INTERNATIONAL MONETARY FUND

Debt Surges—Drivers, Consequences, and Policy Implications

Florian Schuster, Marwa Alnasaa, Lahcen Bounader, Il Jung, Jeta Menkulasi, and Joana da Mota

WP/24/50

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.**
The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

2024
MAR

WORKING PAPER

© 2024 International Monetary Fund WP/24/50

IMF Working Paper
Fiscal Affairs Department

Debt Surges—Drivers, Consequences, and Policy Implications

Prepared by Florian Schuster, Marwa Alnasaa, Lahcen Bounader, Il Jung, Jeta Menkulasi, and Joana da Mota*

Authorized for distribution by Nikolay Gueorguiev
March 2024

IMF Working Papers **describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

ABSTRACT: Many countries find themselves with elevated debt levels, increased debt vulnerabilities, and tight financing conditions, while also facing increased spending needs for development and transition to a greener economy. This paper aims to place the current debt landscape in a historical context and investigate the drivers of debt surges, to what degree they result in a crisis as well as examine post-surge debt trajectories and under what conditions debt follows a non-declining path. We find that fiscal policy and stock-flow adjustments play important roles in debt dynamics with the valuation effects arising from currency depreciation explaining more than half of stock flow adjustments in LICs. Debt surges are estimated to result in a financial crisis with a probability of 11–20 percent and spending-driven fiscal expansions during debt surges tend to result in a high probability of non-declining debt path.

RECOMMENDED CITATION: Florian Schuster, Marwa Alnasaa, Lahcen Bounader, Il Jung Jeta Menkulasi, and Joana da Mota. 2024. “Debt Surges—Drivers, Consequences, and Policy Implications”. IMF Working Paper 2024/50. International Monetary Fund, Washington, DC.

JEL Classification Numbers:	H12, H62, H63, H68
Keywords:	Public debt; debt surges; financial crisis; stock-flow adjustment; exchange rate depreciation; fiscal expansion
Author’s E-Mail Address:	malnasaa@IMF.org, lbounader@IMF.org, jmenkulasi@IMF.org

* The authors would like to thank Kenji Moriyama for his guidance during this project, Vitor Gaspar, Maximilien Queyranne, and Nikolay Gueorguiev for their helpful comments and engaging discussions. Miyoko Asai provided excellent research assistance.

©International Monetary Fund. Not for Redistribution

WORKING PAPERS

Debt Surge Episodes—Conditions, Consequences, and Policy Implications

Prepared by Florian Schuster, Marwa Alnasaa, Lahcen Bounader, Jeta Menkulasi, Joana da Mota[1]

[1] The authors would like to thank Kenji Moriyama for his guidance during this project, Vitor Gaspar, Maximilien Queyranne, and Nikolay Gueorguiev for their helpful comments and engaging discussions. Miyoko Asai provided excellent research assistance.

©International Monetary Fund. Not for Redistribution

Contents

©International Monetary Fund. Not for Redistribution

TABLES

ANNEX FIGURES

ANNEX TABLES

©International Monetary Fund. Not for Redistribution

I. Introduction

Public debt levels are on the rise following the short-lived reduction in 2021–2022, mainly driven by unexpected inflation. The forecast upward trend reflects slowing growth, rising debt service burden, and fiscal deficits (IMF, 2023a). In addition, past shocks such as the Global Financial Crisis and Covid-19 have shown that debt can rise rapidly and on a large scale. Economic challenges related to climate adaptation, the green transition, and demographic changes are likely to imply large-scale spending pressures as well (IMF, 2023b). With debt likely staying elevated or rising across most countries (Arslanalp and Eichengreen, 2023), it is important to understand the attendant vulnerabilities and risks associated with debt surges.

By putting debt surges in a historical context spanning over the past 50 years, this paper contributes to the discussion on the drivers and costs of debt accumulation by zooming into the role of fiscal policy expansions and stock-flow adjustment[1] that are particularly relevant for Emerging Markets (EMs) and Low-Income Countries (LICs) as well as ask: (i) how debt surges affect the probability of a financial crisis and (ii) to what degree a debt surge affects the probability of debt staying high, thereby locking an economy in a longer lasting vulnerable position.

Our analysis, covering 183 countries over 1970–2021, shows that fiscal policy significantly accounts for a steady and sizable increase in debt and explains approximately 30 to 55 percent of the variation in debt forecasts. Within components of fiscal policy, primary spending driven expansions tend to play a greater role as compared to discretionary revenue declines. A critical driver of debt dynamics for EMs and LICs consists of stock-flow adjustments, especially during large debt surge episodes reflecting valuation effects due to currency depreciation combined with high shares of external debt and also crisis resolution related fiscal costs such as bank recapitalization. For LICs, State-Owned Enterprise (SOE) related losses and liabilities and arrears are also shown to be an important driver of large stock flow adjustment. These observations imply that spending-driven and substantial fiscal consolidation will be needed to reduce debt while emphasizing the importance of avoiding exchange rate misalignment and strengthening fiscal risks monitoring and resolution frameworks.

In terms of the consequences of debt surges, we estimate a median predictive probability of 11–21 percent that a debt surge results in a financial crisis, with this probability being as high as 21 percent for LICs. Debt accumulation tends to be one of the dominant factors in explaining these probabilities, implying that sizable macroeconomic adjustments are required to offset the detrimental effect of rising debt on crisis probabilities. Looking at debt trajectories in the aftermath of a debt surge, we find that the predicted probabilities of stable ex-post debt trajectories differ strikingly across country groups. While Advanced Economies (AEs) mostly sustain high debt levels afterwards with a probability of 75 percent, reflecting a higher debt carrying capacity and deeper financial markets, EMs do so with a probability of 57 percent. However, LICs are hardly ever able to keep debt high (only 2 percent) but see downward corrections almost with certainty. This reduces their vulnerability to new shocks but underscores the need for sustained post-crisis external assistance at concessional terms to allow meeting development and social needs.

[1] Stock-flow adjustment in debt is defined as changes in debt stock that are not driven by primary fiscal balances or automatic debt dynamics. Examples include valuation changes from exchange rate movements, materialization of contingent fiscal liabilities, movements in asset prices or quantities, etc.

©International Monetary Fund. Not for Redistribution

This paper contributes to different strands of the literature on drivers of debt accumulation and its consequences. *First*, it contributes to the vast literature assessing the impact of fiscal policy shocks on a range of macroeconomic variables (see Cavallo, A., Dallari, P., Ribba, A., 2018 for a survey of the literature) by analyzing the role of fiscal policy shocks for a large set of countries on debt dynamics. There is scant literature that zooms into the impact of fiscal shocks on debt, specifically with country coverage primarily focused on AEs and EMs, and few studies quantify the impact of fiscal shocks for LICs. This paper shows the significant and substantial role of fiscal policy in debt dynamics as well as it decomposes this contribution in terms of spending and revenue specific shocks. *Second*, it contributes to the literature investigating the determinants of stock-flow adjustments in cross-country settings (Weber, 2012; Jaramillo et al., 2016) and quantifies (i) the role of valuation effects by integrating the currency composition of debt for a large set of countries as well as (ii) non-valuation effects by integrating crisis related fiscal costs as well as non-crisis related contingent liabilities (Bova et al., 2016) in a systematic picture of debt drivers across income groups. *Lastly*, this paper contributes to the rich literature on the cost of debt accumulation (Kose et al., 2021), by zooming into the causal links between debt surges, including their economic drivers on the probability of financial crisis and the likelihood of non-declining debt paths. The rest of the paper is organized as follows. Section II presents the data sources and stylized facts. Section III presents various accounting debt decomposition exercises and documents the role of stock flow adjustments and other drivers of debt. Section IV presents estimates of the role of fiscal policy in explaining debt variations. Section V quantifies the cost of debt surges by estimating probabilities of debt surges resulting in financial crisis as well as the post-surge debt path being non-declining. Section VI concludes by summarizing the main findings and policy implications.

II. Data and Stylized Facts

Our analysis covers debt surge episodes spanning over 1970–2021 using public debt series from the World Economic Outlook (WEO) database. The coverage of public debt series (central government, general government, public sector) is maintained constant for each country over the years as to prevent any changes driven by a change in the definition of debt. The surge episodes were identified following the methodology used in the IMF (2023a, Chapter 3). We restrict our analysis to episodes with a debt increase of 10 percent of Gross Domestic Product (GDP) or higher over the duration of the episode. Within these parameters, we identified a total of 490 episodes, 93 AEs, 247 EMs, and 150 LICs. When computing debt drivers for the debt decomposition exercises, our sample reduces to 343 debt surge episodes (60 for AEs, 171 for EMs, and 106 for LICs) spanning over 1990–2021 due to data availability. Appendix 1 discusses definitions and sources in more detail.

©International Monetary Fund. Not for Redistribution

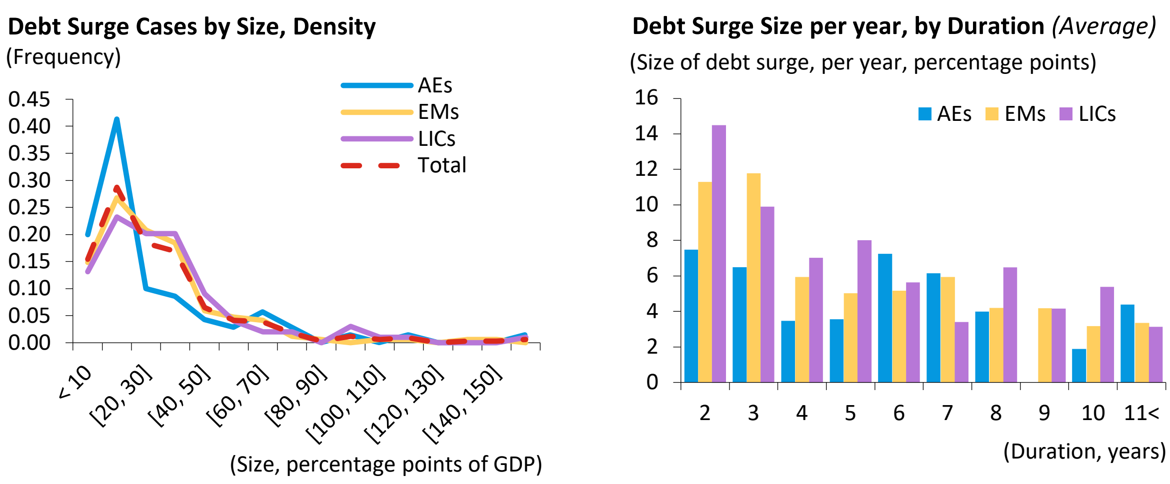
Table 1. Summary Statistics

	1970 – 2021		1990 – 2021	
	Debt accumulation (in pp)	**Surge duration (in years)**	**Debt accumulation (in pp)**	**Surge duration (in years)**
Mean	50.6	8.1	38.5	6.6
SD	107.1	6.7	45.2	5.9
10% percentile	13.7	2	12.9	2
25% percentile	18.9	4	16.7	3
Median	32.3	7	28.4	6
75% percentile	51.6	11	42.8	9
90% percentile	90.6	15	69.1	13
No. of episodes	490		343	
AE	*93*		*64*	
EM	*247*		*173*	
LIC	*150*		*106*	

Source: Author's calculations.

The median surge lasts 6–7 years, with some episodes lasting more than 15 years. The median cumulative change in debt over the duration of the surge is around 28-32 percent of GDP, with 10 percent of episodes recording 12–13 pp of GDP debt surge, and on the other end of the tail, 10 percent of episodes recording debt accumulation of over 70 pp of GDP. Overall, the distribution of debt surges by size is skewed with a much higher frequency of smaller debt surge episodes (below 20 percentage points). In terms of income levels, LICs and EMs tend to have a flatter distribution with a larger number of "high debt surge" episodes. We also observe variation across income groups when we take duration into account. EMs and LICs show larger per year surges in the shorter duration range, while AEs show relatively less variation across different durations.

Figure 1. Stylized Facts



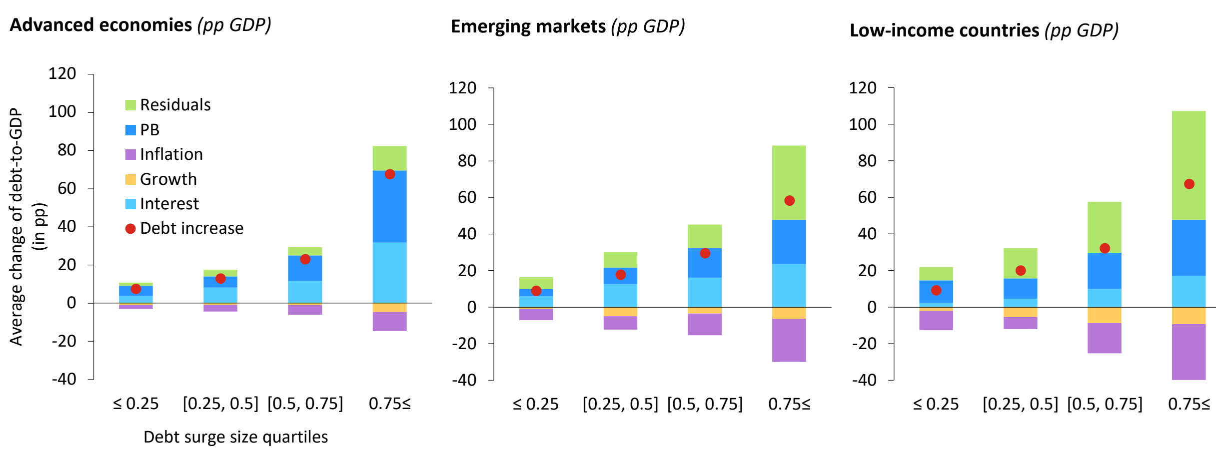
Source: WEO and authors' calculations.

©International Monetary Fund. Not for Redistribution

III. Drivers of Debt

Following a standard debt decomposition technique,[2] we quantify the contributions of various components to the debt surge episodes, namely those of real GDP growth, nominal interest expenses, the primary balance, and inflation. The decomposition shows both commonalities as well as heterogeneity across the income groups. For AEs and EMs, primary deficits and interest payments are the main drivers of debt surges. However, for EMs, Stock Flow Adjustments (SFA) are another important contributor to larger surge episodes. As for LICs, SFA play an overwhelming role across all debt surge brackets with primary deficits also coming as important. While this accounting exercise provides a useful tool for understanding the role of macroeconomic drivers for debt, it falls short of being comprehensive as primary balances are in themselves affected by economic growth and inflation. Mauro and Zilinsky (2016) extend the standard method of accounting by acknowledging the additional role of growth on primary balance through a natural erosion of primary expenditures (Annex II).[3] Applying this Augmented Decomposition (AD) to our sample we are able to strip out the impact of growth and inflation on primary balances and recalculate the impact of fiscal policy on debt accumulation. Figure 2 shows the contribution of fiscal policy for each debt surge size as calculated by the standard decomposition (SD) and AD. Across all brackets, fiscal policy (deficits) plays a larger role once we strip out the indirect effects on growth and inflation. That is, by removing the positive effect of growth on debt-to-GDP embedded in the primary balance, the negative effect of fiscal slippages on debt tends to be higher, highlighting the role of fiscal policy in debt surges.

Figure 2. Standard Decomposition



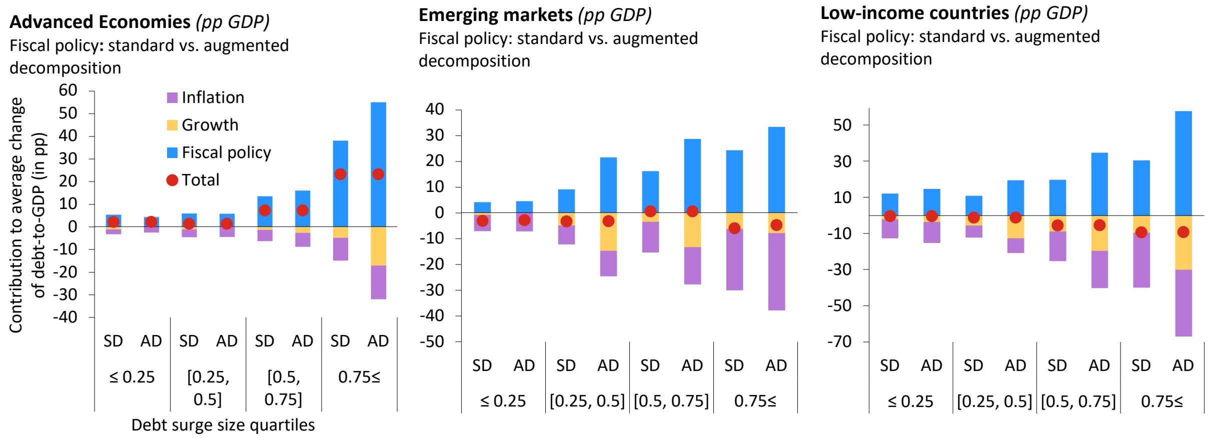
Source: WEO and authors' calculations. Residuals refer to SFA.

[2] A description of the debt decomposition technique is provided in Annex II.

[3] According to Mauro and Zilinsky (2016), a neutral policy stance is one where revenues grow with nominal GDP whereas primary expenditures growth with the GDP deflator. Absent any policy measures this would imply a natural erosion of expenditures and a contribution to primary surpluses. This approach faces the limitation of not accounting for population growth, which can be substantial in LICs.

©International Monetary Fund. Not for Redistribution

Figure 3. Augmented Decomposition



Source: WEO and authors' calculations.

The Role of Stock-Flow Adjustments

As documented above, in EMs and in particular in LICs, SFA explain a significant part of debt accumulation especially in large debt surges making it imperative to understand what is behind SFA. As described in Sever and Laws (2023, Appendix I), there are several reasons that result in non-negligible SFA. These can be the existence of off-budget funds, differences in institutional coverage between debt and fiscal balances statistics, asset valuation effects due to depreciation and its impact on Foreign Exchange (FX) denominated debt, the realization of contingent liabilities such as SOE or bank recapitalization, arrears, cash vs. accrual accounting differences between fiscal balance and debt.

Valuation Driven Stock-Flow Adjustments

In this section, we quantify one of the key drivers of SFA, namely the valuation effects arising from currency depreciation. In computing the FX effect on debt accumulation, we follow the SD and disentangle the FX effect by interacting changes in the nominal exchange rate with the share of FX debt. To do so, we employ the IMF Sovereign Debt Investor Base for EMDE (2023), that has been expanded to include debt by currency. For a total of 222 debt surge episodes during the periods of 1990–2021, the results of SD after further breaking down the *FX effect* and *other SFAs* are presented in Figures 4 and 5.[4] The FX effect is shown to play a quantitatively important role in SFA, particularly for the large debt surge episodes explaining as much as half of the SFA. This reflects, in part, high shares of FX debt (Figure 6) as well as large depreciations (Figure 7). The latter also reflects the high incidence of currency crisis. To further assess the role of crisis (including the role of financial crisis, which may require bank or SOE recapitalizations) in SFA, we divide the sample into crisis cases and non-crisis cases based on Laeven and Valencia (2020) crisis database.[5] Not surprisingly, large SFA tend to be mostly accompanied by crises in both EMs and LICs (Figures 8–11). Debt surge episodes not associated with a crisis tend to have small SFA, with fiscal policy playing a greater role.

[4] The episodes with fixed exchange rate regime or without data of FX debt nor external debt during the debt surge period were dropped. "Other SFA" is defined as SFA – FX effect.

[5] The crisis-related episodes are classified as the debt surge episodes that are accompanied by crises (based on Laeven & Valencia (2020) crisis database) during the debt surge periods or in the previous year (t-1) of the start of debt surge.

©International Monetary Fund. Not for Redistribution

Figure 4. FX Effects and Other SFAs. *EMs*

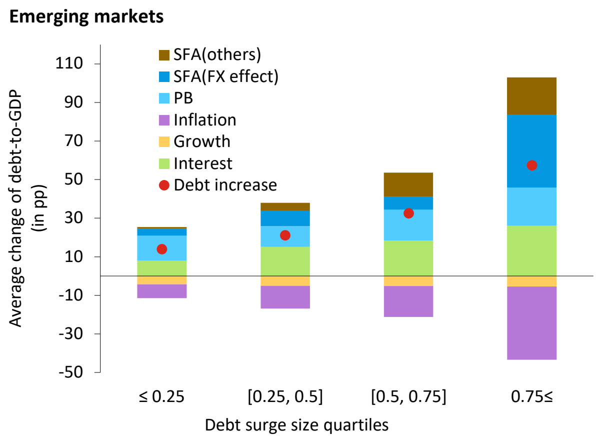
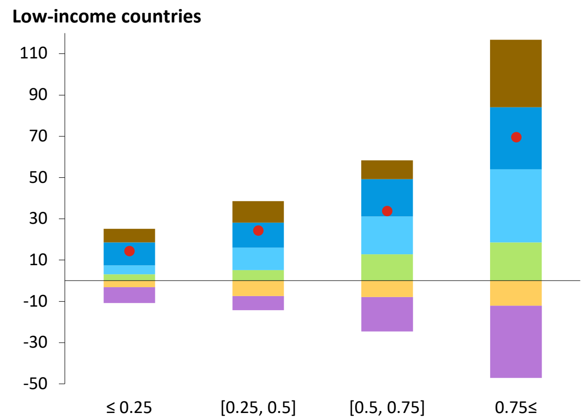


Figure 5. FX Effects and Other SFAs. *LICs*



Source: WEO, Haver Analytics, and authors' calculations.

