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The Federal Reserve's Dollar Swap Lines and the European Central Bank during the global financial crisis of 2007–2009

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Although the literature has studied the role of the Federal Reserve as the global lender of last resort in 2007–2009, many aspects of the Dollar Swap Lines to the European Central Bank need further exploration. Accordingly, we provide original evidence about the auction operations, allotted amounts, and interest rates with regard to the Federal Reserve's dollar swaps and the European Central Bank's dollar provision. More specifically, we examine the demand side of the Dollar Swap Lines (whereas the existing literature mentions the supply side only) and we scrutinise the interest rate (whereas the literature concentrates on volumes) set by the Federal Reserve, and also the rate set by the European Central Bank. Our findings cast light on the nature of the relationship between the Federal Reserve and the European Central Bank. Finally, we contribute to the literature on the global lender of last resort by coining the notion of the financial dilemma, under the dollar system within a framework of globalized financial markets.

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Emmanuel Carré and Laurent Le Maux

Although the literature has studied the role of the Federal Reserve as the global lender of last resort in 2007–2009, many aspects of the Dollar Swap Lines to the European Central Bank need further exploration. Accordingly, we provide original evidence about the auction operations, allotted amounts, and interest rates with regard to the Federal Reserve's dollar swaps and the European Central Bank's dollar provision. More specifically, we examine the demand side of the Dollar Swap Lines (whereas the existing literature mentions the supply side only) and we scrutinise the interest rate (whereas the literature concentrates on volumes) set by the Federal Reserve, and also the rate set by the European Central Bank. Our findings cast light on the nature of the relationship between the Federal Reserve and the European Central Bank. Finally, we contribute to the literature on the global lender of last resort by coining the notion of the financial dilemma, under the dollar system within a framework of globalized financial markets.

1. Introduction

The Dodd-Frank Act adopted in May 2010 forced the Federal Reserve, exceptionally, to lift confidentiality on its credit facility programmes (Government Accountability Office, 2011). The Federal Reserve was thus accountable to the United States Congress for the counterparties and the corresponding amounts. It was then revealed in December 2010 that the most emblematic facility programmes undertaken by the Federal Reserve had contributed to supporting non-US commercial banks, and especially European commercial banks. In addition, the dollar swap lines granted to fourteen central banks, notably to the European Central Bank, were the largest programme, representing almost a quarter of the Federal Reserve's total assets between October 2008 and January 2009. Any attempt by the Congress to narrow the intervention of the Federal Reserve with respect to the US banking system alone may, however, conflict with the effects of financial globalisation. During the financial crisis of 2007–2009, the global activities of US banking and financial institutions partly required the Federal Reserve to extend its responsibilities not only beyond its ordinary operations, but also beyond the banking system's national borders. These dollar liquidity facilities raised a new dilemma—which we term the *financial dilemma*—that the Federal Reserve had to solve: on the one hand, it could ration dollar provision so as to contain moral hazard, but thereby exacerbate systemic instability within globalised finance; on the other hand, it could supply dollars liberally, but thereby encourage risk taking and triggering political struggle with the Congress. In

this paper, we find evidence that the financial dilemma created tension over the need for dollar liquidity and over the interest rate set by the European Central Bank. We show how, after its decision on September 16 and its announcement on October 13, 2008, the Federal Reserve passed dramatically from one horn of the financial dilemma to the other. This new dilemma differs from the Triffin (1960) dilemma inasmuch as it does not concern only international monetary reserves (Seghezza, 2018), but is rather concerned with the global financial (in)stability.

The phrase *global* lender of last resort (Obstfeld, 2009; Walker, 2010; Broz, 2015; Mehrling, 2016) has tended to replace that of *international* lender of last resort, coined by Hawtrey (1932). In the context of the gold standard regime, characterised both by the free movement of capital and the convertibility into gold specie at a fixed rate, the international lender of last resort made emergency loans by transferring metallic reserve. Under the Bretton Woods system, reciprocal central bank swap arrangements addressed foreign exchange crises affecting parity between gold and the dollar and pegged but adjustable exchange rates between the dollar and other currencies (Coombes, 1976). At the same time, controls on international capital movements circumscribed the function of the lender of last resort to the national level and the International Monetary Fund granted temporary advances for funding disequilibria in the balance of payments. In the context of financial liberalisation and the fixed exchange rate adopted by emerging countries in the 1990s, the function of the lender of last resort regained its international status. One view was to argue that the International Monetary Fund should assume the role of international lender of last resort (Fischer, 1999; Goodhart, 1999), while the other view was that the Federal Reserve should do so (Keleher, 1999). We explore the new scope of the lender of last resort in light of the global financial crisis in 2007–2009. Empirically, we find data about the auction formats, allotted amounts, and the interest rates on dollar provision by the Federal Reserve and the European Central Bank. Theoretically, we pay heed to the endogenous process, which depends on (i) financial innovations from the country issuing the international money, (ii) the liberalisation of international capital flows, and (iii) the ensuing interdependency between US and non-US financial institutions.

Notwithstanding the considerable amount of liquidity created through the Federal Reserve's Dollar Swap Line programme in 2008–2009, the related literature remains relatively scarce. Fleming and Klagge (2010) and Goldberg, Kennedy, and Miu (2011) examine the disruptions in the dollar funding markets, the initial structure of the dollar swap line programme, and the changes in breadth and volume of the funding conditions in response to the worsening financial crisis. Allen and Moessner (2010), Allen (2013), and Denbee, Jung, and Paternò (2016) study currency swap arrangements and international liquidity provision with emphasis on the notion of central bank cooperation and the safety network. Seghezza (2018) inspects the central bank swaps as a means for reducing the demand for foreign exchange reserves. Aizenman and Pasricha (2010) and Duran (2015) analyse the dollar swap arrangements in emerging market economies. Allen, Galati, Moessner, and Nelson (2017), Bahaj and Reis (2018) assess their impact on deviations from covered interest parity (the euro-dollar swap spread). McDowell (2012, 2017), Helleiner (2014, pp. 6-7, 43-4), and Morelli, Pittaluga, and Seghezza (2015) study the intervention of the Federal Reserve from the perspective of International Political Economy. Broz

(2015) explores the motivations behind the Federal Reserve's global lending, the response of the Congress in 2010, and the proposal for a Federal Reserve Transparency Act in 2012.

In this paper, we find evidence about the auction operations, allotted amounts, and interest rates with regard to the Federal Reserve's dollar swaps and the European Central Bank's dollar provision. With regard to the supply side, we scrutinise the interest rates (whereas the literature focuses on volumes) set by the Federal Reserve. Furthermore, we examine the demand side of the Dollar Swap Lines (whereas the literature refers to the supply side only) and the interest rate set by the European Central Bank. An important issue, not explored in the literature, is to ascertain how the European Central Bank loaned dollars received from the Federal Reserve. We fill this void by presenting original evidence about the dollar provision and the interest rate set by the European Central Bank. From the qualitative viewpoint, we rely on all transcripts of the meetings and conference calls of the Federal Open Market Committee from August 2007 to December 2008 (hereafter, FOMC Transcripts), hearings before the several committees of the Congress from September 2008 to February 2012 (hereafter, US Congress), and various speeches of members of the Board of Governors of the Federal Reserve System (hereafter, Speech), in order to discern the guidelines laid down by the Federal Reserve. Our findings shed light on the nature of the relationship between the Federal Reserve and the European Central Bank under the context of dollar-denominated banking system and globalized financial markets. We depart from the view that central bank swaps would contribute to building a horizontal safety network through cooperation and we show that the Federal Reserve was self-interested at the national level but at the same time found itself at the apex of the hierarchical structure of central banking at the international level.

The remainder of this paper proceeds as follows. Section 2 outlines the effects of financial globalisation, and the unprecedented policy of the Federal Reserve from 2008 to 2009 in supporting non-US banks. In Section 3, we present the Federal Reserve's dollar swap operations with the other central banks (hereafter, we shall use the term 'central banks' to designate central banks other than, and in relation with, the Federal Reserve). In Section 4, we present evidence about the relations between the Federal Reserve (the supply side) and the European Central Bank (the demand side), and the ensuing interest rate. Section 5 presents original evidence about the dollar provision and the interest rate set by the European Central Bank. Section 6 provides analytical considerations on the financial dilemma, which we separate from the monetary dilemma formulated by Triffin (1960) at the onset of the Bretton Woods period. Section 7 concludes.

