

# FX Reserves in an Era of Deglobalization

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*The past decade of deglobalization is characterized by a decline in official reserve assets relative to GDP. Using new IMF data that allow disaggregating reserves, we analyze how reserve holdings have changed over time. We interpret these disaggregated elements from the perspective of a policymaker ready to defend the domestic currency in case of deglobalization tensions. We find that reserve holding patterns have changed over time and indicate an increased readiness for FX interventions, such as holding relatively more currencies in liquid forms. This pattern can be observed in particular among emerging countries but not for advanced economies. We then calculate a proxy for intervention readiness and assess its value in predicting foreign exchange interventions. Overall, our results highlight that taking a more nuanced view of reserve holdings can help to better understand how interventionist economies are with respect to foreign exchange markets.*

*JEL: F31 (foreign exchange), F33 (international monetary arrangements), E58 (central banks and their policies)*

*Keywords: Foreign exchange intervention, Vulnerability, Emerging and developing economies*

## I. Introduction

For decades trade flows were growing faster than GDP, thus providing a clear indicator of globalization of the world economy. What seemed to be a law of modern times has been disrupted recently, fueling a debate about potential deglobalization (see for instance O’Rourke (2018)). The development of world trade during the last 60 years is shown in Figure 1 by dashed lines. Absolute trade values increased quite continuously (Panel a), the relative share of world trade to world GDP went up from less than 25 percent to more than 75 percent for the world (Panel b) and similarly for the typical country (Panel c). However, this increase has stopped during the last decade.

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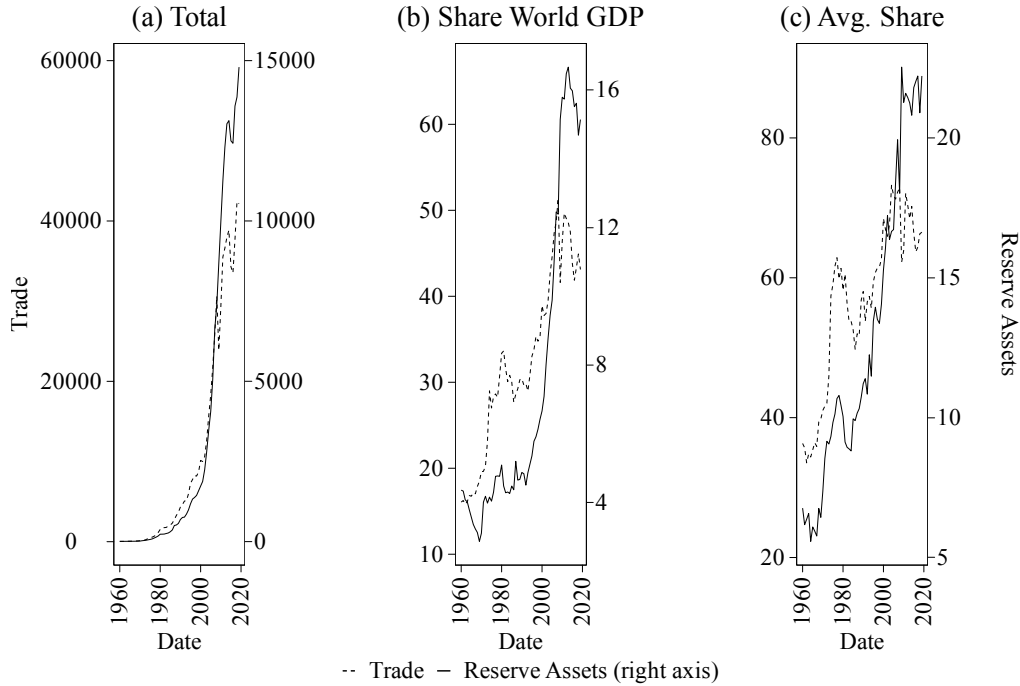
In an apparent parallel to trade flows, official reserve assets have shown a similar increase over the last decades. However, this increase has also stopped in the last decade, in absolute terms and relative to GDP. This is shown in Figure 1 by the solid lines. This parallel development of trade and official reserves may indicate that reserves are a complement to trade; if trade is relatively decreasing, reserves become less useful. Accordingly, countries are less interested in building reserves. However, the seeming relationship between globalization and reserve holdings varies in line with crisis-related precautionary motives. In 1995 to 2008 reserves grew faster than trade because many countries aimed to shield their domestic economies against international crises. Also, deglobalization is characterized by crises, such as trade-related tensions or even trade wars. This has implications on exchange rates and the desire to defend them with the help of tools such as foreign exchange interventions (FXI). Therefore, we ask whether there has been any change in the management of FX reserves during the last 20 years, i.e., in the period directly before and during deglobalization. In particular, we ask whether the readiness for FXI has changed under the surface of a slightly decreasing level of reserves during the last decade.

Thus, we complement the extant analysis of reserve volumes as a policy tool by focusing on the patterns of reserve holdings. Analyzing the potential change in official reserves for FXI – under the surface of largely constant reserve volumes – we assess reserves with their precautionary motive in mind (e.g., Aizenman and Lee (2007)). According to the precautionary purpose, reserves are seen as a policy tool to stabilize the domestic economy against potential external shocks. Therefore, reserves must be readily available for FXI and, thus, are preferably held in specific forms: (i) reserves will be rather held in the form of foreign currency; (ii) reserves will be rather held in liquid deposits than in securities; and (iii) reserves will be more often held at the main trading locations. We then test the validity of our hypotheses and observations by linking the reserve holding patterns to actual FX interventions. First, we check whether countries with more FXI are indeed more likely to hold more reserves. Second, we analyze this relation in more detail by considering a set of control variables.

To the best of our knowledge, this research is the first to systematically analyze the patterns of foreign currency reserves over two decades and across almost 90 countries. We make use of a dataset, the International Reserves and Foreign Currency Liquidity (IRFCL), published by the International Monetary Fund (Kester, 2013), that has recently much improved its coverage.

Our main new finding is the systematic change in patterns of reserve holdings. At the same time, the ratio of reserves to trade remains largely unaffected and the ratio to GDP seems to decline for the world average. Thus, the theme during the current decade of deglobalization is an increased readiness for FX interventions, indicating that respective authorities do not necessarily expect a smooth development of the world economy. This holds in particular for the group of emerging countries.

Figure 1 : Official reserve assets and trade



*Note:* This figure shows the yearly development of total official reserve assets and total trade (exports plus imports) over time. The left panel shows the worldwide sum of official reserve assets and world trade (exports plus imports) in billion 2012 USD. The middle panel shows these figures as share of world GDP. The right panel shows the average trade-to-GDP and Reserve Assets-to-GDP ratio for a world sample (178 economies) over time.

Source: International Financial Statistics (Official reserve asset data); World Bank Development Indicators Development Indicators (Deflator, GDP); Direction of Trade Statistics (Trade data)

Their decisions to change reserve holding patterns seem to indicate preparations for the use of FX interventions. As such, this evidence contributes to the impression of deglobalization and thus to a self-enforcing process.

**Literature.** Our research is related to three strands of literature. First, and most generally, we contribute to the debate about globalization or deglobalization. While the focus of this debate is about trade and international capital flows (James, 2018), we contribute by discussing the role of official reserve holdings.

