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What drives Nepal's debt dynamics: Fiscal Stance, snowball effect or the exchange rate valuation?

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Abstract

This paper is motivated by the renewed debt accumulation and its increased exposure to domestic financing conditions and exchange-rate valuation after FY2015/16 in Nepal. It asks whether Nepal's debt dynamics are shaped mainly by the primary deficits or the macro-financial conditions by combining Debt/GDP decomposition, a time-varying fiscal reaction function, and the local projections estimates on the annual fiscal-year data (N=24) using three models. The decomposition reveals a puzzle indicating that the Debt/GDP falls despite large primary deficits before mid-2010s. The large primary deficits were more than offset by a strong denominator effect (real growth and inflation) and the sizable adjustments of stock flows. After FY2015/16, the primary deficit was accompanied by the increased vulnerability to the financing environment and exchange rate valuation. The IV/placebo and weak IV support the mechanism narrative and highlight the limited precision in small samples. Results emphasize improving debt resilience by focusing on risk management in relation to rollover, interest-rate, and exchange rate valuation shocks (not only to the headline debt levels). These channels can quickly raise the debt service burden and refinancing pressures and worsen the debt indicators even when the debt ratio seems moderate.

Keywords: Debt/GDP decomposition, primary deficits, denominator effects, debt resilience.

JEL Classification: E62, H63, O40

Introduction

The dynamics of public debt are important to Nepal not only due to the relationship they have with the fiscal space, but also, the way they relate to the financing conditions, external shocks, and macroeconomic policy credibility. When the headline debt-to-GDP ratio seems to be moderate, reliance on the domestic borrowing or higher market rates can lead to rise in the interest payments and in the rollover risk. Similarly, the movements in the exchange rates can revalue the external liabilities. These issues are of a major concern in the framework of debt sustainability especially for low-income countries and is also significant in the analysis of debt sustainability in Nepal (IMF, 2018; IMF, 2020).

To deal with this concern, at first, it is useful to begin with the public debt identity. The public debt identity links changes in Debt/GDP ratio to the primary balances including the interest growth (snowball) effect, inflation and the real growth (denominator effect), exchange-rate valuation of foreign-currency liabilities, and the adjustments of the stock flows (Escolano, 2010). However, in many countries and in case of Nepal as well, the debt identity shows the counterintuitive pattern, a kind of puzzle. Over years, in Nepal, the debt ratio has decreased[1] despite continuous negative primary balances because the strong growth of nominal GDP (via real growth and inflation), and below-the-line adjustments of stock flows dominate the debt calculations ignoring the debt pressures. This puzzle is the primary motivation to undertake an empirical inquiry because the question is of the debt mechanisms and not merely of the debt levels.

Based on the debt-identity perspective and also on the fiscal-sustainability diagnostics, this paper questions whether Nepal's debt dynamics are primarily of a fiscal nature (primary deficits) or a macro-financial nature. The standard diagnostics and the debt decomposition with a Bohn type fiscal reaction function and local projections approach (for tracing along the lines of transmission and timing) are used for triangulating the evidences. This mechanism-based analysis is incorporated with an integrated approach to recognize which channels lead to the changes in Nepal's overall debt pattern (Escolano, 2010; Bohn, 1998; Jordà, 2005; IMF, 2018).

In Nepal, the official monitoring which comes from mechanism view only is inadequate for an overall debt analysis. Regarding this, IMF (2023) has asserted that though the headline debt ratios generally appear to be sustainable, the vulnerabilities can rise when the domestic financing costs increase, rollovers tighten, or volatility in the macroeconomic landscape rises. These risks manifest in real terms. The higher interest rates, refinancing pressure, and valuation effects can exacerbate debt-service and liquidity pressures despite the debt ratio changes at a slow pace. Therefore, it is important to focus on identifying the channel that influences debt dynamics and timing rather than on the debt levels only.

Since the assertions of the debt dynamics framework by IMF (especially for low-income countries) focuses on variables such as economic growth, inflation, and the valuation shocks (as the principal drivers of the debt paths), it is necessary for a scenario-based analysis and a cautious interpretation of the residual stock flow movements (especially in the case when the limitations of the data make the outcomes more prone to the shocks) (IMF, 2018; IMF,

[1] See. Table 2 (Results).

2024). An ADB outlook also focuses on how the external situation, commodity prices, remittances inflow, and the global rates tend to shape the macro fiscal landscape for the debt dynamics in South Asia. Aligning to it, a Nepal (a South Asian country) based study would be a useful to analyze a country wise perspective domain (Asian Development Bank, 2024).

The Public Debt Management Office (PDMO) also mentions that the debt strategy of Nepal should focus on the financing mix which can change the risk profile of debt. It asserts that when that financing is aligned with the domestic instruments, the exposure to the interest rate and refinancing risks increases, even in the presence of valuation risks from foreign currency liabilities (PDMO, 2025). In practice, the path of stable deficit can coincide with the debt pressures which are often dynamic unless the financing conditions and the valuation tend to move against the government's debt servicing capacity.

In India, the sovereign debt risks are moderately mitigated by a debt composition that is long dated, fixed rate, local currency dominated, and held by residents (IMF, 2025). India is also assessing whether the debt sustainability is linked with the interest growth differentials (Government of India, 2021). Because Nepal is linked with India (through conventional currency pegged regime as nominal anchor, technically), India's money market and policy situations can act as an external agent for the short-term financing stance of Nepal, making the overall financial conditions empirically testable.

Several applied work in Nepal till date align with the accounting concept only (using headline and baseline scenarios) or is correlation focused (a naïve approach). The integrated analysis of channel wise decomposition, diagnostics of the fiscal reactions, the dynamic transmission scenarios followed by the endogeneity tests and falsification cases are what this paper integrates. This study is thus motivated to ask whether Nepal's dynamics are primarily shaped by the fiscal deficits or by financial conditions (which are transmitted through the interest rate and exchange rate valuation channels). And this study attempts to evaluate these processes by using several empirical tools (Bohn, 1998; Jordà, 2005).

The rest of the study follows a coherent structure. The data and methodology describe the data (the rationale, motivations, and measurements) and the empirical strategies. There are decompositions, the fiscal reaction along with the stability tests, the use of local projections, and use of an IV, placebo, and weak IV robust diagnostics. The Results and Discussion focus the estimates and figures and the discussion of their interpretation in terms of fiscal versus financing situation mechanisms followed by the policy implications. The final section is the conclusions, the limitations, and References.

Data and Methodology

This paper uses annual data (FY 2000/01 – FY 2023/24, N=24) compiled based on the availability and consistency. The empirical analysis comprises of the accounting-based decomposition, the diagnostics of fiscal reaction, and the analysis of the dynamic transmission. Therefore, the data is organized around the components of debt identity[2] and around the two macro financial channels which are highlighted in the debt framework in low-income countries

[2] The debt dynamics decomposition comprises of the primary balance, snowball effect, the inflation and denominator effect, the FX valuation of the foreign currency debt, and the adjustment of stock flows (Escolano, 2010).

(viz. exchange rate valuation and then short-term financing framework) (Escolano, 2010; IMF, 2018).

Data and Variables

Table 1 shows the definition of variables, their sources, and the reason (motivation) behind the choice of the variables included in the study. The emphasis is placed on debt ratio rather than solely on the levels of debt. All the variables are described as a percentage of nominal GDP (pp of GDP) except when mentioned otherwise[3]. The interest rates are as percentage per annum, the exchange rates are as levels (NPR per USD /INR), and FX change is in units of log-differences.

Table 1

Data Sources and Motivations

Variable/s	Definition	Source	Motivation	Bases
Public debt ratio	Public debt (domestic + external) / nominal GDP.	MoF/PDMO debt statistics/NRB.	The main dependent variable used in decomposition. The outcome is in LP/IV.	Escolano (2010); IMF (2018)
Primary balance[4]	It is the Revenue + grants − non-interest expenditure) / GDP.	FCGO/NRB	It is the fiscal policy stance net of interest. Also, the main fiscal flow term in identity and in Bohn's concept.	Escolano (2010); Bohn (1998)
Interest payments	Total cash interest payments on public debt (domestic + external).	FCGO/NRB	This measures the interest burden. It also places a snowball term and the LP outcomes.	Escolano (2010)
Nominal GDP (Y_t), real growth (g_t), inflation (π_t)	Nominal GDP; real GDP growth; inflation (CPI)	NSO /NRB	To assess the denominator effects in the debt identity, for cycle controls, and for construction of output-gap.	Escolano (2010); IMF (2018)
Exchange rate and FX depreciation	USD/NPR and for FX shock, it is Δln (USD/NPR)	NRB	It is the depiction of valuation channel; it also revalues the external debt in domestic currency.	Escolano (2010)
External FX proxy / valuation term	It is first-order valuation proxy ($\Delta \ln FX_t$) × (external debt shares in GDP or in total debt)	It is computed using FX + external debt stock, and the exchange rate from NRB.	It aids to separate the FX revaluation from below-the-line and ASF residual (Escolano, 2010).	Escolano (2010)

[3] The variables are mentioned in annual (percent of GDP) unless stated, the interest rate is in percent form.

[4] The surplus primary balance is greater than 0 and deficit is less than 0, thus, the primary deficit is equal to negative primary balance (deficit recorded as a positive value) which is used throughout this paper.

Variable/s	Definition	Source	Motivation	Bases
Adjustment of Stock Flows (ASF)	The residual term ASF = ΔPublic Debt Ratio − identified components from the identity.	It is constructed from the above series.	It aids in capturing the below-the-line items (timing, cash balances, on-lending, arrears, the valuation which're not captured, and the reconciliation gaps).	Escolano (2010); IMF (2018)
Short rate (Nepal)	91-Day T-Bill rate. The rate-shock ΔTBILL.	NRB	It is used as proxy for the short-term financing conditions which affects debt service and the fiscal stress.	Jordà (2005); Wooldridge (2010)
Indian variables	Weighted Average Call Money Rate (WACR) and Policy rate.	Database on Indian Economy (RBI)	These are the external shift levers for Nepal's short-rate stance in the IV design. It also allows for the over ID checks.	Wooldridge (2010); Stock and Yogo (2005)
FX instruments	Δln(USD/INR) for Δln(USD/NPR) (this is the channel of peg-linked).	RBI/NRB	It has a strong relevance for the FX channel under the pegged regime. It detaches the FX movements (externally driven).	Wooldridge (2010); Anderson and Rubin (1949)

Note. Sources of the data are representative, and the final series are compiled to the FY frequency before estimation.

Empirical Strategy and Research Design

The paper uses three empirical strategies. First, the annual changes in the debt ratio are analyzed using the identity of debt dynamics. Second, the fiscal reaction function, (Bohn type) is estimated, incorporating time variation through rolling and recursive stability analyses. Third, the dynamic responses to foreign exchange and short rate impulses using the local projections are assessed. Thereafter, the identification is established using the IV design, the placebo and falsification, and the weak IV robust inferences. This is done to prioritize the consistency of analysis rather than using the single equation precision for a small sample. Overall, this paper uses an observational (non-experimental) mechanism-based macro-fiscal research design.

Model One- Exact Debt Decomposition

The exact debt decomposition is, PD_{GDPR} analyzed in equation 1, representing the public debt (as a share of GDP). Taking the reference of Escolano (2010), the change in the debt ratio is articulated as the sum of the primary deficit, the growth of interest (snowball) contribution, the effect of the inflation and real growth (the denominator) effects, the exchange rate valuation of the foreign debt, and the residual of the adjustment of the stock flows.

$$\Delta PD_{GDPR} = PRDF_t + SNBL_t + DNMTR_t + VALUTN_t + ASF_t \dots\dots Equation\ (1)$$

Where, $PRDF_t$ is negative of Primary Deficit (a deficit is positive). The $SNBL_t$ is snowball effect which simplifies the interaction of the effective nominal interest rate and the nominal growth. The $VALUTN_t$ is the FX valuation which approximates FX revaluation of the

external liabilities, and the ASF_t helps in reconciling the flows with the observed changes in the stock. In this paper, each contribution is computed in the pp terms and the ASF_t as the residuals so that the identity holds true in the sample.