2. The Federal Reserve and financial globalisation

The Federal Reserve's global lending in 2007–2009 resulted from a twofold evolution of the international monetary and financial system. The first evolution is related to the international status of the US dollar since the end of the Bretton Woods system (Subacchi, 2008; Goldberg, 2010). Deposits and credits in dollars outside the United States—the Euromarkets—continued to expand in Europe (Gibson, 1989), but the increased indebtedness in dollars of European commercial banks did not put the

Federal Reserve in the position of the global lender of last resort. The second evolution refers to financial globalisation, and this appears to be crucial. Financial innovations such as securitisation and credit derivatives such as asset-backed and mortgage-backed securities and collateralised debt obligations have thrived in the United States (Ashcraft and Schuermann, 2008). In the context of the liberalisation of international capital flows, European commercial banks held these US financial products through cross-border banking and shadow banking. They financed them through structured investment vehicles and with short-term funding *vis-à-vis* US banking institutions in the repurchase agreement or commercial paper markets (Acharya and Schnabl, 2010; Shin, 2012). McGuire and von Peter (2009) describe net dollar-denominated foreign positions (defined as long-term assets minus short-term liabilities) of European banks from 2000 to 2009. They give evidence of the diversity of ways in which those banks met their dollar funding requirements.

One measure of the dollar shortage in the funding market from 2007 to 2009 is the increase in the spread between the term interbank (Libor) rate and the overnight-index-swap (OIS) rate (Taylor and Williams, 2008). Another measure is the increase in the euro-dollar swap spread, which ordinarily converges to zero once arbitrage in foreign exchange markets can take place. This deviates from the interest rate parity in stressed conditions, when arbitragers cannot borrow enough dollars (Baba and Packer, 2009a, 2009b; Grad, Mehrling, and Neilson, 2011). However, these two measures of liquidity shortage do not capture the effect related to the commercial banks' jurisdiction (US and non-US). Fleming and Klagge (2010, p. 5) examine this jurisdiction effect in calculating the spread between the average borrowing rate of the thirteen non-US banks and the average borrowing rate of the three US banks, among the sixteen banks of the dollar Libor panel. They show that the spread rose at the onset of the financial crisis in August 2007 and soared in the wake of the Lehman brothers collapse in mid September 2008. In fact, European banks and their subsidiaries mainly funded their long-term asset purchases in the repurchase agreement and commercial paper markets (wholesale funding), whereas US banks could rely to a greater extent on dollar deposits (retail funding) covered by the supervisory authorities. Insofar as runs took place in the wholesale markets, European banks rolled over their short-term debts in dollars with difficulty (Baba, McCauley, and Ramaswamy, 2009). In turn, US banking institutions, holding claims on European banks, were exposed to high counterparties and finally failed to play their role as market makers.

The twofold evolution of the international monetary and global financial system respectively created both a supply of (due to the internationalisation of the dollar) and demand for (due to financial globalisation) liquidity from the global lender of last resort, when the dollar funding markets collapsed. As Minsky (1985) early pointed out, the Federal Reserve is, from the supply side, 'responsible not only for maintaining orderly conditions in the domestic money market but for a vast network of offshore banking that is denominated in its currency and which leads to serious positions by offshore banking institutions in its domestic money market' (ibid, p. 13). Accordingly, 'the Federal Reserve is the *de facto* lender of last resort to the international financial structure [...], to the world dollar-denominated banking system, regardless of where the banks that have the dollar book are domiciled' (ibid, p. 15). From the demand side, 'the US financial structure depends on the continued

use of the dollar as the international currency of denomination,’ and *in fine* on the action in last resort of the Federal Reserve ‘not just for US chartered organizations but for all banks that run dollar-denominated books’ (ibid, p. 16).

The Federal Reserve’s response to the global financial crisis entailed the enlargement of the spectrum of collateral, and also for a broader range of counterparties (US and non-US). In this regard, the Term Auction Facility and Commercial Paper Funding Facility were the most substantial of the Federal Reserve’s facility programmes between 2007 and 2010 (Government Accountability Office, 2011, p. 137). Impressively, non-US banks received almost 65% of the amounts allotted via the Term Auction Facility and 60% of those allotted via the Commercial Paper Funding Facility (Table 1).¹ It may be pointed out that, under these facility programmes, the Federal Reserve set the interest rate by implementing the market format and this interest rate was similar (single price) for all banking institutions (US or non-US). Although all of the facility programmes were publicly announced when they were initiated from 2007 to 2009, the names of the counterparties were only disclosed to the Congress in December 2010, that is, two years after the height of the financial turmoil. According to the Board of Governors (2011, p. 1), the confidentiality of the names of the counterparties and borrowers remained consistent with the central banks’ practice: ‘Releasing the names of these institutions in real-time, in the midst of the financial crisis, would have seriously undermined the effectiveness of the emergency lending and the confidence of investors and borrowers.’

Table 1: Total amount by parent banks’ domiciliation for the Term Auction Facility and Commercial Paper Funding Facility programmes (percentages)

Term Auction Facility		Commercial Paper Funding Facility	
United States	35	United States	41
United Kingdom	17	United Kingdom	18
Germany	16	Belgium	10
Japan	8	Germany	9
France	7	Switzerland	9
Others	17	Others	13
Total	100		100

Source: Government Accountability Office (2011, figure 10, p. 134)

¹ The Government Accountability Office (2011, pp. 196, 231) mentions most principal non-US banks that acquired dollar liquidity through the Term Auction Facility and Commercial Paper Funding Facility programmes, and through the Discount Window. See also Shin (2012, p. 168) for amounts outstanding. On the Term Auction Facility and Commercial Paper Funding Facility programmes, see respectively Armantier, Krieger, and McAndrews (2008), Adrian, Kimbrough, and Marchioni (2011).

Since the onset of financial crisis in August 2007, the members of the Federal Open Market Committee were aware that European commercial banks were encountering growing difficulties in the dollar funding markets (FOMC Transcripts, 2007: Bernanke, Aug. 10, p. 11; Dudley, Aug. 16, p. 15) and they pointed to the spillover effect: ‘the need for dollar funding and dollar term funding by European banks [...] has caused problems in Europe but also bled over to some extent to the dollar markets in the United States’ (FOMC Transcripts, 2007: Bernanke, Sep. 18, p. 127). Until December 2007, ‘the upward pressure in term funding markets and the uncertainty about forward LIBOR rates have caused impairment of the foreign exchange swap market—a market used by many European banks to obtain dollar funding. In this market, bid-asked spreads have widened, transaction sizes have dropped, and some dealers have stopped making markets’ (FOMC Transcripts, 2007: Dudley, Dec. 6, p. 4).

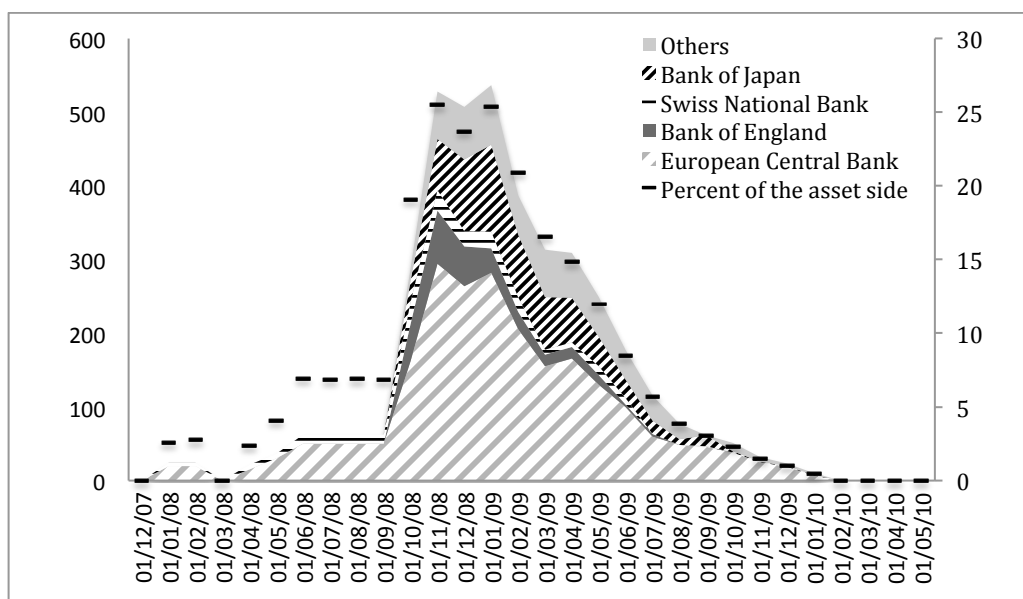
Therefore, many European banks asked for and obtained liquidity at the discount window of the Federal Reserve (FOMC Transcripts, 2007: Rosenberg, Sep. 18, p. 55; Lacker, Sep. 18, p. 146). On the one hand, ‘improved conditions in European dollar trading would guard against the spillover of volatility in such trading to New York trading and could help reduce term funding pressures in US markets’ (FOMC Transcripts, 2007: Sheets, Dec. 6, p. 7). On the other hand, once the Term Auction Facility programme was implemented in December 2007, it was ‘dominated by European institutions’ (FOMC Transcripts, 2008: Lacker, Apr. 29-30, p. 13). As a result, the Federal Reserve bore credit and asset risks for non-US counterparties. So the Federal Open Market Committee expected that the Dollar Swap Line programme would be an effective mechanism by which the Federal Reserve could transfer counterparty and asset risks to other central banks.

