

Monetary Policy When One Size Does Not Fit All: Federal Reserve Banks and the Recession of 1920-1921

Abstract

Prior to the formation of the Federal Reserve's Open Market Investment Committee in 1923, the Federal Reserve banks enjoyed considerable discretion in discounting and open market operations. During the 1920-1921 recession that followed the Fed's abrupt increase in discount rates, we show, using new data, that Federal Reserve banks in hard hit districts expanded rather than contracted credit to their member banks. This group of Federal Reserve banks sought to mitigate the effects of the recession and prevent a banking panic. Although they were individually constrained by gold reserve requirements, as was the System as a whole, the expansionary Reserve banks were able to borrow excess reserves from the other Reserve banks and continue lending. Although they were ultimately compelled to follow the contractionary policy, these Federal Reserve banks sustained lending to their member banks for a prolonged period, thereby limiting the damage to the banking sector, as measured by bank suspensions.

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I. Introduction

This paper explores a largely ignored episode in the history of the Federal Reserve when, during the severe recession of 1920-1921, the individual Federal Reserve banks pursued substantially different policies, responding to the disparate conditions of member banks in their districts. The more industrial and urbanized Federal Reserve districts followed contractionary policies, seeking to restore a price level and interest rates consistent with the gold standard. The commodity price collapse following the end of World War I hit agricultural and rural districts much harder and their Federal Reserve banks implemented expansionary policies aimed at halting the business failures, farm foreclosures, and bank suspensions that might have ignited a banking panic. While the latter were attacked for bailing out speculators and protecting imprudent bankers, their regional policies may have prevented a much worse contraction and a replay of the 1907 panic.

We view the inter-district lending of gold reserves as an inefficient yet reasonably effective conduit for cross-district ‘emergency’ liquidity provision. These gold reserve loans enabled credit expansion that circumvented the prohibition of inter-state branch banking. Correspondent banking, the standard mechanism for inter-regional allocation of funds, worked in periods of moderate economic fluctuations. But in 1920-21, the economy contracted sharply, magnifying the risk of offering credit. Furthermore, it was the first downturn during which the Federal Reserve System was fully operational. Our analysis highlights how inter-district gold reserve lending extended crisis liquidity provision powers beyond the pre-existing clearing house system. In that system, crisis-related liquidity provision was limited to the capital capacity of the clearing house member banks. Given that the Federal Reserve System was largely based on the clearing house system, it is notable that the district banks would have been “limited to the capital of the member banks” as well if the Federal Reserve Act of 1913 had not made provision for lending of gold reserves between District Reserve banks.

The independence of the regional Federal Reserve banks in the very early years of the System is central to understanding the conduct of Fed policy. Richardson and Troost (2009) and Mitchener and Richardson (2011) have shown that the Reserve banks had enough discretionary authority to contain a panic and moderate contractionary forces in the Great Depression before the reform of the System’s governance by the Banking Act of 1935 that centralized authority for monetary policy in the Federal Open Market Committee. However, the period we consider preceded the Federal Reserve Board’s famous Tenth Annual Report (1923) that recognized the need to coordinate discounting and open market operations for consistent general credit policy and led to the formation of the Open Market Investment Committee in the Spring of 1923. Although there was no final determination at that time of whether Reserve banks could initiate operations, a system account was established that made pro-rata allocations of transactions to the Reserve banks; afterwards, independent operations were usually small (Friedman and Schwartz, 1963, p. 251). Thus, we examine a time when the Reserve banks had the greatest latitude for pursuing regional policies, even resisting directions from the Board of Governors and pressure from other Reserve banks.

While the Federal Reserve Board initially deplored their divergent policies, it eventually conceded the success of the dissenting Reserve banks efforts in 1920 to mitigate the recession. In spite of this recognition, the inter-Federal Reserve bank lending that had channeled credit to the harder hit districts was terminated in 1922. In official contemporary documents, the battle within the Fed was minimized, leaving the impression for modern researchers (Eichengreen, et. al.,

2015) that there was seamless cooperation within the System. Yet, internal archival documents, such as the boards of directors' minutes of the Federal Reserve District banks and the correspondence between banks and the Board (White, 2015) reveal an intense struggle over the appearance of a regionalized monetary policy.

In the second section of this paper, we describe the origin and characteristics of 1920-1921 recession; and in the third, the susceptibility of the economy to panics when markets – especially, financial markets -- are less than fully integrated. In the fourth, we document the divergence of policy among the Federal Reserve banks, while in the fifth, we examine the debate among the Federal Reserve banks and members of the Federal Reserve Board over what might be termed, member banks' dissenting policies. In the sixth section, we provide some econometric evidence that inter-district lending of gold reserves permitted Federal Reserve banks in the districts most exposed to the post World War I agricultural price shocks to provide an exceptional increase in credit to their member banks. In turn, these member banks were able to sustain or increase their loans, which may have prevented a worse downturn.

II. The Panic-Less Recession of 1920-1921

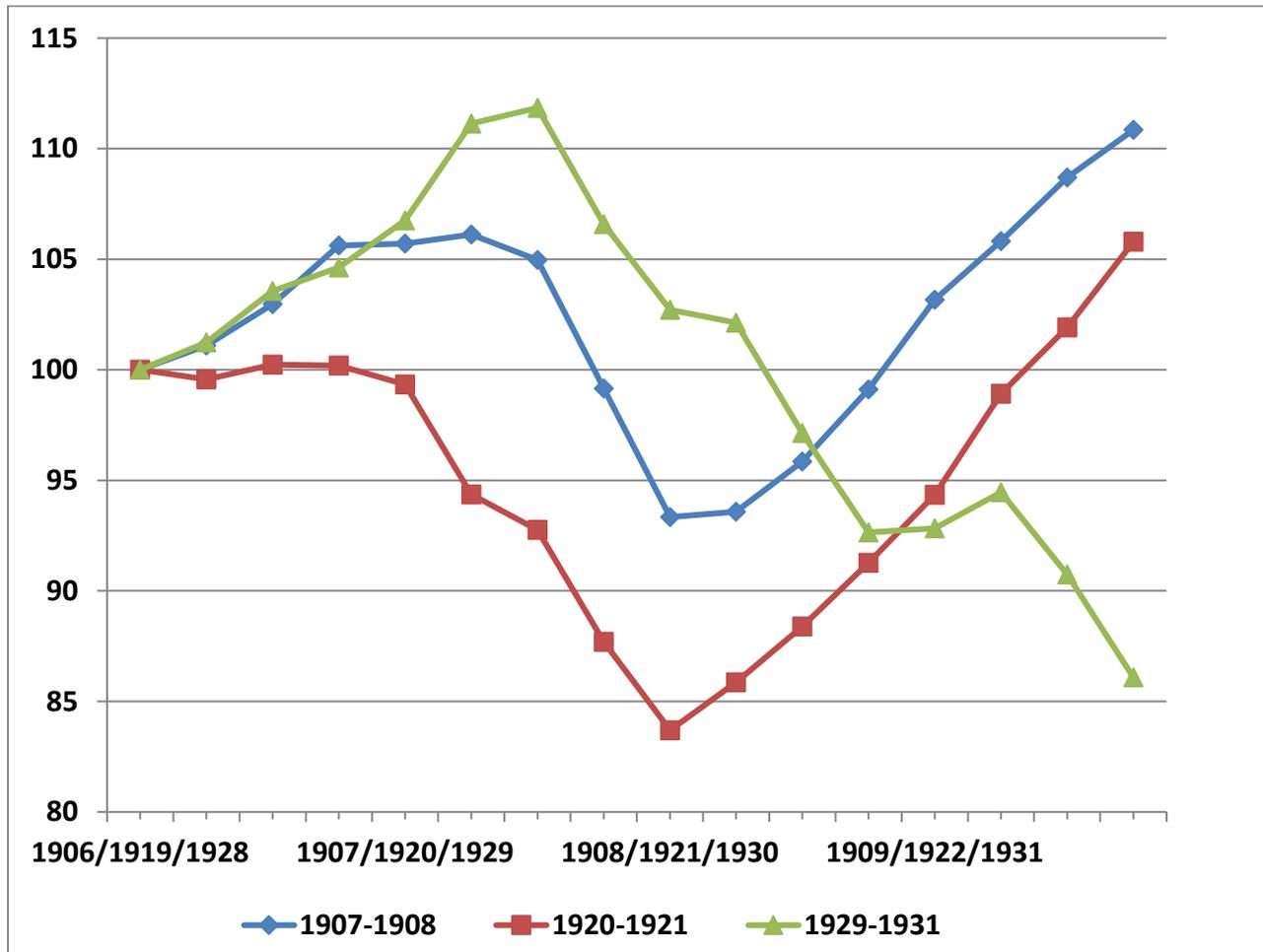
The 1920-1921 recession is known as being severe but relatively brief. Figure 1 compares this recession with those of 1907-1908 recession and the initial years of the Great Depression. The speed and depth of the post-World War I recession is strikingly similar but was unaccompanied by a banking panic. The 1907-1908 exhibits the same V-shape as 1920-1921, with a sharp four quarter drop in GNP of 9.8 percent and a four quarter bounce back of 13.4 percent. For 1920-1921, there was a 16.5 percent decline and a 12.4 percent recovery for the same time spans. From the peak in 1929, GNP fell 12.6 percent in a year; and rather than recovering plunged a further 11.2 percent in the next four quarters. The contracting years 1907-1908 and 1929-1930 both saw major banking panics but not 1920-1921; and the further plunge of GNP in 1931 was accelerated by two more panics.

What would account for the absence of a panic? Table 1 reports the number of bank failures for the same years covered in Figure 1. The condition of banks in the years just before a recession would likely determine to a considerable degree their susceptibility to insolvency [the banking sector being weaker in each successive episode], so the number and the percentage change in failures are displayed as a rough adjustment for any trend factors. Again, the recession of 1920-1921 is no less severe than 1907-1908 and 1929-1930 recessions on the banks, with the number of suspensions rising more sharply. The similarity of circumstances would seem to have presaged a banking panic in 1920 or 1921; but none occurred and the economy experienced a bounce-back recovery.

Both the absence of a central bank in 1907 and the absence of an appropriate policy by the Federal Reserve in 1930-1933 are blamed for the rise in bank failures and the outbreak of panics. The contractionary actions of the Fed during 1920-1921 would seem to would seem to have set up the right conditions for a panic to erupt. We suggest that this “puzzle” is at least partly answered by the fact that monetary policy was decentralized; and while there was a generally contractionary policy, the expansionary policies of the individual Federal Reserve banks in the districts most exposed to agricultural price shocks caused a reallocation of liquidity to those regions, even as total liquidity shrank. The result was to mitigate the effects of the

shocks to the weakest districts, reducing the likelihood of a panic, even as banks closed their doors in record numbers.

