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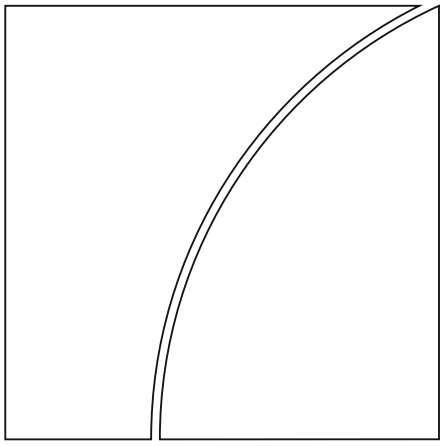

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Monetary and Economic Department

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Central bank swaps then and now: swaps and dollar liquidity in the 1960s

Robert N McCauley and Catherine R Schenk[1]

Abstract: This paper explores the record of central bank swaps to draw out four themes. First, this recent device of central bank cooperation had a sustained pre-history from 1962-1998, surviving the transition from fixed to floating exchange rates. Second, Federal Reserve swap facilities have generally formed a part of a wider network of central bank swap lines. Third, we take issue with the view of swaps as previously used only to manage exchange rates and only more recently to manage offshore funding liquidity and yields. In particular, we spotlight how in the 1960s the Federal Reserve, working in conjunction with the BIS and European central banks, repeatedly used swaps to manage eurodollar funding liquidity and Libor yields. BIS, Bank of England and Swiss National Bank archives show an intention to offset seasonal disturbances to funding liquidity in order to prevent eurodollar yield spikes. Fourth, this earlier cooperation underscores the Federal Reserve's use of swaps to prevent eurodollar shortages from interfering with the transmission of its domestic monetary policy. The US interest in the eurodollar market, and thus its self interest in central bank cooperation, is unlikely to end even when Libor is replaced as the benchmark for US floating-rate loans and mortgages.

Keywords: central bank swaps; international lender of last resort, central bank cooperation; eurodollar market; financial crises; Federal Reserve; Bank for International Settlements.

JEL classification: E52, E58, F33, G15.

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Contents

1. Introduction

The Federal Reserve's decision to offer (ultimately open-ended) swap lines to other central banks in the wake of disturbances to the global financial system in 2007 has attracted considerable academic attention and some political controversy. Obstfeld et al (2009) called it "one of the most notable examples of central bank cooperation in history"; Papadia (2013), "a quantum leap in central bank cooperation". Tooze (2018, p. 210-19) makes a case for the importance of the swaps for restoring confidence in US leadership and the Fed's power in 2007-08. Swap schemes have also been copied by other countries including the People's Bank of China, the European Central Bank (ECB) and the Swiss National Bank (SNB). While empirical research has generally found that the post-2008 swaps were effective in providing dollar liquidity (Fleming and Klaage (2010), Goldberg et al (2010), Allen and Moessner (2010); see also Auer and Kraenzlin (2009)), some members of the US Congress have criticised the system for not serving the US national interest and for using American resources to bail out European banks (Bordo et al (2014); O'Driscoll (2011)).[2] The limited number of countries able to benefit directly from the Fed swaps has also been criticised for unduly reducing the scope of this instrument (Aizenman et al (2011)). Truman (2008, 2010) has proposed linking Fed and ECB swaps with the International Monetary Fund (IMF) in order to stretch the global financial safety net under the Fund's wide membership. Reflecting on the operations from a longer term perspective promises to offer fresh insights into the precedents and potential for this instrument.

In particular, this paper demonstrates that central bank swaps formed part of a broader network of central bank cooperation for over thirty years before they were suspended in the late 1990s, that they served a variety of purposes over time (including uses similar to the 2008 swaps) and that they sought to serve and did serve the US national interest. We conclude by drawing out the similarities and differences between the 20th century and the 21st century swaps systems.

Existing accounts of the 20th century swaps tend to emphasise their purpose to finance currency intervention to protect the pegged exchange rates of the Bretton Woods system, or to manage the subsequently flexible exchange rates. Thus, Bahaj and Reis (2018) drew a sharp distinction between central bank swaps under Bretton Woods and those in 2008-09. So do former officials such as Sheets et al (2018):

> Swaps lines have a long history in central banking. They were used in previous generations to fund intervention in foreign-exchange markets or to provide bridge financing to countries during times of stress [eg in 1982 and 1997]. The Fed's use of swap lines during the crisis [in 2007-08] *pushed that into new territory* by using them to relieve dollar-funding stresses in the global financial system [italics added].

We contend that this view draws the distinction between recent and historic swaps too sharply. The Federal Reserve Bank of New York (FRBNY) set up swap lines with the G10, Switzerland and the Bank for International Settlements (BIS) starting in 1962, and within five years the FRBNY, the SNB and the BIS used them to manage global dollar

[2] Democratic Representative Alan Grayson was particularly vocal in his criticism of the swaps when questioning then Federal Reserve System Chair Ben Bernanke in 2009. https://www.huffpost.com/entry/bernanke-i-dont-know-whic_n_244302

funding liquidity by lending dollars to banks in operations distinct from currency intervention.

The historical literature has paid scant attention to these cooperative operations in the dollar banking market outside the United States, ie the eurodollar market. Charles Coombs, head of the foreign exchange (FX) desk at the FRBNY and the orchestrator of the swap lines, barely mentions the operations to manage Libor in his 1976 memoirs. In his official history of the BIS, Toniolo (2005, p 461) refers to the FRBNY-SNB-BIS operation in late 1966 but notes only that "such operations…became more frequent and more important in size as the market grew larger…". Bordo et al (2015, p. 156) also mention that the FRBNY used its BIS swap to fund eurodollar deposits and they judge that these operations "were often insufficient to the task" without providing evidence. Yago (2013, p 161) remarks on BIS swaps "as a means of regulating and adjusting markets" and highlights the role of the BIS Banking Department but does not provide details. McDowell (2017) ignores the eurodollar operations, which drew on dollars from the Fed, and thereby overstates the extent to which partner central banks drew dollars from the Fed to support their currencies. Our account, drawing on BIS, Bank of England and SNB archives, provides the first systematic analysis of these eurodollar operations.

These operations are of more than historical interest. The drawing of almost $1 billion in one-week funding by six European banks on the ECB's swap line with the Fed on 25 September 2019 remind us that the swap lines can come alive in response to dollar funding strains. Indeed, on 19 March 2020, the Fed renewed its dollar liquidity swap lines to nine central banks at twice the 2008 limits, and the next day enhanced its existing unlimited swaps to Canada, Japan, Switzerland and the ECB as part of the response to the financial implications of the global coronavirus pandemic in 2020.[3] A better understanding of the history of swaps, and their full range of uses, can only improve the policy debate. Our findings have particular relevance for emerging markets economies with currencies increasingly traded and used outside the home country (BIS (2019), Cheung et al (2019)). The Fed's offshore monetary operations in the early eurodollar market add to the menu of policy options to respond to offshore market strains in home currencies.[4]

In the next Section, we first profile swaps during and after the Great Financial Crisis (GFC), and then from 1962 to 1998. In Section 3 we distinguish among the uses of swaps: to fund FX intervention, to provide emergency liquidity assistance, and to manage eurodollar interest rates. In Section 4, we focus in on the Eurodollar operations of the 1960s that had the last purpose. In Section 5 we compare and contrast the

[3] The new facilities announced on 19 March were $60 billion swap lines for six months for the central banks in Australia, Brazil, South Korea, Mexico, Singapore, and Sweden, and $30 billion each for Denmark, Norway, and New Zealand. This was in addition to the unlimited standing swap lines with the central banks of Canada, Japan, Switzerland and the ECB, which collectively drew $206 billion in the week of 25 March 2020.

[4] He and McCauley (2013) cite Toniolo loc cit and write the following: "In the case of emerging market currencies such as the renminbi, one could easily imagine the home central bank carrying out such operations through public or private sector agents in the offshore market were circumstances to warrant interventions. Such policy options should help alleviate concerns for instability that may arise because of interest rate differentials between the onshore and offshore markets". See Hong Kong Monetary Authority (2018).

Eurodollar operations of the 1960s and the swaps during and after the GFC. In Section 6, we draw conclusions.

2. Swaps now and then

2.1 Origin of Fed swaps December 2007

The Fed first considered and approved central bank swaps during the GFC in December 2007 in conjunction with new Term Auction Facility (TAF).[5] At this time, the strains in the term dollar money market were pushing up interest rate spreads, particularly through the end of the calendar year, and making it difficult to borrow dollars for a longer term than overnight. At the same time, stigma, the fear of being observed and thereby arousing suspicions of funding difficulty, deterred banks from borrowing one-by-one at the Fed's discount window. The TAF sought to relieve some of this pressure in the domestic market by offering thousands of member banks a fixed amount of term funding (28-day dollars against broad discount window collateral) on an auction basis. This was preferred to lowering the federal funds rate or the discount window rate because the amount of liquidity would be more easily controlled and predictable.[6]

The central bank swaps scheme arose from discussions that Fed officials had with other central banks as they were planning the TAF in 2007. When ECB officials heard about the Fed's TAF proposals, they responded quickly and asked for "a swap arrangement that would give them dollars *as part of this overall effort* to try to improve liquidity in dollar term funding markets" [emphasis added].[7] Linking swaps to TAF had featured in discussions earlier in 2007 when Fed staff sought to deal with illiquidity in dollar markets in cooperation with the ECB and SNB. On 18 September 2007 the ECB and SNB appeared willing to take a swap of dollars to fund their own dollar credit auctions in conjunction with similar operations by the Fed.[8] This would avoid interest-rate spillovers from European markets into New York and also reduce the calls on term funds in New York. As noted at the FOMC: "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 U.S. markets. Establishment of these swap lines in parallel with the ACF [Auction Credit Facility, later, the TAF] could have broad, positive confidence effects".[9] A particular concern at this point was the year-end premium expected to raise the cost of funding in eurodollar markets.[10]

5 FOMC Conference Call 7 December 2007. See Wiggins and Metrick (2016).

6 Ibid.

7 Ibid.

8 FOMC Minute 18 September 2007. At this point, the market strains seemed to be easing and the chair did not put the facility in the end to a vote. At the time the proposed ECB swap limit was $40 billion and the SNB swap at $20 billion. In the event, they started at $20 billilon and $4 billion, respectively.

9 FOMC Minute 18 September 2007.

10 In advance of reporting dates (monthly, quarterly, and especially end-year) banks (and sometimes central banks) may seek to shrink or to adjust their balance sheets in ways that impair global or regional dollar funding liquidity.

The ECB had earlier resisted suggestions from the Fed to enter a swap agreement to meet its dollar funding needs unless a swap was "in the context of some kind of broader operation".[11] That is, the ECB would only agree to engage in a swap if the Fed went ahead with the TAF. At the time, the Eurosystem had about $200 billion in US dollar reserves, so it did not necessarily need the swap,[12] but the Fed saw advantage in the cooperation itself. Thus Sheets noted that "pursuing some sort of a cooperative arrangement with the ECB would provide us with more advance information about what the ECB is planning to do and would help facilitate monetary control. So we see some advantages arising from cooperation and coordination as opposed to their injecting the reserves just on their own". Governor William Poole (St. Louis) objected to swaps since he worried that they were historically so associated with currency intervention that market participants would take restoring them as a signal of imminent coordinated intervention in FX markets. He also thought that central banks already had enough dollar reserves of their own to provide local dollar liquidity. Bernanke responded that the swap announcement would be linked explicitly to the term liquidity facilities and that it was better from the Fed's point of view to know the amount of dollars the central banks would be providing rather than just learning after the fact about central banks' use of their own reserves.[13] Indeed the potential for drawing other countries into swaps was a argument in favour of adopting the TAF for Bernanke. Since the swap was an FOMC matter, the Committee voted on the ECB swap and approved it (Poole was the only dissenter) on 7 December for 180 days up to $20 billion with a limit on a single drawing of $10 billion. Table 1, first column, shows the initial value of the swap facilities and subsequent columns show how they increased both in amount and scope as the crisis deepened.

An important aspect of the initiation of the swaps in both periods is that they formed part of a deliberate effort at central bank cooperation. For Bernanke, the announcement of central bank cooperation would itself have a positive impact on market confidence, although the success of the operations themselves was uncertain:

> we would be essentially conveying to the market that the major central banks are in communication and that we are working together to try to address some of these problems. This may not work. I don't want to oversell it. We may not get a full bid. The amount may be too small to affect the markets. But I do think it is worth trying. I think it will send a good signal, and particularly I think the international cooperation aspect of this would be well

[11] FOMC Conference Call 7 December 2007. See also Tooze (2018 pp 211-15) Wessel (2009, pp 139-142) on the ECB and Fed.

[12] The decentralised holding of dollars within the Eurosystem may have inhibited their use. The ECB (2008, p 105) reported €32.1 billion in FX reserves at end-2007, of which 79.7%, or €25.6 billion was held in dollars, equivalent to $37 billion. The IMF reports total reserves less gold of $215 billion at end-2007 for the euro area. Less a SDR 8 billion reserve and SDR position in the IMF, FX reserves were $203 billion. At an 80% dollar share, the Eurosystem held $162 billion in dollar reserves. Nathan Sheets' "about $180 billion" (FOMC Transcript 16 September 2008, p 12) implies closer to a 90% dollar share. Distributional issues raised by the use of the Eurosystem's dollars caused President Jeffrey Lacker of the Richmond Fed "discomfort" with the Fed swap: "my understanding is that the distribution within the European system of central banks is uneven, and in some sense this just provides them with a way to circumvent negotiating how those dollars would be distributed from different central banks to different private-sector banks within their own system" (FOMC Transcript 16 September 2008, p 12).

[13] FOMC Transcript 11 December 2007.

received. But I don't know for sure. If we do it, we are just going to have to give it a try and see what happens.

Once the total values were agreed and the Fed Board had approved the TAF, Bernanke got in touch with G10 central bankers. Five central banks drafted a joint statement and released it simultaneously on 11 December.[14]

Federal Reserve swap lines, 2007-08

In billions of dollars Table 1

	12.12.07	11.3. 08	22.5. 08	18.9. 08	24.9.08	26.09.08	29.9.08	13.10.08	28.10.08	29.10.08	30.11.08	30.12.08
ECB	20	30	55	110	110	120	240	NPS	NPS	NPS	NPS	NPS
SNB	4	6	6	27	27	30	60	NPS	NPS	NPS	NPS	NPS
BoJ	0	0	0	60	60	60	120	NPS	NPS	NPS	NPS	NPS
BoE	0	0	0	40	40	40	80	NPS	NPS	NPS	NPS	NPS
BoC	0	0	0	10	10	10	30	30	30	30	30	30
RBA	0	0	0	0	10	10	30	30	30	30	30	30
Denmark	0	0	0	0	5	5	15	15	15	15	15	15
Sweden	0	0	0	0	10	10	30	30	30	30	30	30
Norges	0	0	0	0	5	5	15	15	15	15	15	15
RBNZ	0	0	0	0	0	0	0	0	15	15	15	15
Brazil	0	0	0	0	0	0	0	0	0	30	30	30
Mexico	0	0	0	0	0	0	0	0	0	30	30	30
Korea	0	0	0	0	0	0	0	0	0	30	30	30
MAS	0	0	0	0	0	0	0	0	0	30	30	30
Total	24	36	61	247	277	290	620					

[1] Note. NPS – no pre-specified limit. In October 2008 the ex ante limits on the swap facilities was lifted for 4 swap partners.

Sources: Goldberg et. al (2010).

The ECB and SNB announced that they would use Fed swaps to fund their own TAF-like operations. The ECB used the swap to run a fixed price auction for European banks (set at a spread above the US TAF). SNB held competitive auctions using its $4 billion swap. The Bank of England announced an auction of £10 billion and Canada an auction by year end. Japan and Sweden agreed to make supportive statements and promised to "support liquidity as necessary'. [15]

The FOMC records show that helping the central banks of offshore dollar centres to provide dollars to banks in their jurisdiction served the Fed's interest in keeping offshore banks from bidding up dollar rates before New York opened. Bernanke explained: "There is a problem with dollar funding in Europe. There is a shortage of dollars there early in the day, which often leads the funds rate to open high. It creates problems for our monetary policy implementation. It creates problems in other markets, like the foreign exchange swap market". When European banks sought to

[14] FOMC Transcript 11 December 2007. Press Release: https://www.federalreserve.gov/newsevents/pressreleases/monetary20071212a.htm

[15] FOMC Transcript 11 December 2007.

borrow dollars towards the end of their day, they found that lenders in the US were unwilling to lend so early in their own business day. This pushed European banks to seek liquidity earlier in the Asian markets, which spread the pressure into earlier time zones.[16] Importantly, European banks could and did access the TAF in the US as well as draw from their local central banks, although Goldberg and Skeie (2011) note that foreign banks used the onshore TAF less once they could draw dollars more readily offshore from their local central banks. The combination of swaps and the TAF aimed at increasing funding liquidity in the term dollar money markets.

