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The Dynamic Consequences of Inflow-driven Sudden Stops *

Romain Houssa[†] Jean Paul Madrigal Rodríguez[‡]

July 2026

Abstract

This paper studies the macroeconomic effects of sudden stops using a newly constructed database that expands country coverage to 137 economies and extends the sample to 1985Q1–2025Q4. We document a new wave of sudden-stop episodes in the 2020s, partly reversing the apparent decline observed after the post-global-financial-crisis. Local-projection estimates show that sudden stops are typically preceded by economic expansions and followed by persistent output losses lasting up to two years. The contraction is driven mainly by sharp declines in investment and consumption, while net exports rise because imports contract more strongly than exports. The results reveal two distinct transmission mechanisms. Sudden stops in net external financing operate through forced external adjustment and import compression, with larger and more persistent effects under pegged exchange-rate regimes. By contrast, gross-inflow sudden stops operate through financial conditions: leverage rises, credit conditions tighten, asset prices fall, and investment declines. This financial transmission of gross-inflow sudden stops also differs across country groups, reflecting differences in financial structure. Developing countries are more exposed to increases in financing costs, whereas advanced economies display stronger debt-deflation and asset-price effects.

JEL classifications:E3, E43, E52, C51, C33

Keywords: Inflow-driven sudden stops, dynamics, local projections, economic growth

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1 Introduction

International financial integration has been one of the defining features of the global economy in recent decades. Cross-border capital flows have expanded substantially across both advanced and developing economies, creating opportunities for risk sharing and investment financing, while also exposing countries to sudden stops, episodes in which disruptions in capital flows force macroeconomic adjustment and generate large output losses (Calvo, 1998; Dornbusch et al., 1995; Kose et al., 2009; Lane and Milesi-Ferretti, 2008; Forbes and Warnock, 2012; Milesi-Ferretti, 2025).

Sudden stops are not homogeneous events. They may arise from foreign investors' withdrawal of capital, retrenchment by resident investors abroad, reversals in net flows, or a combination of these factors. Cavallo et al. (2015) distinguish seven types of sudden-stop episodes, according to whether these episodes involve gross inflows, gross outflows, net flows, or their intersections. Recent evidence suggests that inflow-driven sudden stops are among the most disruptive episodes (Cavallo et al., 2015; Hwang et al., 2017). This paper focuses on two such types of episodes. The first is a sudden stop in gross inflows (SSI), in which foreign investors withdraw capital without necessarily generating a sudden stop in net flows. The second is a gross-inflow sudden stop that also translates into a loss of net external financing (SSIN). This distinction is not merely classificatory, it also shapes the transmission mechanism through which sudden stops affect the real economy.

This paper makes three main contributions to our understanding of sudden stops. First, we construct a new database of sudden-stop episodes that expands country coverage to 137 economies and extends the time span to 1985Q1–2025Q4. The database identifies the seven types of sudden stops based on gross inflows, gross outflows, net flows, and their intersections. The expanded evidence documents a new wave of sudden-stop episodes in the 2020s, partly reversing the apparent decline observed after the global financial crisis.

Second, we estimate the dynamic effects of SSIN and SSI on GDP using local projections (Jordà, 2005). Our shock variable equals the year-over-year change in capital flows in the quarter in which a sudden-stop episode begins and zero otherwise (see Section 2.2). We first estimate standard local projections using these raw shocks. To address potential endogeneity, we complement the raw-shock estimates with an instrumental-variable (IV) specification (Stock and Watson, 2018). Our benchmark IV analysis uses the global VIX as an instrument for sudden-stop shocks. We assess robustness of the results using alternative instruments based on US monetary policy shocks, gold price shocks, and US dollar shocks. We further conduct a subperiod analysis to explore time variation in the effects of sudden stops and assess the stability of the IV specification.

Third, we trace the transmission channels through which SSIN and SSI affect GDP. We examine exchange-rate and trade adjustment, credit conditions, asset prices, leverage, and capital formation. The evidence reveals two distinct propagation mechanisms. SSIN episodes operate through forced external adjustment and import compression, whereas SSI episodes propagate through tighter financial conditions, balance-sheet deterioration, and reduced capital formation. We also study heterogeneity across advanced and developing economies to assess how financial structure shapes transmission, and across exchange-rate regimes to evaluate how policy frameworks mediate external adjustment.

We find that both SSIN and SSI generate substantial and persistent output losses. In both cases, sudden stops are preceded by an economic expansion and followed by a sharp slowdown. SSIN episodes combine a reversal in gross inflow with a loss of net external financing, whereas SSI episodes involve the inflow reversal without a corresponding loss of net financing. This difference gives rise to distinct transmission mechanisms.

For SSIN shocks, the evidence reveals a forced external-adjustment channel. Once net external financing dries up, the economy must close the resulting external financing gap through relative-price adjustment and expenditure compression. The real exchange-rate depreciates, import contracts sharply, and consumption and investment subsequently decline. Heterogeneity across exchange-rate regimes supports this mechanism: flexible regimes absorb part of the shock through a faster real exchange-rate depreciation, whereas pegged regimes experience more persistent output losses because adjustment relies more heavily on domestic-demand compression.

For SSI, this conventional balance-of-payments mechanism is less relevant because the reversal in gross inflows is not accompanied by a corresponding loss of net external financing. Instead, the evidence reveals a financial-accelerator mechanism consistent with Mendoza (2010). SSI episodes are associated with higher leverage ratios, deteriorating borrower balance sheets, and tighter collateral constraints. These financial strains operate through two related channels: higher financing premia and debt-deflation dynamics. The withdrawal of foreign capital raises borrowing costs, restricts credit availability, and depresses equity and capital values, thereby reducing investment. In this sense, SSI episodes are better understood as disruptions to capital formation than as current-account crises. The dominant channel differs across country groups: developing economies are more exposed to increases in financing premia, whereas advanced economies experience stronger debt-deflation and asset-price effects.

Our paper is closely related to two strands of the literature on sudden stops. The first is the theoretical literature on the mechanisms through which sudden stops generate output losses. Early work by Calvo (1998, 2001) emphasizes the balance-of-payments adjustment channel. In this view, a sudden stop of net external financing forces a rapid current-account adjustment through real exchange-rate depreciation, import compression, and a contraction in domestic absorption. This mechanism is especially relevant for episodes in which gross inflow reversals translate into a corresponding loss of external financing.

A second theoretical mechanism is developed by Mendoza (2010) who builds a general-equilibrium model in which sudden stops interact with endogenous collateral constraints. When leverage is high, an adverse external-financing shock can make the collateral constraint bind, amplifying its effects through two related channels: a *financing-premium channel* and *debt-deflation channel*. First, reduced access to external funding raises borrowing costs and restricts firms' ability to finance investment and production. Second, debt-repayment pressures force sales of capital assets, depressing asset prices and collateral values. The resulting deterioration in borrowing capacity further reduces consumption consumption and investment, generating a self-reinforcing debt-deflation spiral between asset prices, collateral values, and real activity.

Our contribution is to test these mechanisms empirically while distinguishing between different types of inflow-driven sudden stops. We show that the balance-of-payments mechanism is most relevant for SSIN episodes, in which reversals in gross inflows generate a loss of net external financing. By contrast, SSI episodes, which occur without a corresponding net financing shortfall, propagate through tighter financial conditions, declining collateral values, and reduced capital formation. Thus, the paper provides empirical evidence that the macroeconomic transmission of a gross-inflow reversal depends critically on whether the episode also generates a net external financing gap.

The second strand is the empirical literature on the incidence, determinants, and macroeconomic effects of sudden stops. Cavallo et al. (2015) provide an important benchmark by distinguishing sudden stops in gross inflows, gross outflows, and net flows, for 63 countries over 1980-2012. Using an event-study-style OLS specification, they find that inflow-driven sudden stops, especially SSI and SSIN episodes, are particularly costly for output. Hwang et al. (2017) instead examine net-flow sudden stops using a panel VAR model for 44 countries over 1980-2008. They find negative but short-lived effects on GDP growth, which dissipate after a quarter and a half. Forbes and Warnock (2012) shift attention to extreme movements in gross capital flows, identifying episodes of surges, stops, flight, and retrenchment for 50 countries over 1980–2009. Their analysis focuses on the determinants of these episodes rather than their within-country macroeconomic consequences, and highlights the role of global risk factors. In a related work, Forbes and Warnock (2021) extend this analysis through 2020Q2 and find no significant increase in the incidence of extreme capital-flow episodes after the global financial crisis.[1]

Our paper extends this empirical literature in three ways. First, we expand the sudden-

[1] Other contributions to this literature include Brunnermeier et al. (2012); Calvo et al. (2004); Calvo (2001); Calvo et al. (2012); Guidotti (2007); Alberola et al. (2017)

stop database to 137 economies and update its coverage through 2025Q4, allowing us to document a renewed wave of episodes in the 2020s. Second, we estimate dynamic output responses using local projections and complement the raw-shock estimates with an IV strategy based on global financial shocks. Third, we go beyond average output effects by distinguishing the transmission mechanisms of SSI and SSIN episodes. We show that inflow-driven sudden stops are not homogeneous events: SSIN episodes operate mainly through forced-external adjustment, whereas SSI episodes operate through financial conditions and capital formation.

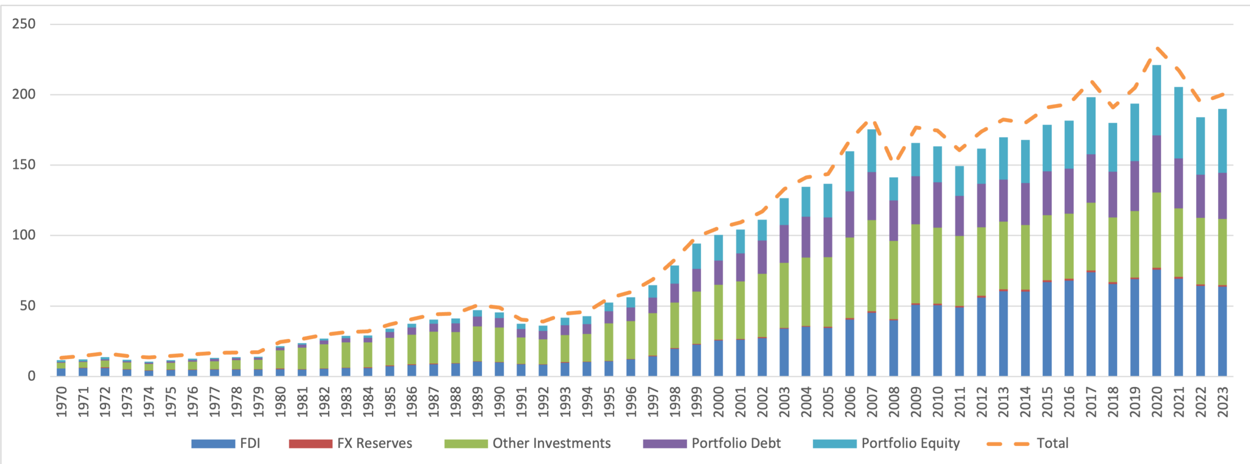
The remainder of this paper is organized as follows. Section 2 presents the updated database and documents stylised facts on sudden-stop episodes through 2025. Section 3 examines the dynamic effects of SSI and SSIN shocks. The last section concludes.

2 A new international database on sudden stops

2.1 Data

Figure 1 presents global external assets as a percentage of GDP over 1970–2023, based on data from Milesi-Ferretti (2025). The figure documents a significant increase in international financial integration, particularly from the mid-1990s onward. This expansion has created opportunities for international risk sharing and for financing domestic investment. At the same time, it has increased countries' exposure to external, as changes in global liquidity, risk appetite, or investor confidence can trigger abrupt reversals in capital inflows and sudden stops in external financing.

Figure 1: World External Asset, Percentage of GDP



To identify sudden-stop episodes and identify their macroeconomic impact, we use quarterly data from the International Monetary Fund (IMF)'s International Financial Statistics (IFS) database. The analysis is restricted to countries with at least 40 consecutive quarters of data. The resulting dataset includes 137 countries, classified according to the IMF country grouping into 37 developed economies and 100 developing economies, and contains approximately 16,648 country-quarter observations.[2] The updated database extends the coverage of sudden-stop episodes through 2025 and distinguishes between episodes involving gross inflows, gross outflows, and net capital flows. This allows us to document not only the overall incidence of sudden stops, but also how their composition has changed across country groups and over time. Section 2.2 reviews the definition and typology of sudden stops, while Section 2.3 discusses the stylized facts on sudden stops using our updated database.

2.2 Identification of sudden stops

The identification and characterization of sudden stops follow a two-step procedure. First, sudden stop episodes are identified using the algorithm proposed by Calvo et al. (2004). Second, each episode is classified according to the typology developed by Cavallo et al. (2015), which distinguishes between different forms of gross and net capital-flow reversals.

Let $X_{t,j}$ denote the value of financial flow j in quarter t for a given country, where j refers to gross inflows, gross outflows, or net flows.[3] Following Calvo et al. (2004), the annualized value of each flow is computed as the sum of the current and previous three quarterly observations: $C_{t,j} = \sum_{i=0}^{3} X_{t-i,j}$. The annual change in these flows is then given by $\Delta C_{t,j} = C_t - C_{t-4}$. Finally, rolling means and standard deviations of $\Delta C_{t,j}$ are estimated over the past successive twenty quarters.

A sudden stop episode is then identified according to three criteria. First, during the episode, at least one observation of the year-on-year change in capital flows, $\Delta C_{t,j}$, is at least two standard deviations below its sample mean. Secondly, the episode ends when $\Delta C_{t,j}$ rises above the the threshold of one standard deviation below its sample mean. Third, the start of the episode is defined as the first quarter in which $\Delta C_{t,j}$ falls below this same one-standard-deviation threshold.

