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The role of central bank swap lines networks after the Global Financial Crisis

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Abstract

We discuss the evolution of central bank swap lines as instruments of monetary policy, pre- and post-crisis. We discuss different models of swap lines to understand the welfare implications of their movement from temporary crisis management tool to permanent feature of the international monetary system. We argue for a reinterpretation of swap lines based on the new politics of money literature.

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1. Introduction

The 2007-8 great financial crisis (GFC) featured the unprecedented use of central bank swap lines. Swap lines are facilities where a central bank can sell a specific amount of a currency to another central bank in exchange for its currency at market rates. There is an agreement to buy back the currency at the same exchange rate on a specified future date.

The emergence of swap lines has to be understood in the context where European banks, once reliant on the U.S. money market and borrowing on foreign currency, were in need of liquidity assistance. At the height of the crisis, in December 2008, these emergency credit lines provided nearly US$ 600 billion to meet the global demand for US dollars.[4] The network of swap lines is still evolving.

Central bank swap lines go back to the long-term discussion on the role of central banks in providing emergency lending facilities and the idea of lender of last resort that will step in to provide credit to illiquid yet solvent institutions during crises, thus reinstating market confidence.[5] They also indicate how central banks, in response to the 2007-8 GFC, were able to come up with a myriad of new liquidity facilities.

It is, however, important to contextualise the swap lines within the broad changes in the principles and practices usually underpinning particular global governance arrangements. By the early 1970s, with a radical change in international finance, international capital flows substantially increased. As financial integration developed, new and more complex forms of financial contagious emerged as well. Crisis resulting from the sudden reversal of capital flows, financial panic reappeared, reminding us of crises that were similar to the period before the 1930s.

The financial integration clearly created a new rationale for an 'international' lender of last resort (ILOLR) to deal with liquidity crises. It is without a surprise, therefore, that from the 1990s onwards, the literature looking at the international lender of last resort shifts from sovereign default into the realm of currency and financial crises (McDowell, 2012, p. 162).

Since the 1990s there has also been an explosion of the "global financial safety net", defined as financial arrangements providing foreign exchange to official borrowers in the event of a crisis. In absolute values, this figure has increased from around US$ 200 billion in 1995 to around US$ 3.5 trillion in 2014, a trend accompanied by the accumulation of foreign reserves (di Mauro & Zettelmeyer, 2017, p. 5).

Within this scenario, it is possible to make the argument that from the 1990s onwards, and particularly after the 2007-8 GFC, we have been looking at weaknesses and strengths of a

[4] The Council on Foreign Relations' Interactive display on Currency Swap Lines gives the recent history of swap lines: https://www.cfr.org/international-finance/central-bank-currency-swaps-since-financial-crisis/p36419#!/%23swap-map

[5] See for example Bagehot (1873), Thornton (2008 [1803]).

global financial safety net, which used to rely on one institution – notably the IMF – but have been expanded to include continent reserves arrangements, and big new players such as regional financial arrangements (RFAs) and [unlimited] central bank swap lines.

An important aspect to be noted here as well is that the demise of the Bretton Woods system in 1973 supposed to allow national currencies to adjust to national economic circumstances rather than being tethered to the US dollar. That the rest of the world would no longer be required to hold dollar reserves might reduce the influence of dollars in the international financial system. The opposite seems to have occurred. A theme of the Jackson Hole 2019 annual meeting of central bankers was the dominance of the US dollar and the implications of financial stability and economic management.

New permanent central bank swap arrangements were not included in the discussion. This is surprising because the arrangements were specifically introduced to make foreign currency wholesale markets more resilient. We argue that this is an omission and that there is a case to answer when thinking about the welfare, moral hazard and political economy considerations of these arrangements. Moreover, we note that these new permanent arrangements have not been discussed in any national assemblies, despite being agreements between organs of foreign government.

So far the literature on swap lines can be divided into five large blocks:[6]

> 1 – Studies looking at the evolution of central bank currency swap lines (Allen & Moessner, 2010; Bordo, Humpage, & Schwartz, 2015; Destais, 2016; Goldberg, Kennedy, & Miu, 2010; Papadia, 2013; Truman, 2013).
>
> 2 – Studies looking at the economic rationale involving demands for swap lines (Bahaj & Reis, 2018; Obstfeld, Shambaugh, & Taylor, 2009) and, at a more general level, the economic rationale involving the demand for a global safety net and ILOLR (Obstfeld, 2009; Scheubel & Stracca, 2016; Truman, 2010).
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> 3 – Studies doing a quantitative analysis of the adequacy and use of swap lines and the safety net more generally, and some of its crisis-mitigating effects (Bahaj & Reis, 2018; Denbee, Jung, & Paternò, 2016; IMF, 2016b; Obstfeld et al., 2009; Scheubel & Stracca, 2016).
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> 4 – Studies looking at political and defensive motives driving the decision to grant swap lines (Sahasrabuddhe, 2019; McDowell, 2012), which, at a more general level, includes a critical assessment of both the qualifying criteria for a state to serve as ILOLR and the conditions that stimulate a state to act as an ILOLR, if they it has capacity too (Eichengreen, 1995; Thompson, 2010).

[6] Expanded upon di Mauro and Zettelmeyer's (2017) division.

5 – Studies looking at the extent to which the financial safety net in general and swap lines in particular could become a source of moral hazard (di Mauro & Zettelmeyer, 2017; and, albeit not their main concern, Denbee et al., 2016; Obstfeld, 2009; Papadia, 2013).

This paper belongs to the fifth block. However, it does depart from it quite substantially by arguing how studies assessing both the need for swap lines and their welfare consequences are somehow trapped in a Diamond-Dybvig's world. Within this world, banks are solvent and swap lines exist to solve a sunspot-type crisis. Thus, these credit lines are not necessarily source of moral hazards and if they are, it is empirically irrelevant. From this perspective, we should welcome the swap line as merely another new player within the global safety net of practices and policies, which serves a potentially useful social function and increases welfare.

However, what if the 2007-8 GFC and the changes we have seen in the shadow-banking sector are due to something else other than sunspots? What if the crisis is more likely to be embedded within the world of Lipsey and Lancaster where there are two or more markets failures? In which case, what are the welfare implications? What if the political motives behind the swaps are as relevant as the economic ones for the analysis?