Model Two – The Fiscal Reaction Function

For the assessment of the fiscal behavior reacting in a debt stabilizing manner, a Bohn type[5] reaction function is estimated (Bohn, 1998) as presented in equation 2.

$$PRB_t = \varrho + \xi PD_{GPR_{t-1}} + \Theta'\psi_t + \mu_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots Equation\ (2)$$

In equation 2, the PRB_t is the ratio of the primary balance to GDP. The $PD_{GPR_{t-1}}$ is the ratio of the lagged debt of the GDP, and the ψ_t represents a proxy of business cycle (output gap or the growth gap), inflation, the depreciation of FX, 91 days T Bill rate (Nepal), and the regime dummies (post 2015, the COVID, and post 2022). A positive ξ is linked with the adjustment whenever there is a rise in the debt (as a sustainability diagnostic). However, it is not interpreted as a causal inference in this paper. Since the samples (annual) are short, this paper uses the HAC standard errors (Newey and West, 1987) and matches the single ξ with the rolling or recursive estimate for the assessment of stability.

Model 3 - The Local Projections

For tracing the time profile of the transmission of macro financial dynamism, this paper estimates local projections[6] (Jordà, 2005) for the horizons, the h[7] ranging from 0 till 5.

$$\Xi_{t+h} = \eta_h + \Omega_h Shock_t + \Gamma_h' Z_t + \vartheta_{t+h} \dots\dots\dots\dots\dots\dots\dots\dots\dots Equation\ (3)$$

In equation 3, the Ξ represents the super set of Debt to GDP ratio, the Primary balance to GDP, and the Interest to GDP ratio. The $Shock_t$ encompass either of the FX depreciation (Δln USD/NPR) or the proxy of the financing conditions (91 Days T Bill-Nepal). The Z_t encompass the lagged debt variable, the inflation, the level of T Bill, and the regime dummies as well. The shocks are scaled for one standard deviation to compare them, and the inference also uses the HAC[8] standard errors to account for the serial correlation in the annual data (Newey & West, 1987).

IV Identifications and Diagnostics

Since the short-term rates and the fiscal outcomes are determined jointly (endogeneity), we use LP/OLS results with an IV design estimated through a two-stage least squares (2SLS) estimation. In the case of the FX channel, these paper instruments Δln(USD/NPR) using Δln(USD/INR) and use the peg-linked channel[9]. In the case of the rate channel, this paper uses an external shift lever of the short-term financing terms in Nepal the WACR (level) of India,

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5 Bohn-type fiscal reaction is a positive fiscal reaction to lagged debt, which is same as the stabilizing fiscal behavior under the broad assumptions (Bohn, 1998).

6 The local projections provide an approximation of horizon specific impulse reactions in a flexible manner and are also resistant to a partial misspecification of the model against the tight-parameterized VARs (Jordà, 2005).

7 The horizon 0 till 5 is informative about the medium-term dynamics, however, the power of it is limited. This study focuses on the directions and mechanisms rather than precise elasticities of the long horizon (Jordà, 2005).

8 The heteroskedasticity -autocorrelation-consistent (HAC), standard errors have been used in the inference (Newey and West, 1987).

9 As NPR has a conventional peg with Indian rupee, USD/NPR is moving mechanically in line with USD/INR; hence USD/INR is an externally based shifter to Nepal USD/NPR changes.

and the policy rate (India). The relevance of the instruments is evaluated using the first-stage Wald -F statistics[10] and the endogeneity and exclusion stories are simultaneously supported with the Durbin -Wu-Hausman tests and the Sargan over-identification tests (Sargan, 1958; Wooldridge, 2010).

Since the sample size is small (annual), and the identification also could be imperfect, this paper also provides a weak-IV robust Anderson-Rubin confidence sets for the specification of the impact (h=0), which hold under the weaker first-stage relationships (Anderson and Rubin, 1949). Lastly, the placebo/falsification test focuses on the regressed lagged results on the contemporaneous shock/IV motivated stance to confirm the pre-trend contamination.

Overall Model Motivation

The overall analysis of the model is guided by a practical domain and a policy goal. The macro-fiscal series of Nepal have restricted statistical capability to perform an entirely structural estimation. The decomposition identifies which component moved a debt to GDP ratio. The fiscal reaction function tests whether the policy adjusts when there is a rise in the debt. The local projections trace timing and persistence. The IV/placebo/weak-IV layer shows the identification of the changing FX and financing-conditions channels (relevant to managing debt risks in low-income countries like Nepal) (Escolano, 2010; IMF, 2018; Jordà, 2005).

Tools of Analysis

This paper's empirical analysis and the graphical depictions were done using STATA 17. The models, figures, and tables were obtained from the STATA output. The STATA Do file was adapted from official StataCorp manuals (StataCorp, 2021).

Results and Analysis

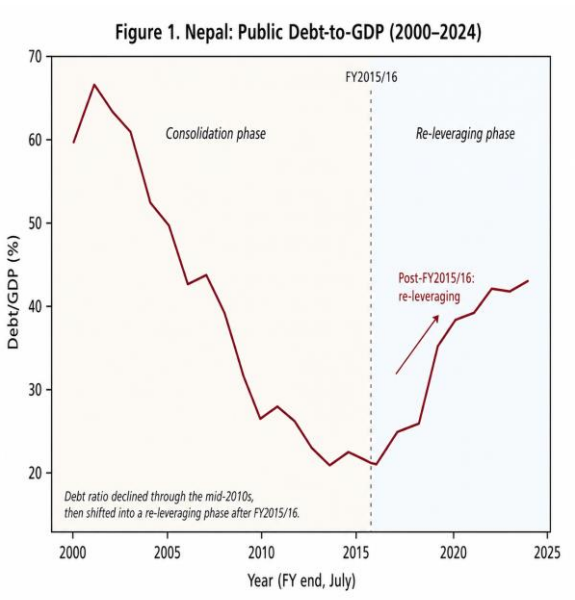
The empirical results progress from clear facts to objective analysis. At first, graphs and summary ratios are analyzed to demonstrate the situation that Nepal has experienced 2000 - 2024 in terms of debt, fiscal balance, interest burden, and the exchange-rate conditions. We then disaggregate changes in the Debt to GDP ratio into the mechanical factors (primary balance, growth-inflation factors, interest / snowball factors, exchange-rate valuation, and the stock-flow factors) to identify which transmission methods explain the debt flows across the subperiods. Thereafter, we estimate dynamic responses using local projections to analyze the dynamics of debt and fiscal responses to the exchange-rate and financing-condition shocks. Finally, due to the concurrent determination of the domestic rates and the fiscal performance, we use external instruments (that can be applied based on Indian money market conditions). We also use identification and placebo/falsification tests, as well as a weak-IV robust inference.

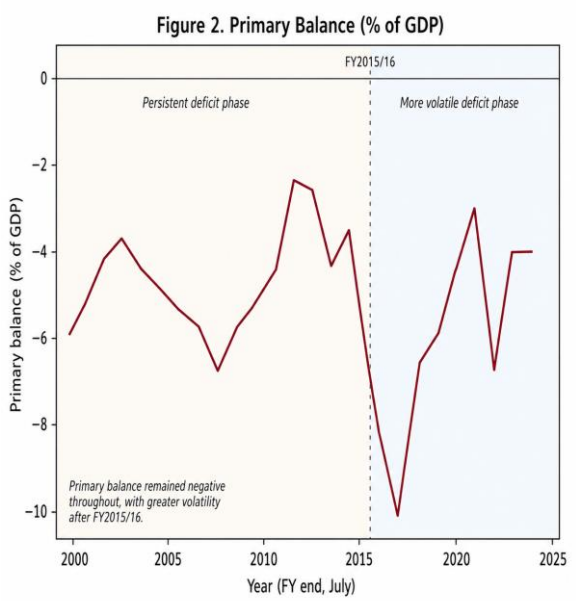
Descriptive Analytics

Prior to analyzing Nepal's debt dynamics, we inspect relevant graphs. In doing so, we analyze the Public Debt to GDP ratio and the Primary Balance to GDP ratio. The public debt to GDP ratio exhibits two regimes. There is a phase of consolidation until the mid-2010s and a re-leveraging phase after the FY2015/16. Table 2 shows the decreasing trend of the debt ratio

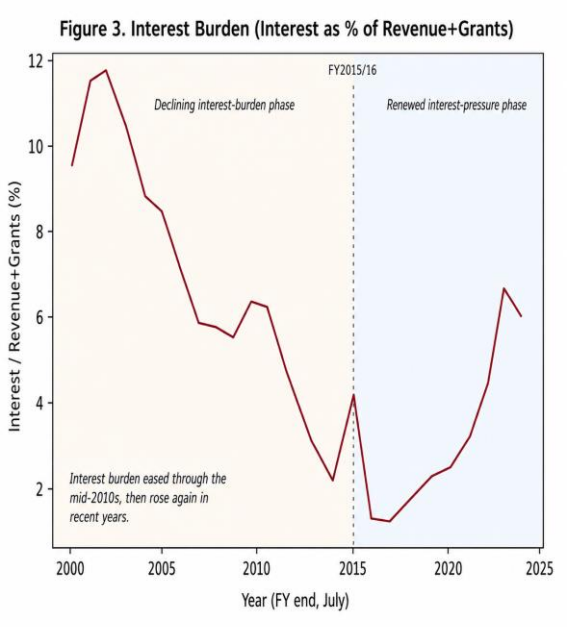
[10] The rule-of-thumb is that when the F stat in the first stage falls below the usual thresholds (i.e. F stat less than 10), it implies that the instruments are weak, and weak-IV has adverse effects on inference by the 2SLS (Staiger and Stock, 1997; Stock and Yogo, 2005).

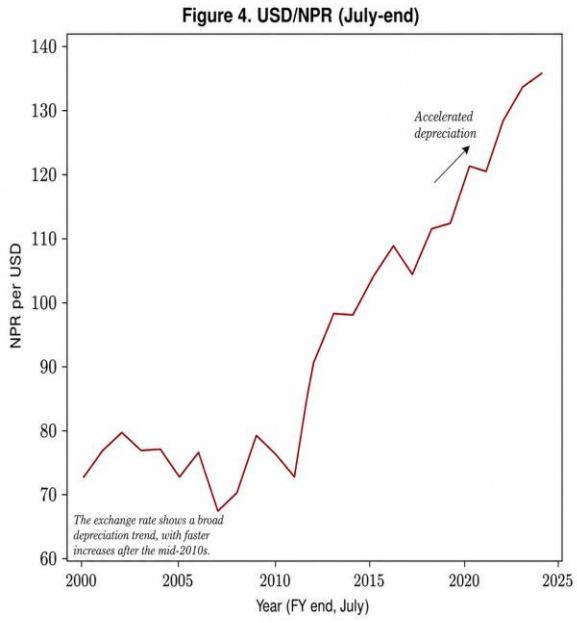
which decreased approximately by 37pp between FY2001-FY2014, and by 21pp between FY2015-FY2024. This is because the post-2015 growth of the ratio is not merely a transition of low drift but rather a regime shift, especially regarding changes in financing requirements and the macro environment, making the debt dynamics more vulnerable to the interest rate and FX mechanisms.





