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The Source Matters: How Reserve Financing Affects Sovereign Credit Risk

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Abstract

We develop a novel balance-of-payments (BoP) classification to distinguish reserves accumulated via public external borrowing (a precautionary "self-insurance" motive) from those built up through private capital inflows (sterilized "leaning-against-the-wind" of capital flows (or LAW interventions) to estimate the impact of reserve changes on sovereign spreads and financial stress according to their source of finance. We find that increases in reserves funded by private inflows significantly compress sovereign credit spreads and reduce the probability of a financial-stress episode, whereas reserves changes due to external debt issuance have a much weaker or a statistically insignificant effect. These findings hold in pre- and post-global financial crisis subsamples and robustness checks.

Keywords: Sovereign spreads; international reserves; balance-of-payments; "leaning against the wind" interventions.

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1 Introduction

Active exchange rate policies in the 2000s, in the form of foreign exchange intervention, have been attributed to two main motives: (1) a self-insurance or *precautionary* motive to create an international liquidity buffer to cope with—and ultimately discourage—self-fulfilling liquidity runs in economies with substantial dollar liabilities (Aizenman & Lee, 2005; Feldstein, 1999; Obstfeld et al., 2010); and (2) an exchange rate-smoothing or *leaning-against-the-wind* (LAW) motive to dampen cyclical exchange rate fluctuations (Adler & Tovar, 2011; Blanchard et al., 2015; Daude et al., 2014; Levy Yeyati & Gómez, 2022).[1] Both could, in principle, be related to prudential considerations. The accumulation of precautionary reserves can be seen as the buildup of a war chest against sudden stops and currency runs of the type driving many emerging market crises in the 1990s (Aizenman & Lee, 2005; Aizenman & Marion, 2004). In turn, LAW intervention may be regarded as a prudential response to procyclical capital inflows, buffering transitory (and possibly excessive) exchange rate swings and thereby reducing the propensity for drastic corrections, for example due to sudden stops (Caballero & Lorenzoni, 2007; Levy Yeyati, 2006).

From a consolidated public sector perspective, the distinction between the two motives is straightforward. When reserves are built from private inflows and sterilized locally (the LAW case), foreign assets increase without a corresponding rise in foreign-currency liabilities, strengthening the public sector's net foreign asset position. In contrast, when reserves are built through external borrowing (the precautionary case), foreign assets and foreign liabilities increase in tandem, leaving the net position unchanged. Because sovereign spreads and crisis propensity depend on this net position, only the first type of accumulation directly improves creditworthiness, as we will show.

Holding reserves has been shown to yield gains in terms of reduced financial fragility—as captured, for example, by lower sovereign credit risk premiums—a pattern documented by Levy Yeyati (2008, 2010) and more recently by Levy Yeyati & Gómez (2020, 2022). Both motives have the potential to reduce sovereign spreads: the first through the liquidity buffer provided by reserves; the second through the improvement in the public sector's net foreign currency position due to LAW purchases.

Does this distinction matter empirically? More specifically, from the point of view of their impact on spreads, does it matter whether reserves are accumulated through the issuance of foreign-currency debt, as assumed in the early literature on the cost of reserves

[1] There is a third viewpoint, more prevalent in the past: the neo-mercantilist accumulation of reserve assets aimed at containing local currency appreciation and fostering export-led growth (e.g. Japan in the 1980s and China in the 1990s). This motive has been widely studied in the literature (Gluzmann et al., 2012; Levy Yeyati et al., 2013; Prasad et al., 2006; Rodrik, 2008).

(Jeanne & Rancière, 2006, 2011; Rodrik, 2006) or through the issuance of local-currency liabilities as in sterilized LAW interventions (Levy Yeyati & Gómez, 2020)?

A notable contribution to this debate is provided by Sosa-Padilla & Sturzenegger (2023), who distinguishes between reserve changes associated with foreign- and local-currency liabilities *of the central bank* to argue that only the latter are associated with lower spreads. However, reserves are rarely purchased through the issuance of central bank securities per se; rather, they are the reflection of changes in the currency composition of the public-sector or private-sector portfolios, or of current account balances, which suggests that a more natural way to identify the differential effect of LAW reserves may lie in the balance of payments (BoP). Moreover, this central bank balance sheet may be insufficient to shed light on the question of this paper: whether any of the two potential contending reasons underlying the correlation between reserves and spreads (a longer foreign currency position of the consolidated public sector balance sheet including the central bank, on the one hand, and a pure international liquidity effect, on the other) is verified in practice.

Consider this example: If the Treasury borrows abroad to finance a local-currency deficit, a LAW central bank should purchase this new supply of foreign exchange in the domestic market against local currency paper to buffer the impact on the exchange rate. While this would look like a sterilized LAW intervention (in particular, an increase in the net foreign currency position) from the perspective of the central bank's balance sheet, in reality it is not, as it does not modify the foreign currency position of the consolidated public sector (*vis-à-vis* the private sector).[2]

Table 1: Example of reserve accumulation from external borrowing

Central bank balance sheet classification	**Balance of payments (BoP) classification**
Records an increase in reserves (+ on the asset side) and a matching increase in central bank liabilities to the Treasury or the market. Does not capture the source of funds beyond the immediate transaction with the central bank.	Records the initial Treasury external borrowing as a public-sector liability (+ in the financial account, debt liabilities) and the subsequent purchase of foreign exchange by the central bank as an increase in reserves. Source of reserves is clearly identified as public borrowing.

Note: In this example, the Treasury issues foreign-currency debt and deposits the proceeds at the central bank, which in turn records the inflow as reserves. While the BoP approach assigns the source to public borrowing; the central bank balance sheet alone does not reveal the ultimate source.

[2] Another way to see this is by noting that changing the currency position of the Treasury, for instance, by de-dollarizing its sovereign debt (issuing local currency debt to purchase the foreign exchange used to cancel foreign currency debt) can be seen as another way of intervening in a LAW fashion (de la Torre et al., 2013).

Under the central bank balance sheet approach captured by Table 1, the above operation would be indistinguishable from one in which the reserves originated from private capital inflows sterilized by the central bank: both appear simply as an increase in reserves and domestic liabilities. In our BoP-based classification, however, these two cases are separated: the first is *debt-financed* reserve accumulation (no change in net foreign assets of the consolidated public sector), while the second is *LAW-type* accumulation (increase in net foreign assets). This distinction matters empirically: we will show that when we re-classify our sample using the central bank balance sheet method, the estimated effect of LAW reserves on spreads is attenuated, consistent with the misclassification of debt-financed operations into the LAW category.[3]

To address these concerns, in this paper we adopt an alternative but complementary approach. First, we identify the sources of foreign currency from the balance of payments: public sector foreign-currency borrowing (from international lenders)—which we divide into Treasury debt and central bank debt (net of the IMF) and borrowing from the IMF—[4], and private sector inflows-which we divide into current and financial inflows. Next, we map changes in international reserves (net of valuation and interest rate effects) based on these sources. Finally, building on the specification from Levy Yeyati & Gómez (2020), we run regressions of credit spreads on changes in reserves from different sources and show that increases in reserves narrow credit spreads particularly when they are funded from private capital inflows.

In addition, we show that the same is true for financial crisis propensity: as the stock of reserves grow from private flows (and the public sector foreign currency position lengthens) financial stress (measured as a credit spread beyond 1,000 basis points) declines, while public borrowing shows no significant effect in different specifications.

These results lead us to conclude that sterilized LAW intervention reduces the perceived probability of a credit event, while the effect is statistically weaker in the case of traditional self-insurance where reserve accumulation is sourced from the issuance of foreign currency sovereign liabilities.[5]

[3] When we re-classify the data using the central bank balance sheet approach of Sosa-Padilla & Sturzenegger (2023), several debt-financed operations are indistinguishable from LAW-type accumulation, attenuating the estimated LAW effect on spreads. The robustness check in Appendix Table A5 confirms that the LAW coefficient is smaller in magnitude under the alternative classification, consistent with the expected misclassification bias.

[4] IMF lending is typically associated to financial stress and its positive correlation with credit spreads reflects the inverse causality. On the role of the IMF as a global safety net, see Fernández-Arias & Levy Yeyati (2010).

[5] One implication from our results is that the benefits in terms of lower credit spreads should not be subtracted from the cost of holding reserves when the latter follow a traditional self-insurance pattern.

2 Reserve accumulation: Sources of finance

As noted, the distinction between self-insurance and leaning-against-the-wind is essential to the way reserve stocks are purchased, which in turn determines the way in which they influence the exchange rate: self-insurance should be, *a priori*, neutral, as it aims at modifying not the composition of net debt but rather to lengthen its average tenor; LAW, in turn, seeks to alter the supply of foreign exchange to counter undesired exchange rate fluctuations.