Second, we address the literature about the motives for reserve holdings. The earlier literature has shown that mercantilist motives may play a role but that – at least since the late 1990s – precautionary motives dominate (Aizenman and Lee, 2007, 2008). Precautionary motives have been fueled by the sequence of financial crises, which were often linked to emerging countries and the volatile capital flows they are confronted with (Kaminsky, Reinhart and Végh, 2004; Aguiar and

Gopinath, 2007). While the view that reserve holdings are useful is widely shared (see also Bianchi, Hatchondo and Martinez (2018); Arce, Bengui and Bianchi (2019)), their optimal volume is subject to debate (Jeanne, 2007; Jeanne and Ranciere, 2011). Reserves tend to be costly, in particular, if they are intended for FX intervention and thus held in liquid assets. In this latter case, for most countries, reserves (which are preferably held in US-Dollar assets) are in effect like an inverse carry trade, i.e., the foregone interest rate income is larger than gains in exchange rate appreciation (Fratzscher et al., 2019; Adler and Mano, 2021). These costs call for a limitation of reserve volumes and may motivate to consciously restructure the patterns of reserve holdings. This is the focus of our research.

Finally, reserves provide to a large part just the means to enable FX interventions. It follows that theoretical justifications for FX interventions in this sense contemporaneously justify the holding of FX reserves. Examples of this new theoretical literature include Gabaix and Maggiori (2015), Cavallino (2019), Fanelli and Straub (2021), and Hassan, Mertens and Zhang (2021), who argue that FX interventions contribute to reducing market-driven volatility, which improves economic welfare. These theoretical motivations for FXI are complemented by recent empirical studies demonstrating FXI effectiveness. See, for example, multi-country studies by Daude, Yeyati and Nagengast (2016), Fratzscher et al. (2019), Adler et al. (2021), the meta-study by Arango-Lozano et al. (2020), and innovative studies on single countries (Chamon, Garcia and Souza, 2017; Kuersteiner, Phillips and Villamizar-Villegas, 2018) or few countries, respectively (Menkhoff, Rieth and Stöhr, 2020). Thus, the case for FXI seems to have become stronger over the last years, which is in line with our observation of a systematic change in patterns of reserve holding towards increased intervention readiness.

This paper is structured into four more sections. Section II contains the data description. The following Section III presents results about patterns of reserve holdings over time for various subgroups. The real-world test of these relations is provided in Section IV which analyzes the role of the found patterns for explaining FX interventions. Section V concludes.

## II. Data

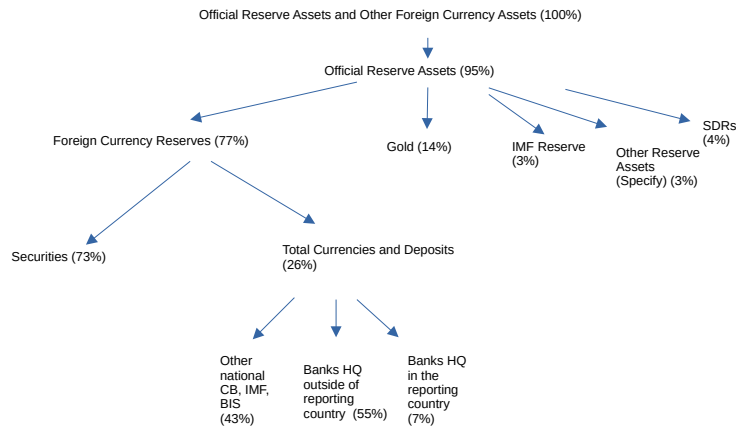
Our main data source is the International Reserves and Foreign Currency Liquidity (IRFCL) data template from the IMF. The IRFCL dataset became a prescribed element of the IMF's Special Data Dissemination Standard (SDDS) in June 1999. While the IRFCL started with a small number of reporting economies, it currently covers 87 economies that account for 93 percent of world GDP. In 2001 49 economies covering 80% of world GDP joined and the remaining 38 countries (13 percent of world GDP) joined at later stages (see also Cady and Gonzalez-Garcia (2007) and appendix figure A1).

How representative are the IRFCL data of global official reserve assets? While aggregate data on official reserve assets have been part of the International Fi-

nancial Statistics (IFS) for a long time, detailed data from the IRFCL has only been recently made available (see Figure A2 for a graphical comparison). Even when restricting the IFRCL to the 49 economies that were part of the IFRCL right from the start, the 49 economies clearly follow aggregate trends of the 188 economies covered by the IFS data. The main difference seems to be China, which only joined the IFRCL in 2015. For the remainder of this paper we work with all 87 economies whenever possible.

What are the prevalent assets to store official reserve assets? Figure 2 shows an outline of the IRFCL dataset structure and the distribution of official reserve asset holdings across different types of assets. More than 90% of the official reserve assets are held in foreign currency reserves (77%) or gold (14%). Foreign currency reserves can then be further dissected into securities (73%) and total currencies and deposits, in short deposits, in short deposits (26%). Basically, all securities are held outside of the respective reporting country. Deposits are primarily held at banks that are headquartered outside of the respective reporting country (55%). Roughly 43% of total currencies and deposits are held at other national central banks, the IMF, or the BIS.

Figure 2 : IFRCL Table 1



*Note:* This figure shows the organization of the IRFCL data with average values over the 2001-2020 for each type of asset holdings. 5 percent of "Official Reserve Assets and Other Foreign Currency Assets" are also held in "Other Foreign Currency Assets". The "Other Reserve Assets (Specify)" category is composed of three additional subcategories. (i) Financial Derivates, (ii) Loans to Non-bank Non residents, (iii) Other.

Table 1 shows additional summary statistics for our main sample. Overall, we

have monthly data on an unbalanced sample of 87 economies from 2001-2020. On average, the 87 economies hold 90.3 billion US dollars (USD) in Official Reserve Assets and Other Foreign Currency Assets. There is large heterogeneity with a standard deviation of 248.6 billion USD. Most economies tend to hold higher amounts in securities compared to deposits.

Table 1: Summary Statistics

	N	Missing	Mean	SD	Min	Median	Max
Official Reserve Assets and Other Foreign Currency Assets	16,912	0	90.3	248.6	0	26.0	3,785.5
Official Reserve Assets	16,869	43	88.0	238.6	0	25.1	3,605.6
Foreign Currency Res. (FX Reserves)	16,868	44	75.2	229.3	0	18.6	3,531.5
FX Reserves: Securities	16,739	173	65.0	220.5	0	12.6	3,520
FX Reserves: Total Currency and Deposits	16,734	178	10.7	23.3	-2.3	2.9	215.0
FX Reserves: Total Currency and Deposits with Banks HQ Outside the Reporting Country	16,280	632	5.7	15.7	-2.5	1.1	199.4
FX Reserves: Total Currency and Deposits with Other National Central Banks, BIS and IMF	16,747	165	4.7	14.9	-1.8	0.6	206.9
FX Reserves: Total Currency and Deposits with Banks HQ in the Reporting Country	6,411	10,501	1.5	6.0	-0.0	0.0	84.9

Note: This table shows summary statistics of the main variables of interest. All figures are in billion 2012 USD.

### III. Patterns of foreign currency holdings

This section describes results about the relationship between patterns of reserve holdings and the readiness for FXI. We discuss results for the aggregate sample of 87 economies and further dissect our sample into advanced and emerging economies (Section III.A). We also show the patterns for the main exchange rate regimes over time (Section III.B).

#### A. Patterns of foreign currency holdings and intervention readiness

We analyze the patterns of foreign currency holdings in three directions, i.e., the share of FX reserves, the structure of FX reserves, and the locations of reserves. We provide two kinds of information for each direction: the left panels in the following figures show absolute volumes, while the right panels show ratios of volumes to GDP. Accordingly, the left panels may be dominated by larger countries, while the right panels are more informative for the typical country. For our discussion, the latter information is more relevant.