The big picture issue is one's implicit framework of analysis. This goes to the heart of efficient markets or a different approach, which also takes us to the heart of the discussion of the rationale for financial policy. Do we base the ILOLR and swap lines on the justification of sunspots? If we assume the world is stable and markets are efficient, then sunspots and weird constraints (Diamond-Dybvig) cause coordination problems and thus justify interventions.

The paper is organised as follows. Section 2 gives a theoretical, technical and historical account of the pre 2007-8 GFC. In Section 3, we discuss the role of swap lines as a ILOLR and its mechanisms, which is assumed to be the new politics of money. We discuss the implications and welfare consequences of central bank swaps in Section 4, considering both the Diamond-Dybvig's and Lipsey-Lancaster view of the world. We conclude in Section 6.

2. Pre 2007-8 Great Financial Crisis

A technical and historical account

Looking back ten years before the Great Financial Crisis, banks around the world dramatically increased their stock of foreign currency assets on their balance sheets. From 1999 to 2007, for example, the European Central Bank increased claims denominated in foreign currencies by 191%, and in this it was not untypical. The counterpart of this expansion was the engagement in medium- to long-term investments in US dollar-denominated claims on non-bank entities, including loans to corporations and hedge funds as

well as holdings of US mortgage-backed securities and other structured finance products (McDowell, 2012, p. 164).

These banks had to fund these assets purchases and they did this by acquiring foreign currency from wholesale markets, via discount windows or borrowing in the dollar private market, or by going to the foreign exchange market for US dollars. These were typically short-term funding exercises, in contrast with the medium- to long-term dollar claims these banks had. These exercises created the following dynamics,

Foreign banks regularly rolled over their debts, borrowing from one short-term source to pay off other short-term loans as they came due. Meanwhile, their own dollar claims matured at a much slower pace. In sum, they were borrowing short while lending/investing long in a foreign currency (McDowell, 2012, p. 164).

Essentially, there was a constant dollar-funding gap created through borrowing short on the wholesale market. Filling this gap was dependent on a well-functioning set of markets and a very liquid supply of dollars. Otherwise, these European banks would get into trouble – as not being able to continue servicing maturing dollar liabilities would call their liquidity and solvency into question.

The 2000s witnessed a considerable increase in the borrowing volume of dollars from credit markets. Lending from the interbank market, central banks and foreign exchange (FX) swap market made up over US$ 1.1 trillion. To this scenario, it must be added that, in the mid-2008, 15 of the largest prime money market funds placing half of their dollar portfolios in foreign banks with a total estimated value of US$ 1 trillion (McGuire & von Peter, 2009, p. 15). European banks relied on money markets for one-eighth of their total $8 trillion in dollar funding (Baba, McCauley, & Ramaswamy, 2009, p. 67). To put this in perspective,

the US-dollar denominated assets of banks outside the United States are comparable in size to the total assets of the US commercial banking sector, peaking at over $10 trillion prior to the crisis. The BIS banking statistics reveal that a substantial portion of external US dollar claims are the claims of European banks against US counterparties (Shin, 2012, p. 3).

If the short-term borrowing to fill the dollar-funding gap had put the European banks in a fragile position, the counterparties that lent this money to these banks were equally at risk. The American financial system exposed to the threat of foreign bank default was significant. A scenario that could easily be exacerbated by the fact that the prime funds mentioned above were also lending to the US institutions (roughly a US$ 1 trillion), playing an essential role in the American credit market as well (McDowell, 2012, pp. 166-167).

If credit makers were to freeze, this entire structure could collapse, leading to bankruptcies, defaults but also breaks the bucket and run on money market investments. As it happens, in August 2007, fears that European counterparties would soon become insolvent due to their ownership of collateralised debt obligations (CDOs) contaminated by subprime mortgages

began to affect the short-term dollar fund dynamics. Credit markets began to seize up, and market participants gradually stopped lending to each other (Schwartz, 2009, p. 191).

Acquiring dollar funding on the wholesale market became costly and difficult. Especially after Lehman Brothers filed for bankruptcy, spreads on the interbank market spiked, and the money market funds and the FX swap market closed completely to some banks (Papadia, 2013). An international dollar shortage began, referred by the Fed Chairman Ben Bernanke as 'a novel aspect of the current situation' (Wessel, 2009, p. 140).

Theoretical account

There is an agreement within the literature that a key feature financial intermediation is to borrow short and lend long. The wholesale shadow banking sector is an example of it. The liquidity mismatch, i.e., bank's portfolio reflecting a mix of illiquid assets and liquid liabilities, is considered to be one of the reasons giving rise to belief driven runs among depositor.

Diamond and Dybvig (1983) and the vast literature that follows explain belief driven bank run arguing that there is a bit more than liquidity mismatch behind it. Economic models within this tradition argue that a sequential service[7] constraint is the mechanism generating bank runs (Ennis & Keister, 2010). That is, the first lenders to recall their loans are repaid, but the last ones receive what is left of the value of the institutions.

The 2007-8 GFC and the idea of credit markets freezing up or that the wholesale markets jammed have generated a literature understanding this crisis to be a bank run at the wholesale level (Andolfatto & Nosal, 2018; Bernanke, 2009; Gorton, 2010). In this sense, it seems appropriate to see this run as analogous to Diamond and Dybvig (1983) model. Essentially, financial intermediaries fund themselves using short-term borrowing are particularly vulnerable to runs.

An important issue here is that within the Diamond and Dybvig (1983) tradition, banks are solvent and stable but subject to sequential service constraints which lack an institutional or empirical explanation. They are modeled as mere sunspots and thus unforeseeable changes in behaviour. Further, the absence of sequential service means there exists no mechanism to trigger bank runs, so banks should otherwise be stable.

Given the way wholesale financial intermediary institutions such as shadow banks fund themselves, i.e., by rolling over short-term debt, Andolfatto & Nosal (2018) suggest that factors other than sequential service can lead to retail bank instability. They challenge the Diamond and Dybvig (1983) tradition, arguing that a sequential service constraint is absent in the wholesale market. However, having a similar design approach to Diamond and Dybvig (1983), their model does offer an alternative mechanism that can generate

[7] The practice of serving depositors on a first-come, first-serve basis.

instability/runs, i.e., increasing returns to scale in the financial intermediary's investment technology, but, while original, this modeling device fails to escape the idea that runs are triggered by a sunspot event.

