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What do we know about the global financial safety net? Data, rationale and possible evolution

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What do we know about the global financial safety net?

Data, rationale, and possible evolution

February 29, 2016

Abstract

We critically review the theoretical basis for the provision of global financial safety nets (GFSN) and provide a comprehensive database covering four types (foreign exchange reserves, IMF financing, central bank swap lines, and Regional Financing Arrangements) for over 150 countries in the sample 1970-2015. We also show some key stylised facts associated with the provision of financing associated with GFSN and compare macroeconomic outcomes in sudden stop episodes depending on how much GFSN were available for countries, and used. We conclude with some speculations on the possible evolution of the GFSN.

Keywords: Global financial safety nets, financial integration, financial globalisation, IMF.

JEL: F32, F33, F34, G01, H87.

1 Introduction

The Global Financial Safety Net (GFSN) is widely considered to be an essential element of the international financial architecture and a necessary infrastructure to support financial integration and globalisation, much in the same way as the domestic lender of last resort function is now seen as essential for domestic financial systems. At the same time, the GFSN is still far from being a coherent construction and does not reflect a widely shared consensus at the international level. It is more the result of the accumulation and stratification of different forms of financial insurance, often influenced by domestic rather than global interests. Indeed, an adjective that often accompanies the description of the GFSN is “patchy”. There certainly is no benevolent social planner behind the current design, internalising all externalities.¹

An evaluation of the current design of the GFSN is often hampered by a lack of a coherent description of its elements and the absence of data availability. Against this backdrop, the purpose of this paper is fourfold. *First*, we provide a detailed description of the current configuration of the GFSN, including in particular its four main elements, (i) own foreign exchange reserves, (ii) IMF loan facilities, (iii) Regional Financing Arrangements (RFA) and (iv) central bank swap lines. As we argue at length in the paper, one important dividing line between different forms of insurance is whether there is conditionality attached or not. Broadly speaking, own reserves and central bank swap lines do not involve conditionality; IMF and RFA lending do. *Second*, we provide the reader with a concise yet comprehensive overview of the existing literature on the GFSN, including about its theoretical underpinnings, from where a lack of consensus on the optimal design of the GFSN is clearly visible and to some extent even unsettling. *Third*, and this is the most important contribution of the paper, we provide an annual database for over 150 countries, available online, of the existing access to the GFSN, together with a comprehensive list of variables that may be useful to understand financial integration and the role of the GFSN to support it. We believe that

¹ Reviewing international financial architecture, including the GFSN, is one of the objectives of the Chinese Presidency of the G20 this year.

any serious discussion on the GFSN should start from an understanding of the facts and solid empirical work, and we hope that our database will provide an impetus to this kind of analysis and to a more informed discussion at the policy level. *Fourth* and finally, we show the potential of our database by providing some key stylised facts about the availability of GFSN. We also provide evidence on the usefulness of the GFSN for individual countries, in particular when faced with capital flow reversals. In this analysis, we find mixed results as to the effect of (actual or potential) access to the GFSN for the severity of the effect of sudden stop episodes. While there is some evidence that a higher GFSN coverage cushions the impact of such episodes, the evidence is not very consistent and robust. Clearly, this is an area where further research is needed.

The paper is organised as follows. In Section 2 we outline the theoretical and practical arguments involved in the optimal provision of international safety nets. In Section 3 we briefly describe the four types of GFSN currently available and our database. Section 4 establishes some interesting stylised facts regarding the provision of GFSN and their effect on countries. Section 5 contains the conclusions and the policy implications, also with a view to the still many open questions ahead of us.

2 Global financial safety nets

2.1 The rationale for GFSN

Why safety nets? The main rationale for the existence of safety nets, in particular publicly provided ones, is the existence of negative externalities. Stiglitz and Orszag (2002) analysis of the optimal size of fire departments is a useful parable. In their model, fires can spread from home to home in the same way as crises may spread between different countries. Orszag and Stiglitz explain that the presence of externalities affects the optimal size of the fire department. A higher probability of fires jumping from one home to the next implies a higher optimal size, but above a certain threshold a further increase may be counterproductive, because it may discourage households

from investing in fire prevention (moral hazard). This moral hazard problem is larger if fire prevention effort is unobservable. Full insurance (a very large fire department) is optimal only for fires that arise for exogenous reasons and are not preventable with fire prevention effort. As in other domains of insurance, fire safety does not imply perfect insurance in equilibrium, because of the moral hazard created by not being able to observe prevention efforts.

Financial crises have a lot in common with fires in that they reflect both effort (good policies) and luck (exogenous shocks), that are difficult to disentangle. Moreover, contagion is a regular characteristic of crisis episodes. The presence of externalities makes private solutions inefficient, and a global social planner may want to internalise the external effects of crisis episodes. For that reason, a certain amount of provision of financial safety nets is *prima facie* sensible. Clearly, the parameters driving the desirability of GFSN are continuously evolving with financial innovation and integration, so it is difficult to make statements of general validity.

A primer on the domestic LOLR function. As pointed out by several previous contributions (Fischer 1999; Fernandez-Arias and Levy-Yeyati 2010), a useful starting point to discuss the role of global financial safety nets is the domestic lender of last resort (LOLR) function.² The doctrine behind the domestic LOLR function is built on the need to prevent costly deleveraging driven by runs on financial intermediaries and their short term debt liabilities.³ “Illiquid but solvent” institutions should receive LOLR funds in case of distress. If private interbank markets are not able to play that insurance role, which is plausible in real life circumstances, a public entity with “deep pockets” has to provide LOLR financing. Because central banks sit at the top of the hierarchy of money, they have been traditionally entrusted with the role of LOLR – indeed some of them, like the Federal Reserve, have been created precisely with that objective in mind. At the same time, being able

² Although the literature on the LOLR is generally underdeveloped, some good surveys are available, for example Grossman and Rockoff (2014).

³ Morris and Shin (2004) extend the same idea to lending relationships more generally. They assume that creditors of a distressed borrower face a coordination problem. Even if the fundamentals are sound, fear of premature foreclosure by others may lead to preemptive action, undermining the project.

to produce money at will is a desirable characteristic of a lender of last resort but not a knock-out criterion, as pointed out by Fischer (1999).

The provision of LOLR financing is fundamentally associated with the risk of moral hazard because it may lead to higher financial fragility and risk. In other words, from the standpoint of a shareholder of a financial intermediary the LOLR function may result in a higher return on equity conditional on taking on more risk; financial fragility loses its disciplinary role that it has in disciplining shareholders and managers.⁴ Central banks, therefore, should not abuse its power and thereby create unnecessary moral hazard. It is important to recognise that moral hazard is a problem without a perfect solution in real-world situations; the best that can be done is to manage the trade-off effectively (Fischer 1999).

An important part of the domestic LOLR doctrine is the Bagehot precept to “lend freely, against good collateral and at a penalty rate”. The requirement to have good collateral (though not as good as that accepted in normal operations or in the interbank market) not only protects the central bank balance sheet, but also prevents the build-up of further moral hazard. With regard to the latter, if it is difficult to distinguish illiquidity and insolvency in real time – as it is indeed almost always the case – it cannot be excluded that LOLR operations result in losses in the absence of collateral. Such losses represent gains for shareholders and managers of financial institutions in distress, creating moral hazard.⁵

The penalty rate is the least settled element of the Bagehot doctrine. Apart from the fact that it is not clear what Bagehot really meant by “penalty” (see Goodhart 1999), the effect of a penalty rate is ambiguous. On the one hand, a penalty might discourage moral hazard by reducing the net present value of LOLR loans for intermediaries in distress; on the other, it would lower the effectiveness of LOLR, which becomes particularly important if externalities are large. As a matter of fact, a penalty rate is not always applied in LOLR operations, in particular this was not generally the

⁴ Reference to Rajan and Zingales on optimal financial fragility

⁵ The requirement to protect their balance sheet was even more compelling when central banks were private institutions, such as the Bank of England in the times of Bagehot.

case during the global financial crisis.⁶

In practice, the provider of LOLR faces a difficult signal extraction problem, where it needs to decide whether a financial institution is in distress due to a “pure” run or due to its fundamental weakness. In Rochet and Vives (2004), for example, runs may be driven by both sunspots and fundamentals. While it is clearly a task for the LOLR authority to prevent deleveraging due to sunspots, runs that are due to fundamentals should in principle not be prevented at all unless they create too large negative externalities.

Ex ante predictability. One dimension of considerable practical importance in the provision of LOLR is the optimal degree of ex ante predictability. To be effective in preventing costly runs and provide beneficial insurance to the private sector (Holmstrom and Tirole 1998), the provision of LOLR should ideally be automatic and based on ex ante eligibility. At the same time, automaticity may worsen moral hazard and encourage intermediaries to game the system. If the LOLR provider could perfectly discriminate illiquidity (due to exogenous shocks) and insolvency (due to inadequate effort or policies) this point would be irrelevant, but if the extraction of the signal is imperfect or costly, it may be optimal not to ensure full automaticity. In fact, some authors have advocated constructive ambiguity (Freixas 1999). This however would give rise to other problems, such as time inconsistency. It is in fact usually optimal to provide LOLR funding ex post, once a crisis is underway, but not to commit ex ante, to avoid moral hazard; the resulting equilibrium may be unsustainable.

What is different in the international context? There are important similarities between the domestic and the international provision of LOLR. Domestic runs are typically determined by fragility of financial intermediaries and in particular by the presence of short term debt in the liabilities side of their balance sheets. It makes conceptually little difference if short term debt is foreign debt or if the debt is denominated in foreign currency; the fundamental rationale and trade-off of the LOLR authority is the same, i.e.

⁶ As in the international context, one important practical question is the seniority of LOLR claims vs. private sector claims and how it affects the optimal provision of LOLR. (see Kahn and Santos 2001).

preventing inefficient deleveraging while being mindful of moral hazard.

There are, however, two important practical differences for the provision of LOLR in the international context. First, if the short term debt is denominated in foreign currency, the central bank may not have the “deep pockets” required to provide LOLR loans effectively. In a sense, the run eventually becomes a run on the domestic central bank, which can only be prevented by an institution with deep pockets *in foreign currency*. Second, an international LOLR (public or private) has fewer means to influence the behaviour of borrowers and to exact adequate collateral, for the simple reason that foreign countries are sovereign.⁷ For example, one way to mitigate moral hazard in the domestic context is to regulate bank and to impose penalties on those who made mistakes, but this is typically not possible in the international context.

Moreover, a wide interpretation of a “run” in the international context comprises any sharp movement of foreign investors (or even domestic investors) out of domestic debt that implies downward pressure on the currency and cannot be adequately countered by the central bank using its foreign reserves. These may take the form of sudden stops, retrenchment, or capital flight (Forbes and Warnock 2012). In many cases the main concern, rather than being that of abrupt deleveraging as such, is a sharp and undesirable depreciation of the currency, possibly characterised by overshooting.⁸ Vulnerability to sudden stops is a function of countries’ financial openness. For that reason, capital controls generally reduce the need of international insurance (Cordella and Levy-Yeyati 2006) – indeed, a country in financial autarky should not need any international LOLR unless it is substantially dollarised.

It is useful here to draw a parallel again with the fire safety example.

⁷ Some see the senior creditor status of the IMF and the World Bank as a form of collateral, however; see Fischer (1999).

⁸ If preventing deleveraging was the only concern, it should in principle be always possible for the domestic central bank to prevent it, possibly by purchasing foreign currency in the forex market. See Blanchard et al. (2015) for a recent analysis why capital flow reversals are costly for countries. More generally, the aim is to prevent an overshooting (of the depreciation), but we still do not know much of why an overshooting would happen or why it would be undesirable from a welfare perspective.

Short term foreign debt is susceptible to run-like behaviour (fire), which is costly. Runs (fires) depend on both fundamentals on which countries have some control (and can expend some effort) and on sunspots (say, the neighbouring country experiences a financial crisis; the neighbouring house goes on fire). In principle fire safety (financial safety nets) should cater only for the second type of phenomena, but in reality they are difficult to tell apart. More externalities (more contagion or more spreading of fire) should lead to more safety nets (fire departments). Home owners could hold large water reservoirs (foreign reserves) to put out fires (sudden stops) but this is costly and it would be globally more efficient to have a global LOLR to provide water (loans in foreign currency) only when needed.

In the same way as private financial intermediaries can access LOLR loans in case of distress, a global financial safety net implies that a central bank should be able to borrow foreign reserves in case of distress at country level (sudden stop or capital flight). And indeed there is evidence that availability of some form of insurance may be beneficial. Eichengreen et al. (2008) show that countries are less likely to experience sudden stops in capital flows in years following IMF programs, in particular if they have strong fundamentals, while Papi et al. (2015) show that IMF lending programs reduce the probability of banking crises. Looking at the global financial crisis, Dominguez et al. (2013) find that countries with higher reserves experienced higher real GDP growth in the crisis years. Goldberg et al. (2010) find that the dollar swap lines among central banks were effective at reducing the dollar funding pressures abroad and stresses in money markets. They also conclude that the central bank dollar swap facilities are an important part of a toolbox for dealing with systemic liquidity disruptions. Obstfeld et al. (2009) note that international reserve demand can be rationalized by a central bank's desire to backstop the broad money supply to avert the possibility of an internal/external "double drain", i.e. a bank run combined with capital flight. They show that a country's reserve holdings just before the current crisis, relative to their predicted holdings based on financial motives, can significantly predict exchange rate movements of both emerging and advanced countries in 2008. Countries with larger reserves holdings did not depreciate, and some

even appreciated. In fact, current account balances and short-term debt levels are not statistically significant predictors of depreciation once reserve levels are taken into account. Fernandez-Arias and Levy-Yeyati (2012) find that in the Lehman episode (an exogenous global shock) a larger reserves to foreign debt ratio predicted a lower increase in sovereign (EMBI) spreads over a cross section of emerging markets.