Figure 1
Three Recessions---Quarterly GNP



Source: Robert J. Gordon, ed., *The American Business Cycle: Continuity and Change* (Chicago: Chicago University Press, 1986), Appendix B and <http://www.nber.org/data/abc/>

Our analysis highlights how inter-district gold reserve lending extended crisis liquidity provision powers beyond the pre-existing clearing house system. In that system, crisis-related liquidity provision was limited to the capital capacity of the clearing house member banks. Given that the Federal Reserve System was largely based on the clearing house system, it is notable that the district banks would have been “limited to the capital of the member banks” as well if the Federal Reserve Board did not facilitate the lending of gold reserves across District Reserve banks.

Table 1
Bank Suspensions in Three Recessions

Year	Number of Suspensions	Percentage Change from Previous Year	Year	Number of Suspensions	Percentage Change from Previous Year	Year	Number of Suspensions	Percentage Change from Previous Year
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
1906	53	-33.8	1919	62	31.9	1928	498	-25.6
1907	90	69.8	1920	167	169.4	1929	659	32.3
1908	153	70.0	1921	505	202.4	1930	1350	104.9
1909	78	-49.0	1922	366	-27.5	1931	2293	69.9

Source: Board of Governors of the Federal Reserve System, Banking and Monetary Statistics (Washington, D.C., 1943), Table No. 66.

To set the stage for analyzing Fed policy, we review the background the evolution of the 1920-1921 recession, beginning with the end of World War I and illustrated with some selected statistics in Table 2. Moving from a wartime to peacetime economy presented major challenges and the Fed committed “several mistakes, some avoidable, some unavoidable in the circumstances” (Meltzer, 2003, p. 90). These policy choices first accelerated the postwar boom and then magnified the bust.

First, there was a fiscal shock. Following the armistice in 1918, the federal government slashed its expenditures and quickly shrank the size of the military. This action contributed to the brief recession of August 1918-March 1919; however, it was partly offset by the low interest rate policy of the Fed that continued to assist the Treasury with the sales of the Victory Bond issue. Desirous of maintaining bond prices, the Treasury favored a low interest policy (Friedman and Schwartz, 1963). In April 1918, the New York Fed had set its rates for discounts and advances on eligible paper at 4 percent, well below the market rates and maintained this rate until November 1919. All the other Reserve banks adhered to this policy and none set a rate higher than 4 ½ percent. The upsurge in discounts to member banks that had been rising quickly paused during the recession and then continued.

Table 2
Selected Economic Statistics, 1913-1929

Year	Manufacturing Production	Consumer Price Index	Manufacturing Wholesale Price Index	Wholesale Farm Products Price Index	Unemployment	Gold Stock	NY Fed Discount Rate
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1913	100	100.0	100.0	100.0	5.7	na	
1914	91.9	100.9	95.0	100.0	8.5	1,526	5.0
1915	102.7	101.5	97.5	100.0	9.0	2,025	4.0
1916	122.4	110.8	126.1	118.3	6.5	2,556	3.0
1917	123.4	133.5	163.9	181.1	5.2	2,868	3.5
1918	121.3	156.9	177.3	207.8	1.2	2,873	4.0
1919	118.5	180.2	184.9	221.1	2.3	2,707	4.75
1920	125.7	208.8	230.3	211.7	5.2	2,639	7.0
1921	97.3	186.5	149.6	123.9	11.3	3,373	4.5
1922	128.8	174.7	146.2	131.7	8.6	3,642	4.0
1923	152.8	177.8	149.6	138.3	4.3	3,957	4.5
1924	140.8	178.1	142.9	140.0	5.3	4,212	3.0
1925	157.6	182.6	147.1	153.9	4.7	4,112	3.5
1926	160.8	184.4	142.9	140.6	2.9	4,205	4.0
1927	156.5	180.9	134.5	139.4	3.9	4,092	3.5
1928	163.4	178.4	132.8	148.3	4.7	3,854	5.0
1929	173.6	178.4	131.1	146.7	2.9	3,997	4.5

Sources: U.S. Index of Manufacturing Production 1863-1930, NBER Macrohistory, <http://www.nber.org/databases/macrohistory/contents/chapter01.html>, U.S. Consumer Price Index, <https://www.measuringworth.com/usdpi/result.php>, Carter, et. al., *Historical Statistics*, Wholesale prices Industrial commodities Series Cc67, Wholesale prices Farm Products Series Cc68, Unemployment, Series Ba745, Governors of the Federal Reserve System, *Banking and Monetary Statistics* (1943), Gold Stock, p. 536, Table No. 156 and New York Federal Reserve Bank discount rate, pp. 439-440, Table No. 115.

This Fed policy to maintain discount rates ‘lower than the market interest rate’ contributed to a commodities and general economic boom, beginning in early 1919 and peaking in January 1920. As seen in Table 2, prices, whether measured by the consumer price index or the manufacturing or farm products wholesale price indexes increased sharply, with manufacturing output also rising quickly. Many of the Federal Reserve banks were alarmed by the rapid decline in their gold reserves, as expansionary policy had led to a drop in the gold stock for the first time in years, with gold flowing out of the United States (Column 7 in Table 2). As a whole, the Federal Reserve System’s gold reserve ratio fell from 50.6 percent in June 1919 to

42.7 percent in January 1920. Under pressure from the Treasury, the Federal Reserve Board exercised its authority to veto requests from the Federal Reserve Banks of New York and Boston to raise their rates. But, when several Reserve banks neared their 40 percent gold reserve minimum, the Board allowed the New York bank to raise its rate to 4 $\frac{3}{4}$ percent in December 1919. The other Reserve banks followed suit and rates rose to 5 and eventually 6 percent. Yet, the upward swing of commodities prices meant that member banks who could charge 10 percent or more on their loans still found it profitable to borrow at the increased Reserve bank discount rates. In an attempt to discourage borrowing, Congress passed the Phelan Act of 1920 that permitted the Federal Reserve to set progressively higher rates for member banks that borrowed heavily. Although the Board retained its authority to veto any basic rate changes, it delegated the power to determine progressive rates to the district banks.

The boom collapsed in January 1920 just as many reserve banks' discount rates reached 6 percent, leading Friedman and Schwartz (1963, p. 231) to comment that "The rise in the discount rates in January was not only too late but also probably too much." In June 1920, the Federal Reserve Bank of New York raised its discount rate to 7 percent. The recession, beginning in January 1920 and reaching a trough in July 1921, became a severe one. Although the annual statistics Table 2 partly mask the full extent of the economic decline, manufacturing output declined 23 percent, while consumer, manufacturing and farm prices plunged by 11, 35 and 41 percent, with unemployment rising to 11.3 percent. Distress on the farm and in the factory led to an unparalleled uptick in bank suspensions from 62 in 1919 to 167 in 1920, and then 505 in 1921, as seen in Table 1.

Yet, many in the Fed were not keen to cut rates quickly. The desire was not only to terminate inflation but to bring prices down to a level that would be consistent across countries when the international Gold Standard was resumed. However, prices stubbornly remained well above any of the prewar price level measures seen in Table 2. The Governor of the Federal Reserve Bank of New York, Benjamin Strong, was opposed to any discount rates cuts so long as market interest rates were higher. In his words, the Fed should be following "Bagehot's golden rule" (Chandler, 1958, p. 173-4) and make the discount rate a penalty rate to deter any inflationary impulse. This expression was an unfortunate misinterpretation of Bagehot, whose rule was aimed at temporary provision of credit during financial crises. Strong was applying the rule to a year of actively contracting credit. He wanted to see member bank borrowing reduced by 20 percent. Although the Federal Reserve Bank of New York steadily cut its bills purchased, its member banks' level of discounts scarcely dropped, leading the bank to raise its discount rate to 7 percent in June 1920, in the midst of the recession. Boston had raised its rate to 7 percent in May 1920; but though other Federal Reserve banks like Cleveland and Philadelphia followed this "austerity" program, they kept their rates at 6 percent. While the policy pushed by the Board and by Strong was favored by some banks, it was resisted by those in agricultural regions where the collapse of the commodities boom threatened the existence of their member banks.

III. Susceptibility to Regional and National Financial Crises

Freixas, Parigi, and Rochet (2000) and Allen and Gale (2009) show that in models of a multi-region economy with systemic risk that liquidity surplus regions can supply liquidity short regions. If there is a shortage of aggregate liquidity, a shock may be transmitted from the weaker regions to the stronger regions by unexpected forced liquidations, which may then yield a general banking and economic crisis. The possibility of a shock producing a regional or general

crisis is greater if money markets are not fully integrated and/or if interbank market for liquidity is characterized by information asymmetries that may be exacerbated by shocks. Both of these conditions appear to have been present in the early 1920s, leaving the twelve Federal Reserve banks facing very different regional conditions during the recession of 1920-21.

In the early twentieth century, the U.S. economy was far less integrated than it is today. One way to look at market integration and the issue of how to structure monetary policy is through the lens of the optimal currency literature. If U.S. regions—or Federal Reserve districts—may be viewed as separate currency areas, there is a case for differential monetary policy or in the extreme, which is what the literature focuses on, different currencies. To be a candidate for a separate currency/monetary area (Rockoff, 2010), a region should have several attributes: (1) it should be a large area, (2) its specialized goods should be subject to shocks that are not symmetric to other regions, (3) labor mobility between regions is limited, (4) capital mobility between regions is limited, and (5) fiscal transfers between regions are limited.

Although there were no legal impediments in the United States to the movement of goods, money/capital, and probably labor, these conditions were at least in part fulfilled. The Federal Reserve districts were approximately as large in size and income as many European countries, and there was a high degree of specialization. The specialized regions may not have conformed exactly to the boundaries of the Fed districts, but their output was distinctive. Most significantly, the Southern and Western regions were heavily dependent on agriculture, much more so than even the Midwest. The most distinctive region was the South. Before the Civil War, sugar, tobacco, rice and cotton were its dominant crops for market; but in the second half of the nineteenth century, cotton absorbed an even larger share of resources than it had before the war. At the time of the 1920-21 recession, cotton was a leading economic sector in the Atlanta, Dallas, Richmond, and St. Louis districts. It was most important in the Sixth District (White, 2015), Atlanta, where the mid-1920 fall in cotton prices caused acute distress for the region's banks whose loans were heavily collateralized by cotton.

The desperate state of cotton was described by one of the directors of the Federal Reserve Bank of Richmond's Board, D. R. Coker

It appears to me that the worst trouble with the whole situation in the country is unequal deflation. The cost of living in our section has not gone down more than a small fraction as much as the deflation of cotton. In less than a year, cotton has declined approximately 80 percent and cottonseed approximately 80 percent in value; that is, the two products of the cotton fields have gone down and are bring in today about one fifth of that they were bringing a year ago. I know of no other agricultural product that has declined so much. (Fifteenth Conference of Federal Reserve Banks, 1921, p. 562).

Coker spoke sympathetically of the “thousands of our desperately poor and ignorant tenants in the South” and gave a painful example: “I know a negro who owned 500 acres of land; he bought 500 acres next to him and paid \$250.00 an acre for it. Unless he is helped for five or six years he will probably lose both farms.” Facing the same dilemma was the plantation owner “who bought 15,000 acres for \$50,000 and borrowed but now he is losing money on his crops, cant' make payments” (Fifteenth Conference of Federal Reserve Banks, 1921, p. 598).