**Share of FX reserves.** The data section has described that FX reserves dominate official reserve holdings with an average share of 77 percent across all countries and over the available 20 year-period. However, there is considerable heterogeneity, being of interest. Looking at the total amounts of foreign currency holdings, i.e., the left Panel A in Figure 3, the development over the last 20 years is largely in line with expectations: overall, FX reserves grew and the increase was higher in emerging than in advanced economies.

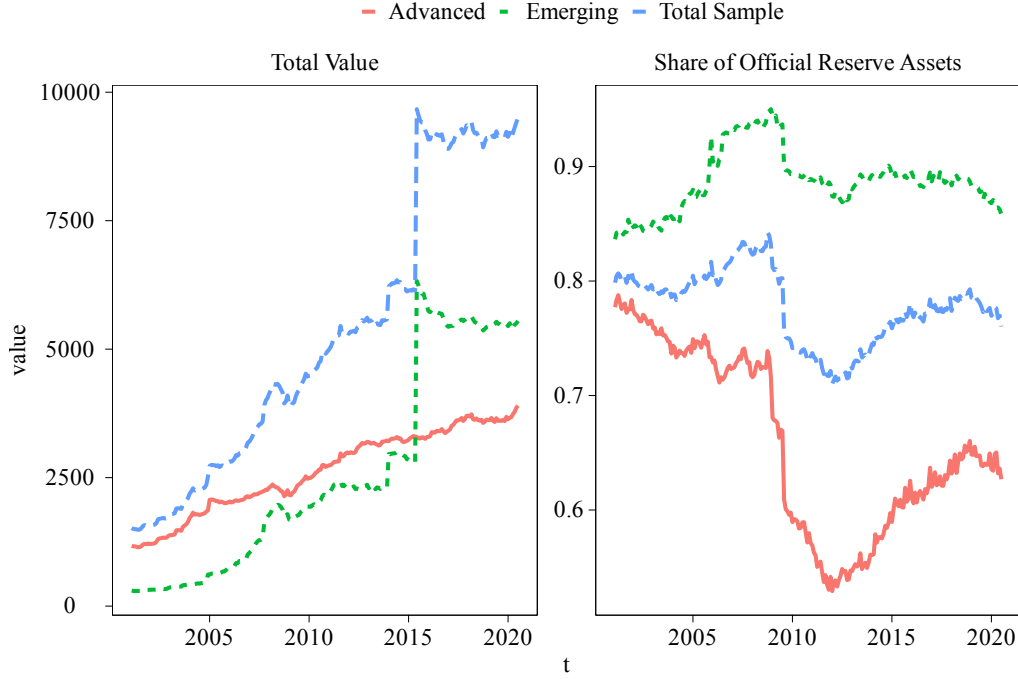
These clear trends become more variable if typical countries are considered. This perspective is shown in Panel (b) of Figure 3. The average share of foreign currency holdings to official reserve assets across all countries remains at about the same level through the two decades. Still, there is a remarked decline in 2008, which is mainly compensated over the subsequent years. However, country groups differ markedly by development level. Advanced economies decreased the share of FX holdings from 80 percent in 2000 to about 60 percent in 2020. By contrast, emerging economies keep their level regarding this share at about 90 percent. Thus, at the end of the sample period, the two country groups seem to prefer a different structure in their official reserve holdings.

**Structure of FX reserves.** According to the IMF classification, FX reserves are held either as securities or deposits (see Figure 2). Securities clearly dominate holdings, as Figure 4, Panel (a) shows. This dominance of securities holds for advanced and emerging economies (see Panels (c) and (e)). Their major advantage is that they promise higher returns. Their disadvantages are potential fluctuations in value and a lower degree of liquidity. These pros and cons make deposits relatively more attractive than securities if they are expected to be used in the shorter term.

As shown in the panels on the right side of Figure 4, the structure of FX reserves to GDP provides two further lessons, which are difficult to spot in absolute values. First, the relative importance of deposits has increased over time. This can be seen in Panel (b), where we use equal weights for countries (by contrast, larger countries dominate the information in Panel (a)). Hence, the importance of deposits relative to securities has increased over the 20 years sample from about 15 percent to more than 25 percent. Second, this change is driven by emerging economies. Whereas deposits remain quite marginal in advanced economies, their level and relative importance have clearly increased in emerging economies.

**Location of reserves.** As third information about patterns of FX reserves holdings, we analyze the location at which reserves are held. The IMF statistic distinguishes three such locations, i.e., banks headquartered in the domestic country, banks headquartered abroad and, international financial institutions, such as other central banks, the IMF, or the BIS. Figure 5 reveals three developments regarding locations: first, reserve deposits are held to a small degree only at domestic banks, and this share has even declined over the sample period. Second,

Figure 3 : Foreign currency reserves over time



*Note:* This figure shows the monthly development of foreign currency reserves over time. The left panel shows the sum of foreign currency reserves across 87 advanced and emerging economies in billion 2012 USD. The 2015 jump in the series is the effect of China joining the IMF's Special Data Dissemination Standard (SDDS). The right panel shows foreign currency reserves as share of official reserve assets. Source: IFRCL (Official reserve asset data), World Bank Development Indicators (Deflator)

the volumes and the share of deposits held at international financial institutions dominate among the three locations. Regarding deposits at banks abroad, advanced economies have decreased this amount and particularly its share whereas emerging economies have quadrupled these volumes and clearly increased their share.

**Lessons learned.** The volumes of FX reserves and their GDP ratio have continued their secular increase over the last two decades. However, the behavior differs between advanced and emerging economies. The former change their patterns of holdings in a way indicating that indicates less interest in an active use of these reserves, particularly regarding FX interventions. Emerging economies, by contrast, keep or even increase their readiness to use FX reserves. First, despite a strong increase in official reserves, emerging economies keep the ratio of FX reserves to total reserves at the high level of 90 percent (while advanced economies show a lower absolute increase and a relative decline of FX reserves). Second, the relative importance of deposits has increased only for this group. Third,



emerging economies have increased the share of deposits held with banks abroad (in contrast to advanced economies). In sum, emerging economies seem to have increased their readiness to intervene in FX markets, while advanced economies have rather done the opposite. This divergence might also be partly reflected in the preferred exchange rate regimes, which we discuss next.

### *B. Patterns of foreign currency holdings in exchange rate regimes*

Regarding exchange rate regimes, we consider the coarse grid classification by Ilzetzi, Reinhart and Rogoff (2019), which has five categories. As the so-called “freely falling” countries are in crisis and, thus, represent rather irregular cases which we neglect here, there remain the four categories of “peg”, “crawling peg”, “managed floating”, and “floating”. Out of the 87 economies, there are 37 economies with pegged exchange rate regimes. 31 economies with de-facto crawling peg regimes, 28 economies follow a managed floating foreign exchange rate regime, and 7 economies fall into the freely floating category. Note that economies can change their given regime over time. This is the case for a number of countries such as Argentina, Brazil, Belarus, Canada, or Russia.

We show how the above-discussed foreign currency reserve holding patterns differ for these four major forms of exchange rate regimes. Theoretically, we would expect that the necessities of regimes are reflected in the patterns of reserve holdings. In general, a floating regime has few requirements regarding the volume and structure of reserves. Thus, we expect floating regimes to form an extreme case. The other extreme may be a managed float because here the central banks operate in largely liberalized markets and, thus, need the power to move prices and expectations. Economies following a crawling peg regime are expected to show similar results as the managed float. At the same time, peg-regimes do not necessarily rely on reserves to a very high degree, so that they may look more similar to the floating regimes.

