

Eichengreen, Barry; Mehl, Arnaud; Chițu, Livia; Richardson, Gary

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## Mutual assistance between Federal Reserve Banks, 1913-1960 as prolegomena to the TARGET2 debate

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EUROPEAN CENTRAL BANK

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## WORKING PAPER SERIES

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### MUTUAL ASSISTANCE BETWEEN FEDERAL RESERVE BANKS

### 1913-1960 AS PROLEGOMENA TO THE TARGET2 DEBATE

Barry Eichengreen, Arnaud Mehl,  
Livia Chițu and Gary Richardson



In 2014 all ECB  
publications  
feature a motif  
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### **Barry Eichengreen**

University of California; e-mail: [eichengr@econ.berkeley.edu](mailto:eichengr@econ.berkeley.edu)

### **Arnaud Mehl**

European Central Bank; e-mail: [arnaud.mehl@ecb.europa.eu](mailto:arnaud.mehl@ecb.europa.eu)

### **Livia Chitu**

European Central Bank; e-mail: [livia.chitu@ecb.europa.eu](mailto:livia.chitu@ecb.europa.eu)

### **Gary Richardson**

University of California, Irvine and Federal Reserve Bank of Richmond; e-mail: [gary.richardson@rich.frb.org](mailto:gary.richardson@rich.frb.org)

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<b>Address</b>	Kaiserstrasse 29, 60311 Frankfurt am Main, Germany
<b>Postal address</b>	Postfach 16 03 19, 60066 Frankfurt am Main, Germany
<b>Telephone</b>	+49 69 1344 0
<b>Internet</b>	<a href="http://www.ecb.europa.eu">http://www.ecb.europa.eu</a>

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## ABSTRACT

This paper reconstructs the forgotten history of mutual assistance among Reserve Banks in the early years of the Federal Reserve System. We use data on accommodation operations by the 12 Reserve Banks between 1913 and 1960 which enabled them to mutualise their gold reserves in emergency situations. Gold reserve sharing was especially important in response to liquidity crises and bank runs. Cooperation among reserve banks was essential for the cohesion and stability of the US monetary union. But fortunes could change quickly, with emergency recipients of gold turning into providers. Because regional imbalances did not grow endlessly, instead narrowing when region-specific liquidity shocks subsided, mutual assistance created only limited tensions. These findings speak to the current debate over TARGET2 balances in Europe.

**Key words**      Monetary policy, Federal Reserve System, gold standard, liquidity and financial crises, risk sharing, TARGET2 balances

**JEL codes**      F30, N20

## NON-TECHNICAL SUMMARY

The European debt crisis has triggered impassioned debate over the heretofore abstruse issue of “TARGET2 imbalances.” Participants in this debate frequently invoke the United States where imbalances in high-powered money flows between the 12 regional Federal Reserve districts are recorded in the Interdistrict Settlement Account (ISA) and netted out each year in the spring. Impressed by the US example, some of these observers have discussed the costs and benefits of importing this mechanism into the euro area, while others have proposed introducing quantity or price restrictions, such as outright caps or surcharges, to limit the growth of TARGET2 balances.

Prior to 1975, imbalances accumulated through interdistrict settlements were not automatically eliminated at the conclusion of the annual settlement round, however. Instead, settlements in gold were, formally, drawn from the reserve holdings of individual Reserve Banks on a daily basis. But the practice of daily settlement was more appearance than reality. In fact, liquidity and banking sector tensions in a Federal Reserve district prompted the extension of mutual assistance by other Reserve Banks. Reserve Banks mutualised their individual gold reserves in emergency situations, which resulted in large gold flows from districts with payment surpluses to those with deficits – flows known as interdistrict accommodation operations.

These operations mainly took the form of rediscounts of discounted paper between World War I and the Great Depression as well as of sales of participations in open market operations, subsequently. They did not require any physical transfer of gold, but only bookkeeping operations. Gold flows across districts in these exceptional situations were very similar in spirit to the liquidity flows via TARGET2 from the euro area “core” to the euro area “periphery.” The evolution of the interregional settlement mechanism from the creation of the Federal Reserve System in 1913 to the 1970s, when the modern mechanism of annual settlement of payments was put in place, thus may provide lessons for present-day Europe.

Our paper seeks to shed light on the history of mutual assistance between Reserve Banks in the early years of the Federal Reserve System, a process through which the area over which the dollar circulated became a full-fledged monetary union. To that end, we use data on accommodation operations by the 12 Federal Reserve districts between 1913 and 1960 (the last year for which such data are available, although the practice of daily settlements continued as aforementioned through 1975). These data span nearly five decades, significantly longer than modern time series for either TARGET2 or ISA balances.

Overall, the data on interdistrict accommodation suggest that mutual assistance was common in response to liquidity crises and bank runs, with regional Reserve Banks pooling their gold reserves every nine years, on average, between 1913 and 1960. They show that fortunes could change quickly, with Federal Reserve Banks taking turns as emergency recipients or providers of gold. Payment imbalances never grew endlessly, instead narrowing once liquidity shocks had subsided, with half of the effect of a typical shock to interdistrict accommodation dissipating after about five quarters. Mutual assistance left the US public largely unmoved and did not trigger insurmountable tensions between US regions in most cases, with the exception of one noteworthy instance, namely immediately before the bank holiday proclaimed by President Roosevelt in March 1933. As a counterexample, this suggests that cooperation between regional Reserve Banks was essential to the cohesion and stability of the US monetary union.

There are parallels between the current situation and this earlier history. Although we do not wish to push them too far, given the different institutional settings and degrees of homogeneity between the US and euro area monetary unions, these findings speak to current discussions of TARGET2 balances in Europe.

That mutual assistance between Reserve Banks was common during liquidity and banking sector tension periods suggests that the increase in TARGET2 balances since the outbreak of the global economic and financial crisis is not exceptional but, rather, a normal concomitant of the operation of a cohesive monetary union. That fortunes could change quickly, with earlier gold recipients turning into gold providers indicates that the notion of “core” or “periphery” regions

within a monetary union is not carved in stone. The fact that imbalances tended to narrow once liquidity shocks subsided is at variance with concerns expressed that TARGET2 imbalances could grow endlessly or to an extent such as to put the stability of Economic and Monetary Union at risk. That mutual assistance left the US public largely unmoved and hardly triggered tensions between US regions suggests that there is no reason that a dispassionate debate in Europe on TARGET2 balances could not be possible. And that cooperation between regional Reserve Banks was essential to the cohesion of US monetary union and its stability indicates that maintaining such cooperation spirit is essential in the euro area.

## I INTRODUCTION

The European debt crisis has triggered impassioned debate over the heretofore abstruse issue of “TARGET2 imbalances”. The controversy has sparked disagreement in academic and policy circles alike. It is not too strong to say that it has fed doubts about the very viability of Europe’s monetary union.

The imbalances in question emerge from the interaction of cross-border payment transactions and central bank operations in the euro area’s real-time gross settlement system, TARGET2.<sup>1</sup> As the crisis intensified in late 2009, banks in the countries of the euro area “periphery” experienced capital outflows, including to so-called “core” euro area countries. Unable to finance those outflows on private markets, they obtained it instead through the Eurosystem (Lane and Milesi-Ferretti, 2012).<sup>2</sup> Their banks turned to euro area national central banks for funding against collateral. Their national central banks thus accumulated TARGET2 liabilities, while central banks in other euro area countries acquired corresponding TARGET2 claims.

There are two interpretations of this increase in TARGET2 balances. One is that TARGET2 balances simply reflect the European Central Bank’s intermediating role, are as secure as any domestic claim, and are integral to the smooth functioning of a monetary union in which €1 deposited at a central bank in one euro area country equals €1 deposited at a central bank in

<sup>1</sup> TARGET2 stands for “Trans-European Automated Real-time Gross settlement Express Transfer system”. Euro area national central banks offer payment and settlement services in central bank money through TARGET2 to banks via the latter’s accounts at their respective national central banks (see ECB, 2011, for further details). TARGET2 has the advantage of offering a centrally-cleared trading platform for borrowing and lending in central bank liquidity, unlike euro area money markets which remain largely over-the-counter. The possibility that Target imbalances could widen seems to have been first envisaged by Garber (1999, 2010).

<sup>2</sup> See Milesi-Ferretti and Tille (2011) and Lane (2013) for evidence that euro area money market significantly re-segmented along national borders in the wake of the crisis and contributed to the widening of TARGET2 balances. For the US, there is evidence that US Fed fund markets during the financial crisis were “stressed, but not frozen” (Afonso, Kovner and Schoar, 2011).

another euro area country (Cour-Thimann, 2013).<sup>3</sup> The opposing view is that TARGET2 imbalances are bailouts of stressed euro area banks and sovereigns, create the risk of taxpayer losses for the “core” countries, and are indicative of convertibility risk within the euro area (see e.g. Cecchetti, McKinley and McGuire, 2012; Sinn, 2012a, 2012b and 2012c; Sinn and Wollmershäuser, 2012; Tornell, 2012). The collateral, in other words, is worth less than meets the eye.<sup>4</sup>

Participants in this debate frequently invoke the United States as an inspiration for possible remedies to the problems of Europe’s intra-country settlement system (see e.g. Biljsma and Lukkezen, 2012; James, 2013; Koning, 2012; Schubert and Weidensteiner, 2012; Sinn, 2012a and 2012c). US imbalances in high-powered money flows between the 12 regional Federal Reserve districts are recorded in the Interdistrict Settlement Account and netted out each year in the spring.<sup>5</sup> Bookkeeping adjustments are used to wipe clean the balance sheets of individual Reserve Banks of the bulk of accumulated surpluses or deficits vis-à-vis other Federal Reserve districts. This practice, which acknowledges the integrated nature of the Federal Reserve System, is seen as a key explanation for why TARGET2 and ISA balances have developed so differently since the onset of the global financial crisis.<sup>6</sup> The clock is virtually re-set each year in the US but not in Europe. Impressed by the contrast and worried by the controversy surrounding the seemingly endless accumulation of inter-country claims, observers have discussed the costs and benefits of importing this mechanism into Europe.

Others (e.g. Sinn, 2011; Sinn and Wollmershäuser, 2012) have proposed introducing quantity or price restrictions, such as outright caps or surcharges, to limit the growth of TARGET2

<sup>3</sup> TARGET2 claims are akin to claims on domestic banks. They too arise from liquidity-provision operations, albeit conducted by the national central bank of another euro area country.

<sup>4</sup> On the controversy, see inter alia Auer (2014), Bindseil and König (2011), Bindseil and Winkler, (2012), Bindseil, Cour-Thimann and König (2012), Buitier, Rahbari and Michels (2011), Cour-Thimann (2013), De Grauwe and Ji (2012), Mody and Bornhorst (2012), Pesenti (2012), Thimann (2013) and Whelan (2014). The risk exposure of the euro area national central banks derives from the conduct of monetary policy operations, not the corresponding TARGET2 balances. This risk is mitigated by collateral requirements. The residual risk is shared among the euro area national central banks in line with their share in the capital of the European Central Bank. This debate has not gone unnoticed in policy-making circles. The evolution of TARGET2 balances has become a key barometer of the intensity of the euro area’s debt crisis, for instance in multilateral surveillance by the International Monetary Fund (see e.g. IMF, 2012a, 2012b, 2013). At an ECB Press conference on 2 May 2013, for example, President Draghi indicated that “a decrease in TARGET2 balances is the best sign we have that there has been a gradual return of confidence”.

<sup>5</sup> See also Bindseil and König (2011), Cour-Thimann (2013) and ECB (2013). Reserve Banks participate in the Fedwire Funds Service which enables participants – banks and certain other financial institutions – to make large-value, time-critical payments amongst themselves via their accounts with the Fed. The Interdistrict Settlement Account reflects the netting of cross-district transactions between regional Reserve Banks. This annual settlement is based on each regional Federal Reserve Bank’s average interdistrict balance during the preceding 12 months (April to March) –hence it does not necessarily bring balances back to zero. Settlement consists chiefly in adjusting the relative shares of the 12 regional Reserve Banks in the common pool of security holdings maintained in the System Open Market Account of the Federal Reserve System (see Board of Governors of the Federal Reserve System, 2010; Wolman, 2013). Regional Reserve Banks with a positive balance receive interest-bearing assets from those with negative balances.

<sup>6</sup> As shown in Figures A and B of Annex I.

balances. They too draw inspiration from US experience. Prior to 1975, imbalances accumulated through interdistrict settlements were not automatically eliminated at the conclusion of the annual settlement round. Instead, settlements in gold were drawn from the reserve holdings of individual Reserve Banks on a *daily* basis. Superficially at least, this would seem to be an example of the second approach to reforming the TARGET2 system, where imbalances are capped at a specified level (here zero) over a specified period of time (here a day). It would seem to be an extreme version of this type of outright cap, zero balances day over day, which would appear to imply a very dramatic adjustment burden on the borrowing region – something that TARGET2 creditors would relish but TARGET2 debtors would presumably find it very hard to stomach.

Given the difficulty of drastic adjustment by countries unable to obtain market financing, how did individual Reserve Banks satisfy the budget constraints imposed by capping daily interdistrict settlement at zero without imposing large money and credit shocks on their local economies? The answer is that the practice of daily settlement was more appearance than reality. In practice, liquidity problems and bank runs in a Federal Reserve district prompted the extension of mutual assistance by other Reserve Banks. Reserve Banks mutualised their individual gold reserves in emergency situations, which resulted in large gold flows from districts with payment surpluses to those with deficits – flows known as interdistrict accommodation operations. These operations mainly took the form of rediscounts of discounted paper between World War I and the Great Depression as well as of sales of participations in open market operations, subsequently. They did not require any physical transfer of gold, but only bookkeeping operations.<sup>7</sup> Gold flows across districts in these exceptional situations were very similar in spirit to the liquidity flows via TARGET2 from the euro area “core” to the euro area “periphery.”

By way of illustration, Figure 1 shows the large interdistrict accommodation operations that took place during the severe slump of 1920-21, as reported by the Federal Reserve Board in 1922. The stock of interdistrict borrowings and loans looks strikingly similar to the familiar TARGET2 “trumpet.”<sup>8</sup> In other words, risk sharing via interdistrict accommodations was quite similar to that which takes place via TARGET2.