In terms of the labor market, the South was the most distinctive region, having limited labor mobility with the rest of the American economy until World War II (Wright, 1996). In

terms of the money market, Landon-Lane and Rockoff (2004) found that for the pre-Depression era, “monetary shocks were communicated to all parts of the United States by financial markets, but that the level and timing of the responses was erratic.” There was less than complete integration for the Plains, the West and the South. For example, vector auto-regressions showed most of the variance in the forecast errors in the Western, Plains and Southern rates are not explained by the national rate. In the South, shocks to the national rate accounted for only 10 percent of the variance of the forecast errors for 1880-1913 and 20 percent for 1914-1943. They concluded: “In the nineteenth century, perhaps until World War II, the peripheral regions of the United States did not simply import interest rate shocks from other regions. They generated their own.....This lack of synchronicity set a difficult problem for a potential monetary authority.”¹

Part of this lack of integration was certainly a result of the prohibition on branching by national banks and most state banks (White, 1983) that created an industry populated almost exclusively by unit banks. Consequently, there were 20,000 commercial banks in the United States in 1920. However, American banks were partly and imperfectly tied together through correspondent banking networks that facilitated the holding of reserves and movement of funds for investment around the country. Complicating matters further was the dual banking system where banks could be chartered by the federal government via the Office of the Comptroller of the Currency or by the states through their state banking agencies. Only national banks and state banks that met most of the qualifications for national banks could be member of the Federal Reserve System. These member banks could receive direct injections of liquidity from a Federal Reserve Bank that discounted their paper; but for the greater number of state non-member banks that had not joined the system; liquidity would then have to be obtained indirectly through the intermediation of member banks.

The success of these banking networks in transferring funds and arbitraging interest differentials relied on limited published information---that did not fully capture the condition of banks’ balance sheets or underlying loan collateral. The only information on another bank could publicly obtain was from the short balance sheets of national banks in the Call Reports published three to five times a year or from the four or five item weekly data published for members of clearing houses. Loan quality was practically invisible. This information asymmetry was partly bridged by reputation but that might easily vanish in the wake of a severe shock. In the Sixth District, for example (White, 2015) a substantial portion of member and non-member bank loans were collateralized by cotton and other commodities that rendered their balance sheets opaque to other banks, especially those outside of the region who were less familiar with its specialized activity. Thus, illiquid banks could find it difficult to access the regional and national intermarket market for liquidity because of the heightened information asymmetries.

To shore up their own liquidity in a crisis, banks refused to renew loans, which were typically short-term, forcing their customers to quickly dump their stocks of commodities on the market. In a process theoretically described by Shleifer and Vishy (1992), Diamond and Rajan (2009), and Caballero and Simsek (2009), fire sales for commodities and commodity-back bills could break out and send prices for the commodities as well as bills backed by them below their fundamental prices. The rapid descent of prices could then produce a cascade of bank failures and possibly a full-fledged bank panic.

Given the regional economic differences in the United States and the less than perfect integration of many markets, shocks could affect regions asymmetrically and lead to very

¹ It should be noted that these tests for market integration all rely on annual data that sometimes may smooth over shocks---booms and busts---and hence may not fully capture the moments of crisis.

different regional economic outcomes. There were no significant fiscal stabilizers to transfer purchasing power to offset the asymmetric effects of negative shocks in the 1920s. Thus, regional conditions perceived by twelve Federal Reserve banks could be quite different, leading to divergent policy efforts. The federalized structure of the Fed was in no small part a reflection of the concerns by local bankers and businesses that a centralized authority would not serve them well and hence the relative degree of autonomy delegated to the Federal Reserve banks----which would be pushed to near its limits during the recession of 1920-21.

IV. Policy Divergence and Inter-Federal Reserve Bank Lending

In contrast to the pre-1914 clearing house assistance to banks, the Reserve banks in more rural districts could expand their discounts because they could borrow gold reserves from Reserve banks with ample reserves.

In the 1920s, monetary policy, although guided by the Federal Reserve Board, was conducted with a relatively high degree of autonomy by the Federal Reserve banks. Even though they were established by the Federal Reserve Act of 1913, the district banks were not government agencies but were owned by their member banks—all national banks and all state banks who voluntarily joined. They were governed by their member-elected boards of directors who closely guided the day-to-day activities of the Reserve banks, meeting either as a whole or as an executive committee once or more a week. Their design resembled the clearing houses that had been established in every major city in the nineteenth century to assist with the clearing and collection of checks and that had provided emergency liquidity in the form of clearing house loan certificates to their members during financial crises. The value of this liquidity provision during the Panic of 1907 led Congress to provide for similar federally established association under the Aldrich-Vreeland Act of 1908, while it considered broader banking reform. Thus, the Federal Reserve banks were an evolutionary extension of the clearing houses and Aldrich-Vreeland associations.

A signal difference, however, was that the twelve Federal Reserve banks provided not just emergency liquidity but regular liquidity to ease the sharp seasonal demands that were thought to be the primary contributors to financial panics. In accordance with this objective and the real bills doctrine's framework, loans were intended to be short-term. Section 14 of the Federal Reserve Act specified that the Reserve banks could “discount notes, drafts, and bills of exchange arising out of actual commercial transactions” “for agricultural, industrial or commercial purposes.” Except for U.S. government securities, they were prohibited from providing credit collateralized by stocks or bonds. The portfolio of the Reserve banks was dominated by discounts, which were provided “passively,” to member banks who applied to the discount window depending on the posted discount rates. The maturity of discounts was limited to 90 days, except for agricultural and livestock paper and bills of exchange that had a maximum permissible maturity of six months. In addition, the Reserve banks could discount trade acceptances with maturity up to three months. Open market operations---“active” policy---were secondary to discounting and were conducted by the purchase of specified types of bills and securities.

Subject to the approval of the Federal Reserve Board, each Reserve bank could set its discount rates. Rates were not uniform and within each instrument-specific rate, they diverged as much as one percent. The Board exercised this authority, frequently denying Reserve bank

requests for discount rate changes or permission to use a new type of collateral. Discounting and open market operations of the Reserve banks were constrained by their individual reserve requirements. The Federal Reserve Act set these reserve requirements in lawful money--- primarily gold and certificates for gold held by the Treasury---at 40 percent for a bank's Federal Reserve notes and 35 percent for member bank deposits held as reserves at the District Federal Reserve Bank. (McCalmont, 1963, p. 12). In practice, the gold reserve ratio of a Bank was calculated as equal to total reserves divided by the sum of its notes outstanding plus net deposits (excluding the float).² A Federal Reserve Bank could violate this requirement if the Federal Reserve Board authorized a suspension, which could be for up to 30 days, renewable for another 15 days.³ However, the Board had to impose a graduated tax on the shortfall.⁴ However, penalties actually imposed were trivial because a Federal Reserve Bank with deficient reserves could call upon other Banks to lend it reserves.

By forming a federalized central bank where each Federal Reserve Bank had to maintain its own reserve ratio, the Federal Reserve Act of 1913 created a problem where regionalized shocks would create major problems for individual Banks. This inherent problem was recognized by Benjamin Strong, when the Act was being debated. He wrote:

the establishment of twelve regional institutions is dangerous...Entire freedom of interchange of discount should exist. Otherwise, when the burden of one district becomes too heavy for the local institution to carry....the other eleven....would endeavor to strengthen their own resources rather than discount for the institution requiring such accommodation. (Chandler, 1958, p. 34).

To manage this potential problem, the Federal Reserve Act gave the Board the power, upon affirmative vote of a minimum of five members, to *require* Federal Reserve Banks to rediscount the discounted paper of other Federal Reserve Banks at a rate of interest fixed by the Board. To manage the regular inter-Reserve bank lending, a "Gold Settlement Fund" was created in Washington, D.C. If a Federal Reserve Bank saw its reserves dropping and approaching the legal minimum, it could sell bills and securities and discourage use of the discount window or it could rediscount bills with another Reserve bank in exchange for gold. The rediscounting bank would then wire the Gold Settlement Fund to transfer gold certificates between the accounts of the two banks. The official reserve ratio of the borrowing bank was then raised and for the lending bank it was lowered. Most of these transfers were voluntary but the Board could compel assistance.

Rediscounting was one method to temporarily transfer reserves from a surplus Bank to a deficit Bank, but there were two other methods that were also employed. Federal Reserve Banks

²This accepted method was conveniently calculated on a daily basis, although it is a slightly higher ratio than that called for by the Act of 1913. McCalmont (1963, p. 17) reports that requirements were later calculated as total (gold) reserves less forty percent of notes divided by net deposits. The two measures are only equal if the reserve ratio is forty percent.

³ This permission to violate the reserve requirements parallels the power of the British Chancellor of the Exchequer to issue a "chancellor's letter" promising to indemnify the Bank of England if it violated its legal minimum reserves under the Bank Act of 1844.

⁴ The 1913 Act set the rates against the shortfall for Federal Reserve notes but left the Board free to set the tax rate on deposit deficiencies (McCalmont, 1963, p. 25) For example, the Board's 1920 Annual Report (p. 46-48) shows that Boston paid \$239, New York \$23,301, Atlanta \$181, Chicago \$147, Minneapolis, \$78, Kansas City \$96, Dallas \$74 and San Francisco, \$547.

also bought bankers acceptances from each other to replenish reserves, and a Federal Reserve Bank could request an alteration in its share of bankers acceptances offered to the System. From the opening of the Fed in 1914 to 1922, “re-rediscunts” were the principal form of interbank assistance, although Reserve banks also bought acceptances from each other; but from 1923 to 1933, there were no re-rediscunts and Reserve banks bought acceptances and government securities from each other to provide reserve assistance. (McCalmont, 1963, p. i).

Although the Reserve Banks initiated re-rediscunts and trading in acceptances, the Board tried to emphasize the importance of its role in the inter-District transfers, as it was anxious “that the men conducting the actual day-to-day operations of the Reserve Banks should not relegate it [the Board] to a minor role.” In its Annual Report of 1918 (p. 3) the Board trumpeted that “Discount transactions between the banks have not, as a rule, been negotiated by the banks themselves, but through the medium of the Federal Reserve Board, instructions being given by telegraph.” In its 1919 Annual Report (pp. 5-6), it reported “There has been such a spontaneous spirit of cooperation between the Federal Reserve Banks 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.” This public posture may consequently have obscured the fact that the Reserve Banks, not the Board, were the driving force in the shifting of reserves because their relative needs to provide credit to their districts.