Figure 6. Share of FX Debt

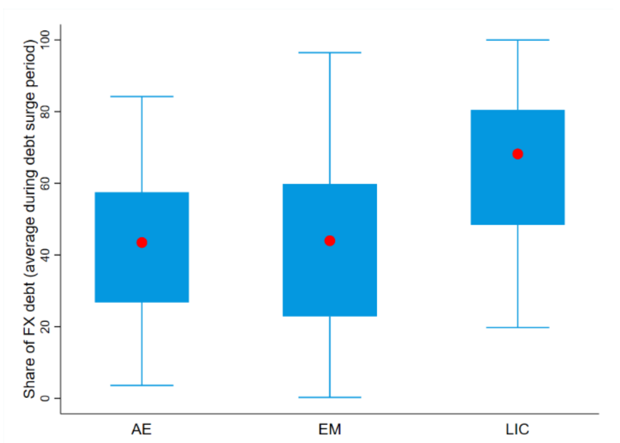
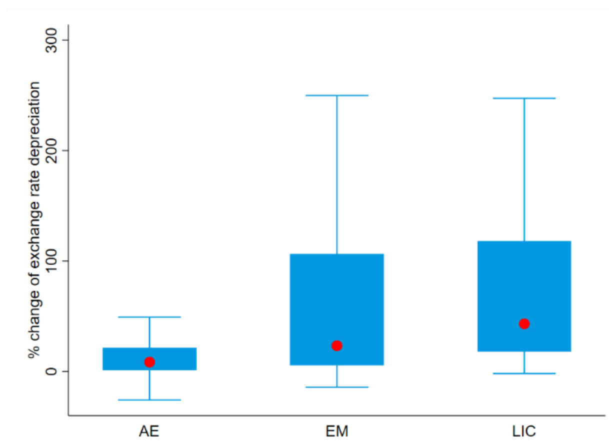


Figure 7. FX Depreciation



Source: IMF Sovereign Debt Investor Base, and authors' calculations.
Note: LIC bar excludes outliers. Red spots mark the median.

©International Monetary Fund. Not for Redistribution

Figure 8. Crisis Cases: *EMs*

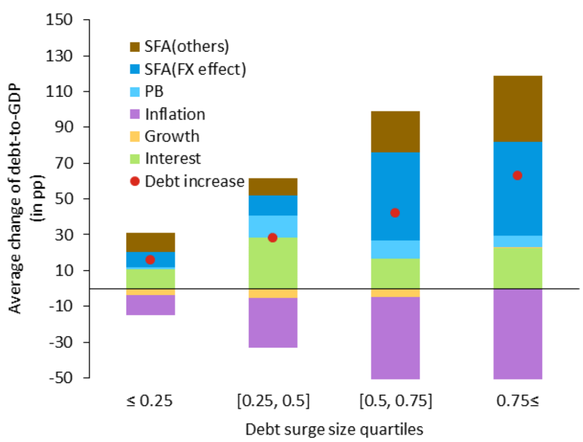
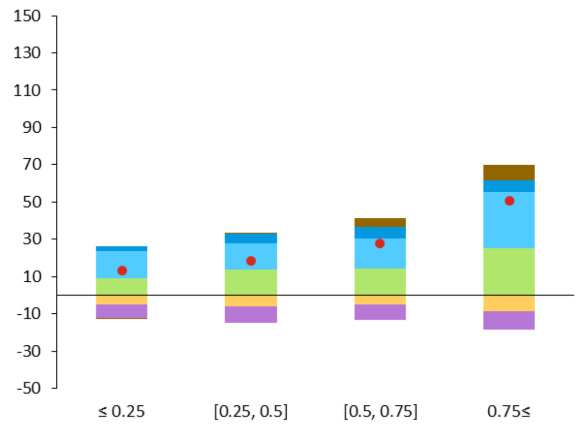


Figure 9. Non-Crisis Cases: *EMs*



Source: Haver Analytics, authors' calculations, Laeven & Valencia (2020) crisis database, and IMF Sovereign Debt Investor Base.

Figure 10. Crisis Cases: *LICs*

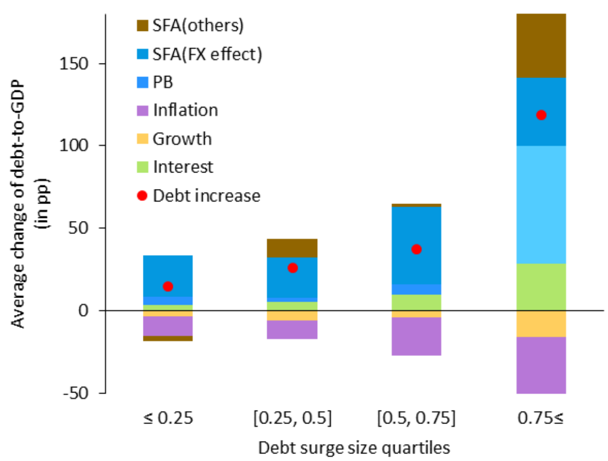
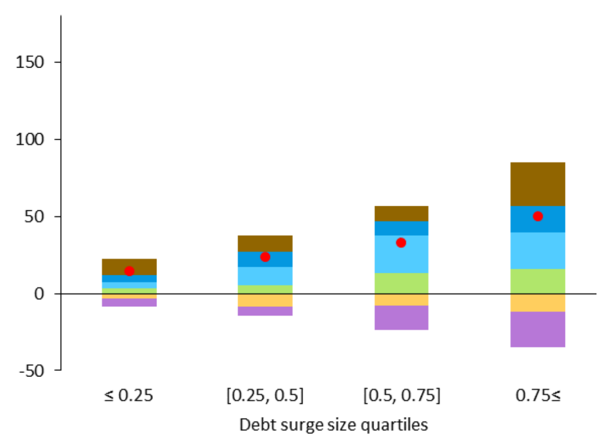


Figure 11. Non-Crisis Cases: *LICs*



Source: Haver Analytics, authors' calculations, Laeven & Valencia (2020) crisis database, and IMF Sovereign Debt Investor Base.

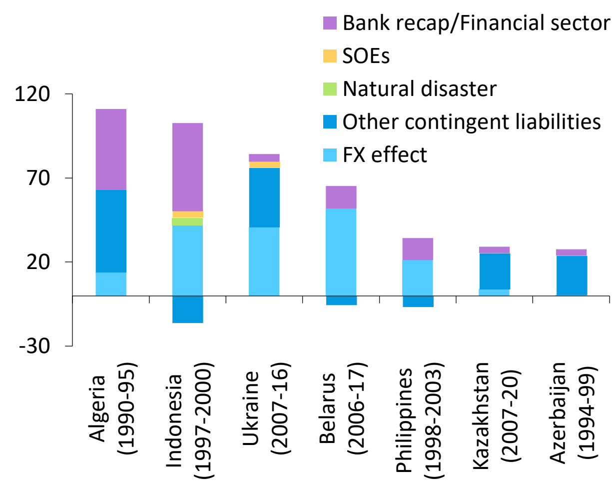
Other Stock-Flow Adjustments

As shown in Figures 8 and 10, non-valuation related SFA (brown bar) also tend to be associated with crisis pointing to crisis resolution related fiscal costs. Using contingent liability data from Bova et al., (2016) and focusing on the top quartile of debt surges, we see that bank recapitalization is a leading contributor to debt surges, followed by SOEs related contingent liabilities and natural disasters (Figure 12). As data on contingent liabilities is not available for LIC, we reviewed staff reports of LIC that experienced the largest debt accumulation (the top 25th percentile) and discovered that about half of the non-valuation related SFA originates from arrears, revision in debt statistics, bank and SOE recapitalizations, off-budget transactions and hidden debt that was later uncovered (Figure 13). As we will show in later sections, non-valuation related SFA

©International Monetary Fund. Not for Redistribution

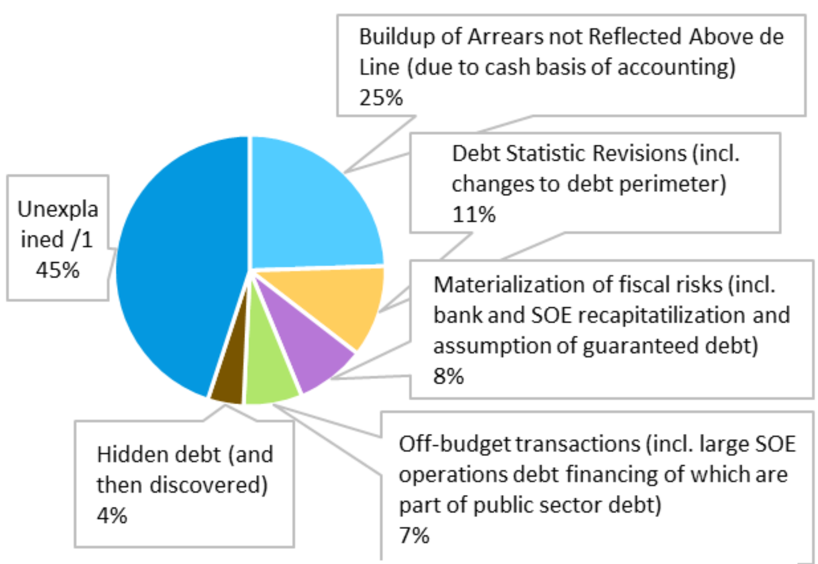
tend to play a significant role in debt remaining permanently higher pointing to the complexities of offloading contingent liability related debt accumulation.

Figure 12. Crisis Cases: FX Effect and Other SFAs



Source: Haver Analytics, authors' calculations, Bova et al., (2016), Laeven & Valencia (2020).
Note: Sample is limited to a few episodes presented above with data available. "Other" are calculated as the residual.

Figure 13. What Explains the Non-FX-Driven Changes in Stock-Flow Adjustments for LICs in the Largest Debt Episodes?



/1 Inspection of country-specific documents did not allow identification of the source of this build-up.

Source: IMF Staff using country-specific documents (incl. IMF Article IV publications).

©International Monetary Fund. Not for Redistribution

IV. Estimating the Role of Fiscal Policy in Debt Surges

The standard and (more strongly) the augmented decomposition of debt drivers showed how fiscal policy, namely fiscal expansions, seem to have a quantitatively large contribution to debt surges. In this section, we go beyond this accounting exercise and estimate the role of fiscal policy shocks in explaining debt surges and answer the following questions:

(i) Does fiscal policy significantly account for the steady and sizeable increases in debt observed over the past decades?

(ii) If yes, is the fiscal policy effect predominantly spending or revenue-driven?

(iii) How does the effect of fiscal policy vary across different income groups?

The first methodological challenge is that of identifying fiscal policy shocks. Since fiscal policy decisions are typically strongly correlated with business cycle fluctuations, the challenge consists of disentangling movements induced by the broader economic environment and structural fiscal shocks. Three approaches to tackle this issue are common in the literature.

The first strand of the literature employs structural Vector Autoregressive (VAR) models to identify government spending and revenue shocks, using either Cholesky decompositions or sign restrictions as identifying assumptions (Blanchard and Perotti, 2002; Perotti, 2005; Pappa, 2009; Galí, López-Salido, and Vallés, 2007; Mountford and Uhlig, 2009; Beetsma et al., 2012; Ilzetzki et al., 2013). The second approach estimates narrative fiscal shocks based on a survey of government documents and the fiscal policy announcements therein (Devries et al., 2011; Jordà and Taylor, 2015; David and Leigh, 2018; Romer and Romer, 2010). Third, some studies derive fiscal shocks from forecast errors, computing the difference between actual fiscal outcomes and their forecasts (Auerbach and Gorodnichenko, 2013; Furceri and Li, 2017; Furceri et al., 2018).

We adopt the first approach and identify fiscal shocks based on a panel VAR, given the adequate availability of time series data for the required macroeconomic variables across many countries. We provide a robustness check for our baseline VAR model by constructing fiscal policy shocks based on WEO forecast errors. Although WEO forecasts date back no further than to the early 1990s, the results are consistent with those from our baseline approach, which further includes the two previous decades. In contrast, we cannot employ the narrative approach as, while being well suited for studying fiscal consolidations, it lacks narrative data for periods of fiscal expansion. The details of our procedure, as well as the results, are outlined in the following.

Identification Strategy

The starting point of our identification strategy is the panel VAR specification:

$$A(L)y_{i,t} = Bx_{i,t} + c_i + e_{i,t}, \qquad (1)$$

where $i \in \{1, \dots, N\}$ and $t \in \{1, \dots, T\}$ index countries and time, $y_{i,t}$, c_i, and $e_{i,t}$ are $(k \times 1)$-vectors of dependent variables, country-fixed effects, and residuals, respectively, $x_{i,t}$ is a $(l \times 1)$-vector of exogenous covariates, $A(L)$ is an order-p lag polynomial of $(k \times k)$-coefficient matrices, and B is an $(l \times k)$-matrix of coefficients of the exogenous covariates. Specifically, the dependent variables included in our system encompass public debt,

©International Monetary Fund. Not for Redistribution

government primary spending and revenue, output, the real effective exchange rate,[6] inflation, as well as a monetary policy variable.[7] We estimate our baseline panel VAR separately with annual data from 1970 to 2021 for 31 AEs, 82 EMs, and 50 LICs. Two lags are included in all regressions, supported by standard selection criteria and in line with previous studies.

We identify structural fiscal shocks from the above baseline specification by applying a Cholesky decomposition. Although sign restrictions would be an alternative method, Cholesky decompositions are well established and widely used especially in the identification of fiscal shocks (Ramey, 2016). In formal terms, let $\Sigma = PP'$ be the variance-covariance matrix of $e_{i,t}$, and P be a lower triangular matrix. We can then rewrite the baseline model in terms of a structural panel VAR.

$$y_{i,t} = \mathrm{B}x_{i,t} + \gamma_i + \Gamma(L)\epsilon_{i,t}, \quad (2)$$

where $\mathrm{B} = A(L)^{-1}B$, $\gamma_i = A(L)^{-1}c_i$, $\Gamma(L) = A(L)^{-1}P$, and $\epsilon_{i,t} = P^{-1}e_{i,t}$, the latter being the structural shocks of interest. The identifying restriction, required to isolate structural shocks, refers to the choice of ordering of variables, where each variable is assumed to have a contemporaneous effect on the variables ordered after, but not on those before. Hence, variables are supposed to be placed according to their degree of exogeneity.

The ordering of dependent variables is the pivotal element of identification when annual data is used. In theory, all variables in the system should be interconnected contemporaneously in general equilibrium. Against this background, some studies of fiscal shocks use quarterly data, exploiting the fact that the implementation of fiscal policy is subject to time lags and thus hardly responsive to output fluctuations in the same quarter (e.g., Blanchard and Perotti, 2002). Although only annual data is available in our setting, a plausible ordering is nonetheless feasible, given the typical procedure of a fiscal year (Beetsma et al., 2012).

Our identifying assumption entails the following ordering. Since spending plans are typically set up in advance for the next fiscal year, we place it first. The same holds true for revenue, which, however, responds more strongly to output fluctuations within the fiscal year. Therefore, we order GDP growth second and government revenue third. Inflation is positioned afterwards, as it is assumed to be responsive to economic activity and fiscal policy in the same year (while responding to monetary policy with longer lags (Havranek et al., 2012)). The real effective exchange rate, being influenced by both GDP and inflation, is placed in the fifth position, followed by monetary policy, which can be argued to respond to GDP, inflation, and exchange rate movements within the year. Public debt is set to be last and affected by all the former.

Our specification takes advantage of the fact that fiscal plans are usually put together in the previous year. Moreover, as annual data is used and budgets are usually passed late in the year, it partially overcomes the challenge of fiscal shocks being anticipated, which is a major threat to the identifying assumption imposed on quarterly data. We prove the robustness of our results by performing the analysis for different orderings, which turn out to leave identified fiscal shocks and responses largely unchanged. Furthermore, we derive equivalent

[6] Although it would also be conceptually appropriate to include the nominal rather than the real effective exchange rate, a comparison of information criteria (AIC, BIC, QIC) suggests that using the real effective exchange rate is preferable.

[7] Fiscal variables are measured in natural logarithms of real per-capita US dollar aggregates, where the GDP deflator is used for the conversion into real terms. Similarly, the real effective exchange rate is denoted in terms of its natural logarithm. To ensure the model's stability, first differences are taken of GDP and the monetary policy variable. The monetary policy variable is the central bank policy rate for AEs, and broad money for EMs and LICs, reflecting differences in data availability. Moreover, we add the oil price as exogenous control variable. All data except from monetary policy variables stem from the IMF's WEO database, while central bank policy rates and broad money data are provided by the Bank for International Settlements and the World Bank's World Development Indicators (WDI), respectively.

©International Monetary Fund. Not for Redistribution

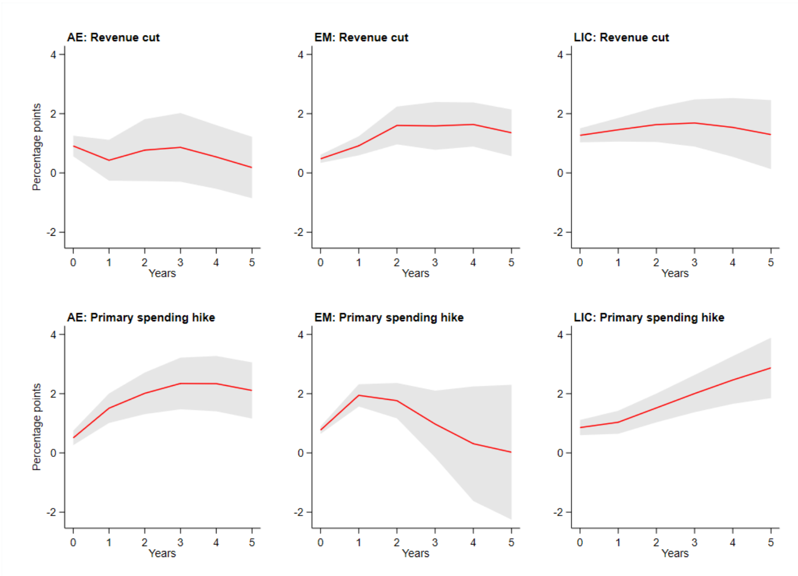
results for fiscal shocks retrieved from WEO forecast errors, which is a method immune to any mispositioning of variables[8] (see discussion below).

Results

The fiscal shocks identified in this vein serve two purposes. First, exploiting the fact that they represent exogenous fiscal policy decisions uncorrelated with other macroeconomic covariates, we will use them as variables for fiscal policy in our econometric analysis of the consequences of debt surges. Second, studying the effects of these shocks allows us to quantify to what extent debt dynamics are driven by fiscal policy. The former is deferred to the next section, while the latter is illustrated in Figure 14. It depicts the responses of the debt-to-GDP ratio to a one percent shock to government revenue and primary spending, respectively, across country groups.[9] The impulse response functions of the full set of variables included in the panel VAR are provided in Figures AIII.1 to AIII.6 in the annex.[10]

Figure 14. Impulse Responses of Debt-to-GDP to Fiscal Shocks

Panel VAR Estimates, 1% Fiscal Shocks



Source: Authors' calculations.
Note: This figure depicts impulse responses of the debt-to-GDP ratio to a negative one percent shock to revenue and a positive one percent shock to primary spending, respectively, as a share of GDP across country groups and based on the above panel VAR. The responses are measured in terms of percentage points. Red lines indicate estimated impulse responses of debt, while grey-shaded areas cover 95-percent confidence intervals.

[8] Data derived from this method is available for 15 AEs, 78 EMs, and 48 LICs from 1993 to 2016, significantly smaller sample than the baseline.

[9] The fiscal shocks depicted amount to a one percent decrease of revenue and increase of primary spending, respectively, as a share of GDP. Considering fiscal shocks in percent rather than in percentage points ensures that they are quantitatively equivalent across country groups, given, e.g., the markedly lower level of revenue and spending relative to GDP in LICs. In contrast, the mean debt level is at roughly 50 percent of GDP for all country groups in our sample.