The evolution of interregional gold reserve sharing mechanisms from the creation of the Federal Reserve System in 1913 to the 1970s, when the modern mechanism of annual settlement of

<sup>7</sup> Note that the concepts of “mutual assistance”, “interdistrict accommodation operations”, “gold reserve sharing” and “gold reserve pooling” will be used interchangeably throughout the paper.

<sup>8</sup> As shown in Annex I.



payments was put in place, thus may provide lessons for present-day Europe.<sup>9</sup> In this paper we therefore use data on accommodation operations by the 12 Federal Reserve districts between 1913 and 1960 (the last year for which such data are available, although the practice of daily settlements continued as previously mentioned through 1975). These data span nearly five decades, significantly longer than modern time series for either TARGET2 or ISA balances.<sup>10</sup>

We show that mutual assistance between regional Reserve Banks was common in response to asymmetric shocks. But fortunes could change quickly, with earlier emergency recipients of gold turning into providers. Imbalances did not grow endlessly but narrowed once shocks subsided. Mutual assistance did not excite experts or the American public, nor in most cases did they trigger insurmountable tensions between regions. To the contrary, cooperation between Federal Reserve Banks was essential to stability and smooth operation of the US monetary union.

There are parallels between the current situation and this earlier history, although we do not wish to push them too far given the different institutional settings and degrees of homogeneity between the US and euro area monetary unions.<sup>11</sup>

Most obviously, US regional payment imbalances were affected by shocks arguably as severe as today's global economic and financial crisis: the post-World War I slump, the Great Depression and World War II. The regional impact of those shocks was uneven. Moreover, the Federal Reserve System then was at a stage of development roughly similar to the Eurosystem today. At the time of the first major shocks that led to a surge in regional payment imbalances – 1920-21 and the Great Depression – the monetary union was little more than ten years old, like the euro area today. Hence this earlier era offers an opportunity to compare regional payment imbalances in two monetary unions at similar stages of evolution.

<sup>9</sup> Annual settlements were introduced in the mid-1970s because gold reserve holdings were insufficiently elastic to keep up with the pace of deepening in the US financial system. It became ever more inconvenient to settle daily clearings among regional Reserve Banks with gold certificates. Growing volumes of clearings within the Interdistrict Settlement Account raised concerns that some regional Fed might not have enough gold certificates for settlement on a given day. Hence it became “increasingly difficult for regional Reserve Banks to earmark significant amounts of gold certificates as collateral for Federal Reserve notes” (FOMC, 1975, p. 40) in a context where adverse clearings could wipe out their holdings of gold certificates. The Federal Reserve Board agreed to discontinue the use of gold certificates as the medium for interdistrict settlements so as to “free the gold certificate holdings and make them fully available as collateral behind note liabilities” (ibid. pp. 40-41). It was also decided to introduce annual settlements instead, consisting of adjustments in regional Reserve Banks' holdings of securities in the System Open Market Account, as mentioned above. Post-1975, there are data on interdistrict settlements, as shown in Figure B of Annex I, which are publicly available for the period 2003-2013; we are not aware of publicly-available data for earlier years.

<sup>10</sup> Which start in 1999 and 2002, respectively.

<sup>11</sup> One difference e.g. is that TARGET2 balances can grow without any requirement of settlement at any point in time. Mutual assistance here is automatic and does not depend on the goodwill of some of the national central banks. Another difference is that fortunes have not changed as quickly as in the early decades of the US monetary union: large TARGET2 imbalances persisted for about five years in the euro area, before they started to decline. This is also why some critics see what they regard as “automatic mutual assistance” as potentially problematic in the euro area.

Finally, the role of the gold standard in this earlier era will speak to those who have drawn parallels between the euro area and the interwar period. Specifically they have drawn parallels in terms of asymmetries between external surplus and deficit economies and the role played by domestic prices and costs relative to exchange rates in the adjustment of imbalances (see e.g. Eichengreen and Temin, 2010; Eichengreen, 2012; Bindseil and Winkler, 2013; Bordo and James, 2013; and O'Rourke and Taylor, 2013). Our focus on a five-decade-long period during which the US maintained gold convertibility in one form or another, except for a brief interlude in 1933-1934, thus offers an opportunity to revisit this debate.<sup>12</sup>

The remainder of the paper unfolds as follows. Section 2 reviews the institutional framework for gold reserve sharing between regional Reserve Banks. Section 3 describes the data and section 4 the evidence they provide. Section 5 draws conclusions and policy implications.

## 2 INSTITUTIONAL FRAMEWORK

The early Federal Reserve System was decentralized.<sup>13</sup> Each Federal Reserve Bank was “semi-autonomous”, in the term used at the time. Each conducted its own monetary policy operations, had its own discount policy, and held its own gold reserves.<sup>14</sup> The ultimate guarantor of currency issued by the Federal Reserve System was gold, into which currency notes were convertible at a fixed price. Each regional Reserve Banks and not just the Federal Reserve System as a whole was required to hold gold in sufficient quantity against its liabilities, as determined by law. The Federal Reserve Act specified that “every Federal reserve bank shall

<sup>12</sup> Bordo (2014) draws parallels between the recent evolution in TARGET2 balances and the functioning of the Bretton Woods system. Our paper also relates to the large literature that followed Friedman and Schwartz's (1963) *Monetary History* (see e.g. Bordo and Rockoff, 2013, for an overview). It relates to the literature on the history of the Federal Reserve and its monetary policy (e.g. Meltzer, 2003, 2009a and 2009b; Hetzel, 2008). It relates to the literature on the microstructure of the US money markets, notably to one of its main insights, the so-called “large-small bank dichotomy” (see Goodhart, 1969; Allen and Saunders, 1986; Allen et al., 1989; Furfine, 1999; and Bech and Atalay, 2010) which has in turn inspired theoretical models of financial contagion (Allen and Gale, 2000; Freixas, Parigi and Rochet, 2000) where cross-regional liquidity differences play a key part. This literature finds that a large number of small deposit banks located in regions away from major financial centres are typically net lenders to banks in major US financial centres e.g. in New York, Chicago and San Francisco. Finally, the paper relates to the literature on currency unions, following Mundell (1961) and McKinnon (1963)'s early studies, notably to the more recent literature on the normative and positive considerations concerning the attribution of policy prerogatives between a union and its member states (Alesina, Angeloni and Etro, 2005) and on cross-country insurance arrangements in a currency union (see e.g. Werning and Farhi, 2012).

<sup>13</sup> In important respects it resembled the international gold standard when it was created in 1913 (James, 2013).

<sup>14</sup> Note that the the Board had to give approval to discount rate changes, however. This compromise was how President Wilson reconciled the preferences of bankers who wanted an independent central bank and the southern and western Democrats who demanded political control. The Board based its power to prevent Reserve Banks from announcing or changing discounting rates without its prior approval on Section 13 of the Federal Reserve Act that gave the Reserve Banks power to establish rates “subject to review and determination of the Reserve Board” (see Meltzer, 2003, p. 77). With the exception of New York, Reserve Banks arguably did not think of themselves as exercising the powers of a central bank in this earlier period. They certainly did not think of themselves as changing their liabilities to achieve macroeconomic objectives. Rather they thought of themselves as sitting on a given supply of money available in dealing with seasonal reserve demands and panics. We are grateful to Robert Hetzel for these observations.

maintain reserves in gold or lawful money of not less than thirty-five per centum against its deposits and reserves in gold of not less than forty per centum against its Federal reserve notes in actual circulation.”<sup>15</sup> The gold reserves of Reserve Banks consisted of coin and bullion stored in their vaults but also of certificates, i.e. book credits in a ledger account at the US Treasury.<sup>16</sup>

A Reserve Bank whose gold holdings fell short of these 35 and 40 per cent minima would be unable to settle with other regional Reserve Banks. And if it could no longer settle, commercial banks in its district could no longer maintain business relations with other districts. Cheques and payments from a district with inadequate gold might then trade at a discount to par. A dollar from this district would be worth less than a dollar from another district, violating the spirit of the clause in the Federal Reserve Act requiring “par clearing” between Federal Reserve Banks.<sup>17</sup> To prevent this from happening, the Reserve Bank short of gold would then be forced to reduce its discounts or other lending to member banks in its district, reducing its own liabilities and restoring the specified minimum reserve ratio. Doing so might cause obvious difficulties for member banks in the affected district, not to mention for their customers.

What, then, obviated the need for disruptive adjustment or else violation of the commitment to maintain clearing at par? The answer is mutual assistance between Reserve Banks through reserve pooling. The strict decentralization foreseen in the Federal Reserve Act, according to which each Reserve Bank was a distinct bookkeeping entity required to maintain its own gold reserves, was in practice relaxed through emergency procedures for sharing reserves in the event of need (McCalmont, 1963, p. 228). The ability to pool gold reserves was actually one of the main benefits claimed for the new Federal Reserve when it was established.<sup>18</sup> World War I provided further impetus for the development of these practices. A Reserve Bank would rediscount a bill on behalf of another Reserve Bank that had previously discounted the bill in question.<sup>19</sup> The Act of 1913 foresaw that such rediscounting might be authorized and if necessary compelled by the Federal Reserve Board. It empowered the Board “to permit, or, on the affirmative vote of at least five members of the Reserve Board to require Federal Reserve

<sup>15</sup> Federal Reserve Act of 23 December 1913, section 16, p. 18.

<sup>16</sup> Gold reserves served to back the deposits of the commercial banks of a particular Federal Reserve district, of the US Treasury, and of foreign governments and foreign banks. The latter was an item especially important for the New York Fed which held custody of most of the dollar reserves of foreign central banks. Gold reserves also backed Federal Reserve notes, i.e. paper currency in actual circulation.

<sup>17</sup> See Section 16(13) of the 1913 Federal Reserve Act: “Every Federal reserve bank shall receive on deposit at par from depository institutions or from Federal reserve banks checks and other items”.

<sup>18</sup> We are grateful to Allan Meltzer for this observation.

<sup>19</sup> Between World War I and the Great Depression, reserve pooling mainly took the form of rediscounts between regional Reserve Banks. However, regional Reserve Banks also purchased bankers’ acceptances from each other.

Banks to rediscount the discounted paper of other Federal Reserve banks at rates to be fixed by the Federal Reserve Board” (Federal Reserve Act of 23 December 1913, section 11b, p. 12).<sup>20</sup>

Rediscount rates were not always higher than discount rates. In other words, lending by Reserve Banks to their partners in the System did not always occur at penalty rates. It was recommended in 1920 that: “The rate of such rediscounts should be variable and fixed by the Board from time to time as the situation may appear to require and without any special regard either for the profit or loss to the contracting banks. In the present situation, we approve the action of the Board in fixing the rate of such rediscounts at 7 per cent” (Board of Governors of the Federal Reserve System, 1921, p. 607). McCalmont indicates that the rate fixed by the Board likely created losses for the Dallas and St Louis Reserve Banks (which charged their member banks only 6 percent on 60 to 90 day commercial paper) while other Reserve Banks broke even (McCalmont, 1963, p. 33).<sup>21</sup> This was mutual insurance by another name.

The mechanics worked as follows. A Reserve Bank rediscounting paper for another made payment by wiring to the so-called “Gold Settlement Fund” (known after 1935 as the “Interdistrict Settlement Fund”), which then transferred gold certificates between accounts accordingly.<sup>22</sup> The transaction lowered the reserve ratio of the Reserve Bank rediscounting the paper, although the latter earned interest on the collateral. It raised the reserve ratio of the Reserve Bank selling paper against gold, allowing it to maintain its required minimum gold reserve ratio and bolstering confidence in its district.<sup>23</sup>

Whether rediscounting should be compulsory was passionately debated by Congress prior to the adoption of the Federal Reserve Act of 1913 (see Hackley, 1973). Some of these discussions

<sup>20</sup> This provision remains law today. The original Federal Reserve Act also required an individual Reserve Bank to increase its discount rate if its gold cover was breached, but in no instances did the System require a Bank to increase its discount rate upon breach (we owe this point to Bob Hetzel).

<sup>21</sup> In a similar vein, penalty rates were not necessarily foreseen for (re)allocations once they replaced rediscounting as the privileged means of extending interdistrict accommodation. For instance, as per the 1944 formula, sales of participations in Treasury bill purchases were made for a week’s duration at the discount rate of 3/8 of 1 percent per annum penalty rates, which was just the market rate (ibid, p. 100).

<sup>22</sup> “Payment should be made by transfer through the Gold Settlement Fund in even thousands, off amounts to be adjusted by a credit to the account of the selling bank on the books of the purchasing bank. The selling bank should decrease the item “loans and discounts” and increase “Gold settlement fund”... The purchasing bank should increase the item “rediscounts for other Federal Reserve Banks” and should decrease “Gold Settlement Fund”. (unpublished Board memorandum X-185 updated, approximately 28 May 1917, quoted in McCalmont, 1963 pp. 241-242). To speed up the handling of re-rediscounting operations, the Federal Reserve Board introduced 27 code words for use in telegraphic communications (ibid). The Gold Settlement Fund account was held at the Treasury and administered by the Federal Reserve Board. At the end of the day, each regional Fed would send a cable to the Board of Governors to indicate the net amount due or owed to other districts. Upon completion of multilateral clearing, a regional Fed that owed another one had its gold account in the Gold Settlement Fund account reduced, while the receiving district had its account increased.