Another aspect that needs attention within the Diamond & Dybvig (1983) tradition is the *type* of contract found in the wholesale market. Optimal liquidity insurance and sub-optimal (simple) deposit contracts play different roles in generating a bank run. Optimal contracts, for example, suggest that bank runs might not be the by-product of ill-designed contractual arrangements, which then open space to look for other mechanisms that generate instability, which is very often the sequential service constraint. While alternative deposit contract arrangements may eliminate the possibility of run all together.

For this paper, the argument that the 2007-8 GFC can be understood within the context of preventing bank runs is plausible. So is the idea that sequential service leads to a very small amount of resources left over for latecomers after a mass withdrawal (Diamond & Dybvig, 1983), or that mass withdrawal means that investments will not be funded to scale, so a low return is likely (Andolfatto & Nosal, 2018). However, we find it less plausible to rely on sequential service as the only game in town to explain bank runs. It also seems unproductive to have the dominance of a framework that assumes banks as solvent and stable, moving to extrinsic events and unforeseeable changes in behaviour (sunspots) to then justify belief-driven runs and sequential service constraint. This type approach leaves open questions wondering about the state of the banks in the pre 2007-8 GFC.

Spikes in the spreads on interbank markets and resulting dollar shortages seems to place the 2007-8 GFC in very different terms than a belief-driven run due to unforeseeable changes in behaviour. It is well known, for example, that the counterparties were very weak and as that information slowly became available in real time, market liquidity dried up. Changes in economic fundamentals seem much more plausible in the 2007-8 GFC context, with banks being anything but not stable or solvent.

3. Swap lines as a lender of last resort

The mechanism

As mentioned in the introduction, a swap line is an agreement between two central banks to exchange currencies. The agreement allows the receiving central bank, also called the home central bank or the recipient-country bank, to obtain foreign currency liquidity from the issuing central bank, also called the source central bank.

The history of swap lines can be traced back to 1962 when they were created to protect central banks from unfavourable dollar positions (Eichengreen, 1995; Thompson, 2010). Thus, they are not new to the Fed's toolkit. What is new is the use of swap lines to affect the liquidity situation of domestic banks, or to temporarily and indirectly influence foreign exchange rates, which was a common case in the 1990s.

Foreign exchange swaps, for example, have been an instrument used by central banks to acquire foreign exchange to fund several interventions. This was the case in the 1990s when the Fed maintained an extensive network of foreign exchange swap lines with various central banks and the BIS.[8] In 2001[9] and in the period since 2007, however, the swap agreements have mainly be oriented to "towards providing foreign currency liquidity to domestic counterparties" (ECB, 2014, p. 65).

2008 marked the 'dramatic' and substantial comeback of swap lines, with the Fed providing an unlimited supply of dollars and turning into the world's *de facto* lender of last resort (LLR) (Sahasrabuddhe, 2019, p. 463). The US dollar swap lines between the Fed and the other central banks accounted for the bulk of activity during and after the 2008-7 GFC.

The Fed provides dollars to other central bank and receives an equivalent amount of their currency at today's spot exchange rate. After a certain period, one week or one month, the central banks re-sell to each other their respective currencies at the same initial spot exchange rate the swap took place at. The receiving central bank is aid an interest rate charged by the Fed. This rate is set today "as a spread relative to the USD overnight index swap (OIS) rate, paid at the fixed term, and settled in USD" (Bahaj & Reis, 2018, p. 5).[10]

The process does not end here. The home central bank has then dollars to lend to domestic financial institutions for the same period of time established in the swap agreement, and the loan rate has to be the same that the Fed charged. This redistribution of foreign currency locally is therefore unconstrained by the level of its foreign reserves.

The recipient central bank judges which banks are eligible for the assistance, and usually accepts high-quality liquid assets as collateral.[11] The home central bank is the institution responsible for paying the Fed back. The monitoring, the choice of the collateral and the payment collection are under the domestic central bank accountability. If the domestic financial institution fails to meet its loan obligation, the recipient central bank has to buy dollars in the market to meet its swap lines obligation. Otherwise, it will lose the currency held at the Fed (Bahaj & Reis, 2018, pp. 5-6).

The New Politics of Money

The economic rationale for swap lines

[8] With the introduction of the single currency in 1999, the swap lines with central banks were discontinued.
[9] In this case it was because of the financial market disruption that followed the terrorist attacks of 11 September 2001.
[10] It can be argued that the implied costs of the US dollar provision also depended on the cost of the collateral that home central banks will have.
[11] The ECB (2014) highlights that a "currency mismatch between the foreign currency liquidity supplied and the euro-denominated collateral also entails foreign exchange risk to the Eurosystem, which is mitigated with an additional valuation margin" (p. 68).

As already mentioned, central bank swap lines became prominent in an adverse context, i.e., the 2007-8 financial crisis, to provide liquidity assistance. In December 2007, the European Central Bank (ECB) began conducting US dollar liquidity-providing operations for limited amounts, but by the time the Lehman Brothers went bankrupt in September 2008, as US dollar funding markets began to freeze up, the size of these ECB operations increased substantially.

In October 2008, due to an increase in the Swiss money market rates, the ECB and the Swiss National Bank (SNB) started swap lines to provide Swiss franc funding to Eurosystem counterparties. With continuous and increasing financial pressures growing throughout 2008, these swap lines were extended to emerging economies (EMEs) as well. Several EMEs requested temporary assistance from the Fed but only four were successful: Mexico,[12] Brazil, Korea and Singapore (Sahasrabuddhe, 2019, p. 469).

Initially, swap lines were arranged between the Fed and the ECB, and within one year with a dozen other central banks. These credit lines ran "between September 2008 and January 2009, with the amount drawn peaking at $586bn" (Bahaj & Reis, 2018, p. 1). In 2011, the Fed and the ECB along with four advanced-country central banks (Bank of England, the Bank of Canada, the Bank of Japan and the Swiss National Bank) established a network of swap lines to provide currency to each other if the need arises. These swap lines were made into a permanent arrangement in October 2013, as it was recognised that they could help to ease pressures in financial markets.[13]

Swaps lines started moving beyond providing liquidity in US dollar, Swiss francs and euro when the ECB concluded swap agreements to provide euro to other central banks, such as Danmarks Nationalbank, Latvijas Banka, the Magyar Nemzeti Bank, Narodowy Bank Polski and Sveriges Riksbank. Finally, and more recently, the ECB and the People's Bank of China also established a swap agreement for the provision of euro and Chinese renminbi (ECB, 2014, p. 66).