Results start with Panel (a) of Figure 6, which plots the share of official reserve assets to GDP for each regime over time. Clearly, and in line with expectations, the float and the managed float form the extreme cases, while the two peg regimes are in between. Economies using a floating or crawling peg exchange rate regime have largely increased their reserves relative to GDP compared to countries using the two other regimes. Panel (b) shows the share of FX reserves relative to all official reserve assets. Again, crawling pegs and managed floaters keep their high readiness through time, while free floaters largely stagnate and pegs even slightly decrease. Panel (c) refers to the ratio of deposits to FX reserves. Only countries with a crawling peg regime have increased this ratio over the last two decades. Finally, Panel (d) informs about the share of deposits held in banks with headquarters abroad. This has decreased, under fluctuations, for all four regimes considered.

Overall, and acknowledging a high degree of instability over time, Figure 6 shows that the form of foreign currency reserve holdings differs across exchange

rate regimes. Most important, the two regimes requiring a more active use of reserves are indeed characterized by elements of readiness: more reserves, a higher degree of FX reserves, and tentatively a larger share of FX reserves being held as deposits.

#### IV. Patterns of foreign currency holdings and FX interventions

In this section, we test whether the above-described relations indicating readiness for FXI are indeed related to FXI activity. First, we relate the indicators for intervention readiness to intervention activity (Section IV.A). In the subsequent section, we build a readiness indicator and test how it relates to intervention activity (Section IV.B).

##### A. Relations between reserve patterns and FX interventions

If the above discussed indicators of intervention readiness are meaningful, then they should be positively related to intervention activity. As measure of intervention activity, we use the recent dataset of Adler et al. (2021) which covers a large share of actual FXI. Although there are several other proxies for FXI activity, we deliberately chose data on actual FXI in order to minimize potential confounding factors. Matching the FXI indicator to our data yields an unbalanced sample of 35 advanced and emerging economies (see also Appendix tables A1 and A3 for an overview and descriptive statistics). Because we are primarily interested in FXI activity, we compute a binary indicator of FXI if any kind of FXI occurs.

Next, we take the share of months with FXI in the 12-month period up to the month of observation. We order countries according to this measure and group them into three buckets, i.e., countries with low, medium and high intervention activity. For each group we run analyses in parallel to those documented in Section III.B above. Thus, we hypothesize that FXI activity is related to (a) the share of reserve assets to GDP, (b) the share of foreign currency reserves to total reserves, (c) the share of deposit holdings to foreign currency reserves and (d) the share of deposits held at banks abroad relative to total deposits. Results are shown in Figure 7.

The results support all four hypotheses as – graphically speaking – the lines for countries with high FXI intensity lie above those of the others, almost all of the time. Regarding the development over time, the four indicators differ slightly in their dynamic. Both the ratio of reserves to GDP and the ratio of foreign currency to reserves do not increase much between 2000 and 2008. However, after the great financial crisis and thus during the period of deglobalization, both ratios increase up very clearly and roughly double. The ratio of deposits to foreign currency reserves follows the same pattern but even increases by a factor of three during the last 12 years. Merely the share of deposits held at banks abroad increases less dramatically over time.

### B. FX reserves, intervention readiness and FX interventions

Building on the insight gained above that there is a clear empirical relation between reserve holdings and FXI and that readiness indicators have the expected relation, we proceed in steps. First, we show correlations between the various readiness indicators. Second, we build a readiness composite measure being closely related to FXI, and we run regressions to test whether readiness is robustly related to FXI and what may influence this relation.

**Correlations.** While the graphical representation has indicated a tentatively positive relation between indicators of intervention readiness and FXI, we now calculate coefficients of correlation. Table 2 shows results. Several coefficients have the expected positive signs. In particular, three out of four indicators of readiness<sup>1</sup> are each positively correlated with FXI, two of the four coefficients being statistically significant. Moreover, most indicators are positively correlated with each other. However, among countries with large reserves, deposits seem to make up a smaller share of foreign currency reserves. This might indicate that countries with greater firing power in terms of reserves can keep relatively less of it at arm's length. The simple averages thus hide some of the heterogeneity with respect to intervention readiness. This motivates the next step, in which we create a condensed measure of FXI readiness that may be more robust to country heterogeneity.

**Readiness indicator.** To create an informative unidimensional measure of foreign exchange intervention readiness based on the systematic variation, we run a principal component analysis on the three single readiness indicators (official reserve assets to GDP, foreign exchange reserves as a share of official reserve assets, and currency deposits as a share of foreign exchange reserves). The first principal component captures 39 percent of the variance across the three indicators. It loads highly on all three indicators with correlation coefficients of -0.57, 0.57, and 0.58, respectively, and explains about 40 percent of the variation for each. This principal component captures the difference between countries that have large amounts of reserve assets but keep few of them in terms of foreign currency and few of the latter in the form of easy to use deposits and countries which keep their smaller reserves ready for potential use in interventions.

**Regressions.** The resulting readiness indicator is standard normalized, thus lending itself to interpreting the strength of relationships in per standard deviation. We estimate a logit model of the form

$$y_{it} = \alpha + \beta * readiness_{it} + \epsilon_{it}$$

where  $y_{it}$  is a binary index indicating the occurrence of a foreign exchange

<sup>1</sup>These four indicators are: Official reserve assets to GDP, Foreign Currency Reserves/Official Reserve Assets, Deposits/Foreign Currency Reserves, Deposits Abroad/Deposits.

(1)					
	FXI	PC (ORA, FX, CD)	ORA/GDP	For. Curr. Res./ORA	Depos./For. Curr. Res.
FXI real	1				
PC (ORA, FX, CD)	0.135***	1			
ORA/GDP	-0.0561***	-0.191***	1		
For. Curr. Res./ORA	0.216***	0.233***	0.267***	1	
Depos./For. Curr. Res.	0.203***	0.364***	-0.110***	-0.0602***	1

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 2: Correlation Matrix

*Notes:* This table shows correlation matrices between actual interventions, the readiness indicator (PC), and different types of asset holdings. Intervention data are based on Adler et al. (2021)

VARIABLES	(1) Total	(2) Peg	(3) Crawling peg	(4) Managed floating	(5) Freely floating
PC Readiness (ORA, FX, CD)	1.29*** (0.000)	1.30*** (0.000)	1.88*** (0.000)	1.11** (0.044)	1.60*** (0.000)
Observations	5,029	689	1,221	1,962	914

pval in parentheses  
\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 3: Odds ratios

*Notes:* This table shows odds ratios from logit regressions. Intervention data are based on Adler et al. (2021). Exchange rate regime classification is based on Ilzetzki, Reinhart and Rogoff (2019).

intervention based on actual foreign exchange interventions by Adler et al. (2021). Index  $i$  identifies the economy and  $t$  is time measured at monthly frequency.

Table 3 shows results of this exercise. The estimate for the total sample in column 1 suggests that a one standard deviation increase in the readiness index is associated with a 29 percent higher probability that a foreign exchange intervention occurs in a given month. The odds ratio can also be estimated separately by exchange rate regime, i.e.,

$$y_{irt} = \alpha_r + \beta_r * readiness_{irt} + \epsilon_{irt}$$

where  $r$  is the exchange rate regime. The resulting  $\beta$  coefficients should not be interpreted as just indicating which regimes intervene more often. This factor is accounted for by  $\alpha_r$ , which is an exchange rate specific constant. Instead,  $\beta_r$  indicates how predictive higher intervention readiness is within a given exchange rate regime. Table 3, columns (2)-(4) show that the best prediction occurs for crawling peg and freely float foreign exchange rate regimes, where the probability of a foreign exchange intervention in a given month is respectively 88 and 60 percent higher for every one standard deviation increase in our readiness indicator. Thus, the indicator is informative in each regime.