2.1 Conceptual framework

Before turning to the econometric specification, it is useful to formalize the balance-sheet mechanics behind our distinction between reserve accumulation motives. We focus on the *consolidated public sector* (Treasury plus central bank), for which the net foreign asset position from the public sector is:

$$\mathrm{NFA}_t^{\mathrm{pub}} \equiv R_t + A_t^{\mathrm{fx}} - D_t^{\mathrm{fx}},$$

where R_t denotes international reserves, A_t^{fx} other net foreign assets (often negligible in our context), and D_t^{fx} public external (foreign-currency) liabilities.[6]

LAW (private-inflow) accumulation. Private capital inflows or current account surpluses increase the domestic supply of foreign exchange. The central bank purchases FX, raising R_t, and sterilizes the liquidity effect by issuing local-currency liabilities. External public debt does not change, so:

$$\Delta\mathrm{NFA}_t^{\mathrm{pub}} = \Delta R_t - \Delta D_t^{\mathrm{fx}} = \Delta R_t > 0.$$

The public sector's net external position improves.

Debt-financed (precautionary) accumulation. The Treasury or the central bank borrows externally ($\Delta D_t^{\mathrm{fx}} > 0$) and converts the proceeds into reserves ($\Delta R_t = \Delta D_t^{\mathrm{fx}}$). Then:

$$\Delta\mathrm{NFA}_t^{\mathrm{pub}} = \Delta R_t - \Delta D_t^{\mathrm{fx}} = 0.$$

Gross foreign assets and liabilities rise in tandem, leaving the net position unchanged.

[6] Consolidation nets out intra–public sector claims. Domestic-currency liabilities issued for sterilization purposes do not affect D_t^{fx}.

Implications for sovereign risk. Sovereign risk premia and crisis propensity are generally decreasing in the net foreign asset position. Only LAW-type accumulation strengthens NFA^{pub} and, all else equal, lowers the perceived probability of default and the spreads investors require. As illustrated in Table 2, only LAW-type accumulation increases NFA^{pub}, thereby enhancing the public sector's external solvency and, all else equal, reducing the spreads demanded by investors. In contrast, debt-financed (precautionary) accumulation leaves NFA^{pub} unchanged, limiting its potential to lower sovereign risk.

Table 2: Reserve accumulation motives and consolidated public-sector NFA

Motive	ΔR	ΔD^{fx}	ΔB^{lc}	$\Delta\text{NFA}^{\text{pub}}$
LAW / Private inflows (sterilized)	+	0	+	+
Precautionary / Debt-financed	+	+	+	0

Note: R = reserves; D^{fx} = public external FX debt; B^{lc} = domestic local-currency sterilization liabilities (do not affect external position). Signs indicate typical directions of change.

Table 2 is also useful to point out that, under the central bank balance sheet approach, looking at sterilized reserve accumulation (ΔB^{lc}) alone makes it impossible to distinguish its source: Did sterilized reserves originate from Treasury debt issuance or from private capital inflows? In both cases, it simply appears as an increase in reserves and domestic liabilities. As mentioned, in our BoP-based classification, what matters is the change in the net foreign asset position of the consolidated public sector.

2.2 Decomposition

Perhaps the simplest taxonomy of how reserve stocks are built up is through the decomposition of Balance of Payments (BoP) flows that alter the investment position of the public and private sectors: a positive reserve variation corresponds to a positive combination of the current account balance, foreign direct investment, and financial flows. In turn, within the latter, we can distinguish changes in the net foreign debt position of the consolidated public sector (namely, the government and the central bank).

As can be seen in Table 3, the financial account decomposition shows that reserve accumulation can be traced back to *public issuance sources*—mainly debt securities and loans by the Treasury or the central bank, net of asset acquisitions—and to *private sources*, such as foreign direct investment, portfolio equity flows, and other investment by the private sector (including loans, currency and deposits, and trade credits). Equivalently, the contribution of private sources can be obtained residually as the share of reserve variation not explained by identified public issuances.[7]

[7] This approach can be extended to the entire Balance of Payments, noting that the sum of the current and capital accounts equals the financial account minus net errors and omissions.

Table 3: Mapping BoP financial account items to issuance categories

BoP, Financial account	Treasury	Central bank	Private sector
Direct investment			X
Portfolio investment			
Debt securities	X	X	X
Equity and investment fund shares			X
Financial derivatives			X
Other investment			
Loans	X	X	X
Currency and deposits			X
Trade credit and advances			X
Reserve assets		X	

Note: "X" denotes the typical presence of the flow type in the corresponding BoP category. Classification follows BPM6 (IMF) standard components.

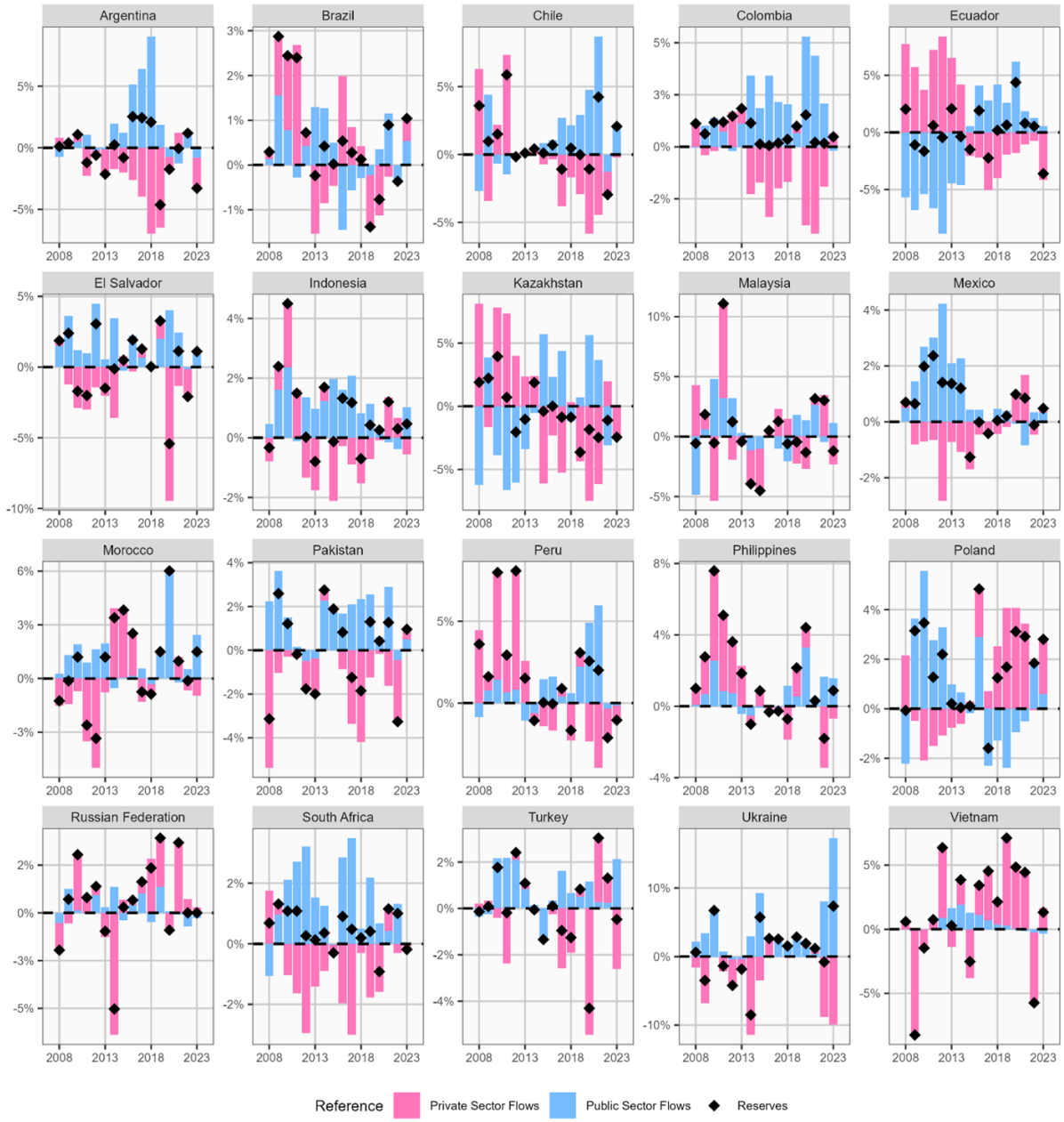
This approach allows us to differentiate *precautionary* reserve build-ups financed by public sector foreign-currency borrowing (e.g., sovereign bond issuance) from *LAW-type* reserve accumulation financed by net private capital inflows (sterilized intervention), as well as to separately track reserves acquired via official IMF lending. We build this taxonomy by leveraging an expanded panel of 44 emerging economies (with around 6,700 monthly observations from 2000 to 2023).[8]

Based on these data, how prevalent is the case where reserves are purchased with foreign exchange public borrowing (in other words, where the change in reserves does not change the foreign currency position)? If we center on the central bank balance sheet, the contribution would be marginal. If we focus on the consolidated position of the public sector (including both the central bank and the government), the answer is: relevant, though not predominant. In short: not all reserves are the flipside of private (portfolio and current account) flows, as consolidated public sector borrowing often plays a role.

In Figure 1 we show an aggregation of this decomposition for a subset of emerging economies. As can be seen, while reserves purchases are primarily sourced from trade and foreign investment flows, public debt flows also play a noticeable role. This reinforces the importance of disentangling the sources of reserve accumulation to better understand which motive—precautionary or LAW—is more relevant in explaining the dynamics of sovereign spreads.

