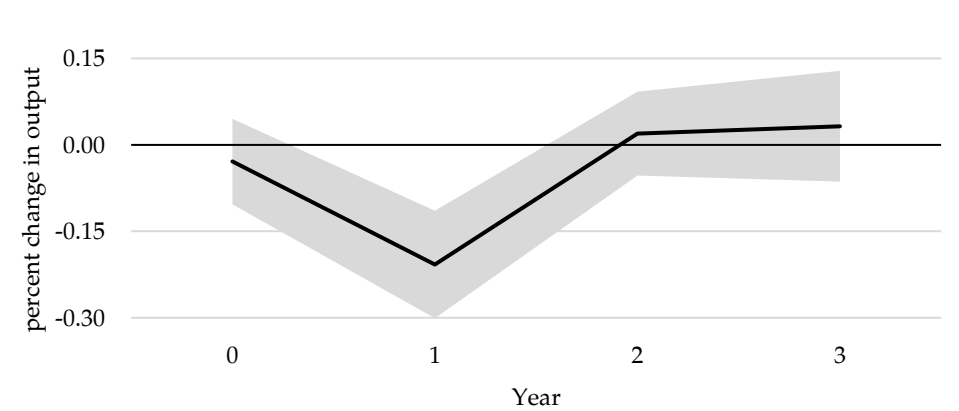
Figure 1 plots the resulting public debt forecast error series. The series shows pronounced spikes during periods of macroeconomic stress, including the 2008 global financial crisis, the COVID-19 pandemic, and the Russia–Ukraine conflict. These patterns have a clear economic interpretation in the context of Pakistan. As a commodity-importing economy, adverse terms-of-trade shocks tend to weaken the balance of payments, raise gross financing needs, and increase external borrowing requirements. In periods of limited foreign exchange buffers, exchange-rate depreciation further amplifies the domestic-currency value of external debt. On the fiscal side, such shocks often trigger discretionary policy responses, such as subsidies, grants, and emergency cash disbursements, aimed at cushioning households and firms, which generate additional unanticipated borrowing needs. The behavior of the forecast error series during crisis episodes therefore supports interpreting it as capturing economically meaningful and policy relevant public debt shocks.

Figure 1: Evolution of Public Debt Forecast Error



Note: Author’s calculations.

Figure 2: Response of Real GDP to Public Debt Shock



Note: $t=0$ is the year of shock. Green Shaded areas denote 90 percent confidence intervals constructed using Newey–West standard errors. The solid green line represents the response to an unanticipated increase in public debt to GDP ratio.

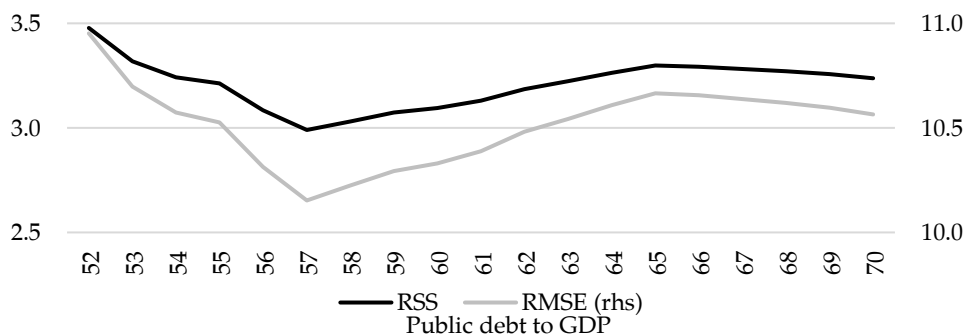
Using the local projection framework and equation (2), impulse responses are estimated to quantify the effect of an unanticipated public debt shock on output, with 90 percent confidence bands constructed using Newey–West standard errors, Figure 2 shows that a one percent unexpected increase in public debt reduces real GDP by about 0.21 percent in the year following the shock, with the effect statistically significant at the 1 percent level.

Table 1: Regression Result, Baseline

	K=0	K=1	K=2	K=3
PUBLIC DEBT SHOCK (T)	-0.03 (0.05)	-0.21*** (0.07)	0.02 (0.04)	0.03 (0.04)
TRADE DEFICIT	0.67*** (0.16)	0.20 (0.15)	-0.40* (0.21)	-0.48** (0.23)
INFLATION	-0.06* (0.04)	-0.17*** (0.05)	-0.21* (0.12)	-0.05 (0.14)
R ²	0.62	0.45	0.23	0.31

Note: The dependent variable is the change in real GDP, where $k=0$ denotes the year of the shock. Newey–West standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively. All variables are tested for stationarity prior to estimation. The lag length is set to one based on information-criterion selection.

