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Sudden Stops in Emerging and Developing Countries
during COVID-19

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Abstract

Despite an initial reversal of capital inflows, the COVID-19 pandemic resulted in relatively mild impacts on net capital flows to Emerging and Developing Economies. In contrast to previous crises, gross capital inflows offset residents' outflows, resulting in relatively stable net capital flows and modest current account adjustments. Liquid international markets, access to official resources, and sound fundamentals allowed for capital inflows, thus preventing the additional costs of widespread Sudden Stops during the pandemic. Still, we show a relatively simple model predicted Sudden Stops in net flows reasonably well in countries with weaker fundamentals.

JEL classifications: F30, F32, F40

Keywords: Sudden stops, Capital flows, Balance of Payments, Capital Account, COVID-19, Emerging and Developing Economies

1. Introduction

The spread of COVID-19 across the world was accompanied by considerable uncertainty. Emerging and Developing Economies (EMDEs) saw sharp withdrawals of external capital in the first quarter of 2020, raising concerns regarding Sudden Stops in capital flows and their implications. Still, perhaps surprisingly given the size of the shock, only 17 out of 106 EMDEs subsequently suffered a Sudden Stop in net flows following conventional definitions—a much lower proportion compared to previous crises. What happened? Net capital flows remained relatively stable throughout the period because there were offsetting forces between flows from non-residents (gross capital inflows) and flows from residents (gross capital outflows).

Digging deeper into the data, we find 10 countries experienced a Sudden Stop in outflows (flows of residents) at the onset of COVID-19, but they avoided a Sudden Stop in net capital flows given strong inflows (flows of non-residents) in 2020.¹ The resilience of net capital flows was driven by greater public borrowing through bond issuance and increased official multilateral lending.

There were notable differences in the pattern of capital flows during the COVID-19 period vis-à-vis previous crises. In the 1990s, for example, episodes of instability in international financial markets, such as the Asian financial crisis and the Russian default, resulted in Sudden Stops in inflows (the flows of non-residents), prompting net flow sudden stops. The resulting forced current account adjustments were associated with a significant contraction in demand and a real exchange rate depreciation; see Calvo et al. (2008). Instead, during the Global Financial Crisis (GFC) of 2008/09, there was market instability and Sudden Stops in inflows (non-resident flows), but in many cases, the instability in gross inflows was offset by the repatriation of capital by residents, resulting in relatively few Sudden Stops in net flows (see Cavallo et al., 2015). During COVID-19 there was again substantial offsetting between resident and non-resident flows in many countries, but predominantly in the opposite direction compared to the GFC, as higher inflows offset increased outflows.

While offsetting between resident and non-resident capital flows has been common in advanced economies since at least the 1990s, it is a relatively new occurrence among emerging markets. One theme that has emerged in the literature is that stronger domestic fundamentals may

¹ On the other hand, six countries experienced Sudden Stops in capital inflows during 2020 but avoided a Sudden Stop in net flows. That is possible if residents repatriate foreign capital while foreign investors sell domestic assets.

entice resident investors to take advantage of investment opportunities left by foreign investors when they leave. That may explain the experiences of several countries during the GFC.² But the offsetting witnessed in many countries during the COVID crisis appears to be of a different nature. This time around, the uncertainty associated with the pandemic prompted residents to hedge by buying foreign assets, prompting capital flight (increased gross capital outflows), while low global interest rates, expansionary monetary policies, and financing available through multilateral financial institutions allowed emerging and developing economies with stronger fundamentals to tap international markets and offset the outflows of residents. We find that 21 countries avoided a net flow Sudden Stop because of their issuance in external sovereign debt markets, their access to official multilateral flows or a combination of the two. The end result was similar to that of the GFC with relatively stable net flows, but the mechanism was quite different.³

The importance of maintaining access to international capital flows, to avoid disruptive external current account adjustments, brings to the fore the role of sound macroeconomic fundamentals. In the 1990s the severity of crises revealed weak fundamentals in many countries, such as high levels of liability dollarization, large current account and fiscal deficits, and low international reserves. During the GFC, emerging and developing economies had improved their macroeconomic fundamentals due to the commodity boom, and while foreign investors retrenched from emerging markets as developed economies faltered, residents repatriated assets held abroad.⁴ During COVID-19, countries with stronger fundamentals were able to borrow externally and avoid sudden stops in net flows. Still, countries with weaker fundamentals experienced sudden stops in net flows.

In this paper, we apply a popular model for predicting sudden stops that considers a small number of key macroeconomic factors. Interestingly, most of the sudden stops in net flows during the pandemic materialized in countries that this simple standard the model identified as being the most vulnerable. Still, we go further and use the model to uncover differences across crisis episodes. We find that each crisis highlights a particular vulnerability which apparently prevented

² The precise reasons why the offsetting behavior might occur remain debated; see Cavallo (2019) for a recent survey of the literature.

³ Still, in the COVID period eight countries (Armenia, Bangladesh, Brazil, Brunei Darussalam, Chile, Namibia, Saudi Arabia, and Vietnam) followed a similar pattern to the GFC with a sudden stop in inflows (non-residents flows, or an SSI) offset by the repatriation of capital from residents. However, more countries experienced a Sudden Stop in outflows (the flows of residents or an SSO), which was then offset by larger inflows from non-residents.

⁴ In the preceding years to the global financial crisis, the region had gone through a period of economic bonanza facilitated in part by good external conditions.

countries from avoiding a sudden stop in net flows. During the 1990s, dollar liabilities and foreign reserves were key determinants. During the GFC the current account balance appeared to be the critical factor or, in other words, we infer that countries with stronger current account positions were more likely to enjoy the repatriation of residents' capital to offset any sudden stop in inflows. During the COVID crisis, we find that the fiscal balance before the crisis hit was the key determinant of whether the country suffered a net flow Sudden Stop or, stated differently, we infer that countries with strong fiscal positions were more likely to retain access to international capital and hence were likely in a position to offset any capital flight from residents with greater debt issuance (or greater official flows) to avoid a net flow sudden stop.

This paper belongs to a strand of the literature that studies the determinants of sudden stops in gross capital inflows and outflows as well as in net capital movements. Forbes and Warnock (2012) found that global factors, especially global risk through changes in economic uncertainty, as well as changes in risk aversion and global growth, were key drivers of these types of episodes. Calderón and Kubota (2013) and Adler et al. (2016) showed that foreign and local investors may react differently to external and domestic shocks, leading to asymmetric responses in gross capital inflows versus outflows.

Agosin et al. (2019) and Forbes and Warnock (2021) are two recent papers that examine the drivers and characteristics of extreme capital flow episodes such as sudden stops and surges over different time periods. Agosin et al. (2019) focus on the pre-GFC period and find that emerging markets were as prone to sudden stops in capital inflows as advanced economies but were less able to offset these episodes through offsetting between inflows and outflows. Forbes and Warnock (2021) focus on both the pre- and post-Global Financial Crisis (GFC) period, finding that extreme capital flow episodes have become less globally synchronized (“ripples” rather than “waves”) and less frequent since the GFC. It is argued that post-GFC episodes have been driven more by idiosyncratic factors such as oil prices rather than global variables including measures of risk. Both papers suggest that inflows and outflows may provide offsetting mechanisms, and the consideration of the two types of flows may indicate alternative policy recommendations.

Our paper differs from these previous papers in three ways. First, we harness a full taxonomy of types of sudden stops in gross and net flows following Cavallo et al. (2015). Second, we analyze gross and net capital flows during the COVID period, as well as pre and post-GFC. We are then able to provide a new perspective on how the incidence of gross and net flow sudden

stops in emerging and developing economies has changed over time. Finally, we apply a relatively simple model including a limited number of macroeconomic fundamentals to analyze the main drivers of sudden stops and find this model does a good job at predicting that relatively few countries suffered from net flow sudden stops during the pandemic. This analysis also indicates the main variables driving those sudden stops have shifted over time.

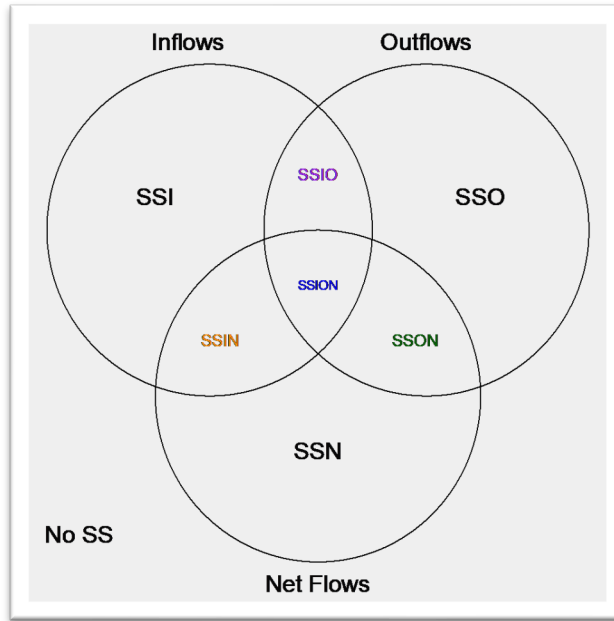
The rest of this paper is organized as follows. In the following section we discuss how we define different types of Sudden Stops. In Section 3 we detail the incidence of these different events during the COVID crisis, comparing the results to previous crises. In Section 4, we focus on the COVID crisis and show how countries boosted capital inflows, to offset outflows, through external debt issuance and official assistance. In Section 5 we estimate a simple model that captures how economic fundamentals affected the likelihood of a net flow sudden stop during the crisis. Section 6 concludes.

2. A Taxonomy of Sudden Stops

A Sudden Stop occurs when foreign financing available to borrower countries unexpectedly dries up, forcing an abrupt current account reversal. Given the difficulty in boosting exports quickly, such a reversal is normally accompanied by a sharp reduction in imports via a sharp recession and/or real exchange rate depreciation. Sudden Stops in net capital flows can thus prove very costly, especially in countries with high levels of liability dollarization. Countries may be more vulnerable to such events, moreover, if i) macroeconomic fundamentals are weak, ii) debt levels and fiscal deficits are high, iii) reserve levels are low, iv) domestic dollarization is significant, and v) current accounts are in deficit.

By year-end 2019, immediately before the onset of the COVID-19 pandemic, 110 out of 149 Emerging and Developing Economies with available data were running current account deficits, some of them substantial. This implies that a very large share of emerging and developing economies were net borrowers when the pandemic began, and therefore they were vulnerable to a Sudden Stop.

Figure 1. A Taxonomy of Sudden Stops



Source: Cavallo et al. (2015).