In the next step, we analyze differences in the strength of the relationship be-

tween our readiness indicator and actual interventions by regime. For this we estimate the above  $\beta$  separately by country, regime, and year. This yields 407 separate estimated coefficients. A substantial part of these are zero because in a given year there have been no interventions. Unsurprisingly, this is particularly frequent among free floating regimes, which by definition do not intervene very often. Focusing on the intensive dimension, i.e., explaining the size of the coefficient when it is different from zero, we then estimate the following regression:

$$\beta_{irt} = \alpha_r + \epsilon_{irt}$$

This shows that, in a given year, the readiness indicator is a particularly strong predictor of interventions in narrow bands and managed floating regimes. For these countries, changes in the readiness indicator thus most strongly indicate an increase in the probability of intervention at the monthly level.

**Advanced vs. Emerging Economies.** Next, we compare our readiness indicator across the advanced and emerging subsamples. Columns (1)-(2) in table 4 show that our readiness indicator does particularly well for emerging economies in predicting in which months interventions occur. For the 23 emerging economies in our sample, the probability of a foreign exchange intervention in a given month is 40 percent higher for every one standard deviation increase in our readiness indicator. Columns (2)-(3) add country fixed effects when estimating the odds ratios. Thus, we absorb all time-invariant country-level heterogeneity, such as a potentially higher likelihoods to intervene due to specific country or central bank characteristics. Comparing the emerging subsample to the advanced subsample, which contains 12 economies, shows that the readiness indicator is more predictive of monthly interventions for emerging economies.

VARIABLES	(1) Adv.	(2) EME	(3) Adv.	(4) EME	(5) Adv.	(6) EME
PC Readiness (ORA, FX, CD)	1.27*** (0.000)	1.40*** (0.000)	1.48*** (0.000)	1.67*** (0.000)	1.73*** (0.000)	1.39*** (0.000)
Observations	2,154	2,875	2,154	2,362	2,154	2,362
Year FE	No	No	No	No	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes
pval in parentheses *** p<0.01, ** p<0.05, * p<0.1						

Table 4: Odds ratios: Advanced vs. Emerging economies

*Notes:* This table shows odds ratios from logit regressions for the advanced and emerging subsample. Intervention data are based on Adler et al. (2021). Exchange rate regime classification is based on Ilzetzki, Reinhart and Rogoff (2019).

**Over time.** Finally, we compare the power of our readiness indicator over time. Table 5 shows odds ratios for specific years. Interestingly, we see that the readiness indicator predicts foreign exchange interventions differently over time. In particular, the readiness indicator seems to do very well in the beginning and the end of our sample. Specifically, after the 2008-2009 period, the probability of a foreign exchange intervention in a given month sharply increased for every one standard deviation increase in our readiness indicator. This strong increase in readiness to intervene indicates a clear pattern: Since the 2008 Great Financial Crisis (GFC), economies have shown an increased readiness for FX interventions.

**Outlook.** In future versions of the paper we plan to compare different time horizons and also analyze how these relationships change with certain country characteristics such as openness of the country to capital flows, foreign exchange volatility, or export dependence. Also, we will study at which time horizons changes in intervention readiness are most predictive. It is likely that adjustments such as moving a larger share of reserves into illiquid assets can predict decreased intervention activity over the following months.

## V. Conclusions

Using newly available disaggregated data from the IMF on a sample of 87 economies, we have analyzed and documented how patterns of reserve holdings have changed over time. In line with the literature, we argue that keeping foreign currency reserves in more liquid forms tends to be more costly. Thus, this behavior is likely to be more common among countries that either want to intervene or that expect shocks which force them to. We find that in particular emerging market economies show higher intervention readiness.

Based on indicators for higher and more liquid reserves, we then create a uni-dimensional intervention readiness index. This index correlates strongly with shifts in the intervention probability both between countries and within countries over time. Accounting for exchange rate regimes and fluctuations over time, we find that the readiness indicator is informative for both emerging and advanced economies.

Overall, our analysis highlights that during the current decade of deglobalization countries have increased their readiness for FX interventions. This may reflect two developments. First, central banks and governments do expect less smooth developments of the world economy and higher economic and non-economic tensions that may call for foreign exchange intervention to stabilize or otherwise defend the exchange rate. Second, central banks and governments might even have become more interventionist.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
PC Readiness (ORA, FX, CD)	2.18*** (0.000)	2.27*** (0.000)	1.94*** (0.002)	0.25*** (0.000)	0.33*** (0.000)	0.38*** (0.000)	0.94 (0.674)	0.92 (0.403)	1.27* (0.063)	1.62*** (0.000)	2.58*** (0.000)	7.04*** (0.000)	3.70*** (0.000)	2.57*** (0.000)	1.99*** (0.000)	1.38*** (0.021)	1.12 (0.285)	1.38*** (0.004)
Observations	180	180	198	205	210	228	257	286	300	315	300	295	324	336	336	343	360	376
Year FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Country FE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

pval in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 5: Odds ratios over time

*Notes:* This table shows odds ratios from logit regressions for different time period subsamples. Intervention data are based on Adler et al. (2021). Exchange rate regime classification is based on Ilzetzki, Reinhart and Rogoff (2019).