3. The Federal Reserve and the Dollar Swap Lines

Until the 1990s the currency swap agreements between central banks had been in place to circumvent tension on the foreign exchange market. During the financial crisis of 2007–2009, central bank swap agreements were different both in degree (unprecedented in monetary history) and in nature (mainly depending on financial globalisation). The Federal Reserve decided on December 6, 2007, to authorize ‘reciprocal currency arrangements (swap lines) with the European Central Bank and the Swiss National Bank’ (Board of the Governors, 2007). The Dollar Swap Lines programme became an important source of international liquidity provision (Figure 1). The format, the ensuing amounts, and the interest rate were designed as follows. On the contract date, currency swaps were set at the prevailing market exchange rate and, at maturity, dollars were repurchased at the same exchange rate. Thus, the Federal Reserve did not bear the exchange risk. In addition, the Federal Reserve provided dollars to central banks, which in turn loaned them and determined the eligible counterparties and the range of collateral. Thus, the Federal Reserve did not bear credit and asset risks (FOMC Transcripts, 2007: Geithner, Sep. 18, p. 139; Sheets, Dec. 6, p. 7; Bernanke, Dec. 11, p. 4). Officials publicly repeated that the Dollar Swap Line arrangement carried no risk to the Federal Reserve and no cost to the taxpayers. Thus, taxpayers did not subsidise the European commercial banks: the

Federal Reserve's 'counterparty is [...] the European Central Bank itself, which in turn is well-capitalized and it has behind it the national central banks of 17 countries.'²

Figure 1: Dollar swap lines with central banks (left scale, in billion dollars) and percentage (right scale) of the asset side of the Federal Reserve's balance sheet (December 2007 – May 2010)



Source: Government Accountability Office (2011, figure 25, p. 201) and Board of Governors of the Federal Reserve System, 'Central Bank Liquidity Swaps'.

Note: Dollar Swap Lines were implemented from December 17, 2007 to February 1, 2010. Fourteen central banks progressively participated in the programme, namely (by date of announcement): the European Central Bank and the Swiss National Bank (December 12, 2007), the Bank of Canada, the Bank of England, and the Bank of Japan (September 18, 2008), the *Danmarks Nationalbank*, the *Norges Bank*, the Reserve Bank of Australia, and the *Sveriges Riksbank* (September 24, 2008), the Reserve Bank of New Zealand (October 28, 2008), the *Banco Central do Brasil*, the *Banco de México*, the Bank of Korea, and the Monetary Authority of Singapore (October 29, 2008).

The design of the central bank liquidity swap agreements described above calls for a remark about the distinction between 'lending in last resort' and 'market making in last resort'. Regarding the injection of *domestic* liquidity by any central bank (for instance, the sterling provision by the Bank of England), both functions are integrated since the banking system is based on the private securities markets. The central bank provides funding liquidity and market liquidity at the same time by

² US Congress (2012: Bernanke, Feb. 29, p. 43). See also Board of Governors of the Federal Reserve System (2007), Bernanke (Speech, Oct. 15, 2008), US Congress (2008: Bernanke, Nov. 18, p. 20). Regarding the legality of the Dollar Swap Line arrangement, officials argued (US Congress, 2009: Bernanke, Jul. 21, p. 56; US Congress, 2011: Bernanke, Oct. 4, p. 13) that there had been a longstanding legal authority to implement swap lines with other *central* banks through section 14 of the Federal Reserve Act. However, these declarations say nothing about the counterparties of 65% of the Term Auction Facilities and of 60% the Commercial Paper Funding Facilities, namely, the European *commercial* banks.

purchasing private and risky securities from domestic banking and financial institutions (Le Maux, 2017). Regarding the injection of *international* liquidity, the design of the Dollar Swap Line arrangement separates the function of issuing international liquidity (for instance, the dollar provision of the Federal Reserve to the Bank of England) and the function of sustaining market liquidity in last resort (for instance, the loans in dollars by the Bank of England to British banks against private security collateral). The Federal Reserve did not bear counterparty and asset risks and only took on the role of issuer and lender in last resort at the international level. The other central banks, not able to issue dollars, plainly took on the role of market makers in last resort at their own level of jurisdiction. All in all, the Federal Reserve played the global-lender and market-maker roles through the Term Auction Facility and Commercial Paper Funding Facility programmes, and it only assumed the global-lender role through the Dollar Swap Line programme.

Another set of questions relates to the nature of the relationship between the Federal Reserve and other central banks, especially in Europe. The literature proposes the following two approaches. The first approach claims that the central bank swap arrangements take place in a global safety network organised by cooperation and reciprocal arrangements (Allen and Moessner, 2010; European Central Bank, 2014, 2016; Denbee, Jung and Paternò, 2016). According to this ‘cooperation’ approach, the Federal Reserve was not so much a lender of last resort as a participant among others in organising an international network based on reciprocity. Historically, during the Bretton Woods experience, the currency swap agreements were *de jure* and *de facto* reciprocal (Coombs, 1976, pp. 74-8; Bordo, Humpage and Schwartz, 2015, pp. 357-9). Their aim was to forestall foreign-exchange crises affecting parity between gold and the dollar on the one side, and pegged but adjustable exchange rates between the dollar and other currencies on the other side—and not to mitigate international financial crises. By contrast, the 2008–2009 experience clearly shows that the central bank swap arrangement was a response to the financial crisis and went in one direction only. The central bank swap lines were *de jure* but not *de facto* reciprocal: the Federal Reserve widely granted dollar swap lines, while the other central banks did not grant swap lines in their own currency to the Federal Reserve. Furthermore, it may also be noted that the Federal Reserve’s policy towards the central banks via the Dollar Swap Line programme was no more cooperative than it was towards non-US banking institutions via the Term Auction Facility and Commercial Paper Funding Facility programmes: in both cases, the market format initially prevailed. The Federal Reserve’s policy was even less liberal for central banks than for commercial banks: in effect, the central banks swapped their own currency at a fixed rate, while the non-US banks posted private and risky securities as collateral. In fact, the cooperation argument had been made so as to avoid the stigma associated with the *de facto* unilateral swap lines. According to the Federal Open Market Committee, the Dollar Swap Line programme pursued ‘*some sort of a cooperative arrangement*’ between the Federal Reserve and the European Central Bank (FOMC Transcripts, 2007: Sheets, Dec. 6, p. 18, emphasize added), ‘*which symbolizes the cooperation and coordination of the two central banks*’ (FOMC Transcripts, 2008: Bernanke, Sep. 16, p. 13, emphasize added). The second approach in the literature on the relations between central banks considers that the currency swap arrangements were neither the result of institutionalized cooperation, nor that of a benevolent hegemon. It is argued that the Federal Reserve’s

intervention was motivated by reasons of self-interest and specifically by concerns about the interests of the major US banking institutions (McDowell, 2012; Broz, 2015; Helleiner, 2014, pp. 43-4). It is claimed that the appearance of *ad hoc* cooperation among central banks was in fact possible only because of the convergence of the participants' interests. Nonetheless, this 'convergence' approach does not characterise the structure of the relationship of central banks between the United States and Europe from an institutional point of view.

Finally, none of these approaches examines in detail the procedures and their timing, nor the allotted amounts, nor the interest rates on the dollar swap lines. So further investigation is necessary in order to discern the nature of the relationship between the Federal Reserve and the European Central Bank. In the following sections, we provide original evidence about the Federal Reserve's dollar swaps and the European Central Bank's dollar provision, shedding light on the structure of central banking at the international level.