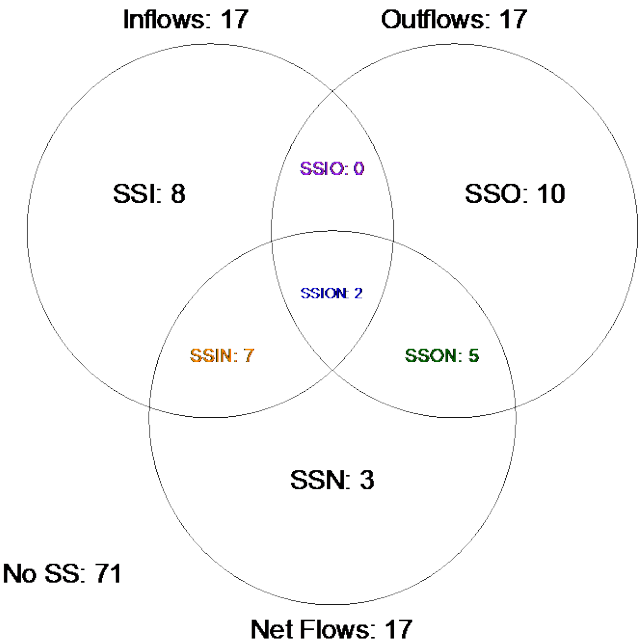
To identify sudden stops empirically, a standard statistical algorithm is applied to the capital flows series. The algorithm, taken from Calvo et al. (2004), identifies a Sudden Stop as an event in which the year-on-year change in net capital flows falls at least two standard deviations below its sample mean. In terms of measuring its length in time, an episode starts in the quarter in which the series falls one standard deviation below its mean. The episode ends when the series goes back to one standard deviation below the mean. To distinguish export booms from financial account reversals, an event is triggered only if GDP growth is below its mean. Sudden Stops can be defined based on net capital flows (as in Calvo et al., 2004) or based on gross flows (as in Forbes and Warnock, 2012). Considering all the possible variants, Cavallo et al. (2015) propose a taxonomy of sudden stops that is illustrated in the Venn diagram of Figure 1.

There are six potential types of sudden stops in the taxonomy. Considering the very center of the figure, an SSION is at the same time a Sudden Stop in gross inflows, a sudden start in gross outflows (i.e., “capital flight” from resident investors), and a Sudden Stop in net capital flows. An SSIN is a Sudden Stop in gross inflows that is also a Sudden Stop in net capital flows, implying that resident investors (i.e., gross capital outflows) do not play a significant role. SSON is a sudden start in gross outflows (i.e., “capital flight” from resident investors) that is also a Sudden Stop in net capital flows, implying that foreign investors do not play a significant role. SSN is a Sudden

Stop in net capital flows that is not concurrently a Sudden Stop in gross inflows or a sudden start in gross outflows; instead, it is a combination of milder reductions in gross inflows and/or increases in gross outflows that add up to two-standard deviations fall in net capital flows, thus qualifying as a Sudden Stop. An SSI is a sudden stop in gross inflows that does not coexist with a sudden stop in net capital flows. This means it must be “financed” by a reduction in gross capital outflows (i.e., capital “repatriation” by resident investors). An SSO is a sudden start in gross outflows that does not coexist with a sudden stop in net capital flows and hence must have been “financed” by an increase in gross inflows from foreign investors. The figure also includes SSIO as a theoretical possibility. In practice, however, the joint occurrence of SSI and SSO is almost always associated with a net flow sudden stop such that SSIO is often an empty set.

We use the quarterly Financial Account flows data from the Balance of Payments Statistics (BOPS) database compiled by the IMF, to assess the incidence of Sudden Stop episodes among Emerging and Developing economies between 2020Q1 and 2022Q4.

Figure 2. Sudden Stops Events during the COVID Crisis



Source: Authors’ calculations based on the Financial Account from the Balance of Payments database (IMF).

Note: Table shows if there was a Sudden Stop from 2020 Q1 until 2020 Q4. See above in Section 2 for the methodology used to identify these events.

Figure 2 illustrates the Sudden Stop episodes for 106 out of 155 Emerging and Developing Economies for which data is available. Considering all the variants, there were 17 Sudden Stops in net flows (= 2 SSION + 7 SSIN + 5 SSON + 3 SSN), 17 Sudden Stops in Gross Outflows (=10 SSO + 5 SSON + 2 SSION), and 17 Sudden Stops in Gross Inflows (=8 SSI + 7 SSIN + 2 SSION). Note that these are not the same countries: 35 countries experienced some type of SS event, several faced more than one type, and 71 faced none.

3. The Incidence of Sudden Stops across Crisis Episodes

How did the incidence of Sudden Stops differ during COVID compared to previous crises? To answer this question, from here on we focus on a smaller set of episodes that encompasses the full taxonomy. We focus on “net flow Sudden Stops” (encompassing SSION, SSIN, SSON and SSN)—or Net SS in short, without distinguishing among the subtypes, and on gross flow sudden stops, i.e., SSI and SSO.

We explore three previous crises: the Tequila Crisis of 1995, the Emerging Market Crises of the late 1990s, and the Global Financial Crisis of 2009. Table 1 details the crisis windows.⁵

Table 1. Crisis Dates

Crisis	Periods	
	Start	End
Tequila Crisis	1995 Q1	1995 Q4
EM Crisis	1998 Q3	1999 Q2
Great Financial Crisis	2009 Q1	2009 Q4
COVID Crisis	2020 Q1	2020 Q4

Note: For each crisis we define a 4-quarter window. We define each window by selecting the quarters where there are more countries with sudden stops in net flows.

Table 2 shows the SS events during selected past episodes and during the COVID pandemic. A first notable result is that only about 16 percent of countries with available data suffered a net flows Sudden Stop event during the COVID crisis. This is about half the share of countries observed during the Emerging Market Crises of the 1990s and the GFC.⁶

⁵ We date crisis windows for each crisis using the 4-quarter window in which most countries suffered a fall in net capital flows of at least 2 standard deviations below the mean.

⁶ Only a small share of countries suffered a Sudden Stop during the Tequila crisis, but this was largely a regional event, with the impacts of the December 1994 Mexican devaluation felt predominantly in Latin America.

Table 2. Sudden Stops in EMDEs across Different Crises

Crisis	WEO Region	Sample	Net Flows SS		Outflows SS		Inflows SS	
			Events	%	Events	%	Events	%
Tequila Crisis	Emerging and Developing Asia	10	0	0.0	3	30.0	2	20.0
	Emerging and Developing Europe	5	0	0.0	0	0.0	0	0.0
	Latin America and the Caribbean	11	4	36.4	0	0.0	2	18.2
	Middle East and Central Asia	5	0	0.0	1	20.0	0	0.0
	Sub-Saharan Africa	3	1	33.3	2	66.7	0	0.0
	Total	34	5	14.7	6	17.6	4	11.8
Emerging Market Crisis	Emerging and Developing Asia	13	6	46.2	3	23.1	5	38.5
	Emerging and Developing Europe	11	3	27.3	1	9.1	4	36.4
	Latin America and the Caribbean	12	4	33.3	3	25.0	3	25.0
	Middle East and Central Asia	6	2	33.3	1	16.7	0	0.0
	Sub-Saharan Africa	3	1	33.3	0	0.0	2	66.7
	Total	45	16	35.6	8	17.8	14	31.1
Global Financial Crisis	Emerging and Developing Asia	22	4	18.2	12	54.5	9	40.9
	Emerging and Developing Europe	15	12	80.0	5	33.3	13	86.7
	Latin America and the Caribbean	21	7	33.3	4	19.0	7	33.3
	Middle East and Central Asia	14	3	21.4	4	28.6	5	35.7
	Sub-Saharan Africa	12	4	33.3	2	16.7	4	33.3
	Total	84	30	35.7	27	32.1	38	45.2
COVID Crisis	Emerging and Developing Asia	23	6	26.1	4	17.4	7	30.4
	Emerging and Developing Europe	16	1	6.3	5	31.3	0	0.0
	Latin America and the Caribbean	24	6	25.0	6	25.0	4	16.7
	Middle East and Central Asia	20	1	5.0	1	5.0	3	15.0
	Sub-Saharan Africa	23	3	13.0	1	4.3	3	13.0
	Total	106	17	16.0	17	16.0	17	16.0

Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF).

Note: Countries with data are the countries that had information for all the periods of the crisis. Table shows if countries had an SS during the period of the crisis. Tequila Crisis shows the SS between 1995 Q1 and 1995 Q4, EM Crisis shows the SS between 1998 Q3 and 1999 Q2, Great Financial Crisis shows the SS between 2009 Q1 and 2009 Q4, and COVID Crisis shows the SS between 2020 Q1 and 2020 Q4.

Net flow Sudden Stops during the COVID crisis were distributed across the world regions. Among the 17 countries with SS Net events, 6 are in Latin America and the Caribbean (LAC) and 6 are in Emerging and Developing Asia (EMDA), 3 are in Sub-Saharan Africa, and just one each in Emerging Europe and in Middle East and Central Asia.

Net flow Sudden Stops were more frequent during the GFC than other crises, and largely driven by a reversal of capital inflows. The share of countries experiencing a sudden stop in inflows

(45 percent) was higher during the GFC compared to any other period in the sample, reflecting the global nature of the crisis.

Table 2 also illustrates that there were fewer sudden stop events of all types during the COVID crisis than during the GFC. Why did this happen if COVID-19 was also a global crisis? To address this question, we focus on gross and net capital flows by quarter, especially in those cases where a Sudden Stop in net flows was narrowly avoided.

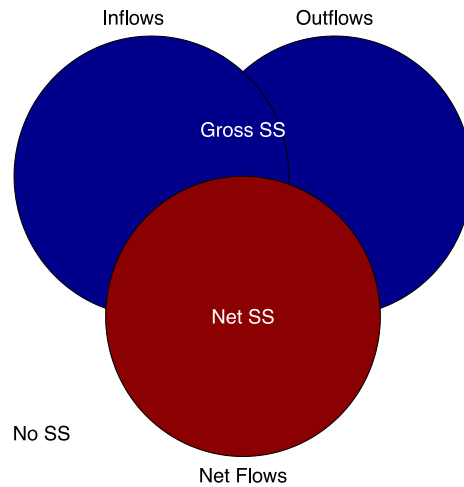
For each of the crises, we divide the sample into three groups: countries that experienced a net flow sudden stop (Net SS) which includes SSN, SSIN, SSON and SSION; countries that experienced a gross flow sudden stop but no Net SS (Gross SS) which includes (SSI and SSO and SSIO), and countries that did not experience any type of sudden stop (No SS), as depicted in Figure 3 (see Appendix A.2. for a list of the countries included in each group in each crisis). Countries in the Gross SS group had some “offsetting behavior” that prevented the gross flow Sudden Stop from becoming an SS Net during that crisis period.