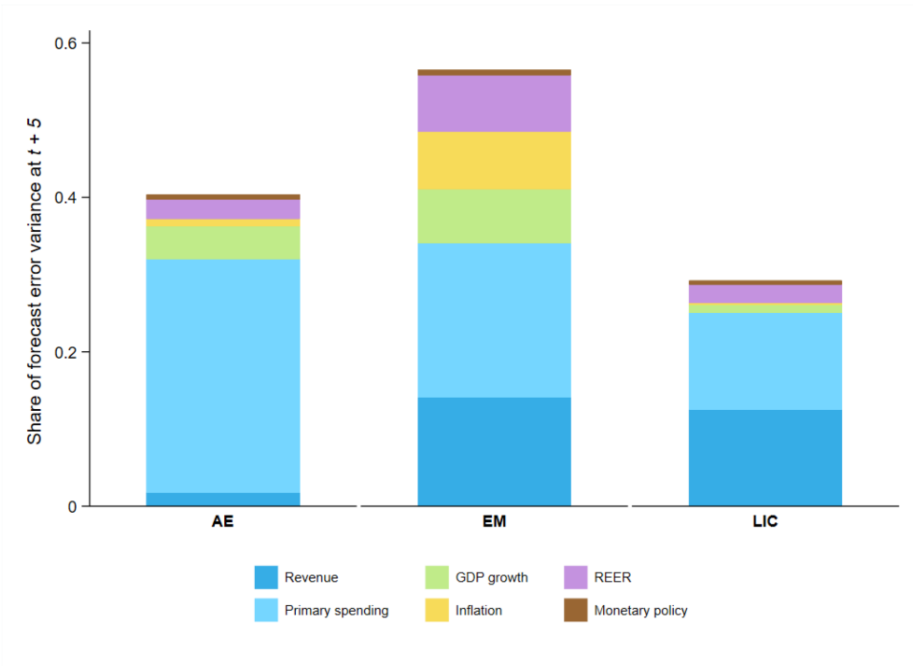
[10] Although the primary balance itself is not a dependent variable, we construct its responses to fiscal shocks ex-post, following Beetsma, Giuliodori, and Klaassen (2006). Specifically, the percentage point change of the primary balance in response to an impulse of revenue or primary spending is computed as $(T/Y)\,(\hat{T}-\hat{Y}) - (G/Y)\,(\hat{G}-\hat{Y})$, where T, G, and Y are government revenue, primary spending, and output, respectively, and variables with a hat refer to their impulse responses to the fiscal shock. The two ratios T/Y and G/Y are evaluated at their group-specific sample means.

©International Monetary Fund. Not for Redistribution

Figure 14 highlights that discretionary fiscal policy contributes sizably to surges of public debt. Throughout all country groups, debt levels rise significantly on impact in response to fiscal policy shocks, and they tend to peak after two to three years. Two distinct patterns stand out. First, primary spending shocks have a larger impact on debt-to-GDP ratios than revenue shocks. While debt responses peak at 0.5 to one percentage points for a one percent hike in primary spending, they stay well below that level in the case of revenue cuts. Second, increases of debt levels are more pronounced in AEs than in EMs, potentially reflecting the fact that increases in spending in AEs do not require subsequent increases of revenue given their far greater access to credit. Considering primary spending shocks, while the instantaneous uptick amounts to roughly 0.25 percentage points in all country groups, responses peak at one percentage point in AEs but barely exceed 0.5 percentage points in EMs.

Figure 15. Forecast Error Variance Decomposition of Debt-to-GDP

Panel VAR Estimates



Source: Authors' calculations.
Note: This figure depicts the forecast error variance decomposition of the debt-to-GDP ratio to various shocks after five years based on the above panel VAR. Blue bars refer to fiscal shocks, while non-blue bars refer to macroeconomic and monetary shocks.

Accounting for the symmetric nature of our panel VAR approach, our results suggest that debt reductions require considerable adjustments on the spending side rather than the revenue side, which is in line with previous findings (IMF 2023a). Furthermore, the greater importance of fiscal policy shocks for debt dynamics in AEs coincides with our above stylized facts on main debt drivers in an accounting sense.

The forecast error variance decomposition in Figure 15 shows that our baseline model explains approximately 30 to 55 percent of the variation in debt forecasts, where the highest share is achieved for EMs. Fiscal policy (shaded in blue) accounts for the lion share of the explained variation, or 30 to 35 percent of the total variation in both AEs and EMs and 25 percent in LICs, underscoring the importance of fiscal policy for debt surges. Within fiscal policy, the largest proportion is attributed to primary spending shocks, especially in AEs. In LICs,

©International Monetary Fund. Not for Redistribution

spending and revenue-related shocks explain an equal fraction of debt dynamics. The decomposition is depicted in further detail in Figures AIII.7 to AIII.9 in the annex.

Overall, in this section, we conclude that fiscal expansions are a significant determinant of debt surges, most prominently in AEs and if driven by primary spending hikes.

Robustness

In this section, we provide a range of robustness checks along two dimensions. The first dimension proves robustness within the domain of panel VAR specifications. We conduct the above analysis for a variety of variable orderings, including linear and country-specific time trends as well as a dummy for oil exporters, and split our sample into shorter time windows, starting at the beginning of the 1990s and 2000s, respectively. Our results are robust to each of these variations (See Annex III).

Admittedly, the former tests show robustness only to the extent that our assumption of a recursive ordering of contemporaneous effects across variables is true. Thus, a complementary specification which does not rely on a Cholesky decomposition is needed. As outlined above, we provide it by constructing alternative fiscal shocks based on WEO forecast errors, following Auerbach and Gorodnichenko (2013), Furceri and Li (2017), Furceri et al., (2018), Honda, Miyamoto, and Taniguchi (2020), and Cevik and Miryugin (2023). Specifically, instead of estimating a panel VAR model, we compute fiscal policy shocks as the difference between actual government revenues and primary spending in a certain year t and their respective one-year ahead forecasts published in October of year $t-1$.[11] Subsequently, we use these fiscal shocks and all the variables included in our baseline panel VAR to estimate local projections of debt. Data is available for 15 AEs, 78 EMs, and 48 LICs from 1993 to 2016.

The results are reported in Figure AIII.10 in the annex.[12] Our alternative measure of fiscal policy shocks proves similarly significant in explaining debt dynamics. We find that debt-to-GDP ratios respond substantially to both hikes in primary spending and cuts in revenue in EMs, which account for more than half of our sample. Importantly, the effects of revenue cuts are smaller than those of spending increases. Responses generally peak after one to two years and subsequently revert back to zero.

In the case of AEs and LICs, the impulse responses of debt to fiscal shocks are not statistically significant, which is partially due to the small sample size. However, our estimates have the expected signs, i.e., debt-to-GDP ratios rise in response to fiscal shocks. In LICs, primary spending hikes give rise to larger responses than revenue cuts. The estimated responses are generally larger in AEs than in other country groups. Reassuringly, these findings confirm the two main patterns retrieved from our baseline analysis. The impact of primary spending hikes is more accentuated than that of revenue cuts, in particular in EMs, and overall responses of debt tend to be the largest in AEs.

[11] Both one-year-ahead and within-year forecasts are used in the literature computing fiscal shocks based on WEO vintages. We opt for the former specification because it allows us to capture fiscal policy surprises that occur during the entire year t, while within-year forecasts published in October of the same year use all available information until then, and hence factor in fiscal policy surprises that occurred previously.

[12] We further show the distribution of our two measures of fiscal policy shocks in Figures AIII.11 and AIII.12 in the annex.

©International Monetary Fund. Not for Redistribution

V. Consequences of Debt Surges

In the previous sections, we have characterized the conditions under which debt surges occur. To be precise, we have shown that SFA, in particular, exchange rate fluctuations and contingent liabilities, as well as fiscal policy, are important economic drivers of debt surges. That holds true both in an accounting sense and from a perspective of statistical significance. The next step of our analysis sheds light on the questions of how debt surges end, what their aftermath is like, and how their characteristics influence these outcomes.
We are interested in two specific questions:

(i) To what extent and under what conditions do debt surges result in a financial crisis? The insights gained from this exercise are useful to draw inferences about policies that help minimize the risk of debt accumulation ending in a crisis.

(ii) What is the debt trajectory following a debt surge, and what are the determinants of whether or not debt levels decline ex-post?

In answering these questions, we focus on the factors that our previous analysis has deemed crucial, i.e., the magnitude and duration of debt surges, fiscal policy, FX effects, and other SFA, mainly capturing the realization of contingent liabilities. To overcome potential endogeneity concerns with regard to fiscal policy, we use the fiscal shocks identified in the previous section as explanatory variables in the following regressions. These shocks are signed in a way to represent fiscal expansion shocks; that is, a positive shock captures an increase in primary spending or a decrease in government revenue, respectively.

Debt Surges and Financial Crises

Empirical Strategy

To explore the link between debt surges and financial crises, we estimate the following panel logit model with random effects, using annual data for 15 AEs, 82 EMs, and 50 LICs from 1986 to 2021.

$$Y_{i,t} = \alpha_i + \sum_{k=0}^{3} \beta'_{t-k} \times S_{i,t-k} \times DebtSurge_{i,t-k} + \sum_{k=0}^{3} \gamma'_{t-k} \times C_{i,t-k} + \epsilon_{i,t}. \quad (3)$$

The binary outcome variable $Y_{i,t} \in \{0,1\}$ is equal to one if country i is in a financial crisis in year t, and zero otherwise. We define financial crisis any banking crisis, currency crisis, sovereign default reported in Laeven and Valencia (2016). Deviating from the benchmark definition used in the literature, we do not distinguish between different types of crises. The reason is that crises tend to come together through interlinkages. For instance, the sovereign-bank nexus and financial repression may translate from surging public debt into a banking crisis. On the other hand, debt accumulation may originate from a deterioration of the general economic environment and market confidence, paving the way for currency or sovereign debt crises.

We include random effects to capture unobserved country heterogeneity.[13] All explanatory variables are lagged to account for endogeneity and are chosen based on their relevance for our research question, data availability, and their significance in previous studies (e.g., Reinhart and Rogoff, 2010; Schularick and Taylor, 2012; Kose et al., 2021). Although standard selection criteria (AIC, BIC, LR test) suggest we could also use more time lags,

[13] The Hausman test suggests using random effects rather than fixed effects.

©International Monetary Fund. Not for Redistribution

we add three lags of each regressor, balancing the trade-off between capturing the dynamic nature of effects and keeping the model as parsimonious as possible.

Specifically, the vector $S_{i,t}$ contains our main debt surge drivers of interest, i.e., debt accumulation itself, fiscal policy shocks, and currency depreciation. They are interacted with the dummy variable $DebtSurge_{i,t} \in \{0,1\}$, which is equal to one if country i is in a debt surge (defined as above) in year t, and a financial crisis breaks out in some later year during this debt surge episode. This cross-term allows us to trace back the effect of distinct debt surge characteristics on the probability that this debt surge results in a crisis. Importantly, for the sake of avoiding messing up interdependencies between debt surges and crises, we focus solely on debt surge episodes which precede a crisis, but neglect those emerging in the wake of one. In addition, the variable $C_{i,t}$ may be either one of a range of typical crisis predictors which we include as covariates in separate regressions.[14]

Table 2. Debt Surges and Financial Crises

Random-effect Logit Regression

	Financial crisis											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L1.DebtAccumulation × L1.DebtSurge	0.0886* (0.0464)	0.0765 (0.0495)	0.0760* (0.0453)	0.0829* (0.0471)	0.0996* (0.0533)	0.0876* (0.0495)	0.0843* (0.0457)	0.0852* (0.0484)	0.0986** (0.0495)	0.1108** (0.0455)	0.0838 (0.0561)	0.0859* (0.0469)
L2.DebtAccumulation × L2.DebtSurge	-0.0049 (0.0533)	-0.0019 (0.0533)	-0.0039 (0.0534)	-0.0138 (0.0552)	-0.0378 (0.0443)	-0.0168 (0.0512)	0.0394 (0.0609)	-0.0087 (0.0550)	-0.0261 (0.0544)	-0.0175 (0.0560)	-0.0055 (0.0526)	-0.0040 (0.0535)
L3.DebtAccumulation × L3.DebtSurge	0.0911 (0.0598)	0.0824 (0.0607)	0.0833 (0.0611)	0.0896 (0.0610)	0.0603 (0.0937)	0.0923 (0.0621)	0.0993 (0.0711)	0.0833 (0.0607)	0.0946 (0.0670)	0.0827 (0.0780)	0.0902 (0.0591)	0.0928 (0.0594)
L1.RevenueShock × L1.DebtSurge	0.6149** (0.2604)	0.6430** (0.2725)	0.5856** (0.2536)	0.6328** (0.2714)	0.4549** (0.2218)	0.6690** (0.2897)	0.5752** (0.2554)	0.6218** (0.2731)	0.6383** (0.2751)	0.4444* (0.2393)	0.5789** (0.2508)	0.6302** (0.2613)
L2.RevenueShock × L2.DebtSurge	0.2041 (0.1414)	0.1934 (0.1424)	0.2062 (0.1401)	0.1444 (0.1294)	0.2227 (0.1728)	0.2760** (0.1382)	0.1984 (0.1391)	0.2031 (0.1449)	0.2332 (0.1442)	0.2500 (0.1783)	0.2285 (0.1420)	0.2115 (0.1431)
L3.RevenueShock × L3.DebtSurge	-0.2634 (0.3755)	-0.2559 (0.3811)	-0.2864 (0.3811)	-0.2472 (0.3601)	-0.2505 (0.3708)	-0.2130 (0.3732)	-0.1837 (0.3412)	-0.2690 (0.3831)	-0.2977 (0.3683)	-0.3571 (0.4596)	-0.2669 (0.3745)	-0.2371 (0.3706)
L1.PrimarySpendingShock × L1.DebtSurge	0.0280 (0.1088)	0.0356 (0.1094)	0.0391 (0.1079)	0.1077 (0.1130)	0.0721 (0.1031)	0.0131 (0.1229)	0.0970 (0.1128)	0.0367 (0.1123)	0.0343 (0.1105)	0.0440 (0.1096)	0.0457 (0.1059)	0.0326 (0.1095)
L2.PrimarySpendingShock × L2.DebtSurge	0.0536 (0.0532)	0.0470 (0.0547)	0.0548 (0.0526)	0.0345 (0.0580)	0.0448 (0.0679)	0.0338 (0.0447)	0.0436 (0.0597)	0.0518 (0.0575)	0.0685 (0.0491)	0.0653 (0.0624)	0.0490 (0.0542)	0.0563 (0.0573)
L3.PrimarySpendingShock × L3.DebtSurge	0.1773* (0.1043)	0.1740* (0.1035)	0.1842* (0.1042)	0.1474 (0.0994)	0.2133** (0.0992)	0.1737* (0.1049)	0.1525 (0.1080)	0.1782* (0.1048)	0.1680* (0.0999)	0.1973* (0.1173)	0.1767* (0.1058)	0.1669 (0.1017)
L1.FXDepreciation × L1.DebtSurge	0.0178 (0.0345)	0.0174 (0.0341)	0.0194 (0.0336)	-0.0026 (0.0371)	0.0237 (0.0190)	0.0217 (0.0441)	0.0140 (0.0290)	0.0178 (0.0351)	0.0116 (0.0390)	0.0079 (0.0243)	0.0184 (0.0284)	0.0179 (0.0337)
L2.FXDepreciation × L2.DebtSurge	0.0155 (0.0128)	0.0147 (0.0127)	0.0149 (0.0131)	0.0034 (0.0135)	0.0141 (0.0111)	0.0141 (0.0129)	0.0069 (0.0127)	0.0149 (0.0127)	0.0061 (0.0132)	0.0140 (0.0140)	0.0158 (0.0121)	0.0153 (0.0128)
L3.FXDepreciation × L3.DebtSurge	-0.0155 (0.0106)	-0.0157 (0.0106)	-0.0140 (0.0108)	-0.0259** (0.0121)	-0.0179 (0.0147)	-0.0155 (0.0105)	-0.0138 (0.0124)	-0.0160 (0.0113)	-0.0221** (0.0110)	-0.0150 (0.0119)	-0.0156 (0.0105)	-0.0150 (0.0102)
3 lags of		debt accumula-tion	primary balance shock	FX deprecia-tion	reserves	bank credit	external debt	growth	inflation	real interest rate	current account balance	GDP per capita
Obervations	2717	2717	2717	2717	2530	2698	2327	2717	2717	2008	2619	2717
AUROC	0.7074*** (0.0226)	0.6958*** (0.0308)	0.7282*** (0.0282)	0.759*** (0.0269)	0.7045*** (0.0303)	0.7473*** (0.0273)	0.7244*** (0.0308)	0.7599*** (0.0261)	0.7566*** (0.0255)	0.734*** (0.0302)	0.6988*** (0.0297)	0.7374*** (0.0281)

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Authors' calculations.

[14] A natural alternative to using panel data would be a cross-sectional analysis based on episodic data. However, this specification lacks a sufficient number of events in the regression sample, resulting in spurious correlations. Against this background, we follow the panel data approach, and draw inferences about fiscal policy and FX-related contributions to crisis probabilities specifically during debt surge episodes from the interaction terms. As for many other covariates, we further control for these variables' effects outside of debt surge episodes as well. A detailed list of variables included in the regressions is provided in Table AI.2 in the annex.

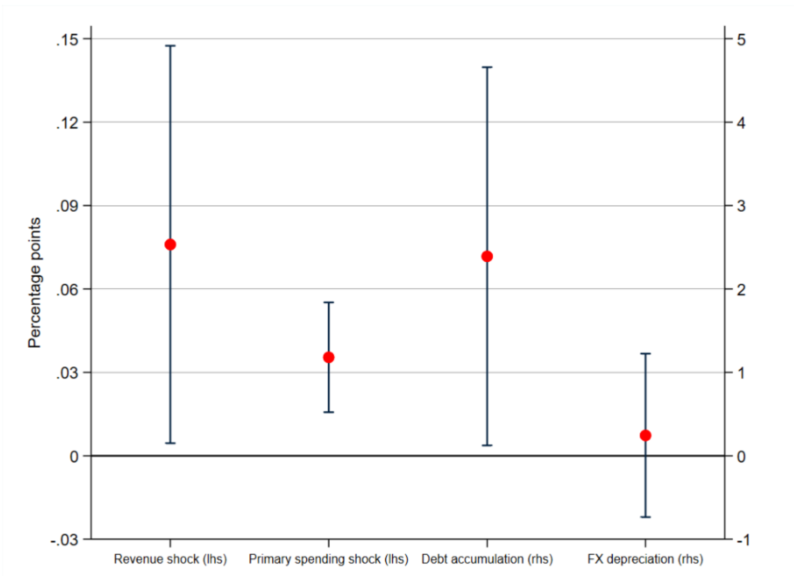
©International Monetary Fund. Not for Redistribution

Results

Table 2 reports the regression results based on equation (3). Column (1) is our baseline specification, including the interaction terms of main debt surge drivers and the debt surge dummy.[15] In columns (2) to (12), we add three lags of a set established crisis predictors each. Importantly, we control for the effects of debt drivers outside of debt surge episodes in columns (3) to (5). Our model proves to have substantial predictive power, as confirmed by the significant AUROC test statistic – acronym for the *area under the receiver operating characteristic curve*, which is essentially testing whether we outperform a fair coin toss in predicting crisis occurrences.

Figure 16. Sum of Marginal Effects of Debt Surge Attributes

Estimates and 90% Confidence Intervals



Source: Authors' calculations.
Note: This figure depicts the sum of marginal effects of the first three lags of selected debt-surge characteristics on the probability of a debt surge resulting in a financial crisis as defined in the main text, as well as their 90-percent confidence intervals. Marginal effects are evaluated at the means of all variables. The effects of a revenue shock, and a primary spending shock (lhs) refer to a one percent fiscal shock, while those of debt accumulation and FX depreciation (rhs) refer to a one percentage point change of the respective variable.

The analysis produces four main results. First, the effect of the first lag of debt accumulation during debt surges is significant and positive under nearly all specifications, implying that surging public debt increases the probability that it ends in a crisis. Second, the same holds true for the first lag of revenue shocks and, third, for the third lag of primary spending shocks during debt surge episodes. Both revenue- and spending-driven fiscal profligacy thus raise the likelihood of a debt surge turning into a crisis. Fourth, the cross-terms of currency

[15] Introducing separately the revenue shocks, expenditure shocks as well as the scale of debt accumulation during a surge serves multiple purposes: i) documenting the effect of the "size" of debt accumulation as well, (ii) controlling for cases where a revenue cut or expenditure hike in a given year during the surge is not associated with debt accumulation, yet it has a signaling effect of future fiscal stance (e.g., revenue cuts tend to be more persistent).