4. The Federal Reserve and the European Central Bank

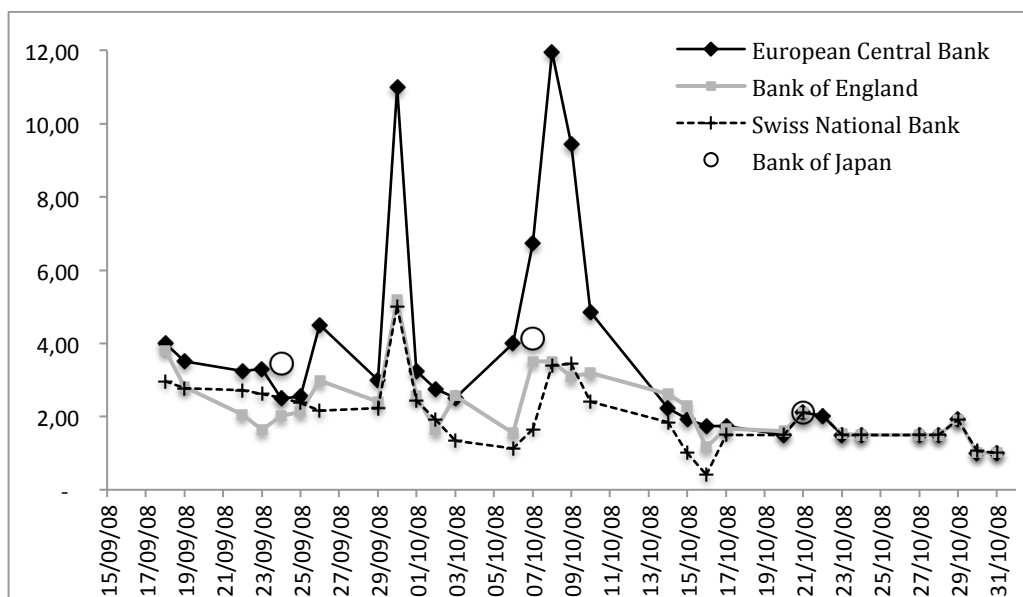
Among the fourteen central banks participating in the currency swap arrangements, the European Central Bank received almost 80% of the aggregate dollar swap lines from the Federal Reserve in 2007–2009 (Government Accountability Office, 2011, Table 24, p. 205). The Federal Reserve could choose two auction formats to carry out its facility programmes in general and the dollar swap lines in particular (Goldberg, Kennedy, and Miu, 2011). The first is the market format auctioning limited dollar amounts: within this market format, pricing can be either at a single interest rate and all allocations are made at the lowest bid interest rate (single price), or at multiple interest rates and all allocations are made at the respective bid interest rate of subscribers (multiple price). The second is the full-allotment format: the allotted amount is unlimited, the interest rate is fixed, and all bids are satisfied.

Until October 10, 2008, the Federal Reserve adopted the market format on the Dollar Swap Line programme with multiple prices so each central bank paid a different interest rate (Figure 2).³ There was a significant difference from September 30 to October 10 between the interest rate paid by the European Central Bank on the one side, and the Bank of England, the Bank of Japan, and the Swiss National Bank on the other side, which meant that the European Central Bank had a considerable need for dollar liquidity. On September 30 and October 8, the interest rate that the European Central Bank paid became exorbitant, soaring above 10%. On October 13, in order to stabilise the swap interest rate, the Federal Reserve radically modified the auction format to the European Central Bank (and also to the Bank of England, the Bank of Japan, and the Swiss National Bank). The Dollar Swap Line programme then corresponded to the full-allotment format at a fixed interest rate equal to the OIS rate plus 100 basis points (Board of Governors, 2008). The change

³ The Dollar Swap Line programme until October 10, 2008 has been likened to the Term Auction Facility programme (Goldberg, Kennedy, and Miu, 2011, p. 14). There was indeed a common feature: the auction format. The two programmes differed, however, with regard to the way interest rates were set: there was a multiple-price format under the Dollar Swap Line programme and a single-price format under the Term Auction Facility programme.

in the Federal Reserve's policy contributed to a reduction in the volatility of interest rates, which dipped by around 2% on October 14, and fell even lower in the following days and weeks. Notwithstanding the importance of the action taken on October 13, a complete examination and systematic analysis remain lacking in the literature.

Figure 2: Interest rate set by the Federal Reserve on dollar swap lines (September 18 – October 30, 2008, percentages)



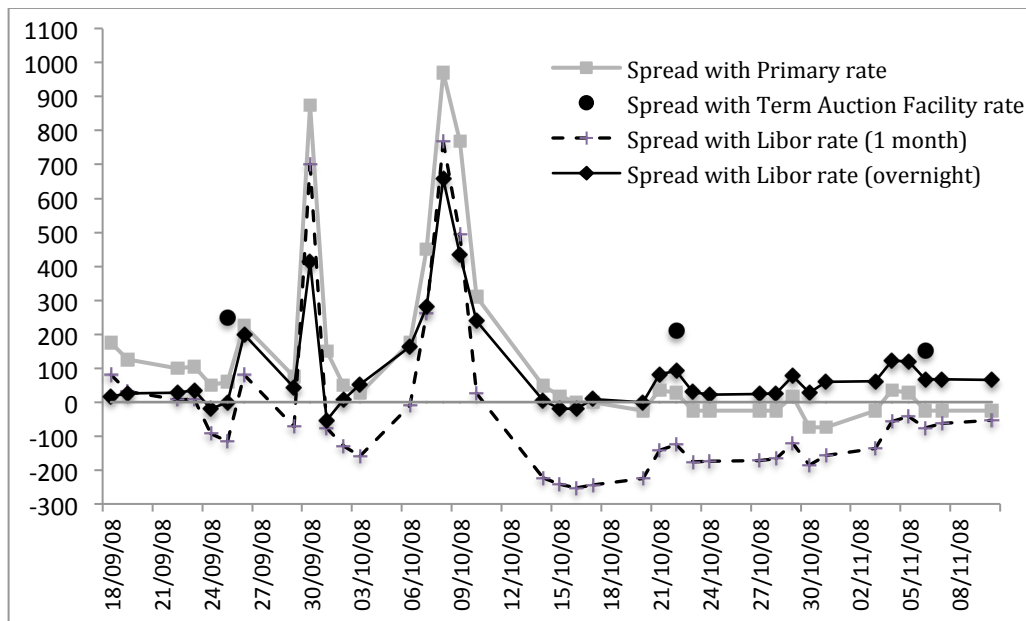
Source: Board of Governors of the Federal Reserve System, 'Central Bank Swap Lines.'

The very high interest rates raise the question of the Federal Open Market Committee's guidelines, especially between September 16 and October 13, 2008. A resolution was passed unanimously on September 16 authorising 'the Foreign Currency Subcommittee [that consists of the Chairman and Vice Chairman of the FOMC, and the Vice Chairman of the Board] to enter into swap agreements with the foreign central banks as needed to address strains in money markets in other jurisdictions. [...] The amounts are *unlimited in principle*, but the decisions will be made by the Foreign Currency Subcommittee as needed and as *appropriate for the particular circumstances*' (FOMC Transcripts, 2008: Bernanke, Sep. 16, p. 18, emphasize added). A similar resolution was passed unanimously on September 29: the Federal Open Market Committee 'authorizes the Federal Reserve Bank of New York to take the following actions to amend the existing temporary swap arrangements with foreign central banks' and 'extends the current delegation of authority to Foreign Currency Subcommittee until April 30, 2009' (FOMC Transcripts, 2008: Madigan, Sep. 29, pp. 9-10). Despite these resolutions, which potentially authorised the Foreign Currency Subcommittee to implement the full-allotment format, the Federal Reserve maintained the market format until October 13 and basically increased the number of auctions and the allotted amounts. Afterwards, the Federal Open Market Committee undertook a short discussion on October 28–29 about the deployment of unlimited dollar swap facilities since October 13, 2008, and simply described how the 'fixed-rate tender dollar auctions' were implemented: 'The ECB swap size is currently about

\$280 billion, more than half the total amount of swaps outstanding’, which ‘led to rapid expansion of [the Federal Reserve’s] balance sheet’ (FOMC Transcripts, 2008: Dudley, Oct. 28-29, pp. 4-6). It was recommended that ‘the FOMC delegate to its Foreign Currency Subcommittee the authority to approve these drawings’ (ibid, Sheets, Oct. 28-29, p. 10).

Without a more explicit statement from the Federal Open Market Committee, the outstanding question concerns the rule governing the Federal Reserve’s *interest rate* policy.⁴ The related literature on the liquidity facilities granted to the commercial banks, for instance through the Term Auction Facility programme, has documented that the Federal Reserve did not strictly practice the rule of the penalty interest rate (Hogan, Le, and Salter, 2015). However, the literature on the Dollar Swap Line programme has not analysed the Federal Reserve’s guidelines in depth. To solve this issue, we compute the spread between the swap interest rate paid by the European Central Bank and other interest rates set by the Federal Reserve (primary rate and Term Auction Facility rate) or interbank market rates (one-month Libor rate and overnight Libor rate) (Figure 3). Most of the time the spread was positive, especially prior to October 13, 2008.