As the crisis intensified in 2008, the combination of TAF and swaps remained the structure for international cooperation. At its meeting on 16 September 2008, the day after Lehman Brothers collapsed, William C. Dudley (FRBNY) reported that the most serious strain was being felt from European banks' dollar liquidity: "foreign banks, especially in Europe, have a structural dollar funding shortfall, and they look to execute foreign exchange swaps or borrow in the dollar LIBOR market to fund that".[17] This put upward pressure on rates in New York and the federal funds rate. Dudley proposed offering facilities to ECB, BoJ, SNB, BoE and possibly Canada without a fixed limit in terms of size or period in order to provide an effective back-stop. Jeffrey M. Lacker (Richmond) repeated Poole's objection that ECB and other central banks already had large dollar reserves that they could use ($160-$180 billion, see footnote 12 above). Bernanke reminded the FOMC that "Whether it's sensible or not, the ECB has made a pretty strong distinction with us between their foreign exchange reserves and their dollars that they use in these operations". This was because "they seem to put a lot of value on having a distinct swap line, which symbolizes the cooperation and coordination of the two central banks as opposed simply to using their own reserves". He recommended that the FOMC should delegate the decision whether to extend swaps to the Foreign Exchange Sub-Committee (consisting of Fed Chair, Vice-Chair of FOMC and the Vice Chair of the Board). Vice Chairman Don Kohn clarified that swaps would only be extended to G10 central banks and *not* to EMEs. Dudley seconded that the purpose was "about the major financial centers and the ability of large banks that operate globally to obtain dollar funding".[18]

Graph 1 shows that outstanding drawings on the swaps peaked at almost $600 billion two months after limits were lifted in mid-October 2008 during the acute phase of the GFC. As Caruana (2012) noted, "the extension of such swaps in unlimited amounts represents a turn in central bank cooperation that the founders of the BIS would have found unimaginable". A second peak of almost $100 billion appears in October 2011 when the Fed reactivated the swaps after the onset of the European debt crisis in 2010. Tooze (2018, p. 214-15) describes the credit flows as "staggering" in scale but argues that they were decisive mainly because they assured markets that the Fed was prepared to act as lender of last resort. The facilities for the core members continue to be available to the present day, and $205 billion was drawn by the ECB, BoE, SNB and BoJ in the week ending 25 March 2020.

This review of the swaps initiated during the GFC highlights three aspects of this form of central bank cooperation that also characterised the swaps at their origination in the 1960s. First, the Fed gave weight to the important psychological effect expected from the announcement of the facilities as evidence of central bank cooperation,

[16] CGFS (2009, 2017))

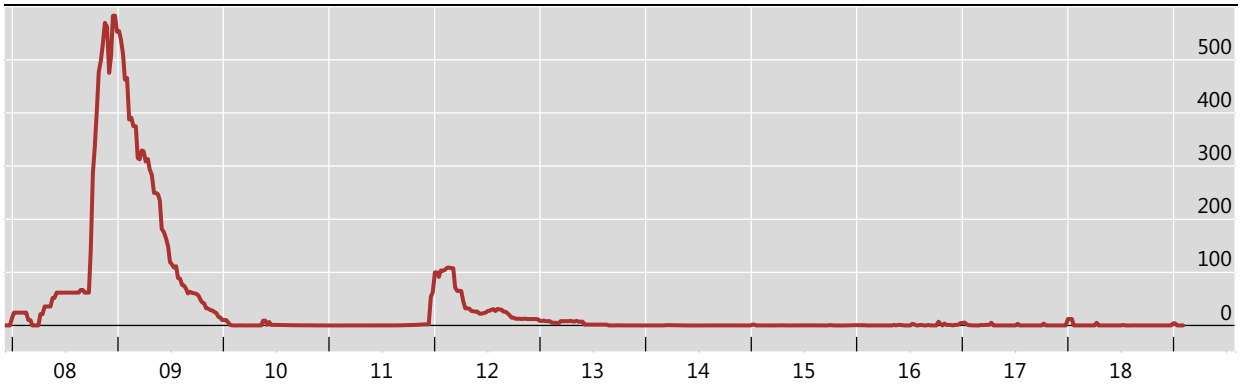
[17] FOMC Transcript 16 September 2008.

[18] FOMC Transcript 16 September 2008.

Secondly, the Fed aimed to offset seasonal fluctuations in dollar funding liquidity. Thirdly, the Fed intended to limit the impact of banks outside the United States scrambling for dollar funding on the New York money markets (through Libor). As Papadia (2013), then head of operations at the ECB put it, "the ECB acted as the thirteenth District Bank of the Fed". In the 1960s, the BIS played this role.

Central bank swaps outstanding of the Federal Reserve

In billions of US dollars, Wednesday observations Graph 1



Source: Federal Reserve release H.4.1.

2.2 Swaps then: 1962-98

The first Fed swaps became possible when the new Federal Reserve System and the Bank of England in 1917 opened mirrored accounts with each other (Potter (2018)). But it was not until 1962 that the Fed built a more formal system of bilateral swap facilities available on a standby basis. From 1960, the Fed had swapped dollars against Swiss franc (CHF) with the SNB to provide dollar cover to encourage the retention of dollar reserves rather than a demand for gold by either Swiss banks or by the SNB. This arrangement was carefully managed by Charles Coombs (head of FX) and his counterpart at the SNB, Max Iklé.[19] But Coombs had grander ambitions. In the spring of 1962 he embarked on a tour of European central banks to conclude formal agreements for standing facilities that could be drawn on by either partner with little notice for a range of purposes. He met with an unenthusiastic response, but by the end of 1962, he convinced seven European banks, the Bank of Canada, the Bank of Japan and the BIS to open swap facilities of $50-$100 million each.[20]

Coombs was keen to increase this amount, but was rebuffed.[21] Governor Brunet of Banque de France told his counterpart at the Bank of England that he "thought that the American idea of organizing swap facilities around Europe for large sums indefinite

[19] Their correspondence is in SNB Archives.

[20] Extract from Governor's Memorandum 11 February 1962. Anglo-US Discussions, Note of a meeting held on 8 March 1962 at the US Treasury. Bank of England Archives [hereafter BoE] C43/742.

[21] Minute of Meeting held at UK Treasury with Bank of England, 3 May 1962. Minute of meeting at UK Treasury 14 May 1962. UK Chancellor of Exchequer et al with US Treasury Secretary Dillon et al. BoE C43/742.

in time was wrong in principle" because it allowed the United States to avoid going to the IMF to resolve "deep seated difficulties" with the dollar.[22] This was a time when the US authorities were somewhat mistrusted. J.M. Stevens of the Bank of England remarked that the American "arrival on the Basle and Paris scenes" threatened the ability to achieve the kind of quick solutions such as the European support for sterling arranged at the BIS in 1961.[23]

The Governor of the Bank of England and his advisers did not relish providing sterling that the Fed could sell to prop up the dollar, but they eventually agreed for the sake of good relations with the Fed and the US Treasury. [24] Deputy Governor Maurice Parsons wrote to Sir Denis Rickett of the Treasury on 15 March concluding that "as an exchange operation we could…only recommend that it be turned down" but that it had "symbolic" importance "comparable to deals done under the Basel arrangements" to demonstrate central bank cooperation.[25] Still "the only justification" for agreeing "would be simply a desire to comply with a request which they have made. They seem to set some store by our compliance in connection with their justification to Congress of the recent moves to bring the Federal Reserve System into the foreign exchange business". There was also the suggestion that "if sterling should run into trouble in the future, the fact of our having entered into this transaction would weigh with them as to the extent to which they could give us further assistance".[26] Roy Bridge was sent to Washington to negotiate the terms with Coombs whom he "had not yet come to trust".[27] They agreed that the "specific aims" of the facilities would be "a) to counter speculative pressures, b) in some measure to offset seasonal swings, c) for such other purposes as might be mutually agreed, e.g. to cushion a sudden and fortuitous exchange loss the publication of which might be capable of adverse psychological effect or even of setting off a speculative movement".[28] This confirms that seasonal pressures were among the original motivations for the swap line and establishes that the Bank of England and Banque de France, at least, were not enthusiastic about the swap line's use for FX intervention.

Under the swap arrangements, the FRBNY exchanged dollars for the counterpart currency of its swap partners with an agreement to repurchase the dollars at the same rate in 3 months (renewable up to three times). Interest was payable at a symmetric rate by both partners. What was done with the dollars if they were not used immediately differed across the partners. The Bank of England swapped dollars with the UK Treasury's Exchange Equalisation Account (FX reserves) and then invested the sterling proceeds in interest-bearing assets/deposits for the account of the FRBNY. [29] The BIS (the only partner that was not a central bank), invested the dollars received via its CHF-denominated swap with the Fed in US Treasury bills. But the BIS also had a second Fed swap for dollars against "other European currencies", which it used

22 Note of Meeting between Cromer and Brunet 8 May 1962. Stevens and Calvet also present. BoE C43/742.

23 Memo JMS 27 April 1962. BoE C43/742.

24 Letter Rickett (HMT) to Stevens, 30 March 1962. BoE C43/742.

25 Letter Parsons to Rickett, 15 March 1962. BoE C43/742.

26 Letter Parsons to Rickett, 15 March 1962. BoE C43/742.

27 Letter from Bridge to Parsons, 5 April 1972. BoE C43/742.

28 Memorandum to Governors and Parsons by Bridge, 12 April 1962. BoE C43/742.

29 BoE C43/742.

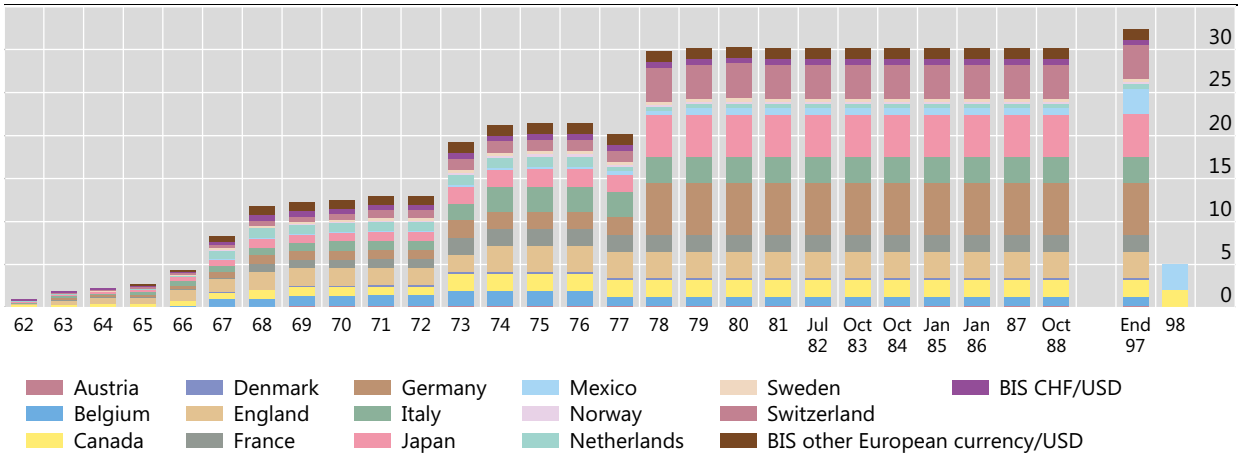
expressly to channel dollars from the FRBNY into the eurodollar market (or at times for its own cash purposes). The European currencies delivered to the FRBNY ultimately came from the deposits of the BIS's central bank customers.

In the end, the swaps proved useful to the Federal Reserve and it asked the partners to increase the limits during the years that followed. Graph 2 shows the nominal value of the Federal Reserve swap facilities and the central banks involved.

Federal Reserve swap lines, 1962-1998

In billions of US dollars at end year

Graph 2

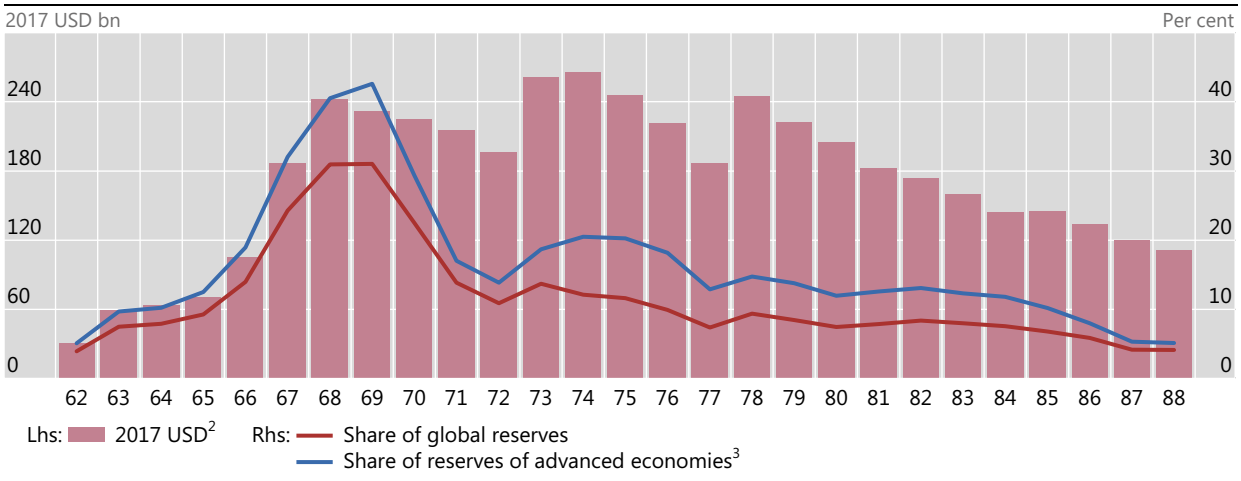


Source: Federal Reserve.

Thus, the central bank swaps system did not disappear when the Bretton Woods system ended; rather it was extended to a broader range of OECD countries as well as the BIS. Indeed the swap lines expanded quickly after the pegged exchange rate regime collapsed in 1973 and again in 1978 in the wake of the dollar exchange rate crisis of that year. This was a time of inflation, so Graph 3 presents the value of the facilities relative to global reserves at the time, and shown in dollars representing the same share of US GDP in 2017.

Fed's reciprocal swap lines in relation to US GDP and global reserves[1]

Graph 3



[1] Swaps data are from end year except: 1983, 1984 and 1988 October, 1985 and 1986 January, 1982 July. [2] Scaled to 2017 US GDP in billions of US dollars. [3] Reserves exclude gold and SDR.

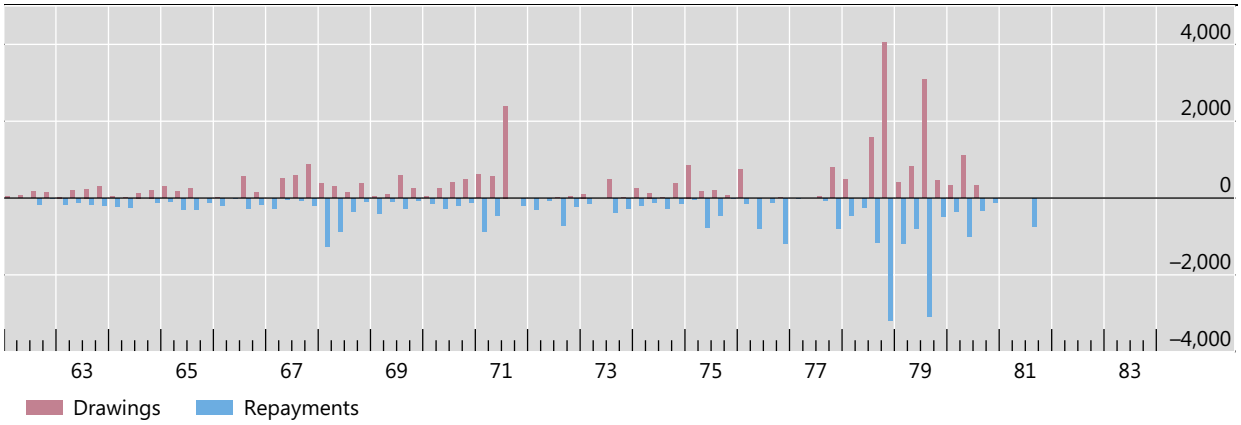
Source: Federal Reserve; IMF, *International Financial Statistics*; Bureau of Economic Analysis; UK Data Service; authors' calculations.

On this showing, the swaps in the early 1970s were large even by the standards of September 2008. At their peak value, the arrangements amounted to the equivalent of over $250 billion. This about matches the $247 billion of facilities available in the Fed swaps at the start of September 2008, before the Lehman Brothers collapse created an even more extreme need for funding liquidity and the Fed lifted the limits on the swaps for the ECB, SNB, Bank of England and Bank of Japan. The 20th century swap facilities were also large relative to global FX reserves, particularly in the late 1960s. They were thus an important part of the global financial safety net.

Fed's gross drawings on and repayments of central bank swaps

In millions of US dollars

Graph 4



Source: Federal Reserve.