Using equation (3), the analysis then examines nonlinearities in the debt-growth relationship by searching for a public debt-to-GDP threshold over the range of 50 to 70 percent of GDP. For each candidate threshold, coefficients are estimated for both high-debt (β_1) and low-debt (β_2) regimes. Across iterations, the estimated coefficient β_1 remains consistently negative. In contrast, the coefficient β_2 is initially positive but turns negative once the debt ratio exceeds approximately 52 percent of GDP. The combined effect of public debt on growth is captured by the sum of the regime-specific coefficients. Consistent with the literature, the threshold is identified at the value that minimizes the residual sum of squares (RSS) and the root mean squared error (RMSE). For Pakistan, both criteria reach their minimum at a debt-to-GDP ratio of approximately 57 percent (Figure 3).

Figure 3: Shock Residual Sum of Squares (RSS) and Root Mean Square Error (RMSE) for the Iterative Regressions

Note: Author's calculations.

5. Robustness Checks

This section assesses the robustness of the baseline results to alternative sample coverage, shock construction, and dynamic specification. A key concern is that proxy-based imputations used to construct public debt forecast errors in the earlier part of the sample may introduce measurement noise. Hence, the baseline specification is re-estimated using a restricted sample starting in 2000, a period for which public debt forecast errors can be constructed exclusively from IMF sources, namely World Economic Outlook (WEO) vintages and Article IV consultation reports. As an additional robustness check, the baseline specification is also re-estimated without lag terms to assess whether the results are sensitive to the assumed dynamic structure.

Table 2: Regression Result

	K=0	K=1	K=2	K=3
(1) Dropping Lag of Variables				
PUBLIC DEBT SHOCK (T)	-0.04 (0.03)	-0.17*** (0.07)	0.04 (0.05)	0.02 (0.06)
R ²	0.59	0.36	0.17	0.15
(2) Reduce Sample Size-From 2000 onward				
PUBLIC DEBT SHOCK (T)	-0.05 (0.04)	-0.21*** (0.07)	0.03 (0.04)	0.04 (0.05)
R ²	0.71	0.52	0.30	0.35

*Note: The dependent variable is the change in real GDP, where $k=0$ denotes the year of the shock. Newey–West standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively*

The results from these robustness exercises closely mirror the baseline findings. An unanticipated increase in public debt continues to produce a negative, economically meaningful short-run response in real GDP, with magnitudes comparable to those obtained in the full-sample specification.

Overall, these robustness checks provide reassurance that the main conclusions are not sensitive to alternative sample definitions, shock construction, or dynamic assumptions, thereby strengthening the credibility of the baseline results.

6. Conclusion

The empirical results have clear policy implications. First, the finding that unanticipated increases in public debt have a contractionary

effect on output highlights the importance of limiting exposure to fiscal surprises. This underscores the need to strengthen fiscal forecasting, enhance the credibility of budget assumptions, and improve transparency in public finances. Building fiscal buffers during periods of relative stability would allow fiscal authorities to absorb adverse shocks, such as commodity price spikes or natural disasters, without resorting to unanticipated debt accumulation that carries short-term growth costs.

Second, the estimated debt threshold is well below Pakistan's current debt level, indicating that the economy has been operating in a high-debt regime for a prolonged period, with associated structural growth constraints. In this context, policies focused solely on stabilizing the debt ratio at elevated levels are insufficient. Instead, a credible medium-term debt reduction strategy is required, anchored in sustained primary surpluses and a clear downward trajectory for public debt.

Accordingly, fiscal reforms should be evaluated not only on efficiency grounds but also on their contribution to durable primary surpluses. Measures such as broadening the tax base, rationalizing untargeted subsidies, containing losses at public sector enterprises, limiting contingent liabilities, and strengthening expenditure control are central to restoring debt sustainability and improving long-term growth prospects when embedded within a coherent medium-term fiscal framework.

Finally, these findings are consistent with the objectives of Pakistan's Fiscal Responsibility and Debt Limitation Act and with IMF–World Bank debt sustainability frameworks, which emphasize keeping public debt at levels consistent with macroeconomic stability and adequate policy space. The persistence of public debt well above the estimated threshold indicates that repeated fiscal slippages have weakened the effectiveness of formal fiscal rules, leaving the economy more exposed to shocks and underscoring the need for a credible, sustained fiscal reform strategy.