What the Federal Reserve Board could influence were the rates for re-rediscunts. On March 15, 1915, the Board fixed the rate of re-rediscunt at 3 ½ percent for all classes of paper under 30 days maturity and 4 percent for over 30 but less than 90 days. On May 29, 1917, the Board set a rate of 3 percent for all paper maturing up to 90 days, but there were no re-rediscunts until December 1917 when it appears that transactions went through at individually established but apparently unreported rates higher than 3 percent as rates for member banks were higher (McCalmont, 1963, p. 31). The Board faced a difficult problem in setting this rate, as Reserve Banks could be charging different rates to their member banks in their respective districts and consequently a fixed rate could result in one Reserve Bank subsidizing another or enforcing losses on a borrowing Bank. Discontent over this issue was raised in the September 1920 meeting of the Federal Advisory Council. The discussion was summarized:

The question now arises, however, whether a Federal Reserve Bank which has been able to maintain high [gold (added)] reserve by reducing the demands for accommodation from its own member banks, which are its depositors, should be required to extend accommodation to member banks in other districts through the medium of their Federal Reserve Bank at the same rates as are established for their own members. (quoted in McCalmont, 1963, p. 32-33).

Acknowledging this problem, the Board raised the interbank rate to 7 percent on September 7, 1920 for paper discounted by the Federal Reserve Bank of Cleveland, and then extended the rate to all inter-Federal Reserve Bank discounts on September 13, 1920. The rate was lowered to 6.5 percent on May 13, 1921, 6 percent on June 23, 1921, and 5.5 percent on November 3, 1921. As economic conditions eased, the concerns about re-rediscunts diminished and there were no longer any re-rediscunts outstanding by March 22 1922. After this date, there were no new re-

rediscounts until 1933. Instead, the Banks pooled open market operations through the System Account,⁵ though discounting remained under the authority of the Reserve Banks.

V. Divergent Federal Reserve Bank Policies

Although it was originally intended to assist with very brief gold reserve shortages, inter-Federal Reserve bank lending also eased the medium-term constraint on any Federal Reserve Bank. If each of the Federal Reserve banks had been legally obliged to maintain their reserve ratios independently in 1920-1921, those in agricultural districts would have been constrained to follow the contractionary policies initiated in Washington, D.C. Instead, the district banks in areas exposed to the dramatic commodity price shocks resisted demands that they adhere to a policy of austerity until the middle of the recession.

This divergence can be seen in Table 3, which depicts the changes in the credit volumes (discounts to member banks and bills purchased) supplied by the Reserve banks to their member banks. The data presented is new, culled from the Annual Reports of the individual Federal Reserve Banks and other sources, which permit a window onto the diverging policies of the Federal Reserve Banks. To provide a sense of the relative size of each banks' operations the outstanding credit at the end of December 1919 is given in Column 3. New York is obviously the giant, with Chicago and Cleveland a distant second and third. The change in each Reserve bank's discount rate from December 1919 to February 1920, the outset of the recession, is shown in Column 4. Column 5 displays the actual reserve ratio for the Reserve banks and in parentheses the adjusted reserve ratio, that is, the ratio that would have resulted if the bank had not borrowed or lent reserves from other Reserve banks. Columns 6 and 7 display the percent change in the volume of credit from the beginning of the recession to mid-recession in September 1920 and the prevailing rates at the end of that month. Column 8 presents the reserve and adjusted reserve ratios for November 1920. The decline of credit during the recession is provided in Column 9 and the discount rates prevailing for the end of the recession, July 1921, in Column 10.

⁵“Once a week each Reserve Bank's proportion of the aggregate purchases of the System would be figured on the basis of its reserve percentage at the close of the preceding week and the distribution would be effected accordingly. Such Banks as may have purchased more than their portion would be requested to make sales from their portfolio to such other Bank or Banks as the secretary of the Open Market Investment Committee might indicate” (McCalmont, 1963, p. 50).

Table 3
Hawks and Doves:
Federal Reserve Banks' Credit Policies 1919-1921

No.	District	Credit Outstanding 12/1919	Discount Rates 12/1919-2/1920	Reserve (Adjusted) Ratios 1/1920	Percent Change in Credit 12/1919 to 9/1920	Discount Rate 11/1920	Reserve (Adjusted) Ratios 11/1920	Percent Change in Credit 12/1919 to 7/1921	Discount Rate 7/1921
1	2	3	4	5	6	7	8	9	10
1	Boston	211,342	4.75-6.00	42.6 (42.3)	-27.4	7.00	55.0(61.9)	-68.3	6.00
2	New York	1,028,991	4.75-6.00	40.3 (39.3)	-2.5	7.00	40.8(39.2)	-62.5	5.50
3	Philadelphia	212,838	4.75-6.00	40.6 (35.4)	-23.1	6.00	49.6(55.4)	-43.5	6.00
4	Cleveland	281,423	4.75-6.00	48.3 (49.0)	-55.1	6.00	56.5(79.4)	-50.7	6.00
5	Richmond	119,963	4.75-6.00	44.6 (41.9)	19.5	6.00	43.2(38.0)	5.1	6.00
6	Atlanta	106,453	4.75-6.00	48.5 (50.6)	59.6	7.00	40.1 (21.2)	-1.2	6.00
7	Chicago	349,009	4.75-6.00	50.3 (57.3)	44.1	7.00	40.3(39.4)	-18.9	6.00
8	St. Louis	115,171	4.75-6.00	48.9 (48.9)	38.9	6.00	41.3(34.9)	-26.4	6.00
9	Minneapolis	84,458	4.75-6.00	50.2 (50.2)	26.7	7.00	39.5(18.0)	-16.3	6.50
10	Kansas City	131,530	5.00-6.00	49.6 (49.6)	43.8	6.00	40.2(24.4)	-29.2	6.00
11	Dallas	61,795	5.00-6.00	62.0 (62.0)	85.4	6.00	40.3(18.9)	24.4	5.50
12	San Francisco	165,300	4.75-6.00	40.3 (41.3)	34.9	6.00	44.9(46.8)	-14.7	5.50

Source: Annual Reports of the individual Federal Reserve banks.

The table is shaded to contrast districts 1 through 4 and districts 5 through 12, roughly the divide between more industrial and more agricultural districts—termed Hawks and Doves to reflect their divergent efforts to contract or expand credit. The latter covered the regions particularly hit by the commodities price collapse and neatly identifies the policy split within the Fed. At the beginning of the recession, the more industrialized districts had much lower reserves generally than the more agricultural districts, though Cleveland, Richmond and San Francisco had somewhat different positions. It is notable that both New York and Philadelphia borrowed reserves via the Gold Settlement Fund; if they had not they would have, at 39.3 and 35.4 percent, fallen below the 40 percent required reserve ratio. These Reserve banks would have been desirous to have their member banks repay their loans and thereby replenish their reserves and provide them with a sufficient gold cushion. In contrast, the more agricultural districts were flush with reserves in January 1920 and even provided some reserves to New York and Philadelphia.

For the Federal Reserve System as a whole, the need to halt inflation and ensure that aggregate gold reserves were sufficient dictated that all the banks raise their discount rates. While they quickly raised their discount rates to 6 percent by February 1920, only Districts 1 through 4 saw declines in the credit to their member banks, large percentage changes, ranging from -23.1 to -55.1 percent, except for New York, which had a small decline. Member banks in the agricultural districts, Districts 5 through 12 had dramatic increases in credit, ranging from

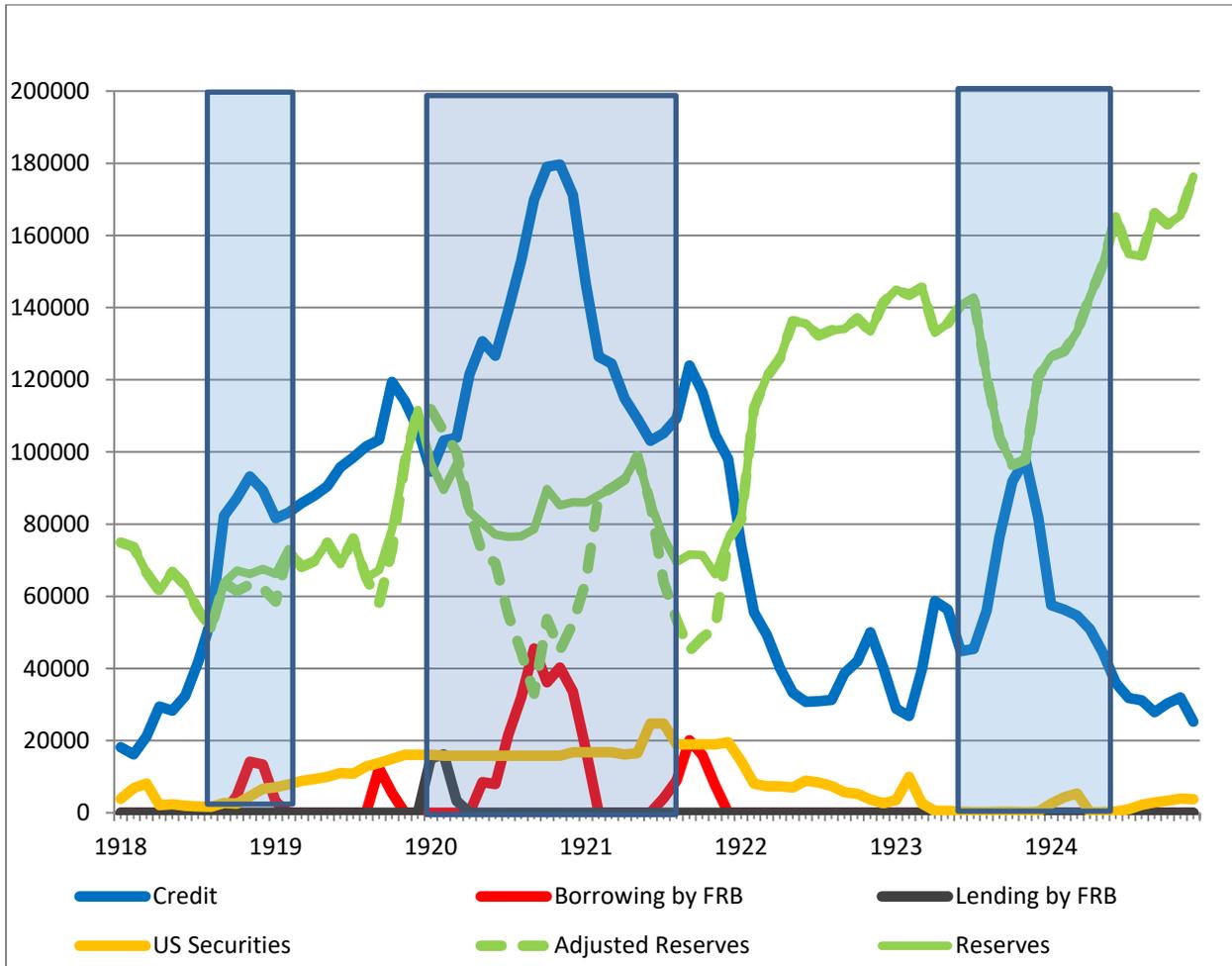
19.5 percent in Richmond to 85.4 percent in Dallas. In both industrial and agricultural regions, these movements were generated not by changes in bills purchased but in discounts to member banks. Member banks in Districts 5 to 12 were not discouraged from borrowing.