Figure 3: Spreads between the interest rate paid by the European Central Bank and interest rates set by the Federal Reserve (primary rate and Term Auction Facility rate) and by the market (Libor) (September 18 – November 9, 2008, in basis points)



Source: Authors’ calculation based on Board of Governors of the Federal Reserve System, ‘Central Bank Swap Lines’, Federal Reserve Bank of New York, ‘Markets’, Datastream.

⁴ This is not the place for a thorough review of the literature on the lender of last resort and Bagehot’s dictum. We stress, however, that the rule of the *very high* interest rate formulated by Bagehot (1873, p. 197) aims at discouraging banks from demanding liquidity in first resort at the central bank’s desk, while the *penalty* rate formulated by the contemporary analysis aims at confining moral hazard. See Meltzer (1986, p. 83), Keleher (1999, p. 3). See also Bernanke (FOMC, 2007: Sep. 18, p. 147, 162), Fisher (FOMC, 2007: Sep. 18, p. 154), Bernanke (Speech, May 13, 2008), Madigan (2009).

One interpretation of the positive spread, especially until October 10, 2008, is that the Federal Reserve allegedly applied Bagehot's dictum of the *very high* interest rate in order to discourage the European Central Bank from demanding dollars at its desk too promptly. However, the rule of the very high rate would have been inconsistent with the purpose of the Dollar Swap Line programme, whereby the non-US banks could turn to the central bank of their jurisdiction to obtain dollar liquidity, and not to the Federal Reserve through the Term Auction Facility programme. It may also be added that Bagehot's dictum of the very high rate was basically a rule of conduct implemented within interbank markets, not a rule governing the relationship between central banks.

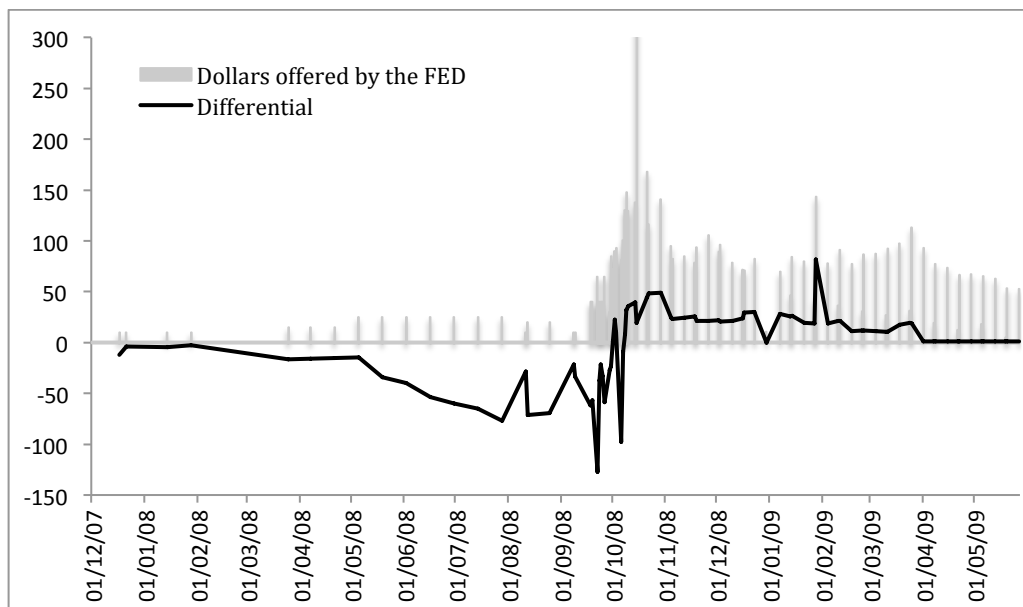
Another interpretation of the positive spread is that it attempted to counter moral hazard by applying a *penalty* rate. Had that been the case, we could then point out a twofold inconsistency in the Federal Reserve's policy. First, the rule confining moral hazard by means of a penalty rate would have been applied to central banks only (through the Dollar Swap Line programme), and not to commercial banks (through the Term Auction Facility programme). Second, such discrimination would have become highly paradoxical as central banks swapped their own currencies against dollars (with no exchange risk borne by the Federal Reserve), whereas the commercial banks posted private and risky securities against liquidity in dollars (with high asset risks borne by the Federal Reserve). Lastly, unlike central banks, commercial banks can become insolvent.

All things considered, the interest rate set by the Federal Reserve was so chaotic over the period from September 30 to October 10, 2008, that Bagehot's dictum or penalty-rate argument must be handled with care. Prior to October 13, the very high interest rate derived from both the supply side (i.e. the auction format and the delay during which the Federal Reserve decided to switch toward the full-allotment and fixed-rate format) and the demand side (i.e. the dramatic shortage in dollars from which the European Central Bank suffered). After October 13, while the interest rate paid by the European Central Bank was stabilised, it remained higher than the market OIS rate and the Term Auction Facility rate paid by commercial banks at the discount window.

5. The European Central Bank and emergency dollar provision

An important issue, not explored in the literature, is to examine the demand side of the dollar swap lines and to ascertain how the European Central Bank loaned within its jurisdiction dollars received from the Federal Reserve. Data about dollars subscribed by the European Central Bank at the Federal Reserve's desk are not publicly available over the period. In order to gauge the European Central Bank's plight, we compute the differential between the dollar amount allotted by the Federal Reserve to the European Central Bank and the dollar amount allotted by the European Central Bank to Eurozone banks (Figure 4). The differential indicates dollar rationing due to the market format (from March to mid September 2008) followed by dollar abundance resulting from the full-allotment format (from mid October 2008 onwards), with a very unstable transitory period from mid September until mid October 2008.

Figure 4: Dollar provision by the Federal Reserve to European Central Bank and differential with dollar provision by the European Central Bank to Eurozone banks (December 2007 – May 2009, in billion dollars)



Source: Authors' calculation based on Board of Governors of the Federal Reserve System, 'Central Bank Liquidity Swaps', and European Central Bank, 'History of all ECB Open Market Operations.'

The negative differential indicates that dollar liquidity pressure met by the Eurozone banks worsened. After stopping dollar funding auctions in January 2008, the European Central Bank restarted them in March 2008 and even requested a rise in the dollar swap lines, to which the Federal Reserve responded but sparingly (FOMC Transcripts, 2008: Bernanke, Mar. 10, pp. 3, 36; Dudley, Apr. 29-30, p. 7-8; Dudley, Jun. 24-25, pp. 6, 8; Dudley, Jul. 24, p. 6). Importantly, the negative differential did not result from the interest rate, which would not have been high enough to induce Eurozone banks to revert to the dollar funding markets. In fact, over-subscription showed how they met a severe coordination problem in the dollar funding markets (Figure 4), and very high rates indicated how the European Central Bank finally failed to handle the dollar shortage (Figure 2). During the transitional period from September 18 to October 10, 2008, the Federal Reserve maintained the market format. Although the number of auctions and allotted amounts increased enormously, the demand for dollar funding from the European Central Bank remained so huge that the swap interest rate climbed to very high levels. Clearly the market format was not sustainable.

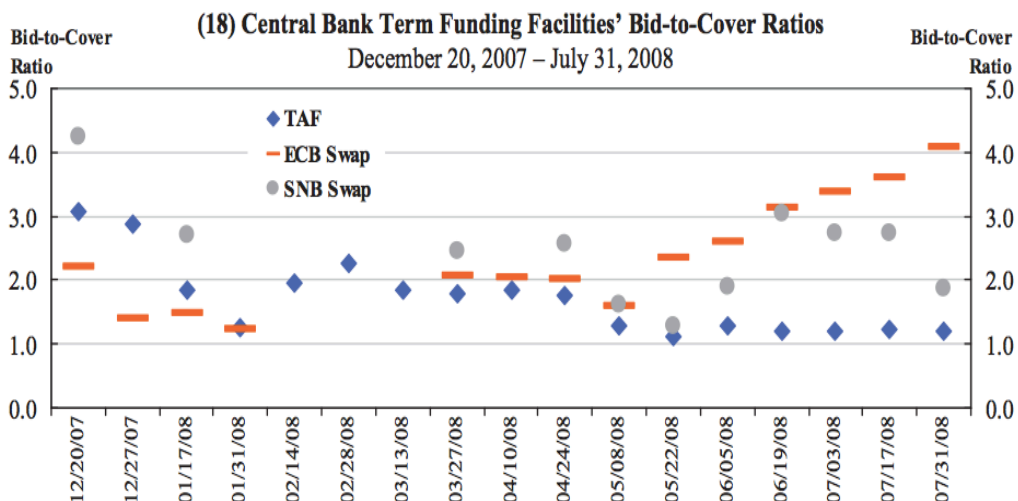
The positive differential after mid October 2008 resulted from the application of the full-allotment format by the Federal Reserve, and the Eurozone banks received all the dollar liquidity they asked for from the European Central Bank. Such over-liquidity, which indicated how the Federal Reserve dramatically changed the terms of the financial dilemma, did not result from the *ex post* uncontrolled supply of dollar liquidity. Indeed, the staff of the Federal Open Market Committee *ex ante* argued that

the ‘important thing here is credibility. In a crisis you need enough force—more force than the market thinks is necessary to solve the problem’ (FOMC Transcripts, 2008: Dudley, Sep. 16, p. 17). And it was emphasised that ‘we want to have the flexibility in case of an emergency to respond, and we also don’t want to communicate to the markets somehow that we have a hard limit that is not going to be changed. That would be potentially bad for confidence’ (ibid, Bernanke, Sep. 16, p. 17). So, in mid October 2008, ‘the Federal Reserve eliminated limits on the sizes of its swap lines [...] so as to accommodate demands for US dollar funding of any scale’ (Bernanke, Speech, Nov. 14, 2008).