[8] The full panel comprises over 13,000 monthly observations for 56 emerging economies. After excluding periods such as the global financial crisis (2008–2009) and Covid-19 (2020), as well as episodes with spreads above 1,000 bp, the sample is reduced to the 44-country, 6,700-observation dataset described in the main text.

Figure 1: BoP contributions to the change in international reserves (in % of GDP)



As expected, not all emerging markets exhibit the same dynamics of reserve accumulation. Countries such as Brazil, the Philippines, Peru, and Vietnam display patterns where changes in reserves appear closely linked to private sector flows, consistent with a leaning-against-the-wind (LAW) strategy aimed at smoothing exchange rate fluctuations during shifts in financial conditions. In contrast, countries like Argentina, Colombia, Indonesia or South Africa, seem to sustain reserve accumulation—or limit reserve drain—through public sector borrowing, a pattern more in line with the precautionary motive.[9]

[9] Further details on the composition of private and public flows are provided in Annex Figure A1.

To provide a clearer sense of the magnitudes involved, we complement this qualitative overview with a simple variance decomposition of reserve changes into its two observable drivers—private and public flows—as well as their covariance. Table 4 presents the results for the full sample (2000–2023, excluding 2008-2009 and 2020) and two sub-periods: before and after the global financial crisis (2000–2007 and 2010–2023 excluding 2020, respectively).

Table 4: Variance decomposition of international reserves and their sources

Period	Reserves	Private	Public	Covariance
2000–2023	0.99	1.53	1.37	-1.79
2000–2007	1.59	1.77	1.23	-1.45
2010–2023	1.15	1.36	1.19	-1.40

Note: Values are expressed as standard deviations (% of GDP) for interpretation purposes, which implies that the decomposition is no longer additive.

As shown, private and public flows are both highly volatile relative to the net changes in reserves, with the standard deviation of private flows consistently exceeding that of public flows. This highlights the dominant role of private sector flows as the primary source of reserve variation, reflecting their greater sensitivity to shifts in global financial conditions and capital account dynamics.

The persistent negative covariance reflects the joint variation between private and public flows, with its negative values indicating that public sector borrowing often offsets private flows. This could suggest a pattern where public sector borrowing tends to compensate for private outflows, a dynamic that can arise under a precautionary motive—where governments draw on external financing to smooth the drain on reserves during external shocks. However, the magnitude of the covariance declines in the post-crisis period, suggesting that countries may have relied less on public sector borrowing to buffer private sector outflows. This shift is consistent with a reduced role for precautionary accumulation and a growing prevalence of LAW interventions in the more recent period.[10]

[10] Further details on the relative weight of private and public flows across time and countries are provided in Annex Figure A2.

3 Estimating the impact of reserves

We build on the model of credit spreads by Levy Yeyati & Gómez (2022), which relates spreads to global factors—such as in González Rozada & Levy Yeyati (2006)—together with reserves-to-GDP and debt-to-GDP stocks. To this framework, we add the sources of variation in international reserves described in the previous section, also expressed as percentage of GDP and lagged one quarter. In addition, because private debts could be seen as implicitly guaranteed by the government or because private demand of foreign currency to repay those debts adds to the exchange rate pressure and the risk of a sovereign credit event, we control separately for private foreign currency debt as an additional source of spread widening. Moreover, because the connection between spreads and BoP flows is likely to be stronger when both are determined simultaneously by an external shock such as the global financial crisis (GFC) or Covid-19, we exclude these turbulent periods from our sample.

Finally, we restrict the analysis to emerging country-years with access to primary voluntary capital markets. Specifically, we include only countries classified as lower-middle-income or upper-middle-income by the World Bank, based on their classification in each corresponding year. This implies that some countries enter or exit the sample over time as their income classification changes.[11] In addition, we restrict the sample to episodes with spreads below 1,000 bp, a standard threshold for market access.[12]

Hence, we estimate the following model:

$$\begin{aligned} log(\text{spread})_{t-l,i} = \alpha_i &+ \beta log(\text{risk aversion}_{t-l,i}) + \gamma log(\text{rating}_{t-l,i}) + \delta log(\text{us10y}_{t-l,i}) \\ &+ \psi log(\text{terms of trade}_{t-l,i}) + \theta log(\text{reserves}_{t-l,i}) \\ &+ \lambda log(\text{public debt}_{t-l,i}) + \kappa log(\text{private debt}_{t-l,i}) \\ &+ \sum_j \phi_j X_{j,t-l,i} + \varepsilon_{t,i} \end{aligned} \tag{1}$$

Where i denotes countries, l the number of lags, α_i captures country fixed effects, and $\varepsilon_{t,i}$ is the error term. Risk aversion, credit rating, the US 10-year Treasury yield and terms of trade are expressed in logarithms, while reserves stocks and all subsequent variables are measured as ratios to GDP. X_j represent additional controls from the balance of payments, which are central to this study and vary in composition across specifications. Specifically, X_j may include the change in reserves, public flows (Treasury net foreign

[11] We adjusted income classifications for countries that were labeled as high-income or low-income for a single year only, in order to smooth out transitory changes and better capture structural shifts in income status.

[12] Excluded observations are addressed in the next section when we center on the propensity to face an episode of financial stress, defined as facing spreads above the 1,000 bp threshold.

borrowing, central bank net foreign borrowing and IMF net lending), and private capital flows, disaggregated into current and financial account components.[13]

Our specifications cluster standard errors along two dimensions—by country and by time—to account for both cross-sectional dependence and common shocks affecting all countries. This two-way clustering yields more conservative inferences; for instance, under the improved specification the previously strong correlation between public debt levels and sovereign spreads becomes less pronounced, suggesting that some of the apparent impact of high public debt may be overstated in simpler models that do not fully capture global or country-specific effects.[14]

While our empirical strategy mitigates simultaneity concerns through two main channels—(i) the exclusion of acute crisis periods such as 2008–2009 or 2020, when reserve changes are more likely to be reactive rather than policy-driven, and (ii) the inclusion of lags in reserve and flow variables to reduce contemporaneous feedback—these steps cannot fully eliminate the possibility of reverse causality. In particular, favorable macroeconomic conditions or global factors (e.g., commodity price booms) may simultaneously lead to tighter spreads and larger private inflows, resulting in higher reserve accumulation. We partially address these concerns by controlling for global risk appetite, international interest rates, terms of trade, and sovereign credit ratings, which capture both global and country-specific shifts in perceived creditworthiness, as well as by focusing on periods of market access (spreads below 1,000 bps) where reserve changes are less likely to be crisis responses. Nevertheless, our results should be interpreted as *consistent with a causal effect* of reserve accumulation—especially when financed through private flows—rather than as definitive proof of causality.[15]

[13] Annex Tables A1, A2, and A3 report the relevant summary statistics, a correlation matrix of key variables, and the countries and periods covered, respectively. Variable definitions and sources are listed in Table A4.

[14] Alternatively, we use a generalized least squares (GLS) panel estimator to address potential serial correlation in spread dynamics, but the GLS procedure severely underestimated standard errors and spuriously made virtually all coefficients appear significant. We therefore rely on fixed-effects panel regressions with robust two-way clustered standard errors as our preferred estimates, which provide a more reliable gauge of significance.

[15] We run two additional robustness checks. First, we re-estimated the battery of specifications only for the post-GFC period (Table 6) and for cases where negative trade-balance was recorded (Table 7). Furthermore, we re-estimated these specifications at a quarterly frequency (averaging spreads over each quarter), which removes the need for monthly interpolation of balance-of-payments data in Tables A6, A7 and A8.

Estimation results for the full sample are reported in Table 5.[16] Overall, signs are generally in line with expectations: higher risk aversion is associated with wider spreads, better credit ratings with narrower spreads, higher international rates with narrower spreads (as the composition of spreads fall for a given cost of credit), and higher debt stocks with wider spreads (although the coefficient on private debt is not statistically significant). The only variable deviating from expectations is the (log of) terms of trade, whose coefficient is positive but not statistically significant.[17]

The findings in column (1) from Table 5 are in line with what has been reported in the literature: the benign impact of the stock of reserves on spreads offsets the adverse impact of sovereign debt (hinting at a positive net effect even if reserves have been purchased with foreign currency external debt), a result particularly stable across different specifications. In addition, reserve accumulation narrows spreads: based on the results in column (2), a 1 p.p. change in the reserves-to-GDP ratio reduces spreads by roughly 2.6%.

Column (3) from Table 5 decomposes the BoP sources of reserve variation and confirms that primarily the reserves accumulated via private capital inflows (the LAW channel) are statistically associated with lower spreads. Public debt-sourced accumulation shows a smaller and less significant effect. The influence of public sources remains once we treat separately the IMF loans, which are non-significant. Results in column (5) show that both current and financial components of private flows are significant drivers of spread compression, with the effect of current flows being stronger: a one–percentage point increase from private current flows is associated with a 4% reduction in spreads, compared to a 2.7% reduction for private financial flows, all else equal.