Why conditionality in the international lender of last resort (ILOLR) function? One element which is often present in the international LOLR but typically absent, at least explicitly, in the domestic setting is the presence of conditionality, i.e. that LOLR loans are provided "with strings attached". Conditionality can itself be ex ante (qualification to obtain LOLR loans) and ex post (LOLR loans can be release only against evidence of compliance). This is particularly true for loans provided by the IMF, where the doctrine of conditionality was developed from the 1950s onwards.⁹ A good overview of conditionality in IMF lending is provided by Dreher (2009).

As described in Jeanne et al. (2008), with the doctrine of conditionality the IMF has developed a "lending technology" whereby it can elicit, more effectively than uncoordinated private investors, policy adjustments from crisis countries. The decision behind IMF lending is therefore not only or even not mainly of the "illiquid or insolvent" type as typical in domestic LOLR provision, but rather if countries are "conditionally solvent", i.e. conditional on good policies. This represents a unique institutional apparatus, not observed in other lending relationships. In part, IMF conditionality may be seen as a form of collateral, impossible otherwise in an international context, as we have seen. Jeanne and Zettelmeyer (2001) emphasise that especially ex ante conditionality is essential to prevent moral hazard. Jeanne and Zetterlmeyer have a broad interpretation of moral hazard as being not only taking risks on the money of the "global taxpayer" (hence IMF lending needs to be paid back) but also with the domestic taxpayer, who can eventually foot the bill

⁹ Bird (2007), among others, suggests that there have been strong signs of an "upward creep in conditionality" over time for IMF lending. Note that RFAs also typically makes resort to conditionality. There is a large literature on conditionality more generally, in this paper we focus only on those elements that we regard as important in the provision of GFSN.

of bad policies. In other words, one needs to avoid that the IMF and the international community at large could become the accomplice of bad domestic policies. There are, however, other possible theories of conditionality, for example based on the incentives by the IMF itself in lending sufficiently for its own sake and interest, though not excessively. In empirical work, for example, Dreher and Vaubel (2004) find that the number of conditions attached by the IMF depends negatively on international reserves and positively on interest rates; this would suggest that conditionality is more stringent for countries with weaker outside options, rather than necessarily weaker fundamentals.

Dreher and Vaubel (2004) and Dreher (2009), among others, raise fundamental concerns about IMF-style conditionality. They go through several important arguments against it, including the fact that it may undermine democracy; the weakness of structural conditionality (Radelet and Sachs 1998); the poor implementation record, which together with the fact that the IMF is almost always paid back weakens the argument that conditionality is a form of collateral; that ex post conditionality is particularly ineffective in reducing moral hazard; that no consensus is often possible on the best policies to pursue, so it is unlikely for the IMF to know them; and so on. Clearly, an understanding of the pros and cons of conditionality also have important implications for the optimal design (and the desirability of different forms) of the GFSN.

Cathalytic role of ILOLR. Similar to the domestic function, the provision of ILOLR may play a cathalytic role in facilitating the return of private capital flows after a sudden stop episode. There may be several reasons for this. For example, conditionality attached to ILOLR may screen out governments that are not serious about reform. Second, ILOLR may by itself, and independent of conditionality, reduce solvency risks, encouraging public and private investors to resume lending. At the same time, other contributions have emphasised that IMF programs are not a guarantee of capital inflow from other sources and that it depends on several circumstances (Bird and Rowlands 2002; Edwards 2006). To our knowledge, no empirical work has yet been done on the cathalytic role of other forms of ILOLR, such as central bank swap lines. An interesting question would be whether a

cathalytic role is visible only in GFSN characterised by strong conditionality or not.

2.2 Who is in the best position to provide ILOLR?

During a capital flow reversal episode, what is needed is essentially foreign reserves, in the same way as central bank money is the primary commodity of the domestic LOLR. One first important question is whether this insurance function is best performed by accumulating reserves individually (self insurance) or pooling (global insurance). Clearly, self insurance is more efficient as it involves less information asymmetries and other frictions, but it is also more costly and inefficient because diversification gains are not reaped. A pooled solution, by contrast, reaps economies of scale and diversification (at least as long as crises are to some extent idiosyncratic) but is fraught with a number of practical complications that we have already seen. A first best solution may therefore well involve a combination of self and pooled insurance. In particular, some form of pooled insurance will generally be needed for truly global liquidity crunches; as noted by Fernandez Arias and Levy-Yeyati (2012), in the event of a global negative shock only the issuer of reserve assets can perform an effective LOLR function. Until the global financial crisis it was relatively uncontroversial that the IMF is the international LOLR provider and this is indeed an essential staple of the Bretton Woods order. With the global financial crisis and the large dislocations in global capital flows, doubts have been raised whether the IMF pockets are sufficiently deep to provide ILOLR effectively.¹⁰ In parallel, major central banks (in particular the US Federal Reserve) have provided large amounts of LOLR loans in the form of swap lines in the wake of the global financial crisis. This has led some authors such as Capie (1988) and Truman (2013) to argue that only central banks have the necessary elasticity of balance sheet to be the ILOLR. Truman is particularly in favour of a more robust global fi-

¹⁰ The key question, more than the absolute size of IMF resources, is one of *elasticity* to potential financing needs. In the context of present IMF governance there is no mechanism to ensure that IMF resources adequately match potential financing needs arising from, say, deepening financial globalisation. The issuance of SDR, for example..

nancial safety net centred on central banks “because that is where the money is”.¹¹

Another problem associated with IMF lending is the stigma effect of IMF conditionality. Bird and Mandilaras (2011) find, for example, that IMF programs have had a significant positive effect on subsequent reserve accumulation, allowing for other determinants, and that this effect endures over time. This suggests (although it does not necessarily prove) that the cost of IMF conditionality pushes countries to self-insure excessively, which may have negative global repercussions (e.g., stoking the creation of global imbalances). Similar to a too high penalty rate in the Bagehot doctrine, IMF conditionality may result in a sub-optimal insurance provision, and lead countries to either excessively self-insure or to under-insure, creating negative externalities. At the same time, if conditionality serves to limit IMF lending and exposure to countries with weak fundamentals, some degree of stigma is not necessarily sub-optimal.

If the IMF faces limits in raising enough funds and if its conditionality doctrine is fraught with problems, should one support a shift towards a GFSN system based on central bank swap lines? Building the global financial safety net around central bank swap lines (or other types of financing) does raise significant problems. Central banks currently do not have the legal mandate to be the ILOLR and can only play this function for overriding reasons of domestic interest, for example to prevent a financial crisis in a country with which their countries have strong trade and financial ties. They are not entrusted with a global mandate. In addition, they do not have the “lending technology” of the IMF which has proved successful at least

¹¹ Bordo, Humpage and Schwartz (2014) describe the early use of central bank swap lines by the Federal Reserve, which were mostly used to prevent gold losses (potentially leading to a dollar depreciation) in the latter phase of the Bretton Woods system when the US had very little foreign reserves. Swap lines with foreign (G10) central banks continued to be used in the 1970s after the collapse of Bretton Woods. Moreover, the US had a swap line with Mexico since 1967 which was drawn upon in the Mexican crisis in the mid 1990s. The use of swap lines as a general tool to forestall prevent runs towards the dollar did not happen before the global financial crisis. Bordo et al. (2014) also discuss the complex interaction with Treasury and Congress related to the use of swap lines by the Federal Reserve.

in terms of repayment rate of LOLR loans and which is still considered to be irreplaceable to prevent excess moral hazard, despite the doubts raised in the academic literature. Moreover, the senior status of IMF loans may be important for the efficient provision of ILOLR (if only *de facto* and not *de iure*) and it is unclear how central bank loans could retain the same status. Finally, combining central bank swap lines (deeper pockets) with IMF conditionality (more efficient lending technology as LOLR), as suggested by Cordella and Levy-Yeyati (2006) and others, is also not unproblematic. It can be argued that IMF conditionality is only as good as its “skin in the game”¹² and it is not clear how conditionality could be delegated. At a minimum, it would raise complex institutional issues that would have to be dealt with.

2.3 The recent debate on the GFSN

An important part of the debate about the GFSN concerns the issue of whether it is sufficient in terms of size and coverage to safeguard global financial stability. Cordella and Levy-Yeyati (2006), Pickford (2011), and Truman (2013) among others maintain that the GFSN does not command sufficient funds to properly safeguard global financial stability. Truman (2013), in particular, points out that the financial crises of the past decades show that financial integration has increased markedly and, subsequently, financial stability has become more dependent on global financial conditions. In his view, the IMF and RFAs are not nearly big enough to safeguard global financial stability. A viable option to address this issue is central bank coordination, perhaps in the form of a central bank swap network, since central banks are in his view the only players with sufficient financial leverage to credibly address future threats.

In a related vein, Hernandez-Arias and Levy-Yeyati (2010) and Shafik (2015) argue that the GFSN is too patchy, in particular as regards its ability to address problems in the poorer countries. Rajan (2014) calls for the global community to better identify those countries that do not have own bilateral, regional, or multilateral liquidity arrangements to fall back on, and to work to

¹² We thank Susan Schabert for suggesting this to us.

improve their situation. In his view, there is strong interest also for developed countries to internalize the possible negative spillovers of EME vulnerabilities which, in part, reflect the expansionary monetary policies in the developed world during the recent past.

Destais (2014) and Hawkins et al (2014) argue that the prominent role of temporary arrangements in the GFSN such as swap lines create the problem of unpredictability. Destais et al (2014) propose that the swap arrangements between central bank should be transparent and have stability in time so that they could be useful in sound management of banks' liquidity risks in foreign currency. Hawkins et al (2014) propose that to convince markets that global financial stability will be preserved sufficient funds should be committed, preferably at the IMF.

It is difficult to assess empirically the sufficiency of the GFSN, and the existing evidence is somewhat mixed. In the debate, one indicator that has been used as indicative of insufficiency of GFSN is the frequency and severity of financial crises in the global arena (Truman 2013). This view is consistent with the earlier study by Jeanne and Wyplosz (2001) who attempt to quantify the potential liquidity needs on an international LOLR in the context of a theoretical model. They conclude that, to safeguard global financial stability, an international LOLR would need to stand ready to provide virtually unbounded mounts of liquidity, thereby making the central banks the only viable option. It is also consistent with the prediction by Herrala (2001) that voluntary co-operation in liquidity provision leads to insufficient insurance cover. However, in a recent study, Denbee et al (2015) use stress testing techniques to show that the GFSN at present appears capable of dealing severe crisis scenarios. Only in unlikely, severe crisis events involving a large number of countries would the existing GFSN coverage be insufficient.

Another important strand of the recent debate concerns the institutional structure, the appropriate roles of the various parties, and governance of the GFSN. In the debate about the appropriate role of the various parts of the GFSN the IMF is credited as having broad and often superior crisis resolution expertise, ability to impose conditionality, and global pooling of funds (Henning 2013; Rhee et al 2013; Eichengreen 2012). Its weaknesses

include limited access to funding, and the perceived stigma associated with its involvement (Rhee et al 2013). While the strengths of RFAs vary across schemes (McKay et al 2011), their potential advantages include additional funding, novel insights about the specific economic and institutional circumstances, and strengthening of ownership of funded projects based on regional economic objectives (IMF 2013). Central banks are seen as ideally suited to handle fast phased crises with practically unlimited potential short term liquidity needs (Truman 2013, Papadia 2013). Their international operations are limited by the domestic mandate (Rajan 2014, Papadia 2013) and they have limited monitoring capability in the international arena.

Various authors have pointed out that the presence of multiple overlapping agents in the provision of GFSN can cause severe co-ordination problems (Henning 2011, Lombardi 2010, Lombardi and Kawai 2012), Rhee, Sumulong and Vallee (2013) and conflict (Eichengreen 2012). Henning (2013, 2011) proposes a set of principles to foster cooperation: ex ante competence building, specialization of IMF and RFAs along comparative advantage, prohibition of competition in selected areas, and transparency.¹³

To promote crisis resolution, Rhee et al (2013) further suggest that the IMF Articles should be changed to allow direct lending to RFAs. The legal basis and operation principles of RFAs should be improved to allow the RFA better cooperation with the IMF. Some authors also propose a division of labour so that the RFAs would focus on smaller, contained, events,

¹³ In November 2011, the Leaders of the Group of Twenty (G-20) endorsed six principles for cooperation between the IMF and RFAs: 1) Cooperation should foster rigorous and even-handed surveillance and promote the common goals of regional and global financial and monetary stability; 2) Cooperation should respect the roles, independence and decision-making processes of each institution, taking into account regional specificities; 3) While cooperation between RFAs and the IMF may be triggered by a crisis, on-going collaboration should be promoted as a way to build regional capacity for crisis prevention; 4) Cooperation should commence as early as possible and include open sharing of information and joint missions where necessary; 5) Consistency of lending conditions should be sought to the extent possible; 6) RFAs must respect the preferred creditor status of the IMF.] IMF engagement with RFAs has thus far been conducted largely on an ad hoc basis reflecting, inter alia, the specifics of the crisis, and the regional institutional setting (IMF 2013). The six general principles for cooperation between the IMF and RFA endorsed by the G20 Finance Ministers and Central Bank Governors (2011) represent non-binding guidelines and thus leave room for a flexible approach.

while IMF involvement would be needed during larger global crises (Sussangkarn 2012; Jeanne 2010). Following further discussions in the course of 2013, there has been no consensus among G20 members on the need to revise the 2011 principles with a large majority of members seeing little value added to revise the principles. However, the lack of more specific guidelines makes the present co-operation framework non-transparent and, according to some authors, susceptible to criticism about unequal treatment (Rajan 2014; Rhee et al 2013; Eichengreen 2012). Worries about IMF biases in favour of advanced economies are exacerbated by the slow phase of IMF governance reform. Some authors furthermore worry that the lack of transparent rules of cooperation may endanger efficient crisis resolution (Eichengreen 2012; Volz 2012).