The sequence from dollar rationing to dollar abundance impacted two bid-to-cover ratios that we shall respectively analyse: (i) the ratio of the amounts subscribed by the European Central Bank to the amounts offered by the Federal Reserve (hereafter, the ECB bid-to-cover ratio); and (ii) the ratio of the amounts subscribed by the Eurozone banks to the amounts offered by the European Central Bank (hereafter, the Eurozone bid-to-cover ratio).

The ECB bid-to-cover ratio. The Federal Open Market Committee provided data (authorised for public release) about the ratio of the amounts subscribed by the European Central Bank to the amounts offered by the Federal Reserve. We include the corresponding chart of the ‘ECB Swap’ (Figure 5), which reveals that the ECB bid-to-cover ratio climbed from 2 in March to 4 in August 2008. By comparison, over the same period of time, the TAF bid-to-cover ratio corresponding to the Term Auction Facility programme declined from 2.2 to 1.1. Unfortunately, the full series over the period of the Dollar Swap Line programme is not publicly available. The ECB bid-to-cover ratio runs from December 2007 to August 2008, which leaves no evidence of the effects of the Federal Reserve’s decision of October 13, 2008.

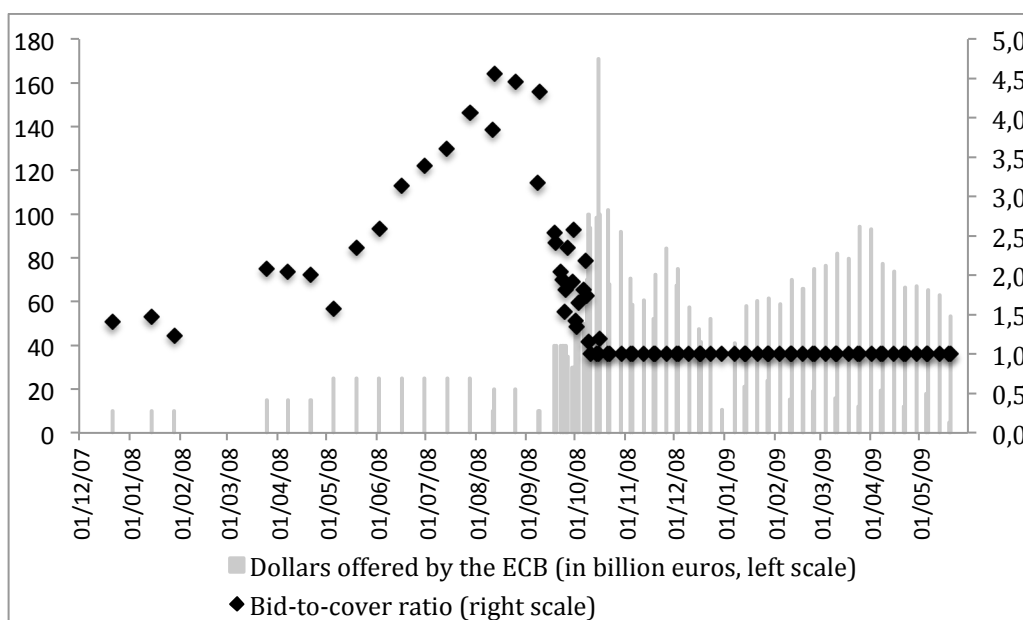
Figure 5: Ratio of dollars subscribed by the European Central Bank to dollars offered by the Federal Reserve (ECB bid-to-cover ratio) (December 2007 – July 2008)



Source: Federal Open Market Committee (FOMC, 2008 : Materials, Aug. 5, Figure 18, p. 136).

The Eurozone bid-to-cover ratio. In order to reach beyond the series publicly provided by the Federal Open Market Committee, we compute the ratio of the amounts subscribed by the Eurozone banks to the amounts offered by the European Central Bank (Figure 6). The Eurozone bid-to-cover ratio climbed from 2 in March to 4.5 in August 2008. These findings are consistent with data related to the ECB bid-to-cover ratio. Then, although it remained at around 2 during the transitory period from September 30 to October 10, the Eurozone bid-to-cover ratio was somewhat unstable. The European Central Bank attempted to respond to dollar demands but at higher interest rates. On October 15, the Federal Reserve massively allocated a total amount of 310 billion dollars to the European Central Bank, which in turn was immediately supplied to Eurozone banks. Finally, the Eurozone bid-to-cover ratio rapidly converged to 1.

Figure 6: Dollar provision by the European Central Bank to Eurozone banks and Eurozone bid-to-cover ratio (December 2007 – May 2009)



Source: Authors' calculation based on European Central Bank, 'History of all ECB Open Market Operations.'

The high level of the Eurozone bid-to-cover ratio over the period from March to August 2008 revealed Eurozone banks' difficulties. Nonetheless, the Federal Open Market Committee argued that the problem was not so much one of the dollar-liquidity demand by Eurozone banks, but one of the dollar-provision format used by the European Central Bank. Indeed, it worried that the European Central Bank did not apply the market format ('noncompetitive' auction) on dollar provision: 'As I noted in an earlier briefing, part of [the] rise of the [ECB bid-to-cover ratio] reflects the fact that the ECB auction is noncompetitive. The bids are prorated, and the [Eurozone] banks pay the US stop-out rate. Larger bids by European banks in the ECB auction do not affect the interest rate they pay for such funding, and that encourages more-aggressive bidding. Conversations with the ECB staff indicate that they are concerned that the outcome could be a bidding spiral. Individual banks

could keep raising the size of their bid submissions to ensure a stable amount of dollar funding' (FOMC Transcripts, 2008: Dudley, Aug. 5, p. 6). Thus, until its resolution passed on September 16, the Federal Open Market Committee judged that the high Eurozone bid-to-cover ratio was mainly due to an inaccurate auction format, namely the European Central Bank's 'noncompetitive' format. In other words, it was not fully recognised that the market format of the Dollar Swap Line programme and the ensuing allotted amounts of dollars were not an adequate response to the Eurozone banks' needs for dollar funding and to the European Central Bank's troubles.

At the meeting on September 16, 2008, the Federal Open Market Committee radically changed its view and emphasised the problem of the demand side. Large banks operating globally in the major financial markets, especially in Europe, had a 'structural dollar funding shortfall' so 'there was significant upward pressure in [the dollar LIBOR] market and that pressure in Europe is leaking over into our market' (FOMC Transcripts: Dudley, Sep. 16, p. 4). Therefore, as an answer from the supply side, the Federal Reserve should not 'create notions of capacity limits because the market then can always try to test those. Either the numbers have to be very, very large, or it should be open ended' and it was suggested that 'open ended is better because then you really do provide a backstop for the entire market' (ibid, Dudley, Sep. 16, p. 11).

The sequence from dollar rationing to dollar abundance that figures 4 and 6 reflect influenced interest rates set by the European Central Bank. Until October 3, the European Central Bank applied the 'noncompetitive' format for providing dollars and applied the same interest rate as was paid to the Federal Reserve. The European Central Bank acted as the conveyor belt of the Federal Reserve's policy. Until October 6, the mechanism failed. The margin, here defined as the difference between the interest rate on dollar provision set by the European Central Bank, and the interest rate on the dollar swaps set by the Federal Reserve, became negative (Table 2). The European Central Bank applied the same maturity as the Federal Reserve (except on October 6) so the difference in maturity of the dollar provision did not explain the negative margin. Because the interest rate paid to the Federal Reserve was exorbitant, the European Central Bank oddly accepted to lend dollar liquidity at a loss so as to allay Eurozone banks' distress.