Expanding discounts to member banks caused the reserves of District banks 5 to 11 to drop as seen by comparing columns 5 and 8. These Reserve Banks now had to temporarily replenish their reserves by borrowing from Boston, Philadelphia and Cleveland. Without these reserves, these seven Reserve Banks would have theoretically had reserve ratios, indicated by the adjusted reserve ratios, of 18.0 to 39.4 percent, many substantially below the 40 percent requirement. The largest interbank lender, the Federal Reserve Bank of Cleveland was particularly upset with the expansion of credit to what it deemed to be failing banks in the South. Up until this point, inter-Reserve Bank lending had occurred at negotiated rates. Unhappy about this arrangement, the Cleveland Fed persuaded the Federal Reserve Board raise its interbank lending rate to 7 percent on September 7, 1920. While discount rates of 6 percent were sufficient in some districts to discourage member bank discounting, they were raised in several districts to 7 percent by November 1920, the highest level for the period. The result was a decline in demand for discounts by member banks, which now fell precipitously across the agricultural districts.

Column 9 records the total decline in member bank credit for the whole of the 1920-1921 recession. For the industrialized districts, total credit fell between 43.5 and 68.3 percent. The total decline in the agricultural districts was far less. Thus, it appears that the Federal Reserve Banks in these areas buffered their member banks from the full shock of the commodity price collapse and may also have buffered businesses in their areas.

To see the divergence of Federal Reserve Bank policy over the whole period, Figures 3 and 4 display key variables for the Federal Reserve Banks of Atlanta and Cleveland who were the leading adversaries in the internal debate over policy during the recession. Covering the years 1918 to 1924, there were three recessions, shaded in blue. During the 1920-1921 recession, the Atlanta Bank rapidly expanded credit, primarily discounts, to its member banks, nearly doubling the dollar value. This increase would have led to a sharp drop in its reserves, as indicated by its adjusted reserves. However, it was able to borrow gold from other District Banks. These borrowings constituted approximately half of its reserves at the peak of its expansion of credit. Discounts were then curtailed in the middle of the recession under pressure from the Board and especially the Cleveland Bank, which pursued a strictly contractionary policy from the outset of the recession, cutting credit and increasing its reserves. While it eventually accumulated \$300 million of reserves, Cleveland lending \$150 million to other Reserve Banks, including Atlanta. When the System forced Atlanta and other agricultural Reserve Banks to reduce discounts, credit to member banks from the Cleveland Bank leveled off.

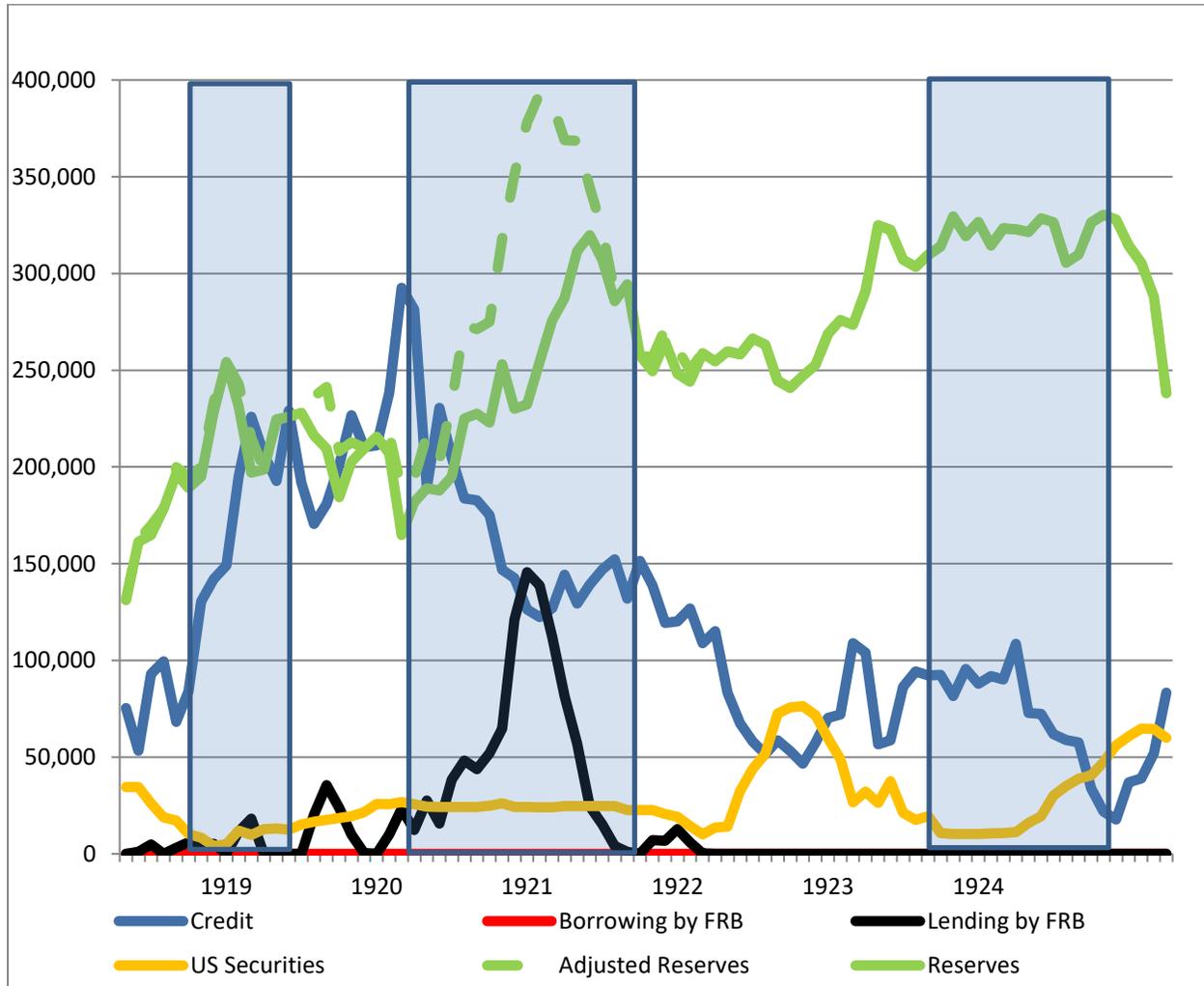
Figure 2
Federal Reserve Bank of Atlanta



Note: In thousands of dollars.

Source: Federal Reserve Bank of Atlanta, Annual Reports (1918-1924).

Figure 3
Federal Reserve Bank of Cleveland



Note: In thousands of dollars.

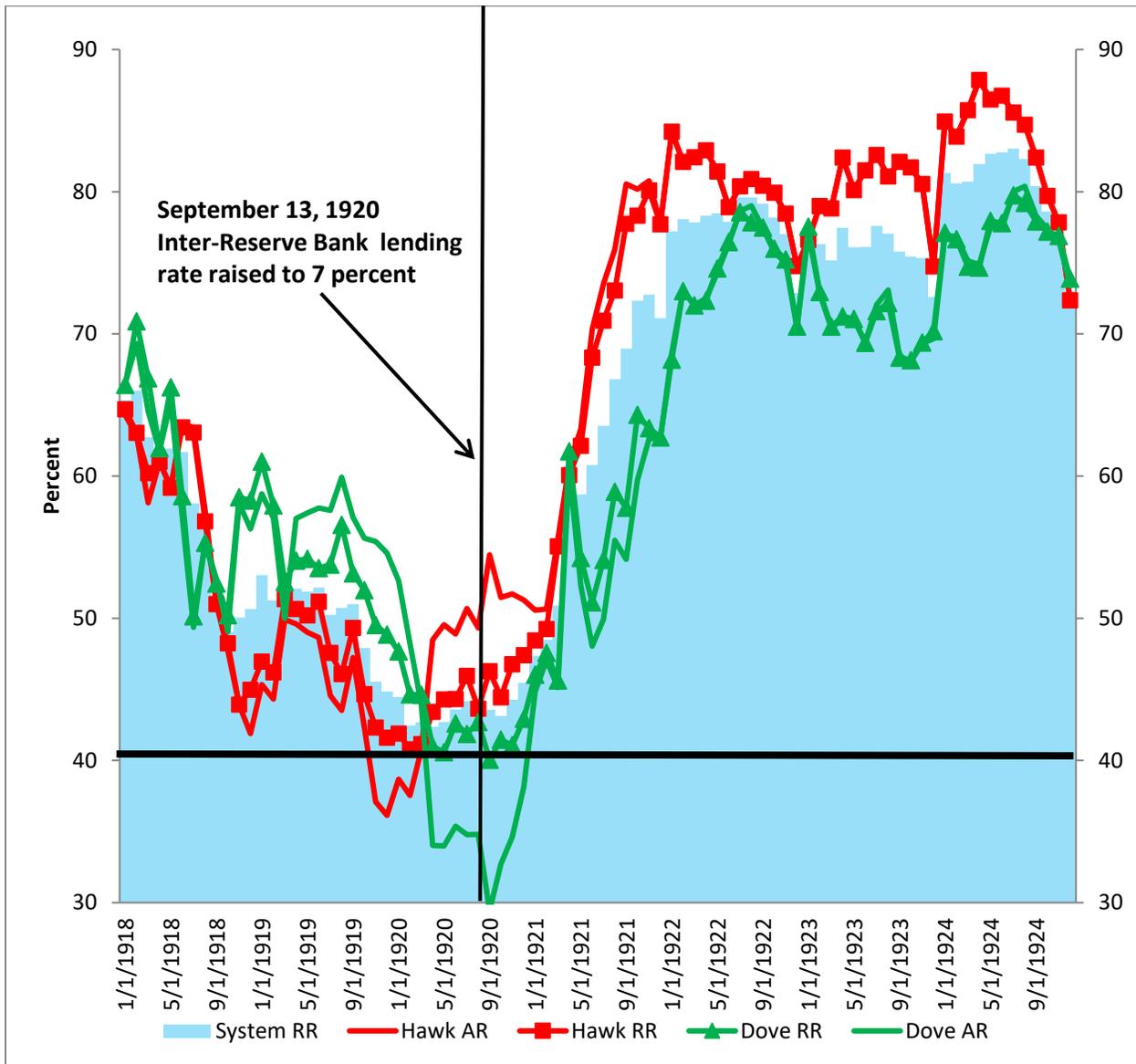
Source: Federal Reserve Bank of Cleveland, Annual Reports (1918-1924).

Figure 4 summarizes for all Reserve Banks the conflict that arose between the more industrialized Federal Reserve districts—the Hawks---and more agricultural Federal Reserve districts---the Doves---during the recession of 1920-1921 by examining the reserve ratios of the whole Federal Reserve System and the aggregated reserve ratios of the Hawks and the Doves. Districts 1 through 4—Boston, New York, Philadelphia and Cleveland are classified as Hawks because they sharply contracted member bank discounts and the remaining districts, 5 through 12---as the Doves because they sharply increased member bank discounts. The “RR” ratios show the actual reserve positions and the “AR” ratios show the adjusted reserve positions or what the ratio of reserves to notes and deposits would have been if there had been no inter-Reserve Bank lending.

