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Surges in the Shadows: Stock-Flow Adjustments and Public Debt Spikes*

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Abstract

In this paper, we study the drivers of public debt surges across 172 countries from 1980-2021. We focus on the role of discrepancies between the annual change in public debt and the budget deficit, referred to as stock-flow adjustments (SFA). The analysis employs survival methods to model the effect of SFA and other macroeconomic factors on the hazard rate for debt spike events. We differentiate between debt accumulation trends and spikes to examine how SFA influences the likelihood of a spike once a country is already on an increasing debt trajectory. Our results indicate that an increase of one percentage point in the SFA to GDP ratio increases the hazard rate of a surge by 15%. This effect is greater for advanced economies (25%) relative to emerging markets (14%). Moreover, contingent on a debt trend, a higher SFA significantly increases the chance that a spike will materialize, especially in advanced countries. We address the self-selection problem associated with SFA by using an IV approach based on the notion that fiscal transparency. We conclude that accurate SFA estimates are critical for debt sustainability analyses. Overall, our analysis provides novel evidence on the mechanisms underlying public debt surges and their consequences. Our findings can guide policymakers in identifying risks from hidden debt trajectories and improving transparency. The results are robust to various sensitivity checks and alternative specifications and methodologies.

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1 Introduction

Public debt has shown a consistent upward trajectory in recent decades, reaching levels that surpass 100% of the global gross domestic product (GDP) in 2020 (International Monetary Fund (2023)). While this escalation coincided with a backdrop of reduced interest rates around the world, changes in global financial circumstances may produce substantial adverse consequences for countries burdened with high debt (Rogoff (2020)). High levels of public debt possess the potential to booster economic growth by facilitating increased funds for investment, crucial for countries characterized by low capital stocks. This effect can complement private debt, amplifying overall investment, and redirecting resources towards more efficient uses. Furthermore, in scenarios marked by diminished demand, public debt plays a role in enhancing aggregate demand (Butkus, Cibulskiene, Garsviene and Seputiene (2021), Fazzari, Ferri and Variato (2020)). However, elevated debt also has the potential to induce negative impacts on economic growth and welfare, while simultaneously constraining government responsiveness in the face of adverse shocks (Obstfeld (2013); Battaglini and Coate (2016); Romer and Romer (2018); Medas, Poghosyan, Xu, Farah-Yacoub and Gerling (2018); Asonuma, Chamon, Erce and Sasahara (2019); Kose, Ohnsorge, Reinhart and Rogoff (2022). Furthermore, countries grappling with high indebtedness are also perceived as more risky and less prone to financial access when needed. This excessive accumulation of debt is what Krugman (1988) coined as a debt overhang: a situation where a high level of existing debt hampers economic growth and investment prospects.

During most of the commodities super cycle (2000–2014), and particularly after the Covid-19 pandemic, there has been a consistent surge in global public debt. In general, this increase is associated with increases in deficits, slower economic growth, and countercyclical economic policies that governments have pursued to provide household transfers, liquidity to firms, and tax breaks. Our study aims to characterize what developed and emerging countries need to consider when facing these debt surges. In particular, we will focus on the role played by discrepancies between the annual change in public debt and the budget deficit, commonly known as *stock-flow adjustments*. From both an academic and a policy perspective, analyzing the channels that contribute to potentially unsustainable debt trajectories can provide invaluable

insights. The unexplained residuals in debt dynamics –stock-flows adjustments (SFA)– may capture opaque accounting practices or intentional misreporting, enabling hidden debt accumulation. Therefore, investigating the role of SFA contributes to the discussion of risks to fiscal sustainability. Ultimately, our findings can also guide policymakers with initiatives to strengthen fiscal transparency, improve debt management, and mitigate future crises. Overall, our paper advances the understanding of rapid debt accumulations and their consequences.

Although previous studies have discussed the role of SFA in debt dynamics (Martner Fanta and Tromben (2004); Budina and Fiess (2005); Jaimovich, Panizza and Campos (2006); Abbas, ElGanainy and Horton (2011); Jaramillo, Mulas-Granados and Kimani (2017); Schuster, Alnasaa, Bounader, Jung, Menkulasi and da Mota (2024)), our research appears to be the first to comprehensively examine this influence through survival analysis, evaluating the likelihood of a debt acceleration event across 172 countries from 1980 to 2021.

Our results suggest that an increase of one percentage point in the ratio of SFA to GDP increases the hazard rate of experiencing a debt spike episode by between 16.6%-25.5%, depending on the specification. This figure is between 28.2% and 68% for advanced countries, but between 13.4% and 21.5% for emerging countries. Furthermore, once a country enters an episode of increasing debt trend, the probability that it culminates in a debt spike episode significantly increases with the SFA. In particular, a one percentage point increase in SFA increases this probability by 62% for advanced countries and by about 69% for emerging countries. These figures are economically relevant, particularly, for emerging and low-income developing countries that suffer disproportionately from fiscal vulnerability (debt spike episodes are more frequent and long-lasting in emerging countries relative to advanced countries). Our results hold after controlling for usual macroeconomic factors, the existence of IMF programs and fiscal rules, and for the institutional quality. Additionally, we check the robustness of our results using various sensitivity analyses, including instrumental variables (IV), alternative measures of the SFA, alternative definitions to identify spike debt episodes, and lags to account for differences in the timing of variables. Our findings underscore the importance of SFA.

Although there is a substantial amount of literature examining the relationship between public debt and economic growth, there is less empirical evidence regarding the drivers of debt surges. Interestingly, the rise in public debt in both advanced and emerging economies over recent decades has prompted new research into the nature and consequences of sharp increases or spikes in public debt levels. Several studies have decomposed the dynamics of public debt to understand the factors underlying episodes of debt spikes. Jaimovich et al. (2006) assembled data on debt spikes for 117 countries from 1972 to 2003 and found that large increases in public debt were mainly driven by SFA rather than budget deficits. They concluded that realized contingent liabilities and balance sheet effects explain some but not all of the SFA accumulation during spikes. Abbas et al. (2011) examined 60 instances of debt escalation from 1880 to 2007 discovering that primary deficits and SFA were significant factors in driving debt surges during non-recessionary periods. Afonso and Jalles (2020) similarly find that SFA are a major driver of public debt growth in OECD countries. More recently, Schuster et al. (2024) in their analysis of the consequences of debt spikes concluded that fiscal policy and SFA play an important role in debt dynamics. These findings highlight the importance of transparency in off-budget operations and accounting practices to fully explain SFA.

The literature seems to agree that SFA reflect unobserved or hidden elements affecting debt. For instance, based on the European experience, Von Hagen and Wolff (2006) argue that governments utilize SFA as a means to bypass fiscal regulations implemented by the European Economic and Monetary Union. They highlight the importance of enhancing fiscal transparency and strengthening the supervision of these supranational regulations to decrease off-budget activities. Moreover, Weber (2012) shows how SFA are a key source of debt increases in 163 countries during 1980-2010, driven by factors such as contingencies, defaults, and exchange rate fluctuations. However, countries that are more fiscally transparent tend to exhibit a smaller SFA on average. In a similar vein, Jaramillo et al. (2017) find that a larger accumulation of SFA increases the probability of a non-declining debt path after a spike. They also conclude that subnational governments' bailouts and other contingent liabilities are major contributors to SFA and debt spikes historically across advanced and developing economies. Overall, there appears to be some consensus on the contribution of SFA

to episodes of public debt acceleration. These spikes, in turn, appear to put debt on a higher trajectory and are associated with lower subsequent economic growth. Consequently, enhanced fiscal transparency and accounting for SFA in debt projections are critical for debt sustainability analyses.

This paper builds on previous research by making several innovative contributions and reviving the debate on SFA. First, we include a panel with more countries and a longer time series than enable use a deeper analysis of the causes of large SFA accumulation on public debt spikes. Second, we differentiate the effect of SFA accumulation in advanced countries from that in emerging countries. Third, we distinguish between debt trends and debt spikes, thereby disentangling the consequences and relative importance of SFA accumulation once countries are already on a debt accumulation trend. Fourth, we account for the endogeneity associated with debt surges. Lastly, we discuss the policy options available to countries to reduce the likelihood of a debt spike once they are on a debt trend acceleration.

Therefore, this project contributes to the ongoing discussion among policymakers and scholars about fiscal vulnerabilities. First, it stresses the importance of accurate SFA estimates for debt sustainability analyses. Second, the paper provides evidence that there cannot be a one-size-fits-all solution, as advanced and emerging countries face different fiscal challenges. Our project also highlights the importance of taking into account public debt denominated in foreign currencies as an additional external factor.

The rest of this paper is organized as follows: Section 2 describes the dataset and our measures of public debt spikes and stock-flow adjustments, Section 3 presents the empirical strategy, Section 4 discusses the main findings and robustness analyses, and Section 5 offers concluding remarks.

2 Data Description

We use publicly available data from the IMF's World Economic Outlook and the Historical Public Debt Database to develop our main indicators of public debt spikes and SFA. We employ the general government approach (including both central and subnational levels) when accessible, or alternatively, we use central government debt to

measure public debt (expressed as a percentage of GDP). Consequently, our panel has 172 countries (139 emerging and 33 developed) over the period 1980 to 2021.

From a debt-decomposition perspective, stock-flow adjustments are defined as the difference between the annual change in gross debt and the budget deficit. Following Weber (2012), Jaramillo et al. (2017), Jaimovich et al. (2006), and Panizza and Taddei (2020), this definition of SFA can be expressed from the basic debt accumulation equation:

$$\frac{\Delta Debt_t}{NGDP_t} = \frac{Fiscal\ Balance_t}{NGDP_t} + \frac{SFA_t}{NGDP_t} \tag{1}$$

where $Debt$ is the gross public debt, $FiscalBalance$ denotes the overall budget deficit, SFA denotes the stock-flow adjustments, and $NGDP$ is the nominal GDP. This definition is simple, transparent, and can be computed from fiscal accounts; but it maylack some of the nuances involved in debt dynamics. Additionally, equation (1) can be rewritten as two parts: the primary balance and the interest expenditure, which together make up the overall fiscal balance:

$$\frac{\Delta Debt_t}{NGDP_t} = \frac{i_t}{NGDP_t} Debt_{t-1} + \frac{Primary\ Balance_t}{NGDP_t} + \frac{SFA_t}{NGDP_t} \tag{2}$$

where i_t is the effective interest rate on debt. Equation (2) states that the change in a country's debt-to-GDP ratio in a given year is determined by three key factors: the interest-growth differential, the primary result, and the SFA. The interest-growth differential is the difference between the interest rate on debt and the nominal GDP growth rate. In essence, SFA represent the difference between the observed change in gross debt and the change implied by officially reported budget deficits. These unobserved factors that affect debt dynamics include accounting discrepancies (time to record debt and deficits), valuation effects, and below-the-line operations (such as financial transactions). This residual could reflect routine statistical issues in some cases. However, as Jaramillo et al. (2017) argues, it may also result from intentional accounting maneuvers by governments seeking to increase debt while avoiding an impact on reported deficits.

Using this first definition, Figure (1) shows that SFA have been positive in advanced and emerging countries, with the latter exhibiting a more consistent positive

pattern than the former.[1] Shocks such as the global financial crisis or the COVID-19 pandemic can explain some of the fluctuations, possibly caused by financial support.

Our discussion based on (1) (or (2)) refers to the variation of debt as a share of GDP, but not necessarily to the increase/decrease of the ratio debt to GDP. The former analyzes changes in public debt without considering the growth effect of nominal GDP. The latter involves a discussion of the variation of public debt relative to the variation of GDP. These two concepts can be very similar with a negligible but technical difference. Making this distinction can bring information not only about the difference in the deficit and debt but also about the contribution of each component relative to the growth effect of GDP. Hence, the debt decomposition looks like this.

$$\frac{Debt_t}{NGDP_t} - \frac{Debt_{t-1}}{NGDP_{t-1}} = i_t \frac{Debt_{t-1}}{NGDP_{t-1}(1+\gamma_t)} - (gr_t + \pi_t)\frac{Debt_{t-1}}{NGDP_{t-1}(1+\gamma_t)} + \frac{Primary\ Balance_t}{NGDP_t} + \frac{SFA_t}{NGDP_t} \tag{3}$$

and rewriting it would be

$$b_t - b_{t-1} = (i_t - \gamma_t)\frac{b_{t-1}}{(1+\gamma_t)} + pb_t + sfa_t \tag{4}$$

where γ is the nominal GDP growth rate, gr is the real GDP growth rate, π is the inflation rate; lowercases refer to variables as shares of NGDP. Notice that the first term of the right-hand side is the contribution of the interest bill, the second term is the contribution of nominal growth (that can be divided into real growth and inflation), the third term is the contribution of the primary balance, and the last term is the SFA. In principle, this second definition provides more information than the first one, but with a downside in terms of the number of observations per country.

By following the second definition, Figure (III.2) shows that SFA are also consistently positive in advanced and emerging countries. Two things are worth noting. First, the volatility of SFA in emerging countries is higher than in advanced countries. Second, there is a considerable dip around the global financial crisis for both advanced and emerging countries, most likely as a result of the contraction of GDP.