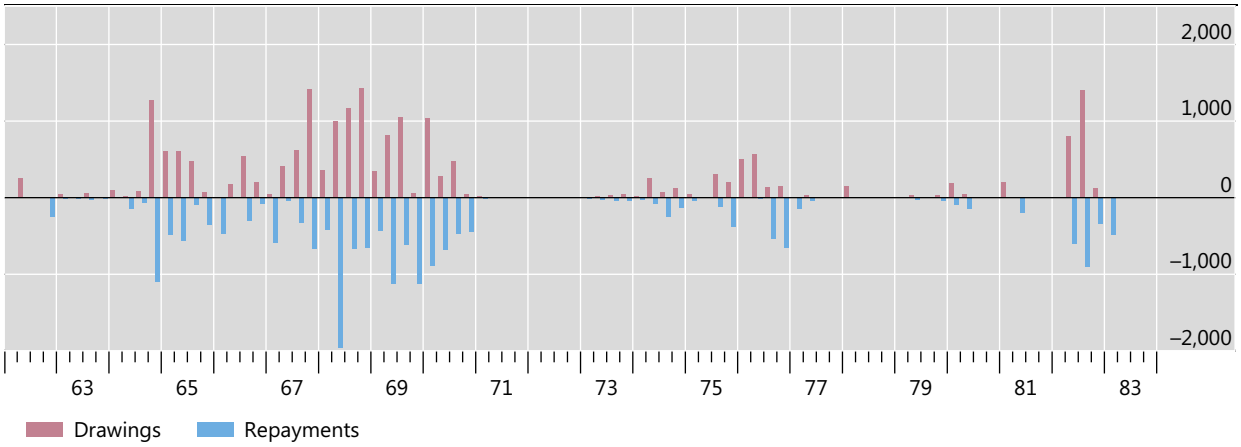
Data on the use of the facilities confirms that the swaps were activated frequently and over a prolonged period, in contrast to the 21st century swaps. Graph 4 shows the quarterly drawing and repayments by the Fed on the system from 1962-1983 during which time the Fed drew a gross total of $15.5 billion (equivalent to about $300 billion in 2008). At its peak in Autumn 1979, the value drawn by the Fed amounted to the equivalent of $25 billion 2008 dollars calculated as a share of US GDP, which is only 4.5% of the amount of outstanding swaps at the start of October 2008. But one purpose of the scheme was to demonstrate the resources available to protect the global monetary system and the strength of central bank cooperation, so the value of the facilities available is arguably as important to the amounts actually drawn.

Graph 5 shows the drawings initiated by the swap partners. This confirms that partner drawings (Fed supplying dollars) dominated the early decades and then US drawings dominated the late 1970s.

Swap partner gross drawings and repayments on Fed swap lines

In millions of US dollars

Graph 5



Source: Federal Reserve.

The Federal Reserve swap lines were embedded in a broader network of central bank cooperation that aimed to provide liquidity for FX intervention in times of crisis and to manage the decline of sterling as an international currency (Table 2). In March and June 1961 European central banks and the FRBNY arranged a series of bilateral facilities to support the sterling exchange rate after a DM revaluation increased speculative pressure on the dollar and the pound. In total the support for the Bank of England amounted to $1,111 million (Toniolo (2005, pp 396-7)) in the form of $US, DM and CHF deposited with the Bank of England and swapped through the UK FX reserves (EEA) to UK Treasury bills. Like the Fed swaps, these European swaps were for up to 3 months' duration. The FRBNY's contribution in April 1961 was a gold/£ swap worth GBP18m plus a $50m dollar/£ swap and a further $50m deposit swapped for UK Treasury bills in June.[30] Encouraged by the success of these operations, the Fed's Chairman W.M. Martin asked the BIS to host a study group to consider cooperative ways of "restraining or neutralizing short-term capital movements arising from interest arbitrage and speculation" (Toniolo 2005; 384). Coombs went further and proposed making the 1961 arrangements more formal and perhaps permanent (ibid.) but this fell on unreceptive ground among the other central bankers. This did not deter him from pursuing bilateral swaps and, as discussed above, Coombs established a network of bilateral swap lines between the FRBNY and several European central banks in early 1962. The idea quickly caught on.

In 1963,16 members of the European Monetary Agreement submitted letters to the BIS expressing their willingness to participate in making facilities available among their central banks, although in the end only G10 central banks were involved. Under these agreements, G10 central banks periodically arranged bilateral facilities that could be drawn on demand. These took the form of deposits of dollars (or national currency) with a repurchase contract usually for 3 months. In March 1963, for example, the Bank of England took $50m dollar deposits each from the central banks of France, Germany, Italy and Switzerland, paying at 3 9/16% p.a. for 1 month (renewed once). The dollars

[30] 'Central Bank Assistance 1961' 23 February 1962. BoE 7A229-9.

were sold forward to affect selling pressure in the forward sterling market. Although not part of the EMA, the Fed often joined in these coordinated schemes by increasing its swap lines with the partner country.[31] In addition to the formal bilateral swap, the FRBNY placed additional dollars with the Bank of England that were swapped into sterling assets with a guaranteed USD exchange rate (so-called 'guaranteed sterling'). These deposits were increased during times of stress on the pound. Unlike the Fed swaps, these wider arrangements coordinated by the BIS often had an IMF backstop, which was activated in 1961, 1964 and 1976 by the Bank of England, when the British government drew on the IMF to repay the deposits the Bank of England had received from participant central banks. Table 2 shows a range of swap facilities arranged under the Bilateral Concerte and specific Group Arrangements coordinated through the BIS in the 1960s and 1970s. The final Group Arrangement for sterling was agreed in February 1977 *after* the British Government borrowed from the IMF at the end of 1976 (Schenk (2010)).

FRBNY swaps embedded in network of swaps 1964-1970

Amounts in millions of US dollars — Table 2

	Date	Bilateral Concerte (+Japan & Canada)	FRBNY swap	BIS	Total
Bank of England	November 1964	1280	1000	250	2530
Bank of England	September 1965	475	400 (GBP deposits) +750 swap	50	925
Bank of England	September 1966	350	1350		1700
Bank of England	November 1967	850	1500 swap + 500	150	3000
Bank of England	March 1968	1075	2000 swap +550	250	3875
Bank of England	March 1969	800	+350	250	1400
Bank of England	June 1976	2600	2000	150	5300
Bank of England	February 1977				3000
Banque de France	July 1968	600	600	10	1300
Banque de France	January 1969	1350	500	100	1950
Banque de France	August 1969	1700	500	300	2500
Banque de France	February 1970	303	500		803
Banca d'Italia	March 1964	350	250		600

[1] Bilateral Concerte are predominantly facilities for $ deposits on 3-month maturity, renewable once. Some are for currency swaps in other currencies (e.g. Banque de France, 6 January 1969 DM/FF swap with offered by Bundesbank for equivalent value of $600m).

Sources: BISA 7.18(23) GIBB9. Schenk (2010).

The BIS acted as the central information centre for the system, receiving alerts whenever a central bank activated the scheme or provided a facility, and sharing information among the group (Yago (2013, p 169)). In 1963, Gilbert of the BIS reassured Coombs that no publicity was required about the operations and that "the procedure is modelled fairly closely on what the FRBNY is now doing. It is hoped quietly and unobtrusively to generalize this method of operating at a time when there is no great urgency to put it into action".[32] This system, known as 'bilateral concerté', took a

[31] The Banca d'Italia also participated through dollar swaps with the Bank of England rather than deposits.

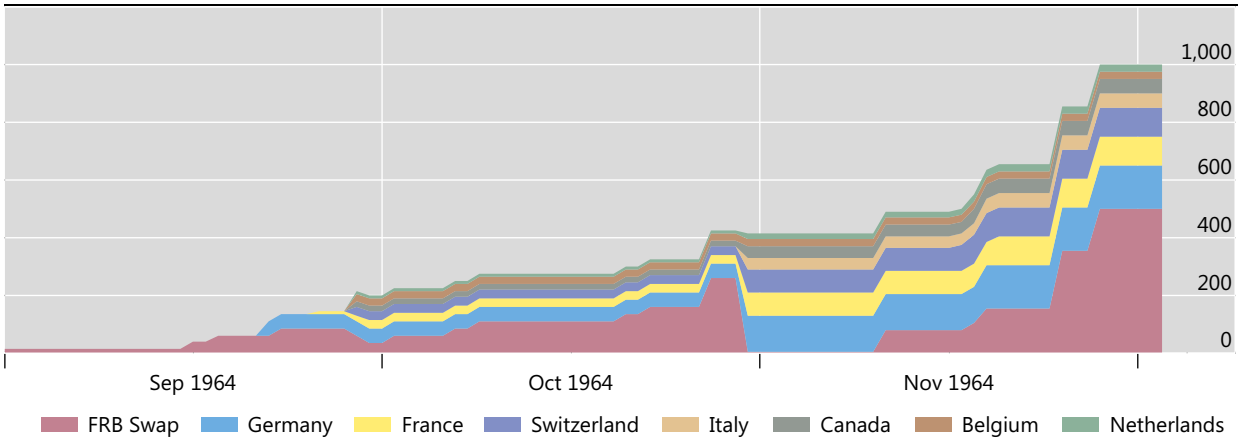
[32] Letter from Milton Gilbert (BIS) to Coombs, 13 March 1963. BISA GILB9 7.18(23).

functional form similar to a central bank swap and was deliberately designed to accord with the Federal Reserve reciprocal currency arrangements. As an example, Graph 6 shows the accumulation of bilateral deposits by the Bank of England in 1964, which were reported to the BIS alongside the FRBNY swaps outstanding. On 30 October, the Bank of England drew on deposit facilities from other central banks to repay (temporarily) all but $5m of the Fed swap. In December 1964, the UK drew on an IMF stand-by facility to pay off all the swaps/deposits. This example demonstrates the interaction between the Fed swaps and the European deposit scheme and the use of the IMF as a backstop for the swap system as a whole.

Bilateral concerte, August to December 1964

In millions of US dollars

Graph 6



Accumulated daily position.

Source: Bank of England Archives, BoE 7A229/9; Germany, France and Switzerland offered 3-month swaps GBP/national currency, the rest deposits of US$ repayable 3-months from date of drawing.

3. Swaps for what?

Central bank swaps can serve four different purposes. First, they can provide the ammunition for central bank intervention in the FX market or redistribute currency risk after such intervention. Second, they can provide the wherewithal for discount window operations in foreign currency, meeting the needs of banks with limited access to the discount window of the currency's home central bank. Third, they can fund operations to prevent offshore rates from rising relative to the policy rate of the home central bank, extending and reinforcing monetary transmission. Finally, as in sovereign and bank debt crises in the early 1980s (Cross (1982, 1983) and mid- to late-1990s, swaps can also serve as bridge funding for multilateral support packages led by the IMF. In Mexico's sovereign debt crisis of 1982, Fed swaps were used by the Banco de Mexico to provide dollar liquidity to overseas (mainly US) branches and agencies of Mexican banks rather than supporting the peso (Alvarez, 2019, p. 152-53).

In practice, the distinctions between purposes can be hard to draw. Pressures in offshore dollar markets may affect the dollar exchange rate; as a result, providing funding to these markets could be seen as part of or akin to FX intervention. For example, resisting upward pressure on eurodollar rates could be seen as taking

pressure off of vulnerable sterling in December 1966 and June 1967. Similarly, providing dollars through central banks to European banks in the wake of the collapse of Lehman Brothers in September 2008 may well have kept the dollar from rising even more than it did. Still, we have found and documented five bouts of swap-funded cooperative operations in the eurodollar market that sought specifically to manage eurodollar rates and flows/liquidity rather than providing resources for FX intervention.

3.1 FX intervention

The common image of swaps under Bretton Woods as occurring to fund currency intervention—ie before or simultaneous with intervention—is at best partial. Central banks on the defence, with limited reserves, did use swaps to obtain the wherewithal to buy their own currency in FX intervention. But they could also first sell foreign currency in the forward market and later use swaps to obtain foreign currency to pay off maturing forward operations. In this case, the swap came well after the initial intervention to support the currency. Or the Bundesbank, SNB or other Continental European central banks could buy dollars in the market to maintain their exchange rate and then later the the Fed could use swaps to borrow their currencies to buy, or to "mop up" in the phrase of Coombs (1976), these accumulated dollars (Bordo et al (2015)).

This last use of swaps should be understood as redistributing the risk of exchange rate depreciation of the dollar from the partner central bank to the Federal Reserve. The redistribution of risk was intended to change behaviour, ie this is a case of benign moral hazard. In particular, FRBNY intended the swaps to prevent exchanges of dollars at the gold window. Swaps were not so much a funding device—the Bundesbank exchanged an ordinary dollar for a dollar to be repaid with a certain sum of Deutsche marks—but rather a risk-sharing device. Exchange rate guarantees, as used in the 1970s sterling arrangements (Schenk (2010), and as proposed by the Banque de France in this context, would technically have served equally well.

In sum, rather than just providing ammunition for intervention in the FX market to affect the price of currency, the swap could also operate as a guarantee. When the Federal Reserve drew on its swaps and bought dollars with the foreign currency, it provided dollar reserves with a certain value in its counterparty's domestic currency over the term of the swap. Bordo et al (2015) note that that this was the primary aim of the swaps in the pegged rate system of the 1960s: to encourage central banks to retain their dollar reserves and not to exchange them for gold.

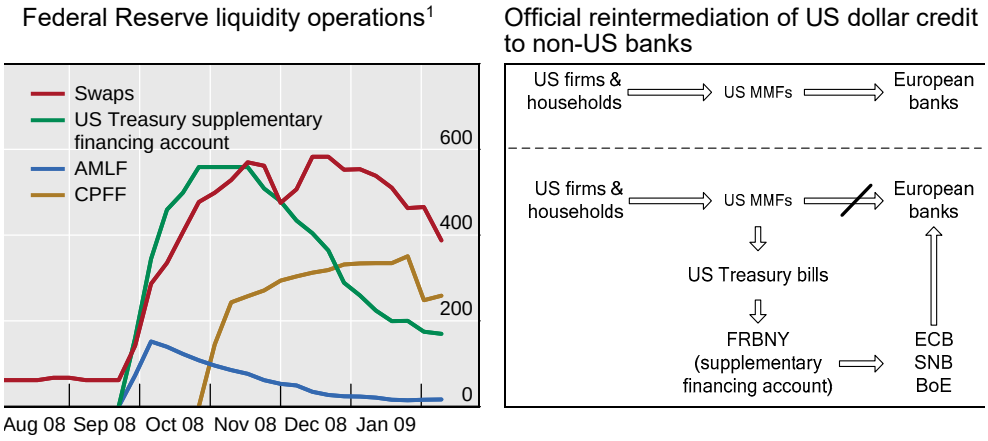
3.2 Emergency liquidity assistance

The association of the 2007 swaps with the TAF for discount window credit identifies the swaps as a means to extend the reach of Federal Reserve emergency liquidity assistance as discussed in the FOMC at the end of 2007. The discount window is the locus classicus of emergency lending assistance to banks coming up short on payments. The TAF innovated by running an auction for discount window credit and thus removing the stigma of approaching the Federal Reserve. The partner central bank receiving dollars likewise distributed Federal Reserve credit through an auction and likewise avoided stigma. This was the dominant aim and use of the Federal Reserve swaps during the GFC, with a notable exception. The SNB drew on its swap in December 2008 to fund a special purpose vehicle (the "Stabilisation fund", ie a bad

bank) to liquidate the toxic assets of UBS; the SNB in February 2009 issued dollar bills to repay the swap (SNB 2008, p 84; 2009, pp 58; Sheets et al (2018, p 9)).

After Lehman Brothers' default, the "breaking of the buck" by the oldest money market fund (MMF) led to a breakdown of the dollar money market that required an emergency liquidity operation. US households and firms had invested in MMFs, which in turn had funded banks headquartered abroad. The sight of a MMF not able to pay 100 cents on the dollar led to a run on institutional "prime" MMFs that held bank paper, mostly into government MMFs. The US Treasury accommodated this switch by issuing Treasury bills in excess of its financing needs and depositing the proceeds with the FRBNY. The Fed lent dollars through swaps to the ECB, SNB and Bank of England, which on-lent the dollars to banks in Europe. The upshot was a longer chain of intermediation between US investors and European banks (Graph 7 from Baba et al (2009)).

Federal Reserve liquidity and official reintermediation — Graph 7

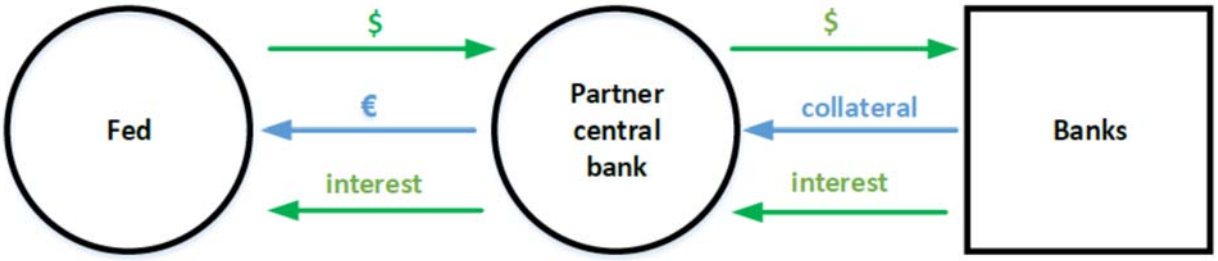


[1] Outstanding amounts, in billions of US dollars; Wednesday observations.

Source: Federal Reserve; Datastream.