The light blue bars that form the background present the reserve ratio of the whole Federal Reserve System and the horizontal black line identifies the minimum reserve ratio of 40 percent. During 1918-1919, the system-wide ratio fell from a high of 66.0 percent in February 1918 to 44.8 percent in December 1919; but it was still well above the 40 percent minimum. During much of this period the “dovish” agricultural districts had greater reserves than the “hawkish” industrial districts. In fact, for a good portion of 1919, the Doves lent reserves to the Hawks, notably the last months of 1919 when without inter-Reserve bank lending the reserves of Districts 1 through 4 combined would have been below 40 percent.

During the recession of January 1920-July 1921, the System’s reserves hovered just above 40 percent and the roles of borrower and lender abruptly and dramatically flip. Owing to their willingness to allow their member banks to obtain more discounts during the downturn, the Doves’ reserves plummeted, as indicated by their adjusted reserve ratio. Only borrowing from the Hawks permitted the Doves to maintain aggregated reserved reserves just above the 40 percent minimum. The lending was substantial as indicated by the difference between the actual reserve ratio and the adjusted reserve ratio of the Hawks. Even though the Hawks were contracting, the System as a whole was perilously close to the minimum of 40 percent---and thus there were fewer and fewer reserves to reallocate among the Reserve banks. After prolonged behind closed doors squabbling over the Doves increased borrowing, the sharp uptick in inter-Reserve Bank borrowing in August-September 1920 enabled the Cleveland bank to persuade the Federal Reserve Board to set a 7 percent rate for all interbank borrowing. This action, indicated by the vertical black line, put an end to the negotiation of rates and set a “re-discount” rate between banks that was higher or equal to all Reserve banks’ basic discount rates.

Figure 4
Combined Hawk and Dove Reserve and Adjusted Reserve Ratios



From this point onward, the Doves began to contract their lending to member banks and consequently their borrowing from the Hawks, as seen in the rapid ascent of the adjusted reserve ratio for the Doves. By the time that all inter-Reserve bank lending is halted in 1921, all Reserve banks had moved through a contractionary phase and they had bolstered their reserve ratios well above 60 percent.

V. Analysis of the Impact of Divergent Federal Reserve Bank Policies

A key question is to what extent inter-District lending permitted dovish Reserve Banks to expand credit to their member banks that were then able to increase their loans and investments while the transfer of gold reserves may have forced hawkish Reserve Banks to contract their credit to their member banks that, in turn, reduced their loans and investments. Alternatively, this reallocation of reserves may not have any effect on banks in Districts 1 to 4, and thus may have significantly expanded credit nationally, especially in distressed Districts 5 to 12. The new data that we have collected from the publications of the Reserve Banks allows us to offer some estimates of interbank lending on Reserve bank credit; however, owing to a lack of data on economic activity by District in these early years we cannot take the next logical step and determine if the divergent policies ultimately mitigated the effects of the recession in the hardest hit regions.

Table 4
Naïve Counterfactual Effects

		No Federal Reserve Credit Counterfactual	No Inter-Federal Reserve Bank Lending Counterfactual
		Effects on Member Bank Lending	Effects on Member Bank Lending
		Percent	Percent
1	2	3	4
1	Boston	-7.9	6.5
2	New York	-9.9	-0.3
3	Philadelphia	-9.5	4.9
4	Cleveland	-4.2	11.8
5	Richmond	-10.3	-5.3
6	Atlanta	-20.8	-11.2
7	Chicago	-15.7	-1.5
8	St. Louis	-18.7	-8.2
9	Minneapolis	-24.7	-8.4
10	Kansas City	-15.0	-7.6
11	Dallas	-10.4	-13.5
12	San Francisco	-7.8	0.8

Before presenting the econometric evidence, we offer naïve counterfactuals that suggest how much Federal Reserve bank credit to member bank may have added to member bank lending. In Table 4, Column 3, assumes that all credit from a Federal Reserve bank would have increased member bank lending dollar for dollar. In this scenario, we consider what the effect of an elimination of Fed credit would have on member bank lending in September 1920, just before inter-Federal Reserve bank borrowing was curtailed. Obviously this is an extreme case and so

Column 4 shows what would have happened to member bank lending, if only inter-Federal Reserve bank lending had been eliminated in September 1920. The lending Reserve banks would have had more reserves to lend while the borrowing Federal Reserve banks would have been forced to contract. Member bank lending in the Atlanta and Dallas districts would have fallen by 11.2 and 13.5 percent respectively, and lending in the Cleveland district would have conceivably increased by 11.8 percent. However, the assumption underlying this table is extreme and does not take into account how Federal Reserve banks responses to changing reserves and member banks' responses to changing Federal Reserve credit may have varied district to district.

To provide a preliminary econometric evaluation of how inter-Reserve bank borrowing influenced both the credit provided by Federal Reserve banks to member banks and the loans provided by member banks to their customers, we offer two simple regressions for each district. The regressions are in levels as there are no trends in credit or lending for this period. The credit equation is

$$(1) CR_t = \alpha + \rho CR_{t-1} + \beta_1 AdjRes_t + \beta_2 AdjRes_{t-1} + \beta_3 Borrowed_t + u_t$$

where:

CR	=	Credit issued by District bank
AdjRes	=	Adjusted gold reserves – those available to district bank if borrowing from other reserve banks was unavailable
Borrowed	=	Volume of gold reserves borrowed from other reserve banks

The lending equation is

$$(2) Lending_t = \alpha + \rho Lending_{t-1} + \beta_1 CR_t + \beta_2 NetDepts_{t-1} + \beta_3 Spread_t + \beta_4 IP_{t-1} + v_t$$

Where:

Lending	=	Member bank lending
CR	=	Credit issued by District bank
NetDepts	=	Net deposits of member banks
Spread	=	Commercial paper rate less District Discount Rate
IP	=	National Industrial Production

We present regressions for each of the Federal Reserve districts in Appendix 1 and Appendix 2 and then graphs that show two counterfactuals in Appendix 3 and Appendix 4. The first graph is for the “Counterfactual Credit” and it displays the actual credit provided by an individual Federal Reserve bank to its members, the fitted credit estimated from equation (1) and the counterfactual credit that would have been provided if there the Federal Reserve bank had no borrowed reserves. The second graph is for the “Counterfactual Member lending” and shows the actual member bank lending and the estimated member bank lending if there had been no borrowing of reserves by the Federal Reserve bank in the district.

Consider two of the most severely affected districts were Atlanta and Dallas, which had both suffered from the dramatic fall in cotton prices. In the credit regression, an increase in

adjusted reserves reduces credit as the Federal Reserve bank is trying to bolster its reserve position, but an increase in reserves borrowed from other districts increases credit. For member bank lending, a rise net deposits of member banks should increase the banks' lending capacity, an increase in industrial production should spur demand for their loans and a rise in the spread should reduce the demand for loans. An increase in credit from the Federal Reserve bank has a strong positive effect on member bank lending. The counterfactuals reveal that if inter-Federal Reserve district borrowing had been forbidden during the 1920-1921 recession, credit from the Federal Reserve bank of Atlanta would have been approximately halved and probably more than halved for Dallas. In the middle of the recession the counterfactual for member lending suggests that lending in the Atlanta district would have been reduced by approximately one quarter and in the Dallas district by approximately one-third.

Guarding its own reserves perhaps more zealously than other districts, the Federal Reserve Bank of Cleveland never borrowed reserves from another bank, and thus its credit and member bank lending were not influenced by borrowing. However, both Boston and Philadelphia borrowed occasionally. For Philadelphia, borrowed reserves had a significant effect on the credit it offered its member banks, that credit did not, in turn, drive member bank lending. In the case of Boston, borrowed reserves did not have a significant effect on credit to member banks and had a negative effect on member bank lending, although it is only a brief effect.

Conclusion

Unfortunately, in the early years of the Federal Reserve System, there is a paucity of data on economic activity by district. Its absence prevents us from determining whether the expansion first of Federal Reserve credit and secondly member bank lending served to prevent an even harsher down turn and perhaps a banking panic in the agricultural districts. However what is clear is that several Federal Reserve banks located in districts where agricultural prices had plummeted initially resisted the call for a sharp contraction of Federal Reserve credit. Instead, concerned about the health of their member banks and their regions' economies' they expanded credit to member banks borrowing gold reserves heavily from Reserve banks in less affected regions. This credit then enabled their member banks to expand loans to their customers, which may have slowed or halted the economic decline. When the Federal Reserve System as a whole neared its 40 percent minimum reserve ratio, the calls by the more hawkish Federal Reserve banks were heeded and all of the Federal Reserve banks contracted credit. Nevertheless, by the end of the recession, bank credit in Southern and Western district of the Federal Reserve was not as severely contracted as in the Northeast.

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APPENDIX 1: Table 1: Counterfactual Credit Regressions

	<i>Dependent variable:</i>					
	Credit _t					
	Atlanta	Boston	Chicago	Cleveland	Dallas	Kansas City
Credit _{t-1}	0.063*** (0.016)	0.171*** (0.035)	0.631*** (0.178)	0.175*** (0.037)	0.046*** (0.015)	0.109*** (0.017)
Adj. Reserves _t	-0.394*** (0.087)	-0.244*** (0.080)	-0.383*** (0.132)	-0.395*** (0.104)	-0.085 (0.127)	-1.207*** (0.203)
Borrowed _t	2.170*** (0.322)	0.837 (0.511)	6.534*** (1.963)		1.381*** (0.254)	0.743* (0.385)
Adj. Reserves _{t-1}	-0.012 (0.013)	-0.076*** (0.024)	-0.209*** (0.057)	-0.102*** (0.034)	-0.018** (0.009)	-0.046*** (0.013)
Constant	102.055*** (9.832)	144.620*** (19.762)	342.666*** (63.703)	224.256*** (28.393)	45.502*** (6.835)	159.217*** (17.654)
Observations	83	84	84	84	84	84
R ²	0.692	0.468	0.480	0.338	0.629	0.743
Adjusted R ²	0.676	0.441	0.454	0.313	0.610	0.730
Residual Std. Error	23.775	41.432	104.739	51.877	14.706	20.276
F Statistic	43.714***	17.381***	18.241***	13.589***	33.522***	56.965***

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 2: Counterfactual Credit Regressions