[1] This observation is consistent with Jaramillo et al. (2017), as they use this first definition as the main indicator for SFA.

The decomposition discussed in (3) and (4) can also be extended to accommodate fluctuations in the exchange rate. This distinction can be crucial for developing countries, especially in recent decades, where more floating regimes and inflation-targeting regimes have been introduced. The essence of this analysis hinges on the choices that countries make regarding the currency used to denote their debt. Because emerging countries denominate most of their international debt in foreign currency, they are exposed to currency mismatches and balance sheet effects associated with currency volatility. This inability of emerging countries to borrow abroad in their own currency has been coined as *original sin* by Hausmann and Panizza (2003) and Eichengreen, Hausmann and Panizza (2007). Initially thought as impossible to overcome due to the structure of the global financial markets, Burger and Warnock (2006) and Burger, Warnock and Warnock (2012), and more recently Du, Pflueger and Schreger (2020), Engel and Park (2022), and Ogrokhina and Rodriguez (2018), have point out the role macroeconomic policies and institutions play in the development of local currency bond markets. Aside from the origins of this constraint, there are clear consequences in terms of the dynamics of debt. If we consider ΔF, the variation of the exchange rate, and α_F, the share of foreign currency in total public debt, we can rewrite (4) as follows.

$$b_t - b_{t-1} = (i_t - \gamma_t)\frac{b_{t-1}}{(1+\gamma_t)} + \Delta F_t \alpha_{Ft-1}\frac{b_{t-1}}{1+\gamma_t} + pb_t + sfa_t \tag{5}$$

Notice that if the share of foreign currency in total public debt approaches zero and/or the exchange rate is fixed (no depreciation effect), then (5) collapses to (4) since there is no exchange rate fluctuation effect to account for. With this third measure, Figure (III.4) shows more fluctuation than the previous measures of SFA, not always reporting a positive figure. This third measure has the main drawback of reducing the number of observations per country by half.[2] This information comes from the Bank of International Settlements (BIS) *Debt Securities Statistics* (DSS).[3] The majority of public

[2] The data on the share of foreign currency in total public debt is not available for all countries/years in our sample.

[3] For this exercise we focus on international debt. Although debt can be issued domestically and internationally, domestic debt can be subject to government interventions to influence the pricing and formation of the market for debt securities through regulatory controls or other arbitrary measures. For each individual country, we construct the measure of foreign currency share as

$$foreign\ currency\ share = 1 - \frac{local\ currency\ public\ debt}{total\ international\ public\ debt}. \tag{6}$$

debt that emerging countries issue domestically is denominated in their local currency. However, most of their international debt is issued in foreign currency. Therefore, by using the percentage of foreign currency in *international* public debt as a proxy for the share of foreign currency in total public debt, we are indeed providing an upper bound of the effect. There is a clear trade-off when deciding the preferred measure for our study, each with its own advantages and disadvantages. Measures (1) and (2) are simple and provide a comprehensive definition that maximizes the number of observations. On the other hand, measure (5) is more accurate but comes with a significant cost in terms of the sample size. Thus, we have decided to use (2) as our primary measure of SFA to provide a more comprehensive analysis. Nevertheless, sections 2 and 3 of the Online Appendix report results when using definitions (4) and (5), respectively.[4]

The other key variable in our analysis is the selection of debt spikes or debt acceleration episodes. Although no single accepted definition exists, studies generally apply ad hoc criteria to pinpoint years or periods experiencing exceptionally large increases in debt-to-GDP ratios. For instance, Reinhart and Rogoff (2010) compare mean debt-to-GDP ratios from 1946 to 2009 across country groupings, Weber (2012) defines a debt spike as an increase in public debt of at least 10 percentage points of GDP over 5 years, Kumar and Woo (2010) identify spikes as years when the debt-to-GDP ratio increases by three standard deviations above its mean during the period. Gomez-Gonzalez, Uribe and Valencia (2023) define spikes as increases in 5-year debt exceeding the 80th percentile in the country-specific distribution. Alternatively, Abbas et al. (2011) identify major multi-year debt changes as sustained increases in gross debt ratios above 10 percentage points, allowing for temporary reversals. This approach focuses on persistent rather than one-time debt increases. Similarly, Jaramillo et al. (2017) start by flagging years with debt growth exceeding 1% of GDP and define a spike episode as consecutive years totaling at least 10 percentage points.

The approach we follow in this paper is a combination of the criteria used by Jaramillo et al. (2017) and Abbas et al. (2011) to identify debt trends and debt episodes. A *debt trend* starts when public debt increases by more than 1 percentage points of

4Results are robust across definitions, with only minor discrepancies occurring when using the third definition (5). We think that these discrepancies arise from the fact that half of the observations are missing, which increases the standard errors of the estimations.

GDP. Then, we observe the multi-year trend. If the overall change in debt during those consecutive years is equal to or greater than 10 percentage points of GDP, we then define it as a *debt spike episode*. Similarly to Jaramillo et al. (2017) there is no time limit in terms of duration; the episode lasts as long as the debt-to-GDP keeps increasing. Once the debt-to-GDP ratio changes (decreases) by less than one percentage point for two consecutive years, the episode and trend come to an end. By following this definition, we can have debt trends that do not culminate in a debt spike episode, but if there is a debt spike episode, there will be a debt trend.

Table (2) presents a summary of our data on debt trends and spikes. We identifiy a total of 611 debt trends and a total of 597 debt episodes for the overall sample.[5] The average duration before a country experiences a debt spike is 8.1 years, while the average number of years a country is in the non-crisis state equals 21.1 years. The maximum number of years in both cases is 42 since the sample period runs from 1980 to 2021.

The accumulation of debt during the debt spike is relatively similar among different groups of countries. As shown in Figure (2), the median debt spike for advanced economies is 25% of GDP, while for developing countries it is 24%. However, the duration of the episode is slightly shorter for developing countries (3 years) compared to advanced economies (5 years). Interestingly, these facts are consistent with Jaramillo et al. (2017).

Following the literature on debt sustainability, our analysis also incorporates indicators such as primary balance and public debt, which are expressed as a percentage of GDP. As previously discussed, we use the general government definition (central and subnational) if available or central government debt otherwise to measure public debt (as a percentage of GDP). In addition to these variables, we also consider the cushion countries have to face debt crises. To gauge this cushion, we add the total amount of reserves as a percentage of GDP. Moreover, we use the growth rate of real GDP, to capture the state of the economy over the business cycle. All these variables are drawn from the IMF's World Economic Outlook and the Historical Public Debt Database.

We use the change of the real effective exchange rate to control for real exchange

[5]This is considerably more cases than the 179 spike episodes among 76 countries found by Jaramillo et al. (2017) from 1945 to 2014.

appreciation, obtained from the IMF's International Financial Statistics, based on the consumer price index and nominal effective exchange rates. An increase in this measure means that the domestic currency has appreciated in real terms. We also include a dummy variable that takes the value of one when a country is under a program with the IMF to account for structural commitments with international organizations. We obtain this variable from the IMF website. To account for the recent trend in the adoption of fiscal rules, we also include a dummy variable that takes the value of one when a country has a fiscal rule in place. We obtain this variable from the IMF's Fiscal Rules Dataset.

Institutional quality is considered one of the main factors that can prevent sudden stops and debt crises (Cavallo, Izquierdo and León, 2020; Fratzscher, 2012). Thus, we calculate a standardized average of the components of the political risk rating index from the International Country Risk Guide (ICRG) to account for the level of institutional quality.[6]

Table (10) provides the definitions and sources of all the variables used in the empirical analysis.

3 Empirical Strategy

3.1 Surviving Debt Spikes

Survival analysis can model the hazard rate for debt spike events to evaluate the effect of stock-flow adjustments on debt spikes. In duration analysis, the hazard rate is the instantaneous rate of occurrence of an event at time t, conditional on the event not yet having occurred. In this context, the "event" is a debt spike in year t. The dependent variable in this case is a binary indicator that takes on a value of 1 if there is a debt spike in country i in year t, and 0 otherwise.

The hazard function can be modeled parametrically by specifying a distributional form, like the exponential or Weibull distributions, or semiparametrically using the

[6]Our standardized measure includes multiple aspects of the institutional quality: democratic accountability, law and order, bureaucratic quality, investment profile, military in politics, religious tensions, corruption, internal conflict, and socioeconomic conditions.

Cox proportional hazards (PH) model. Under the proportional hazards specification, the hazard rate is $\lambda(t, X, \beta, \lambda_0) = \phi(X, \beta)\lambda_0(t)$ where λ_0 is the baseline hazard. The function ϕ can be written as $\phi(X, \beta) = exp(X\beta)$ where X is a vector of covariates and β is the corresponding vector of parameters to be estimated. This way, each estimate is the constant proportional effect of the corresponding covariate on the conditional probability of having a debt spike episode. Researchers use nonparametric analysis to identify the most suitable baseline hazard. In particular, the Cox model does not specify the baseline hazard, but it can be estimated through the method of partial likelihood. Thus, the estimated coefficients indicate how the hazard changes with the covariates X. A positive β means that the covariate increases the hazard rate and shortens the expected waiting time for a debt spike. Time-invariant country factors can also be included to account for heterogeneity in baseline hazard rates between countries.

Estimating the debt spike hazard rate using survival methods allows us to assess the contribution of different factors to increase or decrease the instantaneous probability of a spike. This can help identify key drivers of debt acceleration episodes. Hence, after checking the assumption of proportional hazard of the Cox PH model using scaled Schoenfeld residuals, we complement our baseline results with an accelerated failure time model (AFT). Notice, however, that while in a PH model, the covariates act multiplicatively on the hazard, in an AFT model the covariates act multiplicatively on time. In both cases, we control for fixed effects. The set of covariates we use for these exercises comes from the literature on debt accelerations. These are primary balance, economic growth, stock-flow adjustment, total reserves, public debt, and real effective exchange rate. To alleviate concerns about multicollinearity, we lag all the covariates, except SFA, and introduce them one at a time in the regression. We additionally control for the existence of an IMF program, for a fiscal rule, and for the institutional quality of each country.

Panel A of Figure (3) shows the Kaplan-Meier estimates of the survivorship function for emerging and developed countries. After 2.5 years, there is a significant share of individuals (emerging countries) that enter a debt spike, while both groups have almost certainty of entering a crisis after more than 20 years. In Panel B, we can see the nonparametric (Epanechnikov) kernel estimates of the hazard. These estimates

help determine whether a monotonic function (such as exponential or Weibull) would be sufficient to model the duration until a debt spike episodes are observed, or if it would be more appropriate to include covariates in the form of a proportional hazards model. Interestingly, the nonmonotonic behavior (inverted U-shaped) is significant for both emerging and advanced countries. This calls for the application of advanced survival models that incorporate covariates, such as proportional hazards models.

3.2 Debt Trends and Debt Spikes

To have a complete understanding of the debt spikes, we also take into account the perspective of the debt trend. That is, we additionally analyze what determines a debt spike episode once countries are already in a debt trend. Notice, however, that being on a debt trend does not mean that a debt spike episode will materialize, but if we observe a debt spike episode, then with certainty a debt trend preceded it. For this analysis, we use a binary response model in which the dependent variable is the occurrence of the debt spike episode, conditioned by the existence of a debt trend. By conditioning on a debt trend, our original data turn into a *modified* cross-section, with potentially repeated units at different intervals of time. In that sense, our concern about endogeneity is, in principle, minimized. However, we also consider this possibility in our robustness checks. The specification for our analysis in this section is the following:

$$P(= 1|X) = \beta_0 + \beta_1 Th + \beta_2 X + \varepsilon \tag{7}$$

where T takes the value of 1 for an occurrence of a debt spike episode and 0 otherwise, Th is a continuous variable that captures the length of the debt trend (in years), and X represents the conditioning variable (real GDP growth, stock flow adjustment, real effective exchange rate, public debt, and reserves).

To get more insights into the conditioning effects of the debt trend length, we next consider an interacted specification by switching to a linear probability model (LPM). The LPM presents advantages over a probit or logit model when considering interaction terms due to its inherent simplicity in interpretation. LPM offers direct and easily understandable coefficients that directly relate to the probability change associated with a unit change in the predictor variable, simplifying the explanation of how the interaction

influences the outcome.[7] The main limitation is that the predicted probabilities can be outside [0,1]. However, since our primary interest is to analyze conditional marginal effects, the LPM is still preferred. In a general format, the specification is the following:

$$P(\ = 1|X) = \beta_0 + \beta_1 Th\ + \beta_2 X + \beta_3 Th * X + \beta_4\ + \varepsilon \qquad (8)$$

where T takes the value of 1 for an occurrence of a debt spike episode and 0 otherwise, Th is a continuous variable that captures the length of the debt trend (in years), X represents the conditioning variable (real GDP growth, SFA, real effective exchange rate, public debt, and reserves) one at a time, while is the vector of the remaining controls (excluding the conditioning variable).