Graph 8 clarifies the operation of the swaps and shows how the Fed provided dollar funding to counterparty central banks that then offered dollars to banks in their jurisdictions to meet their liquidity needs. The flows between the circles also portray how the swaps operated in the 1960s.

Providing dollar funding offshore through swaps — Graph 8



Source: authors.

3.3 Managing eurodollar interest rates

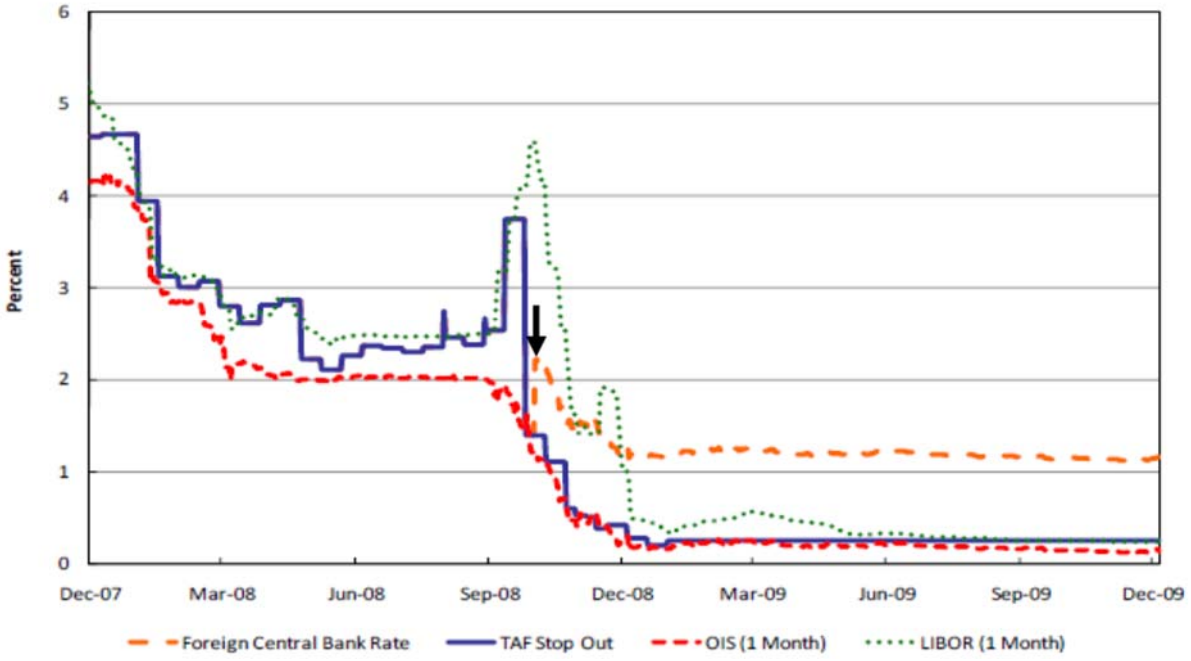
Another way of looking at the Federal Reserve swaps in 2007-08 was that they sought to hold down eurodollar rates. This view is well grounded in the FOMC minutes reviewed above, in which the swaps serve very much as the offshore extension of the TAF. Like the TAF, the way that the partner central bank distributed dollar liquidity against its own-currency collateral provided a stigma-free means of injecting Federal Reserve credit directly into banks headquartered outside the United States.

In the key passages in the minutes, the FOMC members expressed their concern about high offshore rates in terms of the difficulty of controlling the federal funds rate on a morning when eurodollar rates had traded well above it. Indeed, what Bernanke called the "shortage of dollars early in the day" posed challenges to the Fed's capacity to control its policy rate. But this was a symptom of the deeper problem, namely that banks were setting term Libor before noon in London at rates that reflected more the banks' own scramble for term funding than the overnight rates that the Fed was finding difficult to control. A spread to which only traders had previously had paid attention, the gap between overnight interest rate swaps (OIS) and Libor of the same maturity, was sabotaging the transmission from federal funds rate to the benchmark rate of three-month Libor.

In 2008 Libor really mattered because it was the benchmark not only for US and other corporate loan contracts, but also into adjustable-rate US household mortgages (ARMs). In the course of the 2000s, Libor replaced domestic interest rate benchmarks like Treasury bills in most prime ARMs and in all sub-prime ARMs, as Schweitzer and Venkatu (2009) showed for Ohio. As the teaser rates from subprime ARMs written in 2006 re-set at Libor plus rates in 2008, a "Libor surprise" threatened. Had the Fed encountered no problems in controlling the Fed funds rate, dollar Libor well above OIS would prevent the Fed's easing from reaching firms and households (McDowell (2012)).

The swaps served as the means to rein in Libor in 2008. Graph 9, adapted from Goldberg et al (2010), shows an arrow at the point when the Fed removed the ceiling on the total amounts it would offer through swaps to key central banks from 13 October 2008. These operations served to narrow the Libor-OIS spread by about two percentage points within weeks. In short, the Federal Reserve relied on central bank cooperation to repair its monetary transmission. The Fed's open hand to partner central banks struck contemporary critics; the vital US economic interest in these operations is no less striking.

Libor-OIS narrows 2% after unlimited swaps, 13 October 2008 Graph 9



Sources: Goldberg et al (2010), citing Bloomberg (OIS, LIBOR), Federal Reserve (TAF stop out).

4. Managing eurodollar rates with swaps in the 1960s

In the 1960s, the growth of the eurodollar market threatened spillovers, not only to FX markets, but also to domestic money markets. The FRBNY innovated by swapping dollars with the BIS which in turn placed the funds with banks outside the United States. The BIS took credit risk in doing so to a much greater extent than contemporary Fed purchase of two-name paper (ie, bankers' acceptances). Taken as a whole, the eurodollar operations through the BIS not only extended the geographic and time zone reach of Fed operations, but also deepened them, bringing them to bear on what would become benchmark interbank rates.[33]

At this point, a short description of the eurodollar market may serve as useful background to the FRBNY innovation. The market came into existence in 1957 (Schenk (1998)), and by 1962 had established itself as an interbank market in London. It first served as a means to arbitrage Bank of England regulation but it drew its main impetus from side-stepping US regulations (Aliber (1980, 1996), Kreicher (1982), He and McCauley (2012)). These included Fed caps on yields on bank deposits in the United States, requirements for banks to hold non-interest-bearing reserves against them at

[33] Eurodollar operations cut along the grain of contemporary Fed monetary operations. In the 1960s the Fed kept the money market in chronic deficit, that is, in need of claims on the Fed (Meek (1982)). It met this need by *outright* operations, buying Treasury bills or bankers' acceptances, and *reversed* operations, buying bills spot and selling them forward. Depositing funds in the eurodollar market through the BIS also provided reserves to the US banking system. By contrast, intervention in the FX market in support of the dollar drained reserves, cutting against the grain.

the Fed and deposit insurance premia. In short, the Fed and the Federal Deposit Insurance Corporation burdened onshore dollar intermediation and drove it offshore. Dollar depositors, including central bank dollar reserve managers, could get higher rates offshore, including at US-owned banks, at the price of an acceptable, if hard to pin down, increment of country risk.

Turning back to the swaps, from the start, Coombs anticipated their use to manage offshore dollar liquidity. In addition to FX market intervention to support the dollar, the scheme "could be used to provide a groundwork to cope with seasonal payments movements and with hot money swings".[34] In mid-July 1962, the FRBNY set up dollar/CHF swap lines with the SNB and BIS for $100 million each. The latter gave FRBNY a well-used alternative (or addition) to using the former.[35] The operation had the BIS swap gold for CHF with the SNB and swap the proceeds simultaneously for dollars with the FRBNY. The BIS could then hold the dollars in US Treasury bills or make eurodollar deposits. In mid-March 1965 Roche of FRBNY telephoned to Macdonald (BIS) to inform him that FRBNY considered any US Treasury bills held by the BIS as a result of its FRBNY swap to be "freely disposable" by the BIS. Macdonald minuted that "This cryptic formula means a. the Fed would like us to put money in the E-$ market. B. the Fed dare not risk an accusation of putting money even indirectly in the E$ market at a time when they are obliging resident American banks to withdraw funds".[36]

The FRBNY and the BIS clearly distinguished between the swap to be applied to eurodollar operations and the swaps for FX intervention. In July 1965 Coombs suggested a separate swap with the BIS to be against European currencies other than the CHF that the FRBNY "might need temporarily", though in practice it was the BIS that needed the dollars. This was added to the system in August.[37] The second BIS-FRBNY swap line was formally for "other European currencies" against dollars (mainly DM). What practically distinguished the two BIS-Fed swaps was that when the BIS drew dollars from the Fed against DM, the DM played only the role of formal collateral. The BIS merely credited the DM to the FRBNY's account in its books and the Fed did not use them.

The BIS had substantial though episodic resort to this swap line (Graph 10). The value of BIS drawings on FRBNY through this swap was second only to the Bank of England's swap drawings on FRBNY. This "second" swap facility began in 1965 at $150 million and was rapidly increased, so that by March 1968 it amounted to $1,000 million, which was the same size as the Fed swap with the Bundesbank or with the Bank of

[34] Note of Basel meeting 10-12 March 1962. Memo dated 13 March 1962. BoE C43/742.

[35] The BIS also borrowed CHF from Swiss commercial banks and provided the proceeds to the FRBNY in return for Roosa bonds (US Treasury bonds or bills denominated in CHF). By January 1968 this amounted to CHF660 million. BISA 2/1 FRBNY Policy Volume 5. Bordo et al (2015, pp 152-54) describe the difficulties the FRBNY had in buying CHF to repay its swaps with the SNB.

[36] 17/3/65 Phone call Roche/Macdonald. BISA 2/1 FRBNY Policy Volume 5.

[37] Memo of Mandel discussion with Coombs, 10 July 1965. BISA 2/1 FRBNY Policy Volume 5. In the event of the Fed swapping dollars for DM, the BIS would have dollars to invest. Although the formal agreement on the swap referred to investing any resulting dollar balance in US Treasury bills, the BIS and FRBNY discussed employing the dollars in different ways, for example in certificates of deposit with American banks. At this point he BIS had already reached its Bank of England-imposed limit on placements in the eurodollar market (on these limits see Schenk (2010)). Note of a telephone conversation between MacLaury and Macdonald, 30 July 1965. BISA 2/1 FRBNY Policy Volume 5.

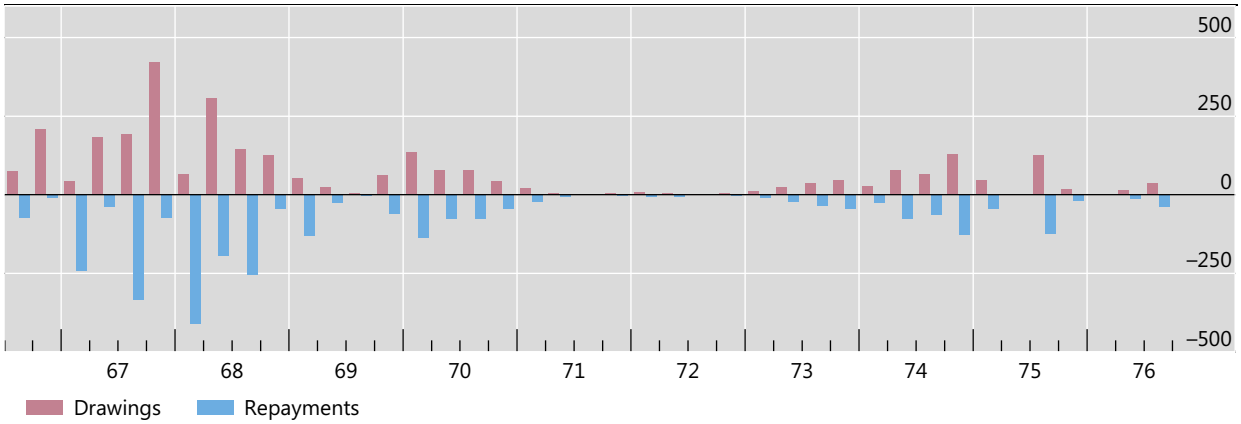
Japan and considerably larger than the BIS CHF swap facility of $600 million. This swap was not a mere side-show of the Fed swap circus, but was in the main tent.

The BIS made the first drawing on this swap to obtain dollars to make its contribution to the 1966 Sterling Group Arrangement, a G10 effort to support sterling.[38] While the swap line would continue to serve temporary BIS needs for dollar cash, it would soon be applied to its larger purpose.

BIS drawings on "second" FRBNY swap (versus DM)

In millions of US dollars

Graph 10



Source: *Federal Reserve Bulletin*, December 1976.

As noted above, the BIS and the SNB had cooperated to make funds available to the eurodollar market at end-year and mid-year to smooth over tightness in the market at the time banks closed their books. In December 1965 the BIS swapped gold for $381 million with the SNB and deposited $244 million in banks offshore ($100 million in London).[39] At the end of 1965 Coombs thanked the BIS for these eurodollar operations "which he characterised as most helpful to the international financial community".[40] Coombs also floated the idea of making funds available to the BIS specifically for this purpose.

In November 1966 the FOMC formally authorised Coombs to tell the BIS that it could draw on the second swap line "if we [BIS] required US dollars to put into the Eurodollar market over the turn of the year and this with the object of damping down a strong rise in interest rates".[41] From then, the BIS mainly used this second swap to place funds in the eurodollar market. On 26 June 1968 MacLaury "confirmed what we

[38] The drawing was $75 million in September 1966. Note of a telephone conversation between Bodner and Mandel, 9 September 1966. BISA 2/1 FRBNY Policy Volume 5.

[39] Memo 11 January 1966. BISA Notes Redigees Vol. 5. Total swaps against gold with the SNB in December were $381 million of which $305 million were placed in banks and $75 million were the "denouement" of CHF/$ swaps with Swiss commercial banks.

[40] Note of a telephone conversation between Coombs and Macdonald, 22 December 1965. BISA 2/1 FRBNY Policy Volume 5.

[41] Note of a telephone conversation between Coombs and Macdonald, 23 November 1966. BISA 2/1 FRBNY Policy Volume 5.

already know, ie that the Federal [stet] regards our second swap line as being available to meet our own cash shortages or for intervention in the Euro-dollar market".[42]

The largest drawings on this swap occurred in the late 1960s and our analysis focuses on five episodes in this period. After this time the international monetary context changed with the float of the DM, rising inflation and the appearance of US current account deficits and we do not find similar swap operations. From 1969, the Bundesbank became more critical of the eurodollar market for undermining its own ability to constrain credit (Altamura (2017, pp 35-36)). The early 1970s featured discussion of the risks of the eurodollar market's growth and a "standstill agreement" to limit central bank deposits in the market, based on the view that these deposits stoked inflation. Also, Europeans criticised the Fed swaps for relaxing the pressure on the United States to correct its imbalance of payments at a time of dollar weakness (Yago (2013, pp 168-9)). These changes probably undermined enthusiasm for using the swaps to manage offshore dollar liquidity. Moreover, as we shall see, tighter US monetary policy also discouraged injecting funds into the offshore dollar market.

The BIS Banking Department's daily sheets recorded drawings by the BIS on this second swap, typically against DM. Extensive dollar depositing in banks outside the United States for the same or later value dates allow the inference that the swap drawings funded particular deposits. Only in the third quarter of 1967 does it appear that the BIS used most drawings on this swap line to fund deposits with, or repayment of deposits from, the Bank of England.[43] To the extent that such deposits may be presumed to have had the purpose of window-dressing the Bank of England's reserves after their run-down by intervention, this use is best considered as intervention-related.

End-year operations in 1966 and 1967 and the end-quarter operation in June 1968 came after US banks reached unprecedented levels of dependence on eurodollars for funding (Klopstock (1968, p 136)). Perhaps for the first time, US banks had heavily used their "internal capital markets" (Cetorelli and Goldberg (2012)), on this occasion to offset policy-induced loss of wholesale funding in the United States. This fund-raising in the eurodollar market, however, left US banks exposed to the seasonal window-dressing of non-US banks, particularly Swiss banks (see below). The risk was that, as the rates on one-month Libid lifted off of New York money market rates, US banks would seek to pass on the higher cost of eurodollar funding. FRBNY cooperated with the BIS to respond to incipient higher rates in these episodes. Klopstock (adviser at FRBNY) observed that "The Federal Reserve's interest in the [eurodollar] market is also demonstrated by the fact that Reserve credit has repeatedly been provided to the market through activation of the System's swap line with the BIS …for placement in the Euro-dollar market" (Klopstock (1968) p 138). Table 3 summarises five episodes when Fed swaps were used to affect liquidity in the offshore dollar market in the 1960s.

In the following five sections, we describe each episode. Then we discuss operational aspects common to the episodes. This allows us in the last section to compare and contrast these 1960s swaps with the 2007-2008 swaps.

[42] Note of a telephone conversation between MacLaury and Macdonald, 26 June 1968. BISA 2/1 FRBNY Policy Volume 5.

[43] BISA, Banking daily, 14/8/67, shows receipt of $50 million, value date 14/8/67, no commercial bank deposits, but a $50 million deposit with the Bank of England, value date 14/8/67 and a "new swap $75 m (we pay Federal Reserve Bank)", value date 15/8/67, the latter under "Group arrangement".