Obstfeld, Shambaugh and Taylor (2009) contextualise the unprecedented US dollar swap lines within reserve levels. They highlight that one important issue in the current international monetary system is the need that countries have to insure themselves against foreign financial outflows and runs on the currency by domestic savers. Foreign reserves play that role, which is confirmed by the high and increasing level of reserves in emerging-market countries since the early 2000s. Advanced economies, on the contrary, had too few reserves and were the main beneficiaries of substantial US swap lines during the GFC.

[12] Mexico was the only EME to have received Fed assistance prior to 2008.

[13] The increasing use of swap lines should be contextualised within the global economic affairs. Some swap lines were discontinued after the GFC but quickly revived after the onset of the euro-zone crisis in May 2010, which then led to the decision in 2011 to create a network of unlimited but still temporary swap lines among the six central banks mentioned above, and later on, in 2013, to the decision to let these arrangements to remain in place indefinitely

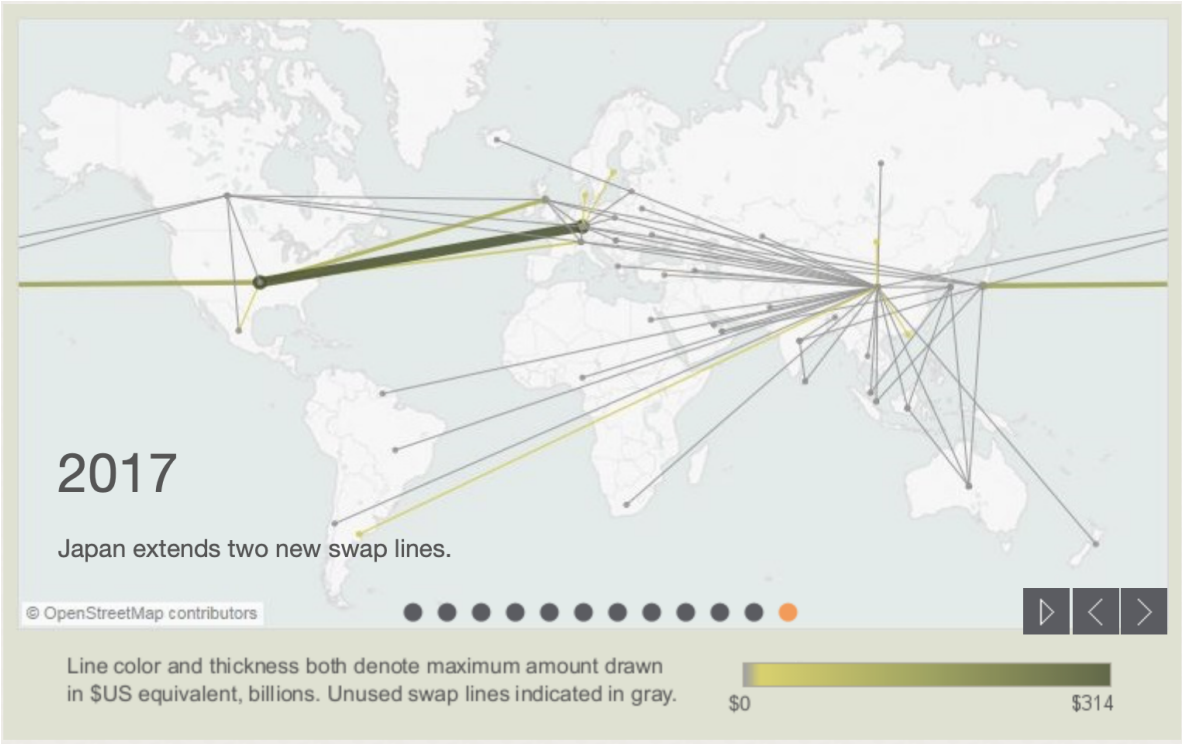
The option for swap lines has also to be understood vis-a-vis its benefits when compared to discount window or borrowing in the dollar private market or going to the foreign exchange market for dollar. These more traditional options to provide dollars can either put pressure on local currency or exhaust the central bank's dollar reserves (Obstfeld, Shambaugh & Taylor, 2009, p. 484). Furthermore, the cost of borrowing must also be considered. The covered interest parity (CIP) had a large spike after 2007, which "created the need for a ceiling as banks have found it expensive to respond to funding shocks in other currencies" (Bahaj and Reis, 2018, p. 9).

Following the argument of economic adequacy, the ECB (2014) made clear that swap lines were designed to contain funding costs faced by the euro area banks when fulfilling their structural funding needs, while ensuring consistency with the domestic operations of the Federal Reserve. Nevertheless, the link between swap lines and a successful story is not only about easing credit market pressures but also "containing the spread between the US dollar London interbank offered rate (LIBOR) and the US dollar overnight indexed swap (OIS) rate" (p. 70). This is key considering the Libor is tallied daily by the British Bankers' Association, which decides at what rate a bank could borrow dollars from other banks. Thus, if interbank lending rate rises among these banks due to risk fears, such as the ones before Lehman collapsed, Libor will show signs of strain, causing the spread to spike.

Regardless of different economic rationales involving demands for swap lines – low reserves, cheaper borrowing, LIBOR/OIS spread –, the story behind swap lines, and more general, the global safety net, is one about a response to the dollar funding shortage outside the US. Equally important, it is a story that places the swap lines within a context of a market dysfunction, of stresses in the money market (Goldberg, Kennedy, & Miu, 2010). They effectively reduce the dollar funding pressure abroad, becoming, therefore, an important part of the toolbox to deal dealing with systemic liquidity disruptions.

The political rationale for swap lines

One can argue that the geography of swap lines is fragmented and its use inconsistent. The figure below shows all swap lines in existence in 2017. Line thicknesses show the relative size of the available swap line.