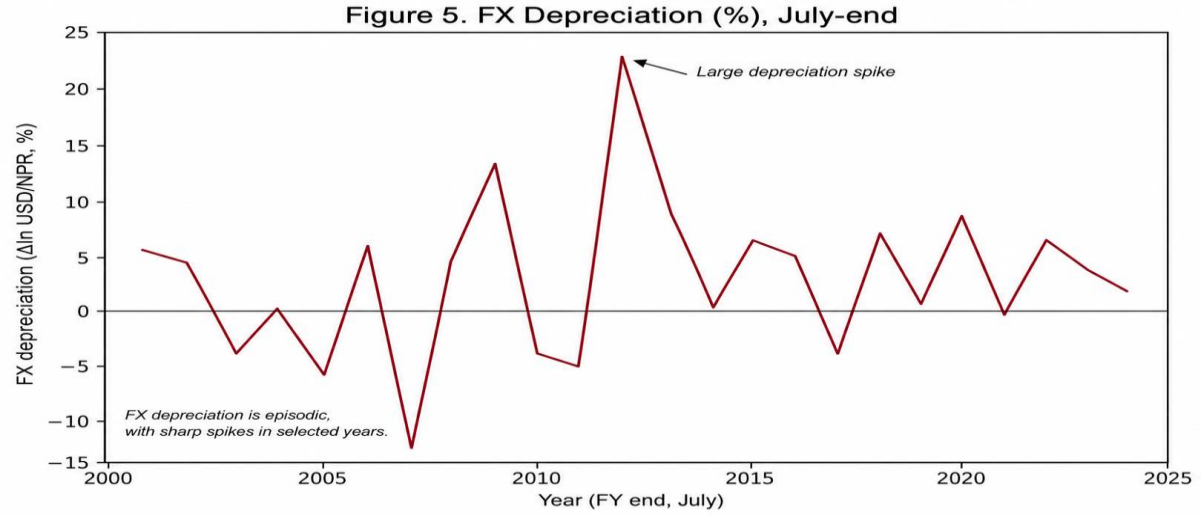
The primary balances are persistently negative, implying the fiscal policy usually increases the debt stock before the interest is paid on debt. The deficits increase sharply around high shocks and policy changes. Table 2 shows the cumulative primary deficits are high in each sub-period (that is, +33.17 pp in 2015-19 and +15.16 pp in 2022-24). This persistence is significant because it suggests that the destabilization of debts in Nepal has traditionally been dependent on automatic factors (growth, inflation, and the adjustment of stock-flows) rather than on a lasting primary surplus.





The interest-burden shows a different story at the current stage. Though the debt ratio does not appear to be very high, the interest payments may become binding when the borrowings (domestic) increase, and the rates also rise. Interest plays a minor role in the debt changes in 2015-19 (+2.44 pp), but it becomes pertinent in 2022-24 (+3.31 pp). This is an indication of change from a low interest/concessional external environment to a more rate-sensitive domestic finances, thereby increasing the policy value of observing interest expenses and the maturity structure.

The USD/NPR has trended upward (depreciation) which means the foreign currency liabilities (in NPR values) can rise without new borrowing. This is where the mechanical valuation channel, on which debt-dynamics accounting focuses, becomes relevant. A positive movement in FX increases the domestic-currency debt stock unless it is fully hedged. In our country, this seems important (even with the peg between two countries), because the external debt is generally dominated in USD and peg cannot neutralize the effects of USD valuation.



The depreciation of the FX is not smooth (Figure 5). However, it is erratic and may be aligned with USD cycles and pressure on domestic liquidity. It shows an episodic nature which is crucial for risk management. The effects of valuations and the cost of serving FX-linked debts can escalate sharply in specific years that cause discrete increases in the debt indicators (when expressed in NPR terms) despite the unchanged fiscal stance.

Combining the graphical analysis with the sub-period summaries, we discover an interesting identification issue, which is that the primary deficits alone cannot be used to infer the movements in the debt ratio of Nepal. Furthermore, the observed pattern of debt growth indicates a mixture of fiscal flows, macro-denominator impulses of growth and inflation, the valuation effects of exchange-rate movements, and a large below the line adjustments (ASF). It is also suspected that the results of debt in each fiscal position can be given a range of significantly different outcomes in diverse macro-financial settings and the stock- flow reconciliation. This informs our initial empirical model of a pure debt-dynamics accounting decomposition that measures the changes in Debt/GDP which can be credited to the primary balance, interest (snowball) effects, real growth and inflation, exchange-rate valuation, and adjustments in stock-flows (ASF).

Analysis of Model One: Exact Debt Decomposition

For the analysis of Model One, we reference Escolano (2010) on the exact debt identity and decompose the annual changes in Debt/GDP ratio into contributions from the primary deficit, interest, real growth, inflation, approximate FX valuation for external debt, and residual non-FX adjustment on the stock flows (ASF).

Table 2

Decomposition of Subperiods

Periods	ΔDebt/GDP (pp)	Primary deficit (pp)	Interest (pp)	Real growth (pp)	Inflation (pp)	FX valuation (pp)	Residual/ASF (pp)	Residual excluding FX (pp)	Samples
2001-14	-36.9	66.3	12.4	-28.3	-38.5	7.5	-48.7	-56.2	14
2015–19	14.6	33.3	2.4	-13.0	5.6	1.9	-13.7	-15.7	5
2020–21	3.5	7.7	1.3	-3.7	-5.5	1.5	3.7	2.2	2
2022–24	3.3	15.2	3.3	-4.1	-4.3	2.4	-6.7	-9.1	3

Note. Author's Analysis

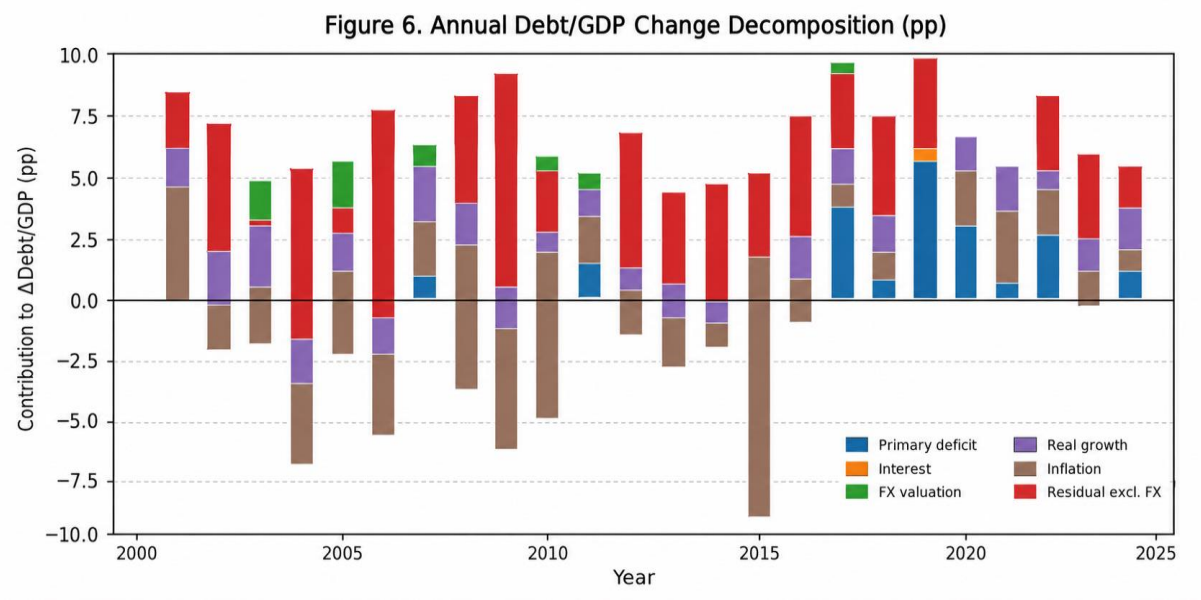
We observe an important decomposition from Table 2. The decline in debt in FY2001-14 (−36.9pp) in Nepal is due to the presence of very large cumulated primary deficits (+66.3pp). However, those are offset by denominator and the stock-flow forces, which are in real growth (-28.3pp), in inflation (-38.5pp), and basically in large ASF (negative residual) (-48.7pp). The debt to GDP rises (+14.6pp) in FY2015-19 due to the cumulated primary deficits (+33.3pp). However, in this period the real growth has declined (-13pp) and inflation has contributed to the growth (+5.6pp), and it also did not mechanically lower the debt ratio. The primary deficits are still large in FY2022-24 (+15.2pp) although it partially offsets with growth (-4.1pp) and inflation (-4.3pp), and a negative residual[11] (-6.7pp) lead to a small (+3.3pp) rise in debt growth.

After analysis of Table 2, which is only a summary of the sub-period drivers, Figures 6 and 7, delve inside years' and inspect the decomposition changes annually, separating the FX valuation spikes with some of the ASF residual adjustments.

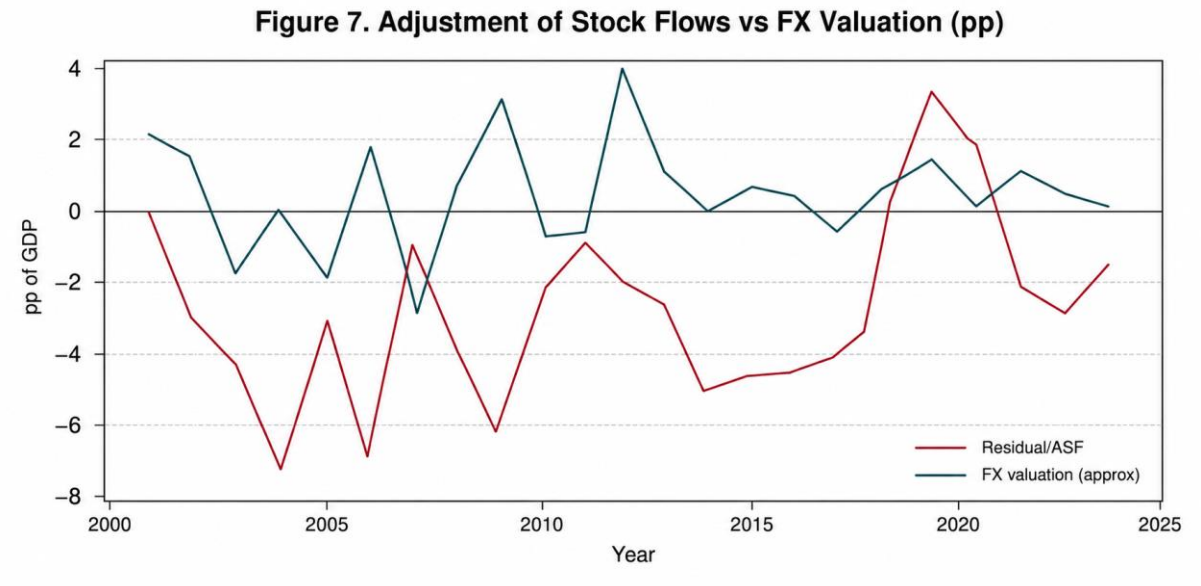
We observe that in the annual decomposition there's a struggle between the fiscal flows (primary deficits and the interest) and the denominator/valuation forces (real growth, inflation, and the FX effects), and massive residual ASF. During the early years, the effect of inflation and the residual/ASF contributed to the significant negative terms that counterbalanced the large primary deficits. This explains why the debt reduced strongly despite recurrent deficits. After 2015, the positive contributions of the deficits are increased and are more sustained in the bars, and the contributions of the inflation and ASF are smaller or more volatile. This is an

[11] The negative adjustment of stock flows (ASF) shows that the measured primary deficits and the snowball/valuation terms should have increased the observed debt stock, which this adjustment instead reduced it. Such negative ASF can be below-the-line considerations in Nepal including the cash-balance drawdowns, debt buybacks/repayments, timing and accounting reconciliation, on-lending/guarantee treatment, and the differences between the flows and stocks in valuation / coverages (Escolano, 2010; IMF, 2024).

indicator that currency reduction is not so automatic and it tends to depend on the policy and is not interpreted as a data error[12].



Having identified with the mechanical channels that determine the change of debt changes, we now pose the question, whether the fiscal policy generates a stabilizing primary-balance response as the debt rise, which is whether the government creates a response that persisted over time using Model Two.



[12] Neither of the adjustment of the stock flows (negative or positive) is necessarily a mistake. However, it is rather a reconciliation term which captures the legitimate below-the-book movements and the coverage/timing differences between the reported flows and the change in the debt stock (for example, cash-balance adjustments, lending/financial transactions, arrears, valuation/coverage differences, and the accounting reclassifications). Also, the data-quality concern makes sense in the case of unusually large persistent unexplainable residuals (Escolano, 2010; IMF, 2018).

Analysis of Model Two: The Fiscal Reaction Function

In Figure 7, the residual/ASF and the FX valuation proxy do not move on a one-to-one basis. Prior to 2015, residual/ASF tend to be strongly negative, and the FX valuation is positive. This implies that the factors (cash balances, time to disburse payments, on-lending, arrears treatment, or the reconciliation of data) offset the flow to the stock mechanics on a systematic basis. By 2019-21, the residual becomes positive, which means that the stock of debt grew more than the standard deficit interest growth.