4 Results

4.1 Main Findings

Table (3) presents our main results for the whole sample. Columns (1), (3), and (5) present the estimates for the Cox PH, while columns (2), (4), and (6) those for the AFT models.[8] To justify the inclusion of an AFT model, we test the assumption of constant proportional hazards of Cox models. For the specifications in columns (1), (3), and (5) the null hypothesis of constant proportional hazard (Schoenfeld residual) is globally rejected (table (II.1)), so an AFT model is analyzed. In Table (3), most of the variables are statistically significant with the expected sign and the results are consistent across specifications. Let us first focus on column (1) where we restrict our covariates to those exhibiting minimal correlation. Here, an increment of one percentage point of the SFA, increases the hazard rate (the probability of entering a debt spike) by 17.7% ($\approx [(0.163) - 1] * 100$). Similarly, an increase of one percentage point in reserves leads to an 11.2% decrease in the hazard rate. It should also be noted that real currency depreciations raises the likelihood of debt spikes.

[7] The interaction coefficient in a probit model does not have a straightforward interpretation. It captures how the effect of one variable (X1) on the z-score changes with another variable (X2). The marginal effects depend on all covariate values through the normal CDF. In contrast, the coefficient on the interaction term in an LPM directly gives the marginal effect of X1 on the probability of Y = 1 as X2 changes

[8] The total number of observations remains the same, for comparison purposes.

Columns (3), (5), and (7) present the estimates of a Cox PH model with additional controls: Primary balance, GDP growth, IMF program, the existence of fiscal rules, and the institutional quality index. In particular, columns (5) and (6) constitute our chosen baseline specification. Interestingly, GDP growth, reserves, and REER growth are consistently significant across specifications, with the expected signs, and with similar point estimates as column (1). Furthermore, the effect of fiscal rules is significant and represents a reduction in the hazard rate of approximately 9.9%. This effect is consistent with the large literature on the benefits of fiscal rules for debt sustainability. Our institutional quality standardized index only significantly enters in column (9), but with a modest effect, around 1.8%. Lastly, an agreement with the IMF may not have a significant statistical effect. However, it is possible that the timing of these agreements could affect their effectiveness, which is further analyzed in the robustness checks section.

At this point, it is important to consider the different interpretations of the AFT model compared to the Cox model when comparing the results with columns (2), (4), (6), (8), and (10). In this case, from column (2), a one percentage point increase of the SFA in the AFT model reduces the "survival time" of a country (increases the probability of a debt spike) in 31% ($\approx [(-0.377) - 1] * 100$). This point estimate for the Cox PH model is higher than that of column (1), and the same trend is observed for some other regressors, which also appear to be higher than those in column (1). For example, a one percentage point increase in reserves as a share of GDP increases the survival time (reducing the probability of a debt spike) in 22.5% compared to 11.2% from column (1).

Column (1) presents an unexpected result with respect to the public debt. Interestingly, it displays a negative coefficient for the Cox PH model. This result might be attributed to the possibility that the average effect does not capture the complexity of the entire distribution of public debt. To take stock of this, we proceed in two steps.

First, in table (4), we re-estimate our specifications by making use of measures of dummy variables that capture public debt as a share of GDP at different percentiles of its distribution.[9] Our results in columns (1), (3), (5), (7), and (9) now show that increasing

[9] We exclude the first interval and then include public debt between the 20th and 39th percentile, between the 40th and 59th percentile, between the 60th and 79th percentile, and then above the 80th percentile.

public debt, when it is between the 20th and 39th percentile, increases the hazard rate (the likelihood of entering a debt spike period), compared to the group below the 20th percentile. This finding supports our expectations that increases in public debt at lower levels are usually caused by liquidity problems rather than solvency issues. A similar effect seems to be at play when public debt is between the 40th and 59th percentiles, and between the 60th and 79th percentiles. These results are also present with the AFT model. The rest of the point estimates are consistent with table (3), they all remain significant and with similar magnitudes.

Second, emerging countries consistently show higher levels of public debt as a share of GDP than advanced countries. Therefore, in table (5) we keep our baseline specification and divide the sample into advanced and emerging countries to unravel some of those effects. Consistent with table (3), an increase of one percentage point in SFA increases the hazard rate (probability of entering a debt spike episode) by 15.4% in emerging countries, while 28.6% in advanced countries. There is some evidence that an increase of one percentage point in public debt seems to reduce the likelihood of entering a debt spike in advanced countries, but less in emerging countries. This could be explained by the differences in the level of public debt between countries. Thus, similar to table (4), in table (6) we re-estimate our baseline specification, distinguishing by type of country, and using dummy variables to capture public debt as a share of GDP at different percentiles of its distribution. In general terms, the results in table (6) are consistent with those in table (4) with a differential effect between countries. For advanced countries, the AFT model reveals that increasing public debt when between the 20th and the 80th percentile increases the likelihood of entering a debt spike period, compared to the group below the 20th percentile. This effect does not appear to survive when estimated using a Cox model, where almost all percentiles do not show significance. For emerging countries, both the Cox model and the AFT model consistently show that higher levels of public debt, in terms of percentiles, are associated with a greater likelihood of experiencing debt spike episodes.[10]

Following our empirical strategy using equation (7), table (7) presents the results from our analysis on debt spike episodes once countries are already in a debt trend.

[10] The negative signs associated with public debt from tables (3) and (5) appear to be driven by advanced countries with public debt levels above the 80th percentile.

For this, we use a probit model on the probability of an occurrence of a debt spike episode, keeping our baseline specification and adding *Trend Length* as an additional regressor.[11] Columns (1)-(3) report the marginal effects for the whole sample, advanced, and emerging countries, respectively. Columns (4)-(6) follow the same logic, but add the index of institutional quality. Our results suggest that the longer a country is in a debt trend, the greater the likelihood of experiencing a debt spike. Interestingly, when controlling for the quality of institutions, this last effect seems to be more relevant for advanced countries than for emerging ones. Table (7) reports marginal effects; therefore, we can also analyze the economic relevance of the results. As expected, real GDP growth and, particularly, reserves seem to reduce the probability of entering a debt spike episode: once a country enters a debt trend, a one percentage point increase in the ratio reserves-to-GDP tends to decrease the probability of eventually experiencing a debt spike episode by 51%. Increasing public debt or the SFA is associated with an increase in the likelihood of entering a debt spike episode. Note that once a country enters a debt trend, a one percentage point increase in SFA increases the likelihood of eventually experiencing a debt spike episode by 68%. Interestingly, the primary balance and the growth rate of REER do not appear significant. Based on these findings, when facing the prospect of a debt spike episode, a sound policy focused on the management of public debt may prove to be more effective than improvements to the primary balance.

To gain further insight into the conditioning effects of the length of the debt trend, we now consider an interacted specification, following equation (8), using a LPM. The conditioning variables –analyzed one at a time– are real GDP growth, SFA, the growth rate of the real effective exchange rate, public debt, and reserves. For this analysis, we skip the regression output but present the marginal effects of each conditioning variable by the length of the debt trend. Figures (4) to (8) present these results for advanced and emerging countries, keeping a common y-axis.

Figure (4) indicates that in advanced countries, an increase in the growth rate of real GDP has a constant negative effect, regardless of the number of years in a debt trend. However, in emerging countries, an increase in real GDP growth also has a negative effect (reducing the probability of entering a debt spike episode) but tends to become smaller as the country remains under the debt trend for a longer time. In both

[11] This setup implies working with a dataset without a clear time dimension.

figures, the effects seem to be significant for the first 7 or 8 years after countries enter a debt trend episode.

The results of SFA are presented in Figure (5). In this case, when advanced countries enter a debt trend, an increase in the SFA tends to increase the probability of experiencing a debt spike episode. Interestingly, the likelihood remains positive over time but tends to decrease the longer they are in a debt trend. For emerging countries, the same positive effect is present, but a more constant effect can be observed over time. This means that the positive relationship between SFA and debt spike episodes is not affected by the length of time that countries are in a debt trend. It should be noted that the effects on debt spike episodes are always greater than one in these figures. This is likely due to the fact that the conditional expectation function is highly nonlinear. Therefore, the LPM seems to produce outcomes that are outside the [0,1]. Thus, even though these results are consistent with Table (7) and show the expected direction of change, we need to treat their economic significance with caution.

In Figure (7), we observe that the impact of public debt is significant for emerging countries. When these countries are on a debt trend, an increase in public debt tends to increase the probability of experiencing a debt spike episode. However, this effect seems to decrease over time. After 8 years, further increases in public debt do not seem to affect the likelihood of entering a debt spike episode. Finally, Figure (8) presents the results for reserves as a share of GDP. In this case, when emerging countries enter a debt trend, an increase in their reserves tends to reduce the probability of a debt spike episode. However, this shielding effect gradually decreases over time and becomes insignificant after 7 years.

4.2 SFA: Endogeneity Issues

In the previous subsection, we characterized the role of the debt trend and SFA as critical drivers of spike debt episodes. Interestingly, we found some heterogeneity in how the debt trend interacts with these drivers, such as SFA and reserves. Considering the unique characteristics of the dataset (a modified panel and cross-section, with units potentially recurring at various time intervals), our analysis inherently presumes that reverse causality is not an issue. That is, causality runs from SFA to debt spike

episodes, but not the other way around. This approach has traditionally been followed by researchers in the field, such as Weber (2012), Jaramillo et al. (2017), and Afonso and Jalles (2020). However, ignoring the possibility of reverse causality and endogeneity might lead to a misleading picture.

To address the concern about the endogeneity of SFA, in this subsection, we use an instrumental variables (IV) approach. We follow a linear specification that requires fewer distributional assumptions than a more structural approach like probit. This IV estimation has several advantages, including a simpler interpretation of the point estimates and the ability to test for the validity of overidentifying instruments and for the existence of weak instruments. By not restricting our analysis to being on a debt trend, our dataset exhibits the properties of a panel. However, finding an appropriate instrument for SFA is a challenging task. Therefore, we rely on the existing literature that has addressed comparable problems.[12]. Following Aklin, Kern and Negre (2021) and Garriga and Rodriguez (2023), we construct an instrument for SFA based on a dyadic measure that captures for each country , the regional average excluding country . The main argument for this, is that SFA can show a regional diffusion pattern that does not necessarily affect the domestic probability of entering a spike debt episode.

Nevertheless, there could be shortcomings in this first approach, so we also construct another instrument. Weber (2012) discusses that greater fiscal transparency, broadly defined, enables a more thorough examination of government finances, making it more challenging for the government to employ deceitful fiscal tactics. This would also improve the accuracy of fiscal information. There is some evidence from previous studies that shows how transparency in handling public finances enhances fiscal performance and sustainability, while also decreasing corruption and market volatility, and improving the economic outlook (Glennerster and Shin, 2008; Peat, Svec and Wang, 2015; Arbatli and Escolano, 2015). Thus, the addition of a measure of fiscal transparency can help address the variation in SFA without impacting the likelihood of entering a debt spike episode. However, measuring fiscal transparency is also a challenging task.

Some scholars have used the report on Observance of Standards and Codes

12For instance, Jácome and Vázquez (2008), Bodea and Hicks (2015), Garriga and Rodriguez (2020), use the lagged values of the central bank independence (CBI) index as an instrument for CBI. In fact, that literature also suggests that one of the main drivers of CBI is regional diffusion (Bodea and Hicks, 2015; Polillo and Guillén, 2005)

(ROSC, as described in Hameed (2005)) and the index of quality of budget institutions created by Dabla-Norris, Allen, Zanna, Prakash, Kvintradze, Lledo, Yackovlev and Gollwitzer (2010), as measures of fiscal transparency. Unfortunately, these datasets do not have a panel structure with enough observations to assess our main question. As an alternative approach, we use the *Open Budget Index* (OBI) from the *International Budget Partnership*. Seifert, Carlitz and Mondo (2013) explain that the OBI offers factual information on the transparency of budget processes in approximately 120 countries since 2006, making it a preferable measure. However, when using this variable as an instrument for SFA, our sample size is significantly reduced by 72%, leading to considerably larger standard errors. The primary rationale for incorporating the OBI is the observed correlation between fiscal transparency and accounting practices, which may influence the SFA but does not directly affect the likelihood of experiencing a debt spike episode. The OBI scale spans from 0 to 100, with 100 indicating the highest level of fiscal transparency and zero being a complete lack of transparency.

As an additional methodology, we also use an instrumental variables approach that exploits the presence of heteroscedasticity in the regression residuals to construct a set of internal instruments that allows the identification of a causal relationship when external instruments are not available – identification through heteroscedasticity (IH).[13] Following Lewbel (2019)'s methodology, as long as we have heteroscedasticity in the data, internal instruments can be used.[14] Given the number of regressors we have, the parameters of interest are obtained using GMM.