Table 2: Interest rate on dollar swap lines set by the Federal Reserve, the interest rate on dollar provision set by the European Central Bank, and the margin (October 3 – October 21, 2008, percentages)

Date	Federal Reserve		European Central Bank		Margin (2)–(1) (%)
	Maturity (days)	Rate (1) (%)	Maturity (days)	Rate (2) (%)	
<i>October 3</i>	3	2.51	3	2.51	0
<i>October 6</i>	1	4.0	85	1.39	–2.61
<i>October 8</i>	1	11.96	1	9.5	–2.46
<i>October 9</i>	1	9.44	1	5.0	–4.44
<i>October 10</i>	4	4.85	4	0.5	–4.35
<i>October 14</i>	1	2.23	1	0.2	–2.03
<i>October 15</i>	1	1.94	1	0.5	–1.44
<i>October 21</i>	28	2.11	28	2.11	0

Source: Authors’ calculation based on Board of Governors of the Federal Reserve System, ‘Central Bank Swap Lines’, and European Central Bank, ‘History of all ECB Open Market Operations.’

As previously noted, although the systemic risk increased hugely in the aftermath of the bankruptcy of Lehman Brothers, the Federal Reserve maintained the market format with limited amounts. From September 16 to October 10, and despite it accelerating the provision of dollars to the European Central Bank, the swap interest rate climbed to very high levels. The delay between the Federal Reserve’s decision on September 16 and announcement on October 13 regarding the full-allotment format is therefore puzzling.⁵ We suggest two different interpretations—the ‘pressure’ and the ‘stigma’ interpretations, respectively.

The ‘pressure’ interpretation is that the Federal Reserve wanted at first to experience the extension of the market format, but the European Central Bank put pressure on the Federal Reserve to implement the full-allotment format. There is no readily available evidence for the ‘pressure’ interpretation, but the observation that can be made is that the Governing Council of the European Central Bank decided on October 8, 2008, to conduct its main refinancing operation with full allotment at a fixed rate (European Central Bank, 2008). However, if the ‘pressure’ interpretation is correct, it remains difficult to understand how the Federal Open Market Committee could provide arguments in favour of the full-allotment format since September 16: ‘if foreign banks worry about capacity limits, even having a large program could in principle not be sufficient in extremis, [but] if the program is open ended, the rollover risk problem goes away’ (FOMC Transcripts, 2008: Dudley, Sep. 16, p. 17). In other words, it is difficult to see how the Federal Open Market Committee proposed to ‘make the offer to them [the Bank of England, Switzerland, the ECB, the Bank of Japan]’ and to ‘leave it to their discretion if they would like to participate’ to the full-allotment format (ibid, p. 11).

⁵ This delay of one month goes beyond the common delays between the announcement and the implementation of a programme during the crisis: for the Term Auction Facility programme, the delay was 5 days (from 12th to 17th) and, for the Dollar Swap Line programme with the market format, 6 days (from 6th to 12th), in December 2007.

Therefore, if the ‘pressure’ interpretation seems flawed, the ‘stigma’ interpretation may be suggested as an alternative explanation. On September 16, 2008, the day after the bankruptcy of Lehman Brothers, Ben Bernanke opened the meeting of the Federal Open Market Committee by claiming that ‘there are very significant problems with dollar funding in other jurisdictions—in Europe and elsewhere’: so ‘I would like to put on the table a request for authorization for swap lines. I prefer not to put a limit on it’ (FOMC Transcripts, 2008: Bernanke, Sep. 16, p. 3). As seen above, the Federal Open Market Committee decided to make this proposal to the European Central Bank, the Bank of England, the Swiss National Bank and the Bank of Japan and let them decide if they wanted to participate. Thus, from September 16 onwards, the European Central Bank could choose between the extension of the market format and the full-allotment format. At first, it opted for the extension of the market format in order to avoid stigmatising Eurozone banks inasmuch as the full-allotment format would have publicly revealed that Eurozone commercial banks had enormous difficulties obtaining dollar funding. Afterwards, it could not but opt for the full-allotment format when the interest rate became exorbitant in late September and early October, thereby showing the ineffectiveness of the market format. If this ‘stigma’ interpretation is correct, the European Central Bank’s announcement on October 8 was not so much pressure put on the Federal Reserve, as a signal that the full-allotment format was supposedly the European Central Bank’s concept. It was important for the European Central Bank (2014, p. 71) to give the signal that ‘the shift to a fixed rate full allotment procedure for the US dollar tenders was consistent with the procedures in place for euro tender operations offered by the Eurosystem.’

At this stage of our investigation (and despite our contacts with some officials involved in these decisions), we cannot definitively adjudicate between the ‘pressure’ and ‘stigma’ interpretations. We cannot settle the question as to whether the very high interest rate was a failure of the supply side (as the ‘pressure’ interpretation presupposes), or a mistake of the demand side (as the ‘stigma’ interpretation indicates). We can, however, suggest that the ‘stigma’ interpretation seems more plausible. In any case, the very high interest rate paid by the European Central Bank precipitated the implementation of the Federal Reserve’s dollar swap lines with the full-allotment format. The European Central Bank announced the full-allotment format in its own euro operations before accepting the full-allotment format for the dollar swap operations (respectively, on October 8 and 13, 2008). After the G7 meeting in Washington on October 10, 2008, Bernanke (Speech, Oct. 15, 2008) declared that ‘this week *we agreed* to extend unlimited dollar funding to the European Central Bank, the Bank of England, the Bank of Japan, and the Swiss National Bank’ (emphasize added). The Federal Reserve was thus tossed from one horn of the financial dilemma to the other—with the European Central Bank acting again as its conveyor belt.

6. From the Triffin dilemma to the financial dilemma?

With regard to the supply of and the demand for the dollar swap lines, the sequence we have discerned in the previous section runs as follows. Prior to the Lehman Brothers bankruptcy, the Federal Open Market Committee did not seem concerned

about the increase in the ECB bid-to-cover ratio, hence revealing a failure of the supply side from March to August 2008. Then, the European Central Bank could have been reluctant to opt for the full-allotment format in order to avoid stigmatisation of Eurozone banks, thus implying a failure from the demand side from mid September to mid October 2008. In the aftermath of the Lehman Brothers bankruptcy, the Federal Open Market Committee eventually became concerned about the European dollar funding shortage, which had a ‘feedback effect’ on business in the US markets (FOMC Transcripts, 2008: Dudley, Sep. 16, p. 10). Officials repeatedly claimed that the Federal Reserve expanded its swap lines with central banks in order ‘to address dollar funding pressures worldwide’, to reduce strains in ‘global money markets and, in turn, in our own markets’, to ease conditions in ‘interconnected dollar funding markets at home and abroad’, in global dollar markets ‘that were spilling over into our own funding markets’ (US Congress, 2008: Bernanke, Sep. 24, p. 30; Oct. 20, p. 5; US Congress, 2009: Bernanke, Feb. 24, p. 7; Mar. 3, p. 4). Inasmuch as many European commercial banks, suffering from dollar shortages, drove up interest rates and created volatility in the US markets, the Dollar Swap Line programme helped ‘bring down interest rates in the global market for dollars’ (US Congress, 2009: Bernanke, Jul. 21, p. 55).

Furthermore, the Dollar Swap Line arrangement placed the Federal Reserve at a higher level than other central banks. The Federal Reserve determined at its discretion the Dollar Swap Line format and the ensuing allocated amounts and interest rates. In an intermediate position, other central banks, the primary dealers, and commercial banks could have access to the Federal Reserve’s desk. At the base, the other non-US banks reverted to the central banks of their jurisdiction to obtain dollar funding. The hierarchical structure rests notably on the institutional criterion of access (or not) to the Federal Reserve’s desk. However, it does not strictly take into account the different levels of interest rate set by the Federal Reserve for central banks or for commercial banks. In fact, the interest rate on the dollar swap lines charged to central banks (with multiple prices) was higher than the interest rate on the Term Auction Facilities charged to non-US banks (with a single price). Moreover, the collateral posted by non-US banks or primary dealers (the private and risky securities, sometimes with no market valuation) was riskier than that swapped by the central banks (their own currency, with no exchange rate risk). Ultimately, the hierarchical structure departed from any cooperative arrangement—*ad hoc* or institutionalised cooperation—and was the adjustment whereby the US monetary authorities accommodated the sizeable demand for dollar funding and solved the financial dilemma.