Figure 2 illustrates the sudden-stop identification procedure using the case of gross inflows in Australia. The procedure identifies sudden-stop episodes around the late 1990s, the mid-2000s, the mid-2010s, and the early 2020s.

Following Cavallo et al. (2015), we combine gross inflows, gross outflows, and net flows to distinguish seven types of sudden stops, as illustrated in Figure 3. The figure shows whether an episode is identified only in one flow category—SSI, SSO, or SSN—or whether

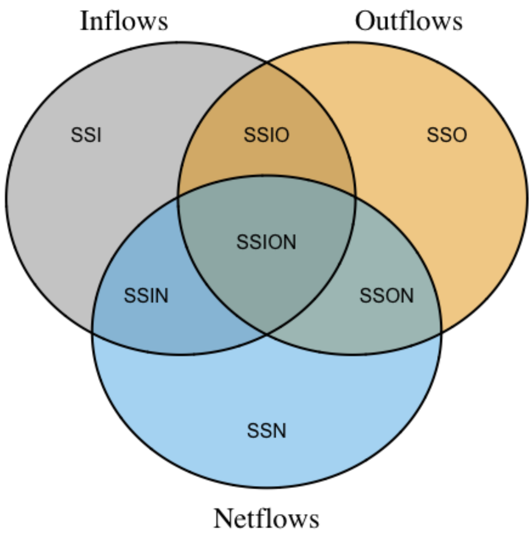
[2] For Norway (1992-1993) and Laos (2000), where only annual data is available, annual figures are divided by four to estimate quarterly data, following Forbes and Warnock (2012, 2021)

[3] Appendix A.1 details the computation of each flow.

Figure 2: Sudden Stops in Gross Inflows - Australia

it corresponds to an overlap between two or three categories, namely SSIN, SSON, SSIO, and SSION. The corresponding binary classification is reported in Table A.2.[4]

Figure 3: Typology of Sudden Stops



2.3 Stylized facts from the new sudden-stop database

The presentation of stylized facts proceeds as follows. We begin with the aggregate evidence of each type of episode (Table 1). We then examine how the composition

[4] Two additional adjustments are made to the classification. First, we exclude sudden stops in gross outflows that are accompanied by an increase in net capital flows, since such episodes do not correspond to a shortage of external financing. Rather, they may reflect a retrenchment of domestic investors or a reallocation of capital that increases net inflows. Second, when sudden-stop episodes occur in immediate succession, we treat them as part of the same evolving shock and give priority to composite episodes. In this hierarchy, SSION episodes are given priority over SSIN and SSON episodes, which are themselves given priority over single-category episodes such as SSI, SSO, and SSN.

of sudden stops varies across country groups and broad subperiods (Figure 4), before turning to the quarterly timing of episodes over the full sample period (Figure 5). Finally, we focus on SSI and SSIN episodes (Figure 6 and and 7), which are particularly relevant for the macroeconomic analysis that follows in the sections because they capture sudden stops driven by gross inflow reversals and, in the case of SSIN, by net external-financing pressures.

Table 1 reports the frequency and average duration of sudden-stop episodes by type and country group. Three main patterns stand out. First, consistent with Cavallo et al. (2015), sudden stops in gross outflows (SSO) remain the most frequent category, indicating that resident-driven retrenchment plays an important role in the dynamics of external adjustment. Second, inflow-related episodes are also central, particularly SSIN episodes, where sudden stops in gross inflows coincide with net-flow pressures. These episodes are especially relevant because they capture events where decline in foreign capital is not offset elsewhere in the financial account and therefore translates into external-financing stress. Third, net-flow episodes and composite episodes involving simultaneous reversals across several flow categories are relatively less frequent. Finally, developing countries exhibit a higher frequency across all types of shocks, accounting for roughly 64% of all episodes over the full sample period.

In terms of duration, sudden-stop episodes are relatively short-lived, generally lasting around three quarters, with limited variation across episode types and country groups. This suggests that the main differences across sudden-stop categories lie less in their persistence than in their incidence and composition.

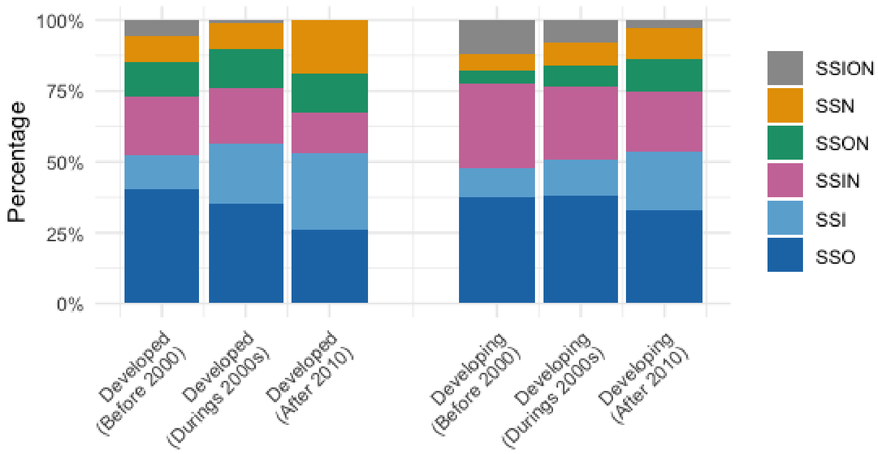
Table 1: Sudden Stops (1985-2025): Frequency and Average Duration

Type	All countries		Developed countries		Developing countries	
	Frequency	Average duration (Q)	Frequency	Average duration (Q)	Frequency	Average duration (Q)
SSI	147	3.5	63	3.8	84	3.3
SSO	255	3.3	89	3.1	166	3.4
SSN	91	3.2	42	3.2	49	3.2
SSIN	155	3.3	48	3.2	107	3.3
SSON	68	2.7	27	2.6	41	2.8
SSION	31	2.1	3	2.0	28	2.1
SSIO	0	NA	0	NA	0	NA

Figure 4 extends Table 1 by showing how the relative composition of sudden-stop episodes varies across country groups and three sub-periods: before 2000 (1985-1999); during the 2000s (2000-2009), and post the 2000s (2010-2025).[5] The figure provides the first insight on our updated database by showing that the structure of sudden stops has changed

[5] Figure A.1 in Appendix complements Figure 4 by showing the average number of episodes across the sub-periods and the country groups.

Figure 4: Relative distribution of sudden stops by country group and sub-period



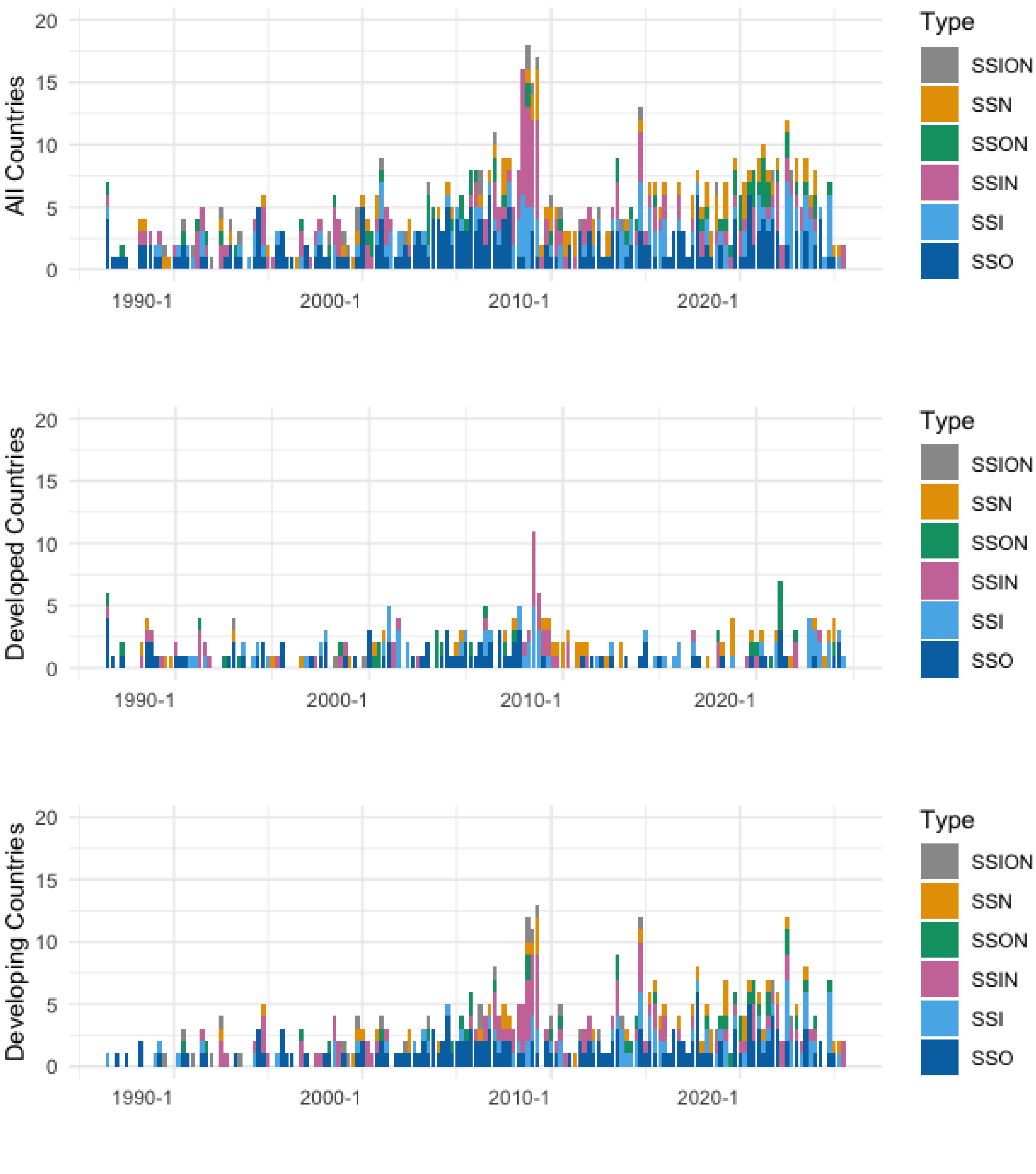
over time. While SSO episodes dominate in most sub periods, their relative importance declines from 2010, especially among developed economies. At the same time, SSI and SSN episodes become more prominent during the post-2000s period.

The within-group composition also points to a gradual shift over time. Before 2000, developing countries displayed a relatively larger share of episodes involving net-flow pressures, particularly SSIN and SSION episodes. Over time, the distinction between developed and developing countries narrows, as both groups exhibit a more diversified composition of sudden stops. In particular, the last sub-period is characterized by a lower relative dominance of SSO episodes and a greater role for SSI and SSN episodes, especially among developed economies.

Figure 5 complements the subperiod evidence by reporting the quarterly incidence of sudden-stop episodes across country groups over 1985-2025, allowing a more detailed comparison between the updated database and the previous literature. The dynamics of sudden stop types before 2010 are broadly consistent with earlier studies, whereas the post-2010 period has received less attention. One important exception is Forbes and Warnock (2021), who also apply the Calvo et al. (2004) algorithm to identify extreme movements in gross capital flows over the period 1985 to the first half of 2020. They show that these episodes remain clustered over time—occurring in waves or "ripples"— while their overall incidence appears to decline after the global financial crisis (GFC).

Our results are consistent with this pattern up to mid-2020 (Figure 5). However, once the period from 2020:Q3 to 2025:Q4 is incorporated, a new and pronounced wave of sudden stops emerges. This wave coincides with disruptions caused by the COVID-19 pandemic and subsequent global shocks, including notably the Russian's invasion of Ukraine that started in 2022. In this interval alone, we identify 137 episodes worldwide, accounting for around 40% of all sudden-stop episodes recorded since 2010. This is a key contribution

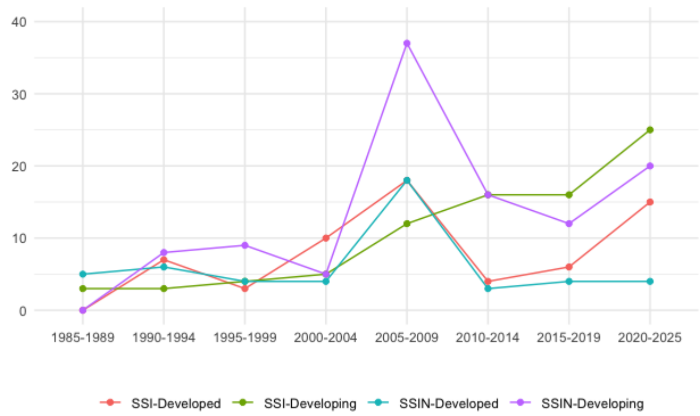
Figure 5: Sudden Stops by Date (1985-2025)



of the updated database, showing that the apparent post-GFC decline in sudden-stop incidence, documented by Forbes and Warnock (2021), is partly reversed once the most recent period is included.[6]

The evolution of sudden stops over the sample can be summarized around three broad phases. The pre-2000 period is characterized by a relatively larger role of episodes involving inflow pressures, especially in developing economies. During the 2000s, the distinction between developed and developing countries narrows, while episodes involving gross flows become more frequent. The post-2010 period, once extended through 2025, shows a renewed increase in sudden-stop incidence in net flows, driven by mild movements in outflows and inflows. However, Figure 5 shows that these episodes are not uniformly distributed over time. Instead, sudden stops occur in clusters, with particularly visible peaks around the 2007–2009 global financial crisis and again during the early 2020s, following the COVID-19 shock and subsequent global disruptions. These crisis episodes account for a large share of the totals observed in their respective periods, confirming that sudden stops are highly episodic rather than smoothly distributed over time.