For the analysis of Model Two, we take reference from Bohn (1998). We use proxy of business cycle (which is the HP output gap or the growth gap[13]), inflation, FX depreciation, the 91-day T-bill rate, and the regime dummies (post-2015, COVID, and post-2022). The standard errors are estimated based on Newey–West HAC (1 lag).

Table 3

The Reaction Pertaining to the Fiscal Estimates[14]

Variables used	Using HP gap	Using Growth gap
Lagged Debt/GDP (pp)	0.08** (0.03)	0.03 (0.03)
Output gap (HP, %)	-0.11* (0.06)	
Growth gap (pp)		0.03 (0.03)
Inflation (pp)	0.25 (0.19)	0.18 (0.25)
FX depreciation (ln FX, %)	0.03 (0.02)	0.03 (0.03)
91-day T-bill rate (%)	-0.43*** (0.12)	-0.44*** (0.13)
Post-2015 dummy	0.93 (0.99)	-1.60 (1.18)
COVID dummy (2020–21)	1.78** (0.82)	3.67*** (1.12)
Post-2022 dummy	-0.01 (1.01)	2.71*** (0.85)
Constant	-8.95*** (2.50)	-5.94** (2.85)
Samples	24	22
R squared	0.68	0.68
Adjusted R squared	0.51	0.48
HAC lags	1.0	1.0

Note. Author's Analysis (*, **, *** denote significance levels at the 10%, 5%, and 1% respectively).

In Table 3, the coefficient of debt reaction is positive and statistically significant in the HP gap section (β=0.08 and S.E.=0.03). This means that a 1 pp increase in lagged debt ratio is integrated in the primary balance (next year) by an average of 0.08 pp increase in GDP (that is, a smaller deficit). This result is consistent with the Bohn (1998)'s concept of debt-stabilizing fiscal behavior. Nonetheless, the macro controls validate that there is mixed cyclicality. The HP output gap is negative and significant (-0.11). This indicates that the primary balance would weaken during times when the economy is above trend (which is a pro-cyclical tendency) and the growth-gap specification is also insignificant. The T-bill (91 days) is negative (-0.43), which is consistent with the concept that other rates are higher when the fiscal stress is more

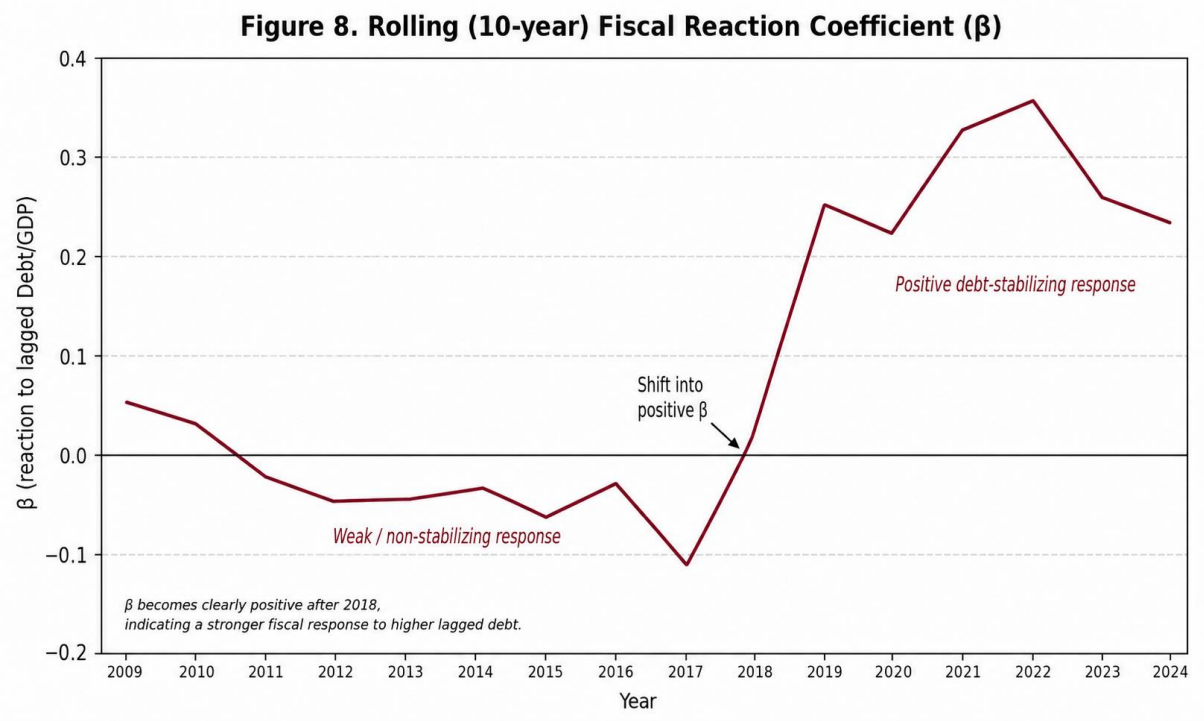
[13] There is no single official (single and consistently constructed for the full sample), long-run potential-output series of the whole sample in Nepal which this study uses. In place of which we use the practical cycle proxies. The output gap picks up the slack of cyclical variation (deviation of the actual output against the potential) and this is important since revenues, transfers, and some expenditures tend to move in accordance with the business cycle. The alternative of growth-gap (which is the actual growth subtracted against a trend/potential growth benchmark) is added as a proxy of robustness that does not depend on any measure of potential-output. This paper uses both because it is useful to check that the fiscal-reaction coefficient is sensitive or not, basically on how the business cycle has been proxied (Bohn, 1998; Girouard & André, 2005; IMF, 2010).

[14] The Dependent variable is the Primary balance, as a percent of GDP.

active along with less primary balances. Both scenarios show positive and significant values of the COVID dummy. This shows a structural change in the primary balance in the years 2020-21. These findings are a sustainability diagnostic and not a causal interpretation (due to the small sample size of 22-24 observations and possibility of endogeneity issues). This is backed up by the evidence which is presented in Figure 8.

In Table 3, there are 24 samples in the HP gap and 22 samples in the growth gap. The standard errors are HAC (1) and both the samples show relatively high R^2 values (0.68 in both) and the adjusted R^2 values (0.51 and 0.48 in HP and growth gap). When there is a small sample, this mix can be an indicator that some dummies and other specification-specific regressors capture a significant proportion of variance. Due to this, the point estimates are not only the one to rely upon, but also are the sign and robustness across the specifications and stability (which is also to be prioritized) (analyzed in Figure 8).

Figure 8. Rolling (10-year) Fiscal Reaction Coefficient (β)



The fiscal reaction function represented by the coefficient (β) is mostly time dependent. It is nearly 0 or negative during the periods of 2011-2017. This suggests that there is a fragile non-adjusting fiscal behavior during the times when the debt rises. This coefficient becomes positive after 2018 and reaches its highest (0.30-0.35) prior to easing a bit. We can interpret a positive β as a behavior of debt stabilization (which means the primary balances improve when there are higher lagged debts). This warns us that an evaluation of a single β can conceal the changes in the regime thereby challenging the stability of the debt as well.

Though the analysis of Model 2 demonstrates that the fiscal response to debt is time-varying and regime-dependent, it does not indicate the nature of shocks that lead to those regime shifts or to the speed of the response of debt and fiscal variables in response to a shock. To track the dynamic transmission of major macro-financial impulse with respect to the exchange rate depreciation, and short-term funding terms, we run Model 3 and estimate the

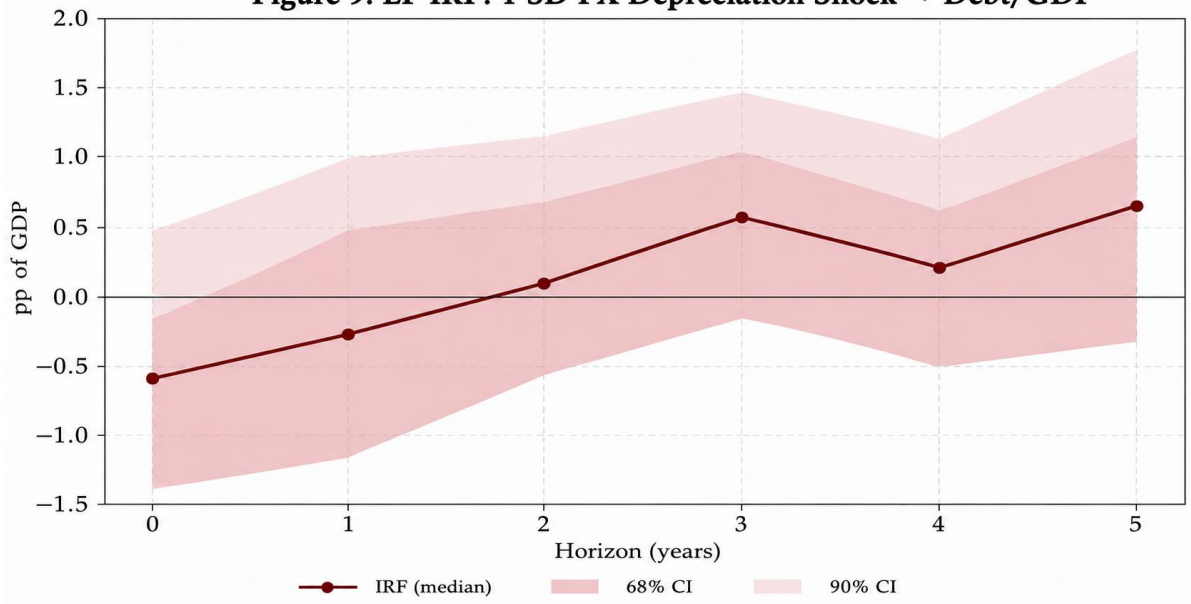
local projections which attempt to trace the impulse response by the debt level and the primary balance and interest burden in the different subsequent horizons.

Analysis of Model Three: The Local Projections

Taking reference from Jordà (2005) we estimate the horizon specific responses. The outcomes variables are Debt/GDP ratio, Primary balance/GDP ratio, and Interest/GDP ratio. The shocks which we use to analyze is the FX depreciation (Δln USD/NPR) and the changes in Treasury bill (91 day) rate. The control variables are the lagged Debt/GDP, inflation, T-bill level, and the regime dummies. The shocks are scaled using one standard deviation, and the error is reported using the HAC bands.

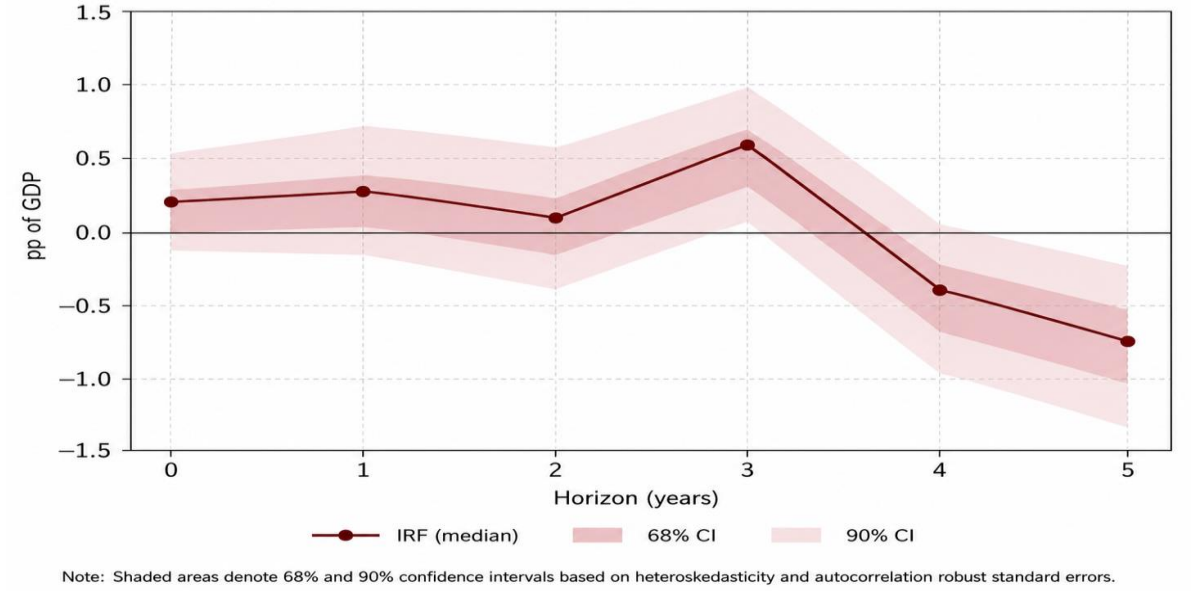
Figures 9 till 14 report the LP impulse responses with the 95 percent confidence bands.