Table (8) displays the outcomes of our IV analysis for the complete sample using the baseline specification. Column (1) shows the results of a fixed effects estimation, whereas the remaining columns employ an IV approach, with each column from (2) to (5) representing a distinct set of instruments. Column (2) uses the average level of SFA in the country's region and its interaction with the lagged value of SFA as

13 The methodology we follow here, was developed by Rigobon (2003); Lewbel (2012), and Baum and Lewbel (2019).

14 Lewbel (2012) considers a (structural simultaneous) model of the form:

$$T_1 = X\beta_1 + T_2\gamma_1 + \epsilon_1 \tag{9}$$

$$T_2 = X\beta_2 + T_1\gamma_2 + \epsilon_2 \tag{10}$$

where T_1 and T_2 are endogenous variables, X is a vector of observed exogenous variables, and $\epsilon = (\epsilon_1, \epsilon_2)$ unobserved errors (that may be correlated with each other).

instruments. Column (3) uses the same set of instruments as in column (2) along with the lagged value of the average level of SFA in the country's region. Column (4) uses the same set of instruments as in column (3) in addition to the lagged values of the OBI. Finally, column (5) presents the results for IH. In general, our results remain qualitatively similar compared to our baseline in Table (3). Interestingly, columns (2) to (4), show that the effect of SFA on the probability of entering a debt spike episode appears to be higher compared to our baseline in Table (3). Consequently, we consider this method to allow us to estimate the upper bound of the effect. In addition, we reject the hypothesis that our instruments are weak (F-statistic of the excluded instruments), and the overidentification tests cannot reject the null hypothesis that instruments are valid and correctly excluded from the estimation equation. Lastly, column (5) shows significant estimates with expected signs and magnitudes similar to our baseline in Table (3).

4.3 Sensitivity Analysis

We conducted multiple additional tests to ensure the robustness of the main results and found that they are indeed robust. The appendices at the end of this paper and the Online Appendix provide the details of these tests, so we just summarize them in this subsection.

Good times - bad times. In Appendix I, we focus our analysis on the periods when the economy is experiencing booms and contractions. To accomplish this, we use the Hamilton (2017) filter to separate the GDP of each country into additive trends and cyclical components.[15] By allowing for time-varying parameters, the Hamilton filter tends to produce business cycle components that are consistent with historical recessions and expansions. We consider good times as periods when the cyclical components, as a percentage of the trend, are positive. Conversely, we define bad times as periods when the cyclical components, as a percentage of the trend, are negative.[16] Our baseline results remain qualitatively similar, with all variables remaining significant. Interestingly, during good times, the effect of SFA on the hazard rate is about 57% while

[15] Applying the Hodrick-Prescott filter yields results that are quite similar.

[16] We also performed this analysis defining good times as positive real GDP growth, and bad times as negative real GDP growth with very similar results. Results are not presented here but are available upon request.

it is only around 10% during bad times. This suggests that other factors become more influential during recessions, affecting the likelihood of entering a debt spike episode.

Lags of key variables. In Appendix I, we lag additional explanatory variables, such as real GDP growth, public debt, and primary balance, to check the robustness of our results to the timing of the variables. We consider two and three lags, separately. In all cases, our results remain consistent with the baseline and with the same level of significance.

Different debt thresholds. In the Online Appendix, we first analyze the sensitivity of our results to the definition of the debt threshold. We make it laxer (20%, instead of the 10% of GDP that we consider in the baseline); therefore, we detect more cases of debt trends with the same number of debt spikes. Despite this modification, our findings remain consistent with the baseline, with very similar point estimates. We also find that the effect of SFA in developed countries is greater than in emerging economies. This could be capturing the fact that during the period of analysis, advanced countries have averaged debt-to-GDP ratios of around 70% compared to 50% for emerging countries.

Alternative measures of SFA. In the second and third parts of the Online Appendix, we analyze the sensitivity of our results to the definition of SFA. First, we consider a measure of SFA that accounts for growth and inflation dynamics (following equation (4)). Second, we also adjust for valuation effects (following equation (5)). Despite the significant reduction in the sample size, in both cases, but particularly when considering valuation effects, results remain consistent with our baseline with similar effects and significance levels. Interesting, the magnitude of the effect of SFA appears to be smaller when considering valuation effects relative to other measures. This could be due to the fact that, compared to our baseline, the growth, inflation, and valuation effects are now explicitly taken into account.

Differences by region and income. In the final section of the Online Appendix, we re-estimate our baseline specification by differentiating between regions and income levels. Firstly, except for Europe and Central Asia, our findings hold true across all regions. Notably, Latin American countries appear to be the primary contributors to the SFA effects, with an average of about 4.5% of GDP during the period of analysis, the highest of all the regions. Secondly, our results are consistent across all income levels,

with point estimates closely matching our baseline. Interestingly, the impact of SFA is more pronounced in high-income countries compared to middle and low-income countries. This aligns with the fact that most high-income countries, as classified by the World Bank, are developed countries.

5 Concluding Remarks

In this paper we analyze the drivers of the surges in public debt, with a particular focus on the role of SFA. Analyzing data from 172 countries spanning 1980 to 2021, we uncover several significant findings. SFA are crucial in driving debt accumulation, particularly during substantial debt surge episodes in both advanced and developing countries. An increase in SFA significantly raises the chances of entering a debt spike episode, with a one percentage point rise in SFA increasing the hazard rate by between 15 and 29%. Once a debt trend begins, the likelihood of encountering a spike continues to grow with SFA. This effect is substantial - a one percentage point increase in SFA elevates the spike probability by 68%.

We address the self-selection problem associated with SFA by using an IV approach that relies on a combination of instruments, based on the notion that fiscal transparency in handling public finances enhances fiscal performance and sustainability. In addition, we conducted multiple analyses to ensure the robustness of the main results. We find strong evidence that our findings are consistent and economically significant.

Overall, our results point to the risk of opaque below-the-line operations and accounting practices captured in SFA, and the need for greater fiscal transparency. Our findings also reinforce the vulnerability of emerging countries to currency mismatches and balance sheet effects that can be reflected in SFA. These findings have significant consequences for policymakers, highlighting the necessity to improve fiscal risk management, prevent foreign exchange discrepancies, and foster sustainable fiscal policies to minimize the chances of debt spikes. For instance, in Latin America, SFA are frequently linked with public enterprises. When state-owned enterprises cover their deficits through borrowing instead of transparently reporting subsidies in the budget, it contributes to the SFA. Such quasi-fiscal activities outside the budget process can make fiscal and debt analyses in the region more complex.

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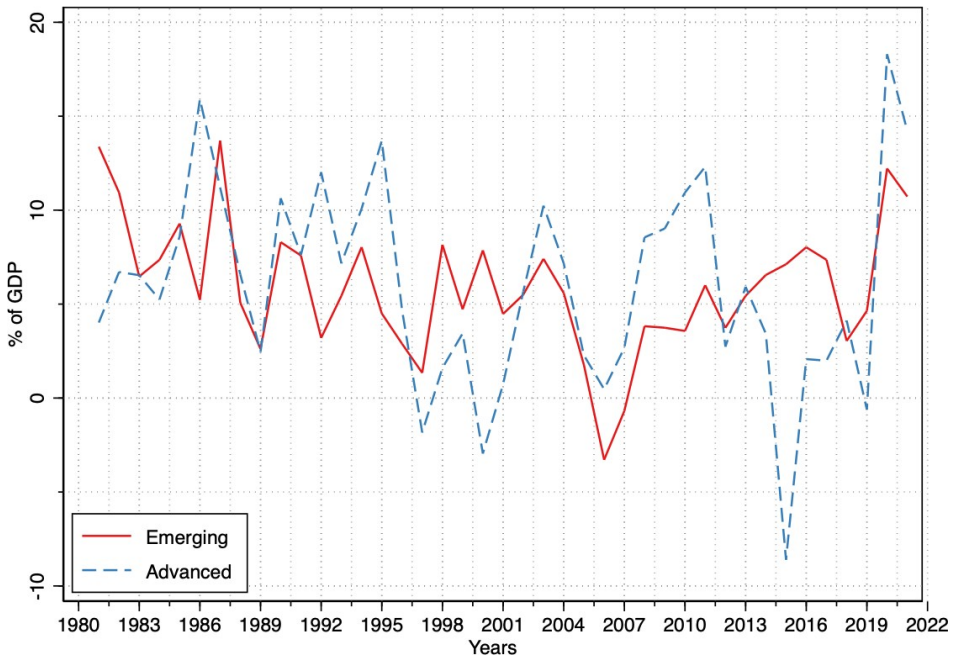
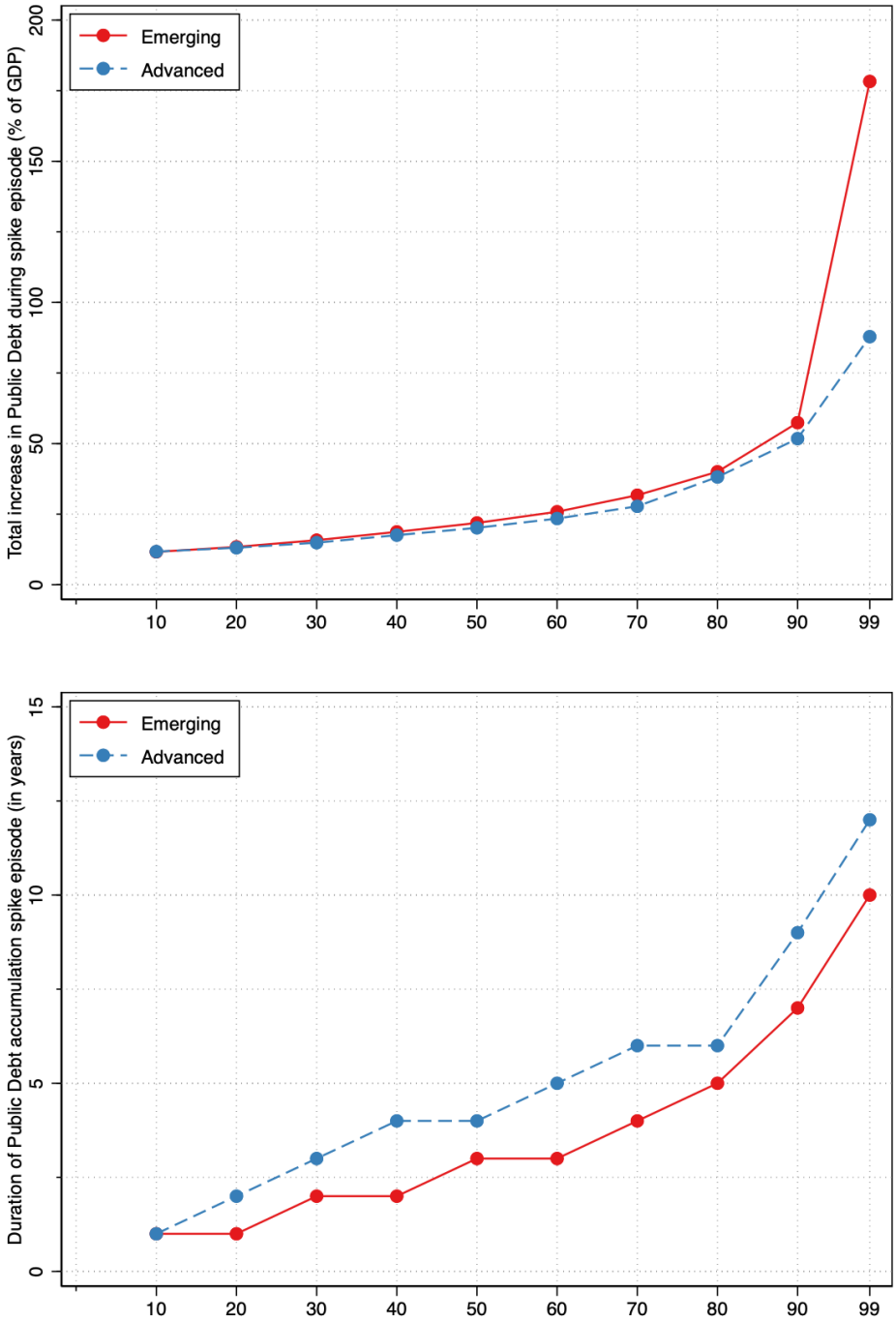
Figures

Figure 1: Average Stock Flow Adjustments



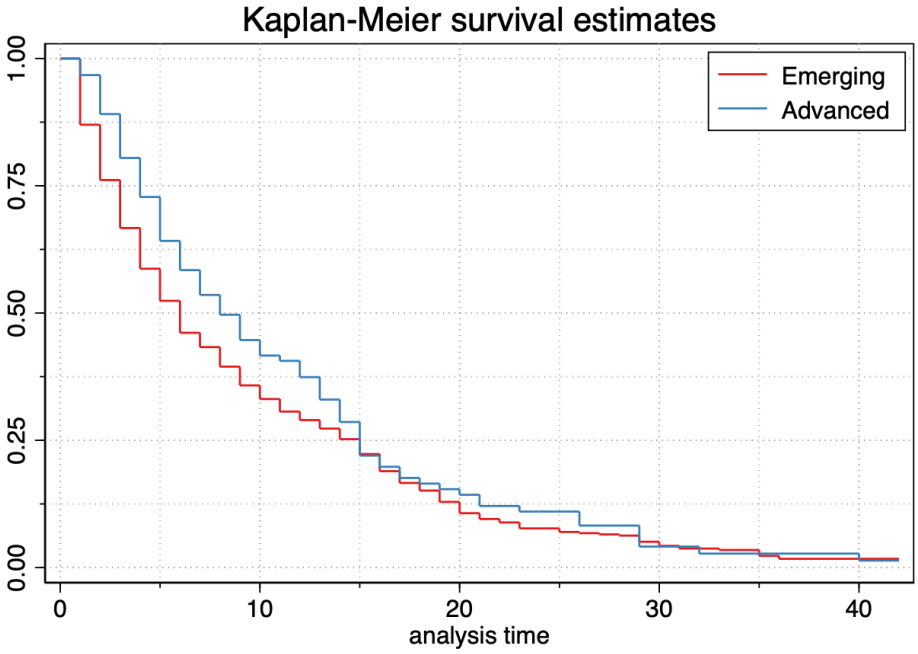
Note: This figure shows the average SFA as a share of GDP (following equation (2)) for advanced and emerging countries from 1980-2021.