Building on these insights, future research could extend the analysis by distinguishing between external and domestic debt shocks, since their transmission channels and growth effects may differ markedly. Further work could also examine nonlinear interactions between debt shocks and macroeconomic conditions during stress episodes and use higher-frequency or disaggregated fiscal data to better identify unanticipated debt shocks.

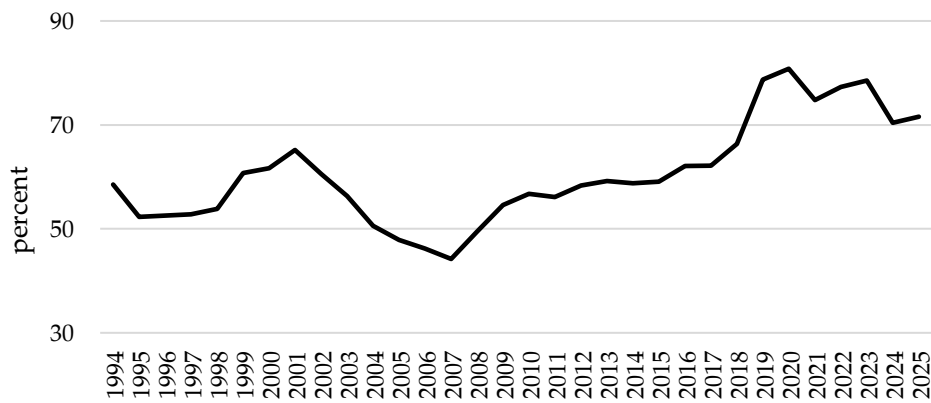
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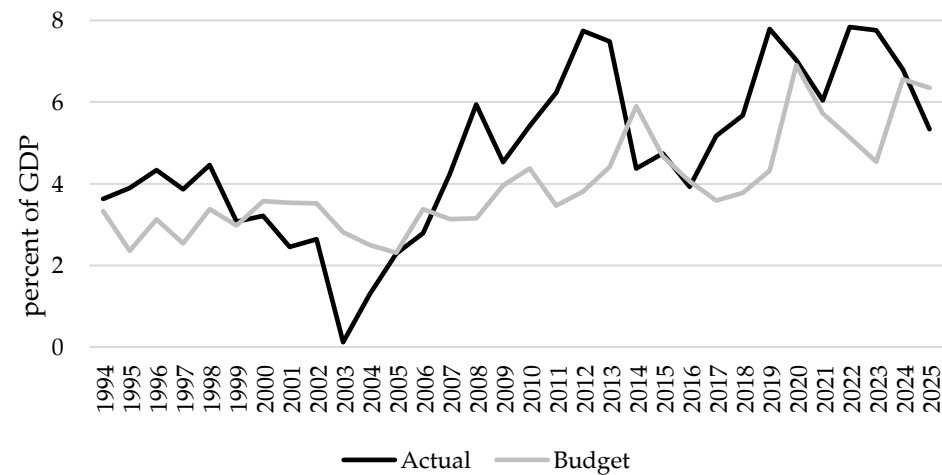
7. *Appendix A. Stylized Facts on Public Debt and Economic Growth in Pakistan*

Figure A1: Pakistan's Public Debt to GDP



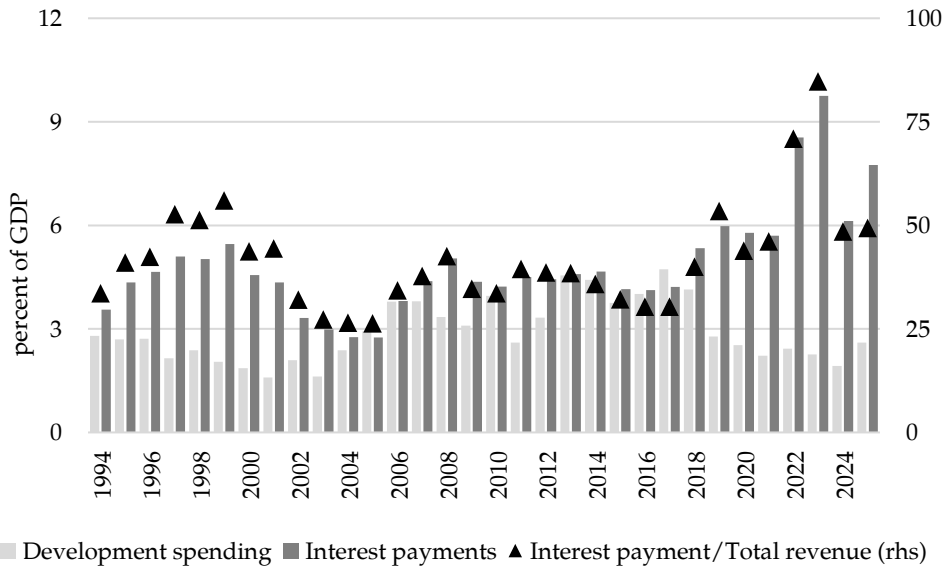
Source: IMF, *World Economic Outlook*, October 2025