Figure 9. LP IRF: 1 SD FX Depreciation Shock → Debt/GDP



Note: Shaded areas denote 68% and 90% confidence intervals based on heteroskedasticity and autocorrelation robust standard errors.

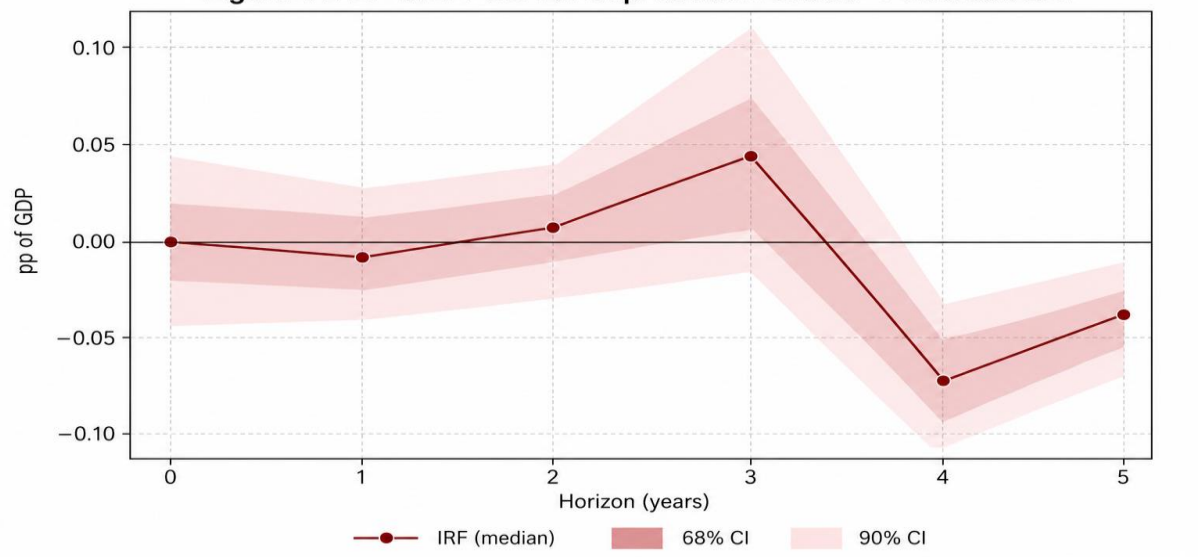
Figure 10. LP IRF: 1 SD FX Depreciation Shock → Primary Balance



Note: Shaded areas denote 68% and 90% confidence intervals based on heteroskedasticity and autocorrelation robust standard errors.

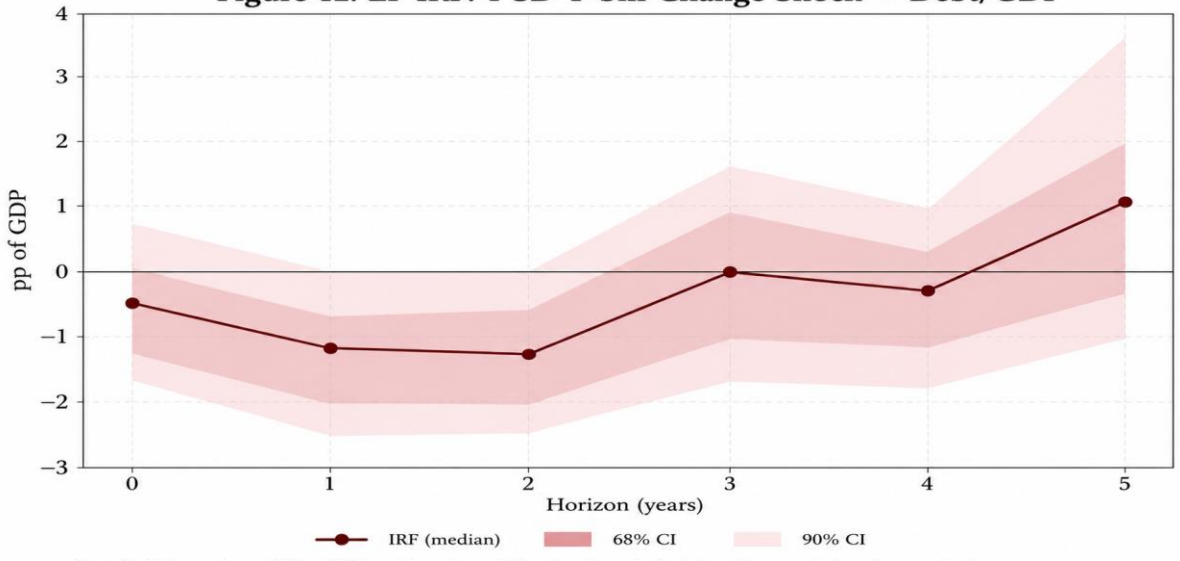
Figure 9 shows that a one standard deviation FX depreciation shock raises the Debt/GDP ratio in the medium term. It shifts to a slight negative change approximately to +0.6 pp in year 3 and remains positive untill year 5. Nevertheless, the 95 percent confidence band is broad and frequently intersects zero, thus the inference is directional as opposed to a precise one. FX shocks can be important for debt dynamics; however, the annual data tends to provide some uncertainties regarding their extent. Figure 10 shows that the top-line balance to an FX shock is non-monotonic in the initial 1-3 years. The reaction starts out or improves moderately (approaches +0.6pp of GDP) during the first years and becomes riskier (around -0.6 -0.7 pp of GDP) in the more distant horizons. One reason for this can be timing, which is in the short run, both inflation and the nominal revenue gains temporarily improve the fiscal balance. However, the expenditure pressures in the long run and increased costs of imported inputs (imported goods and essentials subject to custom duties) can undermine the balance. The expanding band further shows a lack of precision.

Figure 11. LP IRF: 1 SD FX Depreciation Shock → Interest/GDP



Note: Shaded areas denote 68% and 90% confidence intervals based on heteroskedasticity and autocorrelation robust standard errors.

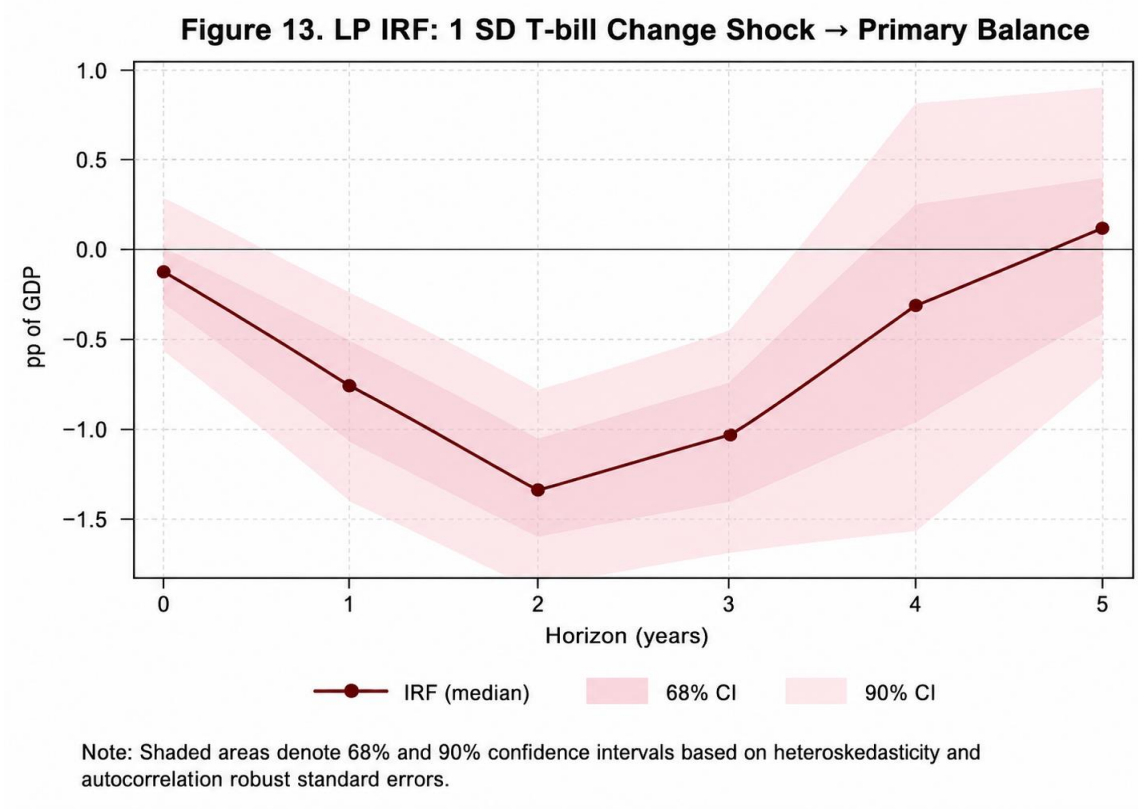
Figure 12. LP IRF: 1 SD T-bill Change Shock → Debt/GDP



Note: Shaded areas denote 68% and 90% confidence intervals based on heteroskedasticity and autocorrelation robust standard errors.

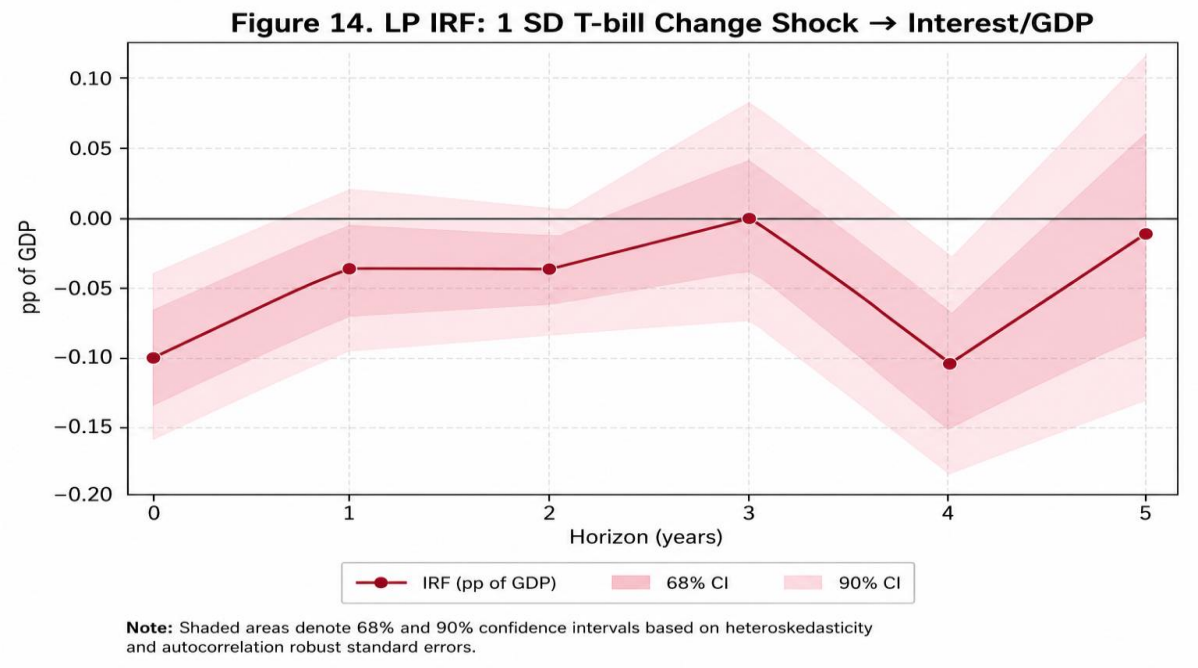
Figure 11 illustrates that the responses of the Interest/GDP to the FX shock is small and imprecise because the data are annual. The estimate increases to approximately +0.05 pp in the third year but has become negative in the fourth year and returns partially. This finding is useful because the confidence band covers the zero at any given horizon. The FX shocks might pass through into interest costs with the lag, but their direction and timing are not constrained by lower frequency debt-service data (for example, in the quarterly cash interest payments on various instruments by the government).