To gauge the economic significance, take the sample average EMBI spread of roughly 350 bp: using the private-sourced component in column (4) from Table 5 (Private Flows$_{t-3}$, coefficient -3.045), a 1% of GDP LAW-type accumulation implies a tightening of about **10.5 bps** in spreads.[18]. In contrast, the reduction in spreads for the public-flows component (Public Flows$_{t-3}$, coefficient -1.753) is about 6.1 bps, statistically significant only at the 90% confidence level (as opposed to the 99% for the private component).

[16] All regressions controls are in monthly frequency and include country fixed effects. For variables originally reported annually, such as debt stocks and GDP, we used splines interpolation to turn them into monthly data. For BoP variables, which are flow-based, we instead repeated the quarterly observations across the three months of each quarter. We run the same model with contemporaneous changes and using alternative thresholds around the 1,000 bp mark, to similar results.

[17] As noted by Di Pace et al. (2025) and Schmitt-Grohé & Uribe (2018), standard measures of terms of trade may be a poor proxy for their economic effects. These studies show that such measures often explain a small share of macroeconomic fluctuations, suggesting that the relationship between terms of trade and economic performance is empirically complex and weaker than conventional wisdom implies.

[18] Computed as $350 \times \left(1 - e^{\phi \cdot 0.01}\right)$ with $\phi = -3.045$. For the current-account component (column (5) from Table 5, $\phi = -3.956$) the effect is $\approx$ 13.6 bps; for the financial-account component ($\phi = -2.677$) it is $\approx$ 9.0 bps.

Table 5: Elasticities of emerging market spreads to reserves and its sources

Specifications: Baseline (2000-2023, excluding 2008-2009 and 2020)					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.719***	0.704***	0.702***	0.703***	0.701***
	(0.050)	(0.051)	(0.051)	(0.050)	(0.051)
Credit Rating	-1.382***	-1.408***	-1.415***	-1.420***	-1.432***
	(0.171)	(0.170)	(0.169)	(0.172)	(0.166)
Terms of Trade	0.204	0.231	0.243	0.247	0.256
	(0.158)	(0.156)	(0.153)	(0.153)	(0.154)
International Rate	-0.078	-0.077	-0.073	-0.072	-0.072
	(0.049)	(0.049)	(0.049)	(0.049)	(0.050)
Sovereign Debt Stock	1.318***	1.336***	1.321***	1.333***	1.344***
	(0.426)	(0.421)	(0.425)	(0.423)	(0.416)
Private Debt Stock	0.560	0.581	0.581	0.584	0.584
	(0.432)	(0.419)	(0.419)	(0.418)	(0.415)
Reserves Stock	-1.221**	-1.072**	-1.072**	-1.071**	-1.040**
	(0.498)	(0.512)	(0.512)	(0.511)	(0.506)
Change in Reserves$_{t-3}$		-2.649***			
		(0.670)			
Public Flows$_{t-3}$			-1.869*		-1.858*
			(0.972)		(0.987)
Private Flows$_{t-3}$			-3.036***	-3.045***	
			(0.836)	(0.837)	
Public Flows, exc. IMF$_{t-3}$				-1.753*	
				(0.964)	
IMF Lending$_{t-3}$				-5.618	
				(5.329)	
Private Flows, Current$_{t-3}$					-3.956***
					(1.097)
Private Flows, Financial$_{t-3}$					-2.677***
					(0.806)
Num. Obs.	6,731	6,599	6,599	6,599	6,599
R2 Adj.	0.807	0.812	0.813	0.813	0.813
R2 Within Adj.	0.567	0.573	0.574	0.574	0.575
RMSE	0.28	0.28	0.28	0.28	0.28
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Importantly, as shown in the side-by-side comparison in Table 5 of the Annex, the LAW coefficient is meaningfully smaller when reserves are classified from the central bank balance sheet (columns 4–6) rather than the balance of payments (columns 1–3). This attenuation is consistent with the misclassification bias arising from the inability of the CB-based measure to fully separate valuation effects from actual LAW-type inflows.

3.1 Robustness

Table 6 replicates the test for the post-GFC period to document the remarkable stability of the results over time. Restricting the sample to 2010–2023 (excluding 2020) focuses on a more recent and relatively homogeneous global environment, after the structural break in capital flows and policy frameworks triggered by the global financial crisis.

Table 6: Elasticities of emerging market spreads to reserves and its sources: Post-GFC

Specifications: Post-GFC (2010-2023, excluding 2020)					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.476***	0.469***	0.468***	0.469***	0.469***
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
Credit Rating	-1.113***	-1.156***	-1.165***	-1.165***	-1.177***
	(0.166)	(0.166)	(0.167)	(0.167)	(0.166)
International Rate	-0.093***	-0.092**	-0.091**	-0.090**	-0.086**
	(0.035)	(0.035)	(0.036)	(0.036)	(0.037)
Terms of Trade	-0.008	0.016	0.050	0.051	0.080
	(0.165)	(0.164)	(0.155)	(0.155)	(0.162)
Sovereign Debt Stock	0.592	0.604	0.595	0.607	0.642
	(0.413)	(0.411)	(0.408)	(0.412)	(0.418)
Private Debt Stock	-0.191	-0.175	-0.167	-0.169	-0.145
	(0.358)	(0.355)	(0.352)	(0.352)	(0.345)
Reserves Stock	-1.283*	-1.142*	-1.147*	-1.148*	-1.150*
	(0.650)	(0.678)	(0.670)	(0.670)	(0.676)
Change in Reserves$_{t-3}$		-2.041**			
		(0.767)			
Public Flows$_{t-3}$			-1.224		-1.131
			(0.782)		(0.786)
Private Flows$_{t-3}$			-2.522**	-2.493**	
			(0.965)	(0.972)	
Public Flows, exc. IMF$_{t-3}$				-1.140	
				(0.828)	
IMF Lending$_{t-3}$				-3.847	
				(5.542)	
Private Flows, Current$_{t-3}$					-3.463***
					(1.161)
Private Flows, Financial$_{t-3}$					-2.079**
					(0.930)
Num. Obs.	4,928	4,870	4,870	4,870	4,870
R2 Adj.	0.799	0.802	0.803	0.803	0.804
R2 Within Adj.	0.280	0.284	0.286	0.286	0.289
RMSE	0.25	0.25	0.25	0.25	0.25
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Another natural robustness check is to consider that the link between spreads and flows may also reflect external shocks other than the GFC or Covid-19, for example, positive terms of trade shocks or drops in international rates, both of which can lower borrowing costs and trigger a sudden increase in the supply of foreign exchange, potentially leading to reserve accumulation out of fear of appreciation. Naturally, countries under a flexible exchange-rate regime may instead allow the currency to appreciate, offsetting the shock through higher imports or capital flows. To filter those cases, we rerun the battery of specifications only for country-years with trade deficit.[19]

Results from Table 7 are surprisingly solid and, as with the post GFC sample, reserves sourced through debt have a weaker and statistically less significant influence on spreads, whereas those sourced from private sector inflows retain their strong, stabilizing effect.

Additional robustness checks can be found in Annex Tables A6, A7 and A8, where the same regressions were run over the quarterly panel to account for interpolation treatment for each variable. In these specifications, balance of payments flows are taken directly from their natural quarterly frequency, and EMBI spreads are averaged within each quarter. This exercise confirms that the main results are not driven by the monthly building up of the panel.

[19] Given that some controls, such as the international rate or the terms-of-trade variable, have not been significant in baseline specifications, this additional check becomes more relevant to ensure that results are robust to non-captured shocks.

Table 7: Elasticities of emerging market spreads to reserves and its sources: Excluding country-time trade surplus from baseline

Specifications: Only cases with negative trade-balance					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.655***	0.647***	0.644***	0.645***	0.646***
	(0.068)	(0.067)	(0.067)	(0.067)	(0.067)
Credit Rating	-1.289***	-1.307***	-1.310***	-1.314***	-1.338***
	(0.147)	(0.143)	(0.143)	(0.145)	(0.139)
International Rate	-0.023	-0.018	-0.016	-0.015	-0.013
	(0.055)	(0.055)	(0.055)	(0.055)	(0.054)
Terms of Trade	0.273	0.261	0.268	0.269	0.262
	(0.258)	(0.257)	(0.257)	(0.256)	(0.255)
Sovereign Debt Stock	1.602***	1.595***	1.582***	1.586***	1.631***
	(0.509)	(0.503)	(0.505)	(0.504)	(0.487)
Private Debt Stock	0.395	0.386	0.388	0.390	0.404
	(0.442)	(0.429)	(0.420)	(0.420)	(0.400)
Reserves Stock	-1.517**	-1.326*	-1.317**	-1.310*	-1.259*
	(0.655)	(0.658)	(0.651)	(0.652)	(0.649)
Change in Reserves$_{t-3}$		-2.746***			
		(0.752)			
Public Flows$_{t-3}$			-1.897**		-1.854**
			(0.886)		(0.835)
Private Flows$_{t-3}$			-3.378***	-3.403***	
			(1.150)	(1.154)	
Public Flows, exc. IMF$_{t-3}$				-1.786*	
				(0.927)	
IMF Lending$_{t-3}$				-4.540	
				(3.896)	
Private Flows, Current$_{t-3}$					-5.302***
					(1.760)
Private Flows, Financial$_{t-3}$					-2.986***
					(1.086)
Num. Obs.	4,060	4,060	4,060	4,060	4,060
R2 Adj.	0.811	0.814	0.814	0.814	0.815
R2 Within Adj.	0.551	0.557	0.558	0.558	0.561
RMSE	0.28	0.28	0.28	0.28	0.27
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4 Reserves and crisis propensity

So far, we have shown that international reserve accumulation, particularly when driven by private sector flows, exhibits a significant and robust dampening effect on sovereign credit spreads across emerging economies with access to voluntary capital markets. A natural extension would be to test whether this mitigating effect translates into a reduced likelihood of external financial stress episodes.