For each type of capital flows (net flows, gross outflows, and gross inflows), we define the following *statistic* to capture the actual changes in capital flows in a standardized fashion: the standardized change in a capital flow (i) is the yearly change of the annualized flow minus the rolling mean of the yearly changes in these capital flows until that period, all divided by the rolling standard deviation of the yearly changes in annualized *net* flows until that same period. Formally, this is:

$$\text{Standardized Change in Capital Flows } (SCCF_{i,t}) = \frac{\text{ChangeYearlyFlow}_{i,t} - \text{mean}_{i,t}}{\text{StandardDeviation}_{net,t}}$$

where i is the type of flow, i.e., net, outflow, or inflow, and t the quarter. In terms of the SS event dating methodology, a SS in net flows becomes *effective* when the SCCF defined employing *net* flows falls below -2 and is said to have started when the SCCF falls below -1 and finishes when it rises above -1. To define the SCCF for all other flows we use the standard deviation of *net* inflows in the denominator, this allows keeping the additivity of statistics, and we weight the deviations from the mean according to their contribution to the deviation in net flows. See Appendix A.3. for the evolution of the SCCF statistics for each country during each of the crises analyzed.

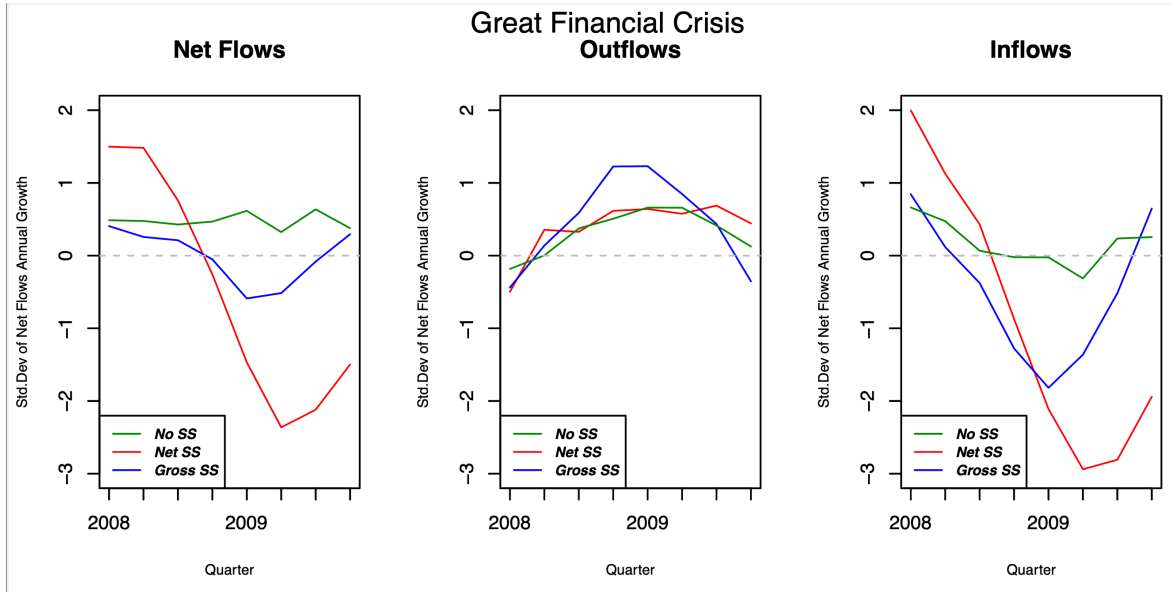
Figure 3. Group Definitions: Net SS, Gross SS, and No SS



Figures 4 and 5 depict the quarterly *average SCCF* for net flows, gross outflows, and gross inflows for countries that suffered different types of Sudden Stops during the GFC and during the COVID crisis. While countries in the Net SS and the Gross SS groups faced a similar decline in gross inflows during the GFC (third panel), there was a repatriation of outflows in the Gross SS group (middle panel), which then meant those countries avoided a Net SS (first panel). This can be seen in Figure 4.

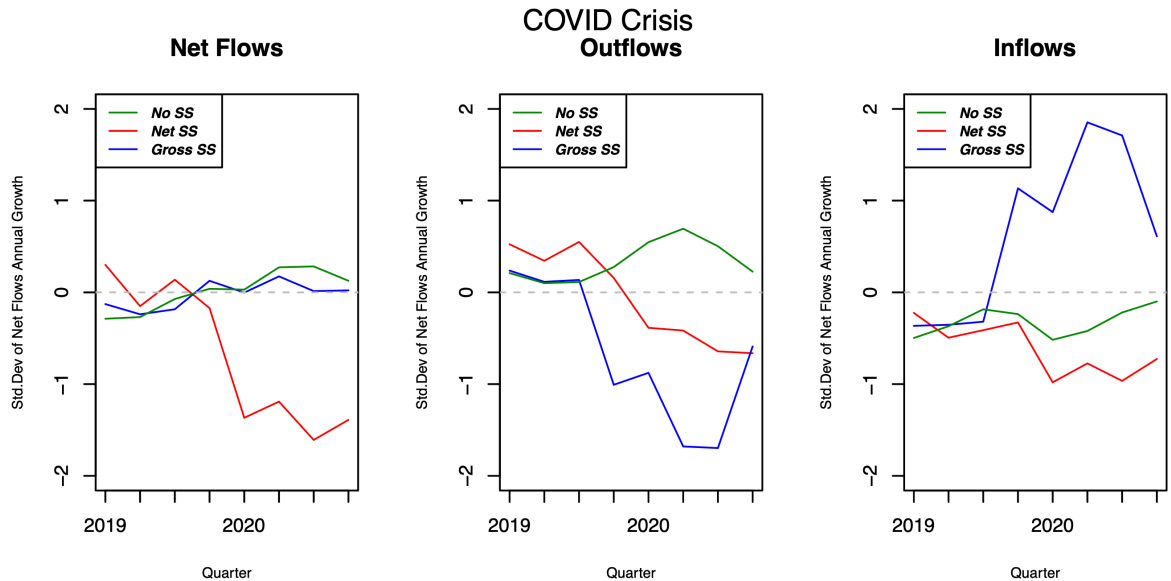
During COVID, the offsetting behavior was in the opposite direction. There was increased capital flight from residents in both the Net and Gross SS groups, as can be seen in the gross outflow statistics in Figure 5 (middle panel). In countries facing gross sudden stops but not Net SS, residents' capital flight was compensated by a rise in foreign capital inflows (third panel), resulting in no net sudden stop (first panel). However, countries in the Gross SS group had access to external credit and inflows increased, as shown in the third panel. In addition, countries that faced an SS in net flows entered the COVID episode with negative gross inflows in the last quarter of 2019, indicating that they were receiving smaller external credit flows than usual even before the COVID shock hit. This group of countries therefore had pre-existing vulnerabilities that led to further capital flight and no access to external credit during the pandemic. We explore this issue further in the following two sections.

Figure 4. Average Flows to Emerging and Developing Economies during the GFC



Note: Figure shows the statistic for each flow type, which is defined as the yearly change in the annualized flow in a quarter minus its rolling mean until that quarter, everything divided by the rolling standard deviation of the net flows until that quarter. We divide the sample into three groups: Net SS: countries that experienced a net sudden stop (SSN, SSIN, SSON, SSION), Gross SS: countries that faced a gross sudden stop but no Net SS (SSO, SSI, SSIO), and No SS: countries that did not experience any type of sudden stop. See Appendix A.2. for a list of the countries included in each group in each crisis.

Figure 5. Average Flows to Latin America and the Caribbean during the COVID Crisis



Note: Figure shows the statistic for each flow type, which is defined as the yearly change in the annualized flow in a quarter minus its rolling mean until that quarter, everything divided by the rolling standard deviation of the net flows until that quarter. We divide the sample into three groups: Net SS: countries that experienced a net sudden stop (SSN, SSIN, SSON, SSION), Gross SS: countries that faced a gross sudden stop but no Net SS (SSO, SSI, SSIO), and No SS: countries that did not experience any type of sudden stop. See Appendix A.2. for a list of the countries included in each group in each crisis.

4. The Role of Sovereign External Borrowing in Preventing Sudden Stops

Access to external credit was crucial for countries to avoid net capital flow Sudden Stops during the COVID crisis. To further examine this pattern, we perform a counterfactual exercise considering the Financial Account while excluding two types of external sovereign lending in 2020. First, we take out external sovereign bond gross issuances; second, we exclude net multilateral lending; and third, we exclude both. We then perform the same exercise for the GFC.⁷

Table 3. Gross External Issuance and Net Multilateral Lending during the GFC and COVID Crises (% of GDP)

Crisis	WEO Region	Sample	Gross Issuance by the Government		Net Multilateral Lending	
			Issuers	Conditional Median	Net Borrowers	Conditional Median
GFC	Emerging and Developing Asia	22	1	1.62	17	0.8
	Emerging and Developing Europe	15	1	0.09	11	2.0
	Latin America and the Caribbean	21	5	1.08	19	0.7
	Middle East and Central Asia	14	1	0.71	12	1.2
	Sub-Saharan Africa	12	0	0.00	9	2.2
	Total	84	8	0.89	68	0.9
COVID Crisis	Emerging and Developing Asia	23	4	1.19	17	1.5
	Emerging and Developing Europe	16	11	3.74	13	0.9
	Latin America and the Caribbean	24	15	2.64	22	1.7
	Middle East and Central Asia	20	6	2.45	15	2.3
	Sub-Saharan Africa	23	3	4.39	23	2.5
	Total	106	39	2.68	90	1.9

Source: Authors' calculations based on data from sovereign bond issuance from Thomson Reuters Datastream, and data for and net multilateral lending from World Bank's Joint External Debt Hub. Net lending is defined as the change in outstanding debt. For COVID Crisis we use 2019's GDP for each country from WEO April 2023. Medians are conditional on having issued bonds or increased outstanding multilateral debt.

For the first exercise we used data for external debt issuance by country. Specifically, we employed data of sovereign bonds issued in foreign jurisdictions during 2020 for each EMDE. For each quarter we aggregate the debt issued at face value during that period. Table 3 shows the amount issued as a percentage of GDP. For each quarter in 2020, we subtract sovereign issuance from Financial Account Liability Inflows. Then we recalculate the Sudden Stop statistics for net flows and gross flows using the counterfactual series.