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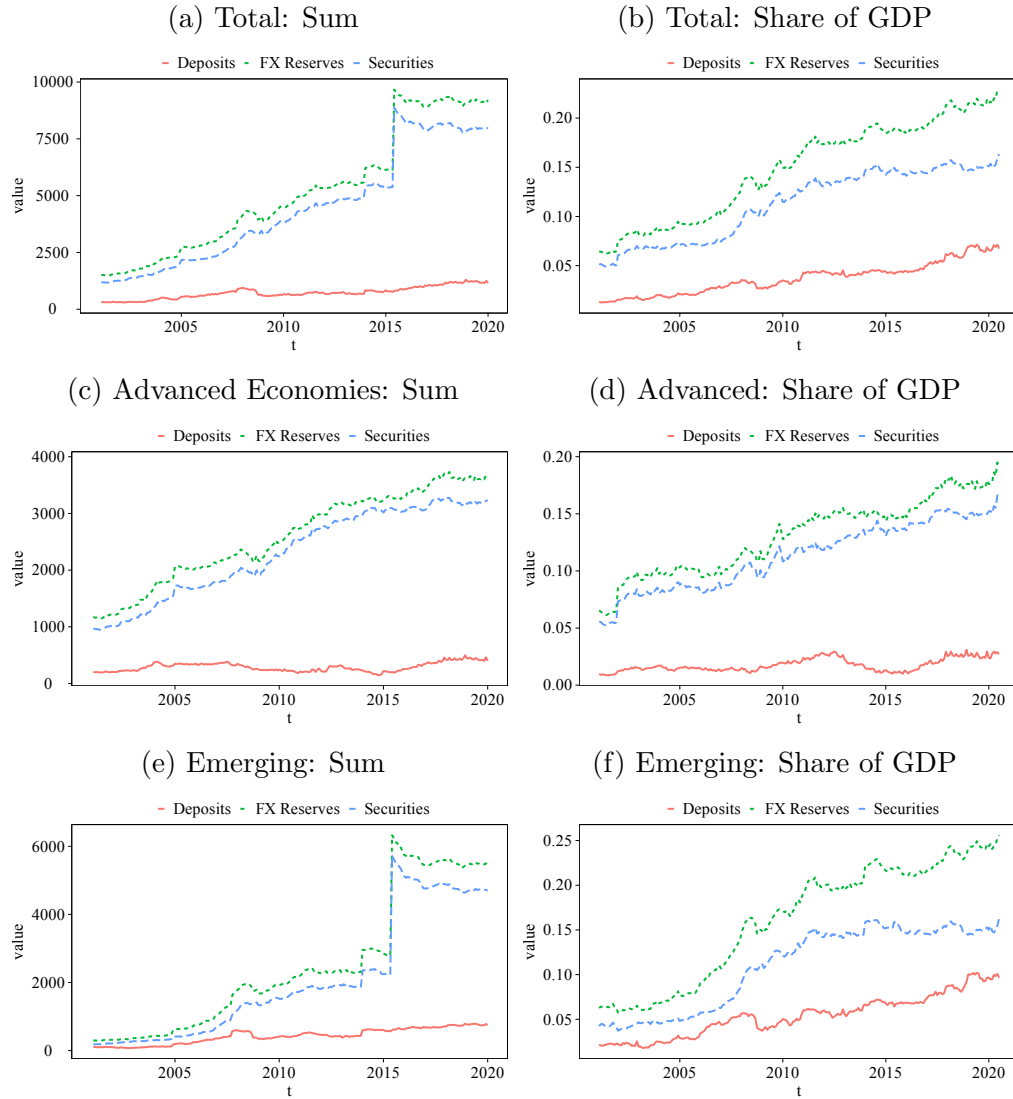
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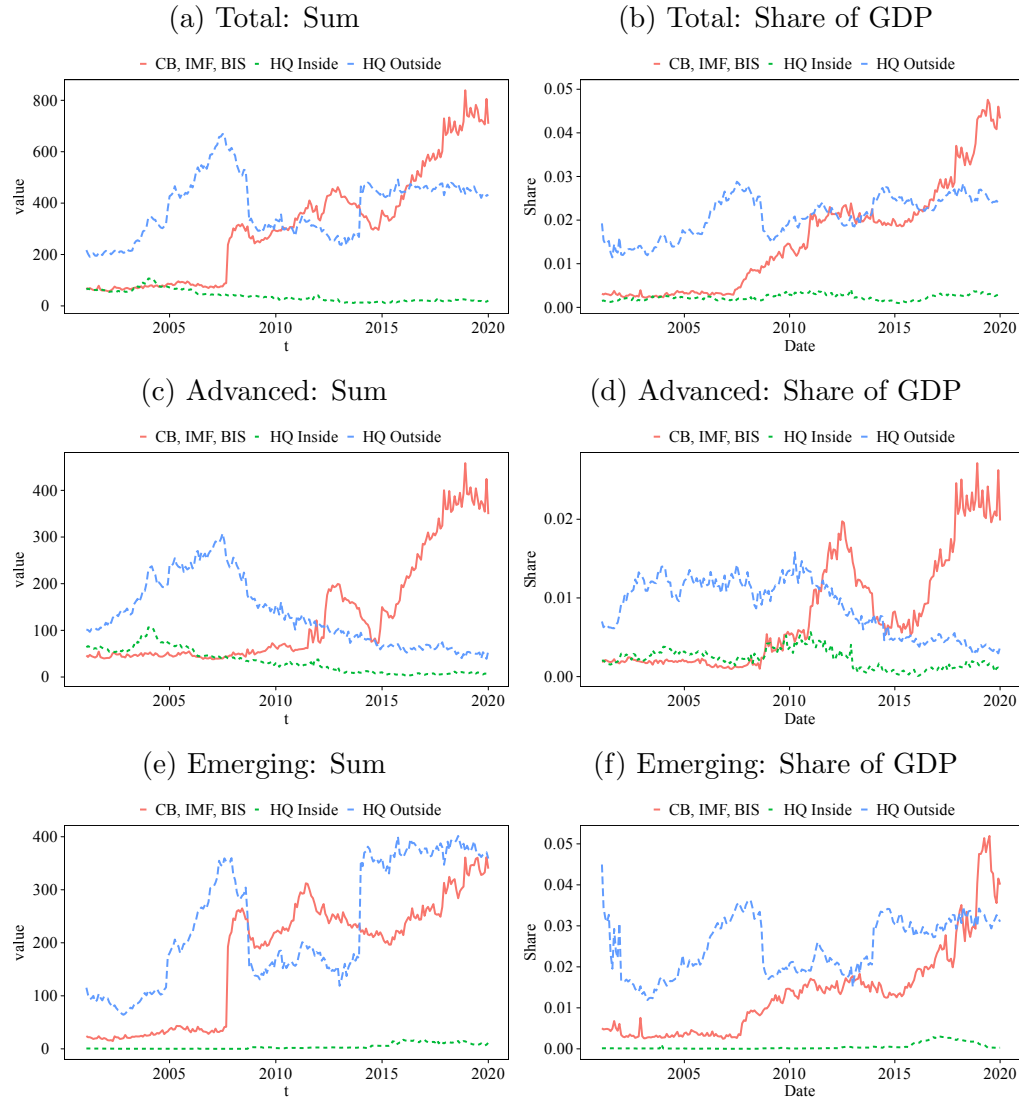
Figure 4 : Official reserve assets held in different asset types



*Note:* This figure shows the monthly total sum (in billion 2012 USD) and the mean share of GDP of these different asset types across a sample of 87 advanced and emerging economies. The 2015 jump in the series in the left panels is the effect of China joining the IMF's Special Data Dissemination Standard (SDDS).

Source: IFRCL (Official reserve asset data), World Bank Development Indicators (GDP)

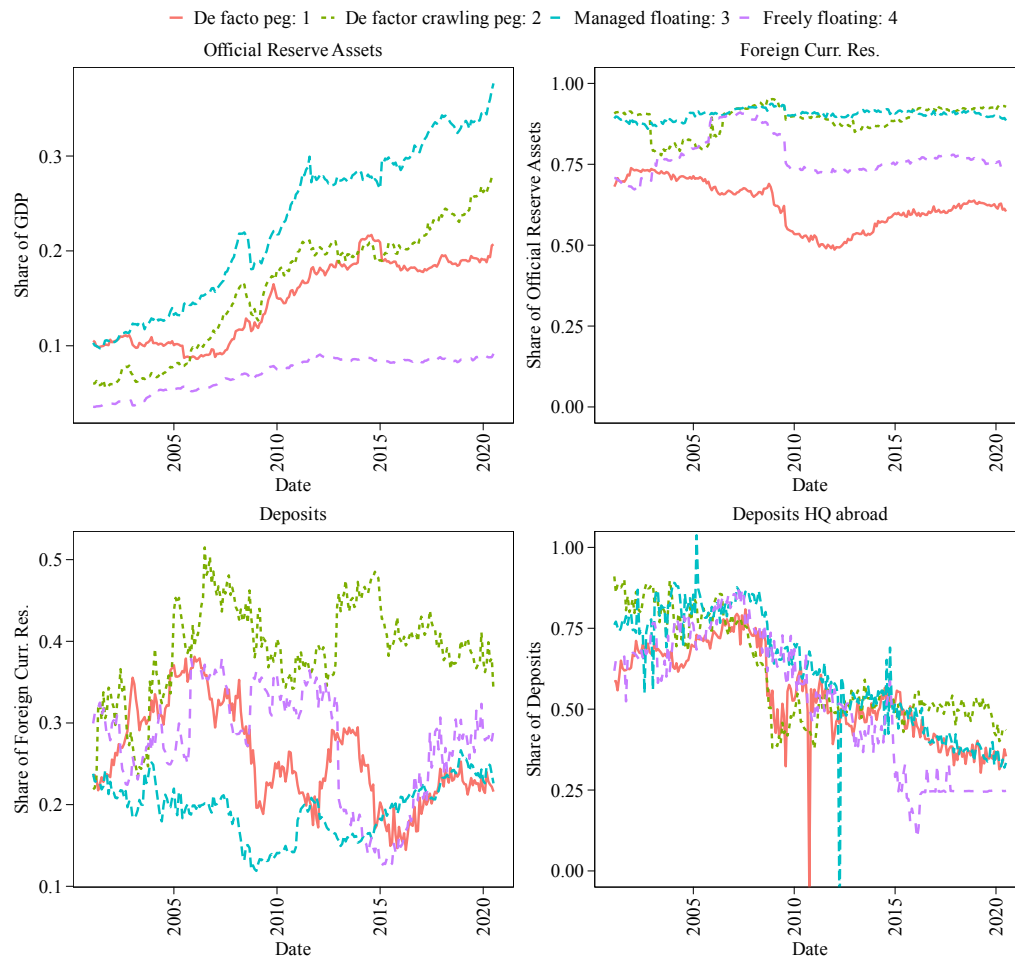
Figure 5 : Deposits held at different locations by country groups