FRBNY – BIS eurodollar operations, 1966-68 Table 3

	Nov-Dec 1966[1]	June 1967	Nov-Dec 1967	Jun 1968[3]	Dec 1968[4]
FRBNY swap	(SNB swap in parens)				
$ millions	200 (160)	143	346	111	80
Number	8 (12)	4	11	3	2
Rate	6% (5⅞%)	4⅜% - 4½%	4¾% - 5⅞% (See Table 3)	5⅞%	6⅛% - 6½%
BIS deposits					
Gross $ millions	371	145	322	111	79.5
# of deposits	91	50	84	35	14
Rate	6¾% - 7⅝% (1 mo) (6¼% - 7¼%)	5⅛% - 5⅝%		6½% - 7%	7⅛% - $7^{5}/_{16}$%
Memo: Spread	*¾% - 1⅛%[2] (⅜% – 1⅜%)*	*$^{11}/_{16}$% - 1⅛%*	*1% (agreed norm) see Table 3*	*⅝% - 1⅛%*	*1% - $^{13}/_{16}$%*

[1] BIS also sold $70-75 million in US Treasury bills and put this money in the market (BISA 7 January Gold and Foreign Exchange Experts Meeting. 7.18(12) DEA 20). [2] Spread calculated over two different periods for FRBNY and SNB. [3] The SNB made a further $110 million available to the BIS to ease pressure in the euromarkets from funds it had raised in swaps with its domestic commercial banks. Points au President, 5 July 1968. BISA. [4] The SNB placed a further $454 million, of which $442 million for value date 31 December 1968 for 6 or 13 days, which the BIS deposited in commercial banks.

Sources: BIS Archives, Banking Department daily sheets.

4.1 The 1966 end-year operation: FRBNY, SNB and BIS

The first operation uniquely saw FRBNY and the SNB both use the BIS as an operational arm to make deposits in commercial banks. The FRBNY-funded operations came first in response to the rise in one-month eurodollar rates from 6½% to 7 3/8% on 29 November 1966 (Coombs (1968, p 41)). The SNB started to provide the BIS with dollars about a week later, with the SNB timing likely governed by the rhythm of the Swiss commercial banks' exchange of dollars for CHF with the SNB. Apparently, Swiss commercial banks wanted to show Swiss francs rather than dollars on their balance sheets in year-end reports. In any case, if Swiss banks by custom withdrew funding, but big US banks needed to retain it, then eurodollar interest rates could rise in response.

Thus, the first big operation had a very modern goal, namely the lessening of year-end strains in arising from commercial bank window-dressing. The end-year tightening of the eurodollar market was discussed among G10 central bank staff who were responsible for gold and FX policy and operations at the BIS in early November 1966.[44] Coombs asked what the others at the meeting expected to happen with window dressing at year end. The Bank of England representative, Roy Bridge, replied that rates would go up and Iklé of SNB expected that central banks would need to put funds back into market. The problem was not trivial. Bridge noted that "this [is] very important. This Dec[ember] is going to be tighter than any Dec in living memory". Coombs warned that "if an end-year rise in interest rates gave rise to several episodes

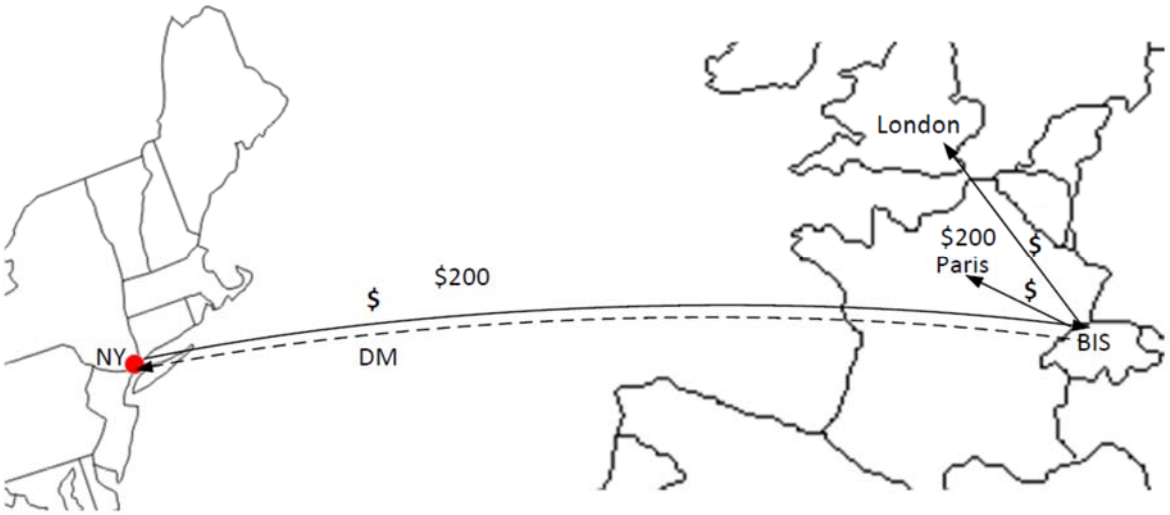
[44] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel, 5 November 1966. BISA 7.18(12) DEA20.

of the Intra Bank variety, could be very serious repercussions".[45] He was thus concerned about financial stability as well as liquidity. He suggested "Haven't the CBs in fact (though involuntarily) acquired a certain responsibility for the market?". Bridge suggested that "Dec '66 [is] potentially dangerous. If so, any CB that finds its [sic] getting $ from these pressures might help by giving the $ to the BIS for return to the Euro$ market". Coombs agreed that this "Would avert trouble and criticism of Central Bank community."

The Fed had particular reason to seek to forestall higher eurodollar yields. When money market yields reached the Regulation Q ceiling in 1966, big US banks with foreign branches had offset four-fifths of the decline in their domestic certificates of deposit (CDs), their main managed liability, by borrowing eurodollars (Klopstock (1968, pp 135-6)). Such funding doubled to $4.3 billion from June to December 1966, reaching half these banks' outstanding domestic CDs. Any tightening of rates on this marginal funding could lead these big banks to tighten lending. Rather than fighting effects of eurodollar stringency in New York, we interpret the FRBNY as extending its credit directly into the offshore money market, to address the problem at its source.

As noted, the FRBNY-funded depositing started in late November when one-month deposits first incorporated the end of the year. Since eurodollar deposits generally matched the T+2 settlement convention of the FX market, 29 November was the first day to trade one-month deposits that would mature in the new year. In the jargon, they included the "turn".

FRBNY-BIS year-end swaps and deposits, 1966 Graph 11



Source: BIS archives.

[45] Intra Bank, Lebanon's largest bank with branches and property investments in the United States and Europe, collapsed on 14 October 1966 after 3-month eurodollar rates rose abruptly from 6.5-7.0% in the last week of September 1966.

Eurodollar yields over 7% posed a challenge to the FOMC's switch to "ease" at its 22 November meeting, which would be reinforced by "somewhat greater ease" at its 13 December meeting. The federal funds rate was bouncing between 5% and 6%, the 3-month Treasury bill rate traded at 5.2%, and one-month domestic CDs offered 5.6%. However weak the integration of the onshore and offshore money markets,[46] offshore rates at such levels pointed in a direction opposite to the one that the FOMC had chosen. Coombs briefed the 22 November FOMC meeting on a "joint effort to cushion the year-end strains", including the BIS drawing on its $200 million swap line "of perhaps no more than a week's duration…to relieve any sudden strains that might develop, at no risk to the System".[47] The flow of funds is pictured on Graph 11.

Staff in the BIS Banking Department hit the phones on 29 November. They placed $50 million for value date 1 December in seven banks. The operation stands out in the daily sheets with a sequence of deposits in dollars that was much longer and more uniform in one-month maturity compared to a normal day. The next day's BIS Banking daily sheet records that, on 30 November, the first $50 million swap was agreed for the same value date but it is a safe inference that the agreement came before BIS traders hit the phones. BIS management understood that FRBNY "authorise [us] to continue to initiate operations under second swap facility with Federal as and when we like"[48].

In the event, "as and when we like" let BIS traders place the bulk of the $200 million swap line amount in the next three days. On the 30th, the BIS deposited $18.5 million with another seven banks, establishing a pattern of wide distribution by nationality. On 1 December the traders placed $27 million with 8 banks and on 2 December $47 million with 10 banks. The BIS covered the cumulative deposits by doing three further swaps with FRBNY for two value dates for a total of $140 million.

At that point, dollars started to arrive at the BIS from the SNB. The dollars took a round-trip from Swiss commercial banks to the SNB and then from the SNB to the BIS (against gold), and then the BIS re-deposited them in the eurodollar market (Graph 12). Iklé described how tightening in the eurodollar market led to higher interest rates and flow of funds out of the United States and into European banks from October.[49] The SNB undertook large swap operations with its commercial banks and channelled about half to the BIS and placed half directly in the eurodollar market.

[46] Hendershott (1967) assumes that the Treasury bill rate affects Libor but that Libor does nnot affect the bill rate. He examined data only through 1964, before large US banks became reliant on eurodollars from their London branches.

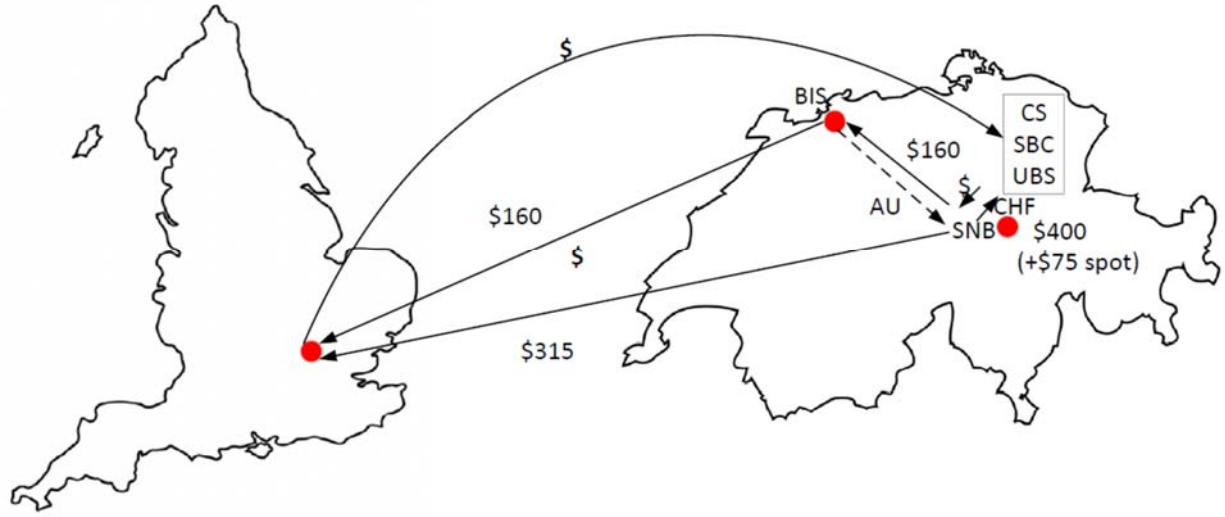
[47] FOMC Transcript 22 November 1966.

[48] BISA 7.24(3) – Banking Daily Sheets, vol. 24, 1 December 1966, p 4.

[49] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel 7 January 1967. BISA 7.18(12) DEA20.

SNB-BIS year-end swaps and deposits, 1966

Amounts in millions of dollars Graph 12



Source: BIS archives.

The SNB conveyed $160 million, about a third of the dollars that the SNB had bought from its commercial banks, to the BIS in a swap against gold. While most of the FRBNY dollars arrived by 6 December, the SNB dollars only started to arrive on value date 7 December and mostly arrived after Christmas. The BIS had a clear view of the scale of the dollars that the SNB would convey in the month[50] and drew down its own holdings of US Treasury bills by $75 million to bridge the gap.[51] By the end of the month, we associate $371 million in gross eurodollar deposits by the BIS with the $360 million it received from the FRBNY and the SNB.

The operation taxed the BIS's capacity as a bank. We count 91 separate deposits. The operation more than doubled the BIS's eurodollar holdings (Table 3, second memo item). While the risk control function at the BIS may not have been formalised at this time, anything approximating counterparty risk limits would have posed a challenge to management. After all, eurodollar holdings represented the largest single non-gold holding, amounting to 15% of the BIS balance sheet in December. [52]

The BIS Banking daily sheets give evidence that the traders shopped for the best rates available. On a number of occasions, discussions with Canadian or US banks end with "we regret" or "they regret" as the banks did not offer what the BIS was looking for. In the graphs below, we source the quotes for 1-month Libid from the BIS Banking Department. Nevertheless, the BIS actually made deposits at yields above those reported. This may be interpreted as signs of successful search by BIS traders for higher yields on offer from the neediest banks.

50 Letter, Ferras to Holtrup, 2 December 1966, Netherlands Bank archives, 8.1/1830/6 – *BIS Correspondentie General Manager Ferras, 1966.*

51 BISA 7.24(3) – Banking Daily Sheets, vol. 24, 7, 13, 14, 16, 19, December 1966, p 4; see Table 3.

52 Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel 7 January 1967. BISA 7.18(12) DEA20.

Both the FRBNY and the SNB set fixed rates on their dollar advances, leaving the spread earned by the BIS on the operation to be inversely related to the success of the operation in holding down eurodollar yields. Both swaps were collateralised, FRBNY with DM and the SNB with gold. The SNB priced its advance against gold at 5 7/8%, while the Fed priced its advance against DM at 6%. With the BIS having placed at a yield as high as 7 5/8%, the range of spreads on FRBNY-funded deposits looks to have been wider than the range on the SNB-funded deposits. It is likely that the BIS earned more on the FRBNY-funded deposits than on the SNB-funded deposits, despite the latter costing 1/8% less.

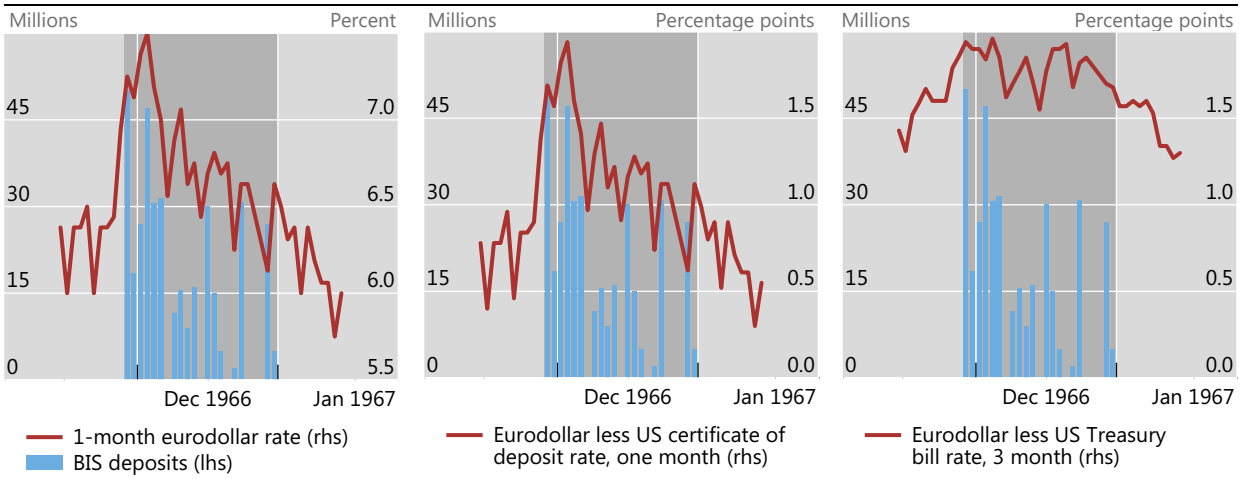
It should be emphasised that this spread compensated the BIS for taking risk with its capital. It stood as an intermediary between a central bank and commercial banks, who might not all repay the uncollateralised deposit. This commitment of BIS capital differs from the *collateralised* advances by the ECB, SNB, Bank of England or Bank of Japan in 2008, as discussed below. Stepping back, in 1966, central banks in effect injected some of their own capital, embodied in the BIS, into the eurodollar market. When one considers the effect of the BIS depositing on Libid, it is important to keep this in mind. Whereas in 2008, central banks drew on swaps to fund collateralised advances to banks, in 1966 the BIS drew on swaps to fund uncollateralised deposits.

Another aspect of the BIS eurodollar operation worth keeping in mind was the absence of an announcement. While the size of the swap lines was public knowledge through regular announcements from the Fed, neither the Fed nor the BIS publicly announced that they were putting $200 million into the market. That said, one can easily imagine that market participants in London and Paris in the last days of November and first days of December compared notes on the BIS placements. A $50 million placement in a day, along with pricing conversations a multiple of that size, must have gotten around the market quickly.