<sup>23</sup> A Reserve Bank could also strengthen its reserve holdings by selling securities from its portfolio directly for gold, including bankers’ acceptances (especially up to the Great Depression) and government securities: “Other [than New York and Boston] Federal Reserve Banks have had, from time to time, surplus funds and with the approval of the Federal Reserve Board have purchased bankers’ acceptances from these eastern banks” (Federal Reserve Board, 1919, p. 7).

were not unlike those concerning TARGET2 balances. A key concern was that compulsory rediscounting might encourage free-riding (Eichengreen, 1992). If the gold reserves of a Reserve Bank were to decline significantly, some critics complained, it could simply borrow from Reserve Banks with sufficient reserves rather than curtailing discounts to local commercial banks presumably engaged in dubious practices. Its incentive to adjust would be diminished, while Reserve Banks compelled to extend accommodation would be saddled with dubious collateral. The House of Representatives understood that compulsory rediscounts had a redistributive aspect, at least in the short run, characterizing it as the ability to “employ the resources of one portion of the country for the advantage of other portions”.<sup>24</sup> Concerns were voiced most forcefully in the Senate, however, where one Senator argued that compulsory rediscounts would “accentuate the rivalry between sections [i.e. Federal Reserve districts] for the accumulation of reserves” and cause “unlimited irritation and friction”.<sup>25</sup>

In practice, Reserve Banks acquiesced to the recommendations of the Board and requests for rediscounting from their partners in the system. Contemporaries stressed that World War I had fostered solidarity among Federal Reserve Banks by making “apparent to all the necessity of subordinating considerations purely of sectional advantage” (Reed, 1922, p. 9). Such is the impact of a foreign war. As a result “It was easy for the Board to insist, in the determination of the inter-district shifting of funds, upon principles which ordinarily might have created some objection” (ibid.). The Federal Reserve Board noted in 1920 that “there has [...] been such a spontaneous spirit of cooperation between the Federal Reserve Banks [during the period of the war] that all transactions suggested by the Federal Reserve Board have been made voluntarily, and in no case has the Board found it necessary to exercise its statutory power to require such operations [...] All payments have been made [...] through the gold settlement fund [...] *without involving any physical transfer of gold* (our italics added)” (Board of Governors of the Federal Reserve, 1920, pp. 5-6).

Only once, in fact, did the Board find it necessary to use its power of compulsion, in the 1933 episode discussed below. That episode had serious repercussions, prompting changes in the structure of the Federal Reserve System which vested more power in the Board and reduced the decision-making autonomy of individual Reserve Banks. A powerful Federal Open Market Committee (FOMC) was first created by the Banking Act of 1933. Membership of that committee was then revised under the Banking Act of 1935, as amended in 1942, which created the present 12 member committee of five members of the Board of Governors and 7 Reserve Bank governors. Under the 1935 Act, Federal Reserve Banks were prohibited from purchasing

<sup>24</sup> See Hackley (1973), p. 163.

<sup>25</sup> Senator Burton, 51 Congressional Record, 667, as quoted in Hackley (1973), p. 174. (Theodore Burton was a Republican from Ohio and former member of the National Monetary Commission).

or selling securities except under instructions from this Committee. The Federal Open Market Committee was further empowered to instruct Reserve Banks to sell or transfer any securities held or purchased to a joint System account.<sup>26</sup>

An additional consequence of the Banking Act of 1935 was that the System Open Market Account took center stage as the principal means of sharing gold reserves.<sup>27</sup> The System Account is the joint account through which open market operations are executed. It is managed by the New York Fed under direction by the Federal Open Market Committee. Open market operations are thus a possible source of payment imbalances across districts, despite the centralization of security transactions in New York, given the fact that the geographical location of US banks' headquarters differs. For instance, even if the New York Fed buys US Treasury bills from a broker located in New York, the high powered money created may flow to an account maintained at the Chicago Fed, if the bank of the seller of the bills in question is one of its members.

Operations undertaken by the New York Fed on behalf of the Federal Reserve System are also allocated among Reserve Banks on the basis of a formula. This formula was originally intended to ensure that all Reserve Banks had sufficient holdings of interest-bearing government securities and adequate earnings.<sup>28</sup> But another goal, which became increasingly important over time, was to even out reserve ratios across Federal Reserve districts. To that end, the Federal Open Market Committee determined that Federal Reserve Banks short of gold and liquidity could be partly or fully exempted from participating in open market operations. To bolster their reserve ratios, they could sell their participation in these operations to other Reserve Banks against gold certificates. This was collateralized lending (loans of gold certificates collateralized by treasury bonds) by another name. Reallocations were given formal status by a Federal Open Market directive in May 1936, which was followed a month later by the introduction of regular

<sup>26</sup> Meltzer (2003), p. 501. Moreover, the experience of the Great Depression encouraged the Fed to increase its purchases of long-dated treasury obligations, in contrast with the previous practice, reducing the importance of discounting and rediscounting. Readers will recall that the previous practice was to acquire short-dated obligations, like bankers' acceptances. As early as 1933, the Fed bought Treasury notes with up to five years maturity, selling short-term securities to lengthen the overall maturity of its portfolio (*ibid.*, p. 436). During World War II, the Fed went as far as conducting open market operations with a view to capping the yield on long-term government bonds (*ibid.*, p. 594). Arguably the Fed reverted to a "bills only" policy in the early 1950s (Fand and Scott, 1958) but abandoned it in the early 1960s.

<sup>27</sup> This open market account had been created as early as 1922, however, largely at the initiative of Governor Strong (see e.g. McCalmont, 1922, p. 51).

<sup>28</sup> The formula was not carved in stone, however. It changed repeatedly over our sample period (in 1923, June 1924, May 1933, February 1935, June 1936, October 1944, January 1948 and September 1953).

quarterly allocations (McCalmont, 1963, p. 86).<sup>29</sup> These reallocations became the basic mechanism for reserve sharing between Reserve Banks in the subsequent three decades.

1936 saw the introduction of the formula used to undertake reallocations within the System Open Market Account. That formula specifies a floor for the reserve ratio of each Reserve Bank. An FOMC directive of 25 May 1936 “authorized and directed [its] executive committee to make thereafter from time to time such readjustments as may be necessary to maintain the distribution of government securities among the Federal Reserve Banks in accordance with such formula [i.e. that of February 1935]; provided that if at any time the reserve ratio of any Federal Reserve Bank should fall below 50% or would be reduced below 50% by reason of the operation of such formula, the executive committee shall make such readjustments in the allotments as shall be necessary to raise the reserve ratio of such bank to 50% by allocating the necessary amount of securities to the other Federal Reserve Banks in accordance with the formula” (see McCalmont, 1963, p. 85).<sup>30</sup>

### 3 DATA

McCalmont (1960, 1963) is our source of data on reserve sharing from 1913 through 1960. McCalmont compiled the available published material, including books and studies by contemporaries and reports by the Federal Reserve Board and district Reserve Banks. He had access to unpublished material from the archives of the Federal Reserve Board, which expressed an interest in the “compilation, review, and analysis of all the data in its possession”. The Board provided assistance, with its staff going to “unusual lengths to seek out and make available [...] technical material”.<sup>31</sup> McCalmont’s investigations were complemented with interviews with Fed Reserve officials from staff to Board members. The Board expressed satisfaction with the end result, especially with “the meticulous way” in which information had been gathered.

The data indicate the extent of interdistrict accommodation operations – i.e. gold provided and received by each of the Federal Reserve Banks through rediscounts or sales of participations in open market operations – between 1913 and 1960 as well as their reserve ratios under the counterfactual that no gold sharing took place (McCalmont, 1963, p. 92 and pp. 133-135). The format of the data was not uniform. Some items had been calculated and harmonized by the

<sup>29</sup> Because some Fed officials perceived the regular quarterly reallocations as making the individual reserve ratios of individual Reserve Banks less informative, it was decided to discontinue their publication. They continued to be computed for internal purposes, however (McCalmont, 1963, pp. 88-92).

<sup>30</sup> The FOMC subsequently lowered the 1936 50% floor to 45% in May 1944 and to 35% in 1945.

<sup>31</sup> See letter of M. Sherman, Secretary, Board of Governors of the Federal Reserve System, 29 March 1960, reported in the incipit of McCalmont (1963).

Federal Reserve System itself.<sup>32</sup> But other items required additional transformation, which McCalmont undertook. Still other data available as time series were of varying frequency. Finally, some data were snapshots of accommodation operations undertaken in a specific crisis episode. In a few cases (e.g. for 1922, 1923, 1925, 1926), information was available on the balance sheets of Reserve Banks providing accommodation but not of those receiving it.

McCalmont was aware of the importance of distinguishing stocks from flows. He noted that stocks are not equivalent to cumulated flows insofar as the maturities of securities transacted by Reserve Banks varied, and securities acquired previously could mature and roll off of the balance sheet. Stock data, he observed, were preferable, although the material needed to construct them were not always available. In the end, McCalmont was able to construct estimates of the relevant stocks except for 1916-1918 and 1922-1926, when for reasons of data availability only estimates of flows were possible.<sup>33</sup>

We used these data to construct time series of quarterly interdistrict accommodation operations undertaken by the 12 Reserve Banks from 1913:Q4 through 1959:Q4. For the period after 1936, no further transformations were required. Before 1936, format varied. While data for 1920-21 and March 1933, two episodes during which interdistrict accommodation operations reached exceptional levels, were available in the appropriate format, data for other years required more extensive transformations (see Annex III). Where possible, we constructed end-of-quarter observations of stocks. We also cumulated monthly observations in each quarter to obtain rough estimates of quarterly stocks, bearing in mind that these are imperfect.<sup>34</sup> We assumed uniform distributions where information was missing. For instance, when data were available for providers only, we assumed that the remaining districts were recipients in identical amounts.<sup>35</sup>

## 4 EMPIRICAL ANALYSIS

We use our data to shed light on four different aspects of mutual assistance between Federal Reserve Banks which are still relevant to today's discussions on TARGET2 imbalances, namely: the scale and determinants of mutual assistance between Federal Reserve Banks; the

<sup>32</sup> Examples include the data on rediscounts and reserve ratios available from 1916 to 1933 as well as those on reallocations and actual reserve ratios available from 1936 to 1960.

<sup>33</sup> Detailed data are available on the stocks of gold reserves received or provided at the 70 regular reallocations that occurred between 1936 and 1960, in particular (McCalmont, 1963, pp. 166-171).

<sup>34</sup> Since the residual maturities of the underlying securities could vary. Note that the assumption is that securities have a residual maturity of three months in the first month of a given quarter, against two months in the second month and one month in the last month.

<sup>35</sup> McCalmont (1963, p. 169) warns that the data may not fully capture "extreme reserve deficiencies" which could have materialized within months of a corresponding quarter. Only data sampled at the infra-monthly frequency – which were not available – could have mitigated possible biases in this case.



evolution in the location of the “core” and “periphery” of the US monetary union; the degree of persistence in regional imbalances; and the few episodes when rising imbalances created tensions between Federal Reserve Banks. We consider these four aspects in turn in what follows.

#### **4.1 SCALE AND DETERMINANTS OF MUTUAL ASSISTANCE BETWEEN FEDERAL RESERVE BANKS**

A first insight from the first 50 years of interdistrict settlement is that there was extensive mutual assistance between Reserve Banks in response to liquidity crises and bank runs. Extensive gold sharing to even out liquidity conditions across Federal Reserve districts took place when those liquidity conditions differed significantly.

Figure 2 shows the evolution of outstanding interdistrict accommodation over the period 1913-1960, scaled by GDP. Amounts are broken down by Federal Reserve district and type (i.e. whether a district was a net provider or a recipient of gold).<sup>36</sup> Figure 3 then shows the evolution of the total volume of accommodation operations undertaken jointly by the 12 Federal Reserve Banks, again scaled by GDP.<sup>37</sup> Accommodation peaked at more than 0.8% GDP in 1933 and again in 1946. This is lower than the volume of TARGET2 balances (about 9% of euro area GDP), although it is only somewhat less than ISA balances in 2011 (somewhat less than 2% of US GDP – see Bijlsma and Lukkezen, 2012, and Figure 4). In part the lower level of accommodation operations in the earlier period reflects the fact that the US banking sector was smaller as a share of the economy then than the US or European banking sectors are of their respective economies now. Volumes are more closely comparable across periods if one uses banking sector assets as the scaling factor. In this case balances are almost 1% of US banking sector assets for interdistrict accommodation in 1933, against roughly 2% of euro area and US banking sector assets for both TARGET2 and ISA balances in 2011.

More often than not, these interdistrict accommodation operations were associated with banking sector tensions. Table 1 reports estimates for selected periods of the impact on interdistrict accommodation operations of all commercial bank suspensions, using data from Flood (1998).<sup>38</sup> These estimates control for the share of the agricultural sector in district GDP (a metric of a district’s exposure to commodity price shocks), net shipments of gold to the rest of the world (a metric of exposure to external financial disturbances) and the interactions between bank

<sup>36</sup> Cumulated flows per quarter are shown for the period 1916-1918 and 1922-1926 as stock data were not available.

<sup>37</sup> US GDP, to be clear, not district GDP.

<sup>38</sup> Data on bank suspensions pertain to all commercial (including national) banks and were available at the US state-level. They were used to reconstruct aggregates at the Federal Reserve district-level, although it is to be noted that US state boundaries do not always overlap with those of Federal Reserve districts.

suspensions and the latter two variables.<sup>39</sup> The estimates are obtained using a panel estimator that controls for time and random district effects. The equation estimated on the full time period yields a coefficient on bank suspensions that is negative, large and significant (see column 1 of Table 1).<sup>40</sup> They suggest that an additional 1,000 bank suspensions in a district was associated with a transfer of gold reserves on the order of 0.4% of US GDP in that district.

Figure 3 also highlights episodes when accommodation was exceptionally large, defined as quarters in which total accommodation exceeded its sample mean by one standard deviation pre-1936 and post-1936, respectively.<sup>41</sup> Mutual assistance was unusually large in three periods: after World War I (1920-21); during the Great Depression (especially around March 1933); and after World War II. So measured mutual assistance was exceptionally large in 19 quarters over our sample period, or about 11% of the time. On average there was a surge in gold reserve sharing every 9 years.

Interdistrict accommodation operations first ballooned during the 1920-21 slump that followed World War I.<sup>42</sup> Several districts were hit by adverse commodity price shocks, giving rise to financial distress and bank failures.<sup>43</sup> The Atlanta, Dallas, Richmond and St Louis districts were adversely affected by declines in the price of cotton and tobacco, while the Chicago, Kansas City and Minneapolis districts were hit by declines in the price of grains, wool and other agricultural products (see Hackley, 1973). All 12 regional Reserve Banks took part in these operations on one side or the other (ten of them participated on both sides at different points in time). Gold reserves were shared mainly by rediscounting bankers' acceptances in the portfolios of hard-pressed regional Reserve Banks. It was chiefly Reserve Banks from agricultural areas in the interior of the country (including Kansas City, Dallas and St Louis) as well as Chicago and Minneapolis that were borrowers, while Reserve Banks from coastal areas (Boston, New York, Philadelphia and San Francisco) were lenders.

There is again evidence that interdistrict accommodation operations were associated with banking sector tensions. The estimates obtained when the sample is restricted to 1920-21 suggest that the impact of bank suspensions on accommodation is negative, significant and

<sup>39</sup> Data on gross value added in the agricultural sector are from the US Department of Agriculture, while those on state GDP are from the Bureau of Economic Analysis. Both pertain to 1965, i.e. the earlier year for which they were simultaneously available. The data on net shipments of gold to the rest of the world are from Jones and Obstfeld (1997). They are scaled by US GDP and available for the period 1913-1945.