Figure 6: Number of SSI and SSIN Episodes
by periods and Country Group



We next examine whether these episodes are driven mainly by gross inflow reversals, gross outflow retrenchment, or net-flow pressures. This distinction is particularly important for SSI and SSIN episodes, which are both frequent in the database and central to the macroeconomic analysis that follows in the remaining sections of the paper. These inflow-driven sudden stops are not only among the most prevalent types of episodes in the recent period, but have also been shown to be particularly costly in terms of output losses (Cavallo et al., 2015; Hwang et al., 2017).

[6] The share of SSN episodes among all sudden stops rose from about 7 percent before 2000 and 9 percent during the 2000s to 13 percent after 2010. Moreover, 57 percent of all SSN episodes in the full sample occurred after 2010, with the share reaching 50 percent in developed countries and 61 percent in developing countries

Figure 6 focuses on SSI and SSIN episodes and reports the number of incidences by country group and across five-year sub-periods. The data show that these shocks are concentrated mainly in developing economies. This pattern reflects the fact that developing countries tend to rely more heavily on foreign capital inflows, making them more vulnerable to abrupt changes in the supply of external financing. Developed economies are not immune, however, as they also experience SSI and SSIN episodes, with SSI episodes becoming more visible in recent periods.

Figure 7: Average SSIN and SSI shocks

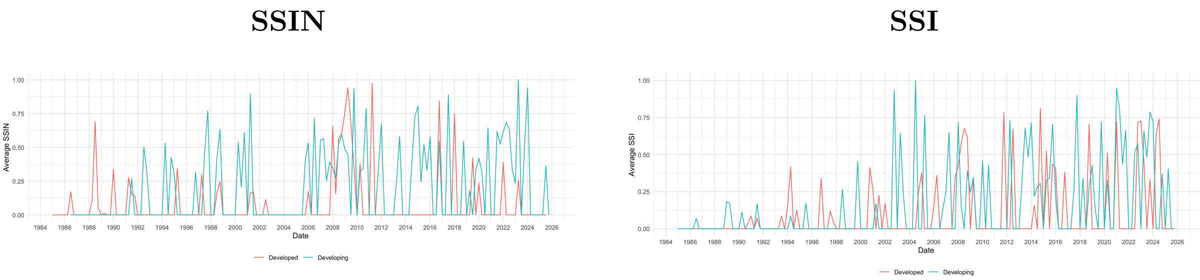


Figure 7 complements Figure 6 by showing the quarterly size of the corresponding shock series, $Shock_{i,t}$, that we use in the estimation part in the next section. The variable $Shock_{i,t}$ is an indicator that takes the value of 1 in the quarter when the sudden stop (SSIN or SSI) begins, multiplied by the magnitude of the associated loss in capital inflows. This multiplication controls for the size of the sudden stop, acknowledging that not all sudden stops are equivalent. The magnitude of the sudden stop is measured as the average of the year-over-year percentage changes in capital inflows during the quarters in which the episode was active.

The data show that SSI and SSIN shocks are not only episodic but also uneven in magnitude. Several quarters display small or near-zero values, while crisis periods are associated with sharp spikes, indicating much larger disruptions in capital flows. For SSIN, the largest spikes are concentrated mainly in developing economies, especially after 2000. This pattern indicates that episodes combining gross-inflow reversals with losses of external financing are not only more recurrent in these economies but also often larger. For SSI, average shock magnitudes become more pronounced after the mid-2000s in both country groups, although developing economies continue to exhibit more frequent large spikes in the post-2010 period.

3 Dynamic impacts of sudden stops

We examine the dynamic responses of GDP and related macroeconomic variables to the SSIN and SSI shocks. To this end, we employ local projections (Jordà (2005, 2023)). The analysis focuses first on GDP and then extend to a broader set of macroeconomic and financial variables in order to identify the transmission channels through which sudden stops affect real activity. Section 3.1 presents the empirical strategy. Section 3.2.1 compares the estimates obtained from the raw shocks and IV specifications. Sections 3.2.2 and 3.2.3 report the results for SSIN and SSI shocks, respectively. Section 3.2.4 examines whether the effects of the shocks vary over time using a subperiod analysis.

3.1 Empirical strategy

Equation 1 estimates $\beta^{(h)}$, the average cumulative impulse response of real GDP to a sudden stop shock at each horizon h (Jordà (2023))

$$GDP_{i,t+h} - GDP_{i,t-1} = \begin{cases} \alpha_i^{(h)} + \beta^{(h)} Shock_{i,t} + \delta^{(h)} Controls_t + \varepsilon_{i,t}, & \text{for } h < 0 \\ \alpha_i^{(h)} + \beta^{(h)} Shock_{i,t} + \sum_{s=1}^{3} \theta_s^{(h)} GDP_{i,t-s} + \\ \delta^{(h)} Controls_{i,t} + \varepsilon_{i,t}, & \text{for } h \geq 0 \end{cases} \quad (1)$$

where $\theta_s^{(h)}$ denotes the coefficients on lagged GDP, and $\delta_i^{(h)} Controls_t$ denotes the coefficients on the remaining control variables. These controls include real GDP per capita from last year to account for differences in initial income levels across countries, as well as deterministic time components including linear and quadratic trends, and an indicator for the Covid-19 period from 2020 to 2022. The horizon h ranges from -4 to 8. Negative horizons ($h < 0$) are included as pre-trend checks, allowing us to assess whether GDP displays systematic movements before the sudden-stop shock occurs. The post-shock horizons ($h \geq 0$) trace the dynamic responses of GDP from the onset of the shock up to eight quarters ahead.

To ensure a common event window across sudden-stop episodes, we retain 20 quarters before and after the onset of each episode, yielding a balanced 41-quarter window. To make the dynamic comparable across countries and episodes, each country-specific GDP series is normalized to 100 in the onset quarter, $t = 0$. When a country experiences multiple episodes of the same type, each country-episode pair is treated as a separate event unit in the panel. For example, two episodes of the same type in Mexico are coded as distinct units, such as Mexico1 and Mexico2. This event-level structure allows output dynamics to be compared across episodes using a common normalization and event window.

To examine the transmission channels, Equation 1 is also estimated for a broader set of dependent variables, normalized to 100 at $t = 0$. These include the real exchange rate, imports, exports, consumption (disaggregated in private and public consumption), investment (disaggregated in fix and inventories investment), credit, equity prices, financing premia, capital stock, and net exports. These series are also obtained from the IMF's IFS database.

We estimate Equation 1 using both the raw sudden-stop shocks reported in Figure 7 and an instrumental-variable (IV) framework. In the benchmark IV specification, the raw sudden-stop shocks are instrumented with the CBOE Volatility Index (VIX), which serves as a proxy for shifts in global financial risk and risk aversion. This approach helps address potential endogeneity of sudden-stop shocks. Estimation proceeds by two-stage least squares (2SLS). In the first stage, we regress the raw shock variable on the Global VIX to get the fitted values of such regression. In the second stage, we estimate Equation 1 using the fitted component of the shock.

Appendix B reports the diagnostics for the IV specification. The benchmark IV analysis begins in 1990, due to VIX data availability. We conduct several robustness exercises. First, we construct a longer volatility series by combining the VXO with VIX indices, which allows us to estimate the model over 1985-2025. Second, we consider specifications in which the VIX is interacted with country-level of vulnerability measures. These vulnerability measures are lagged gross inflows and lagged foreign liabilities as a percentage of GDP. Third, we use alternative instruments, including the US monetary policy shocks (Jarociński and Karadi (2020)) and US dollar shocks.

3.2 Empirical Results

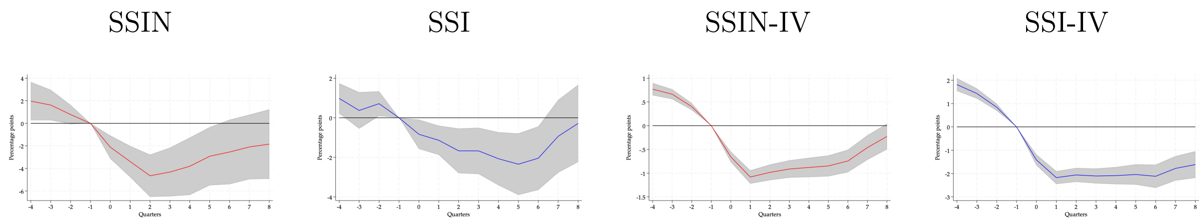
Section 3.2.1 compares the GDP responses estimated using the raw sudden-stop shocks with those obtained from the IV specification. Sections 3.2.2 and 3.2.3 report the results for SSIN and SSI shocks, respectively. Section 3.2.4 examines whether the effects of the shocks vary over time using a subperiod analysis. Section 3.2.5 assess robustness of the results.

3.2.1 GDP responses to raw and IV sudden-stop shocks

Figure 8 compares the dynamic responses of GDP to SSIN and SSI shocks under the raw-shocks and IV specifications. The raw-shock estimates summarize the average response of GDP following observed sudden-stop episodes, while the IV estimates exploit the component of those episodes associated with global financial risk, proxied by the VIX. The two approaches are complementary. The raw-shock specification provides a direct description of GDP following the sudden-stop episodes, whereas the IV specification addresses the concern that these episodes may be endogenous to domestic macroeconomic conditions. For example, capital inflow reversals may occur when economies are already weakening, when domestic financial vulnerabilities are accumulating, or when investors anticipate a deterioration in growth prospects. In such cases, the raw-shock estimates may confound the effect of the sudden stop with the underlying conditions that made the episode more likely. The IV strategy, therefore seeks to isolate the component of SSI and SSIN shocks associated with global financial conditions.

Figure 8 shows that both specifications point to contractionary GDP responses following sudden-stop shocks, although the IV estimates are substantially more precise. Both specifications also indicate that GDP rises during the quarter preceding the shocks, consistent with the view that sudden stops frequently occur at the end of capital-inflow booms or expansionary phases (Mendoza (2010)). Following the shock, output declines sharply and remains below its pre-shock path for approximately two years. The magnitude of the estimates is economically meaningful. The IV specification indicates persistent output losses, with larger effects for SSI than for SSIN. For SSIN, a one-percentage-point increase in the shock is associated with an average cumulative decline in GDP of approximately one percentage point at the trough. The corresponding SSI response reaches roughly two percentage points and remains persistent throughout the horizons. Given their greater precision and their attempt to mitigate concerns about the endogeneity of sudden-stop episodes, we use the IV estimates as the benchmark for the transmission-channel analysis that follows.[7]

Figure 8: GDP responses to SSIN and SSI shocks



3.2.2 SSIN: External Adjustment and Exchange-Rate Regimes

SSIN episodes capture reversals in gross inflows in combination with a corresponding loss of net external financing, implying that the withdrawal of foreign financing is not offset by residents' external retrenchment. This section examines whether the macroeconomic effects of these shocks vary across exchange-rate regimes. We first outline the balance-of-payments mechanism that links SSIN shocks to external adjustment and output losses. We then turn to the results under flexible and pegged exchange-rate regimes, reported in Figures 9 and 10, respectively. The corresponding aggregate responses for the full sample are reported in Figure C.2 in the Appendix.

The central mechanism through which SSIN shocks affect economic activity operates through the balance of payments. This focus is consistent with the early sudden stop lit-

[7] Complete results for the raw shocks are available upon request

erature, which conceptualized sudden stops primarily as disruptions in net financial flows, before later contributions incorporated the differentiation between gross inflows and outflows. In the standard mechanism, capital inflows finance current-account deficits. When foreign financing abruptly stops and is not offset by residents' external retrenchment, the economy can no longer finance the existing external deficit on the same terms. This forces a rapid adjustment of the current-account deficit (CAD) (Calvo, 1998). The adjustment typically involves a depreciation of the real exchange rate (RER), which should support exports and reduce imports. In practice, however, short-run adjustment often occurs mainly through import compression, particularly when exports respond only gradually or when production relies on imported intermediate inputs. AS net financial account dries up, the economy is therefore forced to reduce domestic absorption through lower consumption and investment, resulting in a contraction in aggregate demand.

The impact of SSIN shocks on GDP is therefore likely to vary across exchange-rate regimes. RER exchange-rate depreciation can occur through nominal exchange-rate movements or adjustments in domestic prices, while policy interventions can influence the timing and extent of these adjustments. In this sense, the country's exchange rate regime has an important role in shaping the macroeconomic response to sudden stops. The literature generally finds that, countries with more flexible exchange rate regimes are better able to mitigate the adverse effects of sudden stops (Edwards, 2004; Guidotti et al., 2004; Adler and Mora, 2012; David and Gonçalves, 2021). Under limited exchange-rate flexibility, the required external adjustment must rely more heavily on a reduction in domestic expenditure. By contrast, when the nominal exchange rate is allowed to depreciate, part of the adjustment can occur through relative prices and the trade balance. This facilitates adjustment to the tighter external-financing constraint and may reduce the output cost of the shock, even when a large depreciation is required to restore external balance (Cavallo and Frankel, 2008). Theoretically, we therefore expect flexible regimes to exhibit larger real exchange-rate depreciation but smaller and less persistent output losses.