For the second exercise, we exclude *net* multilateral lending following the same procedure. We define net multilateral lending as the quarterly change in a country's outstanding obligations with multilateral institutions. Then, for each quarter of 2020 we subtract multilateral net lending

⁷ Unfortunately, data limitations preclude us from testing the Emerging Market and Tequila crises.

from Other Investment Liability flows and recalculate the SS statistics for net and gross flows. Table 4 shows net multilateral lending during 2020. Net lending from the IMF was approximately 63 percent of the total of these flows.

Table 4. Actual and Counterfactual 2020 Sudden Stops for COVID Crisis

Crisis	WEO Region	Sample	Net Flows SS		Inflows SS	
			Events	%	Events	%
COVID Crisis	Emerging and Developing Asia	23	6	26.1	7	30.4
	Emerging and Developing Europe	16	1	6.3	0	0.0
	Latin America and the Caribbean	24	6	25.0	4	16.7
	Middle East and Central Asia	20	1	5.0	3	15.0
	Sub-Saharan Africa	23	3	13.0	3	13.0
	Total	106	17	16.0	17	16.0
COVID Crisis Counterfactual: Without Gross Issuance by the Government	Emerging and Developing Asia	23	6	26.1	7	30.4
	Emerging and Developing Europe	16	3	18.8	2	12.5
	Latin America and the Caribbean	24	11	45.8	7	29.2
	Middle East and Central Asia	20	1	5.0	3	15.0
	Sub-Saharan Africa	23	4	17.4	3	13.0
	Total	106	25	23.6	22	20.8
COVID Crisis Counterfactual: Without Outstanding Multilateral Lending	Emerging and Developing Asia	23	7	30.4	8	34.8
	Emerging and Developing Europe	16	2	12.5	0	0.0
	Latin America and the Caribbean	24	9	37.5	7	29.2
	Middle East and Central Asia	20	5	25.0	4	20.0
	Sub-Saharan Africa	23	7	30.4	6	26.1
	Total	106	30	28.3	25	23.6
COVID Crisis Joint Counterfactual	Emerging and Developing Asia	23	7	30.4	8	34.8
	Emerging and Developing Europe	16	5	31.3	3	18.8
	Latin America and the Caribbean	24	13	54.2	9	37.5
	Middle East and Central Asia	20	5	25.0	4	20.0
	Sub-Saharan Africa	23	8	34.8	6	26.1
	Total	106	38	35.8	30	28.3

Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF), data from sovereign issuance from Thomson Reuters Datastream, and data for multilateral lending from World Bank's Joint External Debt Hub.

Note: Table shows the countries that had a Sudden Stop during 2020 for each country in each scenario. In the exercise without sovereign external debt Issuance, we subtract sovereign issuance from Financial Account Liability Inflows. In the exercise without outstanding multilateral lending, we subtract the flow from Liabilities inflows. In the Joint Counterfactual exercise, we subtract both sovereign issuance and outstanding multilateral lending from Liabilities Inflows.

Table 4 presents the summary of SS events identified with the observed and with the counterfactual series, during the COVID crisis. Since we do not modify any outflows (the flows of residents), SSOs stay the same and are not reported. SSI and SS Net events highlighted in bold are those that materialize under the counterfactual series but not with the observed series, that is, the contraction of net flows that was prevented by either sovereign debt issuance or multilateral lending.

Without sovereign issuance, 25 countries would have experienced an SS in Net flows, almost 50 percent more than the 17 observed. The 8 countries with counterfactual sudden stops in net flows that did not actually have an SSN were Belarus, Colombia, Guatemala, Mexico, Namibia, Panama, Peru and Romania. Many of these countries are in LAC and Emerging Europe and have good access to sovereign bond markets. We do not claim that each of these countries would have necessarily experienced a sudden stop had they not been able to issue debt, because residents could have repatriated assets; however, the results indicate that maintaining access to external credit was a very important element.

Net multilateral lending was also critical for countries to avoid Sudden Stops. Thirteen additional economies would have faced a Net SS if multilateral net lending had been zero, an increase of 75 percent over the baseline 17 countries. It is worth noting that zero net lending implies that disbursements match debt coming due, so positive net lending implies an increase in outstanding debt. In this case, most countries that would have suffered a net flow sudden stop in the absence of additional multilateral lending were in Sub-Saharan Africa, the Middle East, and Central Asia, which is consistent with the larger role multilaterals play in low and low-middle income countries in these regions.

When both sovereign bond issuance and net multilateral lending are removed during the COVID crisis data, the number of Sudden Stops in Net flows more than doubles, and the share of countries that would have faced such an event increases to 36 percent. The bottom line is that access to credit was crucial for EMDE countries during the COVID crisis, preventing external crises like those seen during the Great Financial Crisis of 2008 and the Emerging Market Crises of 1998.

The results from performing the same exercise during the GFC are much milder, as shown in Table 5. Excluding gross sovereign bond issuance does not greatly change the observed picture. As the crisis originated in the United States and other financial centers, liquidity in global markets

dried up for many emerging and developing economies, and only 8 countries in the sample issued bonds (see Table 3). Multilaterals also played a less prominent role, and removing their net lending increases the number of Net SS by only 20 percent. This is also consistent with the smaller multilateral net lending effort during the GFC. The median country obtained 0.9 percent of GDP of net multilateral lending during the GFC vs 1.9 percent of GDP during the COVID crisis.

In the next section, we assess the role of the pre-existing economic vulnerabilities through the lens of a sudden stop model. As crises differ in their nature, we find that different vulnerabilities may be triggers for sudden stops.

Table 5. Actual and Counterfactual 2009 Sudden Stops for GFC Crisis

Crisis	WEO Region	Sample	Net Flows SS		Inflows SS	
			Events	%	Events	%
GFC	Emerging and Developing Asia	22	4	18.2	9	40.9
	Emerging and Developing Europe	15	12	80.0	13	86.7
	Latin America and the Caribbean	21	7	33.3	7	33.3
	Middle East and Central Asia	14	3	21.4	5	35.7
	Sub-Saharan Africa	12	4	33.3	4	33.3
	Total	84	30	35.7	38	45.2
GFC Counterfactual: Without Gross Issuance by the Government	Emerging and Developing Asia	22	4	18.2	9	40.9
	Emerging and Developing Europe	15	12	80.0	13	86.7
	Latin America and the Caribbean	21	7	33.3	7	33.3
	Middle East and Central Asia	14	3	21.4	5	35.7
	Sub-Saharan Africa	12	4	33.3	4	33.3
	Total	84	30	35.7	38	45.2
GFC Counterfactual: Outstanding Multilateral Lending	Emerging and Developing Asia	22	8	36.4	11	50.0
	Emerging and Developing Europe	15	12	80.0	12	80.0
	Latin America and the Caribbean	21	6	28.6	7	33.3
	Middle East and Central Asia	14	5	35.7	4	28.6
	Sub-Saharan Africa	12	4	33.3	4	33.3
	Total	84	35	41.7	38	45.2
GFC Joint Counterfactual	Emerging and Developing Asia	22	8	36.4	11	50.0
	Emerging and Developing Europe	15	12	80.0	12	80.0
	Latin America and the Caribbean	21	7	33.3	7	33.3
	Middle East and Central Asia	14	5	35.7	4	28.6
	Sub-Saharan Africa	12	4	33.3	4	33.3
	Total	84	36	42.9	38	45.2

Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF), data from sovereign issuance from Thomson Reuters Datastream, and data for multilateral lending from World Bank's Joint External Debt Hub.

Note: Table shows the countries that had a Sudden Stop during 2009 for each country in each scenario. In the exercise without sovereign external debt Issuance, we subtract sovereign issuance from Financial Account Liability Inflows. In the exercise without outstanding multilateral lending, we subtract the flow from Liabilities inflows. In the Joint Counterfactual exercise, we subtract both sovereign issuance and outstanding multilateral lending from Liabilities Inflows.

5. A Model to Explain the Incidence of Sudden Stops in Net Flows

As noted above, several countries were already facing reduced net flows in 2019 before the COVID crisis hit, and a number of those countries then suffered sudden stops in net flows during the pandemic. In this section, we employ a simplified version of the model developed in Calvo et al. (2012) and rank EMDE economies according to the probability of suffering a Net SS in 2020, based on the 2019 data. The model incorporates domestic factors such as the fiscal balance, reserves, the current account balance, and the degree of liability dollarization, and it is used to estimate the likelihood of a Sudden Stop in net flows in the subsequent year. See Appendix A.4 for more details on the model.

Table 6. Likelihood Estimation for Net SSts in Emerging and Developing Economies

VARIABLES	SS in Net Flows	SS in Net Flows	SS in Net Flows	SS in Net Flows
CA Balance (% of GDP) = L,	-0.015**	-0.092	-0.061**	0.023
	-0.006	-0.057	-0.029	-0.034
Government Balance (% of GDP) = L,	-0.032**	-0.062	0.036	-0.166***
	-0.016	-0.082	-0.074	-0.063
Gross DLD (% of GDP) = L,	0.003	0.077***	0.007	0.009
	-0.002	-0.029	-0.01	-0.008
Reserves (% of GDP) = L,	0.004	-0.240**	0.002	-0.001
	-0.005	-0.093	-0.018	-0.02
Observations	1,137	28	41	57
Crisis	NA	EmergingMarkets	GFC	COVID
Year	All Years	1999	2009	2020
Time Effects	Yes	No	No	No
AUROC	NA	82.29%	70.63%	74.48%

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The first estimation in Table 6 uses the full sample of 1,137 country-year observations and includes year-fixed effects and estimates the likelihood of a net flow sudden stop in each year given data from the previous year. The results suggest that the current account balance and government balance are significant at the 5% level.

However, it is very likely that key vulnerabilities change over time. In particular, considering the Emerging Market crises of the late 1990s, the GFC and the COVID crises it seems likely that key vulnerabilities to predict if a sudden stop would occur or not would be different, as these crises were quite distinct in their nature. We therefore estimate the model separately for each crisis period. While this reduces the number of observations, the results are suggestive of how the drivers of sudden stops may change over time.

The results for the Emerging Markets crisis of 1999 highlight the relevance of the level of Domestic Liability Dollarization (DLD) and International Reserves as identified by Calvo et al. (2012). A lack of liquidity, excessive short-term dollar debt and low reserve levels were particularly important drivers of sudden stops during the Emerging Market crises of the 1990s.

During the Great Financial Crisis (GFC), the results indicate that the current account balance was the key vulnerability. As the GFC was rooted in problems in global financial centers, and lending to emerging and developing markets dried up, countries that relied more on external financing suffered. An alternative way to think about this is—and following the results of the analysis above—that countries with strong current account positions were more likely to have enjoyed the repatriation of residents' capital to offset any sudden stop in inflows that may have occurred.