A juxtaposition of the identified BIS deposits and yields serves to show the market environment that led to the operation and to assess whether it met with success in the sense of yields having fallen after its onset. Graph 12 plots BIS deposits on the day of the deal (not the value date) against Libid. The left panel shows the one-month Libid; discussion between the Fed and BIS typically focussed on these yields. The centre panel shows the spread of one-month Libid over its nearest domestic equivalent, namely the one-month CD rate. And the right panel shows the spread of 3-month Libid over 3-month Treasury bills. This is chosen because a series for the one-month Treasury bill is not available. The so-called Treasury-eurodollar spread, later dubbed the "TED spread", is of interest because of the liquidity and lack of regulatory constraint on the bill rate, unlike the CD rate. In 1966-67, the Fed had capped CD rates at 5.5%, and while secondary market yields could and did rise above this level, outstanding amounts fell. But because the TED spread is for the longer, 3-month term, any effect of shorter term depositing would be attenuated.

Graph 13 shows why the FX experts gathered at the BIS could report satisfaction with the result. The money poured into eurodollars, especially the "fresh" funding from the Fed, seemed to lower yields, whether in absolute or relative terms.

Episode 1: Libid and BIS deposits: November – December 1966 Graph 13



Sources: Datastream; BISA 7.24(3) – Banking Daily Sheets, vol. 24, November - December 1966.

When the central bankers reconvened in Basel in the first week of January 1967, they deemed the operation a success. Coombs went so far as to suggest that "perhaps [the] BIS Euro$ operation in December is a breakthrough. BIS has operated more or less as a Central Bank in the international money market. Suggests that some agency should assume responsibility for market, especially if Euro-$ market continues to grow".[53] Iklé of SNB and Bridge of Bank of England remained more circumspect, suggesting that central banks had an obligation "not to cause disturbances in the market" and that, while end-year operations were useful, central banks did not have to monitor or to manage the market year-round. On the other hand, Iklé predicted that "perhaps the Euromarket is increasingly doing the job of financing balance of payments deficits and surpluses, leaving less for the central banks to do". D.H. Macdonald of the BIS gave his view that "as central banks use the market, they have a responsibility to look after [it], at times when their own commercial banks are disturbing it".[54]

4.2 A four-day operation in the Six Days War, June 1967

The second operation six months later stands out from the others in three respects. First it featured a narrow cooperation between FRBNY and the BIS; second, war triggered it; and, third, almost a month elapsed between the last deposit and the quarter-end. On 1 June 1967 market participants expected war to break out at any

[53] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel, 7 January 1967. BISA 7.18(12) DEA20. In the March 1967 *FRBNY Monthly Review*, Coombs (1967, p 43) restrained himself: the operation was a "joint endeavour of the Federal Reserve and several other central banks, together with the BIS, to minimize a potentially severe strain on the Euro-dollar market toward the close of 1966". He drew the lesson that this "truly international money market…cannot rely, as can a national money market, on the support of any single central bank to relieve temporary stringencies or knots in the market". By the time he wrote his memoirs almost 10 years later, however, Coombs (1976, p 144) framed the operation as a defense of sterling.

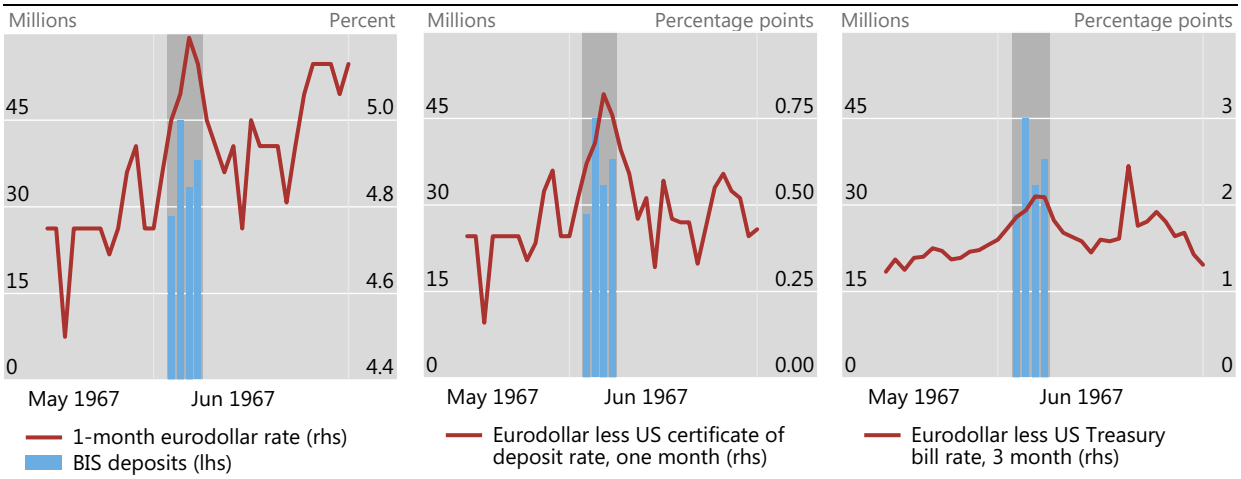
[54] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel, 7 January 1967. BISA 7.18(12) DEA20.

moment, and sterling came under pressure, not only because of the memory of the Suez conflict ten years before, but also because interest rates rose in the eurodollar market. Deposit withdrawals compounded the usual mid-year pressure from window-dressing.

The BIS money market traders set to work on Friday 2 June, placing $28.5 million with 13 banks, mostly for one month, but some for 3 months.[55] The BIS and FRBNY agreed on a $29 million swap for value date Tuesday 6 June. And so on the next week: $46 million in 11 banks on Monday, $33.5 million in 12 banks on Tuesday and $38 million in 14 banks on Wednesday. In four days the BIS deposited $145 million in 50 banks funded by $143 million from the Fed in four swaps.[56] The total deposited reached $155 million including a deposit in an American bank's Caribbean branch. The BIS had increased its eurodollar holdings by over a quarter in four days.

The operation looks prima facie effective, though war and ceasefire could well have traced the same trajectories for the eurodollar rates and spreads (Graph 14). In this case, Regulation Q was not binding, so the middle panel probably provides the clearest reading. It suggests that the spread peaked on the Tuesday after the largest BIS deposits on Monday.

Episode 2: Libid and BIS deposits: Six-day War, June 1967 Graph 14



Sources: Datastream; BIS; BISA 7.24(3) – Banking Daily Sheets, vol. 25, June 1966.

4.3 The November-December 1967 year-end operations

As described in the Fed's monthly review of the eurodollar market (Coombs (1968), eurodollar interest rates began to tighten in September after US rates increased while confidence in sterling ebbed. The Bank of England increased its discount rate by ½% to 6% on 19 October and the FRBNY asked the BIS to "reactivate" the swap line to place "a small amount" of dollars in the market "to help forestall an offsetting rise in rates".

[55] BISA 7.24(3) – Banking Daily Sheets, vol. 25, 5 June 1967, p 4.

[56] BISA 7.24(3) – Banking Daily Sheets, vol. 25, 6 June 1967, p 3-4; 7 June 1967, p 4; 8 June 1967, pp 3-4; 9 June 1967, p 4.

After the Bank of England raised its Bank Rate again to 6.5%, the BIS made deposits of $68 million in 27 banks on 9 and 10 November at 5¾%. These were unusually longer term deposits, with most made for a 3-month maturity.[57]

On 19 November 1967, two days after sterling was devalued by 14.3% and as the year end approached, Coombs told D.H. Macdonald at the BIS that the eurodollar markets "may well show signs of strain and disorder" and suggested increasing the "'second' swap line, upon which we draw for this purpose" from $300m to $500m.[58] An increase followed a crisis meeting of G10 central bank governors in Frankfurt on 25 November to discuss the flow of funds from the eurodollar market into European currencies as confidence in the dollar receded. Eurodollar rates rose as a result. The Fed drew on the Bundesbank to fund the latter's $600m injection into the eurodollar market through swaps, providing dollars against DM spot and buying dollars forward. Coombs (1968, p 51) noted that the swaps' spot leg provided dollar liquidity "especially effective in bringing down Euro-dollar rates", while the forward leg offset speculative demand for DM. At the FOMC on 27 November MacLaury reported that "three-month rate in the Euro dollar market was 5-3/4 per cent just prior to [sterling's] devaluation, during the early part of last week it was 6-1/2 per cent; and on Friday it rose to 7 per cent, where it remained today". [59] The FOMC learned of a "command post" for forward operations in Frankfurt manned by Coombs, Iklé and Johannes Tungeler (Bundesbank). Asked about its objective, Chairman Martin defined the main goal of the operation as stabilising flows, not reaching a target interest rate in the eurodollar market.[60]

The BIS started making one-month deposits as soon as their maturity extended beyond the turn of the year, not waiting for the 30 November announcement that it had agreed to double the "second" swap line to $600m as part of a general increase in Fed swap facilities.[61] The Fed's *Monthly Review* noted that the Fed had swapped $38 million for eurodollar operations at the end of November.[62] In the event, the BIS placed $14 million at 6 ¾% with seven banks through early January, and a short deposit of $7 million with another bank.[63] The BIS offered another $19 million to three Canadian banks at the same rate, but "they all regret".[64] Eurodollar rates fell thereafter, but when they reversed on 7 December, the BIS made 14 deposits amounting to $87 million,

57 BISA 7.24(3) – Banking Daily Sheets, vol. 25, 10 and 13 November 1967, p 3.

58 Note of telephone conversation on 19 November 1967 with Coombs by DH Macdonald BISA 2/1 FRBNY Policy Volume 5.

59 FOMC Minutes, 27 November 1967. After the devaluation, the US shipped several tons of gold to London because the Bank of England had run out of physical stocks. This required the army and airforce.

60 "Mr. Sherrill asked whether the group now operating the 'command post' in Frankfurt had objectives formulated in terms of interest rates on Euro-dollars. Chairman Martin replied they did not; they were concerned with stabilizing flows".

61 Note of telephone conversation on 27 November 1967 with Coombs by DH Macdonald, BISA 2/1 FRBNY Policy Volume 5.

62 BISA 7.24(3) – Banking Daily Sheets, vol. 25, 1 December 1967, p 3, shows the receipt of $38 million

63 BISA 7.24(3) – Banking Daily Sheets, vol. 25, 30 November 1967, p 4, and 1 December, p 4.

64 BISA 7.24(3) – Banking Daily Sheets, vol. 25, 30 November 1967, p 4a. The balance of the $38 million may have funded a withdrawal by the Bank of England of $21 million on the same value date (Daily Sheets, 1 December, p 4).

subsequently funded through a swap with the Fed.[65] A week after this, the largest daily deposit ito date, the BIS and the Fed reviewed tactics.

These operations prompted further discussion. On 14 December, H.H. Mandel of the BIS and David Bodner, Manager in the Foreign Department of the FRBNY, discussed the BIS's eurodollar deposits. Mandel noted that "our policy so far had been to act only if there were a marked increase in rates, but he [Bodner] did not completely share my views in this respect. When asked what increase he considered to warrant an intervention, he replied ¼ of one per cent (this not necessarily applying to American branches [of US banks]". [66] This discussion occurred on a day when the Banking Department's one-month Libid had in fact risen a quarter, but the previous days' depositing had accompanied falling rates.

The deposits continued a week later but were quickly unwound. The BIS responded to a 7/16% rise in one-month Libid on 21 December, its last rise of the year. Mandel phoned Bodner to tell him that the BIS had placed about $30 million for one month in the Eurodollar market at 6 ¾%.[67] According to the daily banking sheets, the BIS deposited $28 million in eight banks.[68] The Fed swaps thus reached a total of $346 by the end of December.In the new year, eurodollar rates subsided and by the end of January, the BIS had repaid the swaps. In fact, FRBNY carefully timed its ability to report the unwinding of the swap. In mid-February MacLaury asked the BIS to "refrain from drawing on the US$/DM swap for any reason whatsoever from 26 February to 8 March inclusive" so that no amount would be outstanding over the turn of the calendar month.[69] The Fed wanted to be able to report that the swaps had all been repaid in its *Monthly Review*.

Table 4 reproduces an end-month BIS summary of its drawings on the FRBNY swap in November/December 1967. On these swaps (which were against DM credited to the FRBNY account at the BIS) the BIS agreed to pay the Fed 1 percentage point below the rate that the BIS earned in the market on its deposits, so the operations would seem to have been profitable for the BIS. But the "E$ less 1%" was a rough norm. For example, for the $87 million of deposits on 7 December, some of the one-month deposits earned more than the 6 ¼% implied by Table 4, but some were of shorter maturity at lower yields. The term of some of the deposits were originally shorter "but were subsequently almost all renewed for a total period of about one month".[70]

[65] BISA 7.24(3) – Banking Daily Sheets, vol. 25, 8 December 1967, p 4.

[66] Note of telephone conversation on 14 December 1967 with Bodner by Mandel. BISA 2/1 FRBNY Policy Volume 5.

[67] Telephone conversation DH Macdonald and Bodner, 21 December 1967. BISA 2/1 FRBNY Policy Volume 5.

[68] BISA 7.24(3) – Banking Daily Sheets, vol. 25, 22 December 1967, p 4.

[69] Telephone conversation MacLaury with Macdonald, 16 February 1968 (5pm). BISA 2/1 FRBNY Policy Volume 5.

[70] Memo "Intervention in Euro-market", 29 December 1967. BISA 2/1 FRBNY Policy Volume 5.

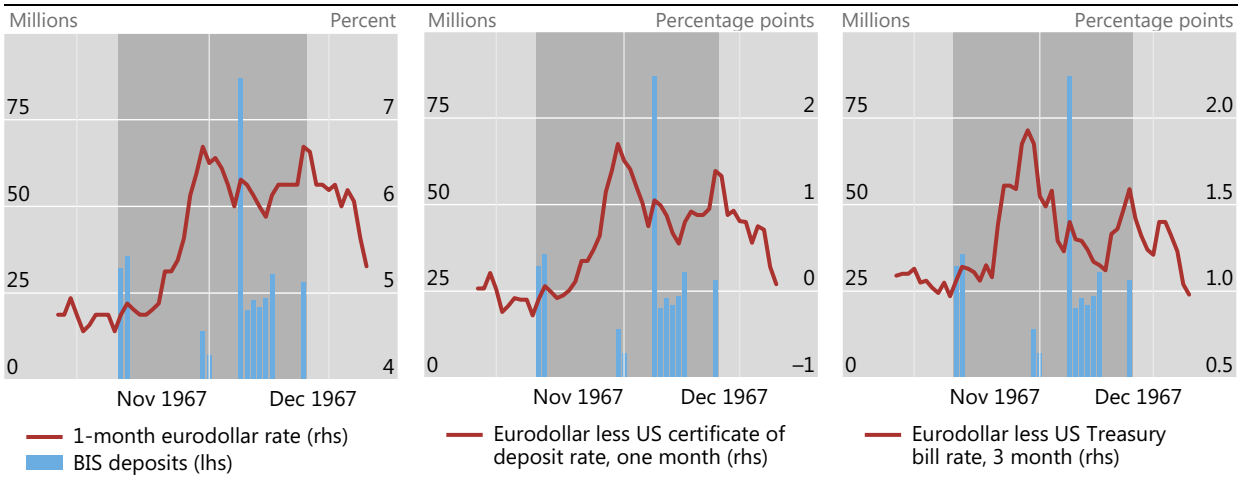
BIS summary of November-December, 1967 BIS depositing and Fed swaps Table 4

Value taken (all 1967)	Period invested in Euro-market	Rate paid to Fed (% p.a.) = E$ less 1%	Amount drawn in $m
13/11	6 weeks to 3 mths	4.75	32
14/11	6 weeks to 3 mths	4.75	36
1/12	1 mth	5.75	38
11/12	About 1 mth	5.25	87
12/12	1 mth	5 5/16	29
13/12	1 mth	5.25	23
14/12	1 mth	5.25	21
15/12	1 mth	5 3/16	18
18/12	1 mth	5 1/8	34
27/12	1 mth	5.75	28
			Total =346

Source: Memo "Intervention in Euro-market", 29 December 1967. BISA Vol 5, 2/1 1965-69.

Stepping back, the dollar-supplying operation, alongside that of the Bundesbank, did see one-month Libid trade no higher than the late November peak during the course of December (Graph 15, left-hand panel). That said, the run-up at the turn in 1967 did prove worse than in 1966. The substantial deposits of 6-week to 3-month funds in earlier November did not seem to succeed in signalling the later substantial BIS dollar deposits sourced from the Fed, as well as the very sizeable Bundesbank provision of dollars sourced in part from the Fed. If the one-month onshore-offshore spread in the middle panel suggests a more successful operation, this resulted from a higher domestic CD rate, which we interpret the operation as seeking to avoid. The narrowing of the three month TED spread from almost 2% to 1-1½% marks the most favourable assessment of the operation. Eurodollar depositing in this episode seemed to exert a more muted impact, but also faced a greater challenge, especially after the sterling devaluation on 16 November, which pressured the US dollar.

Episode 3: Libid and BIS deposits: November – December 1967 Graph 15



Sources: Datastream; BIS; BISA 7.24(3) – Banking Daily Sheets, vol. 25, November - December 1967.