The widening scope of liquidity provision hides the fact that not every central bank requesting these credit lines were granted one. India and Chile, for example, were not qualified for swap lines while Brazil and Mexico were. Small international players such as New Zealand, Sweden and Denmark did obtain swap lines as well while Iceland did not. Japan extended swap lines, but to 'local' countries.

The shift from an 'emergency' rescue tool to a far more permanent feature of the international financial practices and monetary policy tool box was not as inclusive as it was in the beginning. Just a select group of central banks (the Fed, the ECB, the BoE, Bank of Canada, the Bank of Japan and the SNB) is part of swap network, and swap arrangements with EMEs were allowed to expire. By 2017, swap line with EMEs had carried on being a growing sector mainly due to the People's Bank of China (PBoC), notably in Mongolia's bailout. Interestingly, in this case, the emergency character this new lending facility is no longer seen, as the main purpose of the PBoC swap lines is to facilitate trade, investment and international use of renminbi rather than deal with financial instability (di Mauro and Zettelmeyer, 2017, p. 8).

The new lending facility involving the provision of liquidity to foreign banks via their respective central banks is undoubtedly an innovation of the 2007-8 GFC. Although there may not be clarity about who is allowed to play this game, especially when it comes to the EMEs, the network of unlimited swap lines among the six central banks has become a permanent (and powerful) feature of the global financial safety net, with the Fed as the ILOR, albeit not official (di Mauro and Zettelmeyer, 2017, p. 8). For Rey, (2015), this new and powerful player in the global financial safety net also finds its foundation and support in

the idea that only central banks are able to backstop the global financial system given their unlimited capacity to create money.

The Fed as the ILOLR, the inclusion of the swap lines into the monetary policy toolbox and the following discussions over its economic adequacy – most notably, their capability to ease global liquidity shortages, seem to reinforce the idea that monetary policy is an apolitical, technical area of policymaking (Marcussen, 2009). It also challenges the traditional idea of lender of last resort in two senses: i) historically, this role has usually fallen on central banks within the national context; and ii) there has been no formal international lender of last resort, although the IMF has been playing this role in the last four decades.

The international status and widespread use of the dollar is not a novelty (Cohen, 1971; Strange, 1971), so it is neither unexpected that there will be a greater need for this currency. The 2007-8 GFC global liquidity shortage was, in fact, a shortage of dollar, and the Fed is the only central bank capable of providing unlimited supply for dollars. In an attempt to prevent costly liquidation overseas, it seems only natural that the Fed became the world's de facto lender of last resort, prioritising economies more deeply integrated into global finance.

However, even if it is natural or evident that the Fed should play the role of ILOLR, it seems less obvious to understand why under what condition and under would the Fed act as a *benevolent hegemon*[14] and under what conditions (McDowell, 2012). The same type of concerns could also emerged among the public and the Congress in the US,[15] which then helped to push the Fed's main policy making body, the Federal Open Markets Committee (FOMC), to have clear conditions guiding its decision to provide swap lines to foreign central banks, especially when it comes to EMEs. Sahasrabuddhe (2019) summarises these conditions as following: "a country's economic and financial 'mass', its record of sound economic management, its importance as a US trading partner, dollar funding needs, levels of foreign currency reserves, the exposure of US banks to the foreign economy, and whether or not an economy was a global financial center" (p. 463)

The data presented in section 1, Pre 2007-8 Great Financial Crisis, show how the US financial system was deeply exposed to interbank lending, especially money market loans, to non- US entities. This exposure of US banks to the foreign economy has been more frequently analysed and confirmed by the literature (Aizenman & Pasricha, 2010; Helleiner, 2014;[16] McDowell, 2012; McGuire & von Peter, 2009; Shin, 2012).[17] McDowell (2012) particularly discusses the counterfactual on how the freezing up of the market, especially in Europe where the foreign demand for short-term dollar funding was concentrated during the GFC, brought not only "troubling" but also "system and existential" risks to the US financial institutions (p. 148).

[14] See for example (Kindleberger, 1986; Snidal, 1985).
[15] See (FOMC, 2008, p. 32).
[16] Helleiner (2014) also discuss how in other moments in history, the US government was motived to assume leadership in crisis management to protect the vulnerability of US markets and financial institutions.
[17] It is interesting to note, however, that eight of the fourteen central banks granted dollar swap lines with the Fed were not in Europe (McDowell, 2012, p. 169).

Although the exposure of US banks seems to be the most important selection criterion behind grating swap-lines, a comparison between those that did and did not receive swap lines obscures raises doubts regarding the exposure criterion. Central banks of economies where the level of the US bank exposure was not so high, such Demark, New Zealand, Norway, Sweden and Switzerland, did receive swap lines from the Fed. While countries with a similar or higher level of exposure to the countries mentioned before, such as Chile, India, Indonesia, Peru and Turkey, did not (Sahasrabuddhe, 2019, p. 465).

Trade links between the US and the potential swap lines receivers do not seem to be a consistent criterion either. For (Aizenman & Pasricha, 2010) and (Broz, 2015), there is in fact a negative and statistically insignificant correlation between US trade links and swaps. As far as good economic movement goes, Brazil, Korea and Mexico should not have received swap lines given their levels of inflation, especially when compared with countries that had experienced lower inflation, such as Chile, Peru, Iceland, but whose requests for swap lines were denied (Sahasrabuddhe, 2019, p. 486). The argument that reserve levels determined swap agreements is also dubious when considering that substantial collateral in the form of assets in the Fed or in dollar reserves were required from the only four emerging economies granted swap lines in 2008 (FOMC, 200

With a focus on emerging economies, Sahasrabuddhe (2019) argues that the FOMC's stated selection criteria do not adequately explain its choices. The author finds that political considerations were more plausible to be behind the Fed's decision. Meaning, the Fed chose countries that had a preference for greater financial openness and had gained an increased voice in the global economic governance (GEG) framework, being allies with the US within the existing governance framework and preferences for non-reform (p. 462). Countries that "had either not acquired an increased voice in GEG or were vocally opposed to the status quo governance framework as the crisis escalated" were turned down by the Fed (ibid., p. 466).