Finally, the results for the COVID-19 indicate that the state of the fiscal balance was crucial. We posit that this was because of the characteristics of the pandemic induced crisis. As countries implemented lockdowns to contain the spread of the virus, they also implemented unprecedented fiscal packages to assist families and firms through the crisis. Countries with weaker fiscal balances that were also faced with the strains of the pandemic suffered outflows from worried residents and had little access to external funding. They could not issue abroad to boost inflows to avoid a Net SS. In contrast, those sovereigns with stronger fiscal positions, which likely reflected stronger fiscal institutions, had greater access to borrowing and so they were in a position to issue greater amounts of debt to boost inflows to counter any capital flight from residents who wished to hedge. They thus avoided a Net SS.

Additionally, we use machine learning techniques to evaluate the ability of the previous specifications to identify the most vulnerable economies. The AUROC indicator, reported in Table 6, indicates the model fits the data according to the usual statistical tests. See Appendix A.6. for a full description of the exercise.

Still, as this is a relatively simple model, at least two caveats should be noted. First, the model is not well suited for fully dollarized economies. Second, it relies on data on domestic liability dollarization, which are not available for many countries. Still, the bottom line is that the results from the estimations suggest a core of key macroeconomic indicators that indicate short-term vulnerability to Sudden Stops and become relevant depending on the nature of the crisis.

6. Conclusions

The COVID crisis provoked a sharp recession followed by a swift recovery across emerging and developing economies. The impacts could have been even greater if this crisis had been accompanied, as in previous crises, by widespread sudden stops in capital flows. However, perhaps surprisingly—and despite an initial significant reversal of capital inflows—this particular dog did not bite. The adjustment in external accounts was relatively mild.

Still, many EMDEs saw capital outflows from residents, and in several cases, these classified as Sudden Stops in gross outflows (labeled SSOs in a recent taxonomy). However, this capital flight was frequently offset by gross inflows, such that countries avoided net flow Sudden Stops (SSNs), and hence the required current account adjustment was minimized.

This pattern of capital flows was very different from previous crises in EMDEs. In the crises of the 1990s, reversals of capital inflows by foreign investors provoked many sudden stops in net flows. In the global financial crisis, there was a similar reversal in capital inflows, but in many cases these inflow reversals were offset by the repatriation of capital from residents. Hence, sudden stops in gross inflows (SSIs) were common, but net flow sudden stops were not. During the COVID crisis, it appears that residents placed money abroad (an increase in outflows), perhaps as a hedge against domestic risks, but there was an increase in inflows, driven in large part by sovereign bond issuance and net lending from official multilateral institutions. Building counterfactual exercises, we find that many sudden stops in net flows were avoided due to this access to external borrowing.

Still, there was a small set of countries that suffered sudden stops in net flows during the COVID period and did not offset a rise in capital flight (outflows of residents) with greater inflows. In general, these countries had seen inflows fall before the onset of the pandemic and had weaker economic fundamentals. A relatively simple model, including the state of a limited number of key

economic variables in 2019, does a reasonable job of distinguishing countries that suffered net capital flow sudden stops in 2020 from those that did not.

Interestingly, in comparing the application of this model to the COVID crisis versus previous crises, we find that the key macroeconomic variables predicting sudden stops changed. In the 1990s, the degree of liability dollarization and the level of reserves were critical factors. In the GFC the state of the current account appeared to take center stage. Our interpretation is that countries with stronger current account positions were more likely to have benefitted from the repatriation of residents' capital abroad which then may have offset any sudden stop in gross inflows. In the case of the pandemic, the key variables appeared to be the state of fiscal balances prior to the crisis. The COVID crisis provoked governments to implement unprecedented fiscal packages to assist families and firms. Given highly liquid international markets, countries with healthy fiscal positions before the crisis were able to access external markets to help finance those packages. In addition, those countries with stronger fiscal positions were more likely to be in a position to be able to issue greater quantities of debt in international markets to offset any increase in capital flight from residents who may have wished to hedge. In contrast, countries with weak fiscal positions (and likely weaker fiscal institutions) had less access to external funds (despite the low international interest rates) and hence were unable to offset outflows to the same degree, and hence gross outflows led to net flow sudden stops in those cases and to a greater required adjustment in current accounts.

A key policy question is whether, going forward, countries will continue to benefit from the strengths that allowed them to avoid significant external crises, or whether there is a higher risk that countries could face sudden stops in capital flows? The answer no doubt lies in a combination of the state of international financial markets and the strength of domestic macroeconomic fundamentals.

During the Global Financial Crisis of 2008, and more recently during the COVID crisis, Emerging and Developing Economies were able to avoid sudden stops. In both cases, sound economic fundamentals were key. In the first case, with international markets essentially closed for many EMDE borrowers, countries with sound fundamentals benefitted from the retrenchment of private capital flows from residents. During the COVID crisis, with abundant global liquidity, countries with sound fundamentals were able to increase external borrowing to finance fiscal packages and boost inflows. Looking forward, fiscal buffers have been depleted, global interest

rates have risen and liquidity in international markets has dwindled. Restoring fiscal buffers in EMDEs will be important to avoid net flow sudden stops in the next crisis.

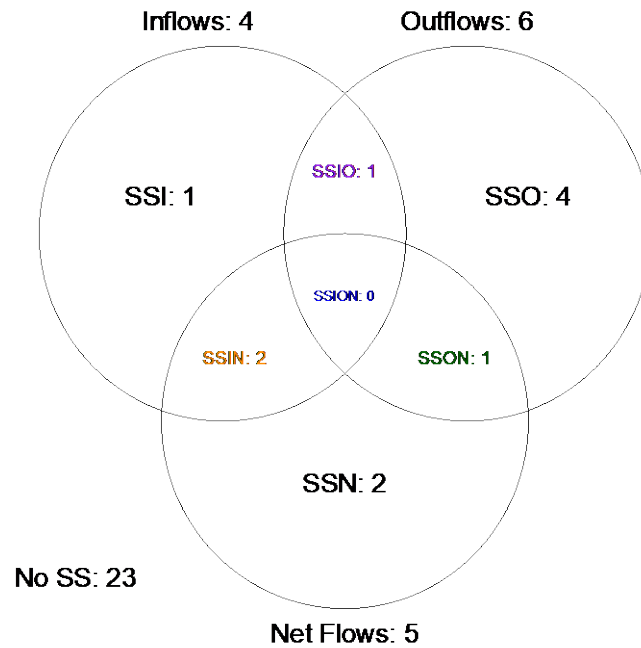
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A 1. Economies Facing a Sudden Stop in Different Crises

a) Tequila Crisis

Figure A.1. Sudden Stops Events during the Tequila Crisis

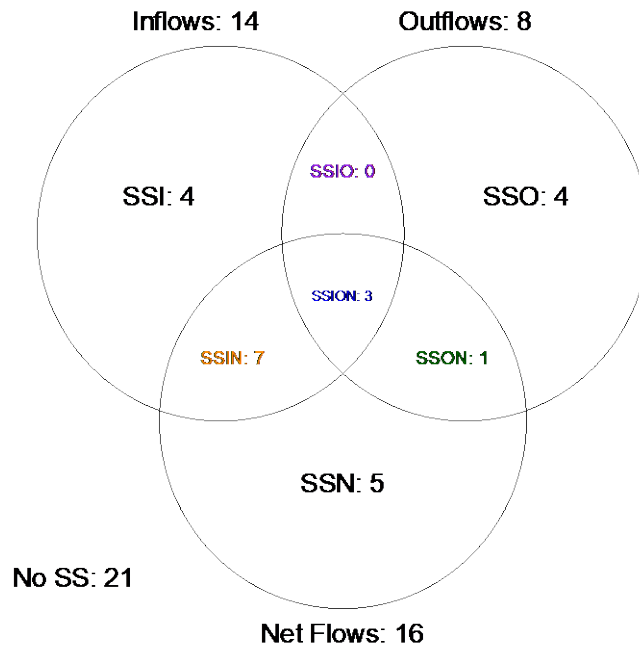


Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF).

Note: Table shows if there was a Sudden Stop from 1995 Q1 until 1995 Q4. We calculate the year-on-year change in financial flows, the rolling mean and standard deviation, and see if the change in yearly flows falls at least two standard deviations below its sample mean.

b) Emerging Market Crisis

Figure A.2. Sudden Stops Events during the Emerging Market Crisis

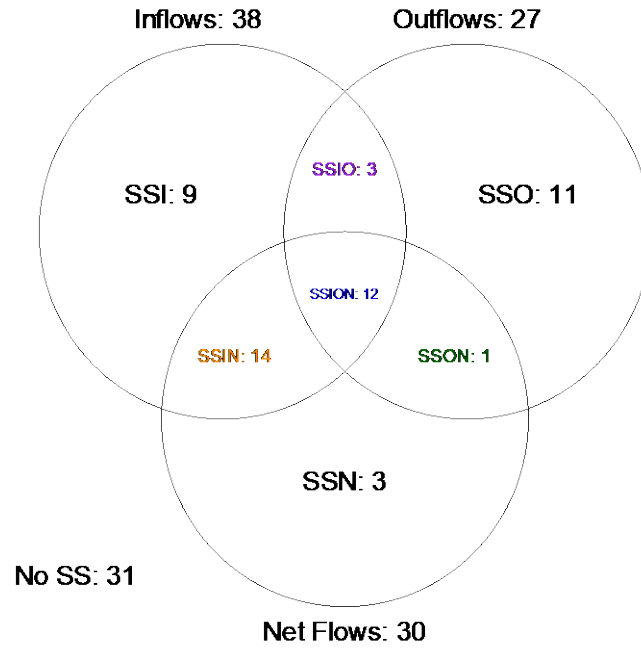


Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF).

Note: Table shows if there was a Sudden Stop from 1998 Q3 until 1999 Q2. We calculate the year-on-year change in financial flows, the rolling mean and standard deviation, and see if the change in yearly flows falls at least two standard deviations below its sample mean.

c) **Great Financial Crisis**

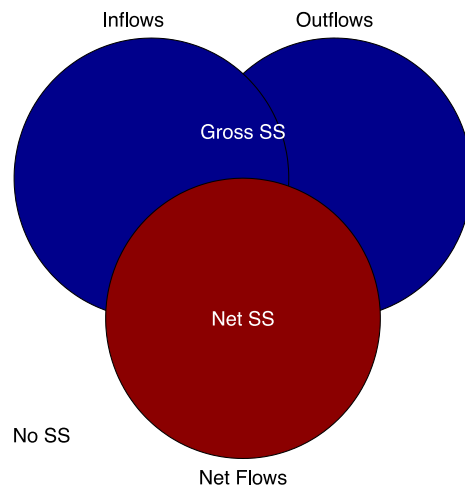
Figure A.3. Sudden Stops Events during the Great Financial Crisis



Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF).