Some authors also propose a division of labour so that the RFAs would focus on smaller, contained, events, while IMF involvement would be needed during larger global crises (Sussangkarn 2012; Jeanne 2010). IMF (Miyoshi, Segal, Sharma and Tailor 2013) falls short of taking a strong explicit stand on how to develop cooperation with RFAs, possibly in part due to the fact that the issue appears to be currently a low priority item for the IMF. The Fund shows some preference towards fine-tuning the current flexible approach to address the most significant issues regarding transparency, rather than establishing overarching and detailed structural procedures. The latter approach is at present challenged by the complex economic and institutional issues that surround IMF-RFA co-operation.

3 The database

3.1 An overview

The GFSN data set builds on the country and country group classification systems used in the World Bank and World Economic Outlook databases. In total, 202 countries and country groups are included. They are identified by a unique three letter iso code, a two letter country code, a three digit IFS country code, and a country/area name. Apart from countries, it is necessary

to include also geographical areas (such as the euro area) to properly indicate access to the GFSN in the euro Area. The data set covers at maximum the years 1960-2014, although many series are available for a much shorter sample.

The data is summarised in Table 1. Most of the variables only cover a part of the data set, as indicated by the *Coverage* column in the table. The variables are primarily expressed as percent of GDP or as a binary indicator (dummy).

[Table 1 about here.]

3.1.1 Foreign currency reserves

Reserves are from the World Bank database, comprising holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities (hence holdings by SWF are not included). They are expressed both as proportion of GDP (*ReservestoGDP*) and as proportion of external debt (*ReservestoDebt*) at country level.¹⁴

One complex question is how to deal with reserve holdings by euro area countries. Our measure considers all reserves as country-held, but this may not be completely correct for the euro area. Hence, we include an alternative variable called *ReservestoGDP2* where euro area reserves are aggregated at euro area level (reported as missing for individual euro area countries). A separate question concerning the euro area is how to deal with Eurosystem TARGET2 imbalances which, according to some, play the same role as foreign exchange reserves.¹⁵ We decide to exclude this variable from the database as in our view this should be seen as part and parcel of the

¹⁴ The World Bank database is used rather than IMF COFER because the former is at annual level

¹⁵ Fagan and McNelis (2014) find that the availability of TARGET2 balances in the euro area greatly mitigated the impact of income during sudden stops, relative to a regime in which such financing is not available. At the same time, they observe that the availability of such financing leads to moral hazard (over-borrowing), increasing the likelihood of sudden stops.

domestic monetary policy function in the euro area, not as an element of the GFSN.

3.1.2 Access to IMF financial support

IMF data are compiled from the International Financial Statistics (IFS), the IMF Monitoring of Fund Arrangements (MONA) database, the World Bank Development Indicators (WDI) database, and IMF Quota and Governance reform reports.

While the IMF's MONA data base contains the most complete account of planned and implemented transactions with the Fund by arrangement, the series only reaches back to 1992. Hence we have complemented information on agreed and drawn amounts by IFS data and WDI data where available. The variable *IMFArrangement* provides information on the type of IMF arrangement. The variable *IMFArrangementNumber* gives a unique identifier for a programme. As programmes may be cancelled during a year and immediately followed by a successor programme, the variable *IMFNrofPrograms* gives the number of programmes during one year if there were multiple programmes during that year. The dummy variable *IMFConcessional* indicates whether a programme is concessional. The dummy variable *IMFPrecautionary* takes the value 1 if the arrangement is a Flexible Credit Line (FCL) or a Precautionary Credit Line (PCL)/Precautionary and Liquidity Line (PLL). The variable *IMFAgreedTotaltoGDP* provides the total amount agreed for a programme which is the same for all years of a programme while the variable *IMFAgreedYeartoGDP* gives the amount scheduled to be disbursed to a country within the calendar year. The variable *IMFDrawtoGDP* gives the actually drawn amount during a calendar year. Appendix A contains a detailed explanation of how we have derived the IMF variables.

We also provide the information which is available from the WDI separately. The variable *IMFLoanUsetoGDP* corresponds to the WDI variable "Use of IMF credit" and includes "purchases and drawings under Stand-By, Extended, Structural Adjustment, Enhanced Structural Adjustment, and Systemic Transformation Facility Arrangements as well as Trust Fund loans

and SDR allocations” while the variable *IMFPurchasesstoGDP* corresponds to the WDI variable “IMF purchases” which comprises “total drawings on the General Resources Account of the IMF during the year specified, excluding drawings in the reserve tranche” and hence includes more programmes, but not SDR allocations. The variables *IMFncloanusetogDP* and *IMFncpurchasetogDP* indicate the non-concessional arrangements for both WDI variables. The variable *IMFQuotatoGDP* taken from the quota and governance reports indicates a country’s¹⁶ quota.

3.1.3 Regional financial arrangements (RFAs)

The Regional financial arrangements (RFAs) covered are the FOCEM (Central American Monetary Stabilization Fund), FLAR (Latin American Reserve Fund), FAR (Andean Reserve Fund), AMF (Arab Monetary Fund), CMI (Chiang Mai Initiative), CMIM (Chiang Mai Initiative Multilateralization), EFSF (Eurasian Fund for Stabilization and Development), BOP (EU Balance of Payments Assistance Facility), EFSM (European Financial Stabilization Mechanism), EFSF (European Financial Stability Facility), ESM (European Stability Mechanism).¹⁷ The recently established BRICS contingent reserve arrangement is not yet included since the system was officially approved only in 2015. The data are collected primarily from the homepage of the respective institutions, except that the data on the CMI and CMIM are from the Bank of Japan website. Three variables are included: an indicator variable (*RFAIndicator*) regarding membership, a string variable (*RFAName*) identifying the respective RFA, and total loans drawn from the RFAs (*RFALoanstoGDP*). The latter indicates broadly the loans drawn during a year in gross terms, without diluting loan repayments. Since it is based on the information detailed in the respective websites, it is not completely harmonized, and should therefore be interpreted as an approximation.

¹⁶ TO BE ADDED WHICH QUOTA MEASURE IS USED

¹⁷ In some case of membership of multiple schemes, such as with EFSF and ESM membership, all schemes are listed, separated by a comma.

3.1.4 Swap lines

Information on swap lines is detailed for four main central banks: the Federal Reserve, the European Central Bank, the Bank of Japan and the People's Bank of China. The data have been collected from the respective central banks and from other central bank sources.¹⁸ Five dummy variables (*SwapIndicator*, *FEDSwapIndicator*, *ECBSwapIndicator*, *BOJSwapIndicator* and *PBOCSwapIndicator*) show the countries which have a bilateral swap line from the central banks, including also the bilateral swap lines related to NAFTA and CMI. An indicator variable (*UnlimitedSwapIndicator*) indicates whether any of the swap lines is unlimited. Two quantitative variables (*SwapLimittoGDP*, *FEDLimittoGDP*) indicate the sum total of all swap line limits from the four central banks and, separately, the Federal Reserve.¹⁹ The amounts drawn from the Federal Reserve (*FEDDrawtoGDP*), the only central bank which publishes this information, are constructed from various unharmonized Federal Reserve sources, and should therefore be taken as an approximation.

3.1.5 Capital flows

The capital flows data is from IMF Balance of Payment (BOP) statistics. Due to data availability issues mainly for developing countries, we only provide capital flows data for 72 selected countries.²⁰ Any analysis of the adequacy or interaction of the GFSN with capital flows must reliably separate public sector capital flows which originate from the safety net, such as swaps between central banks or flows of IMF funding, from private sector capital flows. The variables *CapFloOutPrvtoGDP* and *CapFloInPrvtoGDP* provide our preferred measures of private capital outflows and inflows. Appendix B details how we derive these measures.²¹ The variables *CapFloOuttoGDP* and

¹⁸ In particular, we thank Owen Humpage for providing historical data for the Federal Reserve swap lines.

¹⁹ Whenever there is no limit (unlimited access) the observation is treated as missing.

²⁰ A list is provided in Appendix B.

²¹ In short, we rely on a distinction between public entities and private entities in the BoP data. Similar to previous studies (e.g. Alfaro et al. 2014, 2008), we always consider FDI flows as private flows. The other components of the BoP financial account, port-

CapFloIntoGDP denote total capital outflows and inflows.

3.1.6 Additional variables

Our database also includes macroeconomic variables from the World Bank development indicators database; banking crisis start (*bcstart*) and currency crisis start (*ccstart*) dummies from Laeven and Valencia (2012); and indicator of whether a country has sovereign loans in default (*sovdefault*) from the Bank of Canada database; the Chinn-Ito index for capital account restrictions (*ChinnIto*); Euro area, EU, and G20 membership dummies ; the nowcast error in the April IMF World Economic outlook regarding real GDP growth of that year (*nowcasterror*) as a proxy for macroeconomic shocks, external debt and the VIX index indicating vulnerabilities, World Bank governance indicators (*VoiceandAccountability*, *RuleofLaw*, *RegulatoryQuality*, *PoliticalStability*, *GovEffectiveness*), credit default swap spreads (*cds*) from Bloomberg indicating perceptions of sovereign risk, an indicator about the voting patterns of the countries relative to the US in the United Nations General assembly (*UNGAvoteswithUSA*); GDP per capita (*YPercCapita*); and the share of the country of world GDP (*GDPShare*).

4 Some stylised facts

After describing the database we turn to three key questions, all mainly from a home country perspective: (i) what drives the availability of GFSN? (ii) does a higher availability make countries riskier (moral hazard)? (iii) does a higher availability help smoothing the effect of sudden stop episodes? We deal with each of these questions in each sub-section. The analysis does not aim to establish causality but only to identify a set of stylised facts on which future research may build.

folio investment, financial derivatives (other than reserves and employee stock options), and other investment, are accounted separately for the central bank/monetary authorities, general government, deposit-taking corporations and other sectors. We use this differentiation provided in the BoP to exclude all flows from and to central banks and general government, which should be broadly accurate as long as “other sectors” do not include de-facto public sector entities.

4.1 Summary statistics and general evidence on the GFSN

4.1.1 Coverage

The coverage of reserves to GDP is roughly two thirds, and that of reserves to debt is 39 %. On average, countries had about 14 % of reserves relative to GDP. The highest reserve levels relative to GDP are observed in Libya in 2011 (318): its reserves had been boosted by oil income, while its GDP was in steep decline due to the onset of the Arab Spring. In absolute terms, the largest reserves are held by China, which has reserves to GDP ratio of about 40%.

Throughout the periods for which there is data, about one in five countries belonged to a regional financial arrangement. A typical loan draw from an RFA is small (3.7% of GDP). The largest loan draws are observed in the EU, where they peak at 55% of GDP (Greece). The one negative draw from one scheme is related to a rearrangement of the Euro Area RFAs in which, for one country, show as a negative draw from one scheme (EFSF) and a positive draw from another (ESM).

About one quarter (26%) of countries/periods had a swap line from the big four central banks during periods when there is data. However, except for swap lines from the Fed, the data coverage starts around 1999. The average limit size of a limited swap line was around 37% of GDP. The maximum limit size of 25 times of GDP is for Hong Kong, an important financial hub in Asia, which functions as a clearing house for offshore RMB transactions and has a large swap line from the People's Bank of China.

IMF loan use is on average 3.2% of GDP. The use rates are typically highest in the poorest countries and the peak loan use and purchases are driven by concessional programs. The highest use rate (249% of GDP) is by Liberia during its civil war in the early 1990's. Purchases and use of non-concessional loans are much lower. Maximum non-concessional loan use from the IMF was in 1999 in Moldova during the then ongoing financial crisis.

4.1.2 Coverage of GFSN across countries and time

Reserve assets held by the monetary authorities have increased markedly during the past decades (Figure 1), with some interruption in the trend only during the recent years. The rising trend has been linked by previous studies to increased openness of countries towards the international economy, and the subsequent need to better safeguard against external shocks (Obstfeld et al 2014, Bussière et al 2013). Own reserves have also been found to contribute to the ability of countries to influence the exchange rate (Dominiguez et al 2011).

[Figure 1 about here.]

During the past decade, the number of countries with a swap line from one of the large central banks has furthermore increased dramatically, mainly driven by the expansion of the PBoC swap line network (Figure 2). As a result, the geographical coverage of access to such swap lines is presently quite broad on all populated parts of the world, with the exception of Africa and some parts of Latin America (Figure 3). Not much is known about the actual use of such swap lines, since only the Federal Reserve publishes such information. However, previous studies indicate that swap lines, in line with own reserves, can be effective in reducing exchange rate pressures (Goldberg et al 2010).

[Figure 2 about here.]

[Figure 3 about here.]