The dynamic responses to SSIN shocks are consistent with this mechanism. Figures 9 and 10 compare the responses across exchange-rate regimes. GDP contracts under both regimes, but the decline is more persistent in pegged regimes-currency environments. Under flexible regimes, GDP reaches its trough shortly after the shock and begins to recover within a few quarters, with most of the effect dissipating after approximately six quarters. Under pegged regimes, by contrast, output remains depressed throughout most of the horizons. These differences are consistent with the role of the real exchange rate in facilitating external adjustment. Flexible regimes exhibit a faster and deeper depreciation, whereas pegged regimes show a more muted adjustment. As a result, countries with flexible regimes the current account more rapidly after the shock. Under pegged regimes, adjustment is slower and more persistent, and the current account deficit narrows only gradually over the two-year horizon.[8]

Figure 9: Responses to SSIN shocks in countries with flexible regimes

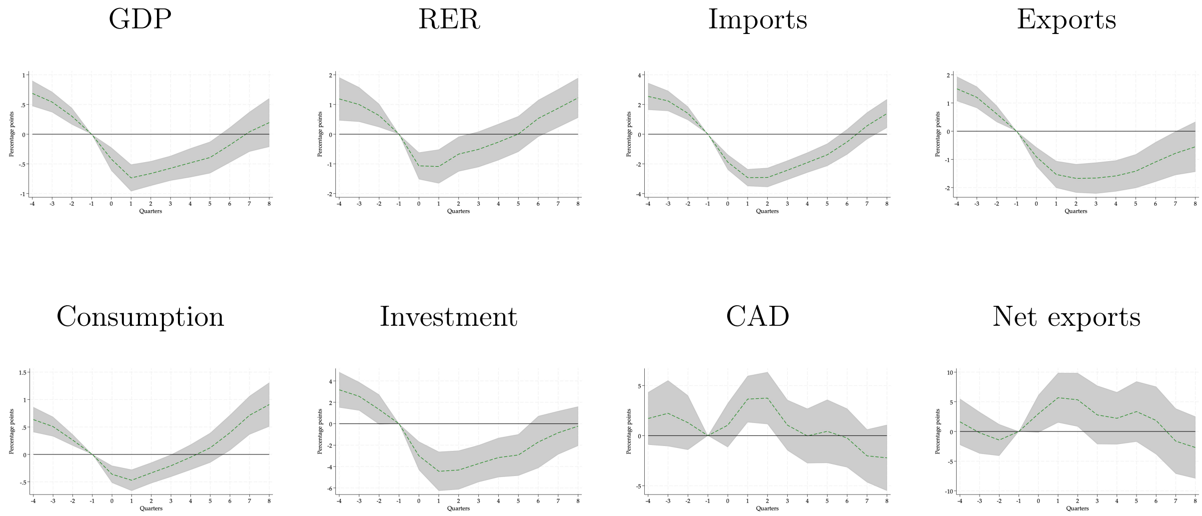
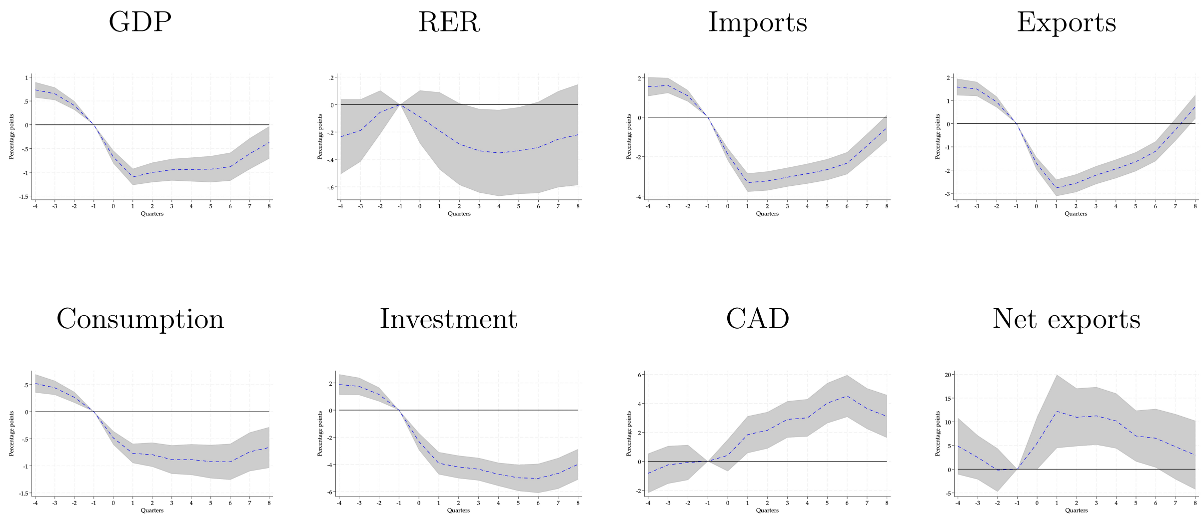


Figure 10: Responses to SSIN shocks in countries with pegged regimes



The current-account adjustment can occur through changes in either exports or imports. Figures 9 and 10 show that it operates predominantly through import compression. Imports contract almost immediately after the SSIN shock and reach their trough within one quarter. Exports also decline under both exchange-rate regimes, suggesting that the shock disrupts not only domestic absorption but also production and trade capacity. This

[8] To measure changes in the current account (positive and negative values expressed as a share of annual GDP prior to the SSIN), the strategy involves adding the lowest observed value plus 0.01 to all current account values within each country. This ensures that all values are strictly greater than zero while preserving their ordinal relationships. By doing so, it becomes possible to index the CAD to 100 at t_0, providing a consistent basis for comparison.

response may reflect tighter credit conditions, reduced working capital, and more limited access to imported intermediate inputs.

The export contraction is substantially more pronounced under pegged regimes. One quarter after the shock, a one-percentage-point increase in SSIN shock magnitude is associated with an export decline of about three percentage points under pegged regimes, compared with roughly 1.5 percentage points under flexible regimes. The fact that current-account adjustment is driven mainly by import compression helps explain the contractionary response of GDP to SSIN shocks. An adjustment based on lower imports reflects a reduction in domestic absorption, especially consumption and investment. It can also weaken productive capacity when firms rely on imported intermediate and capital goods. This mechanism is particularly costly under pegged regimes, where the weaker real exchange-rate adjustment forces a larger and more persistent contraction in domestic absorption. This helps explain why GDP losses are more prolonged under pegged exchange-rate regimes.

The results indicate that domestic absorption declines more sharply and remains depressed longer under pegged exchange rate regimes. Following a one-percentage-point increase in SSIN shock magnitude, consumption under flexible regimes declines by less than 0.5 percentage points at its trough and begins to recover after approximately two quarter. Under pegged regimes, consumption falls by about one percentage and remains depressed for most of the two-year horizon. However, the most disruptive effect is observed in investment. Investment contracts by approximately six percentage points under both regimes, but recovers considerably faster under flexible regimes. Under pegged regimes, by contrast, the decline is more persistent. This pronounced investment response is consistent with its dependence on external financing.

The national accounting identity, linking Investment, I, and saving, S, with the current account, CA, ($I = S - CA$), helps clarify this adjustment. When an SSIN forces the current-account deficit to narrow, CA, rises toward zero. Unless domestic saving increases sufficiently to offset this adjustment, investment must decline to satisfy the identity. This accounting constraint helps explain why investment is the component of domestic absorption most severely and persistently affected by SSIN shocks.

Overall, the results suggest that SSIN shocks affect GDP through a forced external-adjustment channel. Following the shock, net external financing dries up, limiting the economy's ability to finance the current-account deficit. The required adjustment occurs through changes in relative prices and the trade balance, but predominantly through a sharp compression of imports rather than an expansion of exports. Net exports, therefore, increase, but this improvement reflects import compression and a contraction in domestic absorption rather than export-led growth. The shock is transmitted to GDP through lower consumption and, especially, lower investment. The exchange-rate regime plays a central role in mediating these effects. Flexible regimes allow faster and deeper real exchange-rate adjustment and are associated with a quicker recovery. Under pegged regimes, by contrast, the more muted initial relative-price adjustment forces greater reliance on domestic-demand compression, resulting in more persistent declines in consumption, investment and output.

3.2.3 SSI: Financial Conditions and the Investment Channel

SSI episodes capture sharp reversals in gross capital inflows that do not generate a corresponding loss of net external financing. Unlike SSIN episodes, they therefore do not primarily operate through forced current-account adjustment. Nevertheless, we show that SSI shocks generate significant output losses. This section examines the mechanisms through which these shocks affect real activity and whether their transmission differs across developed and developing economies.

We first outline the financial-transmission mechanism, drawing on Mendoza (2010)'s theoretical framework, in which sudden stops tighten financing conditions, trigger collateral constraints, depress asset prices, and reduce investment.[9] We then examine whether the effects differ across developed and developing countries. This distinction is informative because the two groups differ in financial structure. Developed economies tend to have deeper domestic financial markets and rely more heavily on capital markets, while developing countries tend to have shallower domestic financial markets and greater dependence on external funding. Figures 11 and 12 report the results for developing and developed countries, respectively.[10]

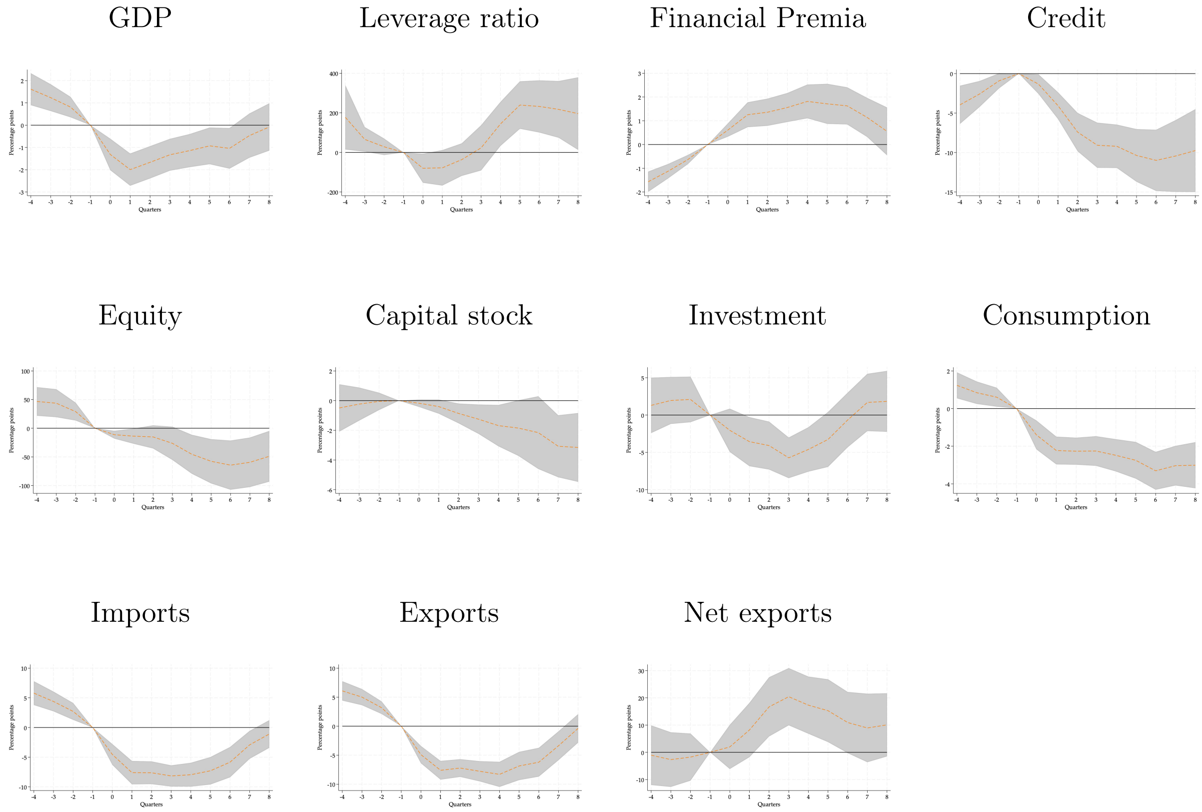
In Mendoza (2010)'s framework, an endogenous collateral constraint binds when leverage (total debt relative to the value of capital) is sufficiently high. This makes the economy more vulnerable to external financing shocks. Once the constraint binds, sudden stops are amplified through two key financial-market distortions. The first is an increase in financing premia, reflecting reduced access to external funding. The second is a debt-deflation mechanism: tighter financing conditions and the need to repay existing debt force firms to sell capital assets, depressing asset prices. This, in turn, reduces collateral values, which further tightens borrowing constraints and reinforces the contraction in credit and capital prices. Consequently, these channels reduce credit availability, depress equity and capital-goods prices, and weaken firms' borrowing capacity. At the macroeconomic level, they translate into lower investment and consumption. To the extent that imports fall with domestic absorption, net exports may improve, however, this improvement is contractionary in nature because it is driven by import compression rather than stronger

[9] Cavallo et al. (2015) argue that SSI episodes are related to financial instability.

[10] The corresponding aggregate responses for the full sample are reported in Figure C.3 in the Appendix.

export performance.