Note: Table shows if there was a Sudden Stop from 2009 Q1 until 2009 Q4. We calculate the year-on-year change in financial flows, the rolling mean and standard deviation, and see if the change in yearly flows falls at least two standard deviations below its sample mean.

A 2. List of countries included in each group in each crisis



<i>Country</i>	Tequila Crisis SS Groups				Emerging Market Crisis SS Groups				Great Financial Crisis SS Groups				COVID-19 Crisis SS Groups			
	Sam ple	Net SS	Gross SS	No SS	Sam ple	Net SS	Gross SS	No SS	Sam ple	Net SS	Gross SS	No SS	Sam ple	Net SS	Gross SS	No SS
ABW	Yes			Yes	Yes			Yes	Yes			Yes	Yes			Yes
AFG													Yes			Yes
AGO													Yes			Yes
ALB					Yes			Yes	Yes	Yes			Yes			Yes
ARG	Yes	Yes			Yes		Yes		Yes			Yes	Yes	Yes		
ARM	Yes			Yes	Yes			Yes	Yes			Yes	Yes		Yes	
AZE									Yes		Yes		Yes			Yes
BGD	Yes		Yes		Yes		Yes		Yes			Yes	Yes		Yes	
BGR	Yes			Yes	Yes			Yes	Yes	Yes			Yes			Yes
BIH									Yes	Yes			Yes			Yes
BLR					Yes			Yes	Yes		Yes		Yes		Yes	
BLZ									Yes			Yes	Yes			Yes
BOL	Yes			Yes	Yes	Yes			Yes		Yes		Yes			Yes
BRA	Yes			Yes	Yes	Yes			Yes	Yes			Yes		Yes	
BRN									Yes			Yes	Yes		Yes	
BTN									Yes			Yes	Yes			Yes
CHL	Yes	Yes			Yes	Yes			Yes	Yes			Yes		Yes	
CHN									Yes		Yes		Yes		Yes	
CMR													Yes			Yes
COD													Yes			Yes
COL					Yes			Yes	Yes			Yes	Yes			Yes
CPV									Yes	Yes			Yes			Yes
CRI									Yes	Yes			Yes	Yes		
DOM													Yes	Yes		

DZA													Yes			Yes
ECU	Yes			Yes	Yes			Yes	Yes			Yes	Yes	Yes		
EGY													Yes			Yes
ETH	Yes	Yes			Yes			Yes	Yes			Yes	Yes			Yes
FJI									Yes		Yes		Yes			Yes
GEO									Yes	Yes			Yes			Yes
GHA													Yes	Yes		
GIN													Yes		Yes	
GMB									Yes			Yes	Yes			Yes
GTM	Yes	Yes			Yes		Yes		Yes	Yes			Yes			Yes
GUY													Yes			Yes
HND									Yes			Yes	Yes			Yes
HRV	Yes			Yes	Yes	Yes			Yes	Yes			Yes	Yes		
HTI									Yes			Yes	Yes			Yes
HUN	Yes			Yes	Yes			Yes	Yes	Yes			Yes		Yes	
IDN	Yes			Yes	Yes			Yes	Yes			Yes	Yes	Yes		
IND	Yes			Yes	Yes	Yes			Yes	Yes			Yes			Yes
IRQ													Yes			Yes
JAM													Yes			Yes
JOR	Yes		Yes		Yes			Yes	Yes			Yes	Yes			Yes
KAZ					Yes	Yes			Yes		Yes		Yes			Yes
KGZ	Yes			Yes	Yes		Yes		Yes	Yes			Yes			Yes
KHM					Yes			Yes	Yes	Yes			Yes	Yes		
KIR													Yes			Yes
KWT													Yes			Yes
LAO					Yes	Yes			Yes			Yes	Yes	Yes		
LBN									Yes			Yes	Yes			Yes
LKA	Yes		Yes		Yes	Yes			Yes		Yes		Yes	Yes		

LSO	Yes			Yes	Yes		Yes		Yes			Yes	Yes			Yes
MAR									Yes		Yes		Yes			Yes
MDA					Yes		Yes		Yes	Yes			Yes			Yes
MDG									Yes			Yes	Yes			Yes
MEX	Yes	Yes			Yes			Yes	Yes		Yes		Yes			Yes
MKD					Yes			Yes	Yes	Yes			Yes			Yes
MMR	Yes			Yes	Yes			Yes	Yes			Yes				
MNE									Yes			Yes	Yes			Yes
MNG									Yes		Yes		Yes			Yes
MOZ									Yes			Yes	Yes			Yes
MRT													Yes			Yes
MUS									Yes		Yes		Yes			Yes
MYS									Yes	Yes			Yes			Yes
NAM									Yes			Yes	Yes		Yes	
NGA													Yes			Yes
NIC	Yes			Yes	Yes			Yes	Yes			Yes	Yes			Yes
NPL	Yes		Yes		Yes	Yes			Yes			Yes	Yes		Yes	
PAK	Yes			Yes	Yes	Yes			Yes			Yes	Yes	Yes		
PAN									Yes			Yes	Yes			Yes
PER	Yes			Yes	Yes	Yes			Yes	Yes			Yes		Yes	
PHL	Yes			Yes	Yes	Yes			Yes		Yes		Yes	Yes		
PNG	Yes			Yes	Yes			Yes	Yes		Yes		Yes			Yes
POL									Yes	Yes			Yes			Yes
PRY									Yes	Yes			Yes	Yes		
QAT													Yes			Yes
ROU	Yes			Yes	Yes		Yes		Yes	Yes			Yes		Yes	
RUS					Yes		Yes		Yes	Yes			Yes			Yes
RWA													Yes			Yes

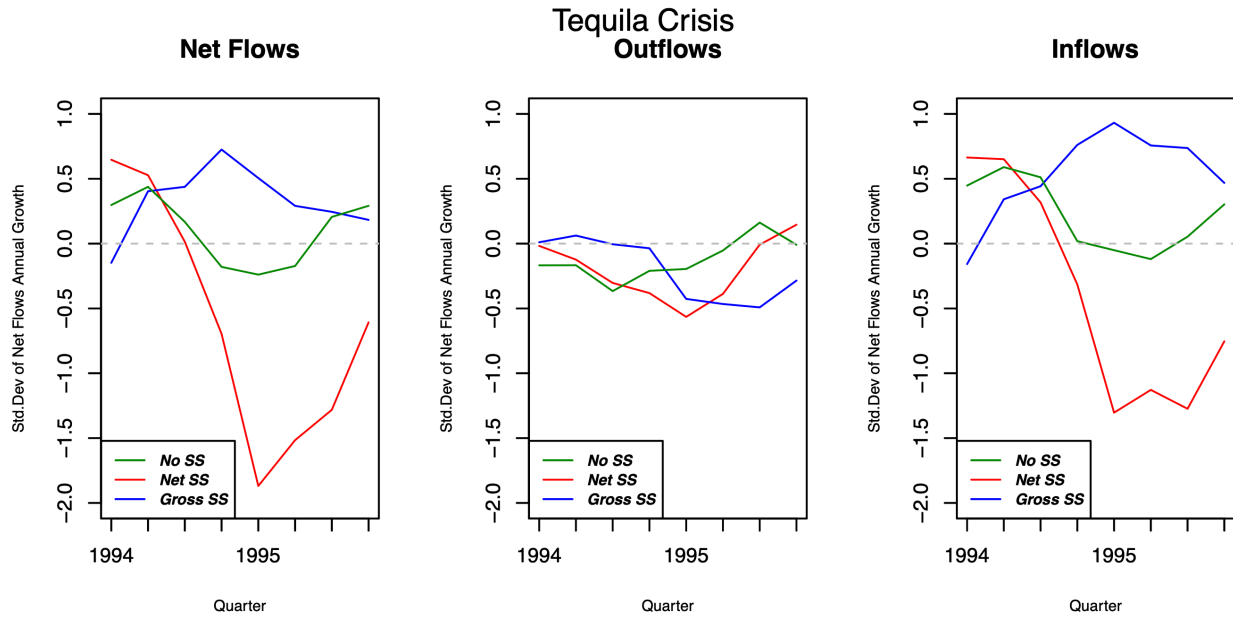
SAU									Yes		Yes		Yes		Yes	
SDN	Yes			Yes	Yes			Yes	Yes		Yes		Yes			Yes
SLB									Yes			Yes	Yes			Yes
SLV									Yes	Yes			Yes		Yes	
SRB									Yes			Yes	Yes		Yes	
STP													Yes			Yes
SUR	Yes			Yes					Yes		Yes		Yes	Yes		
SWZ													Yes			Yes
SYC									Yes	Yes			Yes			Yes
THA	Yes		Yes		Yes	Yes			Yes		Yes		Yes			Yes
TJK									Yes	Yes			Yes			Yes
TLS													Yes			Yes
TON									Yes		Yes		Yes	Yes		
TTO													Yes			Yes
TUR	Yes			Yes	Yes	Yes			Yes	Yes			Yes			Yes
TZA													Yes			Yes
UGA									Yes		Yes		Yes			Yes
UKR					Yes	Yes			Yes	Yes			Yes			Yes
URY									Yes			Yes	Yes			Yes
UVK													Yes		Yes	
UZB									Yes		Yes		Yes			Yes
VEN					Yes			Yes	Yes			Yes				
VNM					Yes			Yes	Yes		Yes		Yes		Yes	
VUT	Yes			Yes	Yes			Yes	Yes		Yes		Yes			Yes
WSM									Yes	Yes			Yes			Yes
YEM									Yes		Yes					
ZAF	Yes		Yes		Yes	Yes			Yes	Yes			Yes	Yes		
ZMB									Yes	Yes			Yes	Yes		

ZWE													Yes			Yes
SS Events		5	6	23		16	8	21		30	23	31		17	18	71
Sample	34	34	34	34	45	45	45	45	84	84	84	84	106	106	106	106
Percentage (%)		14.71	17.65	67.65		35.56	17.78	46.67		35.71	27.38	36.90		16.04	16.98	66.98