Figure 2: Public Debt Spike Episodes: Size and Duration

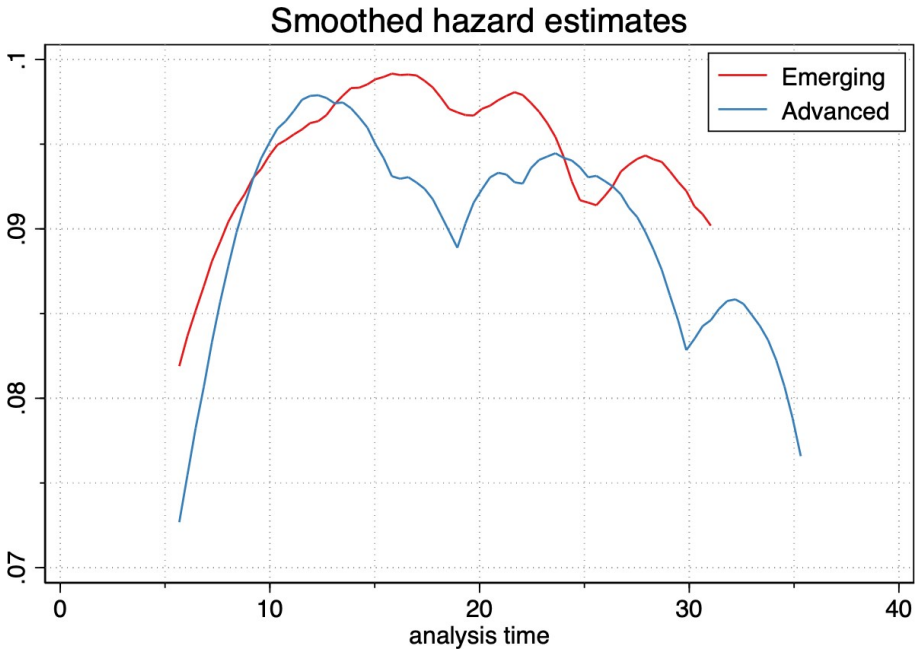


Note: These figures compare to Figure 3 from Jaramillo et al. (2017).

Figure 3: Survivorship to Debt Episode and Hazard Ratios



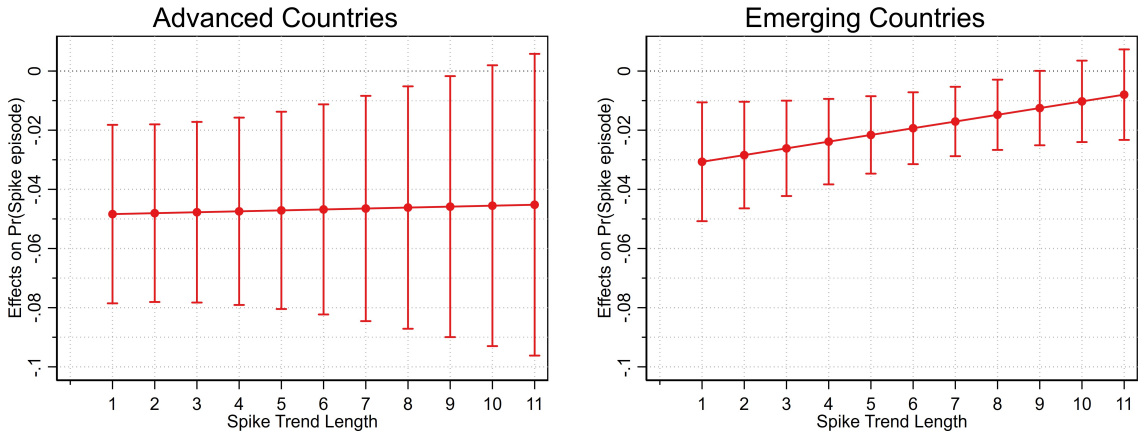
(a) Survival Estimates



(b) Hazard rate

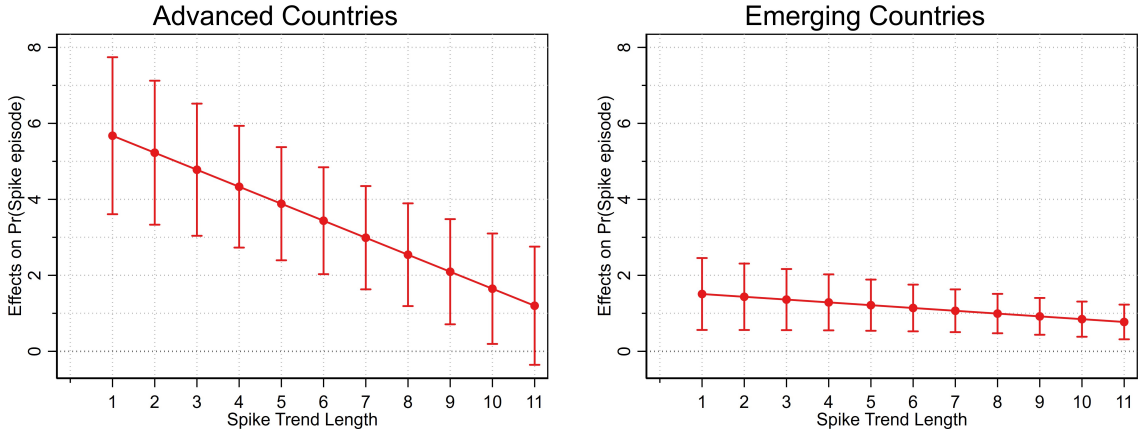
Note: Panel (a) of the figure shows estimated survival probabilities (Kaplal-Meier) for advanced and emerging countries for the full period. Panel (b) shows non-parametric hazard estimates of advanced and emerging countries, for the same period.

Figure 4: Debt Spike Episode, Average Marginal Effect of Growth



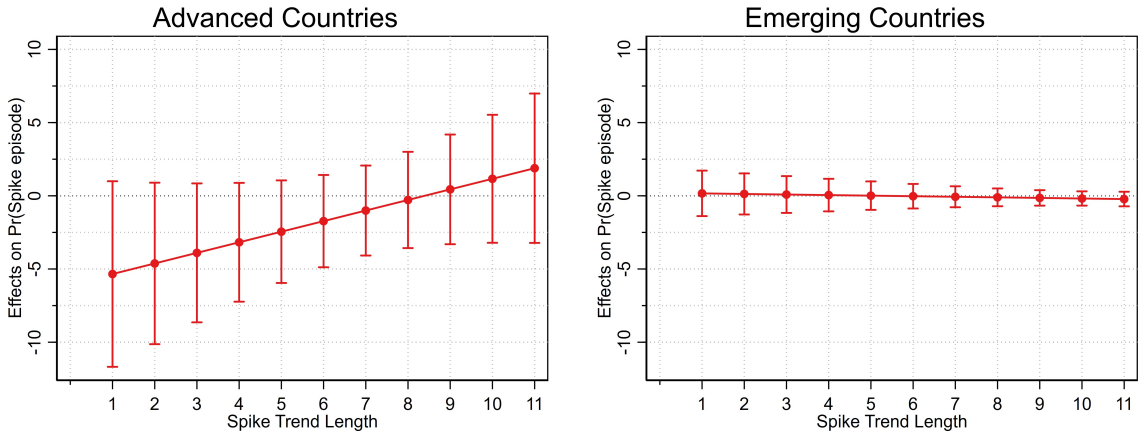
Note: These figures show the marginal effect of GDP growth on the likelihood of having a debt spike episode at different spike trend lengths, for advanced and emerging countries.

Figure 5: Debt Spike Episode, Average Marginal Effect of Stock Flow Adjustment



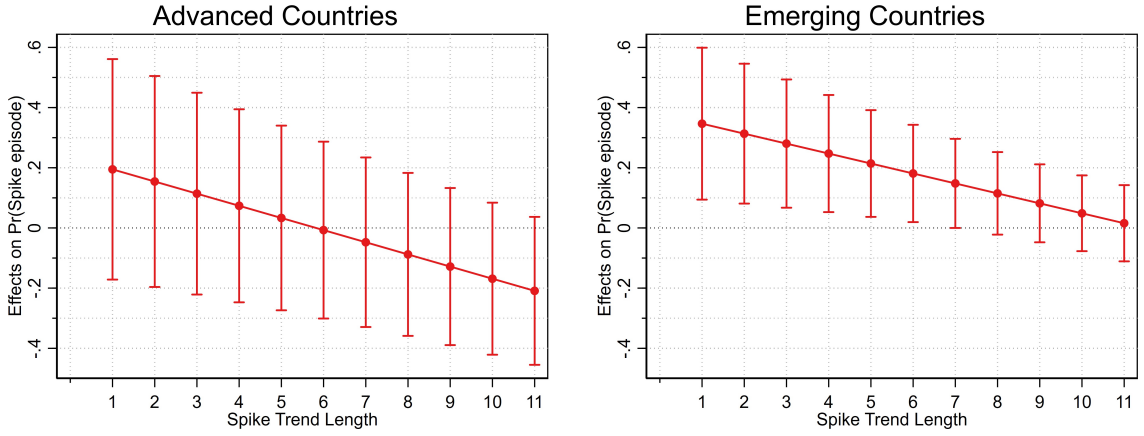
Note: These figures show the marginal effect of SFA on the likelihood of having a debt spike episode at different spike trend lengths, for advanced and emerging countries.

Figure 6: Debt Spike Episode, Average Marginal Effect of REER Growth



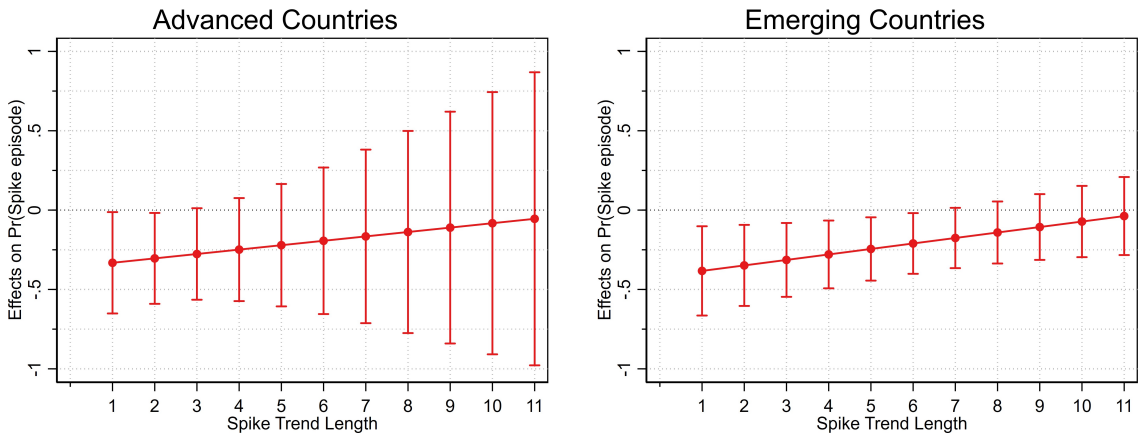
Note: These figures show the marginal effect of REER growth on the likelihood of having a debt spike episode at different spike trend lengths, for advanced and emerging countries.

Figure 7: Debt Spike Episode, Average Marginal Effect of Public Debt



Note: These figures show the marginal effect of public debt on the likelihood of having a debt spike episode at different spike trend lengths, for advanced and emerging countries.

Figure 8: Debt Spike Episode, Average Marginal Effect of Reserves



Note: These figures show the marginal effect of reserves on the likelihood of having a debt spike episode at different spike trend lengths, for advanced and emerging countries.