The choice based on strategic alliances in the global economy is particularly important given both the direct challenge to the centrality of the dollar in the international monetary system after the GFC and growing international influence of other financial actors. According to Helleiner (2014), governance institutions such the Group of Twenty (G-20) and the Financial Stability Board (FSB) had re-emerged to coordinate crisis management together with other economies, following the existing US-led governance framework. However, the US saw its influence threatened given the calls, by the UK and France, for example, for new thinking and international coordination and a new global financial architecture, with many emerging economies, such as India and China, trying to increase their influence and autonomy in GEG (Grabel, 2015, 2017).

The threat to the US economy and international influence leads MacDowell (2012) to argue about the Fed's defensive considerations to act as the ILOLR. It is possible to identify three spillover effects that threatened the US economy and motivated the Fed US to engage in

defensive international last-resort lending during the GFC: financial system exposure, interest rate concerns, and the appreciation in the dollar's exchange rate. The first one echoes the discussion above; the other two are slightly subtle and deserve unpacking.

When the US credit markets tightened during the GFC, the Fed began to cut interest rates in September 2007 an attempt to jumpstart lending. However, since the 1990s, the interest rate in a wide variety of financial products has been indexed to the Libor, which then stopped the interest rate in many contracts from falling. In fact, some of these rates went up, as the Libor was going up as early as the summer of 2007 due to interbank lending risk fear. This was particularly problematic given that 60 per cent of the prime hybrid[18] adjustable rate mortgages (ARMs) – and virtually all the subprime hybrids in the US – were also indexed to Libor (Parulekar, Bishnoi, Kapur, & Garg, 2008, p. 1).

As a consequence, American homeowners with either one of these ARMs started experiencing a significant hike in their monthly payment, and the continuous increase in the Libor could bring about "a second wave of foreclosures as more ARMs prepared to reset at even higher and more unsustainable interest rates" (McDowell, 2012, p. 170-171). To stop this cycle from fully developing, the US needed to try and bring Libor rates under control. Easing the risk and tension in the international interbank lending market in dollars that was pushing the Libor up seemed to be was the obvious thing to do. This intervention had include the foreign banks as well, especially because out of the 16 banks that are polled daily to determine the Libor rate, 13 are non-US institutions. Swap lines were the most suitable candidates. They delivered dollars to these banks, easing the demand for dollars among themselves and bringing the rate they charged each other for dollars down. As a consequence, the Libor rate dropped (ibid., p. 172).[19]

On the appreciation of the dollar, by the summer of 2008, the US exchange rate began one of its steepest periods of appreciation since it began floating in 1973. One of the reasons for this can be found yet again on the consequences following the tightening up of the credit markets, which led foreign banks to rely more heavily on the FX swap market for their short-term dollar funding. The turn of market participants to the global FX market plus the reluctance of US banks to lend money created a dollar shortage and an increase in the cost of borrowing. This, in turn, might have contributed to a sharp appreciation of the currency in late 2008 (McCauley and McGuire, 2009, p. 89). While the dollar appreciation surely had other causes, an interesting trend emerged when the swap programme peaked in size (the end

[18] Hybrid refers to mortgages that begin with a fixed interest rate for the first two or three years and then reset (monthly, semi-annually, or annually) based on the rate to which they are indexed (Schweitzer & Venkatu, 2009).

[19] The TED had several spikes during the crisis. Interestingly, in the first spike, August 2007, 240 bps, the Fed first approached the ECB about opening up a swap line between the two central banks. In the second spike, December 2007, 220 bps, the Fed opened its first two swap arrangements on the same day. The third spike, March 2008, 203 bps, there was the first swap line increases. Finally, when Lehman filed for bankruptcy, the spread peaked at 457 bps, and the Fed's swap programme entered its "dramatic" 40-day period of expansion (Bloomberg, 2010).

of October 2008), i.e., there was an inverse relationship between total aggregate swap drawings and the dollar's nominal value (McDowell, 2012, p. 173).

Overall, political and defensive considerations behind the Fed's decision to grant swap lines to those who requested add an extra layer to the discussion about the economic adequacy and efficacy of swap lines. Although it is impossible to deny that the ultimate outcome was one where the entire system benefited from the stability provided by US intervention, the nature and features of the ILOLR and the swap lines use (and permanency) as a monetary policy tool are yet to be clarified.

4. Implication and welfare consequences of swap lines

Implications related to the use of swap lines

Given the swap lines mechanism and context explained in the previous sections, it is a fair concern to wonder how the significant liquidity provided the swaps lines affect inflation, exchange rate, current account and the profit, if any, made by any of the institutions involved.

Although the currency in circulation in the source country increases, authors such as Bahaj and Reis (2018) argue that the swaps line are consistent with controlling inflation because this increase meets a demand for that currency. For them, it is also important to note that

the swap-line rate is set as a spread over the short-term interest rate used for inflation control, so when the latter moves, so does the swap-line rate, again with no direct implications for source-country inflation (p. 6).

On exchange-rate risk, swap lines, as already explained, are based on the market exchange rate at the time of the initial transaction. In this sense, when the swap is reversed, the two parties go back to the same quantity of their currencies at the initial transaction's exchange rate. Thus, they are insulated from exchange risk, i.e. the losses (or gains) due to fluctuations in the two currencies' exchange rates (Edwards, 1985; McDowell, 2012).

Bahaj and Reis (2018) also argue that there is no exchange-rate risk or interest rate risk for neither of the countries involved in the swap lines agreement. If anything, these swap lines are different from the swap lines used in the past. That is, they are not used to obtain the foreign currency needed to sustain a peg. The terms of the swap agreement are set when the contract is signed. Thus, they are not direct exchange rate interventions. The modern swap lines should not be understood as the source-country using its currency to buy the recipient-country currency and prop up its price. They argue that the large bulk of dollars lent out by the Fed went to the ECB, the Bank of England, and the Bank of Japan had "no explicit target or policies for intervening in the value of their currency vis-a-vis the dollar" (p. 6).

On the discussion on the risk borne by each central bank, the literature is more controversial (Kohn, 2014). In the ECB (2014) Monthly Bulletin, for example, it is argued that these swap lines "represents a monetary policy instrument in which risks are shared at the Eurosystem level" (p. 68). Furthermore, the bulletin also explains that "when providing foreign currency against the regular eligible collateral, the Eurosystem needed to protect itself from the risk of adverse exchange rate movements". Thus, "the implied costs of the US dollar provision also depended on the cost of the collateral that banks had to post" (p. 71).