The use of IMF loan facilities peaks strongly around financial crisis events, and has reached record levels during the recent global financial crisis (Chart 4). The geographical spread of IMF loans is presently much wider than in the early 1970's. They are heavily focused on developing and emerging countries (Chart 5).

[Figure 4 about here.]

[Figure 5 about here.]

The use of RFA loans also peaked during the global financial crisis (Figure 4). Of the RFAs, by far the most active during the crisis period were the European schemes (EFSF, EFSM, ESM) with an average loan size of about 8 % of GDP among borrowing members, and a maximum levels of over 50% of GDP. The FLAR averages a loan size of about 1 % of GDP among its borrowing members, and the AMF about 0.4 %. Of the multilateral RFAs, the CMIM and the EFSD do not report any lending activity. There has been a large geographical increase in RFA membership during the past decades (Figure 6).

[Figure 6 about here.]

4.2 A proxy for aggregate access to GFSN

It is generally difficult to obtain an aggregate measure of access to GFSN, in part due to the need to combine *cardinal* (say, foreign reserves to GDP) and *binary* information (say, whether a country has an unlimited swap line with the Federal Reserve). Among the GFSN types, we have cardinal information on foreign reserves and IMF access to some extent (ex post access under program conditionality, as well as the disbursed amounts); for RFAs we have more limited cardinal information (mainly granted amounts, but only for some of the RFAs and not consistently); and finally for swap lines we have cardinal information on drawn amounts and limit for the Federal Reserve, and limits for the three other central banks (in case the swap is limited). Apart from the Fed, we only have binary information for central bank swap lines without limit and for RFA membership. An additional complication is that access to liquidity from some parts of the GFSN (mainly IMF and RFA loans) is strongly conditional while in other other cases (own reserves, swaps) conditionality is weak or non-existent, thereby implying differences in ease of access. Finally, in the case of euro area, swap lines and own reserves are to a large extent controlled by the Eurosystem and therefore not directly accessible at national level.

4.2.1 Aggregate indicators based on past GFSN access

Based on this situation, for each type of GFSN we build a cardinal measure, GFSN_CARD, which sums access to all of the GFSN sources for which we have cardinal information at each point in time as a share of domestic GDP.²² In other words, we sum available reserves, IMF disbursements during a year with an IMF programme, RFA disbursements during a year for those RFA loans for which we have data, and the limit to a swap line if a country has a limited swap line.²³ Consequently, GFSN_CARD gives us information on the *size* of real-time access to the GFSN for past points in time.

For GFSN sources for which we have ordinal information we simply count the GFSN sources available at each point in time in the past to construct the variables GFSN_COUNT. For example, a country which had unlimited access to, say, an ECB swap line and which received an RFA loan would receive 2 for this variable. For this measure, having access to an IMF programme counts as 1. For reserves, we add 1 if the level of reserves is above the cross-country average in the same year.

Moreover, we split the GFSN_COUNT into conditional and unconditional access. The measure GFSN_COUNT_COND only counts those GFSN elements with conditionality, i.e. non-precautionary IMF programmes and RFA loans. The measure GFSN_COUNT_NOCOND counts access to GFSN elements without conditionality (foreign reserves, swap lines, IMF precautionary facilities).

4.2.2 Aggregate indicators based on potential GFSN access

Finally, we develop three measures of potential GFSN access. The measure GFSN_COUNT_IMF1 is equivalent to GFSN_COUNT, except for (i) just counting RFA membership instead of receiving an RFA loan and (ii) counting potential IMF access measured as having had an above-average number of IMF programmes in the past instead of counting a current IMF programme.

²² For the euro area, we use aggregate reserves at the euro area level.

²³ Note that this implies that unlimited swap lines from the Federal Reserve are not included in this measure.

The measure GFSN_COUNT_IMF2 is equivalent to GFSN_COUNT_IMF1 except for counting potential IMF access as having an above-average quota.

[Table 2 about here.]

Our last measure, GFSN_OVERALL, takes the concept of potential access one step further in that it is constructed like GFSN_COUNT_IMF2, but for swap lines it only contains an indicator of *unlimited* access to a swap line from the Federal Reserve. Table 2 lists all indices. For example, a country with above average foreign reserves, a small IMF quota and access to an unlimited swap line would receive a score in GFSN_OVERALL of 2 (1+0+0+1). This approach gives us the closest approximation to *potential* GFSN access, based on our data.

Clearly, these aggregate measures imply rather arbitrary assumptions and this needs to be kept in mind when interpreting them. Nevertheless, we believe they are a reasonable first pass at measuring overall access to GFSN for individual countries and to study its implications for countries' performance and vulnerability to capital flow episodes.

4.3 Correlates of GFSN access

In Table 3 we report correlations among our measures of (actual or potential) GFSN access. Two facts stand out. First, the cardinal and the ordinal measures are positively correlated, but the correlation is not particularly high. Ordinal measures of actual and potential access are more strongly positively correlated. Second, the correlation between GFSN conditional and unconditional access is relatively low and in one case even negative. Therefore, to the extent that these two forms of insurance play different roles, it is important to look at both separately because one does not imply the other, empirically.

[Table 3 about here.]

In Table 4 we report correlations between three measures of GFSN access (actual cardinal and ordinal, and overall potential access) with measures

of country risk, indebtedness and size. Two stylised facts stand out here. First, actual GFSN access is positively correlated with size and the quality of institutions (Government Effectiveness) as well as a current account surplus, *ceteris paribus*. This suggests that "stronger " countries have more, not less access to GFSN. Second, more financially open countries also have more access to GFSN, while the evidence for external debt is mixed. Clearly, it should be borne in mind that these are unconditional correlations, and we are silent on the direction of causality, which would require a much deeper econometric analysis. We can say, however, that *prima facie* the evidence does not seem suggestive of an overwhelming role of moral hazard; countries with better access to the GFSN on whole do not appear to be riskier or more indebted.

[Table 4 about here.]

4.4 Sudden stops: does GFSN access matter?

As a third element of our descriptive analysis, we look at whether countries are differently exposed to capital flow reversals depending on their access to GFSN. We look at the correlation between the occurrence of capital flow reversals as well as the development of key macroeconomic variables after a reversal, depending on access to GFSN. We should emphasise that also in this case we do not claim to be un-covering a causal relationship and do not deal with potential endogeneity (although we consider GFSN access with a lag in order to mitigate reverse causality).

One important element of our analysis is that in contrast to most earlier work on capital flow reversals we focus on *private* capital flows. Given that the goal of our analysis is to illustrate the impact of public flows, as measured by the GFSN, on private flows, it is essential that we do not include financial flows which are evoked by triggering the GFSN. We follow the literature which has either focused on private flows or on public flows in only selecting specific elements from the BoP for our aggregate measure of private flows. Appendix B details how we measure these elements and how our measure of private flows compares to previous analyses.

The literature has developed several approaches to identifying capital flow reversals. The starting point of the more recent literature are Calvo et al. (2006; 2008), who pinpoint capital flow reversals which are accompanied by sharp increases in aggregate spreads by looking at a year-on-year capital flow fall at least 2 standard deviations below the sample mean. This starting point highlights that the definitions for sudden stops used both in the literature focusing on net flows and in the literature focusing on gross flows reflect the need for a parsimonious measure which can easily be applied and usually define a stop as a deviation, usually by one or two standard deviations, from a benchmark. These benchmarks are often defined in terms of the capital flows themselves (e.g. Forbes and Warnock 2012), albeit with different definitions. Others combine such benchmarks with conditions on the size of capital flows in terms of GDP (e.g. Agosin and Huaita 2012; Furceri et al. 2012) or with conditions on the level of inflows, outflows or net flows (Cavallo et al. 2015). In addition, some authors also use only the size in terms of GDP as the benchmark (e.g. Levchenko and Mauro 2007; Gosh et al. 2014). A more recent approach is to smooth out capital flow series by using a cumulative measure which is standardised with its own standard deviation (e.g. Alberola et al. 2015). However, the Calvo et al. approach or a version of it that does not look at spreads and restricts the sample mean (Forbes and Warnock 2012) is still the most commonly used one (e.g. Korinek and Mendoza 2014; Comelli 2015). One factor that is common across the sudden stop literature is to use at least quarterly data; however, some authors (e.g. Calvo et al. 2004; Forbes and Warnock 2012; Cavallo et al. 2015) deliberately annualise the data to avoid seasonality effects. As we do not have information on reserve holdings, swap lines and foreign exchange reserves on a monthly basis, we also use annual data for our illustrative analyses.

For the sake of being able to compare results derived with this database to previous research, we provide a classification of capital episodes as defined by Forbes and Warnock (2012), which distinguishes between episodes which are triggered by a sharp change in inflows and episodes which are triggered by a sharp change in outflows. Note that we adjusted the approach for annual data and that in contrast to Forbes and Warnock we only use private capital

flows to identify the episodes.

Forbes and Warnock define the following episodes related to capital inflows: Let c_t^x denote capital flows, with $x \in i, o$ indicating inflows or outflows, and $\Delta c_t^x = c_t^x - c_{t-1}^x$ denote the annual year over year change in inflows or outflows. In addition, let $m_4^{\Delta c_t^x} = \frac{\sum_h^{h+3} \Delta c_t^x}{4} \forall h$ denote the 4-year moving average of the change in inflows or outflows²⁴ and let $sd_4^{\Delta c_t^x} = \frac{\sum_h^{h+3} sd(\Delta c_t^x)}{4} \forall h$ denote the standard deviation for the past 4 years. Then, in the spirit of Forbes and Warnock (2012), we define capital flow episodes along the lines of Table 6. For the illustrative analysis in this paper we restrict ourselves to a reversal of foreign capital flows into the domestic economy; in the taxonomy of Table 6 this would be a sudden stop.

After having identified sudden stop episodes, we look at correlations with access to GFSN. The data suggest a limited impact of RFA use on the number of sudden stops. Out of the countries which have ever tapped an RFA, the minimum number of sudden stops between 1970 and 2014 was 0 while the maximum number was 39 with a mean of 29 capital stops. If we restrict the sample to those countries with only RFA assistance and no IMF facility or swap line used, the number of capital stops ranges from a minimum of 34 to a maximum of 39 with an average of 35 capital stops.

The impact of having access to a swap line from the Federal Reserve is similarly limited. Also when looking at those countries which at some point had agreed on a Fed swap line, the minimum number of capital stops is 0 while the maximum is 39 and the mean is 29. For those countries which *only* had a Fed swap line available, the minimum and maximum number of capital stops is the same, but the mean is higher at 33.

Using IMF facilities is associated with a significantly lower number of sudden stops. The countries which at one point used an IMF facility also experienced a minimum of 0 and a maximum of 39 capital stops, but the average at 24 capital stops is lower than for those countries with RFA use. When only looking at countries which only tapped the IMF at one point in time, the minimum number of capital stops is 2 while the maximum is 34

²⁴ Forbes and Warnock (2012) look at the last 20 quarters.

and the mean is 18.

[Table 5 about here.]

A simple analysis of pairwise correlations (Table 5) indicates that higher foreign exchange reserves, the number of IMF programmes and the limit of a Fed swap line if a country has one available are negatively correlated with the number of sudden stops. While the negative correlation between the number of sudden stops and the share of foreign reserves is comparable to the negative correlation between the limit of the Fed swap line, the correlation is slightly less than double for the number of IMF programmes. Surprisingly, there is a positive association between the size of an RFA loan and the number of sudden stops.

Table 5 also indicates that some elements of the GFSN have a substitutive relationship while others seem to be complementary. Foreign exchange reserves seem to be a complement for a Fed swap line, but are substitutive to RFA loans and the number of IMF programmes. It may be possible that IMF programmes or RFA loans are required particularly when foreign exchange reserves are not available. RFA loans are complementary to IMF programmes but substitutive to the number of IMF programmes. Moreover a higher number of IMF programmes tends to be associated with a lower limit of a Fed swap line.

[Figure 7 about here.]

Figure 7 gives an overview of the duration of sudden stops and how the duration of sudden stops is associated with the GFSN. The left hand side of Figure 7 shows the correlation between the average duration of a sudden stop and the average level of FX reserves, RFA loans and Fed swap lines as percentages of GDP. The right hand side shows the correlation between the average duration of a sudden stop episode and the agreed and drawn IMF amounts.

While there seems to be a clear negative association between the level of FX reserves and the duration of a sudden stop, Figure 7 suggests that

the duration of a sudden stop may in fact be longer if a country taps an RFA loan or a Fed swap line. Moreover, the right hand side of f=Figure 7 seems to suggest that a higher agreed amount with the IMF is associated with a lower duration of sudden stops while the amount actually drawn is if at all positively associated with the duration of a sudden stop. This seems to suggest that regarding private capital outflows, high buffers which enhance confidence may lead to lower outflows and lower outflows lead to a smaller reduction in FX reserves or a smaller need to ask for high IMF loans.

4.5 Does GFSN access soften the impact of sudden stops on the macro-economy?

To gauge the macroeconomic effects of sudden stops, we look at their effect on real GDP growth, the current account, inflation, real interest rates, the unemployment rate and foreign exchange reserves around sudden stop episodes. We calculate the average development in the macroeconomic variables by local projections in the spirit of Jordà (2005) for the 4 years after a sudden stop episode for each country in the sample. This means that one country can be represented more than once in the sample of sudden stop episodes. There are in total 3168 observations in the sample. The maximum number of years with sudden stops (of which some may also form an episode which is longer than 1 year) is 10 years.