Tables

Table 1: Debt trends and debt spike episodes. 1980-2021

	All		Emerging		Advanced	
	(1)	(2)	(3)	(4)	(5)	(6)
	Debt Trend	Debt Spike	Debt Trend	Debt Spike	Debt Trend	Debt Spike
Number	611	597	492	501	119	96
Average size (in years)	7.4	2.3	7.5	2.2	7	2.9
Average time to an event (in years)	4.4	8.1	4.4	7.9	4.7	9

Table 2: Descriptive Statistics

	(1)	(2)	(3)
	All	Emerging	Advanced
Stock Flow Adj			
Mean	0.0534	0.0526	0.0564
SD	0.164	0.179	0.0945
Reserves			
Mean	0.152	0.158	0.131
SD	0.324	0.348	0.207
Public Debt			
Mean	0.551	0.553	0.547
SD	0.462	0.481	0.373
REER Growth			
Mean	0.0165	0.0181	0.0101
SD	0.286	0.314	0.124
Primary Balance			
Mean	-0.00454	-0.00511	-0.00245
SD	0.0622	0.0674	0.0373
Growth			
Mean	3.023	3.130	2.565
SD	5.883	6.335	3.288
Observations	6951	5605	1346

This table reports the sample average, standard deviation, and number of observations for the main variables in our analysis

Table 3: Duration Analysis of Debt Spikes. Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.163***	-0.377***	0.157***	-0.382***	0.154***	-0.341***	0.150***	-0.328***	0.151***	-0.330***
	(0.022)	(0.077)	(0.028)	(0.089)	(0.028)	(0.084)	(0.028)	(0.092)	(0.027)	(0.094)
Reserves	-0.119***	0.203***	-0.143***	0.271***	-0.139***	0.287***	-0.140***	0.274***	-0.147***	0.278***
	(0.016)	(0.064)	(0.019)	(0.069)	(0.020)	(0.072)	(0.021)	(0.072)	(0.022)	(0.074)
Public Debt	-0.044***	0.011	-0.052***	0.029	-0.046***	0.029	-0.044***	0.043**	-0.044***	0.044**
	(0.007)	(0.020)	(0.008)	(0.020)	(0.008)	(0.019)	(0.008)	(0.021)	(0.008)	(0.022)
REER Growth	-0.211***	0.407***	-0.201***	0.370***	-0.208***	0.353***	-0.194***	0.328***	-0.193***	0.326***
	(0.024)	(0.078)	(0.024)	(0.074)	(0.025)	(0.069)	(0.023)	(0.060)	(0.024)	(0.060)
Primary Balance			-0.160***	0.277***	-0.185***	0.600***	-0.188***	0.614***	-0.186***	0.612***
			(0.037)	(0.100)	(0.042)	(0.201)	(0.042)	(0.187)	(0.042)	(0.189)
Growth					0.001**	0.002**	0.001**	0.002**	0.001*	0.002**
					(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
IMF Program							-0.003	-0.008	-0.003	-0.009
							(0.003)	(0.011)	(0.003)	(0.011)
Fiscal Rule							-0.104***	0.126***	-0.103***	0.129***
							(0.028)	(0.029)	(0.028)	(0.030)
Inst. Quality									-0.019**	0.017
									(0.008)	(0.023)
Observations	4620	4620	4351	4351	4278	4278	4278	4278	4278	4278
No. of Countries	161	161	158	158	158	158	158	158	158	158
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	13306.44	7465.58	12321.36	6906.95	12156.67	6787.32	12109.38	6738.63	12102.74	6739.29

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Table 4: Duration Analysis of Debt Spikes by Public Debt Percentiles. Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.168***	-0.320***	0.171***	-0.307***	0.162***	-0.276***	0.156***	-0.259***	0.157***	-0.260***
	(0.022)	(0.057)	(0.029)	(0.071)	(0.029)	(0.069)	(0.029)	(0.076)	(0.028)	(0.077)
Reserves	-0.113***	0.148***	-0.134***	0.193***	-0.124***	0.212***	-0.129***	0.201***	-0.136***	0.202***
	(0.016)	(0.057)	(0.019)	(0.064)	(0.019)	(0.069)	(0.021)	(0.069)	(0.022)	(0.071)
Public Debt (20-39)	0.031***	-0.111***	0.028***	-0.106***	0.030***	-0.107***	0.029***	-0.105***	0.028***	-0.105***
	(0.010)	(0.027)	(0.010)	(0.029)	(0.010)	(0.028)	(0.010)	(0.028)	(0.010)	(0.028)
Public Debt (40-59)	0.030***	-0.153***	0.025**	-0.141***	0.028***	-0.135***	0.026**	-0.137***	0.026**	-0.137***
	(0.010)	(0.026)	(0.011)	(0.030)	(0.011)	(0.029)	(0.011)	(0.029)	(0.011)	(0.029)
Public Debt (60-80)	0.021*	-0.173***	0.015	-0.161***	0.021*	-0.158***	0.020*	-0.163***	0.019*	-0.163***
	(0.011)	(0.028)	(0.011)	(0.031)	(0.011)	(0.030)	(0.012)	(0.031)	(0.012)	(0.031)
Public Debt (Above 80)	0.007	-0.184***	-0.002	-0.165***	0.006	-0.157***	0.005	-0.153***	0.006	-0.153***
	(0.012)	(0.030)	(0.013)	(0.032)	(0.013)	(0.031)	(0.013)	(0.032)	(0.013)	(0.032)
REER Growth	-0.223***	0.344***	-0.219***	0.314***	-0.223***	0.303***	-0.205***	0.288***	-0.204***	0.286***
	(0.023)	(0.079)	(0.023)	(0.074)	(0.023)	(0.071)	(0.022)	(0.063)	(0.023)	(0.063)
Primary Balance			-0.120***	0.236***	-0.180***	0.552***	-0.187***	0.569***	-0.185***	0.568***
			(0.036)	(0.083)	(0.043)	(0.199)	(0.043)	(0.187)	(0.043)	(0.188)
Growth					0.001***	0.002**	0.001***	0.002**	0.001***	0.002**
					(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
IMF Program							-0.001	0.001	-0.001	0.001
							(0.003)	(0.011)	(0.003)	(0.011)
Fiscal Rule							-0.104***	0.117***	-0.104***	0.119***
							(0.025)	(0.031)	(0.025)	(0.031)
Inst. Quality									-0.017**	0.010
									(0.008)	(0.021)
Observations	4620	4620	4351	4351	4278	4278	4278	4278	4278	4278
No. of Countries	161	161	158	158	158	158	158	158	158	158
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	13359.07	7374.36	12371.12	6839.98	12206.28	6727.71	12155.23	6680.97	12150.32	6682.45

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Table 5: Duration Analysis of Debt Spikes (Advanced and Emerging Economies). Panel Data from 1980-2021.

	Cox PH		AFT	
	(1)	(2)	(3)	(4)
	Advanced	Emerging	Advanced	Emerging
Stock Flow Adj	0.252***	0.144***	-1.112***	-0.281***
	(0.033)	(0.029)	(0.218)	(0.069)
Reserves	-0.090***	-0.161***	0.260**	0.220***
	(0.033)	(0.023)	(0.116)	(0.063)
Public Debt	-0.091***	-0.021*	0.072**	0.006
	(0.014)	(0.011)	(0.031)	(0.016)
REER Growth	-0.368***	-0.191***	0.868***	0.337***
	(0.090)	(0.026)	(0.313)	(0.070)
Primary Balance	-0.397***	-0.136***	1.115***	0.302**
	(0.099)	(0.048)	(0.417)	(0.140)
Growth	0.001	0.001***	0.011***	0.002**
	(0.001)	(0.000)	(0.003)	(0.001)
Observations	1009	3269	1009	3269
No. of Countries	33	125	33	125
FE	Yes	Yes	Yes	Yes
AIC	2507.29	8585.68	1662.07	4933.80

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Table 6: Duration Analysis of Debt Spikes (Advanced and Emerging Economies) by Public Debt Percentiles. Panel Data from 1980-2021.

	Cox PH		AFT	
	(1)	(2)	(3)	(4)
	Advanced	Emerging	Advanced	Emerging
Stock Flow Adj	0.299***	0.145***	-1.114***	-0.229***
	(0.036)	(0.030)	(0.200)	(0.056)
Reserves	-0.166***	-0.157***	0.243*	0.161***
	(0.059)	(0.024)	(0.126)	(0.056)
Public Debt (20-39)	0.009	0.032***	-0.127*	-0.096***
	(0.030)	(0.011)	(0.069)	(0.028)
Public Debt (40-59)	-0.016	0.030**	-0.152**	-0.117***
	(0.030)	(0.012)	(0.073)	(0.028)
Public Debt (60-80)	-0.025	0.019	-0.141*	-0.137***
	(0.031)	(0.013)	(0.073)	(0.028)
Public Debt (Above 80)	-0.087***	0.021	-0.071	-0.157***
	(0.032)	(0.015)	(0.080)	(0.030)
REER Growth	-0.378***	-0.198***	0.845***	0.291***
	(0.091)	(0.025)	(0.286)	(0.069)
Primary Balance	-0.396***	-0.132***	1.072***	0.268**
	(0.096)	(0.051)	(0.399)	(0.133)
Growth	0.002*	0.001***	0.011***	0.001
	(0.001)	(0.000)	(0.003)	(0.001)
Observations	1009	3269	1009	3269
No. of Countries	33	125	33	125
FE	Yes	Yes	Yes	Yes
AIC	2528.75	8581.87	1655.09	4874.10

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Table 7: Marginal Effect of SFA on Debt Spikes over Debt Trends. 1980-2021.

	(1) All Sample	(2) Advanced	(3) Emerging	(4) All Sample	(5) Advanced	(6) Emerging
Trend Length	0.033***	0.030***	0.034***	0.037***	0.037***	0.038***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
Stock Flow Adj	0.681**	0.624**	0.697**	0.714**	0.700**	0.718**
	(0.319)	(0.286)	(0.328)	(0.328)	(0.318)	(0.332)
Reserves	-0.518***	-0.475***	-0.531***	-0.410***	-0.402***	-0.412***
	(0.099)	(0.086)	(0.104)	(0.096)	(0.089)	(0.099)
Public Debt	0.143***	0.131***	0.146***	0.182***	0.178***	0.183***
	(0.047)	(0.042)	(0.048)	(0.048)	(0.047)	(0.049)
REER Growth	0.191	0.175	0.196	0.208	0.204	0.209
	(0.410)	(0.375)	(0.420)	(0.411)	(0.402)	(0.413)
Primary Balance	-0.642	-0.588	-0.658	-0.524	-0.514	-0.527
	(0.468)	(0.431)	(0.479)	(0.459)	(0.450)	(0.462)
Growth	-0.039***	-0.036***	-0.040***	-0.037***	-0.036***	-0.037***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Inst. Quality				-0.180***	-0.177***	-0.181***
				(0.049)	(0.051)	(0.048)
Observations	471	108	363	471	108	363

Robust standard errors in parentheses

Notes: Marginal effect of the change in the probability of entering a debt spike conditional on being on a debt trend,

Table 8: Effect of SFA on Debt Spikes over Debt Trends. Instrumental Variables. 1980-2021.

	(1)	(2)	(3)	(4)	(5)
Stock Flow Adj	0.644***	0.748***	0.738***	0.394***	0.260**
	(0.161)	(0.236)	(0.233)	(0.147)	(0.108)
Reserves	-0.290***	-0.291***	-0.285***	-0.048	-0.222***
	(0.082)	(0.060)	(0.060)	(0.307)	(0.070)
Public Debt	-0.031	-0.023	-0.025	0.119	-0.089***
	(0.024)	(0.028)	(0.028)	(0.114)	(0.023)
REER Growth	-0.728***	-0.743***	-0.772***	-0.833***	-0.682***
	(0.088)	(0.088)	(0.089)	(0.215)	(0.081)
Primary Balance	-0.993***	-0.881***	-0.890***	-1.980***	-1.400***
	(0.320)	(0.302)	(0.301)	(0.563)	(0.288)
Growth	-0.008***	-0.008***	-0.008***	-0.020***	-0.009***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.002)
Trend Length	0.011***	0.011***	0.011***	0.011**	0.013***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)
Pagan-Hall Test (P value)					0.000
F statistic		3919.86	1962.91	745.18	557.72
FE	Yes	Yes	Yes	Yes	Yes
Observations	4278	4256	4242	578	4278
No. of Countries	158	158	158	102	158
R-squared	0.2543	0.2502	0.2504	0.3528	0.1695

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: Linear probability models with the following instruments by column: (i) Column (1) is a fixed effects regression (with no instruments), (ii) Column (2) uses the average SFA in country's region (without country) and its interaction with the lagged SFA, (iii) Column (3) uses the same set of instruments as in Column (2) along with the lagged average level of SFA in country's region (without country), (iv) Column (4) uses the same set of instruments as in Column (3) in addition to the lagged average OBI (Open Budget Index). Column (5) reports the results for the identification through heteroscedasticity, following Lewbel (2019)'s methodology.

Table 9: Effect of SFA on Debt Spikes over Debt Trends (Emerging and Advanced countries). Instrumental Variables. 1980-2021.