On 2 January 1968 the Fed announced substantial further restrictions on US-resident bank lending to Western Europe both through eurodollar deposits and other loans. The aim was to generate a reflux of funds from overseas back to the US with a target of $500 million during 1968.[71] This rather contradicted FRBNY's own operations in the eurodollar market through the BIS. Two months later, speculation against the dollar mounted and the gold pool supporting the market price of gold at the official rate of $35/oz collapsed. Just before this happened on 17 March 1968, Coombs asked the BIS to increase the "second swap line" from $600m to $1000m and Macdonald, Coombs and Bonder "decided that we should keep in close touch with developments on the Euro-dollar market, but that we should not intervene at this moment".[72] The Fed announced an increase in swap lines across the board on 17 March 1968; it increased the total value of facilities to $9,355 million.

4.4 The quarter-end operation in June 1968

Staff from the BIS regularly travelled to New York to speak to their counterparts at the FRBNY both about operational and strategic issues. As the mid-year stresses in the dollar market approached, D.H. Macdonald met with the FRBNY President and Board of Directors on a visit in late May or early June 1968. This time, Macdonald learned that the BIS should not use its swap to intervene in the eurodollar market to respond to half year movements "because of their [US] domestic monetary policy". But, they did agree that, if the 3-month rate increased to about 7.5%, then "using this swap line might be justified".[73]

Before eurodollar rates rose into this range, the May 1968 unrest in France led to operations that defined the scope of BIS discretion to draw dollars "for cash purposes" from FRBNY if it was not in the US national interest. On 30 May, the BIS proposed (and FRBNY accepted) a $60 million drawing, as usual against DM.[74] This seemed to fund a Banque de France deposit withdrawal from the BIS of $54 million on value date 31 May, the same settlement day as a BIS purchase of FF908 million (about $180 million) from banks in 10 countries against dollars received from the Banque de France.[75] On 31 May, the BIS swapped $150 million against Banque de France gold loco London for value on 4 June. To raise dollars, the BIS drew on the FRBNY for $110m (outstanding reached $170m one day) with the intention of unwinding this swap on 10 June.[76] On 12 June Coombs advised Macdonald that "in his view this facility [the BIS second swap facility] was available to us to fill any short-fall in our US dollar cash position but not

[71] Telegram from Board of Governors of Federal Reserve System to Ferras, 2 January 1968. BISA 2/1 FRBNY Policy Volume 5.

[72] Note of Telephone Conversatlon Coombs and Bodner ith Macdonald, 15 March 1968 10:35am, BISA 2/1 FRBNY Policy Volume 5.

[73] Note of a lunch Macdonald and President and Board of Directors of FRBNY during a visit to the US from 14 May to 6 June 1968, report dated 27 June 1968. BISA 2/1 FRBNY Policy Volume 5.

[74] BISA 7.24(3) – Banking Daily Sheets, vol. 26, 30 May 1968, p 3a.

[75] Ibid, p 3 and 31 May 1968, p 4.

[76] Ibid., 4 June 1968, p 3. Points a signaller au President, 7 June 1968. BISA Meetings. 8/1/60 – 5/12/75 puts the amount at $140 million. See also Telephone conversations between Mandel and MacLaury on 31 May 1968 and Gutzwiller and MacLaury on 5 June 1968. BISA 2/1 FRBNY Policy Volume 5.

to refinance the needs of any particular borrower".[77] Coombs did not want the swap line to be used to supply dollars to the BIS's other central bank customers.

Two weeks later, on 25 June 1968, 3-month Libor (typically 1/8% over Libid) climbed over 7% and Coombs and Macdonald agreed that the BIS should draw dollars on its swap to "reduce the pressure of demand for funds up to and including 28th June".[78] Within the hour, the BIS had placed $36m for value on 26 and 27 June.[79] The next day the BIS drew a further $75m from the swap and placed $73.5 million in 17 separate deposits, just like the day before.[80] In addition, the SNB deposited $80m in dollar Clearing House funds with the BIS, which the BIS placed into the London branches of two US banks.[81] The Fed priced the swap at 5 7/8%, while the BIS placed the dollars at rates between 6 3/4% to 7%, yielding a spread of around one percentage point. The SNB deposited the Clearing House funds at 6% ($30 million) and 6 3/8% ($50 million), and the BIS earned a narrower spread on these high value deposits of 3/8% to ½%. We hypothesise that these operations shifted dollars from New York to London. With $191 million rapidly placed, MacLaury and Macdonald "agreed that the pressure for end of half-year money had clearly decreased and that there was no necessity for us [BIS] to follow the rates down".[82] The juxtaposition of the BIS deposits with Libid and its spreads is consistent with this agreement (Graph 16).

[77] The BIS was asking whether the FRBNY had any objection to the BIS making a US$ advance to Bulgaria and Coombs wanted to be sure that the second swap was not used for this purpose. Telephone conversation between Coombs and Macdonald, 12 June 1968. BISA 2/1 FRBNY Policy Volume 5.

[78] Telephone conversation between Coombs and Macdonald, 4:45pm 25 June 1968. BISA 2/1 FRBNY Policy Volume 5.

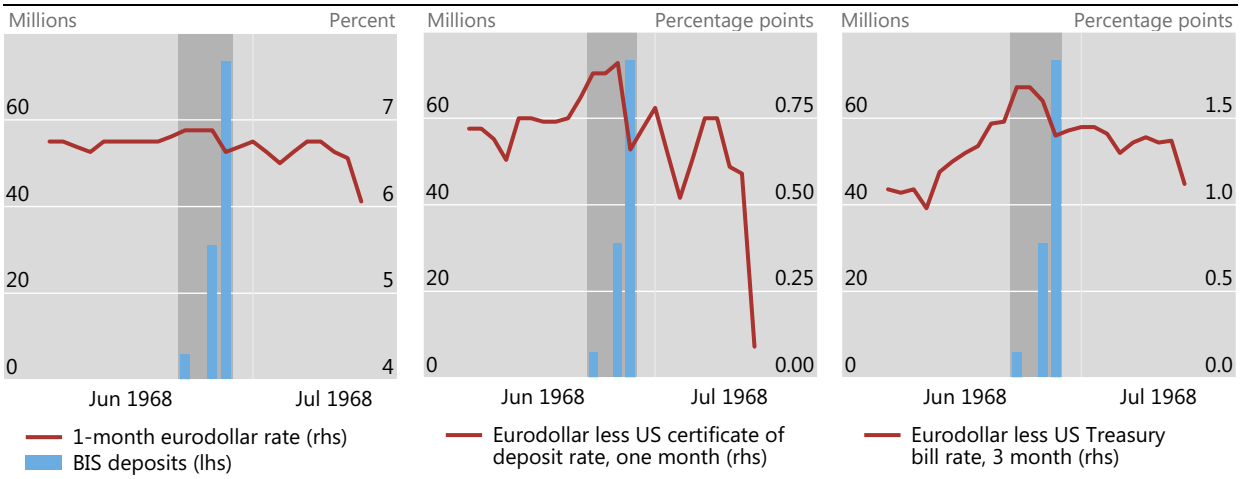
[79] Note of a telephone conversation Coombs and Macdonald, 5:50pm 25 June 1968. BISA 2/1 FRBNY Policy Volume 5. BISA 7.24(3) – Banking Daily Sheets, vol. 26, 26 June 1968, p 4, shows $31 million in 17 deposits on 25, and the same 24 June 1968, p 4, shows a $6 million deposit in an American bank's London branch, originally for value date 24 June.

[80] BISA 7.24(3) – Banking Daily Sheets, vol. 26, 27 June 1968, p 4.

[81] In July the President of the BIS was advised that: "toujours avec but d'attenuer les pressions sur le marche europeen, la BN Suisse a mis a la disposition de la BIS $110m qui representaient une partie des swaps qu'elle a effectues avec les banques commerciales suisses et qui se son eleves a $400m". Points a signaller au President, 5 July 1968. BISA Meetings. 8/1/60 – 5/12/75.

[82] Note of telephone conversation between MacLaury and Macdonald, 26 June 1968 3pm. BISA 2/1 FRBNY Policy Volume 5.

Episode 4: Libid and BIS deposits: June 1968 Graph 16



Sources: Datastream; BIS; BISA 7.24(3) – Banking Daily Sheets, vol. 26, June 1968.

Stepping back, this operation gives ample evidence of restraint born of the potential for conflict between and increasingly restrictive US monetary policy at home and stabilisation of eurodollar rates abroad. Although the operation started at a lower rate than envisaged, it used little more than a tenth of the eurodollar swap line. It seems mostly to have capped rates and reduced spreads. The eurodollar rate declined a month later without further intervention.

4.5 The end-year 1968 operation

In early December 1968 the G10 central bank FX managers met again in Basel and reflected on how the year end might develop. According to the notes of the meeting, Coombs reflected that the "problem we have at this meeting is not the year-end on Euro $ Market, but considering risk of some events that could put Euro$ market in v. bad shape temporarily".[83] The markets had been disturbed by expectations of a franc devaluation and a DM revaluation. The French authorities closed their markets for three days during November after heavy loss of FX reserves and reopened them on 25 November with strict exchange controls, particularly on forward exchange markets. The result was a flow of dollars into the Banque de France that threatened to add extra strain on the eurodollar market over the rest of December.[84] The Banque de France had swaps outstanding at end-October of $612 million (including $375 million with the FRBNY), these rose to $1,091 million at end-November ($571 million with FRBNY) and then receded somewhat to $970 million by 6 December. Coombs then tried to rally more multilateral support for the year-end if required, expressing his "hopes that if BIS has to put a lot into the market, it won't be only from Fed. $1 billion a lot of money. Would like others to take part too'". Leutweiler of the SNB offered that it was "quite prepared to do that with BIS over year end" and Frasca of the Banca d'Italia "thinks

[83] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel 7 December 1968. BISA 7.18(12) DEA20

[84] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel 7 December 1968. BISA 7.18(12) DEA20. There had been a meeting in Bonn to coordinate stabilising the markets.

everyone could contribute". Tungeler also offered that "in a v.[ery] serious situation Bundesbank too would be inclined to step in. Not just a question of interest rates". Coombs warned that "sudden drying up of forward cover in the market, could trigger off an emergency".[85] This discussion highlights Coombs' anticipation of greater strains in the offshore dollar market as the year-end approached and the need to supplement the BIS swap with simultaneous action by other central banks, partly through the BIS.

As in the end-year operation in 1966, the BIS routed fresh dollar funding into the eurodollar market in December 1968 and also recycled dollar funding from the SNB. The balance between the two sources differed from 1966, with the Fed providing $80 million in two swaps, while the SNB deposited more than $400 million. This difference, as well as differences of timing, reflected the ongoing tightening in US monetary policy. This time, higher offshore rates would pose less of a threat to US monetary policy than in 1966.

The 17 December 1968 FOMC considered tightening the federal funds rate against the background of Board consideration of a higher discount rate and higher reserve requirements. In this context, the management of end-year stringency in the eurodollar market was anticipated and the FOMC sought to minimise the potential for "conflict":

> Mr Maclaury observed that at the time of the last BIS meeting Mr. Coombs had advised the group of gold and foreign exchange experts that, while the System was prepared to put some funds into the euro-dollar market, such operations obviously might conflict with U.S. domestic objectives. Accordingly, he had asked that other central banks stand ready to place funds in the market, either in conjunction with the Federal Reserve operations or in lieu of them. ..[B]ecause of the problem of conflict the BIS had been told to limit its placements in the Euro-dollar market financed by drawings on the Federal Reserve to the minimum consistent with the maintenance of orderly conditions, and in any case not to exceed $150 million. In accordance with those instructions, the BIS had placed only $80 million in the market, far less than it might otherwise have done.[86]

Consistent with this restrained approach, the operation in 1968 looks to have leaned less forcefully than its predecessors against a tightening of the eurodollar market. First, the operation started later. In particular, the jump in one-month rates on 28 November elicited no action as a similar rise had in 1966. Moreover, the Fed swap drawings were fewer (the BIS drew only twice) and, taken together, smaller than 1966.

The BIS drew dollars from its FRBNY swap line only the day after Libid hit 7% on 5 December. Before then the BIS had already used other sources of funds to increase its eurodollar holdings by $55 million in December.[87] When the BIS drew on the FRBNY swap for $50 million on 6 December, its traders placed the funds for one month in 10 banks from 4 countries.[88] On 12 December, when Libid had risen to 7 3/16%, the BIS drew another $30 million and placed the funds for one month in just two Canadian

[85] Notes of Gold and Foreign Exchange Experts Meeting, handwritten by Dealtry, Basel 7 December 1968. BISA 7.18(12) DEA20. There had been a meeting in Bonn to coordinate stabilising the markets.

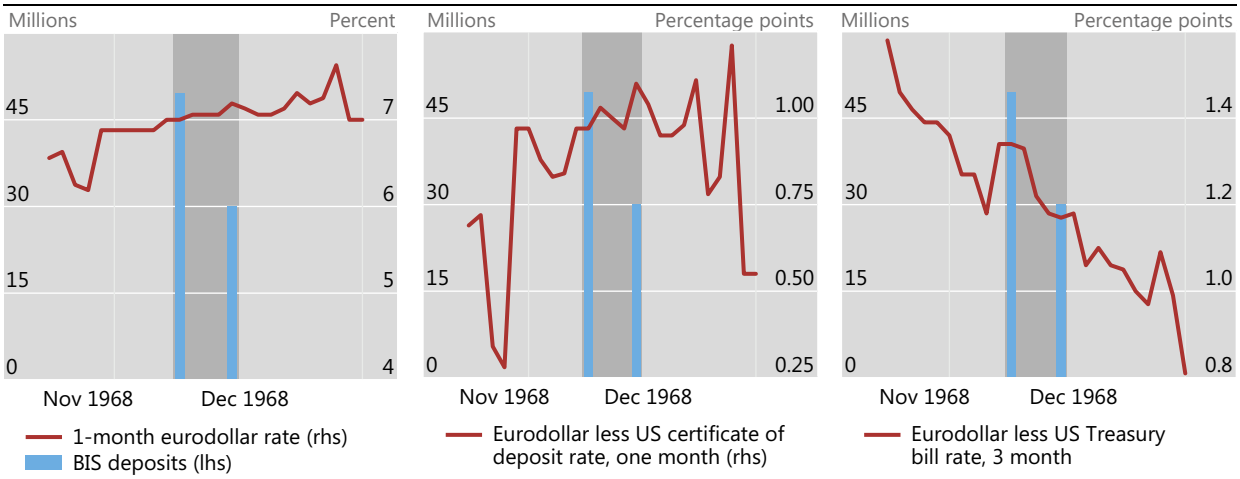
[86] FOMC Minutes, 17 December 1968, pp 20-21,

[87] BISA 7.24(3) – Banking Daily Sheets, vol. 27, 2 December and 10 December 1968 p 1.

[88] BISA 7.24(3) – Banking Daily Sheets, vol. 27, 2 December, 1968 p 1; 9 December, pp 3, 4; and 10 December 1968, p 1.

and two US banks.[89] The BIS spread over the Fed's 6 1/8% on the first swap was 1%, but only 13/16% on the second.

Episode 5: Libid and BIS deposits: December 1968 Graph 17



Sources: Datastream; BIS; BISA 7.24(3) – Banking Daily Sheets, vol. 27, December 1968.

As Coombs had suggested, the SNB stepped up its year-end operation, or at least the part operated through the BIS. However, the SNB committed its funding for the "turn" late in the month, and the BIS did not draw on its own liquidity to make deposits in anticipation of the SNB funding, as it had in mid-December 1966. The SNB started to make deposits at the BIS for 6 or 13 days with value date 31 December, on 20 December with $50 million, added $150.5 million on 23 December, $166.5 million on 24 December and another $75 million on 30 December. Notwithstanding the BIS making the deposits for the turn about as fast as the SNB deposits came in, one-month Libid peaked at 7 5/8% on Christmas Eve, up over 1% since late November. When the BIS books were closed on 31 December, it was holding $880 million in eurodollars, which was more than double the day before.

The impact of the 1966 and 1968 operations were affected by the different circumstances. While the sum of BIS and SNB-funded deposits in December 1968 exceeded that in December 1966, Graph 17 presents a different profile than Graph 13. Given the constraints imposed in line with the stance of US monetary policy, differences of timing and the balance between fresh money from the Fed and funds recycled by the SNB underlay the impact on the Eurodollar rate and the spread against the CD rate. The main effect of the 1968 operations appears in the Treasury bill spread.

The tensions between trying to maintain orderly conditions the Eurodollar market and domestic priorities became more clear. Despite the restrained size of the BIS drawings on the Fed, Governor Sherman J. Maisel, joined by three other governors, worried at the 17 December FOMC meeting that the eurodollar operations, "had the effect of keeping funds in the United States that otherwise would have gone back to the Euro-dollar market".[90] Domestically, the Fed was fighting to slow down reserve expansion and to hold up short term rates as an aid in reducing inflationary pressures.

[89] BISA 7.24(3) – Banking Daily Sheets, vol. 27, 13 December, 1968 pp 3, 4.

[90] FOMC Minutes 17 December 1968, p 20.