For Bahaj and Reis (2018) the credit risk for the source central bank is relatively insignificant since it deals solely with the recipient central bank. For the recipient central bank itself, the credit risk is the same as any other liquidity facility to its banks that, in turn, have their funding needs met. The authors also highlight that because of the terms of the agreements, the recipient central bank makes no profit from swap lines operation while the source central bank only profits from the spread over the rate on reserves it charges.

Regarding current account imbalances, Bahaj and Reis (2018) argue that the swap line is a short-term liquidity program and is reverted in a short period of time, with no policy conditionality. The idea behind the mechanism is to replace private funding, with little effect on net positions (p. 6).

Overall, on top of being taken as an important tool to deal with systemic liquidity disruptions and dollar funding pressures abroad and stresses in money markets, central bank swap lines have been positively seeing as a standing lending facility of dollars to the recipient country, as a supplement to the traditional private funding markets and an instrument that lowers funding costs of banks and in doing so increased funding to firms across borders" (Bahaj & Reis, 2018, p. 4).

An assessment of the welfare consequences of central bank swaps

This scenario above makes the swaps lines not only a big new player within the global safety net practices and policies but a flawless one. To understand what this may be the case, we need to go back to an often-overlooked point in this debate, i.e., the prerogative that an assessment of the welfare consequences of central bank swaps depends on the problem that they are considered to be solving.

Take for example, pure liquidity crisis (Sachs, 1983). In this type of crisis, the borrower loses access to capital market because lenders expect them to but not because they are insolvent. As a consequence, given this expectation, lenders refuse lending and the crisis becomes self-fulfilling. This type of crisis can make good use of a LOLR who can lend to solvent countries (or banks) when the capital markets are closed to these borrowers. In this situation, whoever assumes the LOLR role cannot be a source of moral hazard, as the repayment are certain (no solvency problem) and not party incurs any loses. Here the LOLR steps in to remove a (inefficient) coordination failure among creditors – a market failure.

Nevertheless, pure international liquidity crises of the type that would preclude any moral hazard are virtually non-existent, so a literature did emerge looking at the moral hazards associated with LOLR. This literature takes on board the changes of international finance after 1970s and the financial integration the followed. It considers, for example, the radical change in the potential beneficiaries and losers of financial crises (there is a new class of beneficiaries called international creditors, for example), the new channels of financial contagion, which made much more difficult for the LOLR (usually the IMF) to reduce the spillovers of crises across countries,[20] and the need of rescue mechanisms with a much more complex web regarding who stood to gain or lose.

The LOLR in this context is very like to be a source for moral hazard "at the expense of the *international* taxpayer in the event of large-scale crisis lending to countries with solvency problems" (Barro, 1998). Furthermore, there might also be moral hazard at the expense of other countries, if the LOLR and the proposed tool do not fully protect other countries from contagion; and a "moral hazard at the expense of the *domestic* taxpayer that ultimately needs to repay the international lender (Jeanne, Ostry, & Zettelmeyer, 2008).

In this sense, the financial integration clearly created a new rationale for an 'international' lender of last resort (ILOLR) to deal with liquidity crises (Cohen, 1971; Fischer, 1999; Strange, 1971). However, it also increased both the potential for the so-called international financial safety net to do good and the risk that it might do harm. In context, it seems reckless to not ask both questions *What type of crisis the 2008-7 GFC was? Can swap lines have a detrimental impact on welfare?*

One can make the argument that many of the analyses assessing swap lines are assuming a similar design approach to Diamond and Dybvig (1983) where banks are stable and solvents with no economic fundamental problem. In this setting, the 2007-8 is assumed to be sunspot event and swap lines, therefore, similar to pure liquidity crisis, cannot be a source of moral hazard or if it they are, it is empirically irrelevant.[21] That is, if banks are solvent but suffer from panic bank runs, then swap lines can be welfare enhancing because the are a response to a market failure. In this case it is that banks cannot adequately see the liquidity needs of depositors. If for any reason depositors decide to withdraw beyond the expectation of a bank, then providing liquidity insurance, i.e., the swaps, is a valuable and welfare enhancing policy, removing an (inefficient) unforeseeable changes in behaviour – a market failure. Of course there will be by-product distortions, as with all interventions. Therefore, the availability of the liquidity comes at a price to deter excessive risk taking.

The issues here, as raised in the section one, are two-fold. First, it seems unconvincing to place the 2007-8 GFC within a belief-driven run and sequential service constraint. Second, it

[20] This is particularly important as spillovers via financial centres and confidence effects were much harder to contain.

[21] It should not be a surprise, therefore, that concerns on whether or not swap lines can be a source of moral hazard are only marginal in the literature dealing with swap lines. See, for example, (Denbee, Jung, & Paternò, 2016; IMF, 2016; Obstfeld, 2009; Papadia, 2013). A notable exception is Di Mauro and Zettelmeyer (2017).

seem doubtful assume that banks in the pre 2007-8 GFC and during were stable or solvent. If swap lines are to solve a market failure (the coordination or Diamond-Dybvig run problem), this happens when there is nothing wrong with the institutions, but there is a sunspot event which triggers a run and the nature of the constraint leads to a socially inefficient run. This justifies LLOR and therefore swaps. However, this approach does not explain why the CIP market broke down in the first place, for example. This is left unsaid. Was it a sunspot? No, not necessarily. We now know that the counterparties were very weak and the information slowly became revealed.

In this sense, it is more plausible to consider an alternative approach, namely, the information or fundamentals-driven bank run. In this case the bank may be either insolvent or possibly insolvent. Once this information is revealed then the run begins. There are two market failures here: first, the bank is unable to see the credit worthiness of each other; and second, the central bank cannot fully monitor the riskiness of the banks in its jurisdiction. The correction of the first market failure with swap lines playing the role of LOLR leaves open if the total welfare improves, given the second market failure. This dual constraints approach is similar to (Jacklin & Bhattacharya, 1988).

According to Lipsey and Lancaster's (1956) Theory of Second Best, there is no welfare model to suggest that mitigating one of the two constraints will lead to a welfare improvement. For example, swaps may mitigate the risk of an interbank run (it is simply a foreign currency LOLR function) but at the same time encourage excessive foreign currency borrowing or risk taking at another time which cannot be seen by the central bank (by assumption). In this case the swaps may in fact reduced welfare.