	Emerging					Advanced				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Stock Flow Adj	0.553***	0.610***	0.598***	0.318***	0.234**	2.019***	2.432***	2.422***	2.734***	1.309***
	(0.141)	(0.206)	(0.203)	(0.100)	(0.102)	(0.250)	(0.294)	(0.290)	(0.782)	(0.287)
Reserves	-0.255***	-0.252***	-0.246***	0.098	-0.154*	-0.237	-0.221**	-0.226**	-0.098	-0.331***
	(0.091)	(0.072)	(0.072)	(0.334)	(0.084)	(0.159)	(0.096)	(0.096)	(0.630)	(0.119)
Public Debt	-0.020	-0.017	-0.018	0.126	-0.076***	-0.091	-0.076	-0.088	0.226	-0.129
	(0.024)	(0.026)	(0.026)	(0.118)	(0.023)	(0.099)	(0.065)	(0.065)	(0.377)	(0.081)
REER Growth	-0.721***	-0.729***	-0.733***	-0.821***	-0.695***	-1.159***	-1.247***	-1.267***	0.336	-1.054***
	(0.086)	(0.087)	(0.089)	(0.201)	(0.084)	(0.243)	(0.264)	(0.267)	(1.168)	(0.272)
Primary Balance	-0.698***	-0.644**	-0.654**	-1.625***	-1.110***	-1.540**	-1.018*	-1.096*	0.278	-2.959***
	(0.263)	(0.257)	(0.256)	(0.545)	(0.258)	(0.722)	(0.586)	(0.584)	(1.946)	(0.617)
Growth	-0.006***	-0.006***	-0.006***	-0.013***	-0.007***	-0.011*	-0.010**	-0.010**	-0.025	-0.012**
	(0.002)	(0.001)	(0.001)	(0.005)	(0.002)	(0.006)	(0.005)	(0.005)	(0.024)	(0.005)
Trend Length	0.010***	0.010***	0.010***	0.011***	0.014***	0.004	0.003	0.003	-0.017*	0.008**
	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(0.004)	(0.003)	(0.003)	(0.009)	(0.004)
Pagan-Hall Test (P value)					0.000					0.000
F Statistic		3200.99	1608.15	1070.02	470.01		355.04	183.35	20.57	46.94
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3269	3265	3261	483	3269	1009	991	981	95	1009
R-squared	0.2609	0.2584	0.2575	0.3839	0.1626	0.4479	0.4392	0.4401	0.6401	0.3189

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: Linear probability models with the following instruments by column: (i) Columns (1) and (6) are a fixed effects regression (with no instruments), (ii) Columns (2) and (7) use the average SFA in country's region (without country) and its interaction with the lagged SFA, (iii) Columns (3) and (8) use the same set of instruments as in Columns (2) and (7) along with the lagged average level of SFA in country's region (without country), (iv) Columns (4) and (9) use the same set of instruments as in Column (3) and (8) in addition to the lagged average OBI (Open Budget Index). Columns (5) and (10) report the results for the identification through heteroscedasticity, following Lewbel (2019)'s methodology.

Table 10: Data Sources and Definitions of Main Variables

Variable	Definition	Source
Primary Balance	Lag of Primary balance (% of GDP)	IMF's World Economic Outlook, Historical Public Debt Database
GDP Growth	Lag of growth rate of Real Gross Domestic Product (constant US$)	World Development Indicators(WDI), World Bank (WB)
Stock Flow Adjustment I	Difference between the annual change in gross debt and the budget deficit	IMF's World Economic Outlook, Historical Public Debt Database
Stock Flow Adjustment II	with growth effects	
Stock Flow Adjustment III	with growth and valuation effects	
Reserves	Lag of international reserves (% of GDP)	WEO, IMF
Public Debt	Lag of sovereign total debt (% of GDP)	Bank of International Settlements(BIS), Debt Securities Statistics (DSS)
REER Growth	Growth rate of the real effective exchange rate	WEO, IMF
IMF Program	Dummy for IMF agreement	IMF website
Fiscal Rule	Dummy for fiscal rule	IMF's Fiscal Rules Dataset
Institutional Quality	Lag of standardized average of the components of the political risk rating index	International Country Risk Guide (ICRG)
Debt Trend	Years with debt growth exceeding 1% of GDP	Based on Jaramillo et al. (2017)
Debt Spikes	Consecutive years of debt growth totaling at least 10% of GDP	

Appendix I - Sensitivity Analysis

Table I.1: Duration Analysis of Debt Spikes (Good Times). Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.371***	-0.559	0.459***	-0.993***	0.453***	-0.989***	0.482***	-2.778***	0.483***	-1.003***
	(0.069)	(0.347)	(0.047)	(0.140)	(0.048)	(0.140)	(0.052)	(0.354)	(0.051)	(0.137)
Reserves	-0.129***	0.140	-0.132***	0.262***	-0.135***	0.282***	-0.142***	1.105***	-0.148***	0.284***
	(0.028)	(0.109)	(0.037)	(0.089)	(0.037)	(0.096)	(0.035)	(0.325)	(0.037)	(0.096)
Public Debt	-0.044***	-0.009	-0.051***	0.028	-0.049***	0.040	-0.049***	0.235**	-0.049***	0.066**
	(0.011)	(0.038)	(0.012)	(0.024)	(0.012)	(0.025)	(0.013)	(0.110)	(0.013)	(0.032)
REER Growth	-0.317***	0.514***	-0.292***	0.324***	-0.291***	0.331***	-0.284***	1.196***	-0.285***	0.286**
	(0.062)	(0.108)	(0.066)	(0.122)	(0.066)	(0.117)	(0.071)	(0.406)	(0.071)	(0.116)
Primary Balance			-0.162	0.999***	-0.173*	1.118***	-0.168	1.278	-0.175*	1.101***
			(0.101)	(0.259)	(0.104)	(0.362)	(0.104)	(0.778)	(0.103)	(0.336)
Growth					0.001	0.011***	0.001	0.018**	0.001	0.012***
					(0.001)	(0.003)	(0.001)	(0.008)	(0.001)	(0.003)
IMF Program							0.002	0.035	0.001	0.004
							(0.007)	(0.040)	(0.007)	(0.015)
Fiscal Rule							-0.192***	0.919***	-0.193***	0.170***
							(0.048)	(0.207)	(0.048)	(0.047)
Inst. Quality									-0.027*	-0.008
									(0.014)	(0.030)
Observations	2644	2644	2504	2504	2489	2489	2489	2489	2489	2489
No. of Countries	159	159	156	156	156	156	156	156	156	156
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	4491.96	3084.53	3999.34	2667.33	3985.57	2616.15	4017.71	3239.65	4014.58	2579.65

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: This table presents the results of restricting the analysis to periods where the business cycle is non-negative.

Table I.2: Duration Analysis of Debt Spikes (Bad Times). Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.107***	-0.262***	0.096***	-0.226***	0.091***	-0.225***	0.087***	-0.740***	0.089***	-0.223***
	(0.034)	(0.061)	(0.034)	(0.058)	(0.034)	(0.058)	(0.034)	(0.224)	(0.034)	(0.061)
Reserves	-0.095***	0.146***	-0.115***	0.191***	-0.104***	0.193***	-0.103***	1.039***	-0.107***	0.198***
	(0.021)	(0.055)	(0.026)	(0.050)	(0.028)	(0.050)	(0.030)	(0.306)	(0.031)	(0.051)
Public Debt	-0.047***	-0.017	-0.054***	-0.011	-0.048***	-0.010	-0.045***	0.138	-0.045***	-0.005
	(0.009)	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)	(0.011)	(0.099)	(0.011)	(0.013)
REER Growth	-0.197***	0.309***	-0.196***	0.275***	-0.199***	0.274***	-0.185***	1.075***	-0.185***	0.270***
	(0.030)	(0.078)	(0.031)	(0.072)	(0.031)	(0.072)	(0.030)	(0.197)	(0.030)	(0.070)
Primary Balance			-0.102**	0.378***	-0.149***	0.366***	-0.152***	0.890***	-0.152***	0.379***
			(0.048)	(0.127)	(0.055)	(0.122)	(0.055)	(0.285)	(0.055)	(0.120)
Growth					0.001**	0.000	0.001*	-0.003	0.001*	0.001
					(0.000)	(0.001)	(0.000)	(0.003)	(0.000)	(0.001)
IMF Program							-0.005	0.022	-0.005	0.002
							(0.005)	(0.038)	(0.005)	(0.010)
Fiscal Rule							-0.102***	0.533***	-0.103***	0.060**
							(0.035)	(0.144)	(0.035)	(0.026)
Inst. Quality									-0.013	0.026
									(0.010)	(0.019)
Observations	1872	1872	1747	1747	1747	1747	1747	1747	1747	1747
No. of Countries	159	159	156	156	156	156	156	156	156	156
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	7237.84	4071.11	6740.42	3790.39	6704.39	3792.16	6678.49	4815.96	6678.03	3785.84

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: This table presents the results of restricting the analysis to periods where the business cycle is non-positive.

Table I.3: Duration Analysis of Debt Spikes (With 2 Lags). Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.161***	-0.404***	0.163***	-0.424***	0.161***	-0.383***	0.160***	-0.382***	0.161***	-0.387***
	(0.024)	(0.096)	(0.030)	(0.093)	(0.031)	(0.093)	(0.030)	(0.093)	(0.030)	(0.095)
Reserves	-0.124***	0.231***	-0.133***	0.287***	-0.134***	0.287***	-0.133***	0.277***	-0.142***	0.281***
	(0.017)	(0.073)	(0.021)	(0.074)	(0.021)	(0.077)	(0.022)	(0.080)	(0.024)	(0.081)
Public Debt (2 Lags)	-0.055***	0.050*	-0.060***	0.069***	-0.060***	0.069***	-0.058***	0.088***	-0.058***	0.090***
	(0.008)	(0.027)	(0.009)	(0.025)	(0.009)	(0.025)	(0.009)	(0.028)	(0.009)	(0.029)
REER Growth	-0.204***	0.408***	-0.187***	0.378***	-0.188***	0.368***	-0.178***	0.339***	-0.177***	0.336***
	(0.024)	(0.080)	(0.025)	(0.075)	(0.025)	(0.069)	(0.024)	(0.061)	(0.024)	(0.061)
Primary Balance (2 Lags)			-0.189***	0.409***	-0.175***	0.649***	-0.173***	0.622***	-0.169***	0.617***
			(0.051)	(0.099)	(0.054)	(0.172)	(0.055)	(0.183)	(0.056)	(0.185)
Growth (2 Lags)					-0.057	0.410***	-0.073	0.439***	-0.088*	0.456***
					(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IMF Program							-0.007**	-0.009	-0.007**	-0.009
							(0.003)	(0.010)	(0.003)	(0.010)
Fiscal Rule							-0.116***	0.129***	-0.115***	0.135***
							(0.033)	(0.029)	(0.033)	(0.030)
Inst. Quality									-0.023***	0.027
									(0.008)	(0.020)
Observations	4568	4568	4204	4204	4128	4128	4128	4128	4128	4128
No. of Countries	161	161	158	158	158	158	158	158	158	158
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	13145.83	7361.60	11846.56	6654.25	11684.22	6482.77	11611.42	6434.86	11601.60	6433.63

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: This table presents the results of lagging key explanatory variables (2 lags) with our baseline specification. Specifically, we examined the impact of primary balance, economic growth, public debt, and IMF lending, as we believe these factors can have more delayed effects on the occurrence of a debt spike.

Table I.4: Duration Analysis of Debt Spikes (With 3 Lags). Panel Data from 1980-2021.

	(1) Cox PH	(2) AFT	(3) Cox PH	(4) AFT	(5) Cox PH	(6) AFT	(7) Cox PH	(8) AFT	(9) Cox PH	(10) AFT
Stock Flow Adj	0.156***	-0.407***	0.159***	-0.491***	0.160***	-0.509***	0.160***	-0.517***	0.162***	-0.519***
	(0.024)	(0.106)	(0.028)	(0.100)	(0.030)	(0.099)	(0.030)	(0.097)	(0.030)	(0.098)
Reserves	-0.126***	0.231***	-0.130***	0.283***	-0.132***	0.277***	-0.131***	0.267***	-0.139***	0.268***
	(0.018)	(0.074)	(0.022)	(0.073)	(0.023)	(0.076)	(0.024)	(0.078)	(0.025)	(0.079)
Public Debt (3 Lags)	-0.068***	0.071**	-0.074***	0.069**	-0.084***	0.084***	-0.082***	0.100***	-0.080***	0.101***
	(0.009)	(0.028)	(0.011)	(0.029)	(0.010)	(0.029)	(0.010)	(0.033)	(0.010)	(0.033)
REER Growth	-0.196***	0.396***	-0.191***	0.368***	-0.188***	0.361***	-0.183***	0.338***	-0.182***	0.337***
	(0.024)	(0.080)	(0.025)	(0.077)	(0.026)	(0.078)	(0.024)	(0.067)	(0.024)	(0.068)
Primary Balance (3 Lags)			-0.112**	0.265***	-0.073	0.236	-0.068	0.227	-0.061	0.222
			(0.057)	(0.083)	(0.061)	(0.163)	(0.063)	(0.161)	(0.064)	(0.163)
Growth (3 Lags)					-0.058**	0.243***	-0.065**	0.253***	-0.068***	0.255***
					(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IMF Program							-0.008**	-0.011	-0.008**	-0.012
							(0.003)	(0.010)	(0.003)	(0.010)
Fiscal Rule							-0.121***	0.145***	-0.120***	0.147***
							(0.037)	(0.036)	(0.038)	(0.036)
Inst. Quality									-0.021**	0.011
									(0.008)	(0.019)
Observations	4507	4507	4054	4054	3977	3977	3977	3977	3977	3977
No. of Countries	161	161	158	158	158	158	158	158	158	158
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	12891.54	7163.97	11367.05	6336.14	11072.29	6167.88	11026.81	6114.39	11019.41	6115.83

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Notes: This table presents the results of lagging key explanatory variables (3 lags) with our baseline specification. Specifically, we examined the impact of primary balance, economic growth, public debt, and IMF lending, as we believe these factors can have more delayed effects on the occurrence of a debt spike.