The local projection method is a way of presenting impulse responses which puts fewer restrictions on the impulse responses. Consider the model in equation (1). The local projection is defined as the coefficient on the sudden stop in a regression on the sudden stop of the dependent variable, such as GDP growth, at time horizons after the sudden stop.

$$y_{i,t+h} = \alpha_i + \lambda_t + \beta_h ss_{i,t} + \theta_h ss_{i,t}^{GFSN_{t-1}} + \zeta_h GFSN_{i,t-1} + \gamma y_{i,t+h-1} + \delta \mathbf{z}_{i,t+h-1} + \varepsilon_{i,t+h} \quad (1)$$

where $y_{i,t+h}$ is the macroeconomic outcome of interest at period $t+h$, $ss_{i,t}$ is a dummy variable indicating a sudden stop during year t and $ss_{i,t}^{GFSN_{t-1}} = ss_{i,t} * GFSN_{i,t-1}$ with $GFSN_{i,t-1}$ being one of our aggregate GFSN measures. In other words, $ss_{i,t}^{GFSN_{t-1}}$ indicates a sudden stop in year t interacted with

one of our aggregate measures of GFSN coverage in $t - 1$ (*GFSN*). $y_{i,t-1}$ denotes the lagged value of the dependent variable prior to the sudden stop and $\mathbf{z}_{i,t}$ denotes a vector of control variables.

Figure 8 shows the developments in three key macroeconomic indicators as an unconditional mean in the left panel (i.e. regressing the outcome at each period on the indicator for a sudden stop) and as a conditional mean (i.e. including control variables) in the right panel. The dashed line shows developments after a sudden stop for countries with no GFSN availability. While it is obvious from the unconditional mean that developments in countries with at least GFSN availability were more favourable after a sudden stop than developments in countries with less than no GFSN availability, the conditional mean highlights that countries with GFSN availability seem to return more quickly to pre-crisis levels.

Table 7 shows the detailed local projections for 4 macroeconomic variables which we provide in our data base. The top half of Table 7 illustrates that – conditional on the level of the current account, GDP growth, the foreign exchange rate, and the unemployment rate in the preceding year – economies which experience a sudden stop tend to experience a significant drop in GDP during the year of the sudden stop and the year following the sudden stop. The foreign exchange rate significantly appreciates during the year of the sudden stop and the year after the sudden stop, but shows a downward adjustment from year $t + 1$. The current account is larger during the year of the sudden stop and the following year. The unemployment rate is up to 2 percentage points higher for at least 2 years after the sudden stop. an improvement in their current account in the year following the sudden stop.

[Table 7 about here.]

We also present results for economies with higher GFSN availability, based on the aggregate indices we have developed. The bottom half of Table 7 shows results for a binary measure based on GFSN_COUNT1 which takes the value 1 for all countries which have at least 2 elements of the GFSN available. In other words, the bottom half of Table 7 illustrates to which

extent countries with at least two safety nets differ from all countries experiencing a sudden stop. It is interesting that when defining GFSN access in this very broad and binary way, countries with higher GFSN coverage do not seem to differ mainly during the year of the sudden stop and the following year. GDP does not drop as significantly as for countries with lower GFSN coverage while the current account is significantly lower for the year of the sudden stop and the year following the sudden stop. The unemployment rate is significantly lower than in the full sample during the full time span, but only significantly lower during t and $t + 1$.

[Table 8 about here.]

Table 8 shows the same analysis as in Table 7, albeit now based on the measure GFSN_CARD. When defining the sample on a non-binary measure of past GFSN availability, we see stronger negative effects of longer duration for the sample with low GFSN coverage (top half of the table). However, there is less difference between countries with particularly high assistance, shown in the bottom half of the table, and the countries with low coverage. In particular, the drop in GDP seems to be very similar in both groups. It seems that a higher GFSN coverage in the sense of a larger assistance package is mainly visible in differences in current account developments.

[Table 9 about here.]

Table 9 complements this picture with the same analysis, now based on GFSN_OVERALL, the measure of *potential* GFSN coverage. The picture for the sample with low potential GFSN coverage is similar to the picture based on binary actual GFSN coverage: GDP first drops significantly during t and $t + 1$ before rebounding again in $t + 3$, while the foreign exchange rate first appreciates and then depreciates, and the unemployment rate rises without significantly decreasing during the later years. We see a significant difference for those countries with very high potential GFSN coverage only for the year of the sudden stop. GDP is significantly higher during the year of the sudden stop while the foreign exchange rate is significantly lower. However there is no significant difference in the unemployment rate.

5 Conclusions and policy implications

In this paper we have focused on the Global Financial Safety Net (GFSN) seen as a unitary concept comprising four different types of safety nets, namely the accumulation of own foreign exchange reserves, IMF and Regional Financing Arrangements (RFA) financing, and central bank swap lines. Clearly, these elements are obviously not coordinated or designed in a consistent manner, and rather reflect the accumulation and stratification of different forms of financial insurance often shaped by domestic rather than global interests. However, it is still interesting to understand their interplay and how they form, taken together, a necessary infrastructure for the global financial system.

The main contribution of this work is to provide an annual database of the GFSN for over 150 countries, available online. We cover, in particular, the existing and potential access to the GFSN, together with a comprehensive list of variables that may be useful to understand financial integration and the role of the GFSN in it. In this way, this paper aims at providing a contribution to a rigorous debate on the role and design of the GFSN looking forward. We also distinguish forms of GFSN that are characterised by conditionality and forms that are not, and discuss the theoretical underpinnings for conditionality. We also show the potential of our database by providing some interesting stylised facts about the availability of GFSN across countries, although we are careful not to claim to be undertaking a causal analysis and to be properly dealing with endogeneity. We also provide evidence on the usefulness of the GFSN from the standpoint of individual countries, in particular when confronted with sudden stop episodes. Overall, we reach mixed results in this analysis. There is some evidence that a higher GFSN coverage cushions the impact of such episodes, the evidence is not always statistically significant and not very robust.

Hopefully the main contribution of this paper will be to spark further research on the GFSN. It reviews all the main theoretical and policy arguments surrounding the GFSN as well as, to the authors' knowledge, the only existing comprehensive database of GFSN that is available. Future research

will be essential to underpin the policy discussion of the GFSN and to arrive at a more consistent and globally desirable configuration of the GFSN looking forward.

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Appendix: tables and figures

Tables

Table 1: THE DATA SET - LIST OF VARIABLES

Variable name	Variable definition	Variable type	Source	Notes	Range
Identifiers					
Iso	Country identifier, three letters	string	WEO	Covers all countries and areas in the WEO and World Bank World Development Indicator databases	1960-2014
countryname	Country name	string	WEO	Covers all countries and areas in the WEO and World Bank World Development Indicator databases	1960-2014
weocountrycode	Country identifier, three digit	number	WEO	Covers most countries and areas in the WEO and World Bank World Development Indicator databases	1960-2014
Alpha2	Country identifier, two letters	string		two letter country code	1960-2014
Year	Year, four digit	number			1960-2014
Global financial safety net					
ReservestoGDP	Total reserves, as % of GDP	%	WDI	Reserve assets under the control of monetary authorities, standardized calculation	1966-2014

ReservestoDebt	Total reserves, as % of total external debt	%	WDI	Reserve assets under the control of monetary authorities, standardized calculation	1971-2013
ReservestoGDP2	Total reserves, as % of GDP	%	WDI, own calc	In the euro area, own reserves are expressed at aggregate, euro area level, and not at the country level	1966-2014
RFAIndicator	Membership in a regional financial arrangement (RFA)	dummy	RFA websites	Covers FLAR, FAR, NAFA, CMIM, EFSD, EFSM, ESM, FOCEM, AMF, CMI, BoP, EFSF,	1960-2014
RFALoanstoGDP	Loans drawn from a RFA to GDP	%	RFA websites	Indicative: definition of loans drawn not harmonized across RFAs and time	1966-2014
RFAName	Name of the RFA in which the country is a member	string	RFA websites	member of many RFAs is indicated by a list separated by comma	1960-2014
SwapIndicator	Indicates whether the country has a swap line from FED, ECB, PBOC or BOJ	dummy	FED, ECB, BOJ and PBOC	In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	1962-2014

FEDSwapIndicator	Indicates whether a country has a swap line from the Federal Reserve System	dummy	FED	In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	1962-2014
ECBSwapIndicator	Indicates whether a country has a swap line from the European Central Bank	dummy	ECB	In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	1960-2014
PBOCSwapIndicator	Indicates whether a country has a swap line from the People's Bank of China	dummy	PBOC	In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	2002-2014
BOJSwapIndicator	Indicates whether a country has a swap line from the Bank of Japan	dummy	BOJ	Indicator about whether a country has an unlimited swap line from any of the four central banks. In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	1999-2014
UnlimitedSwapIndicator	Indicates whether a country has an unlimited swap line from FED, ECB, BOJ or PBOC	dummy	FED, ECB, BOJ and PBOC	In the euro area, the countries are indicated but the Euro Area as a whole is not to avoid double counting	1962-2014

SwapLimittoGDP	The sum of limits from swap lines from FED, ECB, PBOC and BOJ to GDP	%	FED, ECB, BOJ and PBOC	Includes only limited swap lines (excludes unlimited swaps)	1999-2014
SwapncLimittoGDP	Non-conditional swap line limits to GDP	%	BOJ	non-conditional swap line limit to GDP: the IMF conditional BOJ swap lines are not included	1999-2014
FEDLimittoGDP	The swap line limit from FED to GDP	%	1962-1999 from Humpage, 2000-2006 from FED Annual reports, 2007-2014 from FED website	Includes only limited swap lines (excludes unlimited swaps)	1966-2014
FEDDrawtoGDP	FED swap line, drawn amount to GDP	%	1962-1999 from Humpage, 2007-2014 from FED website	1962-1999 Humpage, 2014 from website	from 1966-1999, 2007-2014 from FED

IMFLoanUsetoGDP	IMF loan use to GDP	%	WDI	Purchases and drawings under Stand-By, Extended, Structural Adjustment, Enhanced Structural Adjustment, and Systemic Transformation Facility Arrangements as well as Trust Fund loans and SDR allocations.	1970-2013
IMFPurchasetoGDP	IMF purchases to GDP	%	WDI	Total drawings on the General Resources Account of the IMF during the year specified, excluding drawings in the reserve tranche	1970-2013
IMFncloanusetogdp	IMF non-concessional loan use to GDP	%	IFS, MONA, own calc	Purchases and drawings under Stand-By, Extended Fund Facility (non-concessional) as well as SDR allocations	1992-2013
IMFncpurchasetogdp	IMF non-concessional purchases to GDP	%	IFS, MONA, own calc	Total drawings on the General Resources Account of the IMF during the year specified, excluding drawings in the reserve tranche, only non-concessional	1992-2013
IMFQuotatoGDP	IMF quota to GDP	%	IMF	Based on end of year sdr/usd rate	1980-2014
IMFArrangement	IMF program type	string	MONA		

IMFArrangementNumber	Numeric identifier of the IMF program	number	MONA	In case of more than one programme during one year, this identifies the first programme ²⁵	
IMFNrofPrograms	Number of IMF programmes	number	MONA	Number is larger than 1 if there is more than 1 arrangement during 1 year	1992-2014
IMFConcessional	Indicator of ongoing concessional programs	dummy	MONA	IMFConcessional =1 if any of the ongoing programmes is concessional	1992-2014
IMFPrecautionary	Indicator of ongoing precautionary programmes	dummy	MONA	IMFPrecautionary =1 if any of the ongoing programs is precautionary	2000-2014
IMFAgreedYeartoGDPTotal	amount scheduled to be disbursed to a country during the calendar year to GDP	%	MONA		1992-2014
IMFAgreedTotaltoGDP	Total programme amount scheduled to be disbursed over the course of the programme to GDP	%	MONA	If there was more than 1 programme during 1 year, this variable indicates the sum; corresponds to total programme envelope	1980-2014
IMFDrawtoGDP	Amount disbursed to GDP	%	MONA	Total amount disbursed during one calendar year	1980-2014

²⁵For more details on how we have dealt with several programmes during one year, refer to Appendix A.