*Note:* This figure shows total sum (in billion 2012 USD) and as monthly share of GDP across 87 economies. "HQ Inside" describes deposits held at banks headquartered in the Reporting Country; "HQ Outside" describes deposits held at banks headquartered abroad; "CB, IMF, BIS" describes deposits held at Other National Central Banks, the BIS and the IMF. The 2015 jump in the series is the effect of China joining the IMF's Special Data Dissemination Standard (SDDS).

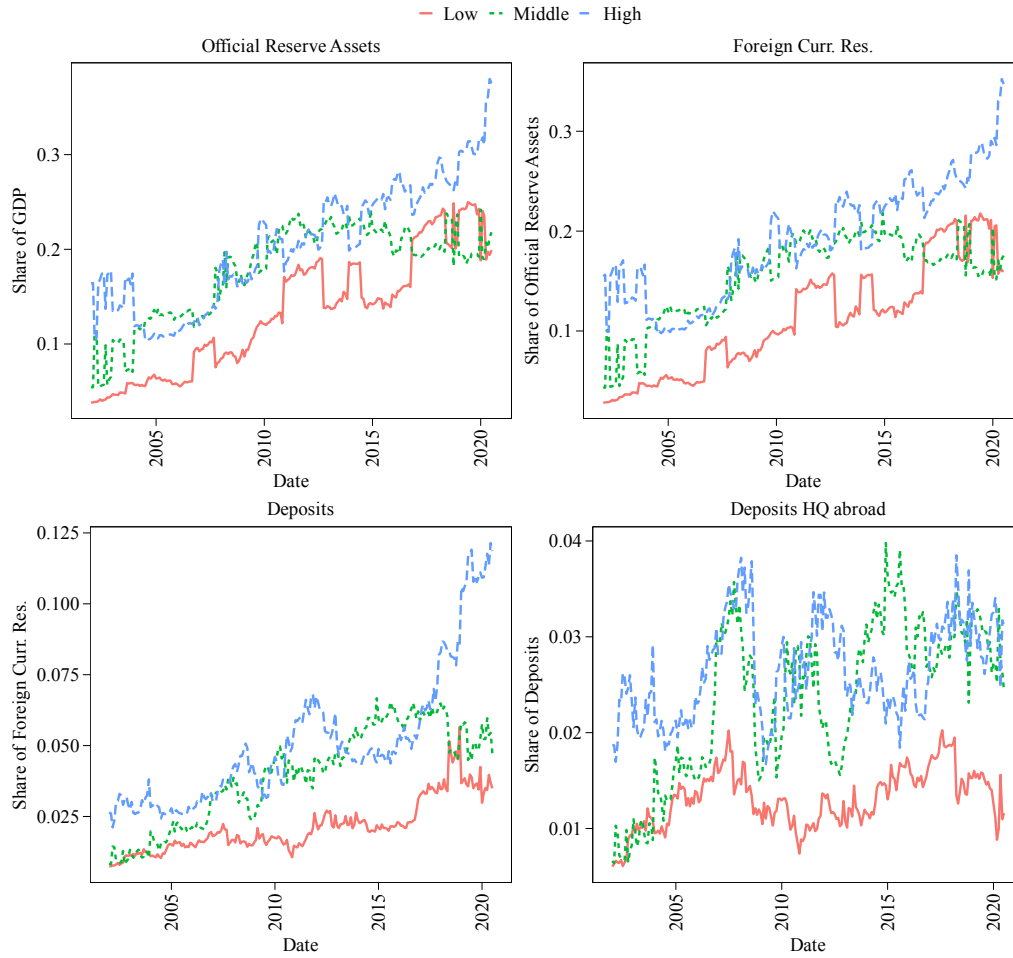
Source: IFRCL (Official reserve asset data), World Bank Development Indicators (GDP)

Figure 6 : Reserve asset shares by type of exchange rate arrangement



*Note:* Exchange rate regime classification is based on Ilzetzi, Reinhart and Rogoff (2019). Source: Own calculations; World Bank Development Indicators (GDP)

Figure 7 : Type of holdings by frequency of interventions



*Note:* This figure shows different shares of foreign asset composition for low, middle, and high interventionist economies. Based on 11-month moving averages of the monthly occurrence of a FX intervention, we classify economies into three groups. Group 1 designates economies at the lower third of the frequency distribution of monthly FX interventions. Group 2 designates the next third of economies. Group three designates the last third of economies.

Sources: own calculations, IRFCL, World Bank Development Indicators (GDP), Intervention Data (Adler et al., 2021)



## APPENDIX

Table A1: List of Countries

Country Name	Joined	Official Res. (2019)	Assets	Share of GDP (2019)	FXI Data
Albania	2014	3.4		24	Yes
Argentina	2000	60		113	Yes
Armenia	2003	1.8		14.6	No
Australia	2000	40		3	Yes
Austria	2000	21.5		5.4	No
Belarus	2004	6.3		23.3	No
Belgium	2000	24.5		5	No
Bolivia	2015	7.8		29.1	Yes
Brazil	2000	338.3		21.7	Yes
Bulgaria	2003	25.2		47.5	No
Canada	2000	78.9		4.5	Yes
Chile	2000	34.9		15.9	No
China	2015	2859.7		28.4	No
Colombia	2000	43.7		14.2	Yes
Costa Rica	2009	6.8		16.8	Yes
Croatia	2000	18.9		29.8	Yes
Cyprus	2010	0.9		3	No
Czechia	2000	129.3		57.2	Yes
Denmark	1999	63.5		17.4	Yes
Dominican Republic	2012	6.3		9.3	No
Ecuador	2018	2.8		3.4	No
Egypt	2009	37.6		29.8	No
El Salvador	1999	3.3		15.4	No
Estonia	2000	0.7		3.1	No
European Central Bank	1999	68.1		0.5	Yes
Finland	2000	9.3		3.8	No
France	2000	153		5.4	No
Georgia	2007	3.1		22.5	Yes
Germany	1999	182.2		5.2	No
Greece	2003	6.8		2.5	No
Guatemala	2008	11.2		23.1	No
Honduras	2010	4.2		25.8	No
Hong Kong SAR China	2000	387.8		164	Yes
Hungary	2000	27.4		20.3	No
Iceland	2000	5.7		37.6	Yes
India	2007	359.2		15.8	Yes
Indonesia	2000	107.8		11.6	No
Ireland	2001	4.7		1.3	No
Israel	2001	106		37	Yes
Italy	2000	139.9		6.9	No
Jamaica	2013	3.2		34.6	Yes
Japan	2000	1148.1		19.3	Yes
Jordan	2006	12.9		46	No
Kazakhstan	2003	27.4		22.5	Yes
Kyrgyzstan	2004	1.9		34.7	No