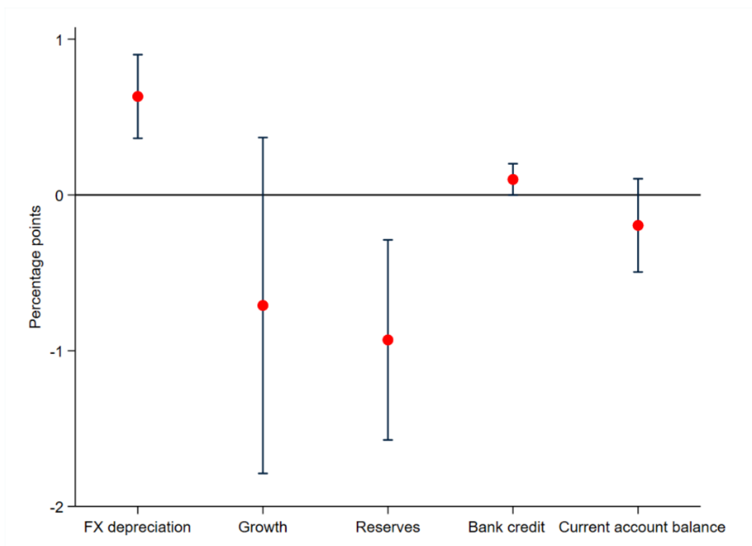
©International Monetary Fund. Not for Redistribution

depreciation and the debt surge dummy are insignificant, suggesting that the impact of exchange rate movements on crisis occurrences is not particularly linked to debt surges.[16]

For ease of interpretation, we convert these estimates into marginal effects, which may be interpreted in terms of percentage point changes of the crisis probability in response to one unit increases of the regressors. Figure 16 depicts estimates and 90 percent confidence intervals of the four main debt surge attributes of interest. The left- and right-hand side axes refer to the effects of fiscal policy and debt accumulation as well as FX depreciation, respectively. The marginal effects of each predictor are computed as the sums of the three lag coefficients, evaluated at the means of all further variables. Note that, given the non-linear character of a logit regression, they cannot be interpreted mechanically but only at the specific variable values chosen for evaluation.

Figure 17. Sum of Marginal Effects of Selected Control Variables

Estimates and 90% Confidence Intervals



Source: Authors' calculations.
Note: This figure depicts the sum of marginal effects of the first three lags of selected control variables on the probability of a debt surge resulting in a financial crisis as defined in the main text, as well as their 90-percent confidence intervals. Marginal effects are evaluated at the means of all variables. All effects refer to a one percentage point change of the respective variable.

We find that fiscal expansions notably increase the likelihood of debt surges, resulting in a financial crisis. During a debt surge episode, accumulating one percentage point more debt as a share of GDP over the past three years raises the crisis probability by 2.4 percentage points (at sample means). This figure is comparably large, reflecting the fact that strong debt accumulation builds up vulnerabilities to shocks, which make a country more prone to crises.

Importantly, crisis scenarios because of policy-driven debt surges can be driven by both revenue and spending shocks. If revenue has been decreased or primary spending has been increased by one percent of GDP during

[16] Exchange rate fluctuations are indeed a highly significant predictor of currency crises. This holds true in general, independent of periods of extensive debt accumulation.

©International Monetary Fund. Not for Redistribution

the previous three years of an episode, the probability of the surge ending in a crisis is by 20 to 40 basis points higher (at sample means).[17]

Our estimates of marginal effects are fairly equal across country groups, as opposed to the predicted crisis probabilities.[18] The likelihood of a debt surge resulting in a crisis is subject to substantial regional disparities. AEs are the most capable of avoiding debt accumulation turning into crises, potentially reflecting their stronger capacity to stabilize the financial sector and general market sentiments even when debt is rising. The median of these countries' respective probability is 11.0 percent. On the contrary, EMs and LICs appear more vulnerable, as debt surges in these countries end in financial crisis with a median probability of 17.0 and 20.8 percent, respectively. These figures are substantially higher than the median of the unconditional crisis probability of 2.9 percent, implying that financial crises are markedly more likely to emerge subsequently to a debt surge episode.

Although these numbers imply that most debt surges do not end in a crisis, it largely depends on the magnitude of debt accumulation and fiscal policy whether they do. To highlight the quantitative significance of our results, we further report the marginal effects of some selected covariates in Figure 17. Evaluated at sample means, a one percentage point stronger depreciation of the nominal exchange rate translates into a 0.63 higher probability of a financial crisis, while a one percentage point higher stock of reserves as a share of GDP reduces it by an average of 0.93 percentage points. Although the coefficients of economic growth, total bank credit to the private sector as well as the current account balance are not significant, they have the expected signs. Comparing these estimates to those of debt surges attributes, we see that sizable macroeconomic adjustments are required to offset the detrimental effect of rising debt on crisis probabilities. On average, to keep a debt surge from ending in a crisis, a one percentage point increase of debt accumulation at sample means needs to be outweighed by an average increase of growth by 3.5 percentage points or reserves by 2.5 percentage points of GDP.

Robustness

The above analysis reveals that fiscal policy plays a major part in determining whether debt surges result in financial crises. We back this result by means of a variety of robustness checks. First, the statistical significance and the magnitude of coefficients turn out to be very robust across the specifications reported in Table 2, including different control variables. Second, although the Hausman test suggests using random effects, we run an equivalent regression using fixed effects, which does not change the results (see Table AIII.1 in the annex).

Third, we perform the analysis for different lag lengths. As mentioned before, given the limited number of positive outcomes in our dataset, we face a trade-off between higher lag lengths and an adequate number of degrees of freedom. Tables AIII.2 and AIII.3 report the results when two and four lags of each regressor are included. Not only do these exercises support our previous findings, but they further unveil a time-varying effect of primary spending. Higher-order lags of primary spending make a substantially larger impact on the probability of a debt surge resulting in a crisis, as compared to lower-order lags as well as the coefficients for

[17] These figures are equivalent to the marginal effects of four to eight basis points for revenue and primary spending shocks, respectively, depicted in Figure 3, which refer to shock of one percent rather than one percentage point of GDP.

[18] We define the probability of a debt surge resulting in a financial crisis as the probability of a financial crisis starting in year t conditional on the country having been in a debt surge in at least one of the three previous years, i. e. $t-3$ to $t-1$.

©International Monetary Fund. Not for Redistribution

revenues. That is, while revenue shocks increase the crisis probability more immediately, primary spending shocks do so over a longer term. We will provide an economic justification for this finding in the next section.

Debt Surges and Ex-post Debt Paths

Empirical Strategy

In this section, we explore the determinants of after-surge debt trajectories and try to answer whether, and under what conditions, debt surges have a permanent effect on debt levels. To explore ex-post debt paths, we estimate the following cross-sectional logit model with annual episodic data for 12 AEs, 55 EMs, and 20 LICs over the period from 1970 to 2014.

$$Y_i = \beta' \times S_i + \gamma' \times A_i + \epsilon_i \qquad (4)$$

Table 3. Debt Surges and Ex-post Debt Paths

Logit Regression

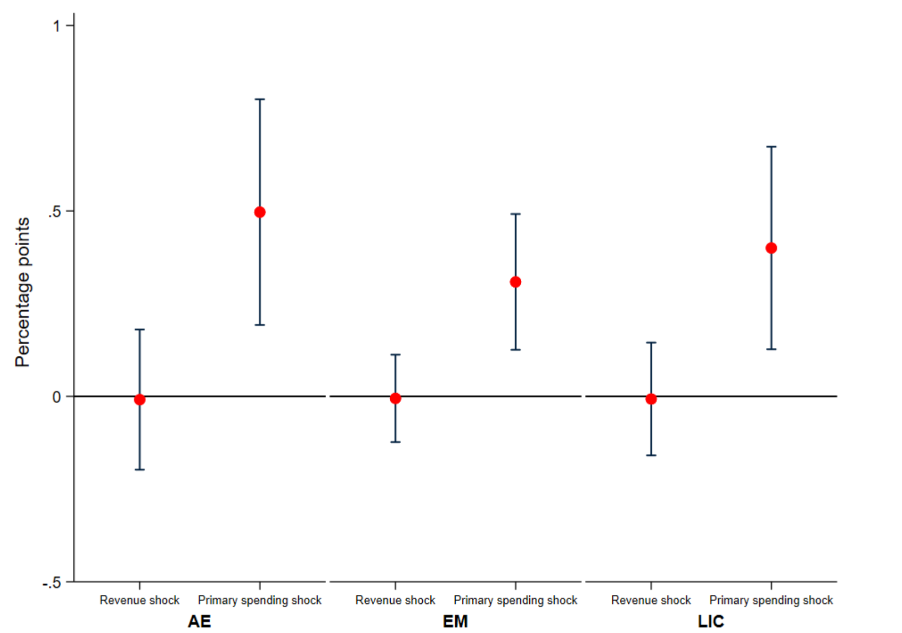
	Non-declining ex-post debt path						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DebtAccumulation	-0.024	-0.0278	0.2628***	-0.0345	-0.0283	-0.0658	-0.0404
	-0.0167	-0.019	-0.1008	-0.0193	-0.0284	-0.037	-0.0369
DebtPeak	-0.0246**	-0.0263**	-0.0263**	-0.0255**	-0.0186	-0.0260*	-0.0249
	-0.0113	-0.0119	-0.0106	-0.0116	-0.0155	-0.015	-0.0193
Duration	0.0338	0.1133	0.1374	0.7235	0.189	0.1631	0.0178
	-0.0614	-0.093	-0.1054	-1.0734	-0.1966	-0.1876	-0.1546
FinancialMarketDepth	1.7751	2.3346	2.291	2.4863	1.2868	1.453	1.2116
	-1.2593	-1.5899	-1.5486	-1.5872	-1.7885	-1.8107	-1.7482
RevenueShock		0.1484	-0.035	-0.1191			
		-0.3152	-0.4606	-0.4457			
PrimarySpendingShock		0.5889	1.9901***	0.989			
		-0.5344	-0.7415	-0.7881			
FXEffect					-0.0888***	-0.0595	-0.4134***
					-0.0311	-0.0517	-0.1498
OtherSFA					-0.0109	-0.1117**	-0.0069
					-0.0219	-0.0546	-0.0969
RevenueShock × DebtAccumulation			0.0077				
			-0.0074				
PrimarySpendingShock × DebtAccumulation			-0.0408***				
			-0.0155				
RevenueShock × Duration				0.0555			
				-0.0571			
PrimarySpendingShock × Duration				-0.0929			
				-0.1492			
FXEffect × DebtAccumulation						-0.001	
						-0.0012	
OtherSFA × DebtAccumulation						0.0031***	
						-0.0012	
FXEffect × Duration							0.0687**
							-0.029
OtherSFA × Duration							-0.004
							-0.0151
PrimaryBalanceAfter	0.1328	0.0868	0.0047	0.0808	0.3343	0.3381	0.5148
	-0.3022	-0.3832	-0.4137	-0.3877	-0.4155	-0.4245	-0.4344
GrowthAfter	-0.3117***	-0.3695***	-0.3911***	-0.3785***	-0.4007**	-0.3727**	-0.4438**
	-0.1129	-0.1308	-0.1356	-0.1354	-0.1783	-0.1868	-0.202
InflationAfter	-0.0913	-0.0322	-0.0164	-0.0285	0.1096	0.0585	0.1251
	-0.0605	-0.0598	-0.0645	-0.0612	-0.1134	-0.1152	-0.1086
RestructuringAfter	0.6344	0.9883	0.6745	1.0969	0.9321	0.8368	2.0104
	-0.8721	-1.0423	-0.9359	-1.0099	-0.8544	-0.801	-1.2984
FXDepreciationAfter	0.0391***	0.0342***	0.0373***	0.0336***	0.0417**	0.0503**	0.0589***
	-0.0127	-0.0126	-0.0136	-0.0129	-0.0167	-0.0227	-0.0183
Episodes	130	118	118	118	81	81	81
AUROC	0.8214***	0.8466***	0.8466***	0.8536***	0.8664***	0.8850***	0.8924***
	(0.0139)	(0.0138)	(0.0138)	(0.0137)	(0.0179)	(0.0161)	(0.0154)

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Authors' calculations. Results are not sensitive to the exclusion of the very few debt restructuring cases in the sample.

©International Monetary Fund. Not for Redistribution

Figure 18. Marginal Effects of Fiscal Policy
Estimates and 90% Confidence Intervals



Source: Author's calculations.
Note: This figure depicts marginal effects of fiscal shocks during a debt surge episode on the probability of debt staying elevated ex-post by country groups, as well as their 90-percent confidence intervals. Marginal effects are evaluated at the means of all variables. All effects refer to a one percent fiscal shock.

The binary outcome variable $Y_i \in \{0,1\}$ is equal to one if debt surge episode i results in an elevated debt level ex-post, and zero otherwise.[19] Following Jaramillo et al., (2016), we compute the ex-post change of debt between the peak level in the last year of the episode and the average across years three to five after the surge. The latter procedure reduces the impact of outliers. In terms of magnitude, we define a debt level staying elevated if it does not decline by more than seven percentage points. Since the definition of the end point of a debt surge requires some downward correction ex-post, we consider seven percentage points a consistent lower bound so that debt paths can be considered declining. Alternative thresholds are applied in order to investigate robustness.

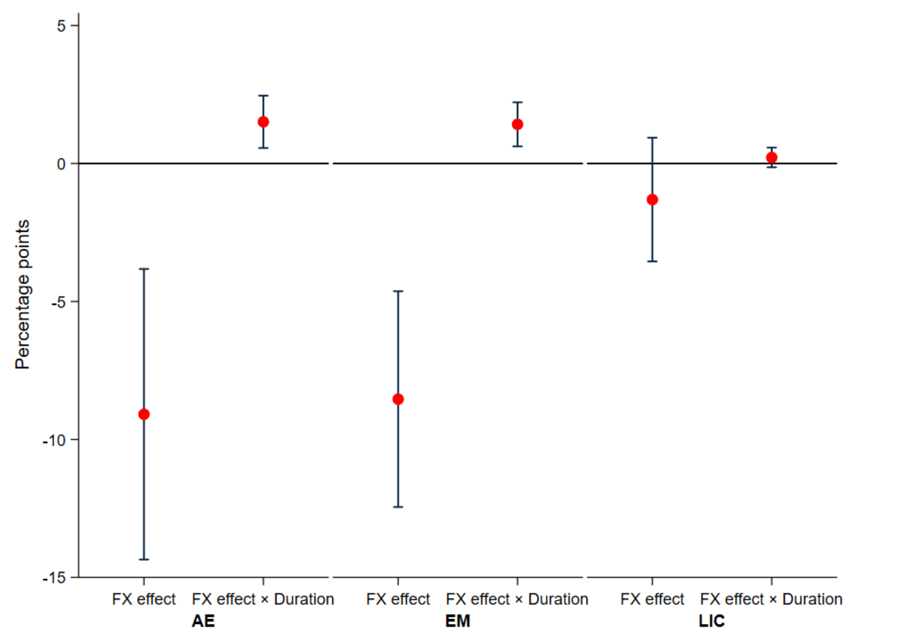
Explanatory variables are chosen based on their relevance for our research question and data availability. The vector S_i contains our main debt surge attributes of interest, i.e., debt accumulation itself, the peak level of debt, the duration of the episode, fiscal policy shocks, the FX component of SFA, as well as other SFA (computed as explained above). In addition, we add the IMF's financial market depth index as a measure of how developed domestic debt markets are. Furthermore, the vector A_i encompasses a set of attributes of the after-surge episode, controlling for factors that influence the probability of debt to decline ex-post. To address endogeneity concerns with respect to fiscal policy in the aftermath of the surge, we use the fiscal shocks retrieved from our baseline panel VAR to construct an exogenous shock to the primary balance.[20]

[19] The dummy variable on debt surge as indicating that a country is in a debt surge and a financial crisis breaks out in some later year.
[20] A detailed list of variables included in the regression is provided in Table AI.3 in the annex.

©International Monetary Fund. Not for Redistribution

Figure 19. Marginal Effects of FX-Component of SFA

Estimates and 90% Confidence Intervals



Source: Author's calculations.
Note: This figure depicts marginal effects of the FX-related component of SFA during a debt surge episode on the probability of debt staying elevated ex-post by country groups, as well as their 90-percent confidence intervals. Marginal effects are evaluated at the means of all variables. All effects refer to a one percentage point change of the FX-related component.

Results

Table 3 reports coefficient estimates and standard errors for different specifications of our baseline model. In column (1), we include only the most basic characteristics of the episode, while we add fiscal policy variables in columns (2) to (4), both separated and interacted with the size and duration of the episode to identify potential non-linearities. The same is done for the decomposition of SFA into an FX effect and other SFA in columns (5) to (7). As the significant AUROC test statistics suggest, our models have substantial predictive power.

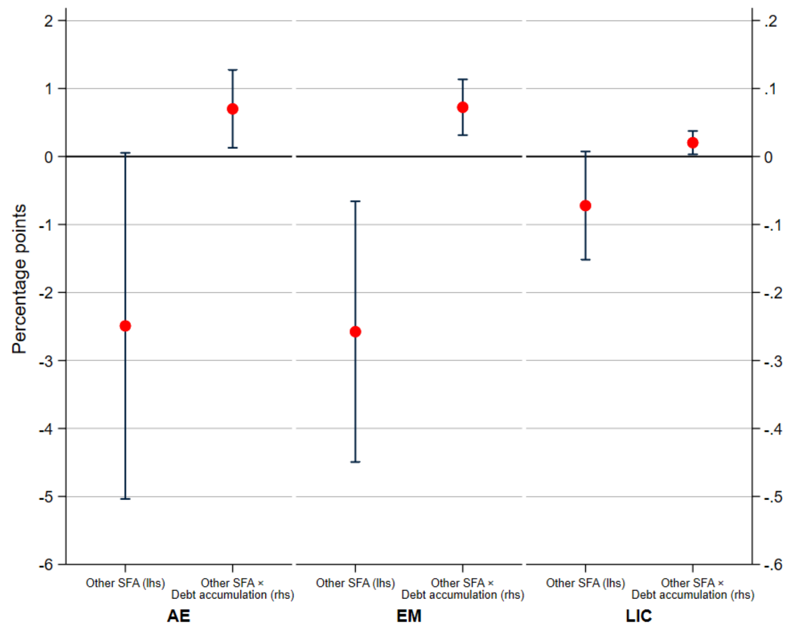
In terms of statistical significance, we find that the probability of debt staying elevated in the aftermath of a debt surge is higher if debt peaks at a higher level, and if the surge has been driven by primary spending hikes.[21] Moreover, taking the non-linearities related to SFA into account, the same holds true for long-term FX-driven debt surges and large-scale debt surges predominantly driven by other SFA. Specifically, if debt surge episodes are attributed to these two SFA components and last longer than 6 years or are associated with debt accumulation of more than 36 percentage points, respectively, debt is more likely to stay high after the episode. Figures 18 to 20 show the marginal effects corresponding to these estimates across country groups evaluated at sample means. Again, these effects are functions of the variable values chosen for evaluation and cannot be interpreted mechanically.

[21] We may neglect the non-linearity with respect to primary spending shocks and debt accumulation because the overall coefficient switches sign only for debt surges larger than 48 percentage points, covering only the largest 20 percent of episodes. The change in sign corresponds to the fact that high end levels of debt are mechanically more likely to be reduced afterwards.

©International Monetary Fund. Not for Redistribution

Figure 20. Marginal Effects of Other SFA

Estimates and 90% Confidence Intervals



Source: Author's calculations.
Note: This figure depicts marginal effects of the non-FX-related component of SFA during a debt surge episode on the probability of debt staying elevated ex-post by country groups, as well as their 90-percent confidence intervals. Marginal effects are evaluated at the means of all variables. All effects refer to a one percentage point change of the non-FX-related component.

Figure 18 shows that fiscal policy during a debt surge is a driver of the ex-post debt path as well. A one percent hike of primary spending during a debt surge increases the probability of debt staying high afterwards by roughly 30 to 50 basis points (all other variables being at their means), where the largest effect is reported for AEs. Revenue cuts do not significantly affect ex-post debt paths. This result can be linked to our previous prediction of debt surges resulting in financial crises. Our findings suggest that primary-spending driven debt surges have gains in the near term, but costs in the longer term. Near-term gains consist in lower crisis probabilities relative to revenue cuts. Longer-term costs stem from the fact that increases of spending are unlikely to be reversed, and thus result in permanently higher debt levels, which make countries more vulnerable to future financial crises.

We further report non-linear relationships between SFA components and the likelihood of permanently higher ex-post debt levels. As shown in Figure 19, debt surges that are more strongly driven by exchange rate fluctuations are, on average, by eight to nine percentage points more likely to see a downward correction of debt afterwards if they last for no longer than six years. As FX depreciation episodes are typically short, debt appears to decline once the FX trigger dissipates and the potential previous REER overshooting reverses itself. However, the situation is different if countries experience repeated periods of currency depreciation, coming along with sustained external imbalances and long-term debt surges. In these cases, debt will most probably stay high ex-post, as indicated by the positive and significant cross-terms in Figure 19. Examples of this type of debt surge episodes are Argentina 2011–2021, Philippines 1998–2003, Sri Lanka 1997–2002 and 2013–2021, or Ukraine 2007–2016.