Capital Flows

CapFloOuttoGDP	Capital outflows to GDP	%		BOP	Selected 72 countries	1970-2013
CapFloIntoGDP	Capital inflows to GDP	%		BOP	Selected 72 countries	1970-2013
CapFloOutPrvttoGDP	Private capital outflows to GDP	%		BOP	Selected 72 countries	1970-2013
CapFloInPrvttoGDP	Private capital inflows to GDP	%		BOP	Selected 72 countries	1970-2013

Other variables

GDP	Gross Domestic Product	Do-	USD bn	WDI		1966-2014
dGDP	Real GDP growth	GDP	%	WDI		1961-2014
XtoGDP	Exports to GDP	to	%	WDI		1966-2014
MtoGDP	Imports to GDP	to	%	WDI		1966-2014
GFCFtoGDP	Gross fixed capital formation to GDP	fixed formation to	%	WDI		1966-2014
FX	Official exchange rate (LCU per USD, period average)	ex- change rate	Index	WDI		1966-2014
CAtoGDP	Current account balance to GDP	to	%	WDI		2005-2014

U	Unemployment,% total (% of total labor force) (mod- eled ILO estimate)		WDI		1991- 2013
POP	Population	number of per- sons	WDI		1966- 2014
bcstart	Start year of banking cri- sis	dummy	Laeven and Va- lencia (2012)		1970- 2012
Ccstart	Start year of currency cri- sis	dummy	Laeven and Va- lencia (2012)		1970- 2012
sovdefault	Sovereign loan default indicator	dummy	Bank of Canada	1: sovereign has loans in default	1980- 2014
ChinnIto	Chinn-Ito in- dex of cap- ital account openness	Index in the unit line	Chinn and Ito (2006)	This is the nor- malized index, where 1=fully open capital account, 0=closed capital account	1999- 2013
EURO	Euro Area membership indicator	dummy	European Commis- sion		1960- 2014
EU	EU member- ship	dummy	European Commis- sion		1960- 2014
G20	G20 mem- bership	dummy	ECB		1960- 2014

nowcasterror	IMF nowcast error for GDP growth in the April WEO	Pp	WEO, own calculation	An aggregate shock variable, calculated by diluting from the GDP growth nowcast of year t in April WEO of year t, the realized value from the WEO of Oct 2015	1999-2014
XdebttoGNI	External debt to GNI	%	WDI		1970-2013
VIX	VIX Index		Bloomberg	End of year value	1990-2014
Voice and accountability	Voice and accountability index	Index	WGI		1996,1998, 2000, 2002-2013
RuleofLaw	Rule of law index	Index	WGI		1996,1998, 2000, 2002-2013
RegulatoryQuality	Regulatory quality index	Index	WGI		1996,1998, 2000, 2002-2013
Political Stability	Political stability index	Index	WGI		1996,1998, 2000, 2002-2013
GovEffectiveness	Government effectiveness index	Index	WGI		1996,1998, 2000, 2002-2013
cds	Sovereign cds spread	Pp	Bloomberg	End of year value	2004-2014

UNGA votewithUSA	Percentage of United Nations General Assembly votes in which the country agrees with USA	%	US Department of State	2000-2014
GDPShare	Share of country GDP of world GDP	%	Own calc	1966-2014

Table 2: COMPONENTS OF AGGREGATE GFSN INDICES

Indicator	Reserves measure	Swap measure	mea- sure	IMF measure	mea- sure	RFA measure	mea- sure
GFSN_CARD	Level of re- serves	Swap limit	line	Agreed dis- bursement		Size of RFA loan	
GFSN_COUNT	Reserves \geq cross-section average	Swap available	line	IMF programme available	pro- gramme	RFA loan available	
GFSN_COUNT _COND	–	–		Non-prec. IMF programme available	pro- gramme	RFA loan available	
GFSN_COUNT _NOCOND	Reserves \geq cross-section average	Swap available	line	Prec. programme available	IMF	–	
GFSN_COUNT _IMF1	Reserves \geq cross-section average	Swap available	line	Above aver- age number of IMF pro- grammes in past	av- erage	RFA mem- ber	
GFSN_COUNT _IMF2	Reserves \geq cross-section average	Swap available	line	Above av- erage quota	IMF	RFA mem- ber	
GFSN _OVERALL	Reserves \geq cross-section average	Unlimited swap available	line	Above av- erage quota	IMF	RFA mem- ber	

Table 3: PAIRWISE CORRELATION OF AGGREGATE GFSN INDICES

	Actual access measure	GFSN Cardinal	Actual access measure	GFSN Ordinal	Actual access measure; Cond.	GFSN Ordinal With Cond.	Actual access measure; Cond.	GFSN Ordinal No Cond.	Potential access measure; on past programs	GFSN Ordinal Based on IMF	Potential access measure; on IMF quota	GFSN Ordinal Based on IMF quota	Potential access measure; on IMF quota and including Fed swap
	Actual access measure	GFSN Cardinal	1										
51	Actual access measure	GFSN Ordinal	0.33*** (0.000)	1									
	Actual access measure; Conditionality	GFSN Ordinal With Conditionality	0.051*** (0.000)	0.072*** (0.000)	1								
	Actual access measure; Conditionality	GFSN Ordinal No Conditionality	0.31*** (0.000)	0.76*** (0.000)	-0.096*** (0.000)	1							

Potential GFSN access Ordinal measure; Based on past IMF programs	0.32*** (0.000)	0.69*** (0.000)	0.091*** (0.000)	0.75*** (0.000)	1		
Potential GFSN access Ordinal measure; Based on IMF quota	0.32*** (0.000)	0.71*** (0.000)	0.054*** (0.000)	0.76*** (0.000)	0.80*** (0.000)	1	
Potential GFSN access Ordinal measure; Based on IMF quota and including Fed sw	0.31*** (0.000)	0.65*** (0.000)	0.087*** (0.000)	0.65*** (0.000)	0.71*** (0.000)	0.94*** (0.000)	1

p-values in parentheses. *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001

Table 4: PAIRWISE CORRELATION OF AGGREGATE GFSN INDICES AND KEY MACROECONOMIC VARIABLES

	Actual access measure	GFSN Cardinal	Actual access measure	GFSN Ordinal	Potential GFSN access measure; Based on IMF quota and including Fed sw	External debt to GNI, % (World Bank de- velopment indicators)	Current account bal- ance (% of GDP)	Chinn Ito in- dex for cap- ital account openness	Government Effective- ness: Es- timate, source: World Bank	Share World GDP, in GDP, %
Actual access measure	1									
Actual GFSN access Ordinal measure	0.52*** (0.000)	1								
Potential GFSN access Ordinal measure; Based on IMF quota and including Fed swap line	0.50*** (0.000)	0.53*** (0.000)	1							
External debt to GNI, % (World Bank development in- dicators)	0.050 (0.127)	0.025 (0.439)	0.11*** (0.001)	1						
Current account balance (% of GDP)	0.076*	0.22***	-0.00099	-0.30***	1					

	(0.020)	(0.000)	(0.976)	(0.000)				
Chinn Ito index for capital ac- count openness	0.11*** (0.001)	0.094** (0.004)	0.12*** (0.000)	0.18*** (0.000)	-0.059 (0.070)	1		
Government Ef- fectiveness: Es- timate, source: World Bank	0.20*** (0.000)	0.26*** (0.000)	-0.014 (0.661)	-0.049 (0.134)	-0.074* (0.024)	0.18*** (0.000)	1	
Share in World GDP, %	0.079* (0.015)	0.26*** (0.000)	0.14*** (0.000)	-0.12*** (0.000)	0.17*** (0.000)	-0.088** (0.007)	0.16*** (0.000)	1

p-values in parentheses

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

Table 5: PAIRWISE CORRELATION COEFFICIENTS: SUDDEN STOPS

	Number of sudden stops	Foreign exchange reserves (% of GDP)	RFA loan available (% of GDP)	Number of IMF programmes	Limit of Fed swap line (% of GDP)
Number of sudden stops	1				
Foreign exchange reserves (% of GDP)	-0.0808	1			
RFA loan available (% of GDP)	0.063	-0.0551	1		
Number of IMF programmes	-0.1311	-0.0437	0.0909	1	
Limit of Fed swap line (% of GDP)	-0.083	0.4667	-0.0902	-0.1196	1

Table 6: IDENTIFICATION OF CAPITAL FLOW EPISODES

Surge	$\Delta c_t^i > \left(m_4^{\Delta c_t^i} + sd_4^{\Delta c_t^i} \right)$ or: $\Delta c_t^i > \left(m_4^{\Delta c_t^i} + 2sd_4^{\Delta c_t^i} \right)$ for at least 1 year	a sharp increase in gross capital inflows
Stop	$\Delta c_t^i < \left(m_4^{\Delta c_t^i} + sd_4^{\Delta c_t^i} \right)$ or: $\Delta c_t^i < \left(m_4^{\Delta c_t^i} + 2sd_4^{\Delta c_t^i} \right)$ for at least 1 year	a sharp decrease in gross capital inflows
Flight	$\Delta c_t^o > \left(m_4^{\Delta c_t^o} + sd_4^{\Delta c_t^o} \right)$ or: $\Delta c_t^o > \left(m_4^{\Delta c_t^o} + 2sd_4^{\Delta c_t^o} \right)$ for at least 1 year	a sharp increase in gross capital outflows
Retrenchment	$\Delta c_t^o < \left(m_4^{\Delta c_t^o} + sd_4^{\Delta c_t^o} \right)$ or: $\Delta c_t^o < \left(m_4^{\Delta c_t^o} + 2sd_4^{\Delta c_t^o} \right)$ for at least 1 year	a sharp decrease in gross capital outflows

Table 7: LOCAL PROJECTIONS ON SUDDEN STOPS - ORDINAL GFSN MEASURE

	(1)	(2)	(3)	(4)	(5)
	t	$t + 1$	$t + 2$	$t + 3$	$t + 4$
Coefficient on the sudden stop in t (β_h)					
GDP (log)	-0.120*** (0.039)	-0.179*** (0.039)	-0.026 (0.030)	0.051 (0.032)	0.003 (0.024)
FX (log)	0.053* (0.027)	0.069** (0.027)	-0.027 (0.023)	-0.084** (0.037)	-0.040 (0.036)
Current account	2.480* (1.282)	4.073** (1.735)	1.762 (1.226)	1.180 (0.997)	0.934 (0.659)
Unemployment rate	0.932* (0.497)	1.956*** (0.700)	0.856** (0.425)	-0.449 (0.520)	0.004 (0.577)
Coefficient on sudden stop in t * GFSN coverage in $t - 1$ (GFSN_COUNT) (θ_h)					
GDP (log)	0.041** (0.020)	0.021 (0.019)	-0.002 (0.014)	-0.012 (0.015)	-0.003 (0.012)
FX (log)	-0.017 (0.014)	-0.000 (0.015)	0.017 (0.012)	0.024 (0.015)	0.009 (0.016)
Current account	-1.150* (0.646)	-1.174* (0.689)	-0.136 (0.571)	-0.470 (0.429)	-0.563 (0.337)
Unemployment rate	-0.360* (0.206)	-0.467* (0.270)	-0.250 (0.173)	0.132 (0.201)	-0.019 (0.246)

Estimation with FE OLS, standard errors adjusted for clustering and serial correlation. Significance level: *** : $p < 0.01$; ** : $p < 0.05$; * : $p < 0.1$.

Table 8: LOCAL PROJECTIONS ON SUDDEN STOPS - CARDINAL GFSN MEASURE

	(1)	(2)	(3)	(4)	(5)
	t	$t + 1$	$t + 2$	$t + 3$	$t + 4$
Coefficient on the sudden stop in t (β_h)					
GDP (log)	-0.074*** (0.023)	-0.181*** (0.028)	-0.046** (0.021)	0.027 (0.020)	0.001 (0.016)
FX (log)	0.043*** (0.015)	0.086*** (0.018)	-0.001 (0.012)	-0.052*** (0.018)	-0.020 (0.018)
Current account	1.462 (0.929)	1.832 (1.212)	0.084 (0.807)	-0.386 (0.661)	1.008** (0.474)
Unemployment rate	0.510 (0.311)	1.458*** (0.426)	0.609** (0.273)	-0.315 (0.276)	-0.215 (0.245)
Coefficient on sudden stop in t * GFSN coverage in $t - 1$ (GFSN_CARD) (θ_h)					
GDP (log)	0.001 (0.001)	0.001** (0.001)	0.001 (0.001)	0.000 (0.000)	-0.000 (0.000)
FX (log)	-0.001** (0.000)	-0.001* (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Current account	-0.037 (0.032)	0.009 (0.034)	0.057** (0.024)	0.031** (0.013)	-0.043*** (0.016)
Unemployment rate	-0.007 (0.008)	-0.011 (0.007)	-0.007 (0.005)	0.004 (0.004)	0.008 (0.006)

Estimation with FE OLS, standard errors adjusted for clustering and serial correlation. Significance level: *** : $p < 0.01$; ** : $p < 0.05$; * : $p < 0.1$.