<sup>40</sup> The negative sign on the coefficient suggests that more bank suspensions in a district are associated with lower (or negative) accommodation. The coefficient remains of the same sign and of similar economic size if one controls for time effects, but it is no longer statistically significant, however (see column 2 of Table 1).

<sup>41</sup> Dividing the sample in 1936 accounts for the replacement of rediscounting by (re)allocations as the principal mechanism for sharing gold reserves between Reserve Banks.

<sup>42</sup> In the words of contemporaries, they then "assumed unprecedented proportions"; see Board of Governors of the Federal Reserve System (1922), p. 26.

<sup>43</sup> On the link between agricultural prices and bank failures, see Alston, Grove and Wheelock (1994).

larger than the estimate for the full sample. They suggest that an additional 1,000 bank suspensions in a district was associated with a transfer of gold reserves on the order of 1.6% of US GDP in that particular district (see columns 3 and 4 of Table 1). Accommodation was also more pronounced in agricultural areas. An increase of 10 percentage points of GDP in the share of the agricultural sector in a district is found to be associated with a transfer of gold reserves on the order of 0.2% of US GDP.

During the Great Depression, interdistrict accommodation operations were larger still. While the gold reserves of the Federal Reserve System as a whole never fell below the statutory minima, some individual Reserve Banks skated close to the edge. Interdistrict accommodation operations occurred in mid-1931, by which time commodity prices had fallen significantly. These involved mainly heavily agricultural districts, where bank failures were widespread, such as Atlanta, Dallas, Kansas City and Richmond, on the borrowing side. These operations consisted mainly of reallocations of holdings of government securities (McCalmont, 1963, p. 72). Much larger reallocation operations then took place in mid-1932. Significant accommodation was extended to the New York bank, from virtually all the other Reserve Banks (*ibid.*, p. 74), presumably reflecting New York's loss of gold to foreigners.

Events in March 1933 were even more dramatic. Markets were demoralized and gold hemorrhaged from the vaults of New York banks to an extent such that the New York Fed's reserve ratio declined to barely 25% in early March.<sup>44</sup> This led Randolph Burgess, the New York Fed deputy governor in charge of securities transactions, to contact the Chicago, Boston, Cleveland, St. Louis and Kansas City reserve banks on March 3<sup>rd</sup> and request that they take government securities in exchange for gold. The Minutes of the Board of Directors of the New York Fed for March 7<sup>th</sup> describe how Burgess was not able to secure the desired cooperation "largely due to the refusal of the Federal Reserve Bank of Chicago to purchase a suggested \$100,000,000 of Government securities from us."<sup>45</sup> With the New York Fed unable to provide assistance to local banks, New York State Governor Herbert Lehman was forced to declare, at the New York Fed's urging, a bank holiday at 2:30 AM on the morning of Saturday, March 4<sup>th</sup>.

Burgess' next step was to contact Eugene Meyer at the Board of Governors later on March 4<sup>th</sup> in order to suggest "the possibility of the Federal Reserve Board bringing pressure to bear on the Federal Reserve Bank of Chicago to buy Government securities from this bank or of the Board's ordering sufficient inter-district rediscounting to rectify our reserve position."

<sup>44</sup> This episode is also recounted in Wigmore (1987).

<sup>45</sup> Federal Reserve Bank of New York, Board of Directors' Minutes, Vol. 33, March 7<sup>th</sup>, 1933, folio page 160.

Strikingly, Governor Meyer reported back that the Board was not prepared to invoke its authority to require inter-district rediscount “at that time.”<sup>46</sup>

This left the new president, Franklin Delano Roosevelt, no choice but to invoke the Trading with the Enemy Act and suspend gold transactions on his first full day in office, Sunday, March 5<sup>th</sup>. There then followed what was initially supposed to be a four-day bank holiday.

Burgess later reported to his fellow directors that while he then took up the issue again on Monday, March 6<sup>th</sup>, again the Board of Governors took no action. Burgess then again telephoned Meyer to press on him the urgency of acting, and Meyer suggested that the directors of the New York bank “formally request the Federal Reserve Board to require other Federal reserve banks to rediscount the discounted paper of this bank,” which it then did.<sup>47</sup> With this political cover, on March 7<sup>th</sup> the Board finally telegraphed the other reserve banks compelling them to rediscount paper on behalf of the New York Fed for the first (and so far only) time in the System’s history, in accordance with Section 11(b) of the Federal Reserve Act of 23 December 1913.<sup>48</sup>

Obviously, these interdistrict accommodation operations were associated with exceptional banking sector tensions, as the Board noted: “Early in 1933 with the recurrence of bank failures and deposit withdrawals the Federal Reserve System was called upon to meet large demands for currency and gold [...] The crisis of February and March 1933 [...] was not a currency crisis but a banking crisis, and was occasioned not by a shortage of currency but by loss of confidence in the solvency of banks and by a depreciation in bank assets [...] caused by the depression [...] General loss of confidence in the solvency of banks [...] was accompanied by considerable but less widespread loss of confidence in the paper currency itself” (Board of Federal Governors, 1934, pp. 1 and 26).<sup>49</sup> The impact of banking sector tensions changed disproportionately when external financial disturbances occurred in this period, as shown by the significant estimate of the interaction coefficient between bank suspensions and net shipments of gold to the rest of the world when the sample is restricted to 1931-35 (see column 5 of Table 1).<sup>50</sup>

Significant accommodation operations again took place after World War II. Large government security purchases by the Fed during wartime had lowered the System’s gold cover ratio toward its legal minimum. To ensure that no individual Reserve Bank’s reserve ratio fell below the

<sup>46</sup> Minutes, folio pp. 160-161.

<sup>47</sup> Minutes, folio p. 161.

<sup>48</sup> This was also the first rediscounting operation since 1922, and the last one ever arranged (McCalmont, 1963, p. 76).

<sup>49</sup> It has been observed that there are interesting parallels that can be drawn between this episode and the ECB’s decision to accommodate bank liquidity needs during the global financial crisis (see Cour-Thimann, 2013, p. 34).

<sup>50</sup> The coefficient has the same sign and is even larger when one controls for time effects, but it is no longer statistically significant, however (see column 6 of Table 1).

regulatory floor (45% since 1944, the formula used to undertake reallocations within the System Open Market Account, which had originally set that floor at 50%), the FOMC reallocated Treasury bills held in the System Account.<sup>51</sup> When this proved insufficient, Congress reduced gold reserve requirements to 25%, while the FOMC reduced from 45% to 35% the floor at which Federal Reserve Banks could cease to participate in open market purchases.

New York was again the largest recipient of gold reserves in mid-1946, but Boston and Philadelphia also received significant amounts; all other districts were gold providers. The New York Fed's reserve ratio fell as foreign central banks and governments began liquidating their dollar deposits, converting them into gold that they were now in a position to repatriate (or to instruct the Fed to hold under earmark). According to the Board of Governors, "At the end of the year foreign-owned dollar deposits, earmarked gold, and securities held for all accounts, including accounts maintained by foreign depositors with the Federal Reserve Bank of New York acting as fiscal agent of the United States amounted to 5,330 million dollars, as compared with 6,830 million dollars at the end of 1945" (Board of Governors of the Federal Reserve System, 1946, p. 56). This was a very large fall in foreign deposits by the standards of the time, implying a large fall in reserves and requiring large amounts of interdistrict accommodation, insofar as deposits could be subsequently converted into gold. Again, however, the direction of accommodation reversed after two years, as this process of foreign repatriation subsided, with New York becoming a net creditor and e.g. Atlanta, Boston, Cleveland, Kansas City and San Francisco taking its place on the borrowing side.<sup>52</sup>

#### **4.2 EVOLUTION IN THE LOCATION OF THE "CORE" AND "PERIPHERY" OF THE US MONETARY UNION**

Thus, an important observation from the first 50 years of the Federal Reserve System is that the pattern of regional imbalances was not carved in stone. Districts that at one point in time were emergency recipients of gold could turn into providers. The identity of the borrower depended on the nature of the shock, and the nature of the shock differed over time, from commodity price shocks in 1920-21 and 1930-31 to external financial disturbances in 1933 and 1946. It depended on whether gold transfers occurred because of inter-state current account imbalances (i.e. reflecting real goods transactions) or because of a capital flight. Hence, there was no well-defined "core" or "periphery" of the Federal Reserve System in its first five decades.

<sup>51</sup> Minutes of the FOMC, 4 May 1944 (quoted in Meltzer, 2003, pp. 605-606). The floor attached to the reallocation formula is described by McCalmont (1960), pp. 100 and 107.

<sup>52</sup> The New York Fed was silent on the proximate cause of this reversal, simply noting that increases in its gold reserve holdings were "largely offset [...] by substantial adverse balance in transactions [i.e. extension of accommodation to other districts] through the interdistrict settlement fund, through which domestic flows between the several Federal Reserve Districts are finally cleared" (Federal Reserve Bank of New York, 1949, p. 52).

This is illustrated in Figure 5, which maps the geographical distribution of interdistrict accommodation operations in the second quarter of 1920, first quarter of 1933 and second quarter of 1946. Districts that were gold reserve providers are shown in dark grey, districts that were gold reserve recipients in light grey, and districts that did not actively participate in white.<sup>53</sup> That fortunes could change is apparent. Although the New York and Boston districts provided substantial amounts of gold to hard-pressed districts in the second quarter of 1920, for example, this situation had reversed by March 1933 when New York was an interdistrict borrower and five other regional Reserve Banks, notably including Chicago, were called on to assist it.

Figure 6 shows the distribution by size of (GDP-scaled) interdistrict accommodation operations undertaken by each of the 12 Federal Reserve Banks over the period. The figure confirms that the same districts could be both providers and recipients of gold at different points in time. Formal statistical tests suggest, however, that the distribution is significantly skewed (see Table 2). The operations undertaken by the New York and Boston districts show a significant negative skew. This means that New York and Boston had a larger than average probability of being recipients of accommodation. In contrast, the operations undertaken by the Atlanta, Chicago, Minneapolis, Richmond and San Francisco districts display a significant positive skew. These districts had a larger than average probability of being on the providing side. These patterns are reminiscent of earlier studies of the geography of the US money markets microstructure (Goodhart, 1969; Allen et al., 1989; Bech and Atalay, 2010) in which banks in regions remote from major financial centres were net lenders to banks in New York during normal times but move to repatriate their previous loans in exceptional periods. Where these studies of the period prior to the advent of the Fed focus on correspondent relationships among commercial banks, our data for the early Federal Reserve period document similar official flows, with the New York Fed often borrowing from other Federal Reserve banks, including Chicago and San Francisco.

### 4.3 PERSISTENCE IN REGIONAL IMBALANCES

A further observation from the first 50 years of the Federal Reserve System is that regional payment imbalances did not grow endlessly but stabilized and reversed once the initial liquidity shocks and bank runs subsided. In the five decades of our sample, interdistrict accommodation declined to low levels following each local peak. It took only a quarter of a calendar year for accommodation operations to revert to pre-crisis levels following the 1920-21 and the 1933

<sup>53</sup> Note that the map is drawn on the basis of state boundaries, which do not always overlap with those of Federal Reserve districts.

episodes. The post-World War II episode was more long-lasting in that it took 16 quarters for accommodation to revert to pre-crisis levels.

Table 3 reports time series estimates obtained when the total volume of accommodation is regressed on its lag and a constant. The table also reports panel estimates (in columns (4) to (6)) obtained when the net accommodation received by each of the 12 Federal Reserve districts is regressed on its lag, a constant and district and time effects. The standard errors reported are robust to heteroskedasticity. These estimates of the dynamics of interdistrict accommodation confirm that persistence was not strong. For the full sample the coefficient on the lagged dependent variable is on the order of 0.9, which points to a half-life of slightly more than five quarters. In other words, only 50% of a typical shock to accommodation operations remained after 1.3 years. Restricting estimation to the period before 1936 (when rediscounting was the principal way of conducting accommodation operations) points to even faster adjustment, with a coefficient on the lagged dependent variable of less than 0.4, and a half-life of less than a quarter.

That gold reserves were shared between regional Reserve Banks and that interdistrict accommodation grew with need were precisely the conditions necessary to overcome liquidity shocks. Contemporaries were aware that real adjustment might be highly disruptive in their absence. Referring to the 1920 episode, the Board of Governors noted that “The table of reserve ratios indicates clearly why interbank accommodation was necessary in 1920 and what banks were in need of it, as well as what banks were in a position to extend accommodation” (Board of Federal Governors, 1922, p. 26). Contemporaries were also aware that accommodation operations were crucial for avoiding widespread failures and the spread of bank failures across US regions. For instance, the Governor of the Federal Reserve Bank of Atlanta observed of the strains created by the post-World War I downturn that: “If this bank [the Cleveland Fed] had failed to stand as a buffer between the business of this section [the Atlanta Fed district] and disaster [...] it would have permitted a situation to develop which would have seriously affected all other sections of the country and every other reserve bank. This district, if made bankrupt through the necessity of immediate liquidation [...] would react upon every section of the country [...]. The mere publication of our actual reserve ratio might possibly have the effect of causing the failure of numerous banks, not only in this district, but in others as well, and *bring*

*on a panic of great magnitude* [italics added]” (unpublished letter to the Federal Reserve Board, 9 December 1920; quoted in McCalmont, 1963, p. 26).<sup>54</sup>

The relief afforded by accommodation operations is evident from Figure 7, which shows the evolution between mid-1936 and end-1959 of the reserve ratios of the 12 Federal Reserve banks as well as of the corresponding adjusted ratios, i.e. the ratios which would have prevailed without interdistrict accommodation. That these two ratios could be very different in some instances – that some Reserve banks would have had much lower gold coverage of their liabilities in the absence of interdistrict accommodation – comes out clearly.

#### **4.4 EPISODES WHEN RISING IMBALANCES CREATED TENSIONS BETWEEN FEDERAL RESERVE BANKS**

This mutual assistance left the US public and even informed opinion largely unmoved. It normally did little to inflame tensions between regions. Typically, gold reserve sharing between Reserve Banks passed unnoticed by the public. McCalmont (1963, p. 1) notes the “surprising contrast between the great worry over our national loss of gold reserves [to foreign countries] and the complete absence of worry over the possible loss of gold reserves by one Federal Reserve district to another... Why,” he asked, “is there never any alarm over actual or feared deficiencies in the gold reserves of individual Reserve Banks?”