Appendix II - Specification of the Proportional Hazards

Table II.1: Specification Tests of Duration Analysis

	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5
Wald test	13279.21	1457.06	2130.97	2403.04	2266.46
P value	0.00	0.00	0.00	0.00	0.00
Schoenfeld Residual	989.01	773.35	745.97	988.66	929.68
P value	0.00	0.00	0.00	0.00	0.00

Notes: Model 1 is the baseline model; Model 2 is Model 1 with IMF pogram & Fiscal rule; Model 3 is Model 1 & Model 2 with Insitutional quality. The null of the Wald test is joint non-significant. The null of the Schoenfeld residual test is for constant proportional hazards assumption.

Appendix III - Alternative Definitions of SFA

Figure III.1: Stock-Flow Adjustments (with growth decomposition)

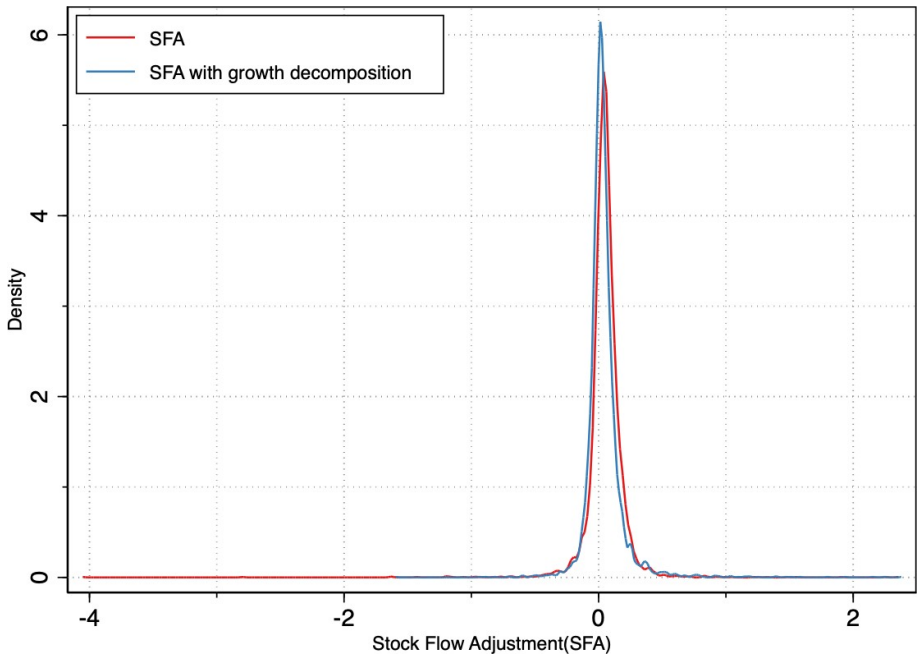


Figure III.2: Stock-Flow Adjustments (with growth decomposition and valuation effect)

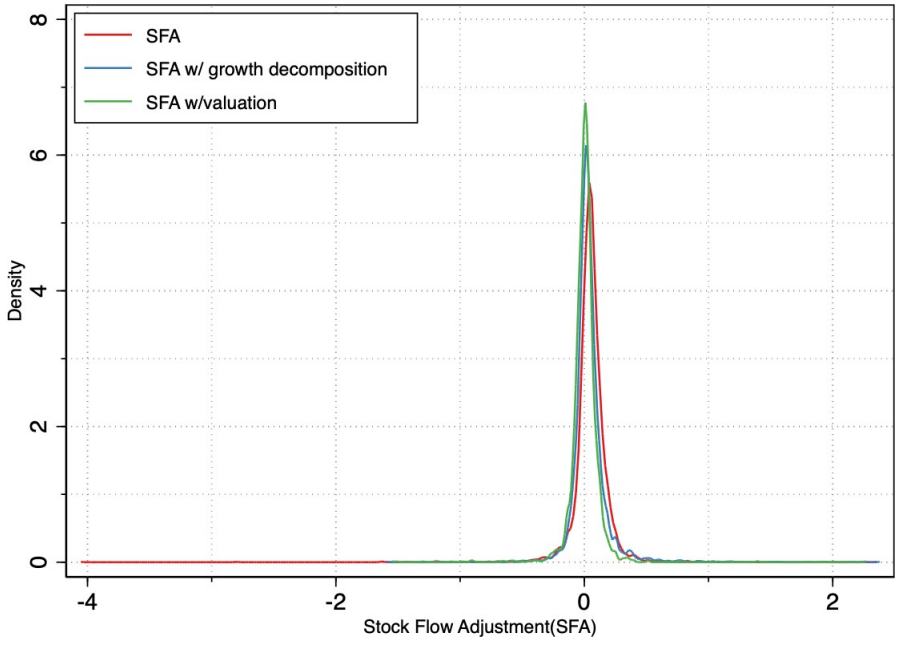


Figure III.3: Average-Stock Flow Adjustments (with growth decomposition)

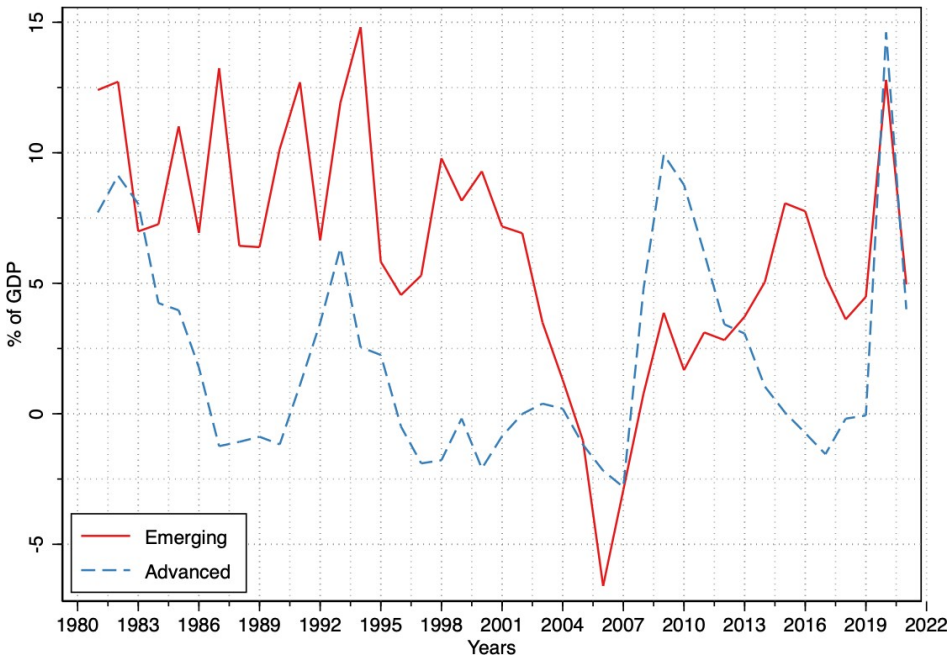
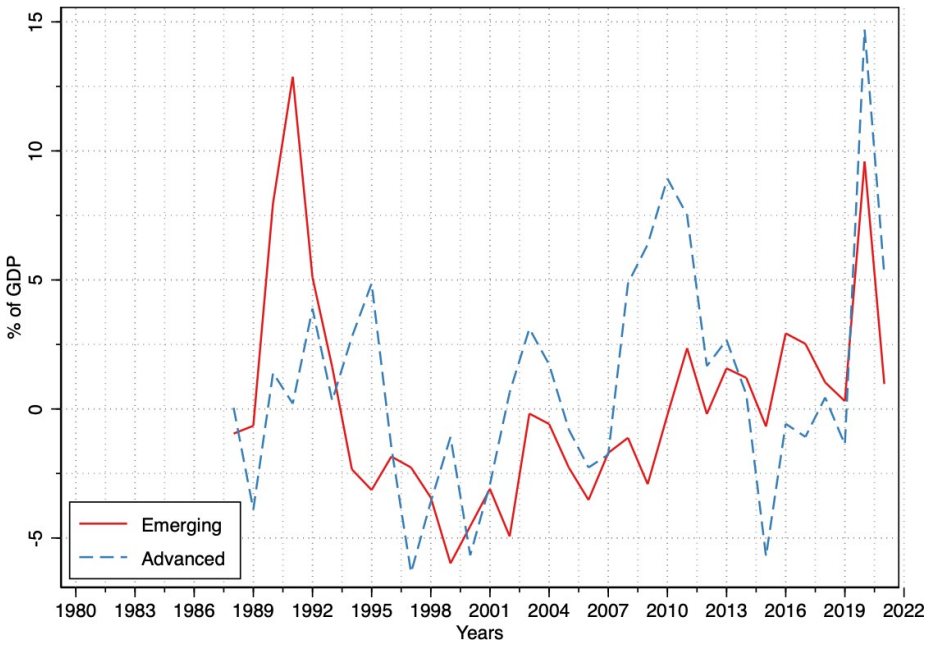


Figure III.4: Average Stock-Flow Adjustments (with growth decomposition and valuation effect)



Appendix IV - Differences in Region and Income

This appendix presents our baseline results by region and income level using World Bank categories.

Table IV.1: Duration Analysis of Debt Spikes by Region (Emerging Countries). Panel Data from 1980-2021.

	ECS		LCN		MEA		SAS		SSF	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Cox PH	AFT	Cox PH	AFT	Cox PH	AFT	Cox PH	AFT	Cox PH	AFT
Stock Flow Adj	0.295***	-1.402***	0.249***	-1.516***	0.150***	-0.913***	0.142***	-1.514***	0.087	-0.714***
	(0.069)	(0.320)	(0.036)	(0.262)	(0.036)	(0.203)	(0.043)	(0.394)	(0.065)	(0.238)
Reserves	-0.610***	3.373***	-0.489***	2.599***	-0.107***	0.918***	-0.203***	1.722***	-0.137***	0.926
	(0.161)	(0.650)	(0.081)	(0.352)	(0.032)	(0.255)	(0.062)	(0.509)	(0.044)	(0.617)
Public Debt	0.028	-0.241	-0.070***	0.113	-0.012	0.051	-0.108***	0.883**	0.008	-0.035
	(0.045)	(0.188)	(0.021)	(0.143)	(0.028)	(0.122)	(0.035)	(0.383)	(0.009)	(0.056)
REER Growth	-0.211***	0.811	-0.166***	1.123***	-0.158**	0.933***	-0.212	0.873***	-0.177***	1.429***
	(0.077)	(0.534)	(0.045)	(0.258)	(0.075)	(0.304)	(0.164)	(0.209)	(0.038)	(0.277)
Primary Balance	-0.326*	1.193	0.065	-0.892	-0.062	0.144	-0.348***	2.799***	-0.180**	0.579
	(0.190)	(0.806)	(0.097)	(0.714)	(0.093)	(0.391)	(0.133)	(0.676)	(0.090)	(0.380)
Growth	-0.002	0.012	0.001	0.001	0.003**	-0.012***	0.001	0.005	0.001	0.003
	(0.001)	(0.008)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)	(0.008)	(0.001)	(0.003)
Observations	398	398	932	932	403	403	564	564	972	972
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	532.41	542.77	1769.86	1536.17	671.99	692.57	815.09	843.74	2751.34	2370.63

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01

Table IV.2: Duration Analysis of Debt Spikes by Income Level. Panel Data from 1980-2021.

	High		Middle		Low	
	(1)	(2)	(3)	(4)	(5)	(6)
	Cox PH	AFT	Cox PH	AFT	Cox PH	AFT
Stock Flow Adj	0.158***	-0.994***	0.039	-0.681	0.220***	-0.911***
	(0.023)	(0.206)	(0.029)	(0.562)	(0.042)	(0.230)
Reserves	-0.244***	1.291***	-0.193***	1.048**	-0.104**	1.527**
	(0.048)	(0.370)	(0.053)	(0.427)	(0.050)	(0.631)
Public Debt	-0.079***	0.232**	-0.125***	0.047	0.003	-0.025
	(0.022)	(0.109)	(0.023)	(0.124)	(0.008)	(0.061)
REER Growth	-0.054	0.534***	-0.229***	1.104***	-0.279***	1.446***
	(0.036)	(0.193)	(0.038)	(0.353)	(0.053)	(0.328)
Primary Balance	-0.144**	0.281	-0.306***	0.903**	-0.032	0.511
	(0.065)	(0.364)	(0.092)	(0.460)	(0.090)	(0.526)
Growth	0.001**	-0.001	0.001*	-0.004	-0.001**	0.005**
	(0.001)	(0.003)	(0.001)	(0.003)	(0.000)	(0.003)
Observations	1233	1233	1146	1146	890	890
FE	Yes	Yes	Yes	Yes	Yes	Yes
AIC	2925.473	2330.692	2130.821	1865.942	1877.211	1740.846

Robust standard errors in parentheses

* < 0.10, ** < 0.05, *** < 0.01