Similarly, Figure 12 indicates that a short-rate (91Day T-bill rate changes) shock has an unclear relationship with the Debt/GDP ratio. The point estimate is negative in the first 1-2 years (low and approximately -1.2 pp) and only becomes positive at the long horizons (approximately +1.1 pp after year five). Such a pattern is suggestive of the weak identification in the annual data where the rate changes are in many cases coincident with other macro/fiscal factors. Thus, the identification of the pure high-frequency causal effects is difficult with these data.



In Figure 13, the primary balance is worsened in the short run (nearly to -1.2pp in year 2) and then slowly the mean reverts to zero over the next five years. This is congruent with the fiscal-stress channel. In there, the increased rates would raise the financing costs and can cause pressure in the budgets, but the consolidation (or normalization) could happen slowly (with a lag). Nevertheless, the wide uncertainty indicates that the outcome should be utilized as a narrative that the stress channel (only being as a specific elasticity). Figure 14 shows the response of the interest /GDP to the short rate shock is counter-intuitive (negative) now of the impact. It also shows that it is imprecise with the confidence intervals being broad throughout the horizons. This highlights a transparency issue. Probably, it is an endogeneity (rates changing under the influence of liquidity/fiscal conditions) and measurement (91-day T bill

rate is a proxy, and the interest payments replicate the weighted-average cost on the stock outstanding) point.



For the assessment of the direction and timing of the fiscal-stress and interest-burden channels, we used the local projections. However, the wide bands of confidence (and even the counter-intuitive short-run interest's effect) remind us that the annual data and proxy rates restrict the accuracy of structural elasticities. To this end, we supplement the empirical IRFs with a simplistic forward-looking example, which maps the other macro-financial paths into the possible debt paths. Figure 15 gives an illustration through the DSA on how the various combinations of growth and financing conditions can mechanically redistribute the Nepal's Debt/GDP ratio path over a medium term, which is as the communication of the intuition of risk rather than being a forecast only.

Analysis of Scenarios Pertaining to the DSA (An Illustration)

We analyze a simulation of DSA[15] (Debt Sustainability Analysis) mimicking the IMF DSA case. We project the 5 years data from the year 2024's Debt/GDP ratio keeping the shocks using the accounting identity, making primary balance constant, and assuming that there is a zero ASF. The purpose of doing this is also for intuition and communication.

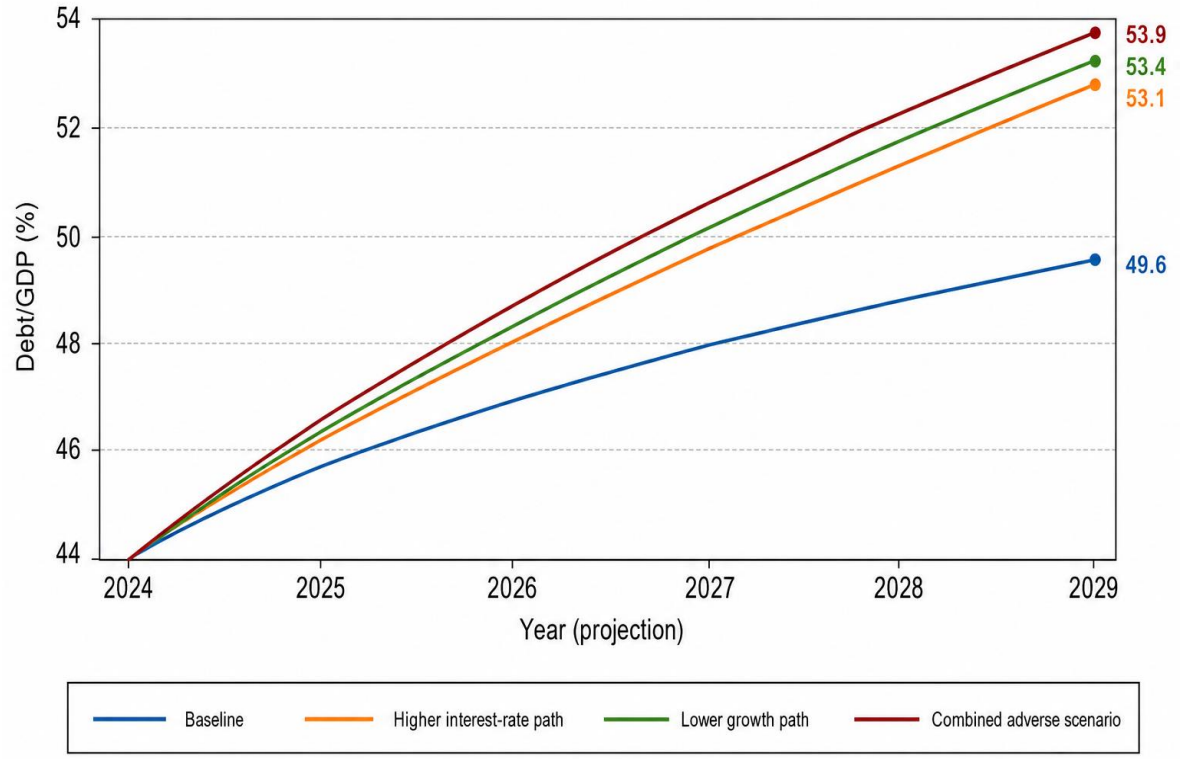
DSA simulation[16] changes the accounting identity to a basic story of stress. Under the postulate of the stated primary balance and the zero ASF, the debt ratio increases its baseline path to 49-50 percent by the year 2029 (which was around 44 percent of GDP in 2024). Under the stressed paths, the Debt/GDP reaches about 53-54 percent by the year 2029, about 3-4 pp above the baseline estimates. The main analysis is not what the end point is, but about the sensitivity. Such as a small negative FX or the rate assumptions compound into significant

[15] Follows the Bank fund LIC Debt Sustainability Framework concepts as the benchmark for the interpretation of the risks of debt risks (IMF, 2018).

[16] This is the forward-looking path providing a visionary direction mechanical mapping on the effective interest rate, minus the Real GDP growth minus the foreign exchange valuations into the alternative debt path and it is not to be interpreted as an official forecast (IMF, 2024).

higher-debt ratios within a five-year horizon. This justifies that why the FX and short rate channels are important to Nepal's debt risk analysis.

Figure 15. Illustration through DSA Scenarios



Takeaways

From the analysis, we inspect the debt dynamics in Nepal which tend to operate using several channels. The primary deficits and interest expenses tend to push the Debt/GDP ratio in upward direction. However, the real growth and inflation tend to push it downward (through the denominator). The exchange-rate valuation increases the NPR value of the external liabilities without the need to borrow new debt that appears in the valuation proxy and/or residual adjustments of the stock flows (ASF). The fiscal reaction coefficient which is β, is also a sustainability indicator. When the value of β is greater than 0, the adjustment in the fiscal side is done when the debt rises (through the uncertainty of small samples causes to overstate the estimate). Lastly, the local-projection introduced a time domain by outlining that the FX depreciation and the short-rate (T-bill) changes lay down the consistent responses in the Debt/GDP ratio, primary balances, and the interest burdens.

Robustness and Diagnostics

After describing main mechanisms and presenting the medium-term debt dynamics based on the DSA scenarios, we determine the extent to which the empirical evidence can be held plausible, which is, are these results the outcome of macro fiscal mechanisms or they are just an outcome due to mechanical correlations and omitted shocks, or the small sample artifacts. For the check of diagnostics, we focus on the interest rate and the FX channels using the instrumental-variables (IV) estimation. We do this to account for the presence of endogeneity in the relationship between domestic financing conditions and the fiscal outcomes.

Second, we do placebo and falsification exercises to test the pre-trends to ensure that the shocks identified systematically forecast the lagged debt or the fiscal variables. Third, we report a weak-IV robust inference (Anderson Rubin sets) to make the valid inferences in the presence of imperfect strong instruments in the annual data. Thereafter, for the further diagnostics (such as cyclicality/CAPB corrections and specification tests) are done to ensure that the key conclusions are an accurate indicator of real macro-fiscal mechanisms as opposed to a measuring decision or regime-specific noise.

Intuition of an IV

The decompositions and local projections seem to be informative in terms of correlation and timing; however, the short-term rate and the fiscal variables can be jointly set. Consequently, endogeneity is the key issue we aim to address. An IV is used to separate the variation in the FX depreciation and the short rate position of Nepal that might be due to factors outside Nepal (such that the estimated dynamic responses are less contaminated by recent domestic fiscal and macro shocks). In other words, an IV design transforms the question of what happens when everything moves in unison, to what happens to the outcomes for debt and fiscal metrics when financing conditions change due to the extraneous factors.

Outcomes of Endogenous Regressors

First, we define our variables as endogenous as well as the macro-fiscal outcomes of interest. Next, we establish the external instruments which produce credibly exogenous change in the FX depreciation and the stance of short-term rate. Specifically, we take the Δln (USD/INR) as an instrument of the Δln (USD/NPR) considering the pegged channel, we use the money-market conditions in India (WACR level) and India's policy rate as an exogenous shifter.

Table 4

Instruments and the Relevance of First Stage

First-stage	Used Instrument(s)	F stat (Wald)	p(F)	Partial R^2	Coefficients
FX: Δln USD/NPR on Δln USD/INR	Δln USD/INR	>10	0.00	1.00	Z: 1.00 (p=<0.00)
Δrate: ΔNepal 91D T Bill on ΔIndia policy	ΔIndia policy	0.72	0.39	0.03	-0.29 (p=0.39)
Δrate: ΔNepal 91D T Bill on ΔIndia WACR	ΔIndia WACR	0.42	0.52	0.01	-0.16 (p=0.52)
Δrate: ΔNepal 91D T Bill on Δ(WACR-Policy)	Δ(WACR-policy)	0.12	0.73	0.00	0.20 (p=0.73)
Δrate: ΔNepal 91d on ΔIndia policy + ΔWACR	ΔIndia policy + ΔWACR	0.72	0.69	0.03	ΔIndia pol -0.40 (p=0.56); ΔWACR 0.13 (p=0.82)
Level: Nepal 91D T Bill on WACR level	WACR level	11.82	<0.001	0.29	-0.94 (p<0.00)
Level: Nepal 91D T Bill on WACR level + India policy level	WACR level + India policy level	21.93	<0.001	0.29	WACR -1.09 (p=<0.00); India pol 0.21 (p=0.71)

Note. Author's Analysis

Table 4 provides the results of the first stage diagnostics and indicates that the level-based specifications are very robust in making the inferences, but the change-based rate-shock specification is very weak in this annual sample, and it is hence not employed in our preferred causal interpretation (All samples are 24). The Wald-F-stat, obtained at the first stage, signifies whether the instrument influences the endogenous regressor or not. In the case of the rate channel, the WACR India level (and WACR + India policy's responses) is a robust explanatory variable of Nepal 91-day T-bill level (F=11.8 and 21.9), which confirms the standard relevant/strong threshold of the instrument. The rate-changes (the shock) specifications however have the F stat less than 1, which signifies, the instruments are practically weak for Nepal's rate changes, and we also do not rely on them to make a causal claim.