There were at least three prominent exceptions, however. There was opposition to rediscounting in the wake of the first such operation in December 1917, when commercial banks in Chicago complained that the reserves they had provided to the Chicago Fed were being “siphoned off” (in the words of McCalmont) by Reserve Banks in Southern States in order to make loans to firms which would “otherwise have borrowed money in Chicago” (see McCalmont, 1963, p. 23). World War I and its demands helped overcome this dissatisfaction, however, as noted above. It brought home to the boards of the individual Reserve Banks that they were in this foxhole together. As Willis put it, “the determination of the United States to enter the war brought [this] early period to a close.” (Willis, 1923, p. 22)

In addition, there were tensions among Reserve Banks in 1932, when the executive committee of the Open Market Policy Conference finally began to expand member bank reserves through open market operations. These arose because of New York’s reluctance to undertake the bulk of

<sup>54</sup> Subsequent observers came to similar conclusions: “If there had been no reallocations or re-rediscounting, reserve-deficient Reserve Banks might have had to refrain from making advances and rediscount for member banks, which in turn might have been obliged to curtail their own extension of credit... borrowers who were thus denied local credit might have often been obliged to curtail their purchases or to sell off their assets” (McCalmont, 1963, p. 233).



the security purchases at a time when it feared large gold losses to Europe without further support from e.g. Boston and Chicago.<sup>55</sup>

The third exception is March 1933, when commercial banks in Chicago pressured the Federal Reserve Bank of Chicago not to assist the New York Fed –which then haemorrhaged gold to foreigners – on concerns that doing so would weaken their own position (Eichengreen, 1992).

One explanation for why gold reserve sharing attracted limited public attention is the strong spirit of cooperation between the regional Reserve Banks. In this view, the explanation of the “puzzling fact that the public is never aware of any worry by any Federal Reserve district over the loss of gold reserves to any other district [...] lies, not in the fact that all parts of the US make use of a common monetary unit, but rather in the cooperative relationships which the twelve legally separate Reserve banks have established” (McCalmont, 1963, p. 231). A further explanation is that cooperation was in the interest of all insofar as sharing gold reserves provided hard-pressed districts with the leeway needed to smooth adjustment to payment imbalances. Finally, that no district could foresee – under a veil of ignorance – whether it would actually need insurance or not, worked to further bolster cooperation.

A final insight from the experience of the first 50 years of the US Federal Reserve System is that cooperation between Reserve Banks was essential to the stability and cohesion of the US monetary union. No episode better epitomizes the point than the banking panic of March 1933. Friedman and Schwartz note that “In the final two months prior to the banking holiday [of 6-15 March 1933], there was nothing that could be called a System policy. The System was demoralized. Each [Federal Reserve] Bank was operating on its own. All participated in the general atmosphere of panic [...] The leadership which an independent central bank system was supposed to give the market [...] [was] conspicuous by [its] absence”.

The breakdown of cooperation among regional Reserve Banks “under the pressure of the crisis” (Wigmore, 1987, p. 747) fuelled self-fulfilling runs on banks and the dollar, which culminated with the bank holiday proclaimed by President Roosevelt between 6 and 15 March. The US monetary union was virtually suspended on those days, insofar as all payments and other activities of the banking system were interrupted.

The paradox is that the gold reserves of the Federal Reserve System as a whole, on the order of USD 3 billion, were more than sufficient to meet gold demands and statutory requirement (see Figure 8). But gold losses were spread unevenly among Reserve Banks. Pressure on New York was particularly intense, as it was the first port of call for foreign investors, both private and

<sup>55</sup> As Governor Harrison put it “Given the comparative reserve positions of the two banks [i.e. New York and Chicago], it is difficult to see why we should pump funds into market which will then be siphoned off to Chicago” (Minutes, New York Directors, 23 June 1932, 2, as quoted in Meltzer, 2003, p. 367).

official, seeking to repatriate US gold. New York lost 61% (or USD 584 million) of its reserves between 1 February and 4 March, whereas the System as a whole had lost only 18% (or USD 571 million).

Initially cooperation was smooth. In the final weeks of February, other Reserve Banks had discounted USD 210 million of bills from the New York Fed and helped it to replenish its gold reserves in still other ways (Brown, 1940, p. 1248). But that cooperation was withdrawn on 3 March. The Chicago Fed refused to rediscount an additional USD 100 million of government securities from the New York Fed. As one contemporary later explained: “some of the member banks of Chicago threatened to put all their deposits out of the Federal Reserve Bank the next morning [...] They did not want the gold transferred to the New York district”.<sup>56</sup> The Chicago Fed had a history of independence within the System. It had resisted the de facto leadership of the New York Fed in the 1920s, and its governor had repeatedly sparred with the influential governor of the New York Bank, Benjamin Strong, over Strong’s desire to cut interest rates to help the United Kingdom first to return to and then stay on the gold standard. The Chicago district also experienced exceptionally severe banking problems in late 1932 and early 1933, notably the prominent difficulties of Charles Dawes’ Central Republic Trust and Henry Ford’s Guardian Group of banks. It was therefore exceptionally concerned to husband its gold reserves and not share them with New York.

Only on 7 March did the Federal Reserve Board compel interdistrict rediscounting by five other regional Reserve Banks. The New York Fed had been left on its own for three days with only USD 381 million of gold reserves, barely half the USD 600 million in foreign deposits in New York banks.<sup>57</sup> Not surprisingly, the New York Fed urged State Governor Herbert Lehman to declare a state bank holiday in order to close down a system that would otherwise “run out of gold” (Wigmore, 1987, p. 749). The suspension of interstate payments led to additional bank failures and disrupted credit flows.<sup>58</sup> It led to a generalized bank holiday in which the par clearing of deposits between, and for that matter within, districts was disrupted for an extended period. This indicates clearly that cooperation between regional Reserve Banks was essential to the cohesion and stability of the US monetary union.

<sup>56</sup> W. Wyatt, Counsel to the Federal Reserve Board (Columbia University Library, Oral History Archives, *Reminiscences of Walter Hyatt*, pp. 3-4, quoted in Wigmore (1987), p. 787).

<sup>57</sup> Including USD 240 million that the Bank of England was eager to convert into gold to reduce its exposure to the risk of a dollar devaluation (ibid.)

<sup>58</sup> Friedman and Schwartz note that over 5,000 banks that were still operating when the bank holiday started did not reopen when it ended and, of these, more than 2,000 never did subsequently (Friedman and Schwartz, 1963, p. 330). See Bernanke (1983) for empirical evidence over the period January 1919-December 1941 of the non-monetary effects of banking failures on the propagation of the Great Depression and, in particular, its detailed discussion of the consequences of the March 1933 episode.

The upshot was the Federal Reserve Act of 1935, which gave the Board of Governors in Washington D.C. full control of purchases and sales of securities of regional Reserve Banks via the System account, which significantly facilitated interdistrict accommodation.

## 5 CONCLUSION

We have sought to shed light on the history of mutual assistance between Reserve Banks in the early years of the Federal Reserve System, a process through which the area over which the dollar circulated became a full-fledged monetary union. Data on interdistrict accommodation suggest that mutual assistance was common in response to liquidity crises and bank runs, with regional Reserve Banks pooling their gold reserves every nine years, on average, between 1913 and 1960. They show that fortunes could change quickly, with Federal Reserve Banks taking turns as emergency recipients or providers of gold. Payment imbalances never grew endlessly, instead narrowing once liquidity shocks had subsided, with half of the effect of a typical shock to interdistrict accommodation dissipating after about five quarters. Mutual assistance triggered tensions between regional Reserve Banks in only one noteworthy instance, namely immediately before the bank holiday proclaimed by President Roosevelt in March 1933. As a counterexample, this suggests that cooperation between regional Reserve Banks was essential to the cohesion and stability of the US monetary union.

These findings speak, in an obvious sense, to current discussions of TARGET2 balances in Europe. That mutual assistance between Reserve Banks was common during liquidity crises and bank runs suggests that the increase in TARGET2 balances since the outbreak of the global economic and financial crisis is not exceptional but, rather, a normal concomitant of the operation of a cohesive monetary union. That fortunes could change quickly, with earlier gold recipients turning subsequently into gold providers indicates that the notion of “core” or “periphery” regions within a monetary union is not necessarily carved in stone. Countries that accumulate TARGET2 credits in one period may find themselves to be TARGET2 debtors in another, if this history is a guide. The fact that imbalances tended to narrow once liquidity shocks subsided is at variance with concerns expressed that TARGET2 imbalances could grow endlessly or to an extent such as to put the stability of Economic and Monetary Union at risk. That mutual assistance left the US public largely unmoved and hardly triggered tensions between US regions suggests that there is no reason that a dispassionate debate in Europe on TARGET2 balances could not be possible. And that cooperation between regional Reserve Banks was essential to the cohesion of US monetary union and its stability indicates that maintaining such cooperation spirit is essential in the euro area.

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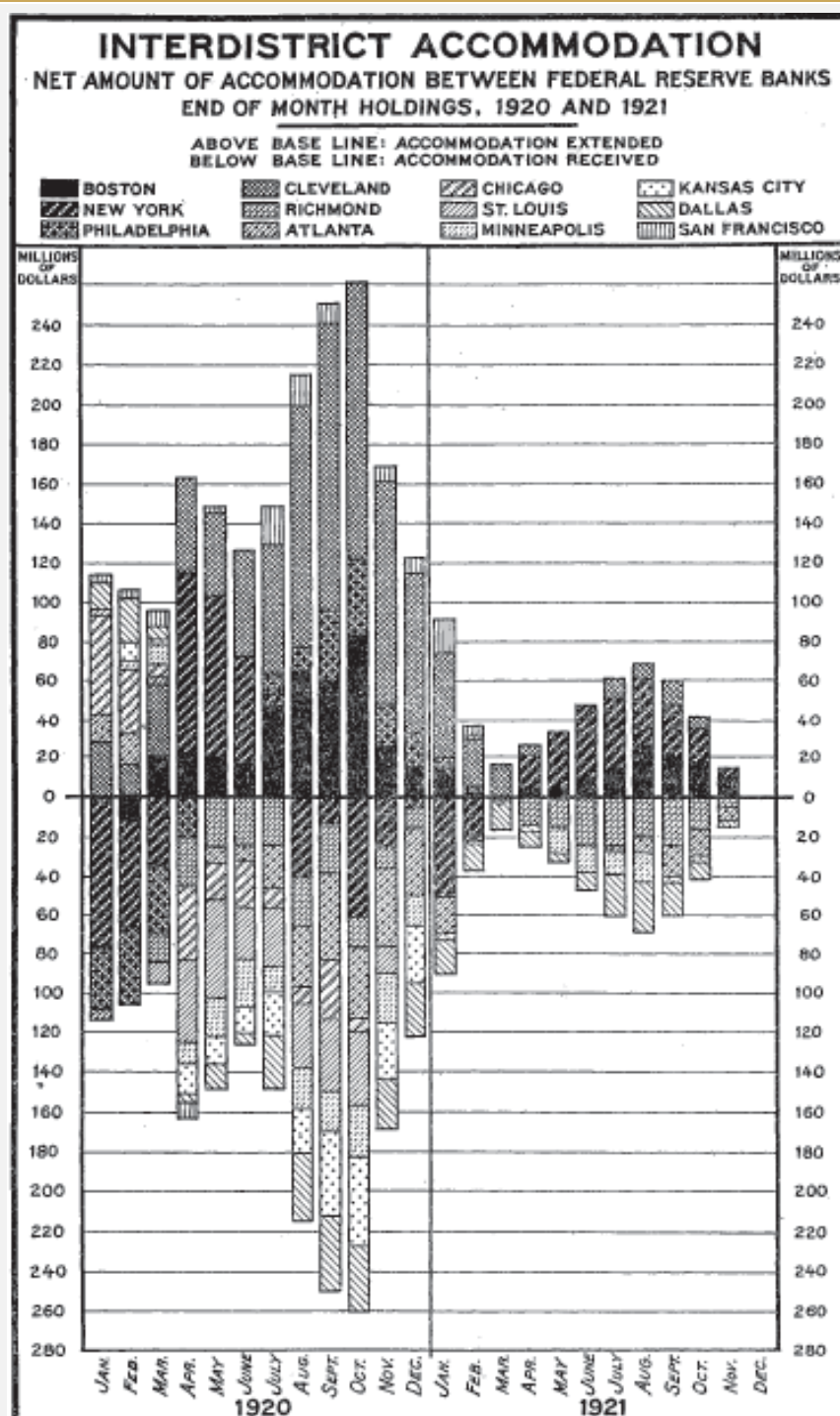
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## FIGURES AND TABLES

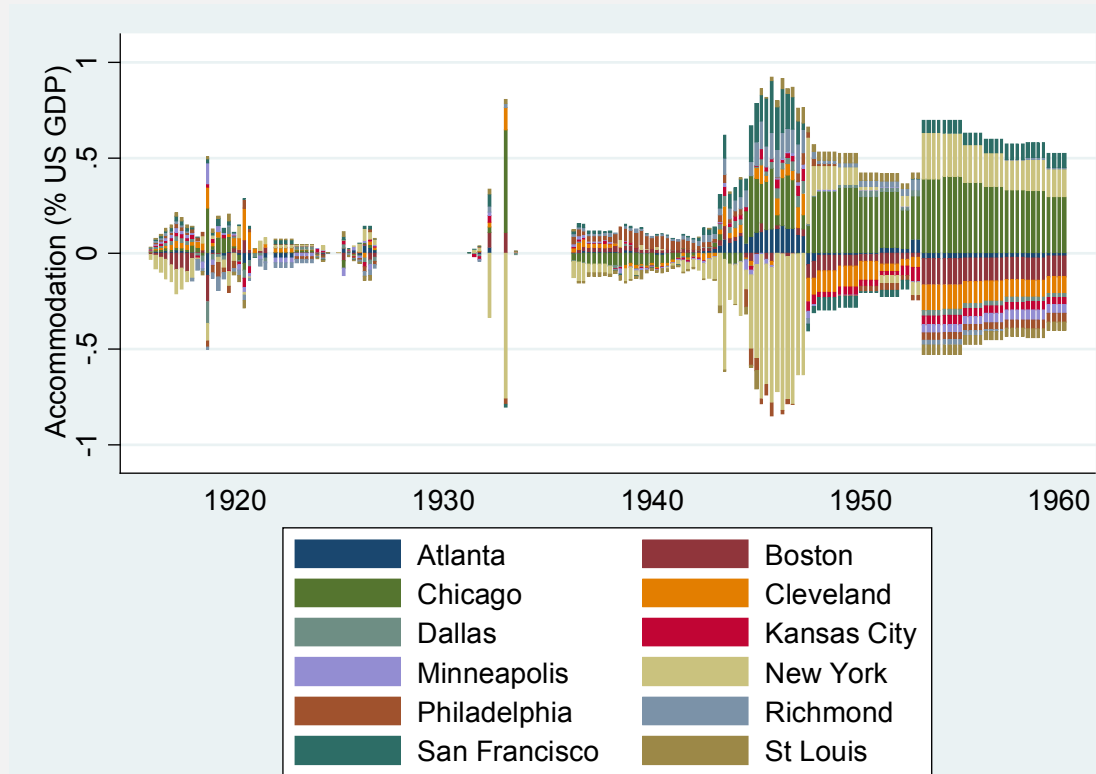
Figure 1 Interdistrict accommodation operations in 1920-1921



Note: The figure shows the evolution of the outstanding amount (in USD million) of the interdistrict accommodation operations undertaken by each of the 12 Federal Reserve districts between 1920 and 1920, as published in 1922 by the Federal Reserve Board (see Board of Governors of the Federal Reserve System, 1922, p. 28). Negative figures indicate districts that are net recipients of gold; positive figures indicate districts that are net providers of gold.