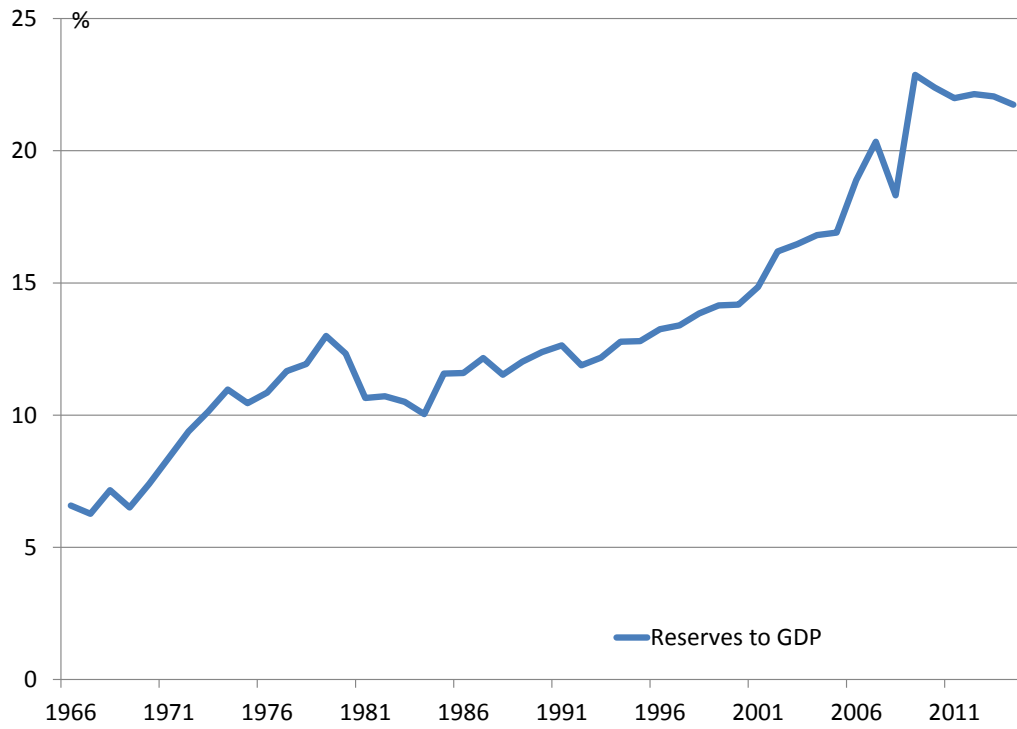
Table 9: LOCAL PROJECTIONS ON SUDDEN STOPS - POTENTIAL GFSN MEASURE

	(1)	(2)	(3)	(4)	(5)
	t	$t + 1$	$t + 2$	$t + 3$	$t + 4$
Coefficient on the sudden stop in t (β_h)					
GDP (log)	-0.088*** (0.023)	-0.170*** (0.029)	-0.022 (0.021)	0.053** (0.023)	0.014 (0.017)
FX (log)	0.051*** (0.017)	0.088*** (0.020)	-0.004 (0.012)	-0.067*** (0.021)	-0.033 (0.020)
Current account	0.787 (0.761)	2.402** (0.928)	1.089 (0.887)	-0.056 (0.673)	0.077 (0.438)
Unemployment rate	0.572** (0.280)	1.385*** (0.388)	0.465* (0.267)	-0.286 (0.382)	-0.106 (0.281)
Coefficient on sudden stop in t * GFSN coverage in $t - 1$ (GFSN_OVERALL) (θ_h)					
GDP (log)	0.030** (0.014)	0.022 (0.018)	-0.008 (0.016)	-0.022 (0.015)	-0.017 (0.011)
FX (log)	-0.022** (0.009)	-0.017 (0.013)	0.006 (0.008)	0.022** (0.010)	0.011 (0.011)
Current account	-0.194 (0.521)	-0.265 (0.524)	0.339 (0.640)	0.353 (0.372)	-0.172 (0.338)
Unemployment rate	-0.208 (0.130)	-0.179 (0.162)	-0.030 (0.118)	0.051 (0.172)	0.069 (0.151)

Estimation with FE OLS, standard errors adjusted for clustering and serial correlation. Significance level: *** : $p < 0.01$; ** : $p < 0.05$; * : $p < 0.1$.

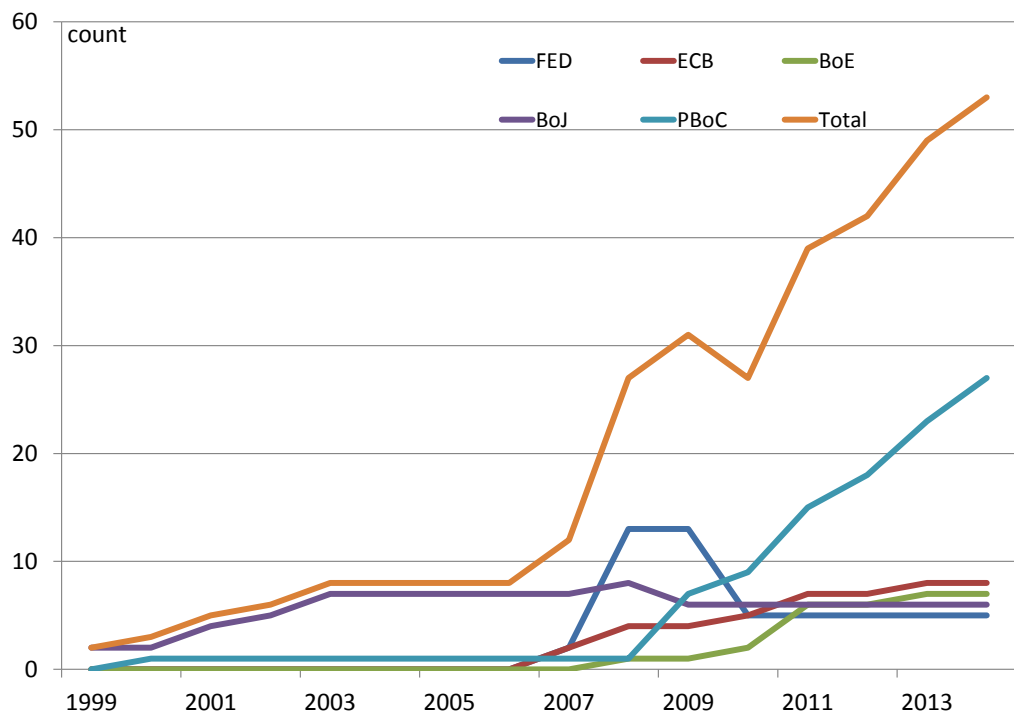
Figures

Figure 1: GROWING SIZE OF RESERVES



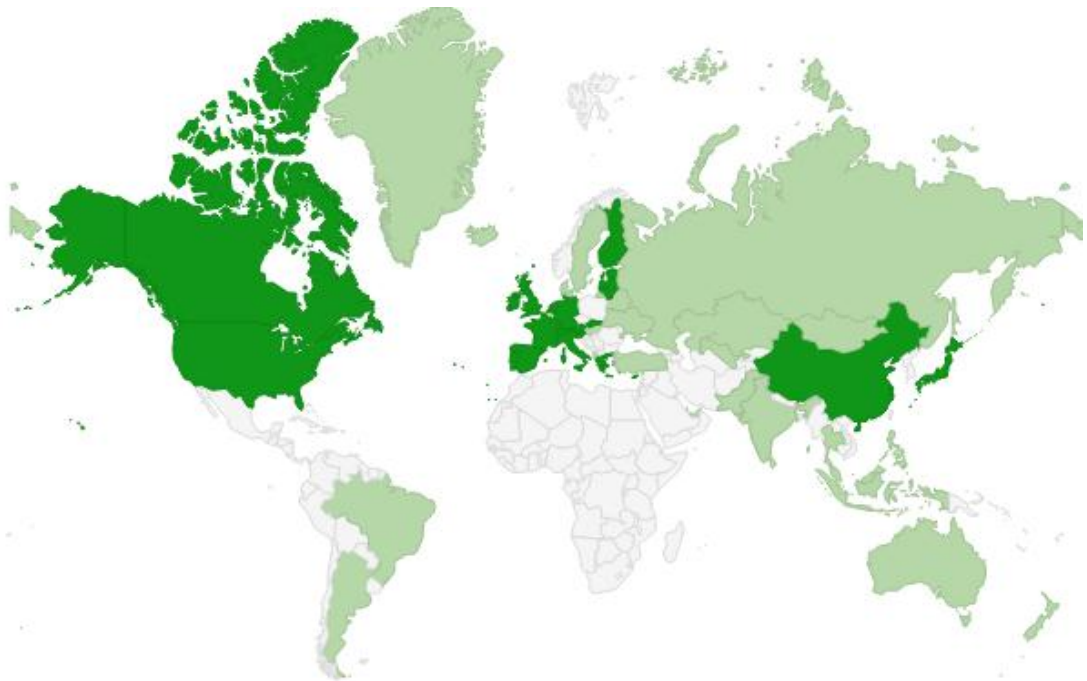
Source: World Bank database, average across countries.

Figure 2: GROWING NETWORK OF CENTRAL BANK SWAP LINES



Sources: BoJ, ECB, Federal Reserve, PBoC. The chart indicates the number of swap line partners of the central banks.

Figure 3: THE SWAP LINE NETWORK HAS GLOBAL COVERAGE



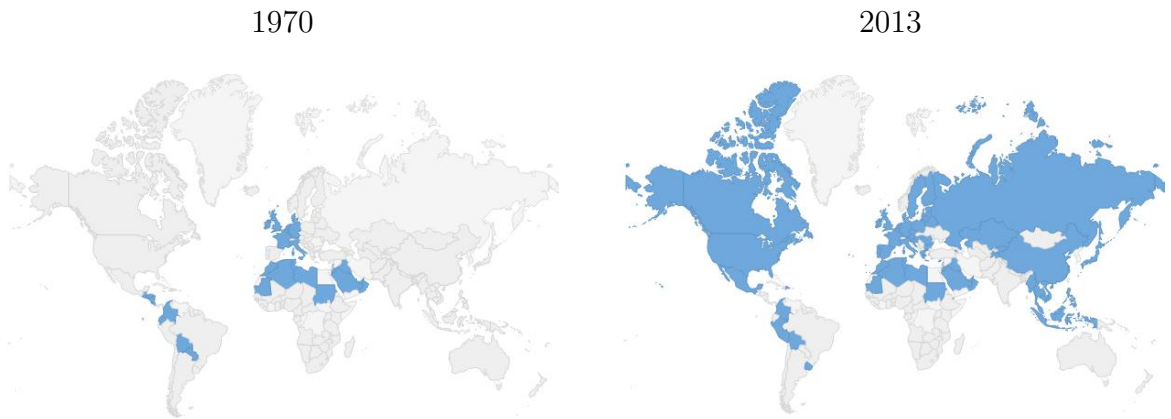
Sources: BoJ, ECB, Federal Reserve, PBoC. Coloured areas indicate countries with a swap line in 2013 from the BoJ, ECB, Federal Reserve or PBoC. Dark green=unlimited swap line; light green=limited swap line.

Figure 4: OUTSTANDING CREDIT WITH THE IMF HAS INCREASED



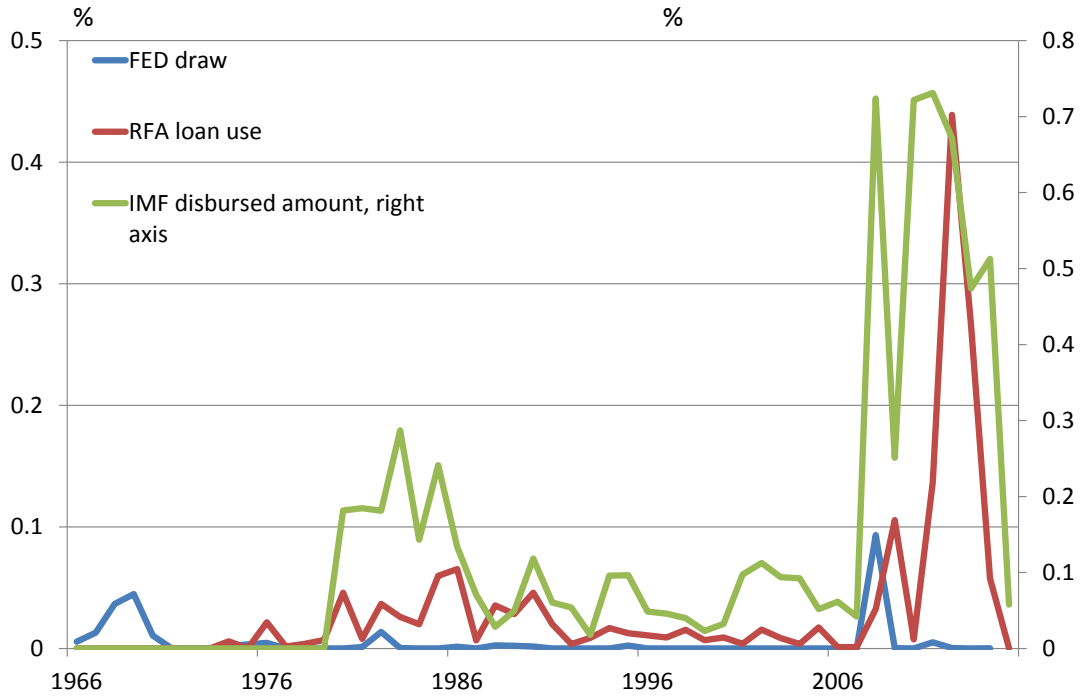
Source: World Bank. Colouring based on outstanding credit relative to GDP, darker red indicates higher value.

Figure 5: MEMBERSHIP IN RFAs HAS INCREASED



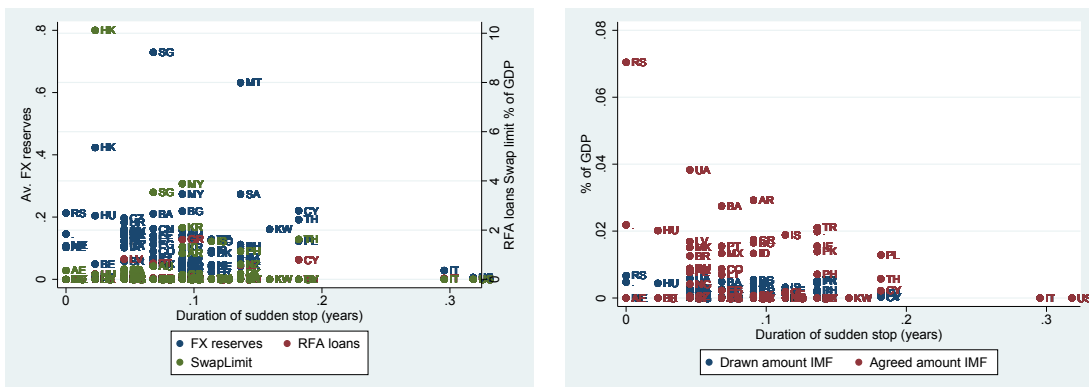
Source: RFA websites. Blue colour indicates membership in a RFA.