Figure 11: Responses to SSI shocks in developing countries

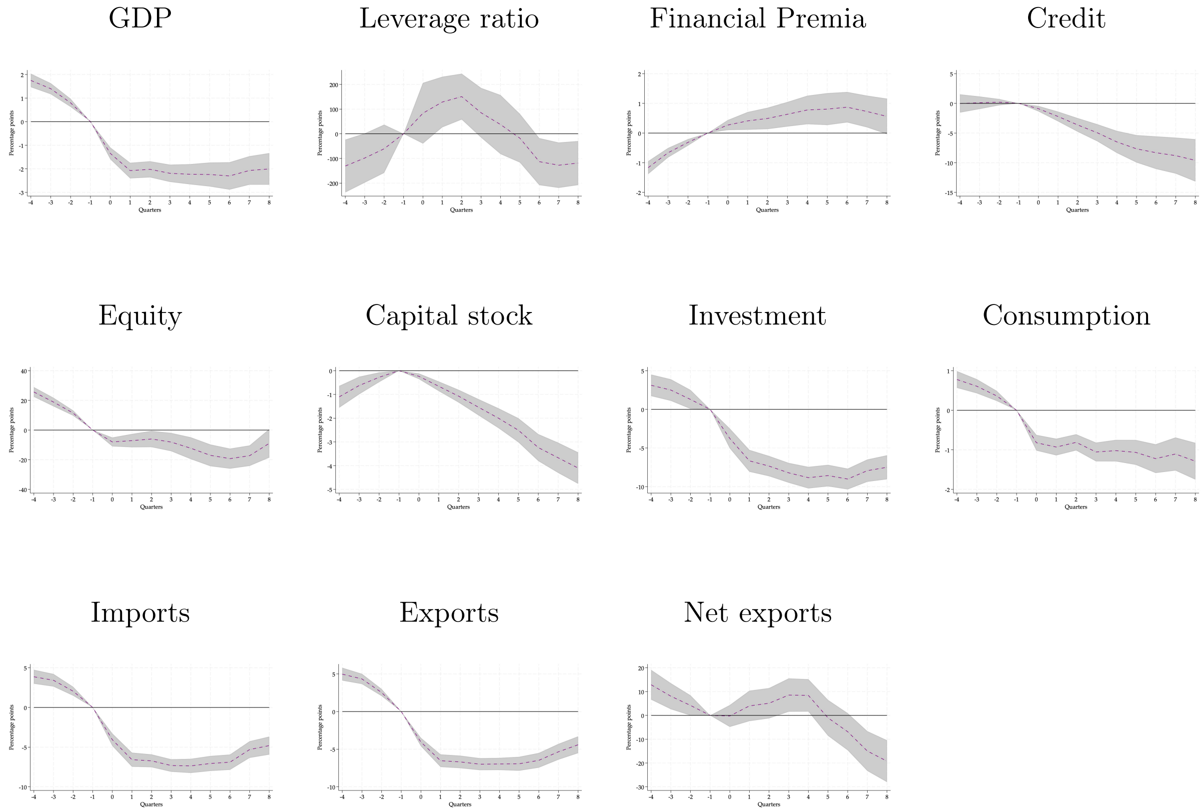


This framework guides the empirical analysis that follows. Since the collateral constraint is not directly observable, we first examine the responses of two observable indicators that capture the tightening of financial conditions more directly: the leverage ratio and the financing premium. We then examine how these financial pressures propagate to credit, equity prices, capital values, investment, consumption, and net exports.

Mendoza (2010)'s framework implies that the collateral constraint is more likely to bind when leverage is high. An increase in this ratio may reflect a rise in debt (the numerator), a decline in the value of capital serving as collateral (the denominator), or both. In each case, it indicates a weakening of the borrower's balance-sheet position relative to the value of available collateral.

The results show that the leverage ratio increases in both developed and developing countries, but the timing differs across the two groups. In developed economies, the increase begins around the onset of the SSI episode and peaks withing the first two quarters, suggesting that SSI shocks may transmit more rapidly through balance-sheet and asset-price channels in economies with deeper financial markets (Figure 12). In developing economies, leverage initially declines but turns positive after several quarters, peaks around the fifth quarter and remains positive thereafter (Figure 11). However,

Figure 12: Responses to SSI shocks in developed countries



because the collateral constraint is not directly observable and may bind only in particular states of the economy, this evidence should be interpreted as suggestive rather than definitive.

The response of financing premia provides a second indication of tighter financing conditions following SSI shocks. We measure financing premium as the spread between the domestic lending rate and the three-month US Treasury yield, used as a benchmark for the global risk-free rate. A widening spread therefore indicates an increase in the cost of domestic credit relative to this global benchmark.[11]

Figures 11 and 12 show the financing premium rises following SSI shocks, particularly in developing economies. In these economies, a one percentage-point increase in SSI shock magnitude is associated with an immediate increase in the financing premium that reaches approximately 1.5 percentage points four quarters after the shocks. By contrast, the response is more muted in developed economies. Together with the leverage responses, these results suggest that SSI shocks propagate differently across country groups. These patterns are consistent with the collateral-channel mechanism, although they should be interpreted as suggestive rather than definitive because the collateral constraint is not

[11] Because the spread may also reflect domestic monetary conditions, expected inflation, and sovereign risk, we interpret it as a broad measure of relative financing costs rather than a pure risk premium.

directly observable and may bind only in specific states of the economy.

These tighter financial constraints are reflected in three interrelated outcomes. *First*, credit to the private sector contracts sharply following SSI shocks, with the decline being particularly large and persistent in developing economies. This response is consistent with the the withdrawal of foreign financing reducing the availability of domestic credit and restricting firms' access to external finance *Second*, equity prices decline, particularly in developed economies. Figure 12 shows that stock prices are elevated before the shock but fall sharply thereafter, with the decline reaching about 10 percentage points in developed economies. This pattern is consistent with the balance-sheet channel: tighter financing conditions, higher discount rates, and liquidity-driven asset sales depress equity valuations and weaken collateral values. *Third*, private-sector capital values also falls following SSI shocks, reinforcing the debt-deflation mechanism. Lower capital values reduce the collateral available to firms, further weakening borrowing capacity and tightening financing constraints. The response is statistically significant in both country groups, although it is smaller and more delayed in developing economies. Taken together, these responses indicate that SSI shocks operate through a broad deterioration in financial conditions, linking the withdrawal of gross inflows to lower credit, declining asset and capital values, and reduced borrowing capacity.

At the macroeconomic level, his deterioration in financial conditions is reflected in three main responses. First, investment declines significantly following SSI shocks (Figures 11 and 12). Second, consumption also contracts sharply. This is consistent with tighter borrowing constraints and negative wealth effects arising from falling capital and asset values, which limit households' ability to smooth consumption over time. Third, net exports increase, driven primarily by a sharp contraction in imports. As domestic demand weaken, households and firms reduce their expenditure on imported consumption, intermediate and capital goods. The increase in net exports should therefore be interpreted as a contractionary adjustment arising from import compression rather than stronger export performance.

Overall, the empirical evidence is consistent with the financial-accelerator mechanism emphasized by Mendoza (2010). SSI episodes are associated with rising leverage, indicating a deterioration in borrowers' balance-sheet positions relative to collateral values. The resulting tightening of financial constraints appear to operate through two related mechanisms: higher financing premia and debt-deflation mechanism. The relative importance of these mechanisms differs across country groups. In developing economies, SSI shocks appear to propagate mainly through higher financing costs, as the rise in financial premia restricts access to credit and weighs on investment, consumption, and imports. In developed economies, by contrast, the evidence is more consistent with a debt-deflation channel. The earlier increase in leverage, together with sharper declines in equity prices and capital values, points to a negative feedback loop between asset prices, collateral values, and credit. The smaller rise in financial premia observed in developed economies further supports this interpretation, suggesting that asset-price and balance-sheet adjustments, rather than increases in borrowing costs, represent the dominant transmission channel.

3.2.4 Subperiod Analysis

This section examines the effects of sudden-stop shocks across three subperiods: 1990–1999, 2000–2009, and 2010–2025. The analysis serves two purposes. First, it assesses whether the effects of SSIN and SSI shocks differ across subperiods. Second, it provides a check on the stability of the IV specification, since the identifying power of global financial-risk instruments may differ across periods. This point is particularly relevant for the 1990s, when sudden-stop episodes were less frequent and affected a more limited set of countries, especially among developed economies. As shown in Figure 6, SSI and SSIN episodes are relatively scarce in the 1990s and become more frequent only in later periods, especially around the global financial crisis and again after 2020. Consequently, the subperiod estimates for the 1990s are based on more limited variation and should be interpreted with caution. We focus on GDP responses. Figures 13 and 14 report the estimates using raw shocks and IV shocks, respectively.

The raw-shock estimates in Figure 13 indicate an important time variation in the output effects of sudden stops. For SSIN, the point estimates suggest that the output cost has diminished over time. In particular, the contraction is the largest in the 1990s. It remains negative but less pronounced in the 2000s and displays very limited impacts after 2010. For SSI shocks, the 2000s display the strongest contraction, while the responses of the other subperiods are less precisely estimated.

The IV estimates in Figure 14 provide a more mixed picture. For SSIN, the responses are contractionary in the 2000s and after 2010, whereas the estimates of the 1990s are either statistically insignificant or counterintuitively expansionary. For SSI, the IV specification also indicates negative responses during the 2000s and the post-2010 period. By contrast, the responses over the 1990s are statistically insignifcant. The contraction is more persistent during the 2000s, while the post-2010 period displays a sharper short-run decline in output followed by a faster recovery. Especially, the impacts are more persistent and negative in the 2000s whereas the 2010s display the strongest output losses although the recovery were faster than in the 2000s. The impact in the 1990s are either statistically insignificant or expansionary.

These results, suggest that the relevance of the VIX instrument varies across subperiods.

The first-stage estimates reported in Table B.4 indicate that, during the 2000s, the VIX strongly predicts both SSIN and SSI shocks. Before 2000, the first stage is also strong for SSIN, but weak for SSI. From 2010 onward, the first stage is weak for both SSIN and SSI. The post-2010 IV responses for both shocks, as well as the pre-2000 response for SSI, should therefore be interpreted with caution.

Overall, the subperiod results suggest meaningful variation over time in the propagation of sudden-stop shocks. However, the reliability of the IV estimates also varies across subperiods. In particular, the IV estimates in the 1990s are unstable, especially for SSI, partly reflecting the lower frequency of sudden-stop episodes and more limited identifying variation in that period. As a result, the subperiod IV results should be interpreted as suggestive evidence of time variation, while the full-sample IV estimates remain the main benchmark.

Figure 13: Sub-period dynamic responses to raw shocks

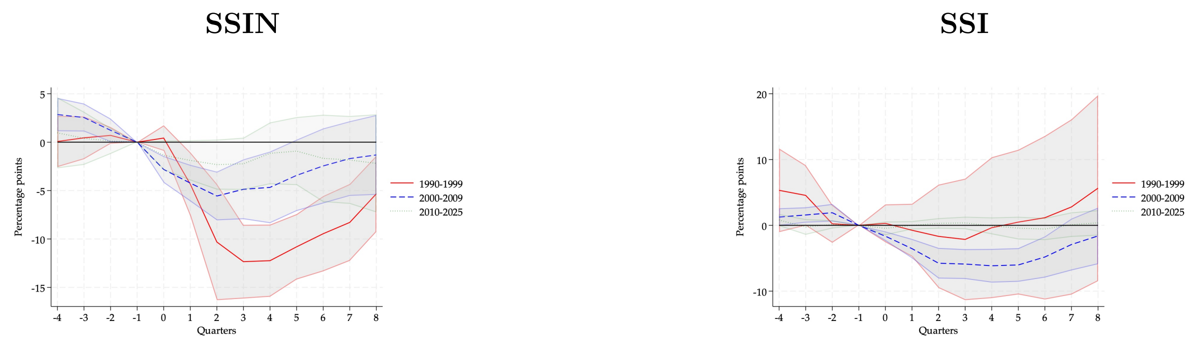
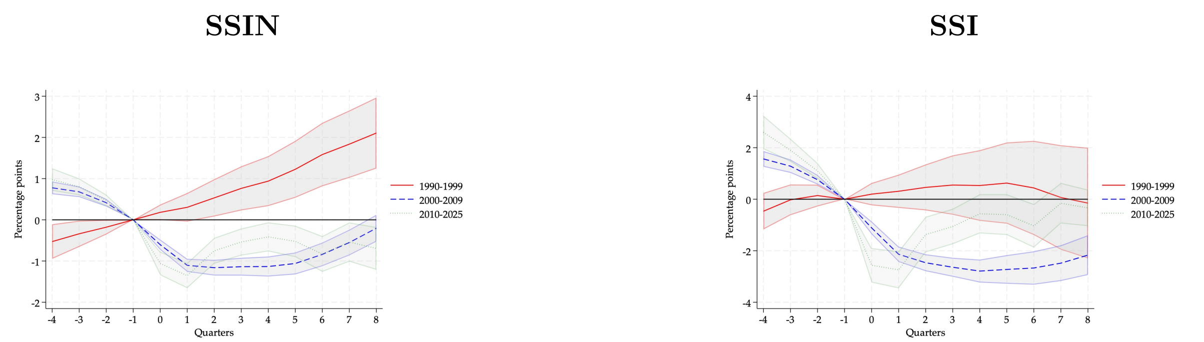


Figure 14: Sub-period dynamic responses to IV shocks



3.2.5 Robustness

We assess robustness of our results along five dimensions. First, we replace the benchmark VIX instrument with two alternative instruments: US dollar shocks (USD) and US monetary policy shocks (MP). The monetary policy shocks are taken from (Jarociński and Karadi (2020)). We construct the US dollar shocks as the residuals from a regression of the first log-difference of the US nominal effective exchange rate on its own first lag and first lag of the VIX. The fitted values from this regression were multiplied by minus one, and all negative values were set equal to zero. The resulting variable therefore captures only predicted US dollar movements in the direction associated with a dollar appreciation after the sign transformation.