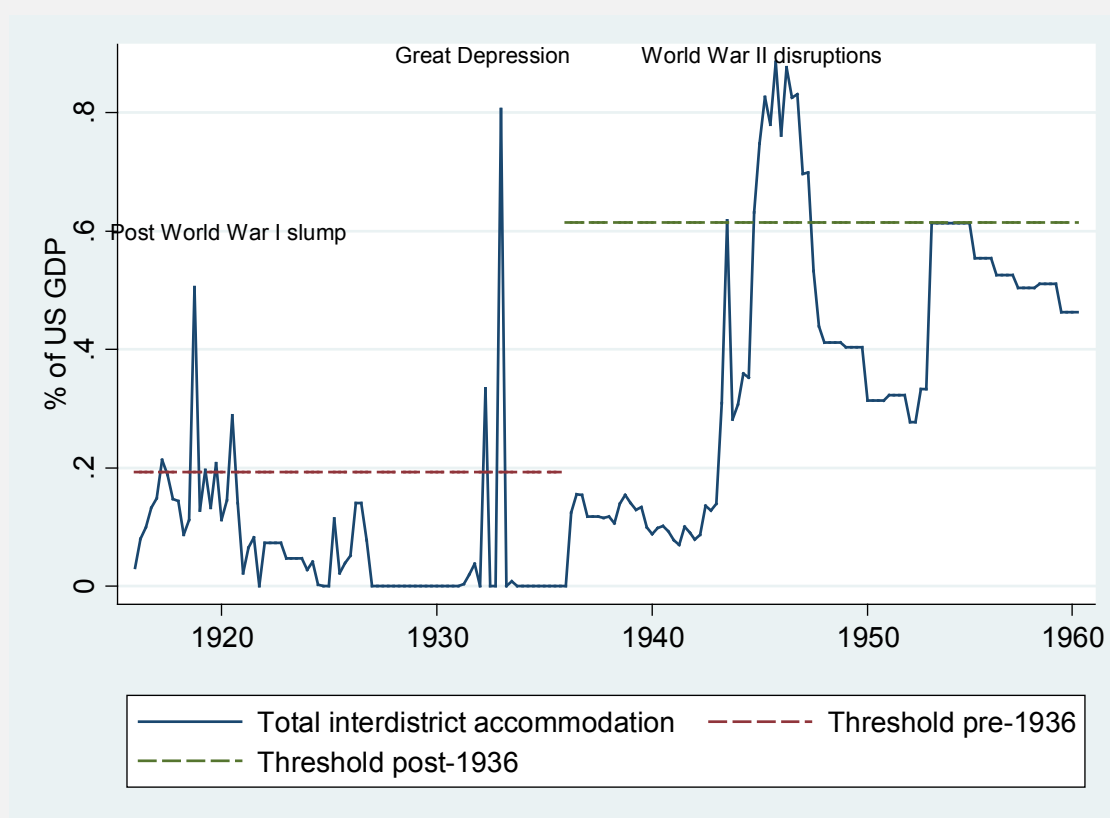
**Figure 2 Interdistrict accommodation operations – 1913-1960**

*(Breakdown by district)*



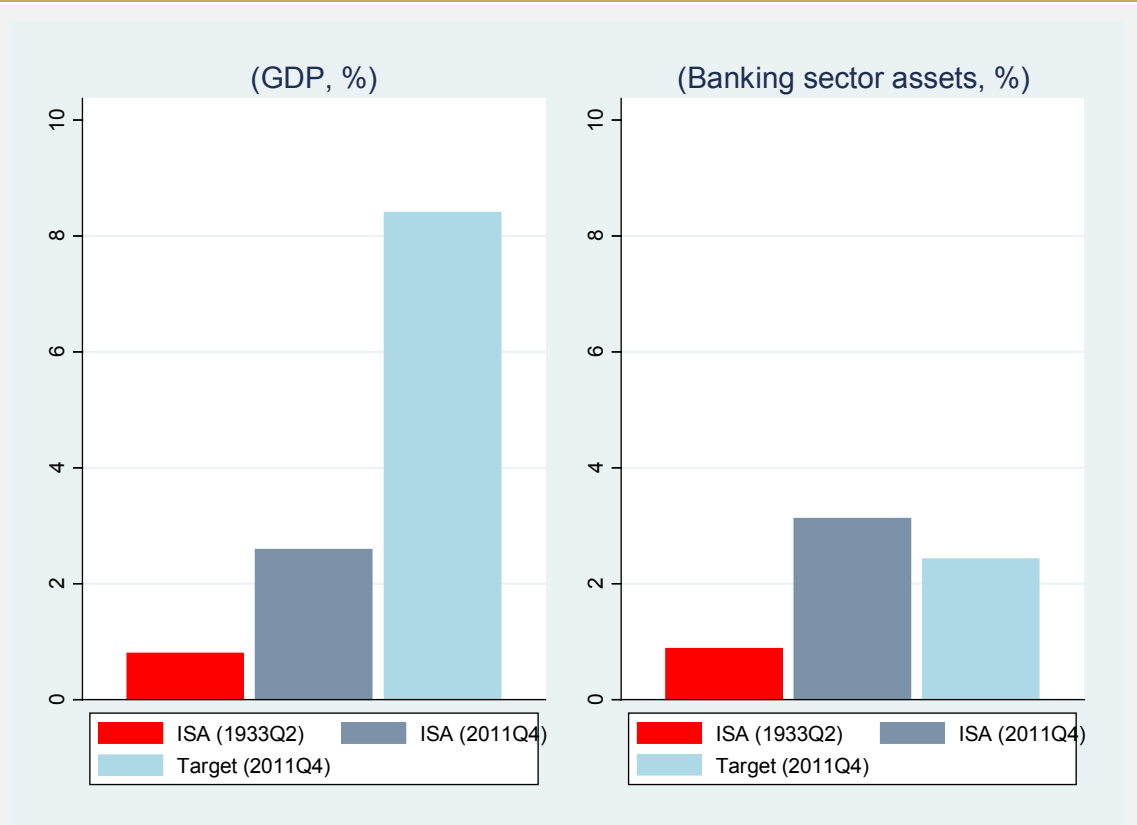
Note: The figure shows the evolution of the outstanding amount (scaled by US GDP) of interdistrict accommodation operations undertaken over the period 1913Q4-1959Q4. Amounts are broken down by Federal Reserve district and type (i.e. whether a district was a net recipient (negative figures) or net provider (positive figures) of gold). Cumulated flows per quarter are shown for the period 1916-1918 and 1922-1926 as stock data were not available.

**Figure 3 Episodes of exceptional interdistrict accommodation**



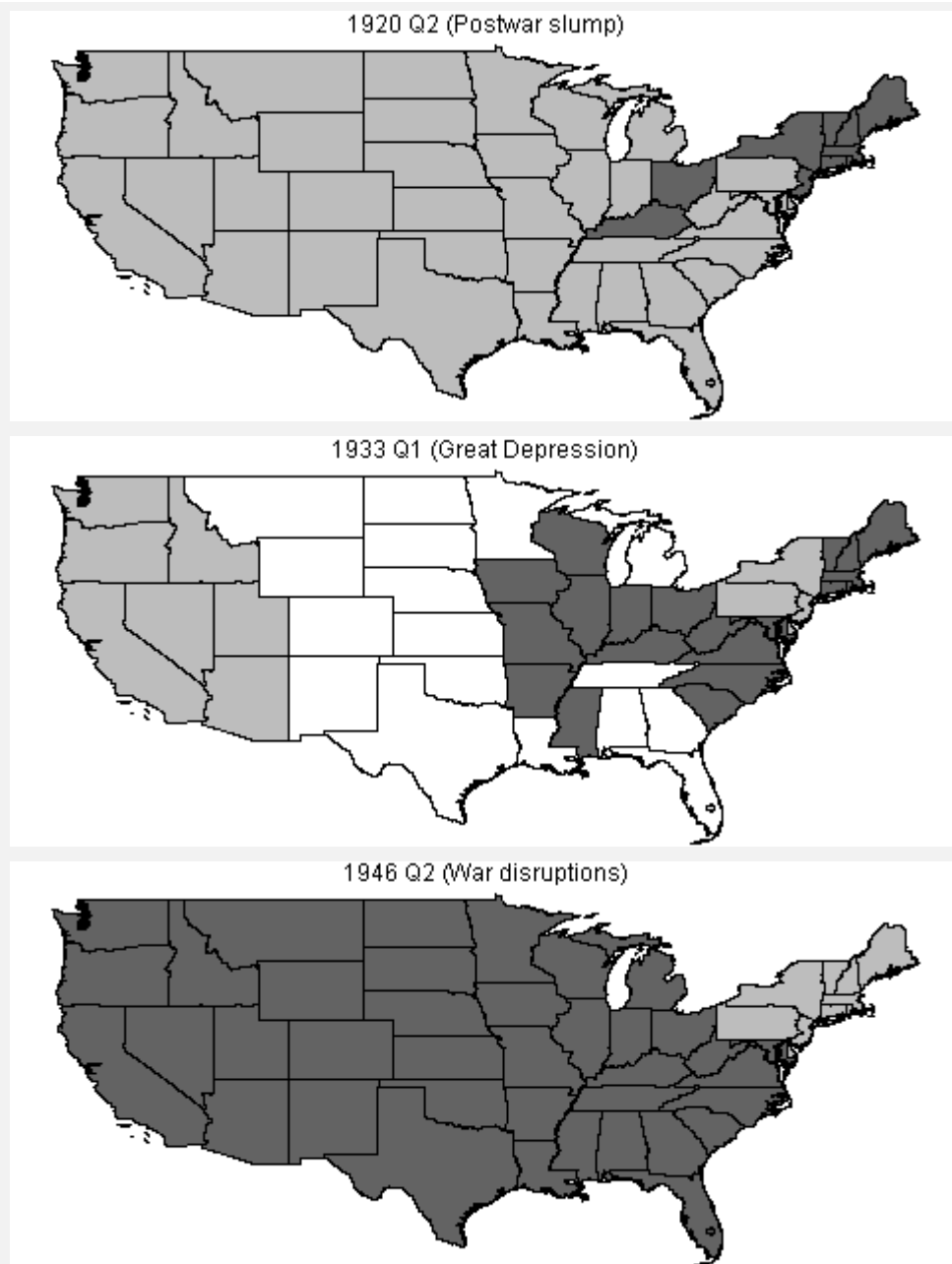
Note: The figure shows the evolution of the total volume (scaled by US GDP) of accommodation operations jointly undertaken by the 12 Federal Reserve districts along with the statistical thresholds used to identify episodes of accommodation of exceptional magnitude. The latter are defined as quarters in which total accommodation exceeded its sample mean by one standard deviation pre-1936 and post-1936, respectively (truncating the sample is meant to account for the displacement of rediscounting by (re)allocations as the premier means of sharing gold reserves between regional Reserve Banks in 1936).

**Figure 4** Relative size of TARGET2 and ISA balances – Now vs. then



Note: The figure shows the relative size of ISA balances and TARGET2 balances in March 1933 and December 2011. Balances are scaled by US and euro area GDP (in the left-hand side panel) and by the assets of US commercial banks and euro area credit institutions, respectively (in the right-hand side panel).