©International Monetary Fund. Not for Redistribution

A similar relationship becomes evident in the case of other SFA, which, as explained above, mainly account for the realization of contingent liabilities, often related to the recapitalization of banks or SOE. We find that, provided other SFA and thus debt accumulation as such is not too large, debt burdens can be successfully unloaded after the one-time surge episode. The probability of debt staying elevated is reduced by 2.5 percentage points for a one percentage point increase of other SFA (all variables evaluated at their means). However, large-scale debt surges exhibiting debt accumulation of more than 36 percentage points and driven by large other SFA are likely to see elevated debt levels ex-post as well. For instance, debt surge episodes in countries burdened by large-scale recapitalizations in the wake of the Asian crises (e.g., Indonesia 1997–2001 or Korea 1997–2000) or the global financial crisis (e.g., Iceland 2005–2011 or Kazakhstan 2007–2011) fall into this category. Perhaps the large new debt generates its own fiscal imbalances, in the form of higher interest bill, which is difficult to offset quickly by increases in the primary balance.

Overall, our findings ascribe a decisive role to government spending, exchange rate fluctuations, and other SFA in explaining elevated debt paths in the aftermath of debt surge episodes. Importantly, the predicted probabilities of stable ex-post debt trajectories differ strikingly across country groups. While AEs mostly sustain high debt levels afterwards (75 percent), EMs do so with a probability of 57 percent. However, LICs are hardly ever able to keep debt high (2 percent) but see downward corrections almost with certainty. This complex finding can be interpreted in number of ways. First, while fiscal consolidation in the wake of a debt surge is generally desirable, the ability to sustain high debt may get in the way, reducing the urgency and the political will to get on with the consolidation. Second, debt surges in EMDEs are more likely to result in crises, as we found out, and crises add political resolve to actions preventing future crises, one of which is debt reduction. Third, countries in crisis are more likely to resort to external assistance, e.g., an IMF-supported program or other support from official sources, which comes with adjustment-related conditions. In LIDCs, the lack of available financing at affordable rates often makes consolidations inevitable. Overall, debt reduction after a debt surge is necessary and beneficial for macroeconomic stability in most countries, as it reduces their vulnerability to new shocks. In LIDCs, this process needs to be supported by sustained post-crisis external assistance at concessional terms to meet their development and social needs.

Robustness

We prove the robustness of our results through using different thresholds for the definition of a declining debt path (ten and 15 percentage points) and an alternative time window for the adjustment period after a debt surge episode (four to seven years). The results are reported in Tables AIII.4 to AIII.6 in the annex, and they broadly confirm the findings presented in this section.

VI. Conclusion and Policy Implications

As public debt levels are climbing back up on the back of slowing growth, rising borrowing costs and fiscal deficits, an impending concern is that of the consequences of debt surges. While the world economy has undergone several debt waves (Kose et al., 2021), macroeconomic conditions and attributes of these waves can be different. In this paper, we investigate the attributes of debt surges over the past five decades and zoom into two main detrimental consequences of debt surges: (i) de-stabilizing an economy through raising the probability of resulting in a financial crisis, and (ii) trapping an economy in high debt levels after debt build-ups.

In documenting the drivers of debt, we see that fiscal policy and stock flow adjustments play a major role in debt surges. SFA tend to be dominant in large debt surges episodes for EMs and LICs reflecting large currency

©International Monetary Fund. Not for Redistribution

depreciations and crisis resolution related fiscal costs from the materialization of contingent liabilities mainly related to financial crisis. The valuation effect explains more than half of SFA pointing to the need to avoid building up large external imbalances as well as keeping prudent debt management mindful of creditor and currency composition.[22] In this respect, allowing exchange rate flexibility, supported by prudent fiscal and monetary policy, should help avoid building up large external imbalances. Non-valuation related SFA mainly reflect the materialization of fiscal risks stemming from either banks or SOEs as well as arrears and off-budget transactions for LICs and, when large, tend to be sticky and raise the probability of debt staying higher after the surge. This suggests the importance of: (i) strengthening fiscal risk management to minimize the direct (higher debt levels) and indirect cost (higher probability of debt staying high); and (ii) enhancing financial sector regulation and supervision as well as developing a crisis resolution framework. For many LICs, a leading source of rising debt is that of SOE contracted liabilities (including guaranteed debt) which often result in materialization of debt. It is therefore important to broaden debt reporting to include SOE debt as well as have SOE oversight frameworks in place in order to monitor and prevent loss-making operations.

Regarding the role of fiscal policy in explaining debt surges, we found it to be significant and mainly driven by primary spending, implying a greater role for expenditure-based consolidations in keeping debt from rising.[23] The long-lasting effect of primary sending shocks on debt-to-GDP (especially in AEs) point to the difficulty in reversing expenditure driven expansions reflecting potential political economy constraints Fiscal policy was estimated to explain 30 to 35 percent of the variation in both AEs and EMs, and 25 percent in LICs pointing other (residual) factors playing a greater role in LICs.

Given the attributes of debt surges, we estimate a predicted probability of 11–21 percent that a debt surge results in financial crisis with this probability being as high as 21 percent for LICs and 11 percent for AEs. For EMs the median predicted probability stands at 17 percent. Debt accumulation tends to be one of the dominant factors in explaining these probabilities implying that sizable macroeconomic adjustments are required to offset the detrimental effect of rising debt on crisis probabilities.

Turning to debt trajectories following a debt surge episode, we find that primary spending driven fiscal expansion tend to increase the probability of debt being on a non-declining path potentially reflecting that spending-driven fiscal expansion tend to be longer lasting due to rigidities. Currency depreciations, when short-lived, tend to be followed by a debt correction; however, repeated depreciations tend to increase the probability of debt staying high in the aftermath of a surge, reflecting the cost of sustained external imbalances. We also estimate that debt accumulation driven by large SFA due to contingent liabilities increases the probability of debt staying high, reflecting the complexities of crisis related debt buildup and the difficulty to offload it.

[22] While decreasing exposure to FX debt reduces exchange rate risks, for some countries, resorting to local currency debt market might not be feasible due to lack of depth and higher reliance on external concessional debt.

[23] As shown in section V, revenue driven debt surges have a significant effect on crisis probabilities pointing to liquidity related risks.

©International Monetary Fund. Not for Redistribution

Annex I. Definition of Variables and Data Sources

Definition of Debt Surges

The approach for identifying debt surges follows that outlined in the IMF (2023a). To break down the time series of debt to GDP into a series of episodes, a two-step process is employed.

In the initial step, turning points in the debt to GDP time series are determined for each country, using the business cycle dating methodology developed by Harding and Pagan (2002). The criteria for identifying these turning points include a minimum gap of 2 years between successive peaks and troughs, as well as a minimum duration of 4 years for a complete cycle. This process results in the segmentation of the entire time series into non-overlapping periods characterized by either debt surges or reductions. Subsequently, a subset of these periods is categorized as stable, with a minimum duration of 3 years. Stability is defined by one of two conditions: either the cumulative change in the debt to GDP ratio falls between 2 and 10 percentage points, or it is less than 10 percentage points relative to the country-specific standard deviation.

FX Effect in Debt Decomposition

We can create a proxy of "FX effect" on debt surges by using the formula below, which will give us the percentage point change in debt-to-GDP due to FX depreciation. Other SFA is then defined as "*other SFAs*" = *Residuals – FX effect*.

$$FX\ effect = \sum_{t=1}^{n} \left(\frac{e_t}{e_{t-1}} - 1\right) \times d_{t-1} \times f_{t-1} \qquad (1)$$

where e_{t-1} is end-of-year exchange rate (LC/$) at the previous year of start of debt surge,

e_t is end-of-year exchange rate (LC/$) at the end year of debt surge,
d_{t-1} is debt-to-GDP ratio at the previous year of debt surge,
f_{t-1} is the share of FX debt to total debt at the previous year of debt surge,
$t = 1\ and\ t = n$ is the start year and end year of debt surge, respectively

Note that we use bilateral USD/LC exchange rates and the data for the share of FX debt are from the IMF Sovereign Debt Investor Base for EMDE (2023) ("ExtendedDataset_Currency") (the share of external debt is alternatively used for missing AEs).

©International Monetary Fund. Not for Redistribution

Variables

Annex Table AI.1. Panel VAR

Variable[1]	**Description**	**Source**
Public Debt	Total General Government Gross Debt (in percent of GDP)	Arslanalp and Tsuda (2014)
Government Primary Spending	General government expenditure: primary expenditure (in percent of GDP)	IMF WEO
Government Revenue	General government revenue, (in percent of GDP)	IMF WEO
Output	Real GDP (constant $)	IMF WEO
Real Effective Exchange Rate	Real Effective Exchange Rate (in natural logarithm)	IMF WEO
Inflation	Year-on-year change of the consumer price index (in percent)	IMF WEO
Monetary Policy	Central Bank Policy Rate used for Advanced economies and Broad Money (in percent of GDP) used for Emerging markets and Low-Income countries.	Bank of International Settlements (BIS) and World Bank WDI
Oil Price	Crude Oil (petroleum), simple average of three spot prices (US$ per barrel)	IMF GAS

[1] Fiscal variables are measured in natural logarithms of real per-capita US dollar aggregates, where the GDP deflator is used for the conversion into real terms. To ensure the model's stability, first differences are taken of GDP and the monetary policy variable.

©International Monetary Fund. Not for Redistribution

Annex Table AI.2. List of Variables (Crisis Prediction)

Variable	Description	Source
FinancialCrisis	Dummy equal to one if a country is in a banking, currency, or sovereign debt crisis in a year, and zero otherwise	Laeven and Valencia (2016)
DebtSurge	Dummy equal to one if a country is in a debt surge episode in a year, and a financial crisis breaks out in some year later than the start year during this debt surge episode, and zero otherwise	Own definition based on IMF WEO
DebtAccumulation	Year-on-year change of the debt-to-GDP ratio (in percentage points)	IMF WEO
RevenueShock	Minus one times shock to the revenue-to-GDP ratio retrieved from a panel VAR (in natural logarithm)	Own calculation based on IMF WEO
PrimarySpendingShock	Shock to the primary-spending-to-GDP ratio retrieved from a panel VAR (in natural logarithm)	Own calculation based on IMF WEO
FXDepreciation	Year-on-year change of the nominal exchange rate vis-à-vis the US dollar (in percent)	IMF WEO
PrimaryBalanceShock	Shock to the primary balance constructed based on fiscal shocks retrieved from a panel VAR and sample average revenue- and primary-spending-to-GDP ratios (in percent of GDP)	Own calculation based on IMF WEO
Reserves	Foreign currency reserves (in percent of GDP)	IMF WEO
BankCredit	Total credit to the private sector provided by domestic banks (in percent of GDP)	World Bank WDI
ExternalDebt	External government debt (in percent of total government debt)	IMF Sovereign Debt Investor Base
Growth	Year-on-year change of GDP in constant 2015 US dollar (in percent)	World Bank WDI
Inflation	Year-on-year change of the consumer price index (in percent)	IMF WEO
RealInterestRate	Average real lending interest rate	World Bank WDI
CurrentAccount	Current account balance (in percent of GDP)	IMF WEO
GDPpc	GDP per capita in constant 2015 US dollar	World Bank WDI

©International Monetary Fund. Not for Redistribution

Annex Table AI.3. List of Variables (Ex-post Debt Path Prediction)

Variable	Description	Source
ExPostDebtPath	Dummy equal to one if a country's debt-to-GDP ratio drops by more than seven percentage points between the last year of a debt surge episode and the average of years three to five afterwards, and zero otherwise	Own definition based on IMF WEO
DebtAccumulation	Change of the debt-to-GDP ratio between the year prior to and the last year of a debt surge episode (in percentage points)	Own calculation based on IMF WEO
DebtPeak	Debt in the last year of a debt surge episode (in percent of GDP)	IMF WEO
Duration	Number of years of a debt surge episode	Own calculation based on IMF WEO
FinancialMarketDepth	Average IMF Financial Market Depth Index during a debt surge episode (between zero and one)	Own calculation based on IMF Index of Financial Development
RevenueShock	Minus one times average of shocks to the revenue-to-GDP ratio retrieved from a panel VAR during a debt surge episode (in natural logarithm)	Own calculation based on IMF WEO
PrimarySpendingShock	Average of shocks to the primary-spending-to-GDP ratio retrieved from a panel VAR during a debt surge episode (in natural logarithm)	Own calculation based on IMF WEO
FXEffect	Part of SFA driven by FX fluctuations computed based on standard debt decomposition SFA, the share of external debt, and nominal exchange rate depreciation during a debt surge episode (in percentage points)	Own calculation based on IMF WEO, IMF Sovereign Debt Investor Base, and standard debt decomposition
OtherSFA	Residual part of SFA during a debt surge episode (in percentage points)	Own calculation based on IMF WEO, IMF Sovereign Debt Investor Base, and standard debt decomposition
PrimaryBalanceAfter	Average of shocks to the primary balance constructed based on fiscal shocks retrieved from a panel VAR and sample average revenue- and primary-spending-to-GDP ratios during the five years after a debt surge episode (in percent of GDP)	Own calculation based on IMF WEO
GrowthAfter	Annualized average change of GDP in constant 2015 US dollar during the five years after a debt surge episode (in percent)	Own calculation based on World Bank WDI
InflationAfter	Annualized average change of the consumer price index during the five years after a debt surge episode (in percent)	Own calculation based on IMF WEO
RestructuringAfter	Dummy equal to one if a country is in a debt restructuring during the five years after a debt surge episode, and zero otherwise	Own calculation based on Laeven and Valencia (2016)
FXDepreciationAfter	Change of the nominal exchange rate vis-à-vis the US dollar between the last year of and the fifth year after a debt surge episode (in percent)	Own calculation based on IMF WEO

©International Monetary Fund. Not for Redistribution

Annex II. Augmented Decomposition

In what follows, we describe the augmented debt decomposition following the lines of Mauro and Zilinsky (2016). The standard accounting identity decomposes the change in debt-to-GDP into three components:

$$d_t - d_{t-1} = \left(\frac{r_t}{1+g_t}\right) d_{t-1} - \left(\frac{g_t}{1+g_t}\right) d_{t-1} - p_t \quad (1)$$

where *d* is the debt-to-GDP ratio, *r* is the real interest rate, g is the real growth rate, and *p* is the primary surplus (the fiscal surplus excluding interest payments on the government's debt).
This standard breakdown of debt changes does not fully capture how economic growth helps lower the debt ratio. For instance, economic growth significantly affects the primary surplus: as the economy grows, tax income rises, which in turn improves the primary surplus.

A comprehensive analysis of growth's influence on the debt ratio discerns that the primary surplus (relative to GDP) is inherently contingent upon economic expansion. In the absence of deliberate policy intervention, it is logical to postulate that revenues move with nominal GDP, while primary expenditures grow with the GDP deflator. A standard neutral policy stance might involve the government adjusting civil servants' remunerations and pensions commensurate with inflationary trends. Based on this presumption, the primary surplus proportionate to GDP would equate to

$$p_t = p_{t-1} + \left(\frac{g_t}{1+g_t}\right) e_{t-1} + m_t \qquad (2)$$

where *e* is the ratio of primary expenditures to GDP, the multiplicative component reflects the erosion of the primary expenditure to the GDP ratio stemming from real economic growth, and *m* is the effect of policy measures (obtained as a residual). If the primary surplus rises by more than implied by the expenditure ratio erosion term, policy measures (tax hikes or real expenditure cuts) must account for the difference.

Let's write the change in debt between year 0 and year N by summing over Eq. (1):

$$d_N - d_0 = \sum_{i=1}^{N} \left(\frac{r_i}{1+g_i}\right) d_{i-1} - \sum_{i=1}^{N} \left(\frac{g_i}{1+g_i}\right) d_{i-1} - \sum_{i=1}^{N} p_i$$

Replacing p_i with its expression in Eq. (2), we obtain:

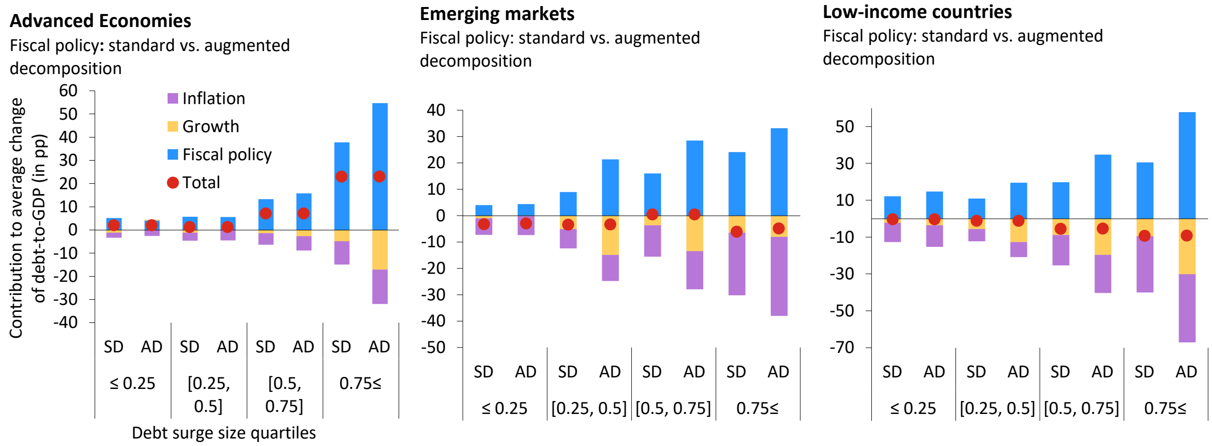
$$d_N - d_0 = \sum_{i=1}^{N} \left(\frac{r_i}{1+g_i}\right) d_{i-1} - \sum_{i=1}^{N} \left(\frac{g_i}{1+g_i}\right) d_{i-1} - e_0 \sum_{i=1}^{N} \sum_{t=1}^{i} \frac{g_i}{\prod_{t=1}^{i}(1+g_t)} - \sum_{i=1}^{N} \sum_{t=1}^{i} \Delta m_t - N p_0$$

where the first item is the contribution of the real interest rate, the second is the direct growth effect, the third item represents the contribution of the "indirect" effect of growth, the fourth shows the effect of fiscal measures, and the last term shows the initial primary balance effect.

We apply this AD, together with the standard one, to the countries in our sample to provide a nuanced view on the contribution of fiscal policy in driving debt surges.

©International Monetary Fund. Not for Redistribution

Annex Figure AII.1. Standard Versus Augmented Debt Decompositions



Source: Authors' calculations.

Figure AII.1 shows that fiscal policy and growth contributions are higher in the AD (AD bars) compared to the standard one (SD bars) in all country groups, across almost all percentiles. Capturing the effect of growth on primary balance, and count it as growth, leads to a higher contribution of growth in the AD vs. the SD. At the same time, by removing the positive effect of growth on debt-to-GDP embedded in the primary balance, the negative effect of fiscal slippages on debt (which is the remaining fiscal policy measure: *the term* $\sum_{i=1}^{N}\sum_{t=1}^{i}\Delta m_t$) tends to be higher.

Within AEs, the AD reflects a pronounced effect from fiscal policy in contrast to the SD, whereas growth's contribution remains relatively marginal, albeit with AD often bearing a marginally higher contribution. In EMs, the AD showcases a more accentuated impact from fiscal policy, especially within the [0.5, 0.75] debt surge quartile. Similarly, for LICs, the fiscal policy contribution is pronounced, with AD consistently revealing a more considerable effect across quartiles when compared to the SD. At the same time, growth displays significant effects in the AD, predominantly in the [0.5, 0.75] and >0.75 brackets.

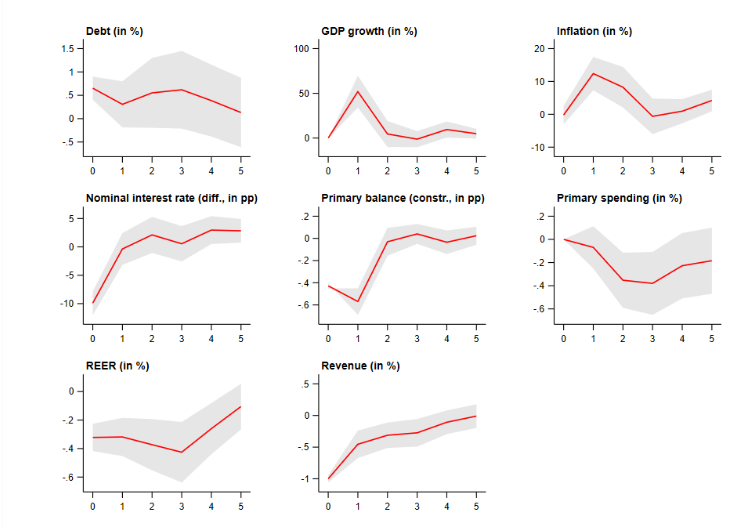
In conclusion, this annex lays out the subtle differences between the standard debt decomposition and the augmented method, disentangling the effect of growth from fiscal policy. While both methods pinpoint the key role of fiscal policy in driving debt surges, the augmented approach seems to offer a more nuanced picture of fiscal policy effects.