Second, we assess robustness of the results to the two-standard deviation criterion used to identify sudden-stop episodes. Specifically, the benchmark definition requires at least one observation of the year-on-year change in capital flows, $\Delta C_{t,j}$, to fall at least two standard deviations below its sample mean. We replace this benchmark with alternative thresholds of 1.5 and 2.5 standard deviations. Third, the benchmark analysis retains a balanced window of 20 quarters before and after the onset of each sudden-stop episode. We assess the robustness of the results by applying alternative event windows of ± 15 and ± 25 quarters. Four, the benchmark analysis follows the hierarchy SSION, SSIN/SSON, and then single-flow episodes such as SSI, SSO, and SSN. we re-estimated the model without applying the exclusion of overlapping episodes. Finally, we re-estimate the model by removing interpolated data.

Appendix D reports the details and results of these exercises. Overall, the estimates are qualitatively similar to those obtained in the benchmark analysis. Across the five robustness exercises, sudden-stop episodes are preceded by an economic expansion and followed by a decline in GDP. Although the magnitude and precision of the estimated responses vary across specifications, the qualitative pattern remains consistent with the baseline results. Taken together, these robustness exercises support the main conclusion that inflow-driven sudden stops are associated with persistent output losses.

4 Conclusion

This paper provides new evidence on the incidence, macroeconomic consequences, and transmission of sudden stops. We constructed a new database encompassing 137 countries from 1985 to 2025, enabling an updated analysis of global trends. Additionally, we focused on inflow-driven events (SSI and SSIN), which are the most harmful in terms of economic contraction. Specifically, we examined their economic impacts over time and the transmission channels through which these impacts unfold.

The empirical analysis focuses on two types of inflow-driven episodes. SSIN episodes combine a sharp reversal in gross inflows with a loss of net external financing, whereas SSI episodes involve a reversal in gross inflows without a corresponding net-flow sudden stop. To account for differences in episode severity, we construct shock measures that scale the onset of each episode by the magnitude of the associated contraction in capital inflows. We then estimate their dynamic effects using local projections and complementary IV specifications.

SSIN is mainly associated with external adjustment through the current account; that is, the Real Exchange Rate (RER) Depreciation Channel. This channel implies that the need to cover the CAD, in the face of a depleted net financial account, triggers a depreciation of the RER to adjust the trade balance. This abrupt adjustment affects consumption and investment, through relative prices. Our results provide evidence of this mechanism. They show that SSIN are followed by significant RER depreciation, triggering a cascade of economic effects that negatively impact GDP. We also explore SSIN heterogeneous effects between the flexible and pegged exchange rate regimes. Our results directly contribute to the "fixed vs. flexible" empirical debate, offering further evidence that floating regimes enhance a country's ability to withstand external shocks.

Now, SSI are more closely related to financial-market disruptions and capital formation channel. This channel introduces a collateral constraint which, in the presence of a sudden stop, may become binding. In other words, a sudden stop may limit the financing capacity of economic agents, through two effects: a higher financial premium, which increases the cost of borrowing, and a debt-deflation mechanism, which creates a negative loop between credit and capital value. Both effects, together or in isolation, end up diminishing investment capacity, being once again the main vehicle by which GDP is affected. Overall, our results support the deployment of this channel following a SSI. Furthermore, considering different financial market structures between developing and developed countries, we conducted a separate analysis. Our finding suggest that, in developed economies, the debt-deflation mechanism plays a primary role, whereas in developing economies, the financial premium effect serves as the predominant transmission channel.

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Online Appendix

A Data details

A.1 Definition of financial flows

Gross financial flows comprise transactions in external assets and liabilities recorded in the IMF's International Financial Statistics (IFS) database for each reporting economy. Gross financial *inflows* correspond to changes in the stock of external liabilities owed by residents and include:

- direct investment receipts (DIL);
- portfolio investment liabilities (PIL);
- other investment liabilities (OIL).

Gross financial *outflows* correspond to changes in the stock of external assets held by residents and include:

- direct investment abroad (DIA),
- portfolio investment assets (DIA),
- other investment assets (OIA).

Under our sign convention, increases in external liabilities are recorded positively as gross inflows, whereas increases in external assets are recorded negatively as gross outflows. Net flows are thus estimated as the sum of gross inflows and outflows.

A.2 Countries, data coverage and income-group classification

The table below lists the countries included in the study, their respective periods of data coverage, and their classification as developed or developing economies based on the IMF-group classification.

Table A.1: Countries in the sample

Country	From	To	Status	Country	From	To	Status
Australia	1989 Q1	2025 Q3	Developed	Georgia	1997 Q1	2025 Q3	Developing
Austria	2005 Q1	2025 Q3	Developed	Ghana	2011 Q1	2025 Q2	Developing
Belgium	2002 Q1	2025 Q3	Developed	Guatemala	1980 Q1	2025 Q2	Developing
Canada	1980 Q1	2025 Q3	Developed	Guinea	2009 Q1	2025 Q3	Developing
Croatia, Rep	1993 Q1	2025 Q3	Developed	Haiti	2004 Q4	2025 Q1	Developing
Cyprus	2001 Q1	2025 Q3	Developed	Honduras	2004 Q1	2025 Q3	Developing
Czech Rep	1993 Q1	2025 Q3	Developed	Hungary	1989 Q4	2025 Q3	Developing
Denmark	1980 Q1	2025 Q3	Developed	India	1980 Q1	2025 Q3	Developing
Estonia, Rep	1992 Q1	2025 Q3	Developed	Indonesia	1981 Q1	2025 Q4	Developing
Finland	1980 Q1	2025 Q2	Developed	Iraq	2013 Q1	2025 Q3	Developing
France	1980 Q1	2025 Q3	Developed	Jamaica	2012 Q1	2025 Q3	Developing
Germany	1980 Q1	2025 Q3	Developed	Jordan	1980 Q1	2025 Q1	Developing
Greece	1999 Q1	2025 Q3	Developed	Kazakhstan	1995 Q1	2025 Q2	Developing
Hong Kong	1999 Q1	2025 Q3	Developed	Kiribati	2013 Q1	2025 Q4	Developing
Iceland	1980 Q1	2025 Q2	Developed	Kosovo	2009 Q1	2025 Q3	Developing
Ireland	2005 Q1	2025 Q1	Developed	Kyrgyz Rep	1993 Q1	2023 Q2	Developing
Israel	1980 Q1	2025 Q3	Developed	Lao	1994 Q1	2025 Q2	Developing
Italy	1980 Q1	2025 Q2	Developed	Lebanon	2002 Q1	2023 Q4	Developing
Japan	1996 Q1	2025 Q3	Developed	Lesotho,	1982 Q1	2025 Q4	Developing
Korea	1980 Q1	2025 Q3	Developed	Liberia	2010 Q1	2024 Q4	Developing
Latvia	1993 Q1	2025 Q3	Developed	Madagascar	2003 Q1	2024 Q4	Developing
Lithuania	1993 Q1	2025 Q3	Developed	Malaysia	1999 Q1	2024 Q4	Developing
Luxembourg	2002 Q1	2025 Q3	Developed	Mauritania	2012 Q1	2024 Q4	Developing
Malta	1995 Q1	2025 Q3	Developed	Mauritius	2000 Q1	2025 Q1	Developing
Netherlands	1980 Q1	2025 Q3	Developed	Mexico	1980 Q1	2025 Q4	Developing
New Zealand	2000 Q1	2025 Q3	Developed	Moldova	1994 Q1	2025 Q3	Developing
Norway	1980 Q1	2025 Q3	Developed	Mongolia	1998 Q1	2025 Q1	Developing
Poland, Rep	2000 Q1	2025 Q3	Developed	Montenegro	2007 Q1	2025 Q2	Developing
Portugal	1980 Q1	2025 Q2	Developed	Morocco	2003 Q1	2025 Q3	Developing
Singapore	1995 Q1	2025 Q4	Developed	Mozambique	2005 Q1	2025 Q2	Developing
Slovak Rep	1993 Q1	2025 Q3	Developed	Myanmar	1980 Q1	2020 Q3	Developing
Slovenia, Rep	1992 Q1	2025 Q3	Developed	Namibia	1999 Q1	2025 Q2	Developing
Spain	1980 Q1	2025 Q3	Developed	Nepal	1980 Q1	2025 Q2	Developing
Sweden	1980 Q1	2025 Q3	Developed	Nicaragua	1992 Q1	2025 Q1	Developing
Switzerland	1999 Q1	2025 Q3	Developed	N. Macedonia	1996 Q1	2025 Q3	Developing
UK	1980 Q1	2025 Q2	Developed	Pakistan	1980 Q1	2025 Q4	Developing
United States	1980 Q1	2025 Q3	Developed	Panama	1998 Q1	2025 Q2	Developing
Afghanistan	2008 Q2	2021 Q1	Developing	Papua NG	1980 Q1	2025 Q1	Developing
Albania	1995 Q1	2025 Q3	Developing	Paraguay	2000 Q1	2025 Q3	Developing
Angola	2012 Q1	2025 Q3	Developing	Peru	1991 Q1	2025 Q3	Developing
Argentina	1980 Q1	2025 Q3	Developing	Philippines	1980 Q1	2025 Q3	Developing
Armenia, Rep	1993 Q1	2025 Q3	Developing	Qatar	2011 Q1	2025 Q3	Developing
Aruba,	1986 Q1	2023 Q4	Developing	Romania	1991 Q1	2025 Q3	Developing
Azerbaijan	1999 Q1	2025 Q3	Developing	Russia	1994 Q1	2021 Q4	Developing
Bahamas	1980 Q1	2024 Q4	Developing	Samoa	2003 Q3	2025 Q3	Developing
Bangladesh	1980 Q1	2025 Q3	Developing	Saudi Arabia	2006 Q1	2025 Q3	Developing
Belarus, Rep	1996 Q1	2025 Q3	Developing	Serbia	2007 Q1	2025 Q3	Developing
Belize	2001 Q1	2025 Q3	Developing	Seychelles	2005 Q1	2025 Q3	Developing
Bermuda	2006 Q1	2024 Q3	Developing	Solomon	2006 Q1	2024 Q4	Developing
Bhutan	2006 Q3	2024 Q4	Developing	South Africa	1980 Q1	2025 Q3	Developing
Bolivia	1988 Q1	2025 Q3	Developing	Sri Lanka	1980 Q1	2025 Q1	Developing
Bosnia and H.	2001 Q1	2025 Q1	Developing	Sudan	1980 Q1	2022 Q4	Developing
Brazil	1980 Q1	2025 Q4	Developing	Suriname	2005 Q1	2025 Q3	Developing
Brunei Darus.	2001 Q1	2024 Q4	Developing	São Tomé	2011 Q1	2025 Q2	Developing
Bulgaria	1991 Q1	2025 Q3	Developing	Tajikistan,	2002 Q1	2025 Q3	Developing
Cabo Verde	1998 Q1	2025 Q3	Developing	Tanzania,	2012 Q1	2025 Q2	Developing
Cambodia	1994 Q1	2025 Q3	Developing	Thailand	1980 Q1	2025 Q3	Developing
Chile	1991 Q1	2025 Q3	Developing	Timor-Leste	2009 Q1	2025 Q2	Developing
China, PR	2005 Q1	2025 Q3	Developing	Türkiye	1984 Q1	2025 Q3	Developing
Colombia	1996 Q1	2025 Q3	Developing	Uganda	2000 Q3	2025 Q3	Developing
Costa Rica	1999 Q1	2025 Q3	Developing	Ukraine	1994 Q1	2025 Q3	Developing
Dominican R	2011 Q1	2025 Q3	Developing	Uruguay	2000 Q1	2025 Q3	Developing
Ecuador	1993 Q1	2025 Q3	Developing	Uzbekistan,	2005 Q1	2025 Q3	Developing
Egypt,	2011 Q1	2025 Q2	Developing	Vanuatu	1987 Q1	2023 Q2	Developing
El Salvador	1999 Q1	2025 Q3	Developing	Venezuela,	1994 Q1	2011 Q4	Developing
Eswatini	2011 Q1	2025 Q1	Developing	Vietnam	1996 Q1	2025 Q3	Developing
Ethiopia	1980 Q1	2024 Q4	Developing	Palestine	2012 Q1	2024 Q4	Developing
Fiji, Rep	2000 Q1	2025 Q2	Developing	Zambia	2005 Q1	2025 Q3	Developing
Gambia	2007 Q1	2025 Q2	Developing				

A.3 Details on stylized facts

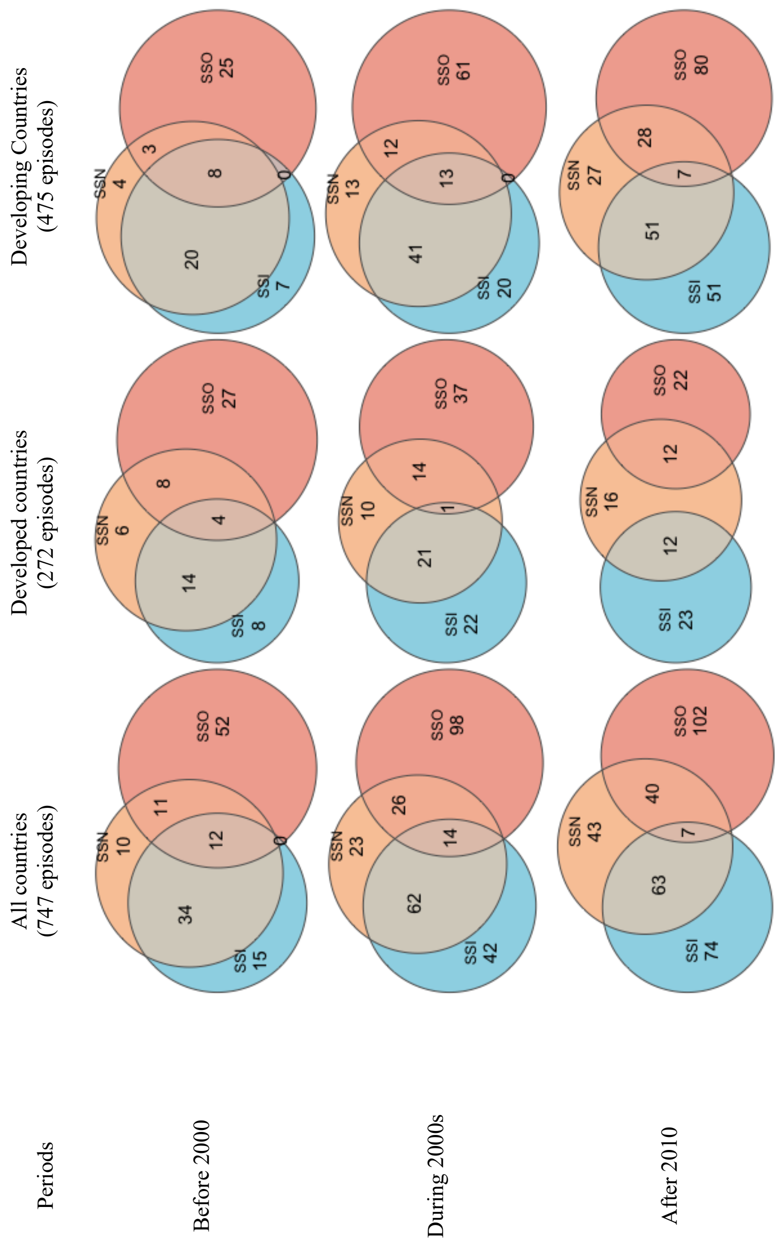
Table A.2 defines the seven types of sudden-stop episodes using indicator variables for sudden stops in gross inflows, gross outflows, and net flows. This complements the information reported in Figure 3 of Section 2.1.