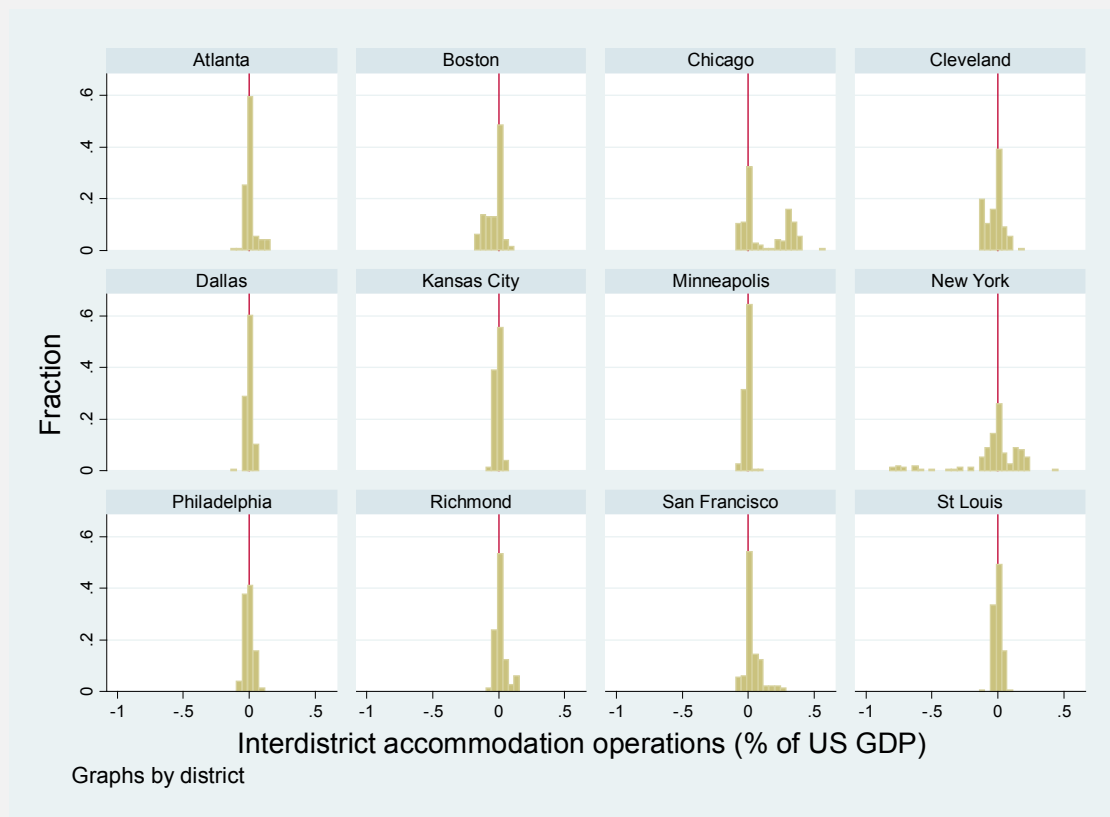
**Figure 5** Geography of interdistrict accommodation operations – “Core” vs. “Periphery”



Note: The figure depicts the geographical distribution across Federal Reserve districts of interdistrict accommodation operations undertaken in the second quarter of 1920, first quarter of 1933 and second quarter of 1946. Each shade corresponds to a specific position (dark grey = districts that were gold reserve providers; light grey = districts that were gold reserve recipients; white = no active participation). Note that the map is drawn on the basis of state boundaries, which do not systematically overlap with those of Federal Reserve districts.

**Figure 6 Histogram of interdistrict accommodation operations**

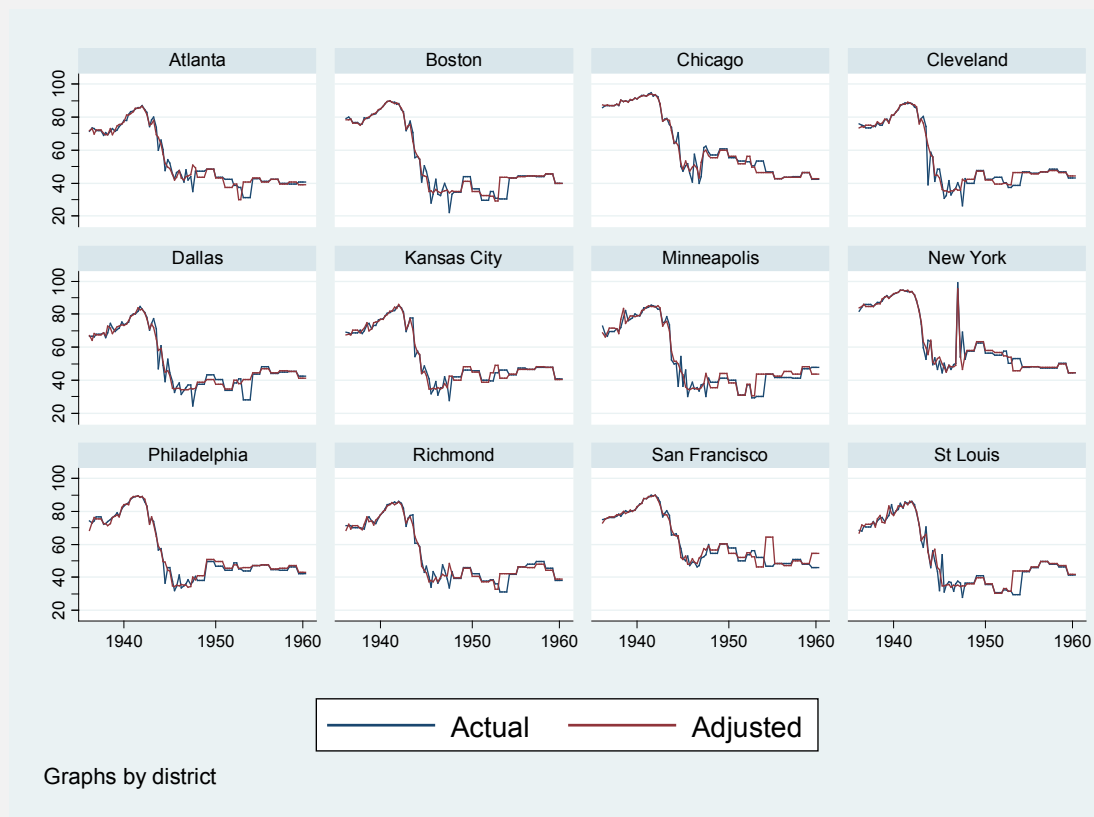
*(Breakdown by district)*



Note: The figure shows the distribution by size of the (US GDP-scaled) interdistrict accommodation operations undertaken by each of the 12 Federal Reserve districts during the full sample period (1913Q1-1959Q4). Negative figures indicate districts that are net recipients of gold; positive figures indicate districts that are net providers of gold.

**Figure 7    Extent of the relief afforded by interdistrict accommodation operations**

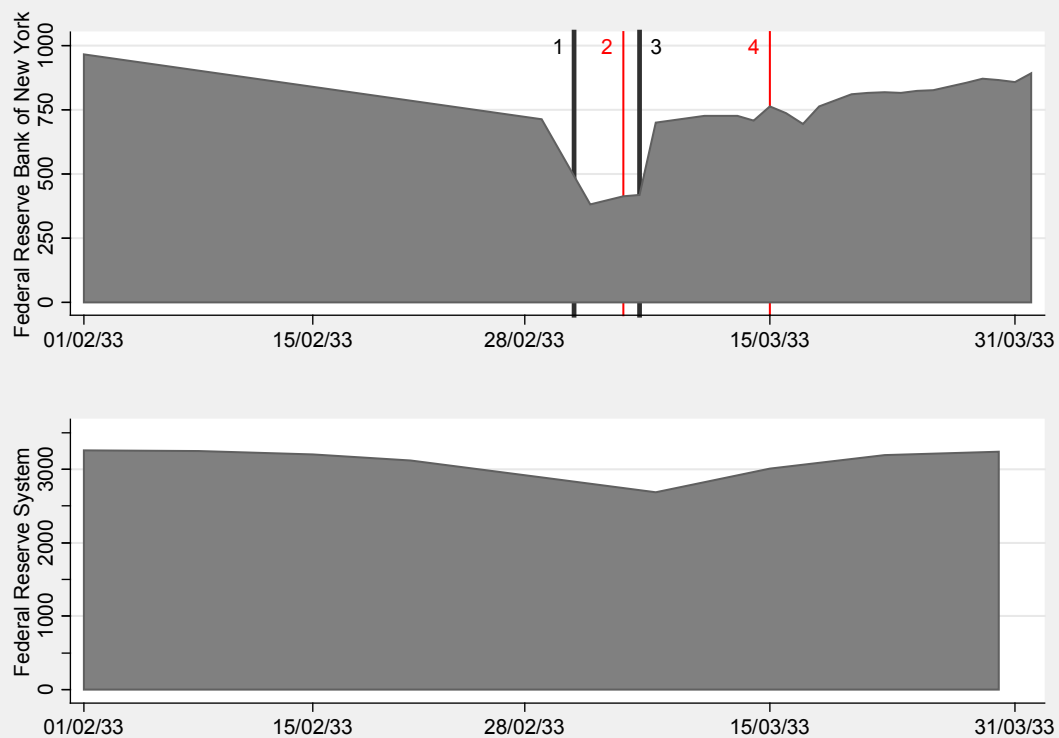
*(Breakdown by district of gold reserve ratios, %)*



Note: The figure shows the evolution between 1936:Q2 and 1959:Q4 of the actual gold reserve ratios of the 12 Federal Reserve banks as well as of the corresponding adjusted ratios, i.e. the ratios which would have prevailed had there been no interdistrict accommodation operations (as calculated and reported in McCalmont, 1963).

**Figure 8 Interdistrict cooperation breakdown – February-March 1933**

*(Gold reserves, USD million)*



Note: Authors' compilation based on Paris (1938), Friedman and Schwartz (1963), McCalmont (1963), Wigmore (1987), Eichengreen (1992) and Meltzer (2003). The figure shows the evolution of the gold reserves held by the Federal Reserve Bank of New York and the Federal Reserve system between 1 February and 31 March 1933 (missing observations are linearly interpolated) along with four specific events: (1) the refusal on 3 March by the Chicago Fed to rediscount securities from the New York Fed (whose reserve ratio stood then at 25.5%); (2) the proclamation by President Roosevelt of a nation-wide bank holiday on the evening of 5 March (banks prohibited from paying out gold; export embargo on gold) and the suspension of interbank payments; (3) the decision on 7 March by the Federal Reserve Board to compel Federal Reserve Banks to rediscount on behalf of the New York Fed; (4) the end of the nation-wide bank holiday on 15 March.



**Table 1 Estimated impact of banking sector tensions on interdistrict accommodations operations**

	(1) Full sample	(2) Full sample	(3) 1920-21	(4) 1920-21	(5) 1931-35	(6) 1931-35
Bank suspensions	-0.429** (0.207)	-0.454 (0.393)	-1.645*** (0.527)	-1.645*** (0.527)	-0.241 (0.402)	-0.151 (0.358)
Agricultural sector	0.009 (0.012)	0.010 (0.015)	-0.029*** (0.011)	-0.029*** (0.011)	0.004 (0.005)	0.003 (0.005)
Gold exports	0.001 (0.014)	0.001 (0.479)	0.027 (0.065)	0.000 (0.000)	-0.008 (0.015)	-0.008 (0.019)
Bank suspensions × agricultural sector	0.056 (0.041)	0.052 (0.041)	0.427*** (0.132)	0.427*** (0.132)	0.049 (0.081)	0.040 (0.072)
Bank suspensions × gold exports	0.215*** (0.074)	0.506 (0.453)	0.000 (0.000)	0.000 (0.000)	0.087** (0.043)	0.199 (0.255)
Constant	-0.028 (0.071)	-0.014 (0.345)	0.113 (0.079)	0.000 (0.000)	-0.030 (0.046)	-0.032 (0.058)
District effects	YES	YES	YES	YES	YES	YES
Time effects	NO	YES	NO	YES	NO	YES
Observations	360	360	24	24	60	60
Number of districts	12	12	12	12	12	12
$R^2$ (overall)	0.0302	0.0340	0.323	0.323	0.320	0.345
$R^2$ (within)	0.0255	0.0298	0.159	0.159	0.342	0.373
$R^2$ (between)	0.0596	0.0604	0.412	0.412	0.266	0.282
$\rho$	0.152	0.140	0.149	0.149	0.248	0.240
$\sigma^a$	0.0815	0.0809	0.0336	0.0336	0.0603	0.0599
$\sigma^u$	0.192	0.200	0.0804	0.0804	0.105	0.106

Note: The table reports estimates for the full sample and selected sub-periods of the impact of commercial bank suspensions (in 1000s) on (US GDP-scaled) interdistrict accommodation operations controlling for the share of the agricultural sector in district GDP, net shipments of gold to the rest of the world (US GDP scaled) and the interactions between bank suspensions and the latter two variables. The estimates are obtained with a random-effects (at the district level) panel estimator and controlling for time effects. The estimates reported in column (3) also control for an outlier observation for the Chicago district in 1933. (\*\*\*), (\*\*), (\*) indicate statistical significance at the 1%, 5% and 10% level of confidence, respectively.

**Table 2 Interdistrict accommodation operations – Selected descriptive statistics**

Federal Reserve district	Mean	Median	Standard deviation	Skewness	Kurtosis
<i>Atlanta</i>	0.008	0.000	0.040	1.458 ***	6.038 ***
<i>Boston</i>	-0.030	-0.005	0.058	-0.524 ***	2.233 ***
<i>Chicago</i>	0.127	0.015	0.168	0.441 **	1.545 ***
<i>Cleveland</i>	-0.021	-0.002	0.064	-0.032	2.511
<i>Dallas</i>	0.000	0.000	0.024	-0.261	5.370 ***
<i>Kansas City</i>	-0.010	-0.002	0.027	-0.030	2.592
<i>Minneapolis</i>	-0.010	-0.002	0.025	0.354 *	6.055 ***
<i>New York</i>	-0.035	0.000	0.230	-1.811 ***	6.480 ***
<i>Philadelphia</i>	-0.003	0.000	0.035	0.197	2.535
<i>Richmond</i>	0.014	0.008	0.040	1.547 ***	5.722 ***
<i>San Francisco</i>	0.030	0.010	0.061	1.551 ***	6.347 ***
<i>St Louis</i>	-0.003	0.000	0.032	-0.079	2.655

Note: The table reports selected descriptive statistics on the outstanding amounts (scaled by US GDP) of interdistrict accommodation operations undertaken by each of the 12 Federal Reserve districts over the period 1913-1959. (\*\*\*), (\*\*), (\*) indicate statistical significance at the 1%, 5% and 10% level of confidence, respectively.