The role of international reserves in enhancing crisis resilience has been widely documented in the literature. For instance, Frankel & Saravelos (2012) identify reserves as one of the most robust leading indicators of crisis vulnerability during the global financial crisis. Similarly, Llaudes et al. (2010) document that emerging markets with larger reserve buffers fared better during the GFC, exhibiting smaller output losses and greater macroeconomic stability. Other studies, such as Bussière et al. (2015) and Eichengreen & Gupta (2016), find that higher reserve buffers were associated with milder output contractions or a lower likelihood of sudden stops in emerging markets. While our analysis excludes the 2008–09 period and 2020 to avoid mixing idiosyncratic fragility with the effects of a global shock, we build on this empirical tradition by asking whether the sources of reserve accumulation—not just the level of reserves—help explain the likelihood of losing market access outside systemic crises.

Specifically, in this section we assess whether higher reserves, and the sources from which they are accumulated, lower the probability that a country's sovereign spread surpasses the 1,000 bp threshold—a commonly used proxy for market access loss. The logic is simple: if reserves reduce spreads, they should also help prevent them from growing to a point at which the country loses access and, absent alternative official sources, faces liquidity shortages and a debt crisis. Do reserves make a financial crisis less likely? And crucially, does the origin of reserves influence their protective power against financial distress?

To this end, we estimate a logit model using the same set of explanatory variables and lags as in the baseline specifications, but with a binary dependent variable equal to one if sovereign spreads exceed the 1,000 bp threshold. To capture the fact that financial stress episodes often exhibit persistence, we include the lag of the crisis dummy as an additional regressor. This reflects the idea that once a country has crossed the market access threshold, the probability of remaining in a crisis state is substantially higher due to short-term inertia. This approach allows us to explore not only whether reserves matter for market sentiment, but also whether they play a preventive role in shielding countries from outright financial crises.

Before running the discrete regressions, we conducted a preliminary assessment to ensure the sample contained the type of variation required for reliable estimation. First, we verified that a sufficient number of countries in our panel had experienced both market access and market exclusion episodes (sovereign spreads below and above the 1,000 bp threshold). Out of 44 countries meeting our baseline criteria, 21 transitioned at least once between the two states. Second, we checked that each combination of reserve variation (increase/decrease) and crisis status (below/above 1,000 bp) was represented in the data, avoiding empty combinations that could lead to perfect separation and unstable logit coefficients. The distribution was broadly balanced: for instance, the share of reserve accumulation was 42.6% outside crises and 44.1% during crises, suggesting a similar proportion in both states and allowing the model to identify effects across them.

In Table 8 we report the results for the baseline specification, which covers the period 2000–2023 and excludes the GFC years (2008–2009) and Covid-19 (2020), focusing on countries that have transitioned between the two different states: market access and exclusion.[20]

First of all, the coefficient on the lagged crisis indicator is large and highly significant across all specifications, highlighting the strong short-term inertia of financial stress episodes: once a country loses market access, the probability of remaining in a crisis state rises substantially.

As shown in columns (1) and (2) of Table 8, the stock of (and the change in) reserves remains a relevant factor in explaining the probability of entering a financial crisis. However, column (3) reveal that not all forms of reserve accumulation contribute equally to crisis prevention: only reserves accumulated via private inflows (e.g., current account surpluses and portfolio inflows) significantly reduce the probability of crisis. Columns (4) and (5) reinforce these findings. The coefficient on IMF lending turns positive—typically reflecting reverse causality, as IMF disbursements are often triggered by financial distress—while reserves sourced from private inflows, particularly those stemming from current account surpluses, continue to exhibit a robust, mitigating effect on crisis propensity.

[20] We repeated the tests using different lags in the explanatory variables, finding similar results. As in the previous section, all models include country fixed effects and two-way clustered standard errors.

Table 8: Sources of reserves and financial stress propensity in emerging markets

Specifications: Baseline (2000-2023, excluding 2008-2009 and 2020)					
Dependent: Spread>1000	(1)	(2)	(3)	(4)	(5)
Spread $> 1000_{t-3}$	3.635***	3.639***	3.662***	3.688***	3.669***
	(0.374)	(0.372)	(0.379)	(0.387)	(0.387)
Risk Aversion	2.198***	2.178***	2.110***	2.064***	2.109***
	(0.665)	(0.651)	(0.666)	(0.664)	(0.665)
Credit Rating	-2.245**	-2.281**	-2.235**	-2.299**	-2.245**
	(0.935)	(0.915)	(0.906)	(0.872)	(0.920)
International Rate	-0.105	-0.029	-0.025	-0.055	-0.019
	(0.495)	(0.517)	(0.536)	(0.536)	(0.532)
Terms of Trade	1.863*	1.933*	1.944*	1.838*	1.946*
	(1.047)	(1.055)	(1.084)	(1.015)	(1.087)
Sovereign Debt Stock	6.136**	6.454**	6.197**	5.724*	6.273**
	(2.760)	(2.797)	(2.712)	(2.520)	(2.738)
Private Debt Stock	-0.676	-0.647	-0.662	-1.027	-0.724
	(2.041)	(2.144)	(2.321)	(2.477)	(2.418)
Reserves Stock	-8.304	-6.827	-6.566	-6.866	-6.482
	(5.420)	(4.892)	(4.942)	(4.948)	(4.813)
Change in Reserves_{t-3}		-23.098**			
		(11.545)			
$\text{Public Flows}_{t-3}$			-11.186		-11.545
			(10.171)		(9.297)
$\text{Private Flows}_{t-3}$			-28.001**	-24.548*	
			(13.436)	(12.691)	
Public Flows, exc. IMF_{t-3}				-18.428	
				(11.254)	
IMF Lending_{t-3}				85.646***	
				(24.219)	
Private Flows, Current_{t-3}					-29.873***
					(10.596)
Private Flows, Financial_{t-3}					-26.958
					(16.465)
Num. Obs.	3,400	3,400	3,400	3,400	3,400
R2 Adj.	0.608	0.611	0.612	0.617	0.612
R2 Within Adj.	0.540	0.545	0.546	0.551	0.545
RMSE	0.22	0.22	0.22	0.22	0.22
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Since the coefficients from Table 8 are in log-odds form (logit coefficients) and thus not directly interpretable as marginal effects, in Table 9 we report the average marginal effects (AME) of the discrete model with persistence of crises, allowing for a more straightforward interpretation of coefficient magnitudes.

Table 9: Average marginal effects (AME) on crisis probability

Specifications: Baseline (2000-2023, excluding 2008-2009 and 2020)					
Variable	(1)	(2)	(3)	(4)	(5)
Spread $> 1000_{t-3}$	0.416***	0.410***	0.412***	0.405***	0.413***
Risk Aversion	0.022***	0.022***	0.021***	0.021***	0.021***
Credit Rating	-0.022**	-0.022**	-0.021**	-0.022***	-0.021**
International Rate	-0.002	-0.001	0.000	-0.001	0.000
Terms of Trade	0.001*	0.001*	0.001*	0.001*	0.001*
Sovereign Debt Stock	0.296**	0.308**	0.294**	0.269**	0.298**
Private Debt Stock	-0.033	-0.031	-0.031	-0.048	-0.034
Reserves Stock	-0.400	-0.300	-0.312	-0.323	-0.308
Change in Reserves$_{t-3}$		-1.102**			
Public Flows$_{t-3}$			-0.531		-0.548
Public Flows, exc. IMF$_{t-3}$				-0.866	
IMF Lending$_{t-3}$				4.026***	
Private Flows$_{t-3}$			-1.329**	-1.154*	
Private Flows, Current$_{t-3}$					-1.417***
Private Flows, Financial$_{t-3}$					-1.279

Note: Asterisks indicate significance from tests on the original logit coefficients (equivalently, on odds ratios), not on the AMEs. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

We can quantify the economic significance in terms of crisis propensity using the AME for private-sourced reserves (column (3) from Table 9, Private Flows$_{t_3}$, AME $= -1.329$): a 1% of GDP LAW-type inflow is associated with a reduction in crisis probability of about 1.3 percentage points. For a typical LAW inflow of $\approx 0.3\%$ of GDP (Table A1), this corresponds to a reduction of roughly 0.39 percentage points.