©International Monetary Fund. Not for Redistribution

Annex III. Estimating fiscal policy shocks and consequences of debt surges

Annex Figure AIII.1. Impulse Responses to a Revenue Cut in AEs

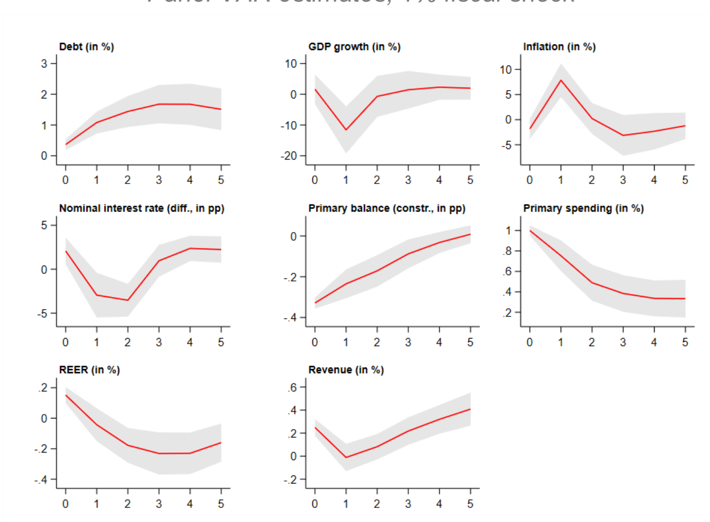
Panel VAR estimates, 1% fiscal shock



Source: Authors' calculations.
Note: This figure depicts impulse responses to a negative one percent shock to revenue as a share of GDP in AEs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

Annex Figure AIII.2. Impulse Responses to a Primary Spending in AEs

Panel VAR estimates, 1% fiscal shock

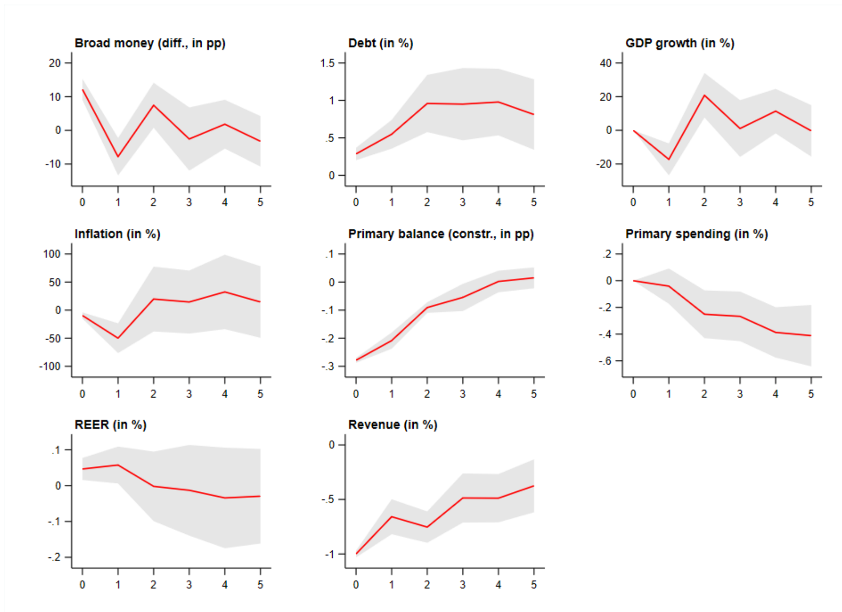


Source: Authors' calculations.
Note: This figure depicts impulse responses to a positive one percent shock to primary spending as a share of GDP in AEs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.3. Impulse Responses to Revenue Cuts in EMs

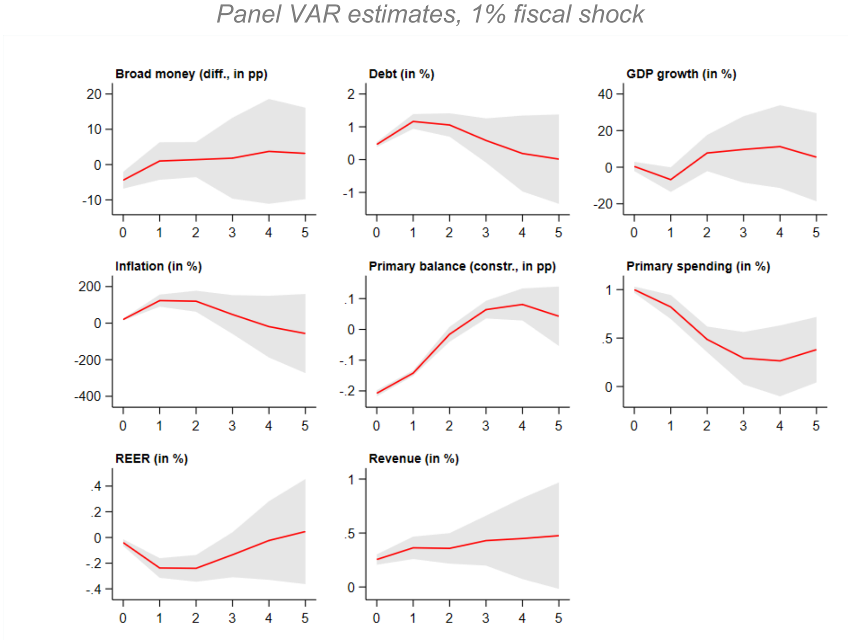
Panel VAR estimates, 1% fiscal shock



Source: Authors' calculations.
Note: This figure depicts impulse responses to a negative one percent shock to revenue as a share of GDP in EMs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

Annex Figure AIII.4. Impulse Responses to a Primary Spending Hike in EMs

Panel VAR estimates, 1% fiscal shock

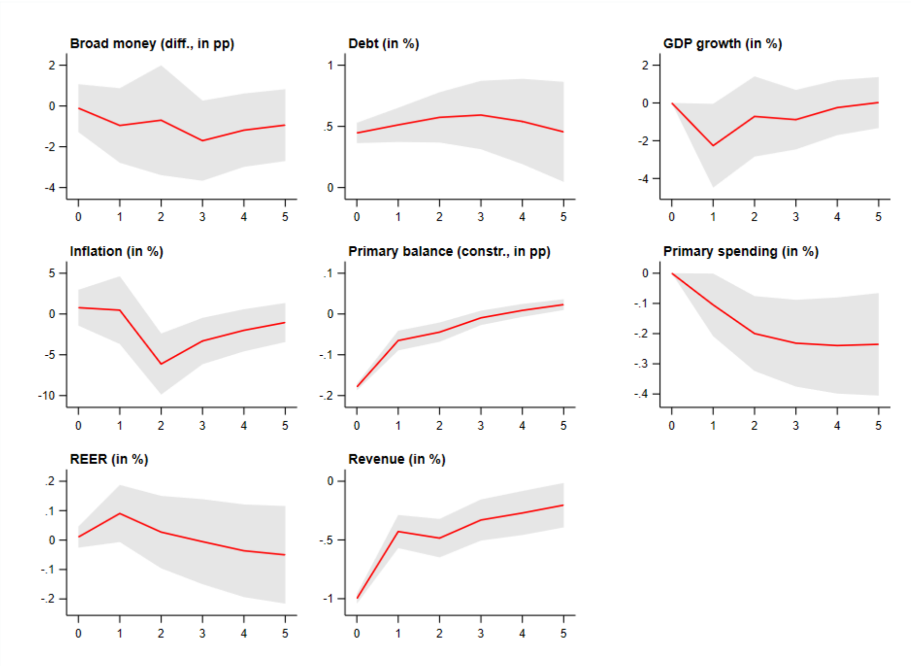


Source: Authors' calculations.
Note: This figure depicts impulse responses to a positive one percent shock to primary spending as a share of GDP in EMs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.5. Impulse Responses to a Revenue Cut in LICs

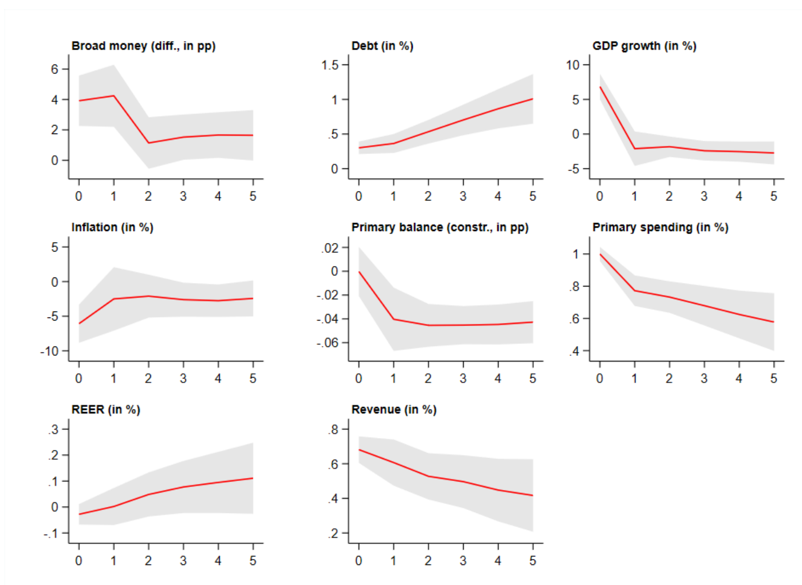
Panel VAR estimates, 1% fiscal shock



Source: Authors' calculations.
Note: This figure depicts impulse responses to a negative one percent shock to revenue as a share of GDP in LICs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

Annex Figure AIII.6. Impulse Responses to a Primary Spending Hike in LICs

Panel VAR estimates, 1% fiscal shock

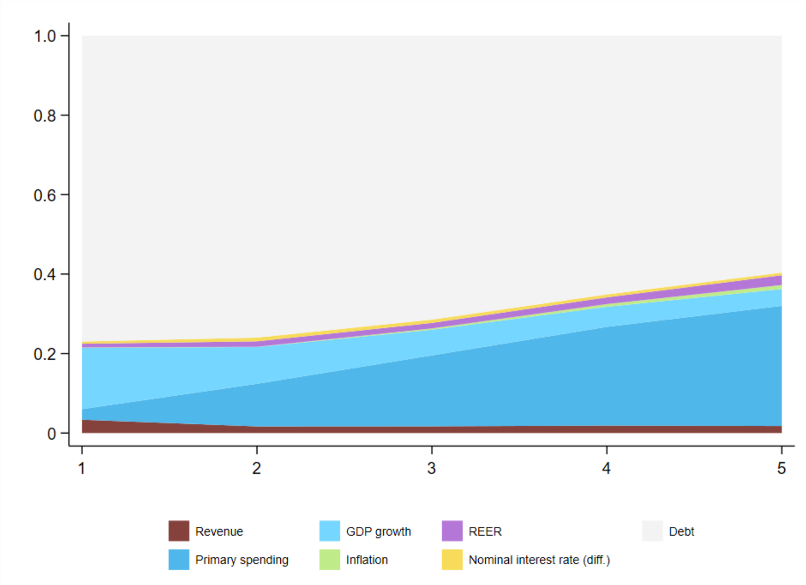


Source: Authors' calculations.
Note: This figure depicts impulse responses to a positive one percent shock to primary spending as a share of GDP in LICs based on the above panel VAR. Red lines indicate estimated impulse responses, while grey-shaded areas cover 95-percent confidence intervals.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.7. Forecast Error Variance Decomposition of Debt-to-GDP in AEs

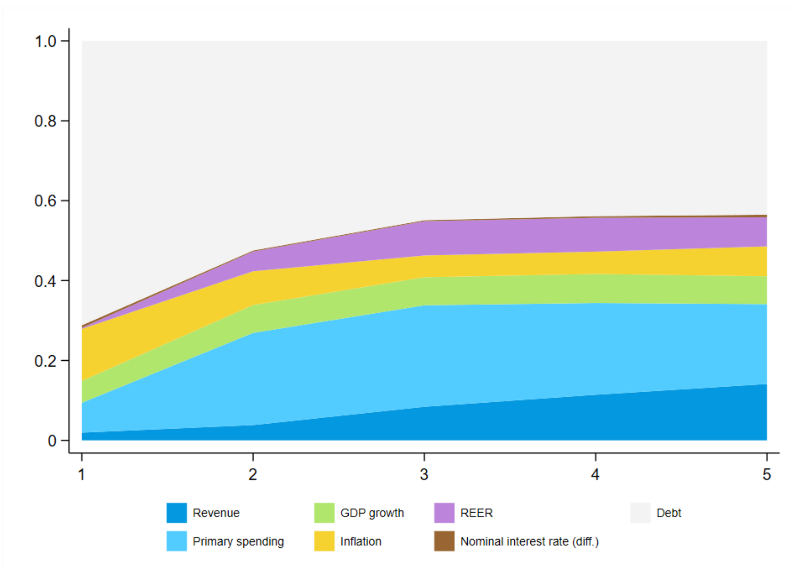
Panel VAR estimates



Source: Authors' calculations.
Note: This figure depicts the forecast error variance decomposition of the debt-to-GDP ratio to various shocks in AEs over five years based on the above panel VAR. Red bars refer to fiscal shocks, while blue bars refer to macroeconomic and monetary shocks.

Annex Figure AIII.8. Forecast Error Variance Decomposition of Debt-to-GDP in EMs

Panel VAR estimates

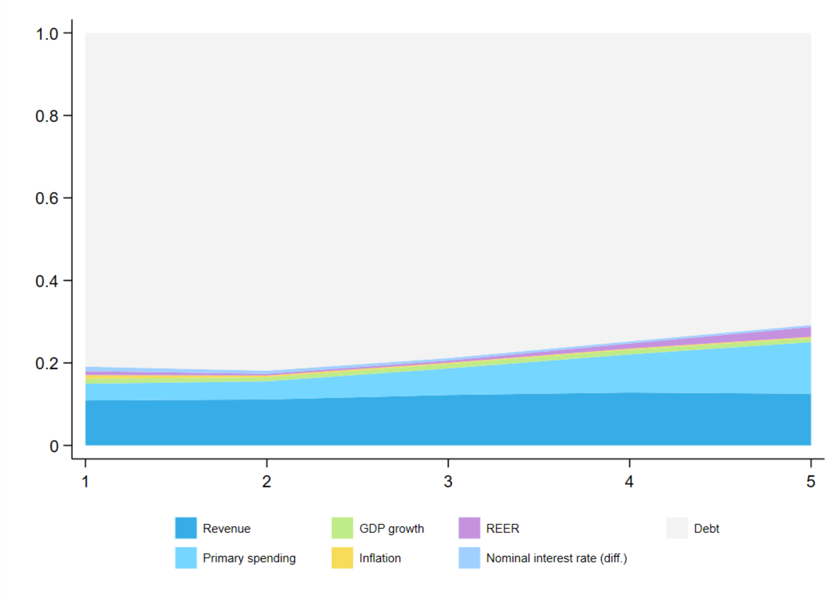


Source: Authors' calculations.
Note: This figure depicts the forecast error variance decomposition of the debt-to-GDP ratio to various shocks in EMs over five years based on the above panel VAR. Red bars refer to fiscal shocks, while blue bars refer to macroeconomic and monetary shocks.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.9. Forecast Error Variance Decomposition of Debt-to-GDP in LICs

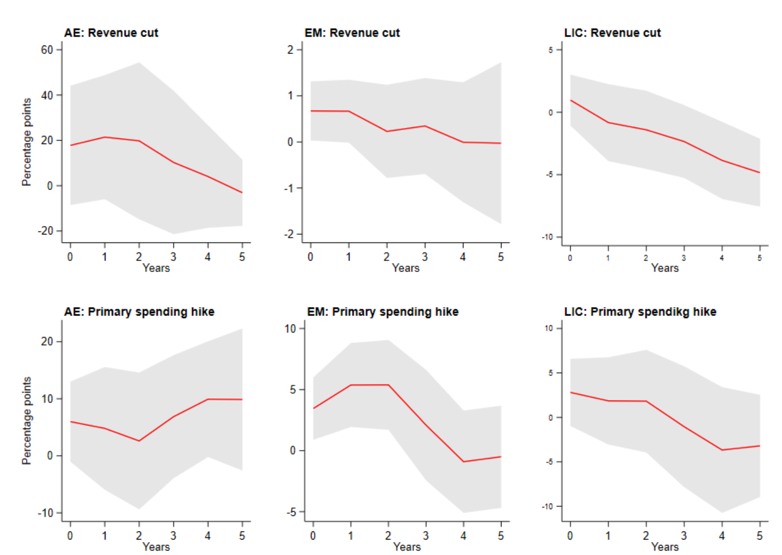
Panel VAR estimates



Source: Authors' calculations.
Note: This figure depicts the forecast error variance decomposition of the debt-to-GDP ratio to various shocks in LICs over five years based on the above panel VAR. Red bars refer to fiscal shocks, while blue bars refer to macroeconomic and monetary shocks.

Annex Figure AIII.10. Impulse Responses of Debt-to-GDP to Fiscal Shocks

Local projections based on WEO forecast errors, 1% fiscal shocks

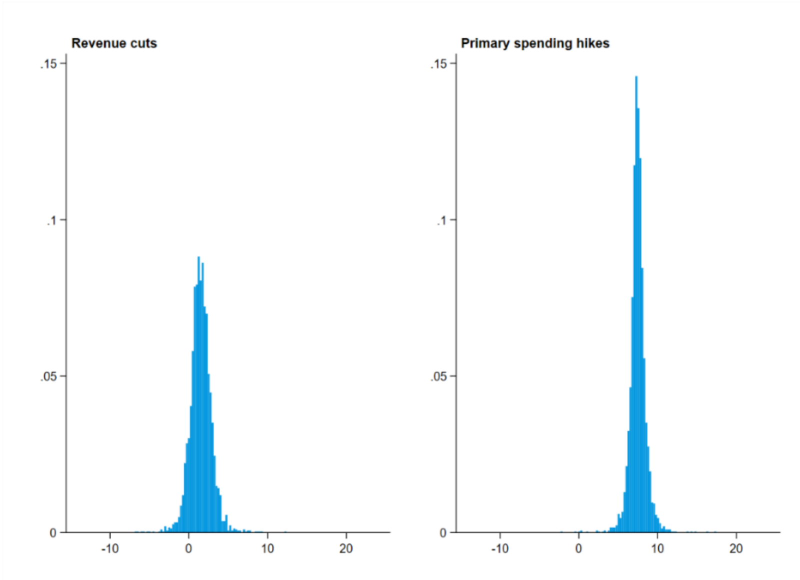


Source: Authors' calculations.
Note: This figure depicts impulse responses of the debt-to-GDP ratio to a positive one percent shock to revenue and a negative one percent shock to primary spending, respectively, as a share of GDP across country groups and based on local projections using one-year ahead WEO forecast errors. The responses are measured in terms of percentage points. Red lines indicate estimated impulse responses of debt, while grey-shaded areas cover 95-percent confidence intervals.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.11. Distribution of Fiscal Shocks

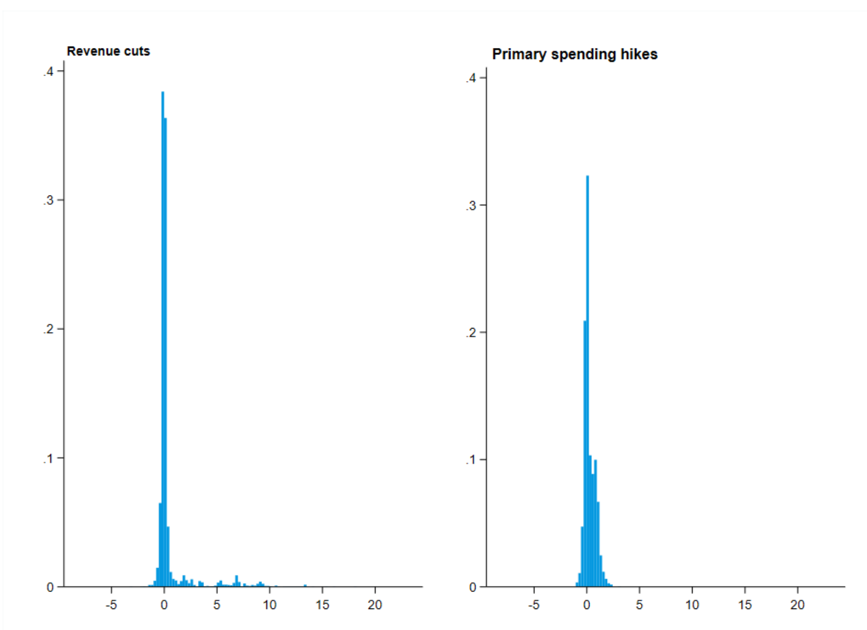
Panel VAR



Source: Authors' calculations.
Note: This figure depicts the distribution of fiscal shocks based on the above panel VAR. Fiscal shocks are measured on the x-axis in percent.