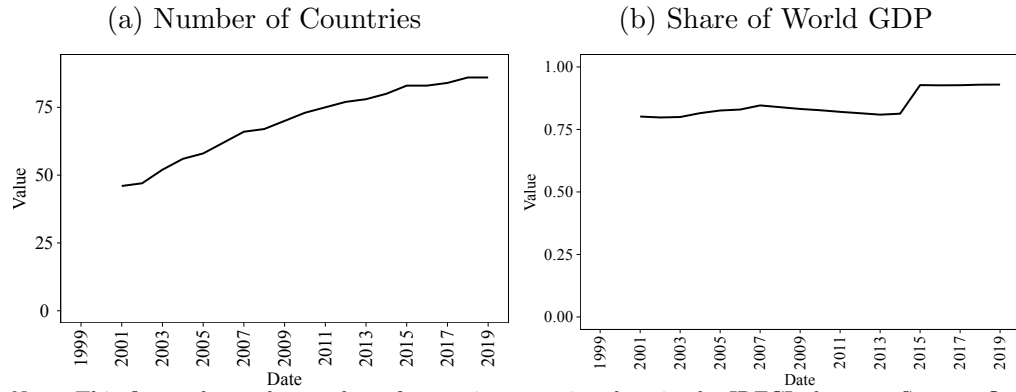


Table A2: List of Countries (continued)

Country Name	Joined	Official Res. Assets	Share of GDP (2019)	FXI Data
Latvia	2000	4	14.3	No
Lithuania	2004	4.1	9	No
Luxembourg	2006	0.8	1.4	No
Malaysia	2000	91.7	25.4	No
Malta	2009	0.9	7.4	No
Mauritius	2007	5.8	47.1	Yes
Mexico	2000	161.9	16.6	Yes
Moldova	2006	2.6	39.1	Yes
Mongolia	2017	3.3	34.9	No
Morocco	2005	21.8	18.8	Yes
Netherlands	2000	35.7	4.1	No
New Zealand	2000	18.3	11	Yes
Nicaragua	2010	2	24.3	Yes
North Macedonia	2011	3	30.4	No
Norway	2000	58.8	12.8	No
Palestinian Territories	2012	0.5	4.2	No
Paraguay	2018	6.9	22.4	Yes
Peru	2001	55.5	31	Yes
Philippines	2000	74	23.2	No
Poland	2000	102	16.8	No
Portugal	2000	23.9	10.6	No
Romania	2007	36.9	20.8	No
Russia	2004	427.1	36.8	Yes
Saudi Arabia	2014	439.7	58.6	No
Seychelles	2011	0.5	39.9	No
Singapore	2000	263.8	85.9	No
Slovakia	1999	5.1	4.7	No
Slovenia	2000	0.9	1.7	No
South Africa	2000	45.6	15.2	No
South Korea	2005	363.9	26.8	No
Spain	2000	64.2	4.3	No
Sri Lanka	2015	5.5	8.3	No
Sweden	2000	55.3	10.6	No
Switzerland	2000	714.5	103.1	No
Thailand	2000	188.4	46.3	No
Tunisia	2001	4.8	13.2	No
Turkey	2000	86.9	13.5	Yes
Ukraine	2002	18.7	41.4	Yes
United Kingdom	2000	178.3	6.9	Yes
United States	2000	113	0.7	Yes
Uruguay	2003	14.8	48.4	No

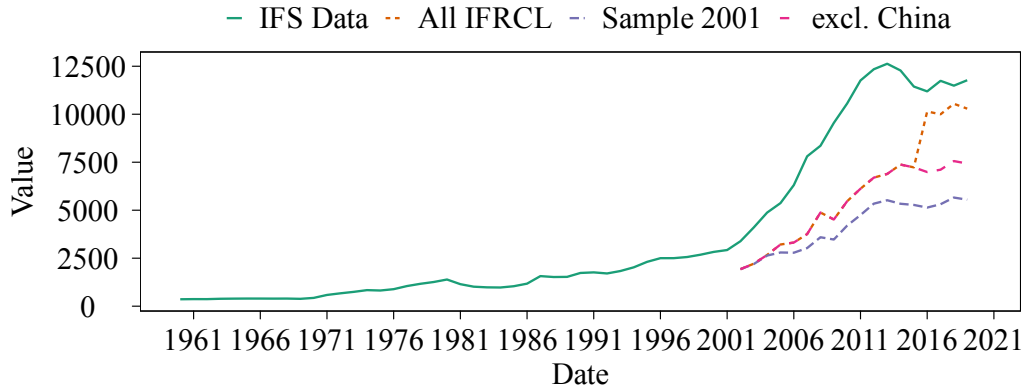
Note: This table shows a list of economies in the sample and the year they first joined the IMF's Special Data Dissemination Standard (SDDS). Figures for Official Reserve Assets are taken for January 2019. Share of GDP (2019) denotes the share of Official Reserve Assets to each economy's GDP in January 2019. All figures are in billion 2012 USD.

Figure A1 : Number of Countries in the IFRCL dataset



*Note:* This figure shows the number of countries reporting data in the IFRCL dataset. Source: Own calculations; World Bank Development Indicators (GDP)

Figure A2 : Sample Comparison Official Reserve Assets: IFS vs. IFRCL



*Note:*

This figure compares four different samples and plots the total amount of official reserve assets in billion 2012 USD. The IFS data comprise data on official reserve assets of 183 economies. The three other series show data on official reserve assets from the IFRCL dataset. 'All IFRCL' shows data from an unbalanced sample of 87 economies. The '2001 Sample' shows data from a balanced panel of 48 economies for which there is data available from 2001. The 'excl. China' shows data from an unbalanced panel of 86 economies excluding China from the IFRCL dataset.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
FXI	5,695	0.546	0.498	0	1
PC (ORA, FX, CD)	5,029	3.76e-10	1.085	-6.302	4.781
Exports/GDP, ln	5,070	-4.087	0.764	-6.667	-1.642
Imports/GDP, ln	5,070	-3.909	0.819	-7.184	-1.571
Exch. Rate Regime Dummy	5,424	2.564	0.983	1	4

Table A3: Descriptive Statistics

*Notes:* This table shows descriptive statistics for the main variables of interest. Intervention data are based on Adler et al. (2021). PC is the readiness indicator and shows common variation from a principal component analysis with eigenvalues larger than one composed of three variables: (i) Official Reserve Assets as share of GDP; (ii) Foreign Currency Reserves as share of Official Reserve Assets; Deposits as share of Foreign Currency reserves. Data on exports and imports come from the IMF's Direction of Trade Statistics. GDP data come from the World Bank's Development Indicators Database. Exchange rate regime dummies follow the coarse classification of Ilzetzki, Reinhart and Rogoff (2019) until 2016 and are then assumed to be constant.