Extending this reasoning, the preventive role of the stock of reserves is clear: for each additional percentage point of GDP in reserves, a country achieves approximately a 1.1 percentage point reduction in the likelihood of crossing the 1,000 bp threshold. Furthermore, the source matters: reserves accumulated through current account surpluses exhibit a robust mitigating effect, with each 1 percentage point of GDP in such accumulation lowering the probability of a spread exceeding 1,000 bp by around 1.4 percentage point, while reserves funded by public flows are not significant at any level. In contrast, reserves built via IMF lending increase the likelihood of crisis by about 3 percentage points per GDP point, consistent with the view that IMF support is triggered by distress rather than as a preventive measure.

4.1 Robustness

Even though the sample becomes insufficiently large to yield reliable regressions estimates—as in the cases of only the post-GFC period or trade deficit episodes—a robustness check that can still be performed is to test, for the same battery of specifications as in Tables 8 and 9, alternative crisis thresholds different from 1,000 bp. This is shown in Table 10, where we test thresholds ranging from 800 bp to 1,200 bp.

Table 10: Average marginal effects on crisis propensity across thresholds

Specification: Baseline (2000–2023, excluding 2008–2009 and 2020)				
Threshold	Public Flows	Private Flows	Private, Current	Private, Financial
800 bps	-0.895^{*}	-1.191^{**}	-1.562^{***}	-1.020^{*}
900 bps	-0.159	-1.077^{*}	-1.450^{**}	-0.893
1,000 bps	-0.531	-1.329^{**}	-1.417^{***}	-1.279
1,100 bps	-0.560	-1.449^{**}	-1.374^{***}	-1.491^{*}
1,200 bps	-0.676^{*}	-1.852^{***}	-1.606^{***}	-1.981^{***}

Note: Asterisks indicate significance from tests on the original logit coefficients (equivalently, on odds ratios), not on the AMEs. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Note 2: "1,000 bps" reported coefficients can be found in column (3) of Table 9 for "Public Flows" and "Private Flows", and in column (5) for "Private Flows, Current" and "Private Flows, Financial".

The table highlights two robust patterns. First, public flows are generally not statistically significant, whereas private flows are almost always significant at the 1% level and exhibit larger magnitudes. Second, a one–percentage-point increase in the flows that feed reserve accumulation (as a share of GDP) is associated with a reduction in the probability of being in crisis of about 1.0–1.8 percentage points, depending on the threshold. Within private flows, current account–related inflows are consistently significant and strongly reduce crisis risk, while financial account inflows provide mixed evidence—becoming more relevant as the crisis threshold tightens (higher spread cut-offs).

An additional robustness check can be found in the Annex Table A9, where the same regressions from baseline specifications were run over the quarterly panel to account for the interpolation treatment for each variable, for the same reasons discussed in the previous section and with similar results.

5 Final remarks

Studies of the costs and benefits of accumulating reserves for self-insurance often overlook the benign effect of holding reserves on spreads and, in turn, on the cost of servicing the debt. These indirect gains effectively reduce the net cost of holding reserves and should be considered when assessing their overall desirability. As we show here, these gains can be substantial, particularly when reserve accumulation is sourced from private inflows rather than from debt issuance.[21]

LAW intervention that builds up reserves against the sale of public sector local currency securities—typically through private sector inflows—significantly lowers credit spreads. The effect is both stronger and more robust than that of traditional self-insurance strategies, where reserves are accumulated via the issuance of foreign-currency debt. Our findings suggest that not all reserve accumulation is equally effective: the source of financing matters for its impact on sovereign risk and financial stability.

[21] Practical considerations may temper the strength of the policy prescription. For example, sustained sterilization of FX purchases typically requires the issuance of domestic liabilities by the central bank, which may generate a quasi-fiscal burden when interest rate differentials are unfavorable–although that quasi fiscal cost has been shown to be minimal for most countries in recent years (Levy Yeyati & Gómez, 2020). Also, frequent and large-scale interventions may complicate the implementation of inflation-targeting regimes and, in some cases, create tensions with central bank independence if the policy is perceived as serving objectives beyond price stability–hence, the importance of a surgical approach that minimizes drastic price responses.

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Statistical Annex

Table A1: Summary statistics of selected variables: Baseline specifications

Variable	N	Mean	Std. Dev.	Min	Max
Sovereign Spread	6,692	351.3	208.8	11.7	998.0
Risk Aversion	6,692	4.8	1.5	2.6	10.7
Credit Rating	6,692	10.9	2.8	4	18
International Rate	6,692	3.0	1.2	1.1	6.7
Reserves Stock (% GDP)	6,692	16.8	9.1	1.7	58.3
Sovereign Debt Stock (% GDP)	6,692	23.2	14.8	1.6	98.6
Private Debt Stock (% GDP)	6,692	16.9	21.6	0.0	152.0
Change in Reserves (% GDP)	6,692	0.3	1.4	-7.7	11.8
Treasury Issuances (% GDP)	6,692	0.3	1.1	-4.7	16.3
Central Bank Issuances (% GDP)	6,692	-0.02	0.5	-6.7	4.7
IMF Lending (% GDP)	6,692	0.04	0.2	0.0	3.7
Private Flows (% GDP)	6,692	0.01	1.5	-16.2	7.7
Private Flows, Current (% GDP)	6,692	-0.3	1.7	-14.2	10.4
Private Flows, Financial (% GDP)	6,692	0.3	1.8	-21.2	12.3

Note: % GDP variables are expressed in percentage points for illustrative purposes. "Treasury Issuances (% GDP)" refers to Treasury debt issuance net of IMF lending.

Table A2: Correlation matrix of key variables

	Spread	Risk	Rating	Reserves	ΔI.R.	TRE	CB	IMF	Priv.	Priv.C	Priv.F
Spread	1.00										
Risk	0.21	1.00									
Rating	-0.74	0.11	1.00								
Reserves	-0.33	-0.04	0.32	1.00							
ΔI.R.	-0.11	-0.07	0.01	0.14	1.00						
TRE	0.05	0.02	-0.07	-0.02	0.29	1.00					
CB	0.00	0.02	-0.00	0.02	0.13	-0.13	1.00				
IMF	0.20	0.05	-0.18	-0.02	0.05	-0.04	0.19	1.00			
Priv.	-0.16	-0.09	0.09	0.14	0.65	-0.43	-0.16	-0.12	1.00		
Priv.C	-0.04	-0.04	0.05	0.18	0.21	-0.22	-0.05	-0.02	0.38	1.00	
Priv.F	-0.09	-0.03	0.03	-0.06	0.33	-0.14	-0.09	-0.08	0.46	-0.65	1.00

Note: ΔI.R., "Change in Reserves"; TRE, "Treasury Issuances"; CB, "Central Bank Issuances"; IMF, "IMF Lending"; Priv., "Private Flows"; Priv.C, "Private Flows, Current"; Priv.F, "Private Flows, Financial".

Table A3: Countries and coverage period

#	Country Name	Start Date	End Date	Obs. (Months)	Obs. (Years)
1	Colombia	Jan-2000	Dec-2023	252	21
2	Mexico	Jan-2000	Dec-2023	252	21
3	Peru	Jan-2000	Dec-2023	252	21
4	Philippines	Jan-2000	Dec-2023	252	21
5	South Africa	Jan-2000	Dec-2023	252	21
6	Turkey	Jan-2000	Dec-2023	249	21
7	Brazil	Jan-2000	Dec-2023	239	20
8	Morocco	Jan-2003	Dec-2023	216	18
9	Panama	Jan-2000	Dec-2019	216	18
10	Russian Federation	May-2001	Feb-2022	214	18
11	Indonesia	May-2004	Dec-2023	200	17
12	El Salvador	Apr-2002	Dec-2023	197	16
13	Ukraine	Jan-2002	Jan-2022	190	16
14	Malaysia	Jan-2000	Dec-2016	180	15
15	Ecuador	Apr-2002	Jun-2022	173	14
16	Kazakhstan	Jun-2007	Dec-2023	163	14
17	Georgia	Jan-2010	Dec-2023	156	13
18	Vietnam	Jan-2010	Dec-2023	156	13
19	Dominican Republic	Jan-2010	Dec-2023	147	12
20	Jamaica	Jan-2011	Dec-2023	134	11
21	Bulgaria	Jan-2000	Dec-2013	133	11
22	Egypt Arab Republic	Jan-2011	Dec-2023	133	11
23	Jordan	Jan-2011	Dec-2023	132	11
24	Azerbaijan	Apr-2012	Dec-2023	129	11
25	Guatemala	Jun-2012	Dec-2023	127	11
26	Mongolia	May-2012	Dec-2023	127	11
27	Costa Rica	Jul-2012	Dec-2023	126	10
28	Argentina	Jan-2000	Jul-2019	125	10
29	India	Oct-2012	Dec-2023	123	10
30	Angola	Oct-2012	Dec-2023	122	10
31	Pakistan	Jan-2010	Apr-2022	122	10
32	Sri Lanka	Nov-2007	Dec-2019	122	10
33	Chile	Jan-2000	Dec-2011	120	10
34	Ghana	Jan-2011	Dec-2021	116	10
35	Belarus	Sep-2010	Jan-2022	113	9
36	Nigeria	Jan-2014	Dec-2023	106	9
37	Hungary	Jan-2000	Dec-2013	97	8
38	Venezuela RB	Jan-2000	Jul-2014	97	8
39	Belize	Mar-2007	Dec-2019	93	8
40	Uruguay	May-2001	Dec-2011	93	8
41	Iraq	Dec-2015	Dec-2023	80	7
42	Thailand	Jan-2000	Mar-2006	75	6
43	Zambia	Oct-2012	Aug-2018	67	6
44	Lithuania	Jan-2010	Dec-2011	24	2

Note: Countries may have excluded observations within start/end dates (2008-09, 2020, spreads>1,000).