Annex Figure AIII.12. Distribution of Fiscal Shocks

WEO forecast errors



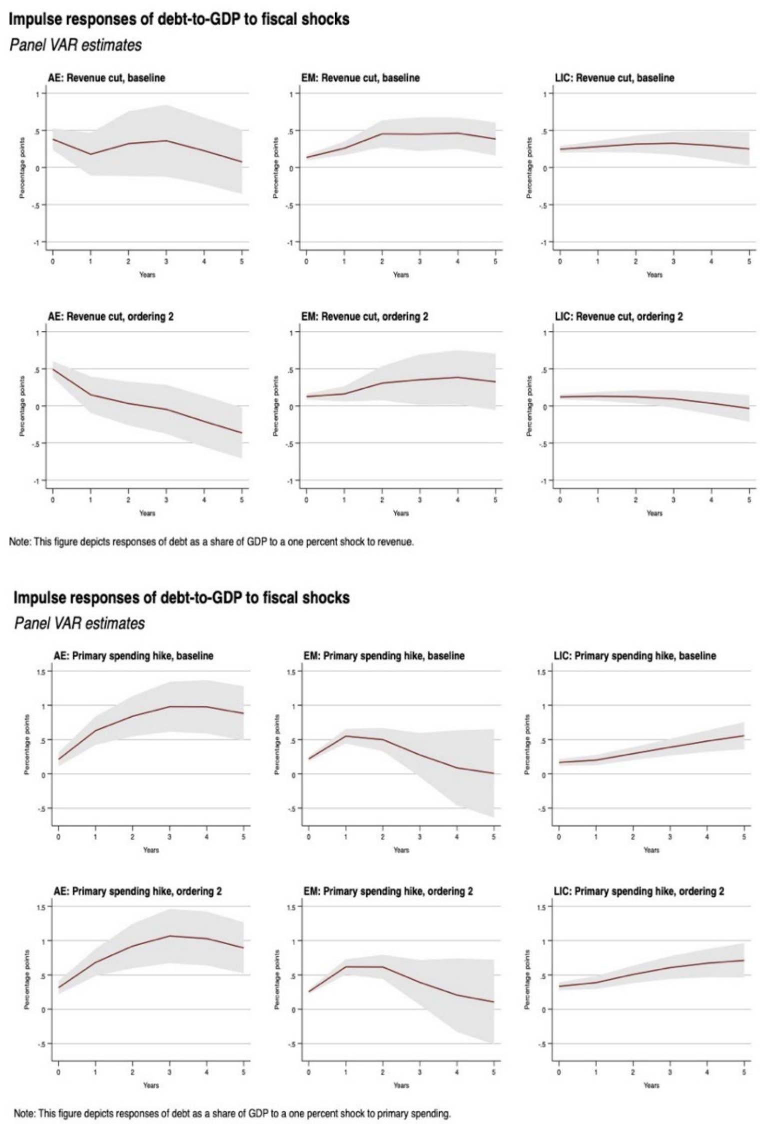
Source: Authors' calculations.
Note: This figure depicts the distribution of fiscal shocks based on WEO forecast errors. Fiscal shocks are measured on the x-axis in percent.

©International Monetary Fund. Not for Redistribution

Robustness Checks

In this section, we consider three alternative orderings to the Cholesky decomposition in Section IV. Relative to the baseline model, ordering 2 swaps the positions of primary spending and revenue, while all else is kept unchanged. The ordering is then: (1) Revenue (2) GDP (3) Primary spending (4) Inflation (5) REER (6) Monetary variable (7) Debt. The results are depicted in the following two figures. The results are robust to this particular change of placing variables in the panel VAR. The only significant difference is that debt responses to revenue shocks are smaller under the alternative scenario compared to the baseline, albeit being insignificant shortly after the impulse.

Annex Figure AIII.13. Alternative Ordering 2

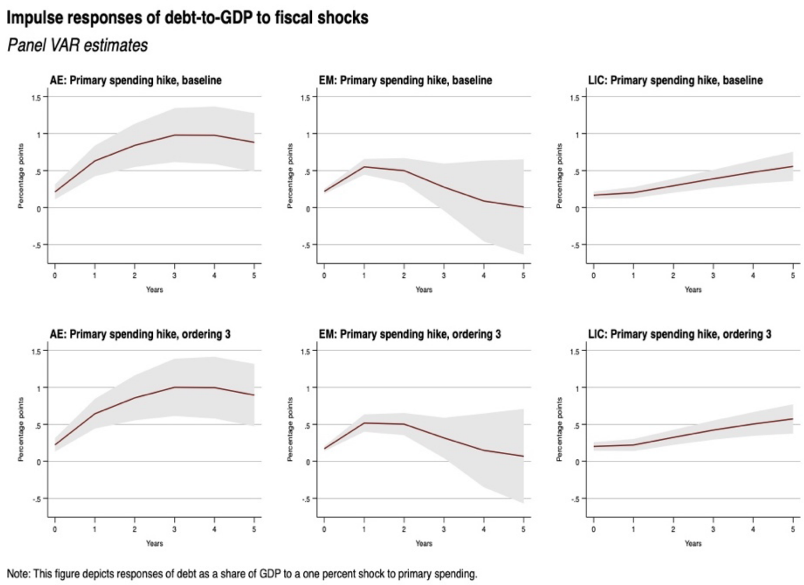


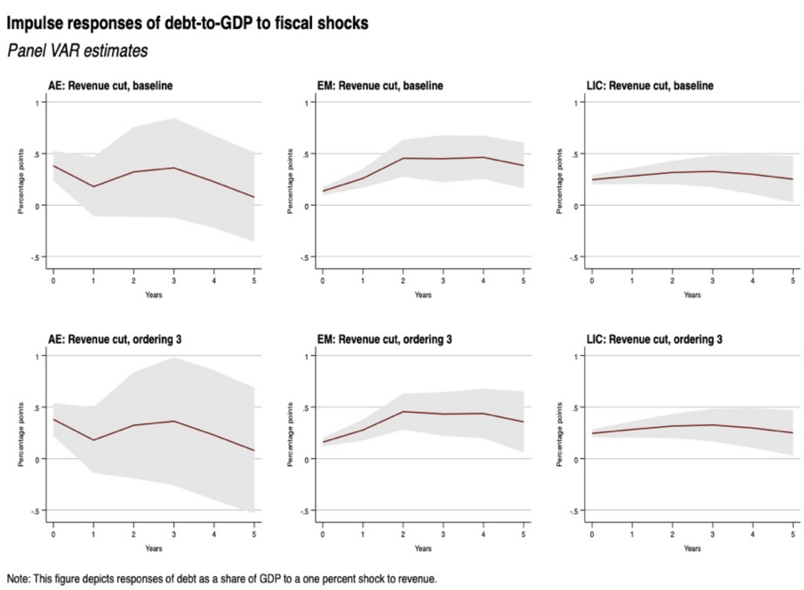
Source: Authors' calculations.

©International Monetary Fund. Not for Redistribution

Under ordering 3, we place the two most exogenous macroeconomic variables, i.e., GDP and inflation before fiscal policy, while maintaining the ordering of spending before revenue, which we argue to be plausible in the main text. The ordering is then: (1) GDP (2) Inflation (3) Primary spending (4) Revenue (5) REER (6) Monetary variable (7) Debt. As the following two figures illustrate, debt responses show very minor changes.

Annex Figure AIII.14. Alternative Ordering 3



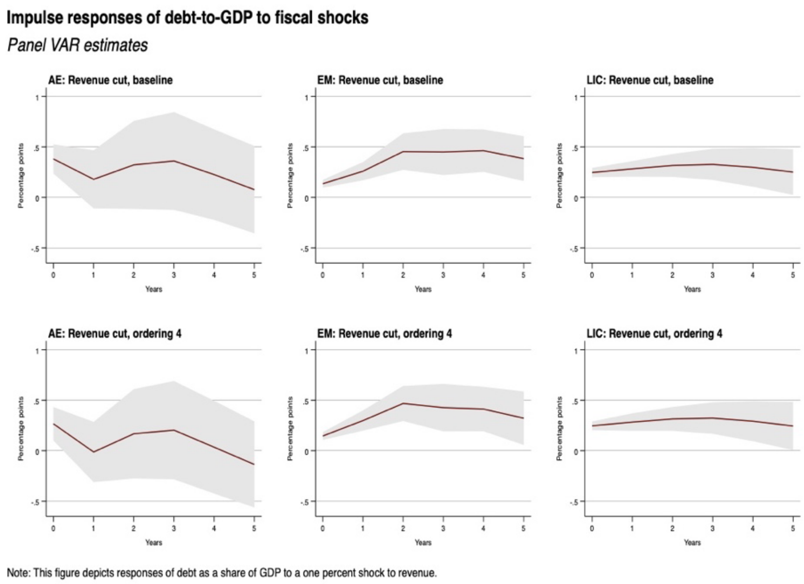


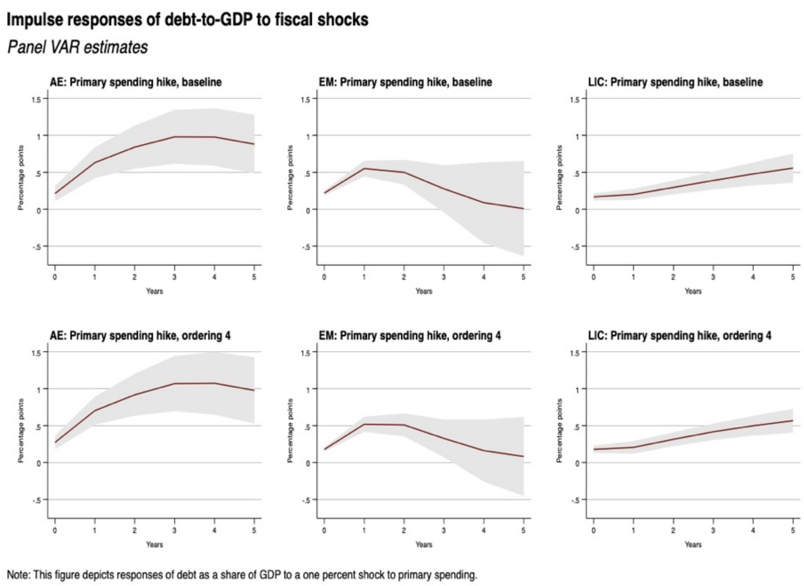
Source: Authors' calculations.

Under ordering 4, we place all macro variables before fiscal policy in order to check how our results change if we consider fiscal policy to be highly endogenous. The ordering is then: (1) GDP (2) Inflation (3) REER (4) Monetary variable (5) Primary spending (6) Revenue (7) Debt. As under ordering 3, no significant changes are found.

©International Monetary Fund. Not for Redistribution

Annex Figure AIII.15. Alternative Ordering 4





Source: Authors' calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.1. Debt Surges and Financial Crises

Random-effect logit regression (fixed effects)

	Financial crisis											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L1.DebtAccumulation × L1.DebtSurge	0.0873*	0.0727	0.0707	0.0788	0.1105*	0.0785	0.0828	0.0862*	0.0937*	0.1111*	0.0815	0.0783
	(0.0494)	(0.0510)	(0.0511)	(0.0488)	(0.0640)	(0.0501)	(0.0563)	(0.0499)	(0.0504)	(0.0594)	(0.0541)	(0.0492)
L2.DebtAccumulation × L2.DebtSurge	-0.0208	-0.0253	-0.0158	-0.0273	-0.0555	-0.0372	0.0197	-0.0272	-0.0383	-0.0333	-0.0284	-0.0264
	(0.0445)	(0.0465)	(0.0457)	(0.0454)	(0.0560)	(0.0454)	(0.0465)	(0.0465)	(0.0457)	(0.0473)	(0.0434)	(0.0447)
L3.DebtAccumulation × L3.DebtSurge	0.0675	0.0579	0.0664	0.0665	0.0310	0.0679	0.0771	0.0597	0.0672	0.0609	0.0600	0.0683
	(0.0445)	(0.0459)	(0.0444)	(0.0450)	(0.0512)	(0.0442)	(0.0501)	(0.0462)	(0.0446)	(0.0469)	(0.0431)	(0.0446)
L1.RevenueShock × L1.DebtSurge	0.5954***	0.6342***	0.5911***	0.6487***	0.5208**	0.6523***	0.5812***	0.5899***	0.6564***	0.4710**	0.5368***	0.5641***
	(0.2043)	(0.2102)	(0.2038)	(0.2113)	(0.2316)	(0.2127)	(0.2147)	(0.2061)	(0.2090)	(0.2320)	(0.2045)	(0.2044)
L2.RevenueShock × L2.DebtSurge	0.2576	0.2440	0.2368	0.1959	0.2894	0.3008	0.2653	0.2501	0.2879	0.2753	0.2839	0.2239
	(0.1950)	(0.1953)	(0.1970)	(0.1919)	(0.2003)	(0.2050)	(0.1986)	(0.1951)	(0.2004)	(0.2023)	(0.1973)	(0.1943)
L3.RevenueShock × L3.DebtSurge	-0.0650	-0.0513	-0.0278	-0.0474	-0.0136	0.0180	-0.0200	-0.0760	-0.0984	-0.1268	-0.0654	-0.0831
	(0.2158)	(0.2172)	(0.2156)	(0.2212)	(0.2477)	(0.2136)	(0.2143)	(0.2191)	(0.2134)	(0.2656)	(0.2183)	(0.2184)
L1.PrimarySpendingShock × L1.DebtSurge	0.0089	0.0191	0.0173	0.0779	0.0362	-0.0204	0.1064	0.0172	0.0115	-0.0141	0.0308	0.0255
	(0.0719)	(0.0727)	(0.0718)	(0.0735)	(0.0791)	(0.0752)	(0.0784)	(0.0734)	(0.0734)	(0.0799)	(0.0729)	(0.0729)
L2.PrimarySpendingShock × L2.DebtSurge	0.0423	0.0362	0.0444	0.0292	0.0366	0.0370	0.0422	0.0432	0.0591	0.0586	0.0406	0.0623
	(0.0793)	(0.0802)	(0.0797)	(0.0811)	(0.0828)	(0.0829)	(0.0837)	(0.0804)	(0.0805)	(0.0874)	(0.0795)	(0.0801)
L3.PrimarySpendingShock × L3.DebtSurge	0.1397**	0.1326*	0.1334*	0.1122	0.1662**	0.1042	0.1280*	0.1420**	0.1319*	0.1502*	0.1423**	0.1354*
	(0.0704)	(0.0710)	(0.0708)	(0.0724)	(0.0732)	(0.0709)	(0.0756)	(0.0715)	(0.0706)	(0.0769)	(0.0715)	(0.0714)
L1.FXDepreciation × L1.DebtSurge	0.0174	0.0163	0.0193	0.0006	0.0247	0.0187	0.0087	0.0176	0.0126	0.0023	0.0261*	0.0184
	(0.0166)	(0.0164)	(0.0164)	(0.0178)	(0.0158)	(0.0176)	(0.0157)	(0.0168)	(0.0173)	(0.0146)	(0.0147)	(0.0165)
L2.FXDepreciation × L2.DebtSurge	0.0196	0.0193	0.0188	0.0074	0.0236	0.0172	0.0094	0.0203	0.0103	0.0152	0.0272*	0.0197
	(0.0128)	(0.0128)	(0.0130)	(0.0140)	(0.0155)	(0.0131)	(0.0133)	(0.0132)	(0.0136)	(0.0142)	(0.0146)	(0.0129)
L3.FXDepreciation × L3.DebtSurge	-0.0110	-0.0115	-0.0097	-0.0197	-0.0100	-0.0115	-0.0096	-0.0114	-0.0164	-0.0137	-0.0095	-0.0114
	(0.0138)	(0.0138)	(0.0138)	(0.0148)	(0.0168)	(0.0137)	(0.0150)	(0.0143)	(0.0137)	(0.0136)	(0.0135)	(0.0137)
3 lags of		debt accumula-tion	primary balance shock	FX deprecia-tion	reserves	bank credit	external debt	growth	inflation	real interest rate	current account balance	GDP per capita
Obervations	1211	1211	1211	1211	988	1211	972	1211	1211	778	1170	1211

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.2. Debt Surges and Financial Crises

Random-effect logit regression (2 lags)

	Financial crisis											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L1.DebtAccumulation × L1.DebtSurge	0.0774**	0.0727*	0.0648*	0.0728*	0.0816*	0.0762*	0.0735**	0.0737*	0.0835*	0.0705*	0.0783*	0.0757*
	(0.0395)	(0.0431)	(0.0369)	(0.0421)	(0.0473)	(0.0420)	(0.0350)	(0.0427)	(0.0449)	(0.0372)	(0.0415)	(0.0393)
L2.DebtAccumulation × L2.DebtSurge	-0.0035	-0.0152	-0.0039	-0.0074	-0.0208	-0.0163	0.0164	-0.0105	-0.0187	-0.0125	0.0009	-0.0024
	(0.0392)	(0.0391)	(0.0393)	(0.0467)	(0.0375)	(0.0375)	(0.0439)	(0.0387)	(0.0480)	(0.0435)	(0.0370)	(0.0390)
L1.RevenueShock × L1.DebtSurge	0.6173**	0.6271**	0.5781**	0.6318**	0.5055**	0.6436**	0.5716**	0.6228**	0.6618**	0.5552**	0.5926**	0.6271**
	(0.2615)	(0.2663)	(0.2500)	(0.2672)	(0.2411)	(0.2823)	(0.2605)	(0.2708)	(0.2735)	(0.2762)	(0.2552)	(0.2613)
L2.RevenueShock × L2.DebtSurge	0.0275	0.0177	0.0202	-0.0194	0.1168	0.0878	0.0357	0.0186	0.0122	0.1095	0.0788	0.0392
	(0.1535)	(0.1561)	(0.1485)	(0.1537)	(0.1621)	(0.1371)	(0.1489)	(0.1643)	(0.1533)	(0.1744)	(0.1424)	(0.1524)
L1.PrimarySpendingShock × L1.DebtSurge	0.0113	0.0179	0.0266	0.0883	0.0470	0.0086	0.0721	0.0188	0.0269	0.0051	0.0377	0.0167
	(0.1044)	(0.1047)	(0.1042)	(0.1049)	(0.1074)	(0.1118)	(0.1150)	(0.1069)	(0.1054)	(0.1141)	(0.1015)	(0.1038)
L2.PrimarySpendingShock × L2.DebtSurge	0.2101***	0.2038***	0.2141***	0.1579**	0.2167***	0.1927***	0.2009**	0.2083**	0.2057***	0.2347***	0.1836**	0.2072***
	(0.0789)	(0.0770)	(0.0777)	(0.0770)	(0.0802)	(0.0736)	(0.0804)	(0.0822)	(0.0759)	(0.0857)	(0.0757)	(0.0780)
L1.FXDepreciation × L1.DebtSurge	0.0196	0.0194	0.0211	0.0003	0.0162	0.0225	0.0151	0.0191	0.0129	0.0151	0.0194	0.0194
	(0.0343)	(0.0341)	(0.0342)	(0.0335)	(0.0242)	(0.0407)	(0.0304)	(0.0345)	(0.0373)	(0.0276)	(0.0282)	(0.0340)
L2.FXDepreciation × L2.DebtSurge	0.0138	0.0136	0.0130	0.0050	0.0041	0.0141	0.0106	0.0131	0.0073	0.0118	0.0152	0.0138
	(0.0095)	(0.0095)	(0.0093)	(0.0105)	(0.0093)	(0.0100)	(0.0110)	(0.0095)	(0.0100)	(0.0109)	(0.0093)	(0.0093)
3 lags of		debt accumula-tion	primary balance shock	FX deprecia-tion	reserves	bank credit	external debt	growth	inflation	real interest rate	current account balance	GDP per capita
Obervations	2866	2866	2866	2866	2678	2848	2465	2866	2866	2134	2768	2866

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.3. Debt Surges and Financial Crises

Random-effect logit regression (4 lags)