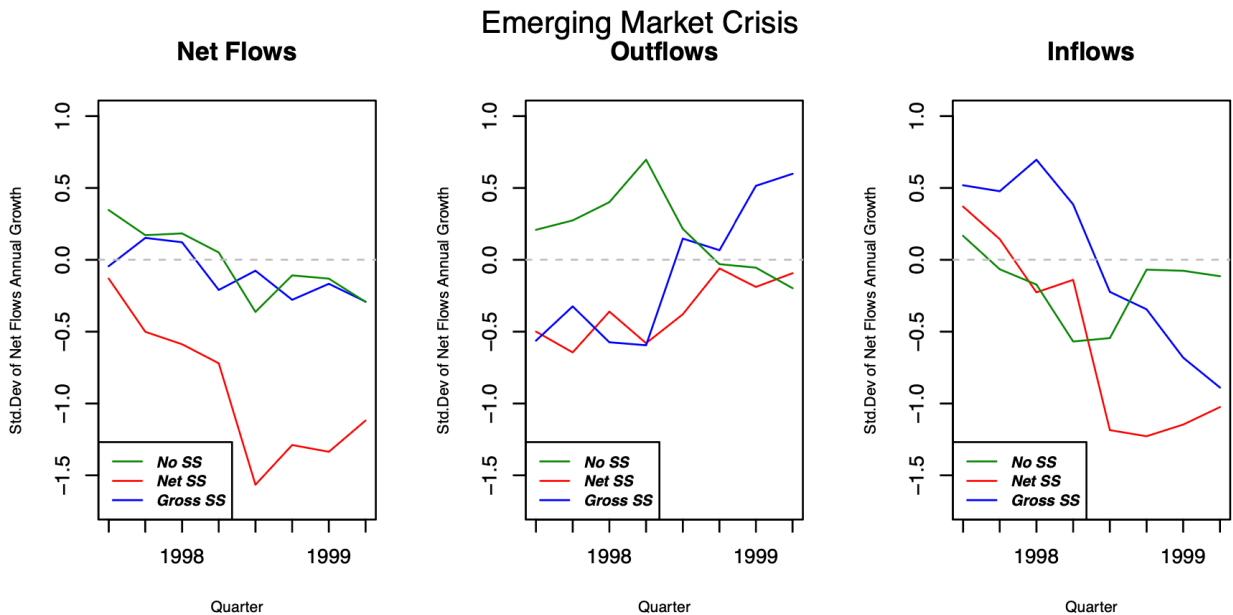
Source: Authors' calculations based on the Financial Account from the Balance of Payments database IMF.

Note: Countries with data are the countries that had information for all the periods of the crisis. Table shows if countries belonged to the group specified: Net SS are the countries that experienced a net sudden stop, Gross SS are the countries that faced a gross sudden stop but no net SS, and No SS are the countries that did not experience a sudden stop.

A 3. Capital Flows during the Tequila and Emerging Market Crises



Note: Figure shows the statistic for each flow type, which is defined as the yearly change in the annualized flow in a quarter minus its rolling mean until that quarter, everything divided by the rolling standard deviation of the net flows until that quarter. We divide the sample into three groups: Net SS: countries that experienced a net sudden stop, Gross SS: countries that faced a gross sudden stop but no net SS, and No SS: countries that did not experience a sudden stop. See Appendix A.2. for a list of the countries included in each group in each crisis.



Note: Figure shows the statistic for each flow type, which is defined as the yearly change in the annualized flow in a quarter minus its rolling mean until that quarter, everything divided by the rolling standard deviation of the net flows until that quarter. We divide the sample into three groups: Net SS: countries that experienced a net sudden stop, Gross SS: countries that faced a gross sudden stop but no net SS, and No SS: countries that did not experience a sudden stop. See Appendix A.2. for a list of the countries included in each group in each crisis.

**A 4. Economies Facing a Sudden Stop during the COVID Crisis
in the Counterfactual Exercises**

<i>Country</i>	COVID-19 Crisis Observed SS			COVID Crisis Counterfactual: Without Outstanding Multilateral Lending SS		COVID Crisis Counterfactual: Without Gross Issuance by the Government SS		COVID Crisis Joint Counterfactual SS	
	Net Flows	Outflows	Inflows	Net Flows	Inflows	Net Flows	Inflows	Net Flows	Inflows
ABW									
AFG									
AGO									
ALB									
ARG	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARM			Yes	Yes	Yes		Yes	Yes	Yes
AZE									
BGD			Yes		Yes		Yes		Yes
BGR									
BIH									
BLR		Yes				Yes		Yes	
BLZ									
BOL				Yes				Yes	
BRA			Yes		Yes		Yes		Yes
BRN			Yes		Yes		Yes		Yes
BTN									
CHL			Yes		Yes		Yes		Yes
CHN		Yes							
CMR									
COD									
COL				Yes		Yes		Yes	
CPV				Yes	Yes			Yes	Yes
CRI	Yes	Yes		Yes	Yes	Yes		Yes	Yes
DOM	Yes	Yes		Yes		Yes	Yes	Yes	Yes
DZA									
ECU	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EGY									

ETH				Yes	Yes			Yes	Yes
FJI				Yes	Yes			Yes	Yes
GEO									
GHA	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
GIN		Yes							
GMB									
GTM						Yes		Yes	
GUY									
HND									
HRV	Yes			Yes		Yes	Yes	Yes	Yes
HTI									
HUN		Yes							
IDN	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
IND									
IRQ									
JAM									
JOR									
KAZ									
KGZ				Yes				Yes	
KHM	Yes	Yes		Yes		Yes		Yes	
KIR									
KWT									
LAO	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
LBN									
LKA	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
LSO				Yes				Yes	
MAR				Yes	Yes			Yes	Yes
MDA									
MDG									
MEX						Yes		Yes	
MKD								Yes	Yes
MNE									
MNG									
MOZ									
MRT									
MUS									
MYS									
NAM			Yes		Yes	Yes	Yes	Yes	Yes
NGA									
NIC									

NPL		Yes							
PAK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PAN						Yes	Yes	Yes	Yes
PER		Yes		Yes	Yes	Yes	Yes	Yes	Yes
PHL	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
PNG									
POL									
PRY	Yes	Yes		Yes		Yes		Yes	
QAT									
ROU		Yes				Yes		Yes	
RUS							Yes		Yes
RWA				Yes	Yes			Yes	Yes
SAU			Yes		Yes		Yes		Yes
SDN									
SLB									
SLV		Yes						Yes	
SRB		Yes							
STP									
SUR	Yes			Yes	Yes	Yes		Yes	Yes
SWZ									
SYC									
THA									
TJK									
TLS									
TON	Yes	Yes		Yes		Yes		Yes	
TTO									
TUR									
TZA				Yes	Yes			Yes	Yes
UGA									
UKR				Yes				Yes	
URY									
UVK		Yes							
UZB				Yes				Yes	
VNM			Yes		Yes		Yes		Yes
VUT									
WSM									
ZAF	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZMB	Yes			Yes		Yes		Yes	
ZWE									
SS Events	17	17	17	30	25	25	22	38	30

Sample Percentage (%)	106	106	106	106	106	106	106	106	106
	16.04	16.04	16.04	28.30	23.58	23.58	20.75	35.85	28.30

Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF), data from sovereign issuance from Thomson Reuters Datastream, and data for multilateral lending from World Bank's Joint External Debt Hub.

Note: Table shows if the countries that had a Sudden Stop during 2020 for each country in each scenario. In the exercise without sovereign external debt Issuance, we subtract the sovereign issuance from the Financial Account Liability Inflows. In the exercise without outstanding multilateral lending, we subtract the flow from the Liabilities inflows. In the Joint Counterfactual exercise, we subtract both sovereign issuance and outstanding multilateral lending from Liabilities Inflows.

A5. Economies Facing a Sudden Stop during the GFC in the Counterfactual Exercises

<i>Country</i>	Sample	GFC Observed SS			GFC Counterfactual: Without Outstanding Multilateral Lending SS		GFC Counterfactual: Without Gross Issuance by the Government SS		GFC Joint Counterfactual SS	
		Net Flows	Outflows	Inflows	Net Flows	Inflows	Net Flows	Inflows	Net Flows	Inflows
ABW	Yes									
ALB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARG	Yes									
ARM	Yes									
AZE	Yes			Yes		Yes		Yes		Yes
BGD	Yes									
BGR	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
BIH	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
BLR	Yes			Yes		Yes		Yes		Yes
BLZ	Yes									
BOL	Yes		Yes							
BRA	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
BRN	Yes									
BTN	Yes									
CHL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHN	Yes			Yes		Yes		Yes		Yes
COL	Yes								Yes	
CPV	Yes	Yes					Yes			
CRI	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECU	Yes									
ETH	Yes									
FJI	Yes		Yes							

GEO	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
GMB	Yes									
GTM	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
HND	Yes									
HRV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HTI	Yes									
HUN	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
IDN	Yes									
IND	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JOR	Yes									
KAZ	Yes			Yes		Yes		Yes		Yes
KGZ	Yes	Yes	Yes		Yes		Yes		Yes	
KHM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAO	Yes									
LBN	Yes									
LKA	Yes		Yes		Yes	Yes			Yes	Yes
LSO	Yes									
MAR	Yes			Yes	Yes	Yes		Yes	Yes	Yes
MDA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MDG	Yes									
MEX	Yes			Yes		Yes		Yes		Yes
MKD	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
MMR	Yes									
MNE	Yes									
MNG	Yes		Yes		Yes	Yes			Yes	Yes
MOZ	Yes									
MUS	Yes			Yes	Yes	Yes		Yes	Yes	Yes
MYS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NAM	Yes									

NIC	Yes										
NPL	Yes										
PAK	Yes										
PAN	Yes										
PER	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PHL	Yes		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
PNG	Yes		Yes		Yes				Yes		
POL	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PRY	Yes	Yes						Yes			
ROU	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RUS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SAU	Yes		Yes								
SDN	Yes			Yes				Yes			
SLB	Yes										
SLV	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SRB	Yes										
SUR	Yes		Yes								
SYC	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
THA	Yes		Yes	Yes		Yes		Yes		Yes	Yes
TJK	Yes	Yes			Yes		Yes	Yes		Yes	
TON	Yes		Yes	Yes		Yes		Yes			Yes
TUR	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UGA	Yes		Yes								
UKR	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
URY	Yes										
UZB	Yes		Yes								
VEN	Yes										
VNM	Yes		Yes								
VUT	Yes			Yes		Yes		Yes			Yes

WSM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YEM	Yes		Yes		Yes				Yes	
ZAF	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZMB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SS Events		30	27	38	35	38	30	38	36	38
Total Sample	84	84	84	84	84	84	84	84	84	84
Percentage (%)		35.71429	32.1429	45.238	41.66666667	45.23809524	35.71428571	45.23809524	42.85714	45.238

Source: Authors' calculations based on the Financial Account from the Balance of Payments database (IMF), data from sovereign issuance from Thomson Reuters Datastream, and data for multilateral lending from World Bank's Joint External Debt Hub.