Figure A2: Fiscal Deficit, Actual viz-a-viz Budget



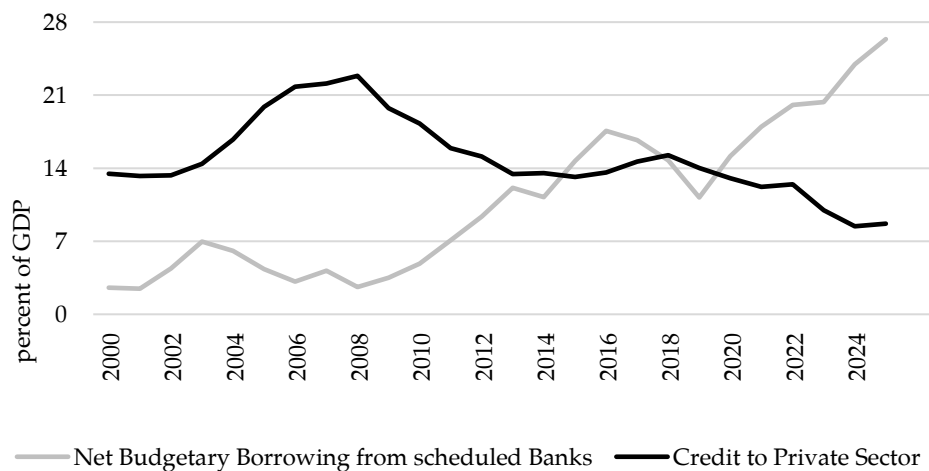
Source: IMF, *World Economic Outlook* (October 2025), and Ministry of Finance, *Pakistan Economic Survey* (various years).

Figure A3: Government's Interest Payment viz a-viz Development Spendings



Source: Ministry of Finance, Pakistan Economic Survey (various years).

Figure A4: Government Net Budgetary borrowing from Scheduled Banks and Credit to Private Sector



Source: Ministry of Finance, Pakistan Economic Survey (various years).

Appendix B: Construction of Public Debt Forecast Error Series

This appendix documents the data sources, assumptions, and construction methodology used to derive the public debt forecast error series, which serves as an exogenous shock in the empirical analysis.

B.1 Conceptual Definition

Following De Soyres, Kawai, and Wang (2022), the public debt shock is defined as the forecast error in the change in the public debt-to-GDP ratio, computed as the difference between the realized change in the debt ratio and the change implied by contemporaneous WEO forecasts. To ensure that the shock captures unanticipated fiscal developments only, both actual and forecasted debt ratios are expressed relative to actual nominal GDP, thereby removing mechanical GDP forecast error effects.

B.2 Data Sources and Period Coverage

Due to data availability constraints, the construction of the forecast error series relies on multiple sources across the subperiods.

2010–2023: IMF WEO Forecasts

The actual public debt stock is taken from the IMF World Economic Outlook (latest vintage). The forecasted public debt stock is obtained from IMF World Economic Outlook vintages published each October.

2000–2009: IMF Article IV Reports

Public debt forecasts are drawn from IMF Article IV consultation reports, preferably those published during the July–December window to align with post-budget macroeconomic assessments. When forecasts are reported as ratios, absolute debt stocks are reconstructed using rebased nominal GDP.

Pre 2000: Proxy Based Imputations

Because publicly available systematic debt forecasts are unavailable, percentage deviations of the fiscal deficit (as a share of GDP) from budget estimates are used as a proxy for unexpected debt accumulation. This approach is motivated by the close accounting relationship between fiscal deficits and changes in public debt.