The second market failure may be a significant problem for the use of swap lines as LOLR. Yes, the recipient central bank is indeed an agent that bears the credit risk. However, we may ignore the lessons from the 2007-8 GFC when assuming, like Bahaj and Reis (2018) do, that the term and operation of swap lines guarantee that recipient central banks will be able to effectively monitor the banks in their jurisdiction and choose the most liquid collateral from their banks, especially because we should not assume either that recipient central banks would have fully information about asset's quality of their banks.

At a more general level, it seems plausible to assume that moral hazard is always a possibility within swap lines because its use involved a mix between liquidity and solvency problem. We could then be dealing with quite a few moral hazard channels associated with swap lines.

1. The guarantee of foreign currency by central banks may induce risk-taking behaviour.
2. The lower interest rate for foreign currency means it might increase the danger of credit booms financed by short-term lending;

3. Swap lines could foster currency mismatches on the balance sheets of households and firms indebted in foreign currency, resulting in mass bankruptcies if the domestic currency depreciates;
4. It could expose the source central bank to credit risk, especially because, different than standard official crisis lending, there is no conditionality that would ensure that it gets repaid (di Mauro & Zettelmeyer, 2017, p. 20).

With the decision, in 2011, to create a network of unlimited but still temporary swap lines among the six main central banks (the Fed, the ECB, the BoE, Bank of Canada, the Bank of Japan and the SNB), made permanent in 2013, it is believed that some of these moral hazards have been mitigated. To start with, swap lines among these banks are assumed to be highly selective *ex ante*. These central banks belong to countries that would certainly passed the test that the IMF requires as a condition for access to its flexible credit line. Second, these central banks have increasingly become (re-)involved in banking supervision.[22] Thus, whoever is playing the ILOR "has the information about banks' asset quality and, more importantly, the micro- as well as the macroprudential tools to deal with imbalances". Third, these central banks are part of a small and close community, which meets regularly and pushes for transparency. Finally, overall central banks tend to be concerned about protecting the independence of their respective monetary authorities, so they would be reluctant to take on risky assets and keen to avoid accusations of being politically motivated (di Mauro & Zettelmeyer, 2017, p. 20).

The moral hazard discussion is more problematic for EMEs. Their swap lines were allowed to expire and, as for now, these economies are in a 'constructive ambiguity' type of situation, i.e., the credit lines are not closed but not open either. This uncertainty can be explained by the fact that source central bank has no information about banks' asset quality in the jurisdiction of these EMEs central banks. It is important to reiterate that swap lines constitute a radical departure from the traditional model of international crisis lending (IMF), where there used to be an agreement with the debtor government, which was typically followed by a policy conditionality. These credit lines avoid the IMF stigma and bypass the policy conditionality imposed on national governments, which can indeed be very attractive but at the same time may not prevent or avoid moral hazards,[23] such as the losses of national taxpayers forced to rescue banks after a credit boom that benefited only a few, or incentives for policy makers to be less careful about avoiding crises.

Overall, assuming that the 2007-8 GFC was a massive bank run driven by information or fundamentals, we are probably dealing with a situation of two market failures, which –

[22] For example, the ECB has recently received the mandate for banking supervision within the euro area.
[23] In order to mitigate moral hazard, Destais (2014) proposes a repository of central bank swaps at the IMF or at the BIS to create transparency about the swap networks. Truman (2011; 2013) proposes similar ideas and argues that this is necessary to help to legitimise their swap lines as de facto international lenders of last resort. di Mauro & Zettelmeyer (2017), considering merging economies and small industrial countries, argue that these countries have to pass the pre-qualification test associated with the access to the IMF's Flexibility Credit Line (FCL) in order to have access swap lines.

according to the Lancaster and Lipsey's Theory of Second Best – leads us to a situation where we do not really know if the use of swap lines will lead to a welfare improvement.

5. Conclusion

In the new politics of money, central bank swap lines are positively seen as a standing lending facility of dollars to the recipient country, a lender of last resort and a big new player within the global safety net practices and policies. However, a closer look to the literature assessing swap lines show two important points.

First, assessing the global liquidity shortage of dollar behind and 2007-8 GFC and understanding the swap lines as the LOLR should also scrutinise under what condition would the Fed to do so. Despite a list of criteria put forward by the FOMC, the decision to grant swap lines is also very much based on political and defensive motives. These motives may explain both the lack of consistency on the Fed's choice to who was entailed to swap lines and the granting of swaps to countries whose [un]sound economic management would definitely not pass the type of IMF test of conditions that could avoid or mitigate some type of moral hazards.

Second, the Diamond-Dybivig paradigm, albeit seminal to analyse financial crisis and bank runs, may not be enough to give us the entire picture behind the demand, use and the welfare consequences of swap lines. If the "wholesale market froze" pre and during the 2007-8 GFC, it was because information was revealed that their counterparties were in trouble and so by implication the authorities could not (and cannot) monitor them fully, if at all. Thus, are we all really happy to base policy on the idea of Diamond-Dybvig like interbank runs?

If we are not in Diamond-Dybvig's world, we are then in the world of where there are two or more markets failures. There is no economics to say that in this world deposit insurance such as swap lines, leads to a better outcome. We just cannot say. In this case we have a major intervention and established policy tool but what might justify this new policy?

A condition of moral hazard, where there are two or more market failures at the same time will lead to an even worse outcome. But the reason for a different view goes back to whether the framework of analysis is sunspots or fundamentals-driven bank runs. The last decade surely makes us pause for thought and debate before agreeing to accept such policy measures. The political and defensive motives behind swap lines are an important part of the puzzle which must be understood.

Ranging from optimistic views where swaps are taken as the most notable example of central bank cooperation in history among countries that had too few reserves to keep up with a 'torrential downpour'[24] day to sceptical views highlighting the political aspects of

[24] Obsfeld, Shambaugh & Taylor (2009) highlight that international reserves are the ultimate rainy day fund for a country, but the 2008-7 GFC was more than a rainy day, it was a "torrential downpour" (p. 486).

swap lines, which favoured and defended a US-centric governance system, we seem to be unclear about the nature and features of this 'modern' ILOLR and its use (and permanency) as a monetary policy tool. Further research is required.

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