	Financial crisis											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L1.DebtAccumulation × L1.DebtSurge	0.1048**	0.0908*	0.0810*	0.0972**	0.1003**	0.1046**	0.1027*	0.0996**	0.1176**	0.1491***	0.1059**	0.1024**
	(0.0473)	(0.0503)	(0.0451)	(0.0462)	(0.0498)	(0.0471)	(0.0536)	(0.0496)	(0.0482)	(0.0533)	(0.0536)	(0.0480)
L2.DebtAccumulation × L2.DebtSurge	-0.0703	-0.0733	-0.0682	-0.0833	-0.0587	-0.0767	-0.0228	-0.0747	-0.0835	-0.0419	-0.0672	-0.0697
	(0.0614)	(0.0640)	(0.0617)	(0.0643)	(0.0732)	(0.0640)	(0.0731)	(0.0622)	(0.0699)	(0.0660)	(0.0659)	(0.0603)
L3.DebtAccumulation × L3.DebtSurge	0.1143*	0.1122*	0.1157*	0.1154*	0.0736	0.1127*	0.1112*	0.1160*	0.1176	0.1104	0.1112*	0.1182*
	(0.0617)	(0.0623)	(0.0621)	(0.0613)	(0.0793)	(0.0659)	(0.0672)	(0.0608)	(0.0779)	(0.0721)	(0.0619)	(0.0612)
L4.DebtAccumulation × L4.DebtSurge	0.0883**	0.1061***	0.0886**	0.0804**	0.0112	0.0909**	0.0607	0.0875**	0.0955***	0.0856**	0.0838**	0.0908**
	(0.0377)	(0.0400)	(0.0384)	(0.0385)	(0.0619)	(0.0384)	(0.0447)	(0.0356)	(0.0354)	(0.0402)	(0.0384)	(0.0362)
L1.RevenueShock × L1.DebtSurge	0.5720**	0.5663**	0.5254**	0.6022**	0.4170**	0.6112**	0.5898**	0.5790**	0.5850**	0.4689**	0.5462**	0.5925**
	(0.2461)	(0.2538)	(0.2340)	(0.2597)	(0.2020)	(0.2606)	(0.2512)	(0.2525)	(0.2529)	(0.2211)	(0.2375)	(0.2458)
L2.RevenueShock × L2.DebtSurge	0.2207	0.1668	0.2299	0.1409	0.1622	0.3197	0.1629	0.2225	0.2224	0.1273	0.2498	0.2388
	(0.2038)	(0.1792)	(0.2001)	(0.1889)	(0.2266)	(0.1967)	(0.1909)	(0.2008)	(0.2026)	(0.2536)	(0.2023)	(0.2013)
L3.RevenueShock × L3.DebtSurge	-0.1299	-0.1089	-0.1075	-0.1403	-0.0867	-0.0802	-0.0880	-0.1201	-0.1623	-0.1525	-0.1270	-0.1091
	(0.3764)	(0.3594)	(0.3518)	(0.3578)	(0.2848)	(0.3739)	(0.3822)	(0.3752)	(0.3719)	(0.3785)	(0.3622)	(0.3809)
L4.RevenueShock × L4.DebtSurge	-0.5041	-0.4843	-0.4807	-0.5029	-0.8877**	-0.4621	-0.3804	-0.4864	-0.5333	-1.0016*	-0.4988	-0.4488
	(0.4320)	(0.4183)	(0.4198)	(0.4284)	(0.4130)	(0.4385)	(0.4008)	(0.4146)	(0.4436)	(0.5459)	(0.4371)	(0.4113)
L1.PrimarySpendingShock × L1.DebtSurge	0.0735	0.0808	0.0911	0.1408	0.1107	0.0691	0.1294	0.0818	0.0773	0.0707	0.0813	0.0760
	(0.0958)	(0.0945)	(0.0942)	(0.0986)	(0.0886)	(0.1033)	(0.0995)	(0.0979)	(0.0959)	(0.0907)	(0.0938)	(0.0963)
L2.PrimarySpendingShock × L2.DebtSurge	0.0530	0.0571	0.0496	0.0534	0.0904	0.0138	0.0385	0.0525	0.0676	0.0986	0.0560	0.0528
	(0.0795)	(0.0750)	(0.0794)	(0.0773)	(0.0982)	(0.0641)	(0.0828)	(0.0828)	(0.0769)	(0.1002)	(0.0801)	(0.0809)
L3.PrimarySpendingShock × L3.DebtSurge	0.0041	-0.0009	0.0001	-0.0374	-0.0239	0.0013	-0.0097	0.0006	-0.0014	0.0285	-0.0011	-0.0013
	(0.0799)	(0.0767)	(0.0774)	(0.0757)	(0.0781)	(0.0821)	(0.0893)	(0.0805)	(0.0821)	(0.0818)	(0.0778)	(0.0812)
L4.PrimarySpendingShock × L4.DebtSurge	0.2364**	0.2350**	0.2371**	0.2432**	0.3219**	0.2311*	0.2238**	0.2284**	0.2344*	0.2908*	0.2346*	0.2179**
	(0.1192)	(0.1139)	(0.1169)	(0.1214)	(0.1300)	(0.1199)	(0.1135)	(0.1105)	(0.1254)	(0.1488)	(0.1225)	(0.1100)
L1.FXDepreciation × L1.DebtSurge	0.0077	0.0087	0.0114	-0.0125	0.0214	0.0121	0.0060	0.0080	0.0023	-0.0097	0.0068	0.0082
	(0.0415)	(0.0410)	(0.0377)	(0.0415)	(0.0164)	(0.0492)	(0.0307)	(0.0404)	(0.0426)	(0.0318)	(0.0349)	(0.0398)
L2.FXDepreciation × L2.DebtSurge	0.0270*	0.0272*	0.0260*	0.0106	0.0247*	0.0258*	0.0189	0.0257*	0.0180	0.0210	0.0265*	0.0268*
	(0.0143)	(0.0142)	(0.0145)	(0.0152)	(0.0132)	(0.0149)	(0.0145)	(0.0144)	(0.0146)	(0.0140)	(0.0141)	(0.0143)
L3.FXDepreciation × L3.DebtSurge	-0.0190*	-0.0188*	-0.0192*	-0.0214*	-0.0134	-0.0190*	-0.0149	-0.0205*	-0.0204*	-0.0151	-0.0143	-0.0191*
	(0.0109)	(0.0111)	(0.0112)	(0.0123)	(0.0129)	(0.0102)	(0.0102)	(0.0109)	(0.0124)	(0.0117)	(0.0107)	(0.0108)
L4.FXDepreciation × L4.DebtSurge	0.0075	0.0077	0.0062	0.0101	0.0150	0.0093	0.0136	0.0077	0.0109	0.0110	0.0118	0.0081
	(0.0124)	(0.0122)	(0.0126)	(0.0144)	(0.0125)	(0.0130)	(0.0129)	(0.0123)	(0.0153)	(0.0133)	(0.0135)	(0.0121)
3 lags of		debt accumula-tion	primary balance shock	FX deprecia-tion	reserves	bank credit	external debt	growth	inflation	real interest rate	current account balance	GDP per capita
Obervations	2568	2568	2568	2568	2382	2549	2189	2568	2568	1883	2470	2568

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.4. Debt Surges and Ex-post Debt Paths

Logit regression (10 percentage point threshold)

	Non-declining ex-post debt path						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DebtAccumulation	-0.0065 (0.0140)	-0.0072 (0.0150)	0.1660* (0.0958)	-0.0130 (0.0172)	-0.0264 (0.0377)	-0.0621 (0.0452)	-0.0381 (0.0398)
DebtPeak	-0.0324*** (0.0115)	-0.0369*** (0.0125)	-0.0371*** (0.0122)	-0.0362*** (0.0124)	-0.0378** (0.0173)	-0.0462*** (0.0175)	-0.0520** (0.0234)
Duration	-0.0236 (0.0486)	0.0079 (0.0734)	0.0224 (0.0780)	0.5769 (1.0768)	-0.0434 (0.1819)	-0.0925 (0.1779)	-0.3172* (0.1832)
FinancialMarketDepth	1.4700 (1.0027)	2.7056* (1.4337)	2.6376* (1.4190)	2.8278** (1.2992)	2.4400 (1.5582)	2.9998* (1.7238)	3.0406* (1.7266)
RevenueShock		0.2106 (0.2620)	0.2171 (0.4099)	-0.0785 (0.3841)			
PrimarySpendingShock		0.3534 (0.4721)	1.2136* (0.7208)	0.7103 (0.7272)			
FXEffect					-0.0518 (0.0349)	-0.0365 (0.0515)	-0.2412*** (0.0799)
OtherSFA					-0.0058 (0.0175)	-0.0890** (0.0397)	-0.0368 (0.0494)
RevenueShock × DebtAccumulation			0.0011 (0.0077)				
PrimarySpendingShock × DebtAccumulation			-0.0232* (0.0133)				
RevenueShock × Duration				0.0584 (0.0550)			
PrimarySpendingShock × Duration				-0.0892 (0.1495)			
FXEffect × DebtAccumulation						-0.0003 (0.0011)	
OtherSFA × DebtAccumulation						0.0025** (0.0010)	
FXEffect × Duration							0.0477*** (0.0152)
OtherSFA × Duration							0.0031 (0.0095)
PrimaryBalanceAfter	0.0047 (0.0658)	-0.0979 (0.3364)	-0.1502 (0.3506)	-0.1038 (0.3445)	0.1501 (0.5436)	0.1199 (0.4875)	0.3951 (0.5428)
GrowthAfter	-0.2818*** (0.1088)	-0.3948*** (0.1302)	-0.4116*** (0.1350)	-0.4088*** (0.1334)	-0.5251** (0.2101)	-0.5193** (0.2174)	-0.6281*** (0.2414)
InflationAfter	-0.1353** (0.0577)	-0.0884 (0.0608)	-0.0802 (0.0620)	-0.0865 (0.0620)	-0.0320 (0.1067)	-0.0854 (0.1119)	-0.0873 (0.1255)
RestructuringAfter	0.0820 (0.7758)	0.2747 (0.8907)	0.0401 (0.8885)	0.3455 (0.8365)	0.3581 (0.9783)	0.2093 (0.8390)	1.5087 (1.2543)
FXDepreciationAfter	0.0342*** (0.0115)	0.0274** (0.0109)	0.0290** (0.0121)	0.0264** (0.0106)	0.0470*** (0.0153)	0.0555*** (0.0189)	0.0708*** (0.0202)
Episodes	130	118	118	118	81	81	81

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.5. Debt Surges and Ex-post Debt Paths

Logit regression (15 percentage point threshold)

	Non-declining ex-post debt path						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DebtAccumulation	0.0150	-0.0040	0.1206	-0.0159	0.0371	-0.0309	0.0620
	(0.0143)	(0.0169)	(0.1257)	(0.0177)	(0.0288)	(0.0566)	(0.0722)
DebtPeak	-0.0527***	-0.0560***	-0.0549***	-0.0600***	-0.0617***	-0.0854***	-0.1521**
	(0.0134)	(0.0157)	(0.0156)	(0.0175)	(0.0181)	(0.0184)	(0.0702)
Duration	-0.0581	0.0017	-0.0043	3.4167	-0.1539	-0.3439	-1.1731**
	(0.0504)	(0.0979)	(0.0944)	(2.5635)	(0.3125)	(0.3103)	(0.5308)
FinancialMarketDepth	1.0733	1.1457	0.9503	2.0301	2.6286	4.0595	5.1445
	(1.5403)	(2.2739)	(2.2684)	(1.7136)	(2.5590)	(2.7858)	(3.2881)
RevenueShock		-0.1712	-0.3889	-1.0043*			
		(0.2889)	(0.5089)	(0.5300)			
PrimarySpendingShock		-0.5093	0.1581	1.3735			
		(0.5856)	(0.9364)	(1.1602)			
FXEffect					-0.1023***	-0.0975*	-0.6520***
					(0.0376)	(0.0590)	(0.2348)
OtherSFA					-0.0428**	-0.1718***	-0.1493**
					(0.0174)	(0.0499)	(0.0713)
RevenueShock × DebtAccumulation			0.0059				
			(0.0086)				
PrimarySpendingShock × DebtAccumulation			-0.0181				
			(0.0173)				
RevenueShock × Duration				0.2066*			
				(0.1115)			
PrimarySpendingShock × Duration				-0.5005			
				(0.3573)			
FXEffect × DebtAccumulation						0.0002	
						(0.0015)	
OtherSFA × DebtAccumulation						0.0039***	
						(0.0013)	
FXEffect × Duration							0.1237**
							(0.0513)
OtherSFA × Duration							0.0012
							(0.0121)
PrimaryBalanceAfter	-0.0227	-0.2239	-0.2124	-0.3475	0.8244	0.6656	2.6215**
	(0.0791)	(0.4568)	(0.4704)	(0.5686)	(0.7567)	(0.7851)	(1.1747)
GrowthAfter	-0.3738***	-0.5621***	-0.5802***	-0.6629***	-0.8115***	-0.9399***	-1.5786**
	(0.1425)	(0.1564)	(0.1612)	(0.1770)	(0.2401)	(0.2476)	(0.7048)
InflationAfter	-0.1548***	-0.1267**	-0.1231*	-0.1396**	-0.0310	-0.1301	-0.0721
	(0.0557)	(0.0636)	(0.0631)	(0.0658)	(0.0998)	(0.1139)	(0.2604)
RestructuringAfter	-0.2541	-0.6681	-0.8792	-0.5771	-1.1172	-1.2786	1.7751
	(0.8478)	(0.7461)	(0.7802)	(0.7305)	(0.9679)	(1.1366)	(2.4162)
FXDepreciationAfter	0.0344***	0.0350**	0.0352**	0.0382**	0.0750***	0.0915***	0.1798***
	(0.0124)	(0.0150)	(0.0155)	(0.0180)	(0.0211)	(0.0299)	(0.0636)
Episodes	130	118	118	118	81	81	81

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

Annex Table AIII.6. Debt Surges and Ex-post Debt Paths

Logit regression (4–7-year time window)

	Non-declining ex-post debt path						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DebtAccumulation	0.0037 (0.0115)	0.0065 (0.0143)	-0.0651 (0.1130)	0.0063 (0.0142)	0.0891* (0.0503)	0.0554 (0.0398)	0.1062 (0.0646)
DebtPeak	-0.0196** (0.0078)	-0.0209** (0.0088)	-0.0205** (0.0094)	-0.0208** (0.0087)	-0.0317* (0.0178)	-0.0330* (0.0194)	-0.0396 (0.0260)
Duration	0.0194 (0.0534)	-0.0110 (0.0811)	-0.0160 (0.0841)	-0.2241 (0.8768)	-0.2423 (0.2085)	-0.2346 (0.2396)	-0.5895** (0.2766)
FinancialMarketDepth	3.7157** (1.7643)	3.2982 (2.4356)	3.4969 (2.5895)	3.3145 (2.4873)	5.2773 (3.5164)	5.6739* (3.3197)	6.6278 (4.7818)
RevenueShock		-0.4225 (0.2780)	-0.3767 (0.4747)	-0.3663 (0.3818)			
PrimarySpendingShock		0.4037 (0.4893)	-0.0569 (0.8029)	0.2719 (0.6736)			
FXEffect					-0.0872*** (0.0314)	-0.1324*** (0.0406)	-0.2280*** (0.0645)
OtherSFA					-0.0685** (0.0302)	-0.0771 (0.0489)	-0.1507 (0.0921)
RevenueShock × DebtAccumulation			-0.0018 (0.0072)				
PrimarySpendingShock × DebtAccumulation			0.0099 (0.0159)				
RevenueShock × Duration				-0.0130 (0.0500)			
PrimarySpendingShock × Duration				0.0321 (0.1245)			
FXEffect × DebtAccumulation						0.0011 (0.0007)	
OtherSFA × DebtAccumulation						0.0002 (0.0011)	
FXEffect × Duration							0.0282*** (0.0103)
OtherSFA × Duration							0.0106 (0.0138)
PrimaryBalanceAfter	-0.1393 (0.1448)	0.1570 (0.3574)	0.1424 (0.3679)	0.1681 (0.3679)	-0.4414 (0.4498)	-0.4632 (0.4889)	-0.0396 (0.6189)
GrowthAfter	-0.3008** (0.1230)	-0.4239*** (0.1602)	-0.4018** (0.1646)	-0.4173*** (0.1614)	-0.4380 (0.2698)	-0.4620 (0.2830)	-0.4632* (0.2615)
InflationAfter	-0.1084** (0.0502)	-0.0988* (0.0573)	-0.1012* (0.0578)	-0.0986* (0.0573)	0.0362 (0.0693)	0.0683 (0.0913)	0.0624 (0.0616)
RestructuringAfter	-0.7057 (0.7629)	-0.8580 (0.8558)	-0.7028 (0.9453)	-0.8469 (0.8384)	-0.4747 (1.0503)	-0.3497 (1.1592)	-0.1854 (1.3554)
FXDepreciationAfter	0.0227** (0.0093)	0.0176** (0.0079)	0.0187** (0.0080)	0.0177** (0.0080)	0.0358** (0.0171)	0.0422** (0.0179)	0.0543*** (0.0178)
Episodes	123	111	111	111	74	74	74

Standard errors in parentheses
* p<0.1 ** p<0.05 *** p<0.01

Source: Author's calculations.

©International Monetary Fund. Not for Redistribution

References

Arslanalp, S., Eichengreen, B., & Simpson-Bell, C. (2023). Gold as International Reserves: A Barbarous Relic No More?. International Monetary Fund.

Arslanalp, M. S., & Tsuda, M. T. (2014). Tracking global demand for emerging market sovereign debt. International Monetary Fund.

Auerbach, A. J., & Gorodnichenko, Y. (2013). Output spillovers from fiscal policy. American Economic Review, 103(3), 141-146.

Moreno Badia, M., Arbelaez, J. G., & Xiang, Y. (2022). Debt Dynamics in Emerging and Developing Economies: Is R− G a Red Herring?. Journal of Globalization and Development, 13(2), 269-304.

Batini, N., Eyraud, L., Forni, L., & Weber, A. (2014). Fiscal multipliers: Size, determinants, and use in macroeconomic projections. International Monetary Fund.

Beetsma, R., & Giuliodori, M. (2012). The changing macroeconomic response to stock market volatility shocks. Journal of Macroeconomics, 34(2), 281-293.

Beetsma, R., Giuliodori, M., & Klaassen, F. (2006). Trade spill-overs of fiscal policy in the European Union: a panel analysis. Economic policy, 21(48), 640-687.

Blanchard, O., & Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. the Quarterly Journal of economics, 117(4), 1329-1368.

Bova, M. E., Ruiz-Arranz, M., Toscani, M. F. G., & Ture, H. E. (2016). The fiscal costs of contingent liabilities: A new dataset. International Monetary Fund.

Cevik, S., & Miryugin, F. (2023). It's Never Different: Fiscal Policy Shocks and Inflation.

Cavallo, A., Dallari, P., Ribba, A. (2018). The Macroeconomic Effects of Fiscal Policy Shocks: A Review of the Literature. In: Fiscal Policies in High Debt Euro-Area Countries. Springer, Cham

David, M. A., & Leigh, M. D. (2018). A new action-based dataset of fiscal consolidation in Latin America and the Caribbean. International Monetary Fund.

Leigh, M. D., Pescatori, M. A., Devries, M. P., & Guajardo, M. J. (2011). A new action-based dataset of fiscal consolidation. International Monetary Fund.

Furceri, D., & Li, B. G. (2017). The macroeconomic (and distributional) effects of public investment in developing economies. International Monetary Fund.

Duval, M. R. A., Furceri, D., & Miethe, J. (2018). The needle in the haystack: what drives labor and product market reforms in advanced countries?. International Monetary Fund.

Galí, J., López-Salido, J. D., & Vallés, J. (2007). Understanding the effects of government spending on consumption. Journal of the european economic association, 5(1), 227-270.

Harding, D., & Pagan, A. (2002). Dissecting the cycle: a methodological investigation. Journal of monetary economics, 49(2), 365-381.

Havranek, T., & Rusnak, M. (2012). Transmission lags of monetary policy: A meta-analysis.

©International Monetary Fund. Not for Redistribution

Honda, M. J., Miyamoto, H., & Taniguchi, M. (2020). Exploring the output effect of fiscal policy shocks in low income countries. International Monetary Fund.

Ilzetzki, E., Mendoza, E. G., & Végh, C. A. (2013). How big (small?) are fiscal multipliers?. Journal of monetary economics, 60(2), 239-254.

International Monetary Fund.(IMF). 2023a. World Economic Outlook: A Rocky Recovery. Washington, DC. April

International Monetary Fund (IMF). 2023b. Fiscal Monitor: Climate Crossroads: Fiscal Policies in a Warming World. Washington, DC: IMF, October.

Jaramillo, L., Mulas-Granados, M. C., & Kimani, E. (2016). The blind side of public debt spikes. International Monetary Fund.

Jordà, Ò., Schularick, M., & Taylor, A. M. (2015). Leveraged bubbles. Journal of Monetary Economics, 76, S1-S20.

Kose, M. A., Nagle, P., Ohnsorge, F., & Sugawara, N. (2021). Global waves of debt: Causes and consequences. World Bank Publications.

Laeven, L., & Valencia, F. (2020). Systemic banking crises database II. IMF Economic Review, 68, 307-361.

Mauro, P., & Zilinsky, J. (2016). Reducing Government Debt ratios in an era of low growth (No. PB16-10).

Mountford, A., & Uhlig, H. (2009). What are the effects of fiscal policy shocks?. Journal of applied econometrics, 24(6), 960-992.

Pappa, E. (2009). The effects of fiscal shocks on employment and the real wage. International Economic Review, 50(1), 217-244.

Perotti, R. (2005). Estimating the effects of fiscal policy in OECD countries. Available at SSRN 717561

Ramey, V. A. (2016). Macroeconomic shocks and their propagation. Handbook of macroeconomics, 2, 71-162.

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. American economic review, 100(2), 573-578.

Romer, C. D., & Romer, D. H. (2010). The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. *American Economic Review*, *100*(3), 763-801.

Schularick, M., & Taylor, A. M. (2012). Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008. American Economic Review, 102(2), 1029-1061.

Sever, C., & Laws, A. (2023). Revamping the West African Economic and Monetary Union (WAEMU) Fiscal Framework. *Selected Issues Papers*, *2023*(028).

Weber, A. (2012). Stock-flow adjustments and fiscal transparency: A cross-country comparison. International Monetary Fund.

©International Monetary Fund. Not for Redistribution

PUBLICATIONS

Debt Surges Episodes—Conditions, Consequences, and Policy Implications

Working Paper No. WP/2024/050