Figure 6: USE OF THE GFSN HAS INCREASED



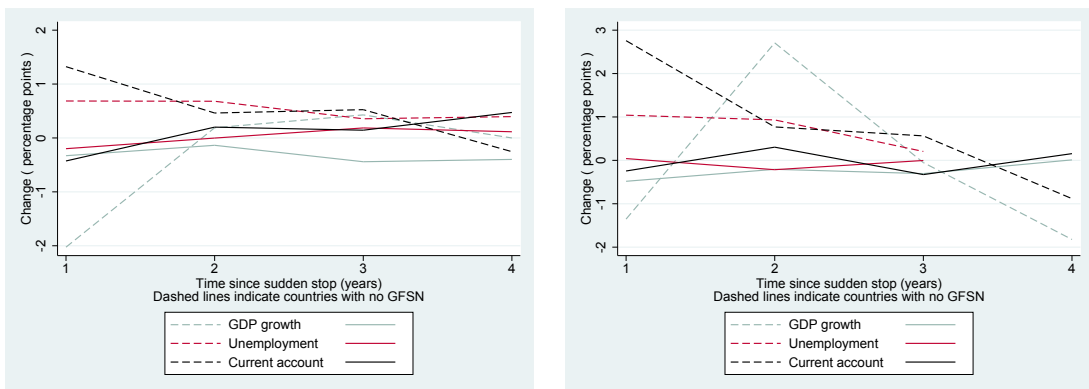
Source: World Bank, RFA websites, Federal Reserve. The chart shows the annual cross-country average.

Figure 7: DURATION OF SUDDEN STOPS AND GFSN COVERAGE



Source: Authors' calculations.

Figure 8: DEVELOPMENTS IN KEY ECONOMIC VARIABLES AROUND SUDDEN STOP PHENOMENA



Consumer price index originally measured as index (2005 = 100), here year of sudden stop indexed as 100.

Appendix A: Details on data related to IMF programmes

Any analysis of the Global Financial Safety Net (GFSN) or the usefulness of IMF lending facilities benefits from a clear measure of Fund support to each supported country at each point in time. However, as Fund programmes may start during each month of the year and often span across more than one year, finding a measure which accurately reflects support on an annual basis is not trivial. Both the IIP/BoP and the IMF's accounts follow year-end accounting. However, programmes typically start when they are needed such that a 2-year programme may also span across up to 3 calendar years. Moreover, countries often apply for successor arrangements or change the type of arrangement during a year which implies that there may be more than one arrangement during one year. In addition, the size and nature of Fund support may not only change when the type of programme is switched, but also during a programme when waivers are granted or programme targets are amended. Consequently, *actual* Fund support may differ largely from *agreed* Fund support.

Information on past IMF financial support is usually taken either from the IMF's International Financial Statistics (IFS) or from the World Bank (WB) may entail some inconsistencies. This information on a country's access to IMF funding is either drawn from a country's international investment position (IIP)/balance of payments (BoP) or directly from the IMF's Treasury department. IFS data on a country's transactions with the IMF is related to its BoP reporting. Hence the data available in the IFS depends on the accounting of the country. While accounting standards are the same, the fact that disbursement in IMF programmes are linked to reviews while data is collected in parallel on originally planned reviews and disbursements, the date and amount of which may be changed during a programme, makes a proper accounting of disbursements prone to misunderstandings. In addition, government accounts are at most published quarterly which already introduces the need for summing IMF support at least over a quarter. Finally, since 2009, IFS data has been discontinued for some indicators on IMF support, such as agreed and drawn amounts (i.e. agreed and actual purchases) by

lending tool. By contrast, WB data on IMF support is directly informed by the IMF Treasury according to the World Bank, and hence it contains longer time series than the IFS. However, information provided by the World Bank is similar, but not identical to the IFS not only because of a different time series. Based on our current investigations, there is no consistent approach in either IFS or World Bank data on whether to express IMF support for each period or whether to sum up the support for each period which belongs to a programme, such that IMF support is expressed cumulatively. Moreover, the World Bank neither records Fund support for some areas, such as European countries, nor amounts granted under the Fund's precautionary facilities.

A more detailed account on IMF financial support is provided in the IMF's MONitoring of Fund Arrangements (MONA) data base. The IMF MONA data base contains all information usually provided in the Memoranda of Economic and Financial Policies (MEFPs) between a country and the IMF, grouped into several variables. Inter alia, MONA contains information on the amount agreed for each programme and on funding disbursed to a country (it's 'purchases' of SDR). MONA data as provided by the Fund is not organised by year, but by programme and by review. This makes the MONA information difficult to use with an annualised panel.

As we are mainly interested in access to Fund support, we focus on the total programme envelope and on the funding which has actually been disbursed. The information on agreed amount and drawn amount used in this paper is compiled from the information on programme envelope and from the information on actual disbursements during each review. We consider the account of Fund lending in MONA as the most reliable data source and thus use information derived from MONA as our main source of information on IMF lending for the years for which data in MONA is available. For years not covered by MONA, we supplement the data first with the IFS and particularly for developing countries and for years earlier than the 1980s we supplement the data by the information collected by the World Bank.

Appendix B: Details on measuring private capital flows

There are two main concepts of recording international capital flows which have been used for the analysis of financial flows and positions. The standard Balance of Payments (BoP) provides information on capital flows between residents and non-residents whereas the recording of the International Investment Position (IIP) provides information on stocks of financial assets and liabilities. This implies that the researcher interested in (sudden) capital movements, particularly at shorter frequencies, should prefer to look at the flows recorded in the BoP.

Private versus public flows

Both public and private capital flows, which are also the basis for the financial position recorded in the IIP, are accounted for in the financial account of the BoP. We can think of the financial account being composed of public and private flows (also refer to Bayoumi et al. 2014):

$$\text{Financial account} = \text{public flows} + \text{private flows}$$

However, both the IIP and the financial account recording of the BoP list assets and liabilities by functional category, which include (i) direct investment, (ii) portfolio investment, (iii) financial derivatives (other than reserves and employee stock options, (iv) other investment, and only for assets (v) reserve assets. Consequently, we have to divide public from private flows for these functional categories. For example, IMF loans and SDR allocations are recorded under “other investment” while SDR holdings are recorded as “reserve assets.”

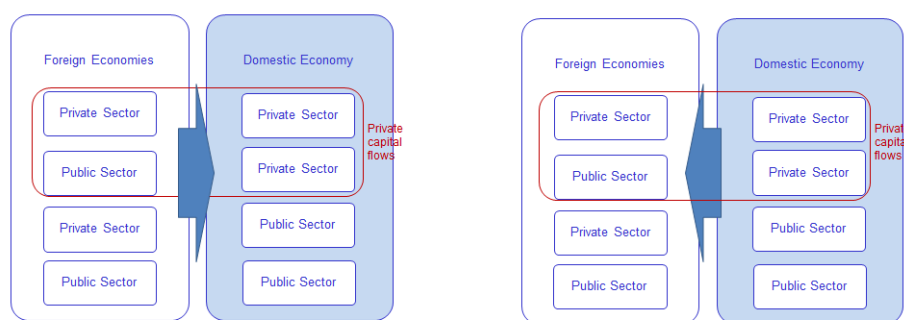
Consequently, private flows can either be derived separately from these BoP items or calculated as the financial account net of public flows and the approach in the few papers which have attempted to do so depends on the research question. To show an inverse relationship between public and private capital flows, Dasgupta and Ratha (2000) define FDI flows and all portfolio flows as private, and official flows as all bilateral governmental and multilateral flows other than the IMF. Milesi-Ferretti and Tille (2011) select those items of the BoP for which a bank is involved in the transaction to measure financial integration. In contrast, Bayoumi et al. (2015) aim to single out

public capital flows. They sum reserves and net portfolio investment and other investment for central bank and general government, making adjustments for countries with e.g. large pension funds or sovereign wealth funds. Alfaro et al. (2014) focus on private flows, acknowledging the difficulty of differentiating public and private issuers and holders of debt securities. Particularly for “debt securities’ which are recorded under “portfolio investment’ (BoP item 3.2) it is difficult to distinguish between public and private issuers and holders of debt securities. For this reason, Alfaro et al. (2014) combine IMF BoP data with the World Bank’s Global Development Finance database, which contains this information for developing countries, and consequently focus their analysis on developing countries. Our approach Our approach to approximating private sector capital flows based on BoP statistics is similar to Alfaro et al. (2014) and Lane and Milesi-Ferretti (2001). In particular, we also count errors and omissions, which denote the accounting difference between inflows and outflows, as unrecorded capital outflows such that they are added as part of private debt assets. However, our approach differs in the main respect in that we look at gross instead of net flows. In addition, we have to make some assumptions as BoP statistics are not bilateral. Consider the depiction of capital inflows and capital outflows in figure 9.

A proper identification of private capital inflows and outflows requires data from both the creditor and the debtor side. From the BoP statistics we know the sector of the domestic economy, i.e. the sector to which capital is flowing in or the sector from which capital is flowing out, but not the source or destination sector of the foreign economy. Source or destination sector in the foreign economy can also be private or public. This leads to the four types of bilateral flows depicted in figure 1. Consider inflows to the domestic economy first. As we do not know the source sector, we treat all flows which are recorded in the domestic private sector as private and all flows which are recorded in the domestic public sector as public. As long as we can assume that foreign public capital flows which are eventually targeted at the private sector, such as foreign aid, are first channeled via the public sector in the domestic economy, the measure of private flows largely excludes those flows which should be considered public. We apply a similar logic to outflows by

considering all outflows from the private sector as private and all outflows from the public sector as public.

Figure 9: IDENTIFICATION OF PRIVATE CAPITAL INFLOWS AND OUTFLOWS



Inflows defined as (private and public) flows from foreign investors to the domestic private sector. Outflows defined as flows from private agents resident in domestic country, investing in (public or private) assets abroad.

While most earlier studies have focused on net capital inflows, more recent studies have looked at gross outflows and gross inflows separately to better gauge foreign and domestic triggers of capital flows separately. It is important to stress, as already noted by Forbes and Warnock (2012), that “gross inflows is the net of foreign purchases and foreign sales of domestic assets, while gross outflows is the net of domestic residents’ purchases of foreign assets and domestic residents’ sales of foreign assets.’ In other words, gross inflows effectively measure net financial transactions from non-residents and gross outflows measure net financial transactions from residents. Consequently net inflows/outflows denote the difference between domestic and foreign net flows. Looking at net flows would not allow distinguishing between changes in foreign and domestic flows.

As the new Balance of Payments Manual (BPM) 6 was introduced in 2012, with effect on data series from 2005, differences between BPM5 and BPM 6 are also reflected in the data. The data set covers years 1970-2015. This means that for BoP data from 2005 onwards, we have used it accounted according to BPM 6. For the financial account, which is the source for

the data on capital flows, changes are minor. First, “reverse investment’ in “direct investment’ was reclassified which does not affect our composition of private capital flows since we assume that all direct investment is by definition private, as detailed below. In addition to some changes in accounting of portfolio investment, the Balance of Payments Manual (BPM 6), which was introduced in 2012, switched the sign for gross outflows. While we use data accounted for under BPM6 for years after 2005, we stick to the BPM5 signing convention, i.e. similar to earlier research we denote outflows with a negative sign.

In contrast to Forbes and Warnock (2012), this approach cannot distinguish between foreign and domestic investors. However this paper does not focus on the behaviour of investors. For gauging the adequacy of the GFSN during past capital flow episodes, it is important to adequately capture private flows, but not the type of investor. Moreover, residency-based capital flows data can be heavily distorted by the use of tax havens or low-tax areas.

We use annualised data, but note that capital flows data is available quarterly. When only focusing on the behaviour of capital flows, data at a higher frequency than annual is useful due to the high volatility of capital flows particularly around crises. Moreover, capital flow episodes may not span more than one year. Consequently, particularly for analysing capital flow episodes, using at least quarterly data should be preferable. However, data for two of the four elements of the GFSN (reserves, RFA access) is not available quarterly. Therefore, we opt for annual data also for capital flows, but note that the methodology could in principle also be applied to quarterly data.

However, we should note a concern which led Alfaro et al. (2014) to focus their paper on developing economies only. The distinction between private and public entities in “portfolio investment’ and “other investment’ is not available for all IMF-reporting countries for longer time series. Particularly during the 1970s and 1980s, data separated by public and private entity is not available for many countries. Moreover, the fact that information is missing for those years for some countries may be non-random, for example related to the degree of financial integration of a country or to its exchange rate regime.

Despite these data issues we believe that the consistency of accounting of BoP data and availability for most countries at least for analyzing episodes since the mid-1990s make the BoP data a valuable source for analyzing the interaction between the GFSN and private capital flows.

Data coverage on BoP capital flows is limited particularly for years earlier than the 1990s and for many developing economies. Corresponding to the size of the economies, the size of capital flows differs across countries. This implies that for some emerging and developing economies in our sample, hardly any capital flows are recorded. Moreover, as the size of capital flows was generally lower during the 1970s and 1980s, there are fewer non-missing observations for those years. In addition, since BoP reporting is voluntary on some items, we cannot rule out non-random non-reporting by some countries.

To deal with large numbers of missing data and zeros particularly for developing countries and for years prior to 1990, we restrict the sample for the analysis of sudden stops to the 80% largest economies or 72 countries in total. Although this is a reduced and possibly non-randomly restricted sample, we believe it contains the non-negligible capital flows. Moreover, since we treat errors and omissions as unrecorded capital outflows, we try to address at least part of the bias resulting from ‘non-zero zeros’ in the data.