Table A4: Variable definitions and sources

Name	Description	Frequency	Source
Sovereign Spread	J.P. Morgan EMBI Global Diversified Index, average of daily values, in bps	Monthly	Bloomberg
Income Classification	World Bank Analytical Classifications. We only considered "LM" and "UM" income country-years	Yearly	World Bank, *World Development Indicators (WDI)*
Risk Aversion	ICE BofA US High Yield Index, average of daily values, in bps	Monthly	Federal Reserve Bank of St. Louis
Credit Rating	Sovereign Rating, long term debt, end of period, foreign currency. We built an index starting in 1 at "Not Rated (NR)" up to the top in 29 at "AAA"	Monthly	Standard & Poor's
International Rate	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, average of daily values, in bps	Monthly	Federal Reserve Bank of St. Louis
Terms of Trade	UNCTAD Net barter terms of trade index	Yearly	World Bank, *World Development Indicators (WDI)*
GDP	GDP, current US dollars	Yearly	World Bank, *World Development Indicators (WDI)*
Reserves Stock	Total international reserves	Monthly	IMF, *International Financial Statistics (IFS)*
Sovereign Debt Stock	Public and publicly guaranteed debt from private creditors	Yearly	World Bank, *International Debt Statistics (IDS)*
Private Debt Stock	External debt stocks, private nonguaranteed	Yearly	World Bank, *International Debt Statistics (IDS)*
Change in Reserves	Change in reserve assets	Quarterly	IMF, *International Finance Statistics (IFS)*
Treasury Issuances	Net incurrence of liabilities – Net acquisition of assets (Debt securities by Government + Other Debt by Government) – IMF Lending	Quarterly	IMF, *International Finance Statistics (IFS)*
Central Bank Issuances	Same calculation as in Treasury Issuance but applied to Central Bank (without subtracting IMF).	Quarterly	IMF, *International Finance Statistics (IFS)*
IMF Lending	Net lending flows (Disbursements - Repayments) from GRA, PRGT and RST programs	Monthly	IMF, *Financial Data Query Tool*
Private Flows	Change in Reserves – Treasury Issuance – Central Bank Issuance – IMF Lending	Quarterly	IMF, *International Finance Statistics (IFS)*

Note: The Frequency column refers to the original frequency data obtained through different queries. All variables were subsequently transformed into monthly frequency as explained in footnote 16.

Table A5: Accountability of reserve accumulation.
Central Bank balance-sheet vs. Balance of Payments classification methods

Sample	CB balance-sheet method		BoP method	
	C. Bank Flows	LAW	Public Flows	LAW
Baseline	−1.829	−2.699***	−1.869*	−3.036***
	(1.941)	(0.706)	(0.972)	(0.836)
Post-GFC	−0.925	−2.100**	−1.224	−2.522**
	(1.781)	(0.792)	(0.782)	(0.965)
Negative TB	−1.304	−2.814***	−1.897**	−3.378***
	(2.769)	(0.784)	(0.886)	(1.150)

Note: Robust standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. "Negative TB" refers to the negative trade-balance subsample specifications.
Note 2: "LAW" from the CB balance-sheet method is a synthetic measure of sterilized reserve accumulation as in Sosa-Padilla & Sturzenegger (2023), which could be the counterpart of foreign-currency public debt issuance.
Note 3: "LAW" from the BoP method from this table is strictly equivalent to "Private Flows" from column (3) in Tables 5, 6 and 7.

Table A6: Quarterly panel: Baseline regressions

Specifications: Baseline (2000-2023, excluding 2008-2009)					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.721***	0.706***	0.703***	0.704***	0.702***
	(0.059)	(0.059)	(0.059)	(0.058)	(0.059)
Credit Rating	-1.387***	-1.418***	-1.424***	-1.430***	-1.444***
	(0.169)	(0.166)	(0.166)	(0.169)	(0.162)
International Rate	-0.076	-0.076	-0.072	-0.071	-0.065
	(0.056)	(0.056)	(0.057)	(0.056)	(0.057)
Terms of Trade	0.185	0.211	0.223	0.228	0.240
	(0.159)	(0.156)	(0.154)	(0.154)	(0.155)
Reserves Stock	-1.157**	-1.015*	-1.018*	-1.016*	-0.987*
	(0.520)	(0.532)	(0.534)	(0.532)	(0.529)
Sovereign Debt Stock	1.344***	1.356***	1.339***	1.352***	1.366***
	(0.434)	(0.426)	(0.431)	(0.429)	(0.420)
Private Debt Stock	0.546	0.566	0.566	0.569	0.570
	(0.422)	(0.408)	(0.409)	(0.408)	(0.404)
Change in Reserves$_{t-1}$		-2.676***			
		(0.657)			
Public Flows$_{t-1}$			-1.911**		-1.886*
			(0.922)		(0.953)
Private Flows$_{t-1}$			-3.052***	-3.063***	
			(0.849)	(0.848)	
Public Flows, exc. IMF$_{t-1}$				-1.785*	
				(0.909)	
IMF Lending$_{t-1}$				-6.014	
				(5.263)	
Private Flows, Current$_{t-1}$					-4.120***
					(1.162)
Private Flows, Financial$_{t-1}$					-2.644***
					(0.788)
Num. Obs.	2,248	2,204	2,204	2,204	2,204
R2 Adj.	0.809	0.815	0.815	0.815	0.816
R2 Within Adj.	0.575	0.582	0.582	0.582	0.584
RMSE	0.28	0.27	0.27	0.27	0.27
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Note 2: Spread, Risk Aversion, International Rate and Reserves Stocks are computed as the average of monthly values; Credit Rating is taken as the median (to account for discrete changes); variables requiring interpolation (GDP, Sovereign Debt Stock, Private Debt Stock, and Terms of Trade) are spline-interpolated to a quarterly frequency; Balance of Payments variables are kept at their original quarterly frequency.

Table A7: Quarterly panel: Post-GFC regressions

Specifications: Post-GFC (2010-2023)					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.466***	0.457***	0.456***	0.457***	0.456***
	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)
Credit Rating	-1.122***	-1.162***	-1.172***	-1.172***	-1.186***
	(0.164)	(0.164)	(0.164)	(0.164)	(0.163)
International Rate	-0.090*	-0.089*	-0.087*	-0.087*	-0.081*
	(0.046)	(0.046)	(0.046)	(0.046)	(0.048)
Terms of Trade	-0.031	-0.006	0.032	0.033	0.072
	(0.176)	(0.174)	(0.166)	(0.166)	(0.172)
Reserves Stock	-1.304*	-1.171	-1.179*	-1.181*	-1.188*
	(0.689)	(0.700)	(0.689)	(0.689)	(0.696)
Sovereign Debt Stock	0.577	0.595	0.580	0.593	0.637
	(0.420)	(0.417)	(0.415)	(0.419)	(0.425)
Private Debt Stock	-0.162	-0.143	-0.135	-0.137	-0.109
	(0.359)	(0.351)	(0.349)	(0.350)	(0.340)
Change in Reserves$_{t-1}$		-2.087***			
		(0.741)			
Public Flows$_{t-1}$			-1.166		-1.039
			(0.764)		(0.785)
Private Flows$_{t-1}$			-2.624***	-2.588**	
			(0.956)	(0.967)	
Public Flows, exc. IMF$_{t-1}$				-1.068	
				(0.800)	
IMF Lending$_{t-1}$				-4.205	
				(5.432)	
Private Flows, Current$_{t-1}$					-3.756***
					(1.189)
Private Flows, Financial$_{t-1}$					-2.103**
					(0.904)
Num. Obs.	1,644	1,625	1,625	1,625	1,625
R2 Adj.	0.799	0.802	0.802	0.802	0.803
R2 Within Adj.	0.278	0.283	0.285	0.285	0.289
RMSE	0.25	0.25	0.25	0.25	0.25
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Note 2: Spread, Risk Aversion, International Rate and Reserves Stocks are computed as the average of monthly values; Credit Rating is taken as the median (to account for discrete changes); variables requiring interpolation (GDP, Sovereign Debt Stock, Private Debt Stock, and Terms of Trade) are spline-interpolated to a quarterly frequency; Balance of Payments variables are kept at their original quarterly frequency.