Table A.2: Sudden-stop (SS) dummies

Episode	SS in inflows	SS in outflows	SS in net flows
SSI	1	0	0
SSO	0	1	0
SSN	0	0	1
SSIN	1	0	1
SSON	0	1	1
SSION	1	1	1
SSIO	1	1	0

Figure A.1 reports the number and composition of sudden-stop episodes by country groups and subperiods.

Figure A.1: Sudden Stops by period (1985-2025)



B Instrument relevance and identifying assumptions

The raw sudden-stop shocks may be endogenous in Equation 1. For instance, domestic vulnerabilities may affect both capital flows and GDP, while anticipated or realized output weakness may trigger capital-flow reversals. As a result, the raw-shock estimates may confound the effects of sudden stops with factors that make these episodes more likely. To address this concern, we estimate LP-IV specifications in which the SSIN and SSI shocks are instrumented by the CBOE Volatility Index (VIX).

An instrument must satisfy both the relevance and exogeneity conditions (Wooldridge, 2009). Relevance requires the VIX to predict the raw sudden-stop shock measures, conditional on controls. Increases in the VIX capture heightened global risk aversion and are typically associated with contraction in global capital flows (Rey, 2015), thereby increasing the likelihood of sudden-stop episodes (Eichengreen and Gupta, 2016; Gonçalves and David, 2019).

B.1 Full-sample analysis

Table B.3 reports the first-stage regressions for the SSIN and SSI shock measures. The regressions include country fixed-effects. The estimated coefficients on the VIX are positive and statistically significant in both specifications. The excluded-instrument F-statistic is 62.138 for SSIN and 9.761 for SSI. Relative to the critical value of 10 proposed by Staiger and Stock (1997), the first-stage relationship is strong for SSIN but only borderline for SSI. The SSI estimates should therefore be interpreted with caution.

The exogeneity condition requires that, conditional on the controls included in Equation 1, the VIX affect GDP only through its effect on the sudden-stop shock measures. This exclusion restriction cannot be tested directly. Moreover, this condition is demanding because the VIX may affect real activity through channels other than sudden stops, including global demand, asset prices, exchange rates, and borrowing costs. For instance, Rey (2015) shows that the VIX co-moves with global financial cycle, credit and asset prices. We therefore treat the conditional exogeneity of the VIX as a maintained identifying assumption. We assess its plausibility by examining the robustness of the results to alternative instruments (see Section D.0.1). Moreover, we document the direct channels through which sudden-stop shocks affect GDP through the VIX.

Table B.3: First-stage regressions for SSIN and SSI shocks

	SSIN	SSI
VIX	0.001206***	0.000501**
	(0.000153)	(0.000160)
t-statistic	7.883	3.124
p-value	0.000	0.0018
Total sum of squares	44.577	35.503
Residual sum of squares	44.099	35.438
R-squared	0.0107	0.0018
Adjusted R-squared	-0.0160	-0.0259
F-statistic	62.138	9.761
Numerator df	1	1
Denominator df	5,735	5,286
F-statistic p-value	0.000	0.0018

Note: The table reports the first-stage regressions of SSIN and SSI shocks on the VIX. Standard errors are reported in parentheses. Both regressions are estimated using country fixed effects. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

B.2 First-stage regressions for subperiod analysis

The first-stage estimates reported in Table B.4 indicate that, during the 2000s, the VIX strongly predicts both SSIN and SSI shocks. Before 2000, the first stage is also strong for SSIN, but weak for SSI. From 2010 onward, the first stage is weak for both SSIN and SSI.

Table B.4: First-stage regressions across subperiods

	1990-1999	2000-2009	2010-2025
Panel A: SSIN shocks			
VIX	0.000604***	0.001621***	0.000268
	(0.000175)	(0.000126)	(0.000203)
t-statistic	3.451	12.850	1.320
p-value	0.0006	< 0.0001	0.1869
Total sum of squares	4.905	20.738	18.934
Residual sum of squares	4.895	20.158	18.928
R-squared	0.0021	0.0280	0.0003
Adjusted R-squared	-0.0249	0.0017	-0.0267
F-statistic	11.908	165.114	1.742
F-statistic p-value	0.0006	< 0.0001	0.1869
Panel B: SSI shocks			
VIX	0.000117	0.000993***	-0.000101
	(0.000094)	(0.000120)	(0.000209)
t-statistic	1.254	8.284	-0.483
p-value	0.2099	< 0.0001	0.6291
Total sum of squares	0.810	10.781	23.912
Residual sum of squares	0.810	10.643	23.911
R-squared	0.0003	0.0128	0.00004
Adjusted R-squared	-0.0275	-0.0146	-0.0278
F-statistic	1.572	68.619	0.233
F-statistic p-value	0.2099	< 0.0001	0.6291

Note: The table reports first-stage regressions for the group-specific SSIN and SSI shock variables. Countries are classified according to the period in which their SSIN or SSI episode started. In each column, the dependent variable is the interaction between the relevant sudden-stop indicator and the corresponding shock-period group indicator. The instrument is the interaction between the VIX and the same group indicator. All regressions include country fixed effects. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

C Other results from the benchmark analysis

Figure C.2: Responses to SSIN shocks in all countries

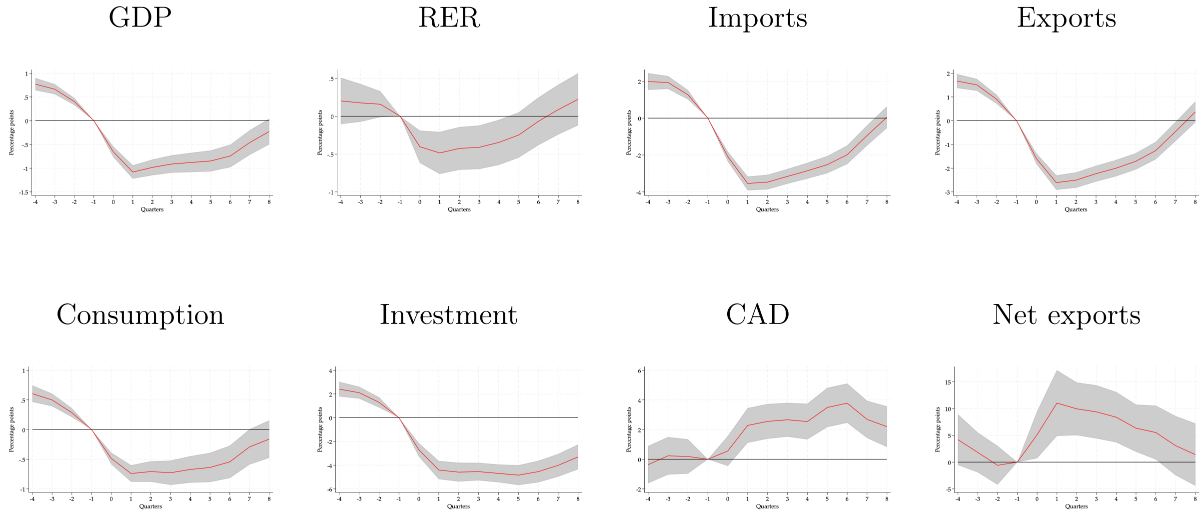
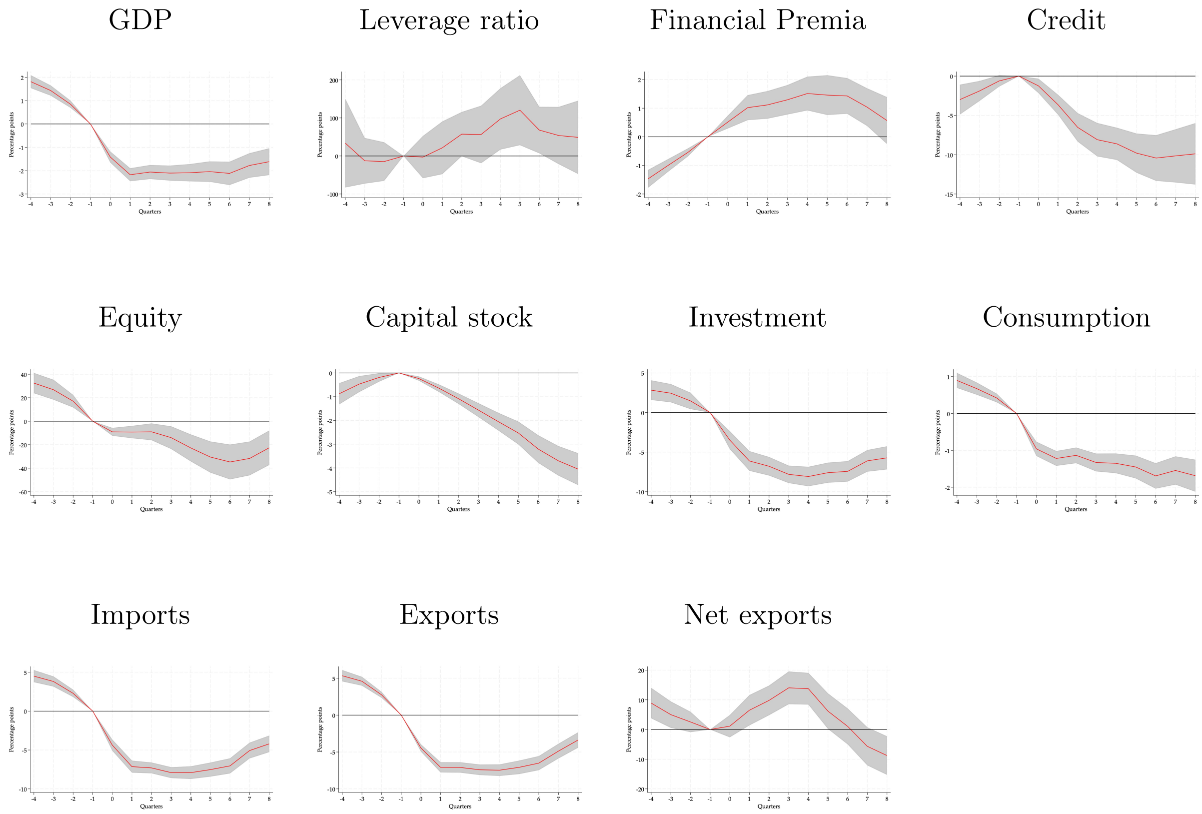


Figure C.3: Responses to SSI shocks in all countries



D Results from robustness exercises

D.0.1 Other instruments

Figure D.4 reports the dynamic GDP responses obtained when the benchmark VIX-based instrument is replaced by two alternative external instruments: US dollar shocks (USD) and US monetary policy shocks (MP). These exercises assess whether the main results are specific to the use of the VIX or instead reflect a broader external financial channel. The alternative-IV estimates provide complementary evidence in support of the benchmark for SSIN and SSI findings. Across both specifications, episodes are preceded by an economic boom and then followed by a decline in GDP, although the magnitude and precision of the estimates vary across instruments. For instance, the output decline is relatively short-lived under the USD instrument for SSIN but more persistent under the MP instrument, whereas the SSI response remains negative for several quarters under both instruments. Overall, the qualitative pattern from the alternative instruments is consistent with the baseline evidence that inflow-driven sudden stops driven are followed by output losses that can persist for several quarters.

The first-stage estimates are reported in Tables D.5 and D.6, for USD and MP, respectively. The USD instrument strongly predicts SSIN shocks, while the first stage is only borderline for SSI. The MP is also weak for SSIN, and has virtually no predictive power for SSI. Accordingly, the MP-IV estimates should therefore be interpreted with considerable caution, particularly for SSI. Therefore, USD-based estimates provide more credible complementary evidence for the benchmark SSIN results, while the remaining alternative-IV estimates should be regarded as suggestive.