Validity of an IV

We report the Durbin Wu Hausman (DWH) and Sargan tests[17] to enhance the validity of the IV tests. The DWH tests specify whether endogeneity is a realistic issue (examine whether there is a difference in the OLS and the IV estimates). When there is a difference found, then it refers that taking the rate as endogenous is deceptive and the IV would be justified. The Sargan overidentification test is applied when the two instruments (India's WACR level and India's policy level) are used for the one endogenous regressor (91 Days T Bill rate). This is done to analyze whether the instruments are consistent with the exclusion restriction (whether the variables affect the outcomes only through the short-term rate of Nepal or through other channels). The analysis of DWH test and Sargan Overidentification test is given in Table 5.

Table 5

DWH and Sargan Overidentification Test

Outcomes	DWH test		Sargan test (WACR + India's Policy)	
	p-value (WACR IV)	p-value (WACR+Policy IV)	df=1	p-value
Debt/GDP	0.11	0.19	2.39	0.12
Primary balance/GDP	0.91	0.99	0.54	0.46
Interest/GDP	0.35	0.35	0.38	0.54

Note. Author's Analysis

In Table 5, the Sargan p-values are above 0.10. This implies we fail to reject the null hypothesis (the instruments are jointly valid). This provides no statistically significant evidence against the exclusion restriction in this sample. The DWH tests, however, appear mixed (have high p-values) and do not consistently indicate a strong endogeneity. Consequently, we present the IV as an identification and robustness mechanism. This provides resistance against the possible simultaneity (not merely the presentation of a decisive statement that the OLS estimates are always biased).

[17] The use of Sargan tests over identifying restrictions (joint instrument validity) which is homoscedastic, and the DWH which compares OLS vs IV as a suggestive endogeneity test and neither of these tests is used to indicate the exclusion of any other instruments (Durbin, 1954; Wu, 1973; Hausman, 1978; Sargan, 1958).

Local Projections and the Dynamic Effects

When the checks of DWH and Sargan validate the feasibility of the IV setup, we quantify the dynamics of the FX and the interest rate channel over time. We then project the specific horizons (h ranging from 0 to 5) using local projections. Thereafter, the results are depicted in panels, which each representing a specific shock, where the IRF (SE) and the p-values are expressed in percentage points (pp).

Table 6

Panel A - The FX Channel

h-value	Debt/GDP	PB/GDP	Interest/GDP
0	-0.55 (0.56), p=0.33	0.25 (0.16), p=0.12	-0.00 (0.02), p=0.96
1	-0.20 (0.63), p=0.74	0.33 (0.20), p=0.11	-0.01 (0.02), p=0.62
2	0.12 (0.54), p=0.82	0.11 (0.23), p=0.65	0.00 (0.02), p=0.82
3	0.59 (0.44), p=0.17	0.65*** (0.19), p=0.00	0.05 (0.03), p=0.15
4	0.23 (0.45), p=0.62	-0.34* (0.20), p=0.09	-0.07*** (0.02), p=0.00
5	0.62 (0.55), p=0.25	-0.66** (0.27), p=0.02	-0.04** (0.02), p=0.02

Note. Author's Analysis

From Table 6, the results of the estimation of Debt/GDP do not seem to be statistically significant because they possess large standard errors and wider confidence intervals. However, PB/GDP is statistically significant which is responsive at medium horizon (evidently around, h=3). This trend is in line with short-run changes in revenue/nominal impacts with a slow adjustment of fiscal changes. However, the magnitude of it should be taken with caution, because of our sample size, N=24).

Table 7

Panel B – The Rate Channel

h-value	Debt/GDP	PB/GDP	Interest/GDP
0	-1.21 (2.80), p=0.66	-1.14 (1.06), p=0.28	-0.09 (0.16), p=0.58
1	-2.87 (6.36), p=0.65	-0.32 (0.84), p=0.70	0.04 (0.11), p=0.71
2	-2.26 (7.68), p=0.76	0.63 (1.81), p=0.73	0.02 (0.18), p=0.89
3	-1.16 (4.48), p=0.79	1.23 (0.89), p=0.16	0.01 (0.18), p=0.99
4	-1.82 (2.79), p=0.51	1.74 (1.66), p=0.29	-0.01 (0.16), p=0.99
5	-2.77 (3.83), p=0.46	0.76 (1.57), p=0.63	-0.01 (0.26), p=0.96

Note. Author's Analysis

Table 7 represents the local projections (with the short-term rate) estimating tightening in the short rate situation in Nepal. The instruments are WACR and Indian policy rate. The estimates support the existence of a fiscal-stress channel, where the tighter financing conditions are followed by worsened primary balances and higher Debt/GDP ratios. However, the confidence bands are broad in this sample on an annual basis, making the panel rather to be seen as an indicator of direction and timing than for elasticities of interest in the long run.

To check the robustness, we instrument 91-day T-bills of Nepal, on the WACR of India (only exact identified IV). The results are weak and insignificant where the Debt/GDP is negative at every horizon although they are never significant (p=0.57-0.81). The PB/GDP is positive in the medium horizon but again statistically weak (p=0.15). The Interest/GDP is basically at zero. Overall, this points to the general story but brings out the lack of specificity

of annual data; thus, we consider it as sensitivity evidence and adopt the two-instrument design in testing overidentification.

Table 8

Panel C - Robustness - IV

h-value	Debt/GDP	PB/GDP	Interest/GDP
0	-1.45 (3.01), p=0.63	-1.11 (1.06), p=0.29	-0.09 (0.16), p=0.57
1	-2.88 (6.46), p=0.65	-0.31 (0.85), p=0.71	0.03 (0.12), p=0.81
2	-1.87 (7.35), p=0.79	0.79 (1.77), p=0.65	0.03 (0.18), p=0.86
3	-1.19 (4.88), p=0.81	1.29 (0.89), p=0.15	-0.01 (0.21), p=0.96
4	-2.78 (4.83), p=0.56	1.39 (1.28), p=0.28	-0.01 (0.17), p=0.96
5	-4.07 (7.44), p=0.58	0.70 (1.75), p=0.69	0.03 (0.18), p=0.86

Note. Author's Analysis

Credibility Tests - Placebo Tests and a weak-IV Inference

Placebo and falsification tests are basically applied to assess whether the shocks are merely picking up an already existing trend or not. We regress the fixed outcomes on the realized shock, which is realized at time t, or an IV induced stance at that time. Provided the story that mentions such identification is credible, these placebo coefficients must be nearer to zero and irrelevant to the statistical tests, since the shock should not be able to predict the past fiscal or debt position. Meanwhile, due to the small annual sample size and the imperfect instruments, this paper provides a weak-IV robust inference of the Anderson-Rubin[18] (AR) confidence sets, which is also valid with the weak first stages. In all, the placebo tests help to prevent any hidden pre-trends and the AR intervals aid in protecting the 2SLS claims where there is a weak identification.

Table 9

Placebo[19] / Pre-Trend Tests

Tests performed	β	SE	p-value
Debt (t-1) on FX shock(t)	0.00	0.00	0.53
PB (t-1) on FX shock(t)	-0.03	0.03	0.34
Interest (t-1) on FX shock(t)	0.00	0.00	0.97
Debt (t-1) on instrumented TBill(t) (WACR+Policy)	-0.00	0.00	0.51
PB (t-1) on instrumented TBill(t) (WACR+Policy)	-0.27	0.65	0.67
Interest (t-1) on instrumented TBill(t) (WACR+Policy)	-0.03	0.05	0.58

Note. Author's Analysis (All the samples are 24 only)

The falsification results and the placebo provide assurance regarding the situation in the absence of pre-trends. The regression of lagged values on the current shock yields economically irrelevant (statistically insignificant) coefficients on the FX channel (Debt (t-1) on the FX shock is virtually zero, p=0.53). The PB channel (using a negative coefficient on PB (t -1)-0.27, p=0.34), and the interest channel (nearly zero, p=0.97). The coefficients in the IV placebo regression based on the instrumented T-bill position (WACR+Policy) also do not show

[18] The weak instrumental sets do not invalidate the Anderson Rubin confidence sets which are generally broader and credible when the identification is not perfect (Anderson and Rubin, 1949).

[19] The Placebo/falsification tests the predictive validity of the identified shocks on pre-treatment (lagged) outcomes, this is useful to provide the defense on the identification narratives (Angrist and Pischke, 2009).

significant values (p-values 0.51-0.67). In general, these trends indicate that the detected FX shock and IV-induced rate position is not merely a reflection of the observed movements in the debt or fiscal variables. This is an indication of the validity of the identification strategy.

Table 10

2SLS (h=0) Test with Weak IV AR

Outcome	2SLS (β)	SE	p-value	AR 95% CI
Debt/GDP	-0.54	1.24	0.67	[-10.48, 1.05]
Primary balance/GDP	-0.51	0.47	0.28	[-4.25, 3.24]
Interest/GDP	-0.04	0.07	0.58	[-0.61, 0.12]

Note. Author's Analysis

Table 10 provides the (h=0) impact response of the preferred 2SLS specification and a weak-IV robust Anderson-Rubin (AR) confidence sets. The 2SLS estimates of the debts to GDP, PB to GDP, and Interest to GDP are all negative but none of them is significant (p-values as 0.28-0.67). The AR 95 percent confidence intervals are very broad compared with the standard 2SLS intervals. The intervals of Debt/GDP range between -10.48 and +1.05 which bear very little information regarding the exact amounts. Based on this, we take these estimates as loosely estimated evidence and focus on the strength and the general mechanism consistency and not on sharp elasticity assertions.

Analysis of Cyclically Adjusted Primary Balance

Because the AR confidence limits are large and as far as annual IV estimates, we assess a little more than the business cycle rather than a policy adjustment (which is operating on the fiscal responses). The primary balances usually work to enrich booms and worsen in downturns and therefore even when policy does not change, a raw PB/GDP series can still be running. To a better extent, we consider the cyclically adjusted primary balance (CAPB[20]) as the data is unadjusted intensity of the cyclical theme to capture the underlying (structural) fiscal stance. This is used to evaluate the debt patterns of a specific country (debt and fiscal) that are operating even with cyclical variations.

Table 11

Analysis of CAPB

Measuring metric	Value
Semi-elasticity β (PB/GDP on output gap)	-0.12
SE (β)	0.04
p-value (β)	0.01
Correlation (PB/GDP, output gap)	-0.51
Mean PB/GDP	-5.13
Mean CAPB/GDP	-5.13

Note. Author's Analysis

Table 11 shows the primary balance in Nepal is clearly cycle sensitive. The PB/GDP is semi-elastic to the output gap (β =-0.12, SE = 0.04) and co-moves to the gap (correlation = -0.51) negatively. The negative sign suggests a pro-cyclical tendency of the primary balance

[20] The cyclically adjusted primary balance (CAPB) eliminates the predicted cyclical part of PB with the help of an output-gap proxy, which is an estimate of the structural fiscal position (Girouard and Andre, 2005).

becoming weak because of an above-potential activity instead of a strengthening of this tendency. We thus express the cyclically adapted primary balance (CAPB) (as CAPB=PB/GDP - β gap). This process eliminates the cyclical component that is predicted. We do this to estimate the underlying (structural) fiscal position. The equal sample averages of PB/GDP and CAPB (both -5.13) show that the averaging of cyclical effects are equalized in the entire period, however, the CAPB is essential when explaining the change per annum as either structural or cyclical.

Defendable Inferences

The most defensible inferences seem implicative. The FX channel identification is high since the pegged movements in USD/INR reflect the speculation with a good predictive of USD/NPR depreciation resembling a proper external shifter. In the rate channel, the preferred IV employed (WACR and policy-rate in India), satisfy the standard relevance criteria, as well as allow an overidentification (Sargan) test. There seem no signs of pre-trends in the placebo tests, which makes the narrative of identification true. Nonetheless, the sample size (N = 24) seems to be constraining statistical power and provides a broad Anderson Rubin confidence interval, so this paper highlights the strength and consistency of mechanisms across the decomposition and LP and IV. This is opposed to such accurate long-horizon estimates.

Consolidated Diagnostics

Since the behavior of the time series and the serial correlation can impact the inference, we analyze the diagnostic tests. We also test for the ADF and KPSS tests followed by the residual autocorrelation test (Ljung-Box as LB test[21]), and with the compact IV diagnostics panel-based tests in Table 10.