Note: Table shows if the countries that had a Sudden Stop during 2009 for each country in each scenario. In the exercise without sovereign external debt Issuance, we subtract the sovereign issuance from the Financial Account Liability Inflows. In the exercise without outstanding multilateral lending, we subtract the flow from Liabilities inflows. In the Joint Counterfactual exercise, we subtract both sovereign issuance and outstanding multilateral lending from Liabilities Inflows.

A6. Estimating the Probability of a Sudden Stop

To estimate of the probability of a sudden stop in a year (say 2020), we follow the methodology proposed in Calvo et al (2012). In our case we use data from the previous year (2019 in our example) to predict whether a net flow Sudden Stop occurred in a given year (2020 in our case). Annual information for the previous period includes the general government fiscal balance, reserves, current account balance, and the dollarization of liabilities. Data for general government net lending/borrowing, reserves, and current account balance as a percentage of GDP come from the IMF's World Economic Outlook database. We obtain data for gross domestic liabilities dollarization (GDLD) and GDP data in current local currency from the World Development Indicators (WDI). The data on deposits included in broad money, transferable deposits included in broad money, and liabilities to non-residents are from IFS of IMF. GDLD is calculated as the ratio of the sum of foreign liabilities and the deposits in foreign currency to total deposits. The deposits in foreign currency to total deposits ratio is calculated using data from each central bank.

We estimate the following probit model where the dependent variable is a dummy equal to 1 if the country suffered a Sudden Stop and zero otherwise:

$$P(SS_t = 1) = \Phi(\alpha_0 + \alpha_1 NetDLD_{t-1} + \alpha_2 FiscalBal_{t-1} + \alpha_3(1 - \omega_{t-1}(CA)) + \alpha_t),$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution, $NetDLD_{t-1}$ is the Net Liabilities Dollarization, which is the Liabilities Dollarization net of international reserves, $FiscalBal_{t-1}$ is the fiscal balance, $(1 - \omega_{t-1}(CA))$ represents the change in the real exchange rate that results from a stop in financing, note that $\omega_{t-1}(CA)$ depends on the Current Account Balance,⁸ and α_t is a time dummy found with a restricted ML.

a. Assessing the Model's Performance

To evaluate the ability to identify the most vulnerable economies we employ a signaling model that gives a positive SS signal whenever the estimated probability is above a given threshold and calculate the true positive and false positive rates given the observed data. Formally, these rates are:

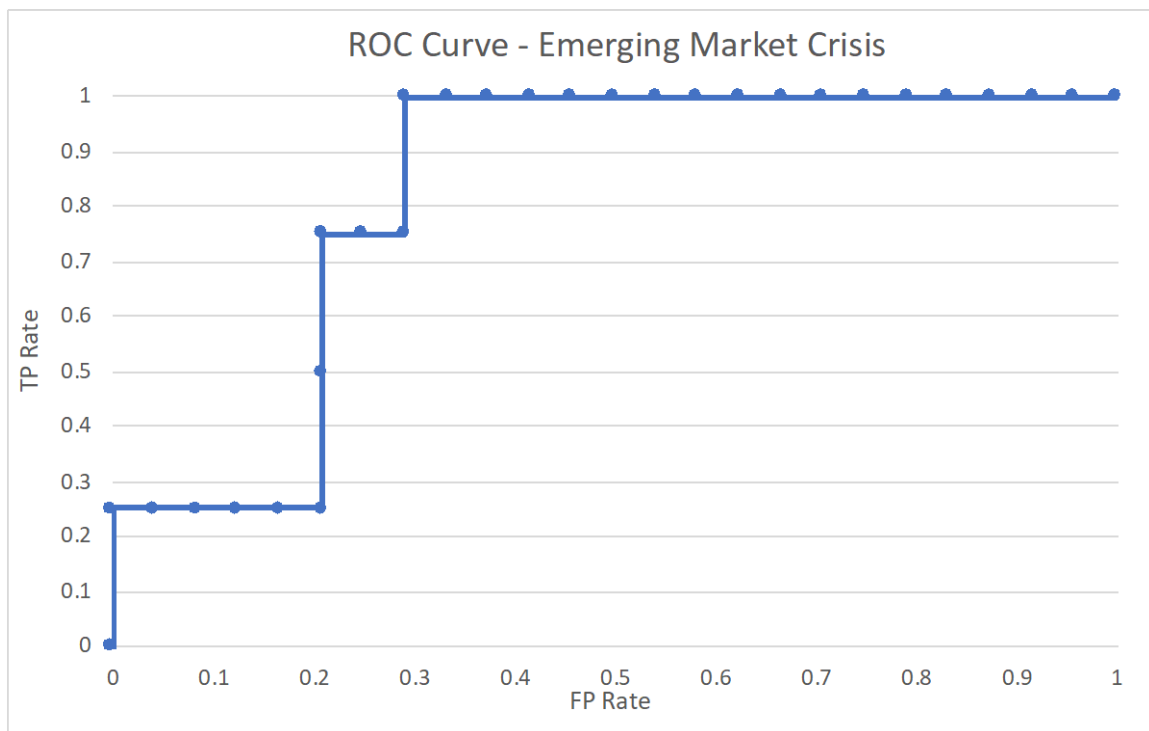
$$TPR = \frac{TP}{TP+FN}, \text{ and } FPR = \frac{FP}{FP+TN},$$

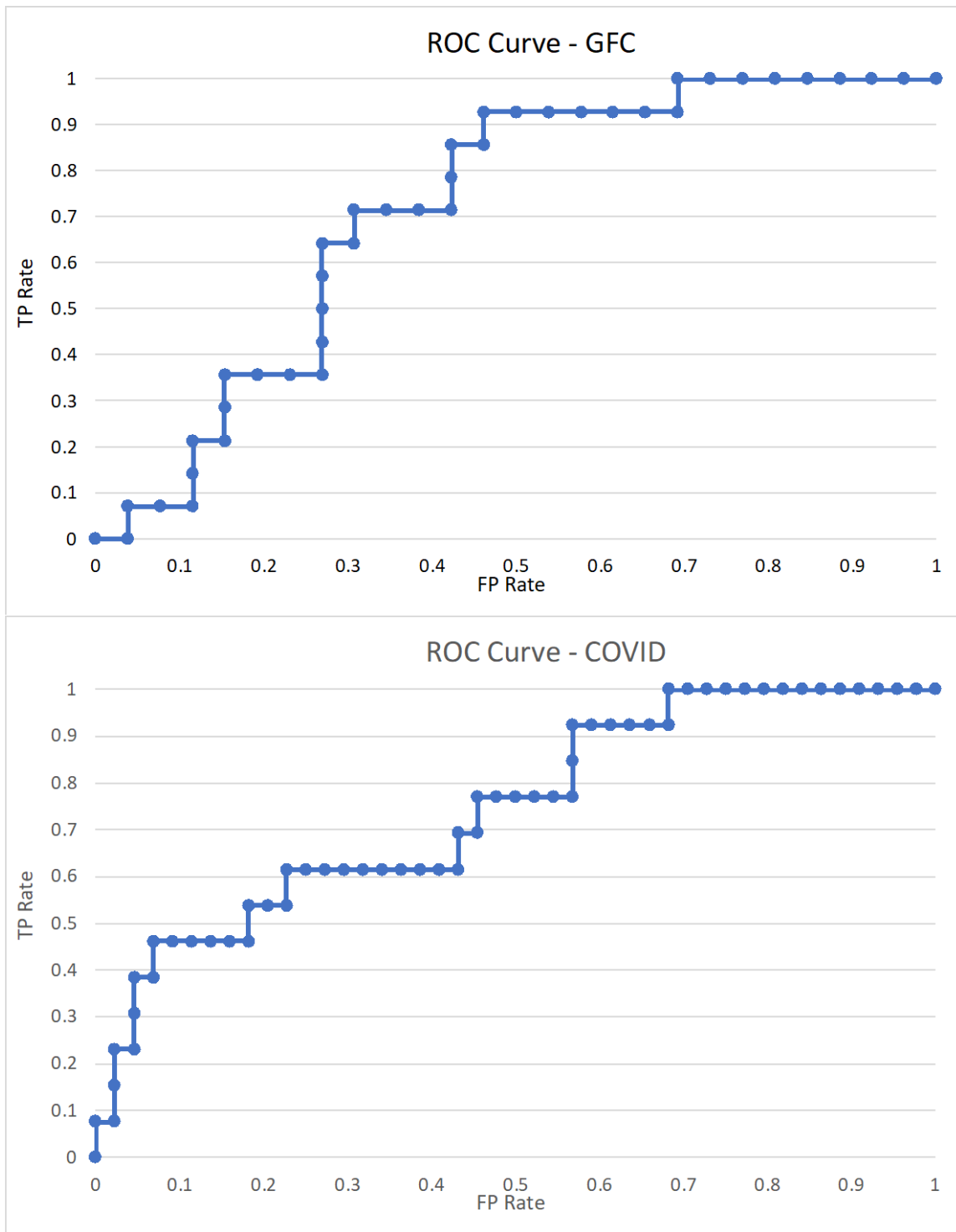
⁸ For a detailed explanation of the construction of $\omega_{t-1}(CA)$ refer to Calvo, Izquierdo, and Loo-Kung (2012).

where TPR is the true positive rate, TP are the true positive values, FN are the false negative values, FPR is the false positive rate, FP are the false positive values, and TN are the true negative values.

We then repeat the process for all possible thresholds and plot the relationship between the true positive and false positive rates, in the signaling machine learning literature this is called the Receiver Operating Characteristic (ROC) curve, shown in Figure A 4.1.

Figure A 6.1. ROC Curve for Model's Predictions for Emerging Market Crisis, GFC and COVID Crisis





When the threshold is very high, all signals are negative; that is the point (0,0). As the threshold value decreases, positive signals appear, which may be either true or false. When the threshold is sufficiently low, all signals are positive, all positives are true positives, and all

negatives are false positives, hence this is the point (1,1). In the middle part of the curve, when the threshold reaches one of the model's predicted values, the signal turns positive. If it is a true positive, the curve will jump up; otherwise it will jump to the right.

The area under this curve (AUROC) is generally used as a measure of signal strength. When all positives are ranked above all negatives, the model perfectly discriminates, the AUROC is 1.0, as all jumps up come before all jumps to the right. A random signal should generate an AUROC of 0.5, as false positives and negatives appear randomly as the threshold decreases. Values below the 0.5 suggest the signal is better at predicting the opposite behavior, that is, the signal predicts negatives, not positives. In the machine learning literature, an AUROC over 0.7 is understood as a good performance. In our case, the AUROC has a value of 0.9, suggesting that the model ranking is informative, and it fits very well.