**Table 3** Estimates of persistence effects in the dynamics of interdistrict accommodation operations

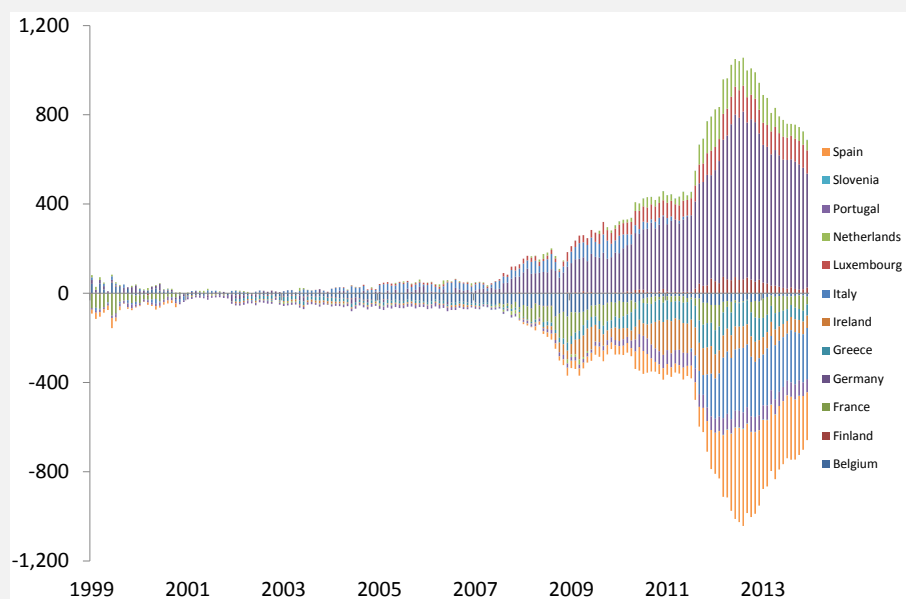
	Time series estimates			Panel estimates		
	(1) All sample	(2) Pre-1936	(3) Post-1936	(4) All sample	(5) Pre-1936	(6) Post-1936
Lagged accommodation	0.878*** (0.052)	0.150 (0.135)	0.930*** (0.032)	0.879*** (0.020)	0.390*** (0.088)	0.884*** (0.019)
Constant	0.032** (0.013)	0.062*** (0.017)	0.031** (0.012)	0.000 (0.003)	0.000 (0.005)	0.001 (0.002)
Observations	175	79	96	1,680	552	1,128
Log likelihood	127.7	55.40	112.8	2909	1241	1825
Number of districts				12	12	12
$R^2$ (overall)	0.770	0.022	0.891	0.808	0.204	0.832
$R^2$ (within)				0.772	0.151	0.782
$R^2$ (between)				1.000	0.997	1.000
$\rho$				0.0172	0.0504	0.0269
$\sigma^a$				0.00576	0.00601	0.00812
$\sigma^u$				0.0435	0.0261	0.0488

Note: The table reports estimates of persistence effects in the dynamics of interdistrict accommodation operations. Columns (1) to (3) provide times series estimates obtained when the total volume of accommodation (shown in Figure 2) is regressed on its lag and a constant. Columns (4) to (6) provide panel estimates obtained when the net accommodation received by each of the 12 Federal Reserve districts is regressed on its lag, a constant as well as fixed and time effects. The estimates are obtained using the full sample period (i.e. 1913Q1-1959Q4). The standard errors reported are robust to heteroskedasticity. (\*\*\*), (\*\*), (\*) indicate statistical significance at the 1%, 5% and 10% level of confidence, respectively.

# ANNEX I REGIONAL PAYMENT IMBALANCES IN THE GLOBAL ECONOMIC AND FINANCIAL CRISIS – EURO AREA VS. US

**Figure A Target balances: 1999-2013**

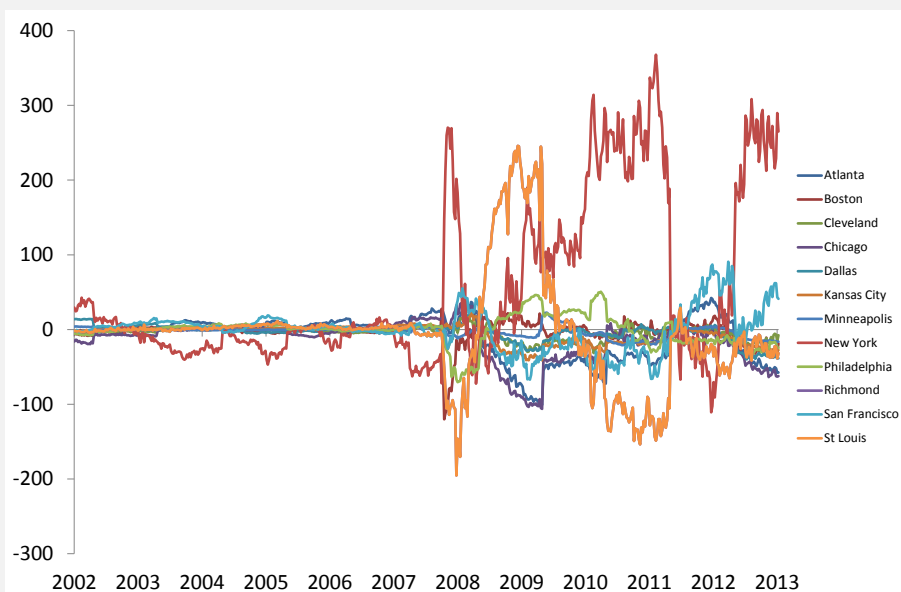
(€ billions)



Sources: Euro area national central banks and Haver Analytics.

**Figure B ISA balances: 2003-2013**

(\$ billions)



Sources: Economic Research, Federal Reserve Bank of St Louis (<http://research.stlouisfed.org/fred2>).

## ANNEX II

### Statement of condition of the Federal Reserve Bank of Boston, 1925

(in \$000s)

<b>Earning Assets</b>	<b>151,140</b>	<b>Capital and surplus</b>	<b>25,631</b>
- Loans to member banks (vs. commercial or agricultural paper, acceptances or Treasury obligations)	53,114	- Capital paid (i.e. 3% of capital and surplus of member banks)	8,611
- Acceptances bought in the open market	84,714	- Surplus	17,020
- US government securities bought in the open market	12,735		
- Foreign loans on gold	577		
<b>Cash reserves helds vs. deposits and circulation</b>	<b>178,703</b>	<b>Deposits</b>	<b>143,506</b>
- Gold held by the Federal Reserve Agent (collateral issued by the Bank to secure Federal Reserve notes)	78,505	- Member bank deposits (legal reserve vs. deposits of their customers)	141,802
- Gold Redemption Fund	6,289	- US government deposits	895
- Gold held in the Gold Settlement Fund (for the purpose of settling current transactions between district Feds)	32,809	- Other deposits (incl. foreign bank deposits, deposits of non-member banks, etc.)	809
- Gold and Gold certificates in the bank's own vaults	40,402		
- Legal tender notes, silver and silver certificates	20,698		
<b>Non-reserve cash</b> (National Bank notes, Federal Reserve Bank notes and minor coin)	<b>6,733</b>	<b>Currency in circulation</b> (Federal Reserves notes in actual circulation, payable in gold on demand; these notes are secured in full by gold and discounted and purchased com- mercial paper and acceptances)	<b>174,559</b>
<b>Miscellaneous resources</b>	<b>75,940</b>	<b>Miscellaneous liabilities</b>	<b>68,820</b>
<b>Total resources</b>	<b>412,516</b>	<b>Total liabilities</b>	<b>412,516</b>

Source: Federal Reserve Bank of Boston (1926), p. 12-13. Note: The overall reserve ratio (as reported by the Federal Reserve Bank of Boston in its annual report) is 56.2%, i.e.  $178,703 / (143,506 + 174,559)$ . The reserve ratio for deposit liabilities is 124.5%, i.e.  $178,703 / 143,506$ , while that for currency in circulation is 102.4%, i.e.  $178,703 / 174,559$ , well above the 35% and 40% legal minima in force in 1925.

## ANNEX III DATA SOURCES AND TRANSFORMATIONS

This annex describes the data available from McCalmont (1963) along with the assumptions and transformations needed to obtain quarterly amounts outstanding of interdistrict accommodation operations undertaken by the 12 Federal Reserve Banks between 1913:Q4 and 1959:Q4.

**1916:** McCalmont reports detailed data on monthly participation by Federal Reserve Banks in open-market purchases of acceptances made by the Boston and New York Federal Reserve Banks but without specifying whether these data were stocks or flows. To err on the cautious side, we assumed that these were flow data and cumulated monthly participations within each quarter to obtain estimates of the corresponding stocks (as noted before, these are imperfect estimates given that the residual maturities of the underlying securities could vary).<sup>59</sup> In so doing, we further assumed that gold provided to the Federal Reserve Banks of New York and Boston originated uniformly from other regional Reserve Banks.

<sup>59</sup> Note that the implicit assumption made is that securities have a residual maturity of three months in the first month of a given quarter, against two months in the second month and one month in the last month.

**1917:** As in 1916, McCalmont provides detailed data on monthly participations by Federal Reserve Banks in open market purchases of acceptances made by the Boston and New York Reserve Banks, as well as data on re-discounts and purchases of acceptances for that year. To the first category of data, we apply the same transformation as in 1916. For the second category, we assume a residual security maturity of three months (in line with McCalmont's observation that this was the typical maturity of bankers' acceptances at the time) and estimated quarterly amounts outstanding by dividing by four the (posited) annual stock of re-discounts and purchases of acceptances.

**1918:** More complete data are available, including records of daily and monthly flows, together with the identity of the Federal Reserve Banks involved in these transactions. To transform flow data into stocks, we cumulated monthly flows within each quarter to obtain rough estimates of the corresponding stocks (subject to the caveat noted before).

**1919:** Outstanding accommodation operations provided and received by each Federal Reserve Bank are available as stocks at a monthly frequency. We took March, June, September and December observations as our estimates of quarterly amounts outstanding of interdistrict accommodation operations.

**1920-1921:** McCalmont (1963, p. 149) indicates that "the published information is in most respects so satisfactory and complete that we need only reproduce it here exactly as it appeared in the Federal Reserve Bulletin vol. 8, Jan. 1922, pp. 27-31". The reported outstanding amounts are monthly. We therefore took March, June, September and December observations as our estimates of quarterly amounts outstanding of interdistrict accommodation operations.

**1922-1923:** The volume of interdistrict accommodation in these years appears to have been smaller than in 1920-1921. The Board appears to have compiled or preserved less information as a result. Flow data are available only on an annual basis and only for accommodation providers. We divided these annual flow data by four to obtain a rough estimate of quarterly data. Federal Reserve districts unidentified as accommodation providers were considered as recipient of accommodation, again assuming a uniform distribution.

**1924-1926:** Based on the information in McCalmont (Table 4, p. 164) on providers and recipients of accommodation, we assumed that throughout 1924 the Cleveland, Minneapolis, Kansas and Dallas districts were providers of gold and other districts were recipients. There was limited information with which to identify providers of gold for 1925 and 1926. As for 1922-23, Federal Reserve districts not identified as accommodation providers were classified as recipient of accommodation, again assuming a uniform distribution.

**1927-1930:** McCalmont notes that there were no-rediscouts in this period. Whether any accommodation by means of interbank purchases of acceptances or government securities occurred is not known (McCalmont, 1963, p. 1965).

**1931-1935:** Snapshots of stock data on interdistrict accommodation operations as of selected months (e.g. November 1931) or date (e.g. 7 March 1933) appear in Board letters and memoranda. We assigned these amounts to the quarter to which they refer. There is no record of accommodations between November 1931 and April 1932 (McCalmont concludes that “very likely they were none”).

**1936-1959:** Quarterly stock data on (re)allocations are readily available from the Board and require no additional transformation. The data reported by McCalmont between 1944 and 1959 may slightly underestimate or overestimate actual interdistrict operations, since the sum of all the providers’ and recipients’ positions do not net out (accounting for roughly 10-25% of their cumulated amount in absolute terms).

## **ANNEX IV      LEGAL FRAMEWORK FOR GOLD RESERVE SHARING BETWEEN RESERVE BANKS**

### **Federal Reserve Act of 23 December 1913**

*(Authorisation to rediscount; Section 11(b), p. 12)*

“The Federal Reserve Board shall be authorised and empowered [...] to permit, or on the affirmative vote of at least five members of the Reserve Board to require Federal reserve banks to rediscount the discounted paper of other Federal reserve banks at rates of interest to be fixed by the Federal Reserve Board.”

*(Definition of gold reserve ratios; Section 16, p. 18)*

“Every Federal reserve bank shall maintain reserves in gold or lawful money of not less than thirty-five per centum against its deposits and reserves in gold of not less than forty per centum against its Federal reserve notes in actual circulation, and not offset by gold or lawful money deposited with the Federal reserve agent.”

### **Board Memorandum X-185 of 28 May 1917**

*(Procedures for handling re-rediscount operations; quoted in McCalmont, 1963, pp. 241-242)*

“Payment should be made by transfer through the Gold Settlement Fund in even thousands, off amounts to be adjusted by a credit to the account of the selling bank on the books of the purchasing bank. The selling bank should decrease the item “loans and discounts” and increase

“Gold settlement fund”... The purchasing bank should increase the item “rediscounts for other Federal Reserve Banks” and should decrease “Gold Settlement Fund”.

### **Federal Reserve Board, Rules and Regulation, Regulation M, 4 July 1933**

*(Distinction between dividend and reserve ratio motives; Section (2))*

“To allocate among all participating Federal Reserve Banks the aggregate amount of government securities and their obligations held for their account and to adjust such allocations from time to time to meet the changing needs of the respective Federal Reserve Banks. Such allocations shall be made with the view primarily of (a) enabling each Federal Reserve Bank to maintain a suitable reserve position and (b) equalizing as far as practicable the net earning position of the Federal Reserve Banks.”

### **Federal Open Market Committee’s directive adopted on 25 May 1936**

*(Systematic reallocation with reserve ratio floor; quoted in McCalmont, 1963, p. 85)*

“(c) authorized and directed the executive committee to make thereafter from time to time such readjustments as may be necessary to maintain the distribution of government securities among the Federal Reserve Banks in accordance with such formula [i.e. that of February 1935]: provided that if at any time the reserve ratio of any Federal Reserve Bank should fall below 50% or would be reduced below 50% by reason of the operation of such formula, the executive committee shall make such readjustments in the allotments as shall be necessary to raise the reserve ratio of such bank to 50% by allocating the necessary amount of securities to the other Federal Reserve Banks in accordance with the formula”.

### **Minutes of the Federal Open Market Committee meeting on 14-15 April 1975**

*(Switch to annual settlement of interdistrict payment imbalances, p. 41)*

“It was recommended that the clearings be effected through the use of inter-office accounts among the Federal Reserve Banks that would be settled once each year by increasing or decreasing each Bank’s holdings of securities. That approach would obviate the need for monthly reallocations of the System Open Market Account to equalize gold-to-note liability ratios. The new procedure would take effect at the beginning of May, a convenient starting point since the end of April marked a coincidence of a month end and an end-of-week statement date.”