	<i>Dependent variable:</i>					
	Credit _t					
	Minneapolis	New York	Philadelphia	Richmond	San Francisco	St. Louis
Credit _{t-1}	0.058*** (0.013)	2.446*** (0.318)	0.175*** (0.031)	0.069*** (0.020)	0.133*** (0.032)	0.076*** (0.012)
Adj. Reserves _t	-0.702*** (0.101)	-1.074*** (0.084)	-0.511*** (0.107)	-0.361** (0.169)	-0.294*** (0.086)	-0.382** (0.150)
Borrowed _t	0.997*** (0.342)	0.237 (0.819)	1.499*** (0.476)	0.643* (0.375)	0.054 (6.187)	1.560*** (0.315)
Adj. Reserves _{t-1}	-0.023*** (0.008)	-0.566*** (0.114)	-0.036** (0.018)	-0.044** (0.018)	-0.057*** (0.017)	-0.034*** (0.010)
Constant	86.576*** (7.813)	1,276.972*** (86.799)	194.459*** (23.125)	105.607*** (15.716)	172.250*** (19.286)	92.570*** (14.767)
Observations	84	84	84	84	84	84
R ²	0.741	0.903	0.713	0.467	0.440	0.715
Adjusted R ²	0.728	0.898	0.699	0.440	0.411	0.701
Residual Std. Error	14.919	110.436	34.516	25.425	42.016	19.627
F Statistic	56.406***	184.565***	49.123***	17.287***	15.501***	49.669***

Note:

*p<0.1; **p<0.05; ***p<0.01

APPENDIX 2: Table 1: Counterfactual Member Lending Regressions

	<i>Dependent variable:</i>					
	Member Lending _t					
	Atlanta	Boston	Chicago	Cleveland	Dallas	Kansas City
Credit _t	0.611*** (0.113)	-0.827*** (0.144)	0.357* (0.184)	-1.131*** (0.214)	0.720*** (0.178)	0.648*** (0.124)
Net Deposits _{t-1}	0.018 (0.016)	-0.010 (0.033)	0.056 (0.126)	-0.046 (0.101)	-0.020 (0.017)	-0.006 (0.020)
Member Lending _{t-1}	-0.015 (0.013)	0.020 (0.027)	-0.051 (0.108)	0.035 (0.088)	0.020 (0.014)	0.004 (0.017)
Spread _{t-1}	-10.370* (5.748)	5.643 (11.375)	-167.775*** (39.443)	6.201 (19.268)	-15.085*** (5.670)	-1.586 (6.795)
IP _{t-1}	53.065*** (4.048)	79.732*** (7.371)	182.706*** (26.605)	102.449*** (13.450)	32.825*** (3.917)	42.045*** (4.133)
Constant	147.351*** (26.067)	710.831*** (42.300)	1,272.713*** (153.447)	1,101.576*** (81.267)	100.896*** (24.946)	304.629*** (25.265)
Observations	72	71	72	72	72	72
R ²	0.740	0.788	0.570	0.693	0.562	0.687
Adjusted R ²	0.721	0.771	0.537	0.670	0.529	0.664
Residual Std. Error	21.119	45.273	147.400	81.236	21.559	21.720
F Statistic	37.667***	48.234***	17.464***	29.798***	16.952***	29.036***

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 2: Counterfactual Member Lending Regressions

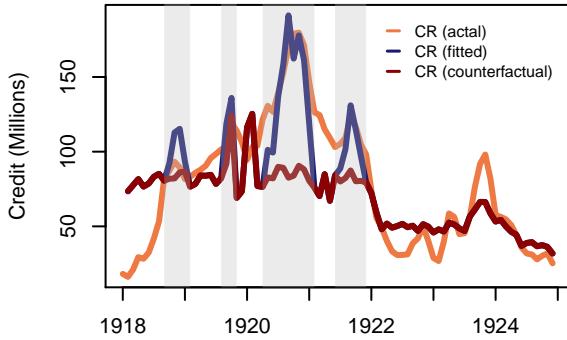
	<i>Dependent variable:</i>					
	Minneapolis	New York	Philadelphia	Richmond	San Francisco	St. Louis
	Member Lending _t					
Credit _t	0.150 (0.128)	0.533*** (0.183)	0.091 (0.147)	0.121 (0.086)	0.591 (0.554)	-0.267** (0.112)
Net Deposits _{t-1}	-0.006 (0.013)	-0.995* (0.535)	0.027 (0.041)	-0.012 (0.011)	-0.118 (0.117)	-0.020 (0.018)
Member Lending _{t-1}	0.004 (0.011)	0.634* (0.327)	-0.023 (0.034)	0.010 (0.009)	0.118 (0.099)	0.019 (0.015)
Spread _{t-1}	-3.933 (4.666)	-279.623*** (93.244)	1.180 (12.870)	1.456 (3.660)	-140.806*** (42.446)	-9.539 (6.117)
IP _{t-1}	21.436*** (3.464)	379.503*** (52.652)	56.062*** (9.044)	26.536*** (2.933)	89.907*** (27.383)	45.696*** (4.403)
Constant	194.811*** (22.216)	3,784.011*** (293.061)	593.001*** (54.244)	416.265*** (20.829)	667.173*** (166.570)	336.347*** (25.094)
Observations	72	72	72	72	72	72
R ²	0.430	0.492	0.376	0.623	0.379	0.738
Adjusted R ²	0.387	0.454	0.328	0.595	0.332	0.719
Residual Std. Error	17.714	313.650	54.058	14.393	160.290	25.989
F Statistic	9.962***	12.785***	7.945***	21.858***	8.063***	37.269***

Note:

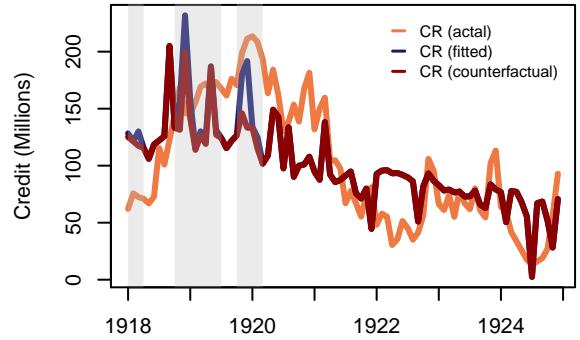
*p<0.1; **p<0.05; ***p<0.01

APPENDIX 3: Creditfactual Credit

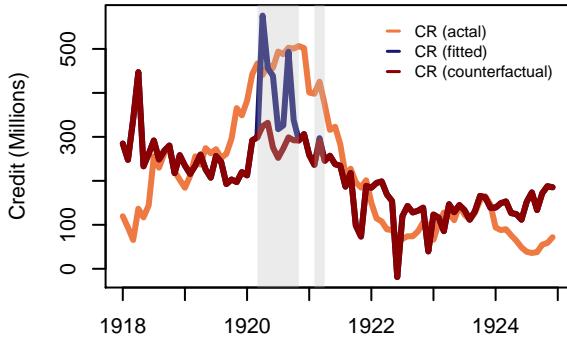
Atlanta



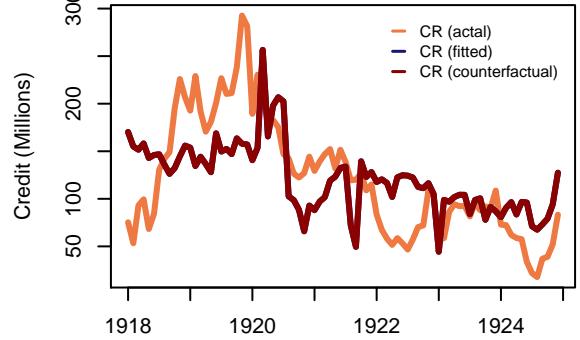
Boston



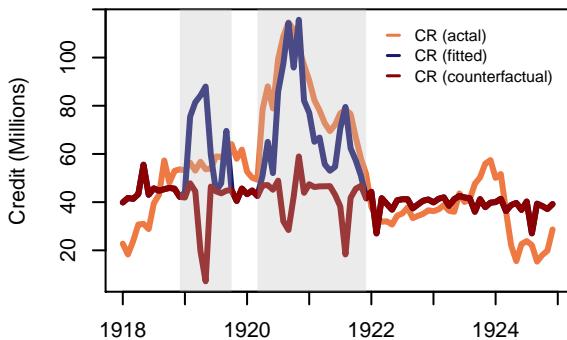
Chicago



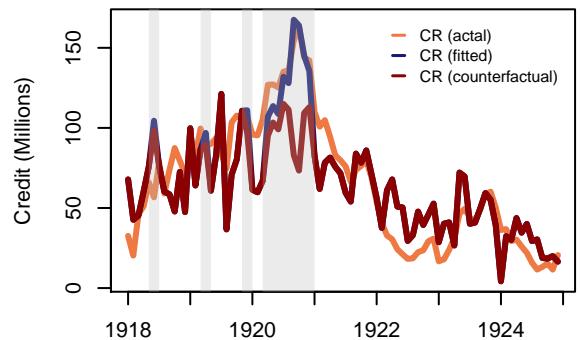
Cleveland



Dallas



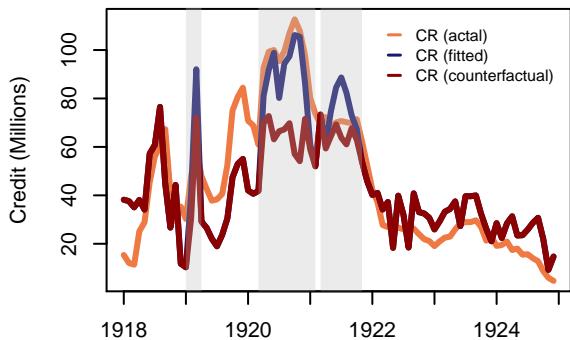
Kansas City



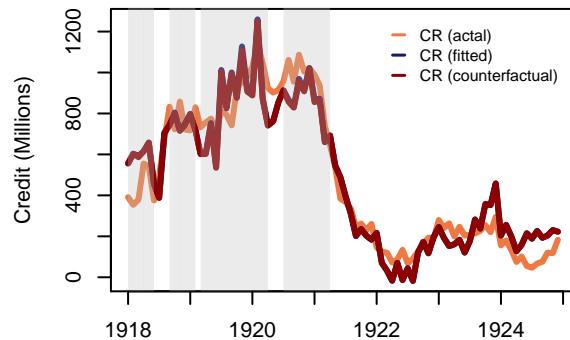
Note: Grey bars indicate years in which borrowing occurred.