Table 12

Consolidated Diagnostic tests

Heading (panels)	Model and Series	N	Statistics and Value	p-value (s)
A. Stationarity (ADF/KPSS)	Debt/GDP (%)	24	ADF=-0.17; KPSS=0.18	ADF p=0.99; KPSS p=0.02
A. Stationarity (ADF/KPSS)	Primary balance/GDP (%)	24	ADF=-3.17; KPSS=0.05	ADF p=0.02; KPSS p=0.10
A. Stationarity (ADF/KPSS)	Nepal 91D T-Bill level (%)	24	ADF=-2.69; KPSS=0.09	ADF p=0.07; KPSS p=0.10
A. Stationarity (ADF/KPSS)	India WACR level (%)	24	ADF=-3.80; KPSS=0.08	ADF p=0.00; KPSS p=0.10
A. Stationarity (ADF/KPSS)	India policy level (%)	24	ADF=-3.08; KPSS=0.46	ADF p=0.03; KPSS p=0.05
A. Stationarity (ADF/KPSS)	FX depreciation Δln(USD/NPR) (%)	24	ADF=-3.13; KPSS=0.26	ADF p=0.02; KPSS p=0.10
A. Stationarity (ADF/KPSS)	The Output gap (HP, %)	24	ADF=-2.36; KPSS=0.07	ADF p=0.16; KPSS p=0.10
B. Residual acr (Ljung–Box)	Debt/GDP on TBill + Control Var (OLS)		LB (1) p=0.42	LB (2) p=0.71
B. Residual acr (Ljung–Box)	Debt/GDP on FX shock + Control Var (OLS)		LB (1) p=0.83	LB (2) p=0.92

[21] The LB represents the Ljung Box Q test of the multiple lag autocorrelation of the residuals (Ljung and Box, 1978).

Heading (panels)	Model and Series	N	Statistics and Value	p-value (s)
C. IV diagnostics (rate stance IV)	First-stage Wald F (HAC) - TBill level on WACR+India policy		21.93	
C. IV diagnostics (rate stance IV)	First-stage partial R^2		0.29	
C. IV diagnostics (rate stance IV)	DWH endogeneity p-value (Debt/GDP)			0.19
C. IV diagnostics (rate stance IV)	DWH endogeneity p-value (PB/GDP)			0.98
C. IV diagnostics (rate stance IV)	DWH endogeneity p-value (Interest/GDP)			0.35
C. IV diagnostics (rate stance IV)	Sargan J p-value (Debt/GDP, df=1)			0.12
C. IV diagnostics (rate stance IV)	Sargan J p-value (PB/GDP, df=1)			0.46
C. IV diagnostics (rate stance IV)	Sargan J p-value (Interest/GDP, df=1)			0.54

Note. Author's Analysis (where, acr = autocorrelation, and LB is Ljung-Box)

The level of Debt/GDP passes neither the ADF test (p=0.992) nor the KPSS test (p=0.022), however, PB/GDP, and the external shifts (India's WACR and India's policy levels) are more likely to be stationary. The Ljung-Box p-values are acceptable (above 0.10) indicating that there is no strong residual serial correlation in the reported OLS checks. In preferred rate-level IV, the instrument's relevance is strong (first stage F= 21.931; partial R^2= 0.298), the Sargan p-values (0.12-0.54) are not significant to reject the identifying restrictions, and DWH p-values are mixed. Hence, at this point, IV is applied more as an identification discipline than as a robustness check, even in a small annual sample due to the restrictions in data availability.

Conclusions

The study discusses whether debt dynamics in Nepal are caused by the fiscal deficit or macro-financial conditions by incorporating the debt-dynamics accounting, a fiscal reaction mechanism, and dynamic transmission analysis. The results focus on a multi-channel process. Prior mid-2010s, the decrease of Debt/GDP was due to the impact of favorable denominator forces (real growth and inflation) and large below-the-line adjustments of stock flows, counteracting the direct deficit and the interest contributions. The regime seemed more fragile after FY2015/16. The primary deficit seemed to be persistent, however, the debt ratio seemed more vulnerable to the financing conditions and the valuation mechanism in the domestic financing. This result is also reflected in the dynamic results (local projections) and the identification exercises (IV, placebo, falsification, and weak-IV robust inference). In general, the research question is answered in the sense that deficits do count, though the observed path of debt and the risks in Nepal cannot be irrationally attributed to the growth-inflation, exchange rate valuation. and ASF corrections, besides the time-varying fiscal response. The findings match with the well-established model of debt-sustainability which disaggregate the change in the debt into the primary balances, the snowball term (interest-growth), the valuation effect, and the residual adjustments of stock flows (Escolano, 2010; IMF, 2018, 2024). These fiscal reaction-functions tend to align with the sustainability diagnostic as suggested by Bohn (1998). Except for a positive change of the primary balance in reaction to the increased lagged debt is a good indication of adjustment, our local-projection framework is in line with the suggestion of Jordà (2005) to trace the response of the history through the time. With the data obtained in

Nepal (N=24), a systematic response of mechanism and risk communication would be the most valuable contribution to the data set. The analysis and the fiscal response and the LP/IV tests with placebo and weak-IV robust controls, provide a narrative for policy-advice relating to the timing of debt pressures (financing conditions and the valuation shocks). This presents the reason that interpretations of deficit only could be confusing and inadequate.

Overall, the story of Nepal's public debt is not only about the level of debt that the country has, but is also about the risks associated with the composition of the debt. The domestic debt is subject to the interest rate and rollover risk whereas the external debt is subject to the exchange rate valuation risk. Taking example from Sri Lanka when the servicing expenses and rollover pressures increase, the macro-instability may be the next step even though those issues accumulate gradually (Athukorala and Wagle, 2022). More recent evaluations continue to report that the aggregate and external debt distress is small, and the headline debt ratio is even below the average of the peers (IMF, 2024). Nevertheless, the debt structure profile also indicates that the mix of domestic and external debt and the valuation exposure should be considered. This is why the legal provisions, such as the restrictions on monetary financing by using NRB holdings/overdraft limits and the ceiling according to the Public Debt Management Act, 2022 are highlighted. This is supported by the mechanism-oriented findings of this paper. Specifically, the FX valuation and the tighter domestic financing conditions can mechanically increase the value of the NPR as well as the servicing burden. Therefore, the focus of the policy attention should be on maturity/refinancing risk, FX exposure, and the improvement of durable primary balance.

Limitations

Firstly, this paper is based on the annual data, which demonstrates weak statistical power and renders long-horizon estimates somehow inclined. Secondly, adjustment of the stock flows and valuation proxies which indicate a difference in measurement/coverage and timing and thus are to be understood as a mechanism of reconciliation, rather than a clean structural shock. Thirdly, an IV strategy has enhanced identification, and it does not demonstrate the exclusion (the exclusion of instruments is maintained here to support an argument, but not to prove causality). Fourthly, the use of annual data generally restricts the timing of shocks (however, monthly observations were not available for all the series, so annual data were used for consistency). The tools can still capture regional or global situations that partly overlap with Nepal macro environment.

Appendix

Data availability: The data is available on the link, https://docs.google.com/spreadsheets/d/11BOyIMQQiNQsF8IzP6FTFx6INZzP6LBX/edit?gid=1421004756#gid=1421004756

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Disclaimer: Views are mine and not of where I work. Any errors are my own.

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References

Anderson, T. W., & Rubin, H. (1949). Estimation of the parameters of a single equation in a complete system of stochastic equations. The Annals of Mathematical Statistics, 20(1), 46–63. https://doi.org/10.1214/aoms/1177730090

Angrist, J. D., & Pischke, J.-S. (2009). Mostly harmless econometrics: An empiricist's companion. Princeton University Press. https://press.princeton.edu/books/hardcover/9780691120355/mostly-harmless-econometrics

Asian Development Bank. (2024). Asian Development Outlook April 2024: Unlocking the potential of an aging Asia. Asian Development Bank. https://www.adb.org/publications/asian-development-outlook-april-2024

Athukorala, P.-C., & Wagle, S. (2022). The sovereign debt crisis in Sri Lanka: Causes, policy response and prospects. United Nations Development Programme. https://www.undp.org/publications/sovereign-debt-crisis-sri-lanka-causes-policy-response-and-prospects

Bohn, H. (1998). The behavior of U.S. public debt and deficits. The Quarterly Journal of Economics, 113(3), 949–963. https://doi.org/10.1162/003355398555793

Durbin, J. (1954). Errors in variables. Review of the International Statistical Institute, 22(1/3), 23–32. https://doi.org/10.2307/1401917

Escolano, J. (2010). A practical guide to public debt dynamics, fiscal sustainability, and cyclical adjustment of budgetary aggregates (IMF Technical Notes and Manuals No. 10/02). International Monetary Fund. https://doi.org/10.5089/9781462396955.005

Girouard, N., & André, C. (2005). Measuring cyclically adjusted budget balances for OECD countries. OECD Economics Department Working Papers, No. 434. OECD. https://doi.org/10.1787/787626008442

Government of India. (2021). Economic Survey 2020–21. Ministry of Finance, Government of India. https://www.indiabudget.gov.in/economicsurvey/ebook_es2021/index.html

Hausman, J. A. (1978). Specification tests in econometrics. Econometrica,46(6), 1251–1271. https://doi.org/10.2307/1913827

IMF (2018). Guidance notes on the Bank-Fund Debt Sustainability Framework for low-income countries. International Monetary Fund. https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/02/14/pp122617guidance-note-on-lic-dsf

IMF. (2010). A practical guide to public debt dynamics, fiscal sustainability, and cyclical adjustment of budgetary aggregates (IMF Technical Notes and Manuals No. 10/02). International Monetary Fund. https://doi.org/10.5089/9781462396955.005

IMF. (2023). Nepal: 2023 Article IV consultation—Press release; staff report; and statement by the executive director for Nepal (IMF Staff Country Report No. 23/158). International Monetary Fund. https://doi.org/10.5089/9798400241222.002

IMF. (2024). Nepal: Fourth review under the Extended Credit Facility arrangement and request for modifications of performance criteria—Press release; staff report; and statement by the executive director for Nepal (IMF Staff Country Report No. 24/225). International Monetary Fund. https://doi.org/10.5089/9798400282331.002

IMF. (2025). India: 2025 Article IV consultation—Press release; staff report; and statement by the executive director for India (IMF Country Report No. 25/314). International Monetary Fund. https://doi.org/10.5089/9798229030809.002

International Monetary Fund [IMF]. (2020). Nepal: Staff report for the 2020 Article IV consultation—Debt sustainability analysis. International Monetary Fund. https://doi.org/10.5089/9781513539751.002.A003

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. American Economic Review, 95(1), 161–182. https://doi.org/10.1257/0002828053828518

Ljung, G. M., & Box, G. E. P. (1978). On a measure of lack of fit in time series models. Biometrika, 65(2), 297–303. https://doi.org/10.1093/biomet/65.2.297

Newey, W. K., & West, K. D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica,55(3), 703–708. https://doi.org/10.2307/1913610

Public Debt Management Office [PDMO]. (2025). Public debt bulletin (half-yearly). Ministry of Finance, Government of Nepal. https://pdmo.gov.np/pages/bulletin/

Sargan, J. D. (1958). The estimation of economic relationships using instrumental variables. Econometrica,26(3), 393–415. https://doi.org/10.2307/1907619

Staiger, D., & Stock, J. H. (1997). Instrumental variables regression with weak instruments. Econometrica, 65(3), 557–586. https://doi.org/10.2307/2171753

StataCorp. (2021). Stata statistical software: Release 17. StataCorp LLC. https://www.stata.com/stata17/

Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression. In D. W. K. Andrews & J. H. Stock (Eds.), Identification and inference for econometric models: Essays in honor of Thomas Rothenberg, 80–108. Cambridge University Press. https://www.nber.org/papers/t0284

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data (2nd ed.). MIT Press. https://mitpress.mit.edu/9780262232586/econometric-analysis-of-cross-section-and-panel-data/

Wu, D.M. (1973). Alternative tests of independence between stochastic regressors and disturbances. Econometrica, 41(4), 733–750. https://doi.org/10.2307/1914093