Through swaps with the BIS, the Fed was increasing reserves and was striving to ease Euro-dollar rates, which had the effect of maintaining or increasing the availability of credit in U.S. domestic markets.[91]

Fed Governors also took exception to the limited advance consultation and after-the-fact review of its foreign operations. One pointedly said, "For example, at the November 26 meeting the Special Manager (Coombs) might well have commented on the matter of possible operations in the Euro-dollar market".[92] MacLaurey replied that the domestic desk was kept appraised of the swap operations and, in the passage quoted above, that the BIS had kept its drawings small. A memo for the FOMC was promised. Coombs returned to the discussion in January and added that, "As that memorandum would indicate, operations of the type Mr Maisel had referred to had been undertaken only at times, such as year-ends, when the domestic Desk was also operating in the same direction".[93]

It remains unclear whether such concerns on the part of FOMC members led to the subsequently reduced use of the "second" swap line between the BIS and FRBNY (Graph 10 above). Certainly, there was less incentive to increase liquidity in the offshore market and reduce the interest rate in these markets when US monetary policy was tightening. Indeed, it seemed that using the swaps in this way could work against domestic monetary policy. In 1969 the Fed continued its tighter policy and sought to create a barrier between the on-shore and off-shore markets to impede US banks' channelling dollar funding from Europe to circumvent tight money at home. In October 1969 the Fed imposed a 10% reserve requirement on marginal eurodollar liabilities.

5. Contrast and comparison: the eurodollar swaps and 2008

The operations in the 1960s and those in 2008 offer both points of contrast and points of comparison. Differences include the state of the market, the instrument used, amounts involved and the monetary transmission mechanism. Similarities include using central bank cooperation to stabilise dollar money markets, the relative scale of operations, premium pricing for offshore dollars and the main maturity of operations.

First, it is clear that the market environment differed. The 1960s operations took place in response to strains arising from window dressing, speculative pressure affecting dollar liquidity and even war. However the 2008 operations took place in the middle of a transatlantic crisis featuring both general and acute state of bank illiquidity as well as widespread and unclear risk of bank insolvency. The scale also differed. The 1960s operations amounted to hundreds of millions of dollars; amounts outstanding under the 2008 uncapped swaps almost hit $600 billion. Even taking into account the 20-fold rise in US nominal GDP, the thousandfold rise is striking.

The instrument used to convey dollars to banks in Europe also differed. The BIS made unsecured deposits in the 1960s while in 2008 the Fed's swap counterparties either auctioned off or offered secured dollar advances. Given the circumstances of 2008, it would have required a brave General Manager of the BIS to have increased its

[91] Ibid, p 17.

[92] Ibid, p 23.

[93] FOMC Minutes, 14 January 1969, p 9.

deposits of dollars with its counterparty commercial banks—central banks in general cut back on their deposits with commercial banks starting in late 2007 (McCauley and Rigaudy (2011)). Yet, if the aim was to lower Libor, unsecured term advances would offer the better match and thus more powerful instrument than secured, term advances, as with the TAF and swaps.

The monetary transmission differed: dollar rates in London exerted a direct effect on monetary conditions in 2008. In the 1960s, Libor rising as banks window-dressed their balance sheets posed a more subtle and diffuse threat to US monetary transmission. Higher offshore rates might put upward pressure on US commercial paper rates and bank lending rates. In 2008, a rising Libor against the backdrop of Fed easing did not just threaten such spillovers to US financial conditions. Instead, it imposed an immediate tightening on trillions of dollars of outstanding Libor-linked liabilities. We return below to the implications of Libor reform for the exposure of US monetary transmission to strains in the offshore dollar market.

These differences, as striking as they are, should not obscure important similarities. First, in both cases, central bank cooperation sought to stabilise the global dollar money market. In parallel to the Fed's recent swaps, the ECB and SNB extended credit to other central banks to stabilise euro and Swiss franc money markets, respectively. That said, the 1960s episodes involved the BIS, an embodiment of multilateral cooperation, whereas the Fed's 2008 swaps operated only a parallel bilateralism. In the December 1966, June 1968 and December 1968 operations, moreover, FRBNY, the BIS and the SNB engaged in a well-articulated triangular cooperation.

Second, both operations reached a substantial fraction of the eurodollar market size. If we combine the BIS and SNB placements in December 1966, they reached $675 million, out of a eurodollar market estimated by the BIS (1967, p 142) of $13 billion. The maximum reached by the 2008 swaps, just short of $600 billion, represented a smaller share of the eurodollar liabilities in 2008 of almost $13 trillion. Similarly sized injections had not dissimilar effects, notwithstanding the different market conditions. In Graph 12 above, it appears that the December 1966 operation brought down eurodollar rates by about 1 percentage point. In 2008, the shift to swaps of unspecified size brought down eurodollar rates by about 2 percentage points.

Third, in both cases commercial banks paid more for dollar liquidity offshore. In the 1960s, the Fed set the swap rate above its domestic rate and then the BIS added a credit intermediation spread. In 2008, the Fed at first set its swap rate at the stop-out rate on the TAF, affording banks offshore access to dollars at yesterday's auction rate in New York. But from 13 October 2008, the offshore auctions were offered at OIS, based on overnight rates in the Federal funds market, of the relevant maturity plus 100 basis points. This meant that the Fed priced the swap financed auctions by its partner central banks about 1% above the TAF rate. This gave banks an incentive to maximize their takings at the TAF, and intended to encourage the re-appearance of the offshore interbank market.

Fourth, monthly maturities were the main focus in both eras. There was limited experimentation in November 1967 with 3-month deposits by the BIS. The Fed allowed three month operations after July 2008, but it was not until three-month funds were offered on an unlimited basis in November and December that this tenor came to represent a third of the outstandings. Again, recall that it was (and is) 3-month Libor that serves as a benchmark.

Given the widespread benchmark status of 3-month Libor by the 1980s (McCauley (2001)), the 2008 swaps might have worked more rapidly had they financed more

advances at this term earlier on. The FOMC minutes suggest that members focused much more on controlling the overnight federal funds rate than on the longer term rate actually used in trillions of dollars of corporate loan and mortgage contracts.[94] Despite the focus on offshore dollar liquidity and Libor as a target for the swaps, members spoke much less about Libor than about the federal funds rate. This was particularly the case for the presidents of federal reserve banks. Members tended to recognise offshore dollar market strains as more of a risk to the Fed's control of the fed funds rate than as a market-led tightening of monetary conditions in contradiction to Fed policy. By contrast, in the 1960s the Fed explicitly designed operations to depress London interbank dollar rates.

An interesting question for the future is whether the intended repatriation of the US dollar money market benchmark from London to New York (Schrimpf and Sushko (2019)) will affect the response of the Fed to any future strains in the offshore dollar market. The experience of the 1960s points to Fed engagement with offshore dollar rates even before they were hard-wired into corporate loan and mortgage contracts.

6. Conclusions

Central bank swaps had a long history in the last century, from 1962 to the late 1990s. While invented during a period of fixed exchange rates, the swaps survived the transition to floating exchange rates in the early 1970s and served a range of purposes. In this history, the BIS often played a pivotal role not only as a coordinating forum for participants, but also as a principal, employing its balance sheet in operations.

Although the focus of this paper has been on the bilateral Federal Reserve swaps, we emphasise their broader context. These facilities were part of a much wider system of bilateral swaps and swap-like facilities provided by G10 central banks to each other both in dollars and in their national currencies. They amounted to a global financial safety net stretched under the global monetary system

Our archival evidence undermines the sharp distinction drawn between swaps then and now. Swaps have recently served to provide funding liquidity and to manage yields in the offshore dollar market, but they also served the same purpose soon after the Fed swap system was established in the 1960s. Both in 2008 and in the late 1960s, the Fed conveyed dollars through swaps in order to alleviate funding liquidity shortages in the offshore dollar market. Finally, the archival evidence speaks clearly to the US interest in swaps as a means to provide funding to the eurodollar market, to manage yields there and to prevent interest rate spillovers in the global dollar market at the source. Resurrecting this largely forgotten history of the 1960s swaps system exposes the precedents for international central bank cooperation, the scope for innovation (particularly through the BIS) and the way the Fed used swaps both at their origins in the 1960s and in 2007-08 to manage US monetary transmission. There are more forms of the international lender of last resort (Kindleberger (1986)) than are dreamt of in our textbooks.

[94] FOMC Transcript, 28-29 October 2008. At this meeting, only a minority of 7 FOMC members (of which only 2 were presidents) mentioned Libor (17 times). By contrast, FOMC members mentioned federal funds or its variants no less than 97 times.

References

Aizenman, J, Y Jinjarak and D Park (2011): "International reserves and swap lines: substitutes or complements?," *International Review of Economics & Finance*, vol 20, no 1, pp 5-18.

Aliber, R (1980): "The integration of the offshore and domestic banking system", *Journal of Monetary Economics*, vol 6, no 4, October, pp 509–26.

——— (2002): *The new international money game*, 6th edition, Chicago: University of Chicago Press.

Allen, W, G Galati, R Moessner and W Nelson (2017): "Central bank swap lines and CIP deviations", *International Journal of Finance and Economics*, vol 22, no 4, pp 394-402.

Allen, W and R Moessner (2010): "Central bank cooperation and international liquidity in the financial crisis of 2008-09", *BIS working paper* 310, May.

Alvarez, S (2019) *Mexican banks and foreign finance: from internationalization to financial crisis, 1973-1982*, London: Palgrave.

Auer, R and S Kraenzlin (2009): "Money market tensions and international liquidity provision during the crisis", *VoxEU*, 14 October.

Baba, N, R McCauley and S Ramaswamy (2009): "US dollar money market funds and non-US banks", *BIS Quarterly Review*, March, pp 65-81.

Bahaj, S and R Reis (2018): "Central bank swap lines", Bank of England *Staff Working Paper* no 741, July.

Bank for International Settlements (2019): *Triennial central bank survey of foreign exchange and over-the-counter (OTC) derivatives markets in 2019*, September.

Bordo, M, O Humpage, and A Schwartz (2014): "The evolution of the Federal Reserve swap lines since 1962", *Federal Reserve Bank of Cleveland, Working Paper* no 14-14.

Bordo, M, O Humpage and A Schwartz (2015): *Strained relations: US foreign-exchange operations and monetary policy in the Twentieth Century*, Chicago: University of Chicago Press.

Boughton J (2001): *Silent revolution: the International Monetary Fund 1979-1989*. IMF.

Carauna, J (2012): "Central bank cooperation: reflections on the experience of the last eight decades', CEMLA's 60th Anniversary Commemorative Conference on Central bank cooperation at the beginning of the 21st century, 20 July.

Cecchetti, S (2014): "Toward an international lender of last resort", in *Re-thinking the lender of last resort*, *BIS Papers*, no 79, September, pp 131-136.

——— (2014): "The global dollar system", remarks at the Federal Reserve Bank of Dallas conference on "The Federal Reserve's role in the global economy: a historical perspective", 18-19 September.

Cetorelli, N and L Goldberg (2012): "Liquidity management of U.S. global banks: internal capital markets in the Great Recession", *Journal of International Economics*, vol 88, no 2 (November), pp 299-311.

Cheung, Y-W, R McCauley and C Shu (2019): "Geographic spread of currency trading: the renminbi and other emerging market currencies", *China & World Economy*, vol 27, issue 5 (September-October), pp 25-36.

Committee on the Global Financial System (2009): *The functioning and resilience of cross-border funding markets*, *CGFS Papers*, No 37, March.

_____ (2017): *Designing frameworks for central bank liquidity assistance: addressing new challenges*, *CGFS Papers*, No 58, April.

Coombs, C (1963-1968): "Treasury and Federal Reserve foreign exchange operations", *Federal Reserve Bank of New York Monthly Review*.

Coombs, C (1976): *The arena of international finance*, New York: Wiley.

Cross, S (1982, 1983): "Treasury and Federal Reserve foreign exchange operations", *Federal Reserve Bank of New York Quarterly Review,* Winter and Spring, pp 55-78.

Denbee, E, J Carsten and F Paternó (2016): "Stitching together the global financial safety net", *Bank of England Financial Stability Paper*, no 36, February.

European Central Bank (2008): *Annual Report 2007*, Frankfurt: ECB

Fleming M and N Klaage (2010): *The Federal Reserve's foreign exchange swap lines*, Federal Reserve Bank of New York, *Current Issues in Economics and Finance*, vol 16, no 4, April.

G20 Eminent Persons Group on Global Financial Governance (2018): *Making the global financial system work for all*, *Report*, October.

Goldberg, L, C Kennedy and J Miu (2010): "Central bank dollar swap lines and overseas dollar funding costs', *Federal Reserve Bank of New York Staff Reports* no 429, January..

Goldberg, L and D Skeie (2011): "Why did U.S. branches of foreign banks borrow at the discount window during the crisis?" *Liberty Street Economics*, 13 April 2011.

He, D and R McCauley (2012): "Eurodollar banking and currency internationalisation", *BIS Quarteerly Review*, June, pp 33-46.

_____ (2013): "Offshore markets for the domestic currency: monetary and financial stability issues", in Y-W Cheung and J de Haan (eds), *The evolving role of China in the global economy*, Cambridge: MIT Press, pp 301-338.

Hendershott, P (1967): "The structure of international interest rates: the U.S. Treasury bill rate and the eurodollar deposit rate", *Journal of Finance*, vol 22, no 3, September, pp 455-65.

Hong Kong Monetary Authority (2018): "The People's Bank of China to issue bills in Hong Kong", *Press Release*, 20 September.

International Monetary Fund (2016): *Adequacy of the global financial safety net,* March.

Kindleberger, C (1986): "International public goods without international government", *American Economic Review*, vol 76, no 1, March, pp. 1–13.

Klopstock, F (1968): "Euro-dollars in the liquidity and reserve management of United States banks", FRBNY *Monthly Review,* July, pp 130-138.

Kohn, D (2014): "The Fed's role in international crises", presentation at the FRB Dallas conference "The Federal Reserve's Role in the Global Economy".

Kreicher, L (1982): "Eurodollar arbitrage", *Federal Reserve Bank of New York Quarterly Review*, Summer, pp 10–22.

McCauley, R (2001): "Benchmark tipping in the money and bond markets", *BIS Quarterly Review*, March, pp 39–45.

McCauley, R and J-F Rigaudy (2011): "Managing foreign exchange reserves in the crisis and after", in *Portfolio and risk management for central banks and sovereign wealth funds, BIS Papers* no 58, October, pp 19-47

McDowell, D (2012): "The US as 'sovereign international last-resort lender': the Fed's currency swap programmed during the Great Panic of 2007-09", *New Political Economy*, vol 17, no 2, April, pp 157-178.

_____ (2017): *Brother, can you spare a billion?: the United States, the IMF, and the international lender of last resort*, Oxford: Oxford University Press.

Meek, P (1982): *U.S. Monetary Policy and Financial Markets*, New York: Federal Reserve Bank of New York.

Moessner, R and W Allen (2013): "Central bank swap line effectiveness during the euro area sovereign debt crisis", *Journal of International Money and Finance*, vol 35, pp 167-178.

O'Driscoll, G P (2011): "The Federal Reserve's covert bailout of Europe", Cato Institute.

Obstfeld, M, J Shambaugh and A M Taylor (2009): "Financial instability, reserves and central bank swap lines in the panic of 2008", *American Economic Review*, vol 99, no 2, pp 480-86.

Papadia, F (2013): "Central banking cooperation in the Great Recession", *Bruegel Policy Contribution*, June.

Papadia, F and T Välimäki (2019): *Central banking in turbulent times*, Oxford: Oxford University Press.

Potter, S (2018): "The Federal Reserve and central bank cooperation over the past 100 years", speech for the Commemoration of the Centennial of the Federal Reserve's US Dollar Account Services to the Global Official Sector, New York City, 20 December 2017, *BIS Review*, 12 January, www.bis.org/review/r180112a.htm

Schenk, C (2010): *The decline of sterling*, Cambridge: Cambridge University Press.

Schenk, C (1998): "The origins of the eurodollar market in London: 1955–1963", *Explorations in Economic History*, vol 35, pp 221–38.

Schrimpf, A and V Sushko (2019): "Beyond LIBOR: a primer on the new benchmark rates", *BIS Quarterly Review*, March, pp 29-52.

Schweitzer, M and G Venkatu (2009): "Adjustable-rate mortgages and the Libor surprise", Federal Reserve Bank of Cleveland, *Economic Commentary*, January.

Sheets, N, T Truman, C Lowery (2018): The Fed's swap lines during the crisis: lender of last resort on a global scale", Hutchins Center, Brookings Institution, and Program on Financial Stability, Yale School of Management, 11-12 September.

Swiss National Bank (2009, 2010): *101st, 102nd Annual Report 2008, 2009*.

Toniolo, G (2005): *Central bank cooperation at the Bank for International Settlements, 1930-1973,* Cambridge: Cambridge University Press.

Tooze, A (2018): *Crashed: how a decade of financial crises changed the world*, New York: Viking.

Truman, T (2008): "On what terms is the IMF worth funding?" Peterson Institute for International Economics Working Paper, 08-11, December.

_____ (2010): "The G-20 and international financial institution governance", PIIE Working Paper 10-13, September.

Wessel, D (2009): *In FED We Trust: Ben Bernanke's War on the Great Panic*, New York: Crown Business.

Wiggins, R and A Metrick (2016): "The Federal Reserve's Financial Crisis Response C: Providing US Dollars to Foreign Central Banks", 1 February. *Yale Program on Financial Stability Case Study* 2015-1C-V1.

Yago, (2013): *The Financial history of the Bank for International Settlements*. London: Routledge.

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