Counterfactual Credit

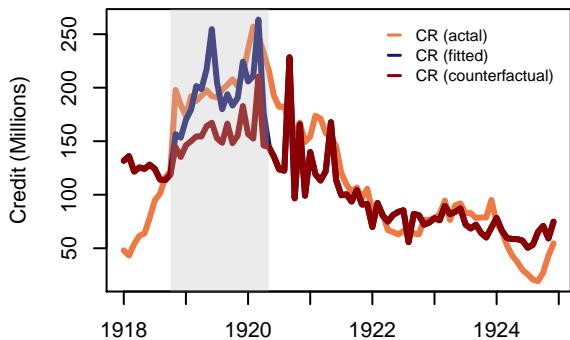
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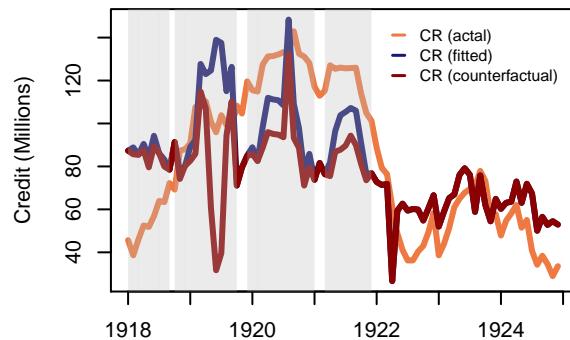
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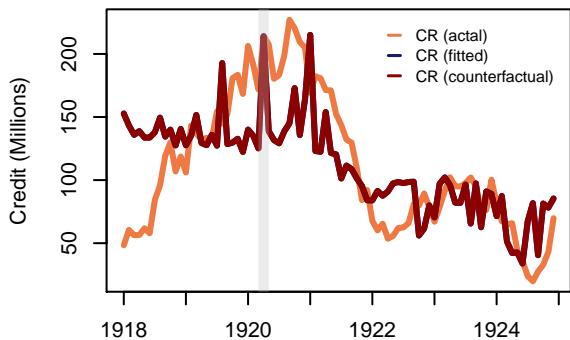
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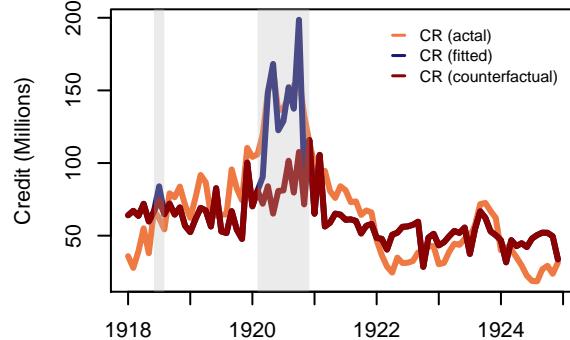
Richmond



San Francisco

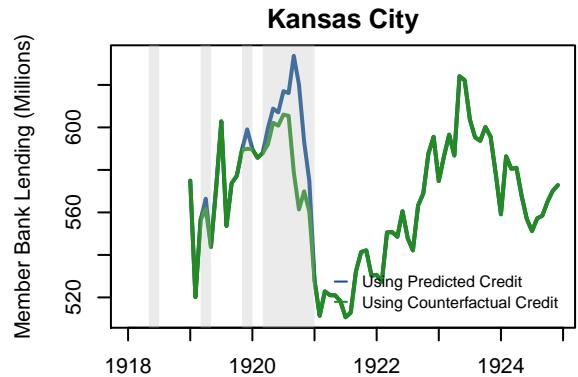
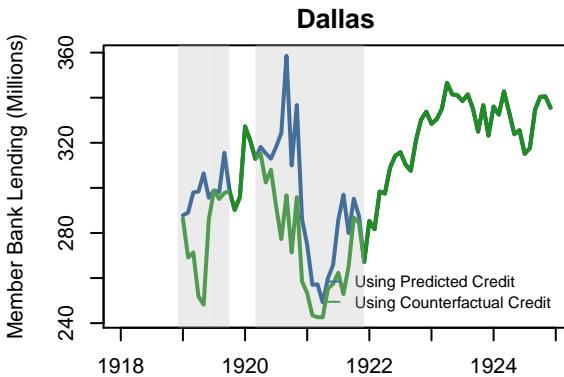
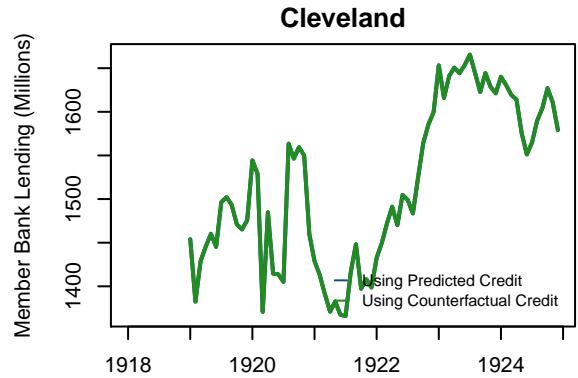
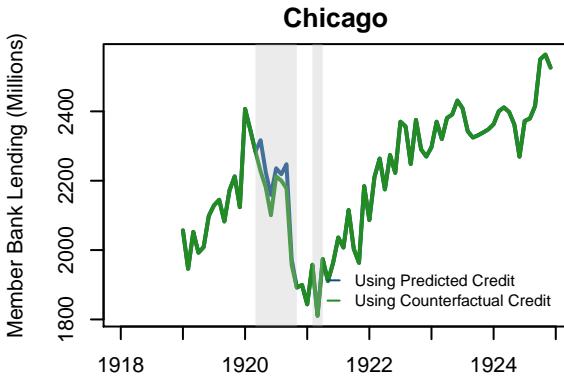
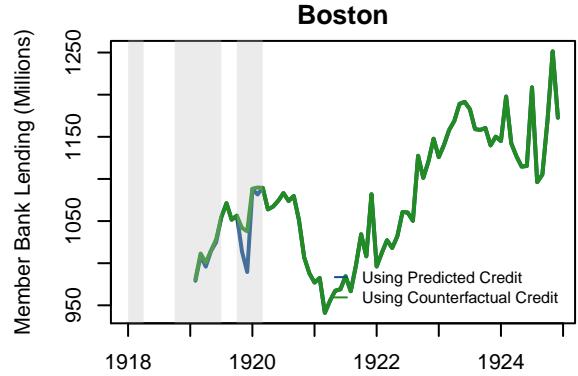
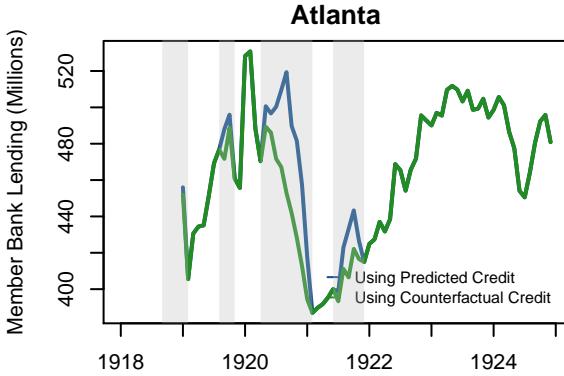


St. Louis



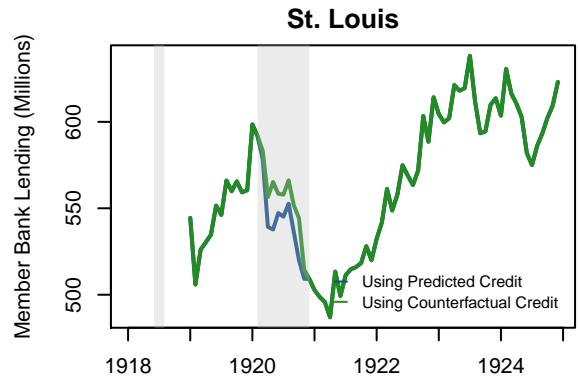
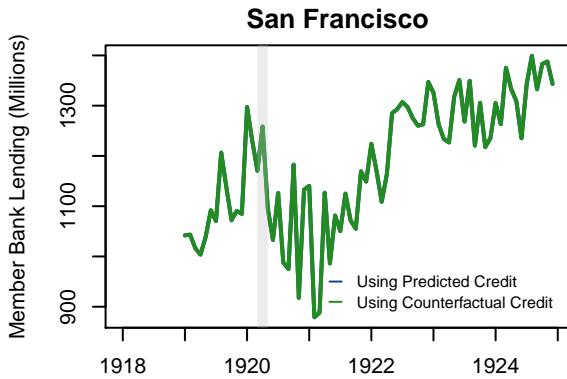
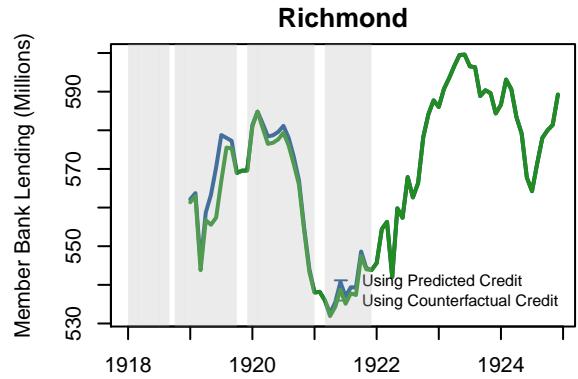
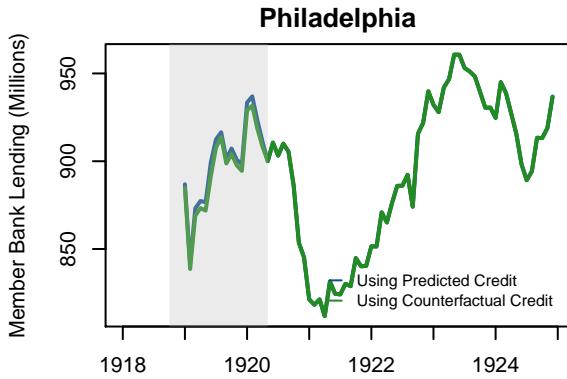
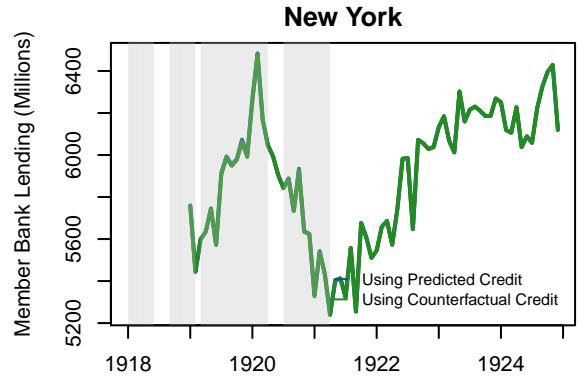
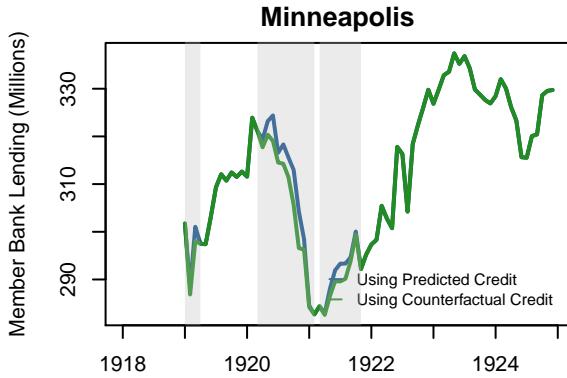
Note: Grey bars indicate years in which borrowing occurred.

APPENDIX 4: COUNTERFACTUAL MEMBER LENDING



Note: Grey bars indicate years in which borrowing occurred.

Counterfactual Member Lending



Note: Grey bars indicate years in which borrowing occurred.