The dilemma famously formulated by Robert Triffin (1960) corresponded to the conventional view prevailing during the Bretton Woods period. At that time, the international monetary system was characterised by fixed exchange rates with the US dollar as the key-currency, and by international capital flow controls. In the present day, the floating exchange rate system and financial globalisation have transformed the nature of the dilemma, which is no longer a *monetary* matter (how to ensure international monetary stability in accordance with multilateral exchange rate agreements and dollar parity?) but a *financial* one (how to ensure global financial stability in accordance with the Federal Reserve’s mandate as the national lender of last resort?) The financial dilemma we discern may therefore be formulated as

follows: either the Federal Reserve decides to ration its dollar provision in order to contain moral hazard, which may thereby worsen systemic instability within globalised finance; or the Federal Reserve provides dollar liquidity liberally in order to allay global financial crises, but risk taking among foreign commercial banks and political struggle with the Congress may ensue. We have subsequently found that Minsky (1985, p. 17) foresaw such a dilemma in the following terms: on the one hand, ‘there is an open question of how the US central bank can fulfil its duties as lender of last resort without encouraging banks to adventure; there is a “moral hazard” problem with regard to the protected multibillion-dollar banks that does not exist for smaller banks’; on the other hand, ‘the Federal Reserve cannot stand aside and ignore destabilizing developments in dollar-denominated banking in London or Singapore, for instability abroad will quickly be felt in New York.’

The Federal Open Market Committee expounded in September 2007 the two options of the financial dilemma: on the one hand, it worried that ‘we are subsidizing foreign banks without really doing anything to mitigate [moral] hazard’ and it was not sure that ‘the public understands that’; on the other hand, it was recognised that ‘we all understand that we have systemic responsibilities’ (FOMC Transcripts, 2007: Fisher, Sep. 18, p. 154).⁶ The first option of the financial dilemma could operate in either of two ways: the extreme way was to let foreign central banks manage dollar shortages with their own dollar reserve holdings (FOMC Transcripts, 2007: Poole, Dec. 6, p. 16; Dec. 11, p. 8), and the moderate way decided on December 6, 2008, was to supply dollar swap lines to central banks with limited amounts and a market auction format (FOMC Transcripts, 2007: Resolutions, Dec. 6, p. 18; Dec. 11, p. 14). The second option of the financial dilemma, decided on September 16 and announced on October 13, 2008, was the format with full allotment at a fixed rate. And the reason for the second option was clearly exposed in October 2008, concerning the emerging market economies and European countries as well: ‘the privilege of being the reserve currency of the world comes with some burdens. Not that we have an obligation in this sense, but we have an interest in helping these guys [*sic*] mitigate the problems they face in dealing with currency mismatches in their financial systems. We have an interest in helping them meet that in some sense. It’s not our obligation. We have the same basic interest that led us to be responsive to the European need in some cases’ (FOMC Transcripts, 2008: Geithner, Oct. 28-29, p. 21).

The currency swap arrangements were initially presented as a reciprocal assistance framework, a horizontal safety network based on an auction format, with rationed currency amounts. However, the endogenous process set in motion by financial globalisation drove the Federal Reserve to respond to an intense dollar shortage and to change, at its discretion, its dollar swap line policy from a market-auction to a full-allotment format. Therefore, the Federal Reserve endogenously rose to the highest hierarchical level, and the European Central Bank was the channel for transmission of its global lending policy.

From the foregoing, the financial dilemma raises the question of the nature of international central banking. On the one hand, in the field of International Political

⁶ For the Federal Open Market Committee, the cost-benefit analysis allowed to solve the moral hazard issue (FOMC Transcripts, 2007: Lacker, Sep. 18, p. 145); as long as financial markets can severely collapse, a ‘moral hazard issue would be more than offset by the functioning of financial markets’ (ibid, Kohn, Sep. 18, p. 162).

Economy, Keohane (1984) argues that hegemony is neither a necessary nor a sufficient condition for cooperative relationships. Although it does not specifically deal with the international lender of last resort, Keohane's contribution is consistent with the 'cooperation' approach: the central bank safety network established a cooperative relationship that basically remained reciprocal and horizontal, without a full-fledged hierarchical relationship (Allen and Moessner, 2010, p. 27; European Central Bank, 2014, p. 73; Denbee, Jung, and Paternò, 2016, p. 10). However, the currency swap arrangement in 2008–2009 ran in one direction only—which is nonsensical for a network. In fact, there are reasons to think that the 'cooperation' argument had been made so as to avoid the stigma associated with the unilateral swap lines.

On the other hand, Kindleberger (1973, 1978, 1981, 1986) proposes the notion of the hierarchical structure, especially regarding the international lender of last resort.⁷ Kindleberger (1973, p. 28) famously argues that 'the international economic and monetary system needs leadership, a country which is prepared, consciously or unconsciously, under some system of rules that it has internalized, to set *standards of conduct* for other countries and to seek to get others to *follow* them, to take on an undue share of the burdens of the system' (emphasize added). On the one hand, the words 'to take on an undue share of the burdens of the system' have led to the interpretation that Kindleberger would have narrowly argued that the leadership should be benevolent. And it may be noted that the European Central Bank and other central banks should 'pay us back with interest, so we don't lose anything, but it helps relieve the funding tensions for European banks' (US Congress, 2012: Bernanke, Feb. 29, p. 51) and 'the total profit to the US taxpayers for the swaps that we engaged [in 2008 and 2009] was about \$4 billion' (US Congress, 2012: Dudley, Mar. 27, p. 14). So the US monetary authorities were not strictly benevolent. On the other hand, more important in our perspective is Kindleberger's view that the leadership should 'set the standards of conduct' that other countries 'follow'. This was typically the case under the Dollar Swap Line programme before and after October 13, 2008. The Federal Reserve set the format and decided to change it so as to efficiently solve the global financial crisis, while the other central banks just followed, acting as the conveyor belt. So the Federal Reserve was the stabilizer of the global financial system.

7. Conclusion

This paper has considered the Federal Reserve's dollar swaps and the European Central Bank's dollar provision with regard to auction formats, allotted amounts, and interest rates. We discern a new dilemma—here termed the financial dilemma—now facing the US monetary and political authorities. Either the Congress enforces the mandate given to the Federal Reserve in order to addresses

⁷ Carré and Le Maux (2019) examine Kindleberger's contribution to the theory of international lender of last resort and distinguish two kinds of argument: (i) the pecuniary *burden* that the leadership partly or mostly shares because of the problem of free riding (Kindleberger, 1978, p. 220) and (ii) the institutional *efficiency* with which the leadership operates as the stabilizer in accordance with the monetary or financial context (Kindleberger, 1967 [1981, pp. 26, 30]).

moral hazard, but the monetary authorities cannot fully respond to the needs of the global banking institutions and worsen the spillover effect; or the Federal Reserve liberally provides dollar liquidity to foreign commercial banks and central banks, but it worsens moral hazard and the Congress expresses its concern about the terms of the mandate it gives to the Federal Reserve. After the European Central Bank paid very high swap interest rates, and distributed dollars to Eurozone banks at a loss, the Federal Reserve implemented the format with full allotment at a fixed rate on October 13, 2008. We infer from the way the Federal Reserve solved the financial dilemma that the international relationship of central banking was hierarchical. The Federal Reserve changed the auction format of the Dollar Swap Line programme at its own discretion. The European Central Bank was *in fine* dependent on its global lending policy.

The relationship among central banks with regard to the auction format and interest rate policy, before and after October 13, 2008, reflects a hierarchical structure among central banks. On the one hand, the hierarchical structure is a departure from a cooperative or horizontal network: the Federal Reserve unilaterally provides international liquidity and determines at discretion the allotment format and interest rates on dollar swap lines. On the other hand, the hierarchical structure does not arise from any benevolent attitude: the European Central Bank agrees to share the burden of paying very high rates or interest rates higher than the market rate. Our analysis partly supports Kindleberger's thesis that a hierarchical structure of leadership is necessary to effectively stabilise the globalised financial system. Notwithstanding the similarity with Kindleberger's view, we emphasise that the endogenous process set in motion by the liberalisation of international capital flows, and the financial innovations produced by the US banking industry, creates the need for a global lender of last resort. Thus, the hierarchical structure does not derive from the need for benevolent leadership, but corresponds to the need for an efficient stabiliser within dollar-denominated and globalised finance.

The dollar is our currency, but your problem. This quip by the United States Treasury Secretary John Connally in Rome in 1971 followed the Nixon administration's unilateral decision to close the Gold Window. Thirty-six years after the end of the Bretton Woods system, the global financial crisis, and the Federal Reserve's unprecedented policy from 2007 to 2009, have tended to bring the international problem of the dollar to the door of the United States. The Federal Reserve's institutional response to the systemic dollar shortage in 2008–2009 relied on the emergency lending facilities, notably facility programmes from which non-US banks benefited. The Dollar Swap Line programme, with full allotment at a fixed rate, helped the European Central Bank to meet serious difficulties in distributing dollars in its jurisdiction. Latterly, the Congress discovered that the internationalization of the dollar coupled with financial globalisation had become some sort of a problem for the United States.

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