Table A8: Quarterly panel: Negative trade balance regressions

Specifications: Only cases with negative trade balance					
Dependent: *log*(spread)	(1)	(2)	(3)	(4)	(5)
Risk Aversion	0.653***	0.646***	0.643***	0.644***	0.644***
	(0.077)	(0.076)	(0.075)	(0.076)	(0.076)
Credit Rating	-1.302***	-1.319***	-1.322***	-1.326***	-1.353***
	(0.142)	(0.137)	(0.138)	(0.141)	(0.133)
International Rate	-0.023	-0.019	-0.016	-0.015	-0.012
	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Terms of Trade	0.266	0.254	0.259	0.260	0.254
	(0.253)	(0.252)	(0.252)	(0.251)	(0.251)
Reserves Stock	-1.504**	-1.314*	-1.307*	-1.297*	-1.235*
	(0.686)	(0.689)	(0.683)	(0.685)	(0.682)
Sovereign Debt Stock	1.619***	1.615***	1.600***	1.605***	1.656***
	(0.508)	(0.500)	(0.503)	(0.503)	(0.480)
Private Debt Stock	0.401	0.389	0.390	0.393	0.409
	(0.444)	(0.432)	(0.425)	(0.424)	(0.400)
Change in Reserves$_{t-1}$		-2.731***			
		(0.718)			
Public Flows$_{t-1}$			-1.899**		-1.842**
			(0.803)		(0.789)
Private Flows$_{t-1}$			-3.347***	-3.378***	
			(1.144)	(1.146)	
Public Flows, exc. IMF$_{t-1}$				-1.781**	
				(0.833)	
IMF Lending$_{t-1}$				-4.732	
				(4.274)	
Private Flows, Current$_{t-1}$					-5.547***
					(1.802)
Private Flows, Financial$_{t-1}$					-2.911***
					(1.069)
Num. Obs.	1,359	1,359	1,359	1,359	1,359
R2 Adj.	0.810	0.813	0.813	0.813	0.814
R2 Within Adj.	0.555	0.562	0.562	0.562	0.566
RMSE	0.27	0.27	0.27	0.27	0.27
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Note 2: Spread, Risk Aversion, International Rate and Reserves Stocks are computed as the average of monthly values; Credit Rating is taken as the median (to account for discrete changes); variables requiring interpolation (GDP, Sovereign Debt Stock, Private Debt Stock, and Terms of Trade) are spline-interpolated to a quarterly frequency; Balance of Payments variables are kept at their original quarterly frequency.

Table A9: Quarterly panel: Discrete regressions

Specifications: Baseline (2000–2023, excluding 2008–2009)					
Dependent: Spread>1000	(1)	(2)	(3)	(4)	(5)
Risk Aversion	2.120**	2.090**	2.010**	1.970**	2.006**
	(0.852)	(0.832)	(0.843)	(0.850)	(0.845)
Credit Rating	-1.678***	-1.689***	-1.658***	-1.725***	-1.672***
	(0.608)	(0.608)	(0.603)	(0.608)	(0.619)
International Rate	-0.183	-0.127	-0.120	-0.166	-0.105
	(0.672)	(0.693)	(0.725)	(0.727)	(0.723)
Terms of Trade	2.423**	2.483**	2.457**	2.311**	2.469**
	(1.199)	(1.222)	(1.250)	(1.178)	(1.244)
Reserves Stock	-6.970	-5.574	-5.986	-6.700	-5.812
	(5.880)	(5.548)	(5.538)	(5.705)	(5.338)
Sovereign Debt Stock	7.367***	7.560***	7.118**	6.526**	7.280**
	(3.062)	(3.080)	(2.930)	(2.726)	(2.993)
Private Debt Stock	-0.892	-0.888	-0.875	-1.290	-1.013
	(2.148)	(2.160)	(2.339)	(2.370)	(2.534)
Spread $> 1000_{t-1}$	3.782***	3.770***	3.812***	3.840***	3.824***
	(0.373)	(0.376)	(0.379)	(0.394)	(0.394)
Change in Reserves$_{t-1}$		-15.104			
		(11.270)			
Public Flows$_{t-1}$			-0.401		-1.156
			(13.810)		(12.797)
Private Flows$_{t-1}$			-21.624	-18.314	
			(13.549)	(11.877)	
Public Flows, exc. IMF$_{t-1}$				-9.236	
				(15.525)	
IMF Lending$_{t-1}$				97.636***	
				(26.676)	
Private Flows, Current$_{t-1}$					-24.612**
					(12.434)
Private Flows, Financial$_{t-1}$					-19.720
					(17.672)
Num. Obs.	1,020	1,020	1,020	1,020	1,020
R2 Adj.	0.575	0.574	0.575	0.579	0.573
R2 Within Adj.	0.540	0.540	0.541	0.545	0.538
RMSE	0.23	0.23	0.23	0.23	0.23
Std. Errors	by: country & date				
FE: country	X	X	X	X	X

Note: Robust std. errors in parentheses. FE denotes fixed effects. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.
Note 2: Risk Aversion, International Rate and Reserves Stocks are computed as the average of monthly values; Credit Rating is taken as the median (to account for discrete changes); variables requiring interpolation (GDP, Sovereign Debt Stock, Private Debt Stock, and Terms of Trade) are spline-interpolated to a quarterly frequency; Balance of Payments variables are kept at their original quarterly frequency.

Figure A1: Expanded BoP contributions to the change in reserves (in % of GDP)

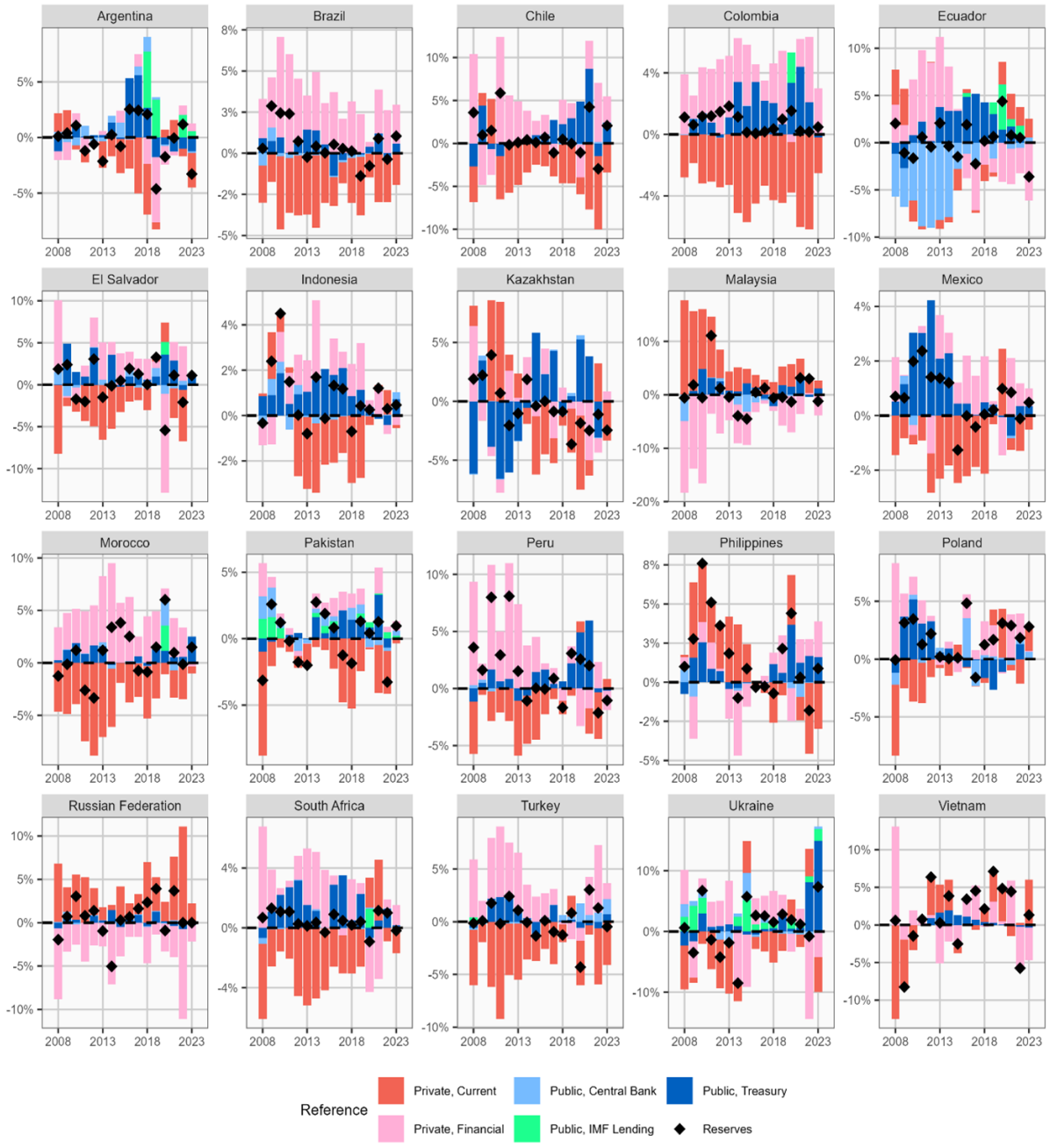

Figure A2: Relative weight of private and public flows in reserve dynamics

Note: Since values can be positive/negative, weights are calculated as proportions of absolute values.