Figure D.4: GDP responses to SSIN and SSI shocks (alternative instrumental variable)

SSIN-IV-USD | SSI-IV-USD | SSIN-IV-MP | SSI-IV-MP

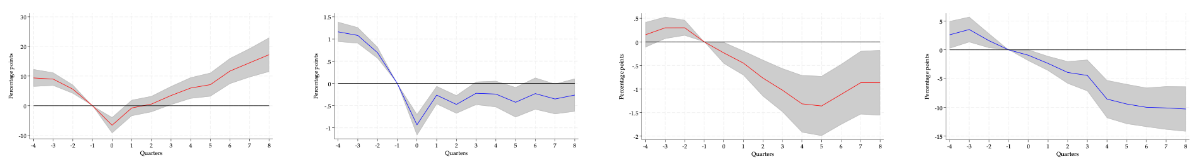


Table D.5: First-stage regressions for USD shock instrument

	SSIN	SSI
USD shock	0.034650***	0.016737**
	(0.006197)	(0.005933)
t-statistic	5.591	2.821
p-value	0.000	0.0048
Total sum of squares	44.463	35.491
Residual sum of squares	44.221	35.437
R-squared	0.0055	0.0015
Adjusted R-squared	-0.0216	-0.0264
F-statistic	31.262	7.959
Numerator df	1	1
Denominator df	5,694	5,260
F-statistic p-value	0.000	0.0048

Note: The table reports the first-stage regressions of SSIN and SSI shocks on the US dollar shock. Standard errors are reported in parentheses. Both regressions are estimated using country fixed effects. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table D.6: First-stage regressions for monetary policy shock instrument

	SSIN	SSI
Monetary policy shock	-0.058416*	-0.006359
	(0.023285)	(0.022663)
t-statistic	-2.509	-0.281
p-value	0.0121	0.7790
Total sum of squares	44.171	33.507
Residual sum of squares	44.121	33.506
R-squared	0.0011	0.0000
Adjusted R-squared	-0.0266	-0.0291
F-statistic	6.294	0.079
Numerator df	1	1
Denominator df	5,584	5,042
F-statistic p-value	0.0121	0.7790

Note: The table reports the first-stage regressions of SSIN and SSI shocks on the US monetary policy shock. Standard errors are reported in parentheses. Both regressions are estimated using country fixed effects. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

D.0.2 Threshold to identify sudden stops

The benchmark sudden-stop identification procedure follows the literature (Calvo et al., 2004). It requires that at least one observation of the year-on-year change in capital flows, $\Delta C_{t,j}$, fall at least two standard deviations below its sample mean. To assess the robustness of our results to this criterion, we repeat the identification procedure and re-estimate the main local-projection models using alternative thresholds of 1.5 and 2.5 standard deviations. Tables D.7 and D.8 report the numbers of sudden-stop episodes identified for each alternative threshold, the change relative to the benchmark, and the corresponding average episode duration. Figures D.5 and D.6 report the corresponding impulse responses obtained from local projections.

As expected, lowering the threshold increases the number of identified episodes, whereas increasing it reduces the number and identifies longer-duration episodes. Despite these changes, the estimated GDP responses remain broadly consistent with the benchmark results. Sudden-stop episodes are generally preceded by an economic expansion and followed by a decline in GDP in both the raw-shock and IV specifications. The magnitude, persistence, and precision of the responses vary across thresholds, with the 2.5 threshold generally generating larger output contractions. These results indicate that our main findings are not driven by the benchmark two-standard-deviation cutoff.

Table D.7: Robustness check using a 1.5-standard-deviation threshold

	All countries			Developed countries			Developing countries		
Episodes	Number	Change	Avg. dur.	Number	Change	Avg. dur.	Number	Change	Avg. dur.
SSI	206	+59	2.8	89	+26	3.1	117	+33	2.5
SSO	408	+153	2.5	155	+66	2.5	253	+87	2.6
SSN	122	+31	2.5	65	+23	2.6	57	+8	2.4
SSIN	294	+139	2.6	93	+45	2.4	201	+94	2.6
SSON	168	+100	2.1	60	+33	2.2	108	+67	2.0
SSION	83	+52	1.9	9	+6	2.0	74	+46	1.8
SSIO	0	0	NA	0	0	NA	0	0	NA

Figure D.5: GDP responses to SSIN and SSI shocks (1.5 standard deviations)

SSIN SSI SSIN-IV SSI-IV

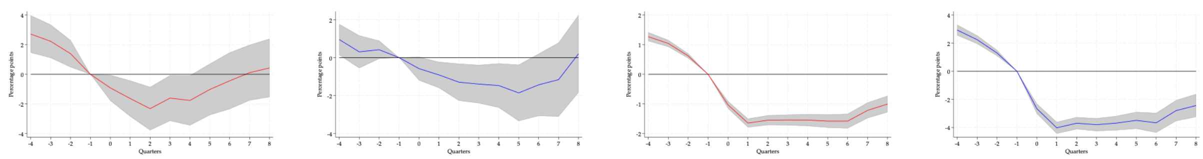
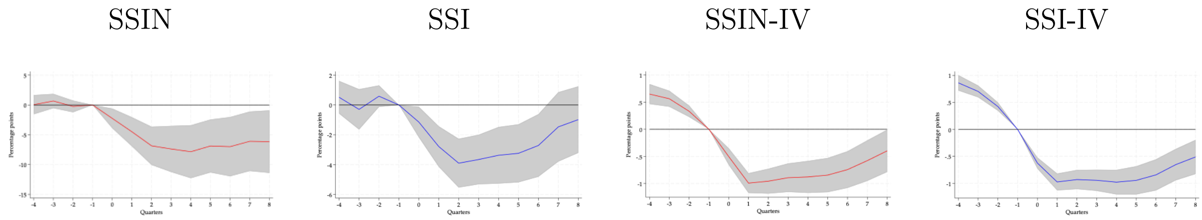


Table D.8: Robustness check using a 2.5-standard-deviation threshold

	All countries			Developed countries			Developing countries		
Episodes	Number	Change	Avg. dur.	Number	Change	Avg. dur.	Number	Change	Avg. dur.
SSI	89	−58	4.1	49	−14	4.3	40	−44	3.9
SSO	132	−123	4.3	47	−42	3.8	85	−81	4.5
SSN	52	−39	3.5	24	−18	3.5	28	−21	3.4
SSIN	63	−92	4.0	22	−26	4.1	41	−66	4.0
SSON	17	−51	2.8	3	−24	2.7	14	−27	2.9
SSION	12	−19	2.7	2	−1	2.0	10	−18	2.8
SSIO	0	0	NA	0	0	NA	0	0	NA

Figure D.6: GDP responses to SSIN and SSI shocks (2.5 standard deviations)



D.0.3 Overlapping sudden-stop episodes

In the baseline classification, episodes that satisfy the criteria for more than one sudden-stop category are assigned to the most comprehensive composite category. Specifically, we apply the following hierarchy: SSION, followed by SSIN and SSON, and then the single-flow categories such as SSI, SSO, and SSN. This rule ensures that each episode is assigned to a unique category why preserving information about the different capital-flows components involved. For instance, an episode initially detected as a sudden stop in gross inflows may also satisfy a criterion for a reversal in net flows. Classifying such an episode as SSIN rather than SSI records both dimensions of the event and avoids counting the same episode in multiple categories.

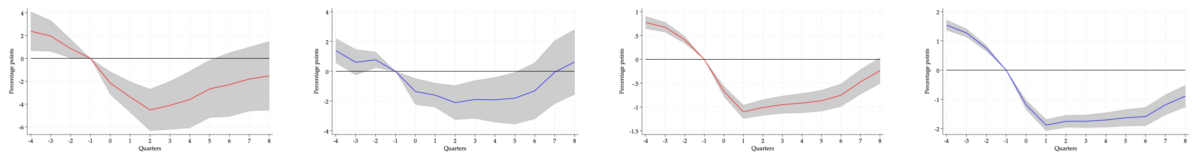
To assess whether the results are sensitive to this classification rule, we re-estimated the whole model without applying the exclusion of overlapping episodes. Table D.9 reports the numbers of sudden-stop episodes identified for the alternative rule, the change relative to the benchmark, and the corresponding average episode duration. Figure D.7 reports the corresponding impulse responses obtained from local projections. As expected, allowing for overlapping episodes increases the number of observations assigned to most categories. Nevertheless, the dynamic responses of GDP remain qualitatively similar to the benchmark estimates. These results indicate that our main findings are not driven by the treatment of overlapping episodes.

Table D.9: Robustness check including overlapping episodes

	All countries			Developed countries			Developing countries		
Episodes	Number	Change	Avg. dur.	Number	Change	Avg. dur.	Number	Change	Avg. dur.
SSI	223	+76	2.9	94	+31	3.3	129	+45	2.7
SSO	328	+73	3.1	114	+25	3.0	214	+48	3.2
SSN	173	+82	2.4	77	+35	2.5	96	+47	2.3
SSIN	176	+21	3.1	51	+3	3.1	125	+18	3.1
SSON	83	+15	2.5	29	+2	2.4	54	+13	2.5
SSION	31	0	2.1	3	0	2.0	28	0	2.1
SSIO	0		NA	0		NA	0		NA

Figure D.7: GDP responses to SSIN and SSI shocks (including overlapping episodes)

$\text{SSIN}_{176.}$ SSI_{223} SSIN-IV_{176} SSI-IV_{223}



D.0.4 Alternative Event Windows in the Local Projections

To ensure a common event window across sudden-stop episodes, the baseline analysis retains observations from 20 quarters before and after the onset of each episode. This choice is motivated by two considerations. First, it allows us to examine both the pre-episode dynamics and the medium-term adjustment following the shock. This is important because sudden-stop episodes are often preceded by capital-inflow expansions and may generate persistent macroeconomic effects. Second, the window is broadly consistent with the event-study literature on sudden stops, in which the choice of pre- and post-event periods is necessarily empirical. For example, Cavallo et al. (2015) use a window of 10 quarters before and after each sudden-stop episode. We use a wider window to exploit the long coverage of our database, which covers almost four decades of quarterly observations, and to capture potentially persistent adjustment following sudden-stop episodes.

To assess the sensitivity of the results to this choice, we re-estimated the main specifications using alternative event windows of ±15 and ±25 quarters. The results, reported in Figures D.8 and D.9, remain qualitatively similar to the benchmark estimates. This suggests that the main findings are not driven by the specific choice of the ±20-quarter window.

Figure D.8: GDP responses to SSIN and SSI shocks (using a ±15-quarter window event)

SSIN_{W15} SSI_{W15} SSIN-IV_{W15} SSI-IV_{W15}

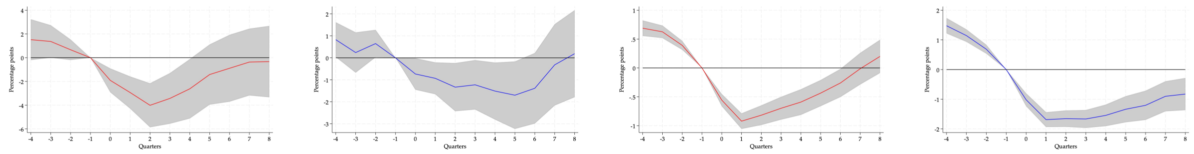
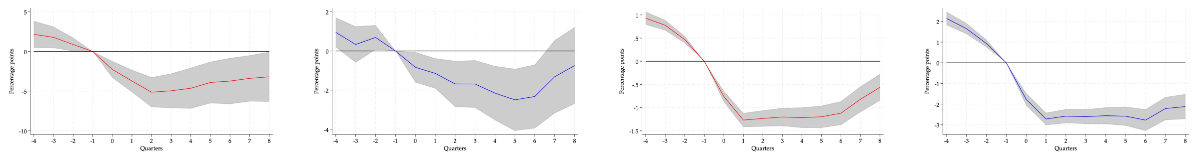


Figure D.9: GDP responses to SSIN and SSI shocks (using a ±25-quarter window event)

SSIN_{W25} SSI_{W25} SSIN-IV_{W25} SSI-IV_{W25}



D.0.5 Quarterly interpolation of data for Norway and Laos

Quarterly observations are missing for two short period in two countries (Norway for 1992–1993 and Laos for 2000). In the baseline analysis, we estimate missing quarterly observations from annual data by dividing annual values by four. This procedure follows Forbes and Warnock (2012) and Forbes and Warnock (2021).

To assess whether this treatment affects the results, we conduct a robustness exercise by excluding the periods for which quarterly data unavailable. Specifically, we retained observation for Norway only from 1994 onward and for Laos only from 2001 onward. Table D.10 reports the numbers of sudden-stop episodes identified for the alternative rule, the change relative to the benchmark, and the corresponding average episode duration. Figure D.10 reports the associated impulse responses obtained from local projections. The number and classification of sudden-stop episodes remain essentially unchanged across all countries. The dynamic responses of GDP to sudden-stop shocks remain qualitatively similar to the benchmark estimates.

Table D.10: Robustness check excluding quarterized observations

	All countries			Developed countries			Developing countries		
Episodes	Number	Change	Avg. dur.	Number	Change	Avg. dur.	Number	Change	Avg. dur.
SSI	146	-1	3.5	62	-1	3.8	84		3.3
SSO	252	-3	3.3	87	-2	3.1	165	-1	3.4
SSN	91		3.2	42		3.2	49		3.2
SSIN	154	-1	3.3	47	-1	3.2	107		3.3
SSON	68		2.7	27		2.5	41		2.8
SSION	31		2.1	3		2.0	28		2.1
SSIO	0		NA	0		NA	0		NA

Figure D.10: GDP responses to SSIN and SSI shocks (excluding quarterized observations)

$\text{SSIN}_{excl.}$ $\quad$ $\text{SSI}_{excl.}$ $\quad$ $\text{SSIN-IV}_{excl.}$ $\quad$ $\text{SSI-IV}_{excl.}$