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Liquidity Risk, Bank Networks, and the Value of Joining the Federal Reserve System

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Abstract

Reducing systemic liquidity risk related to seasonal swings in loan demand was one reason for the founding of the Federal Reserve System. Existing evidence on the post-Federal Reserve increase in the seasonal volatility of aggregate lending and the decrease in seasonal interest rate swings suggests that it succeeded in that mission. Nevertheless, less than 8 percent of state-chartered banks joined the Federal Reserve in its first decade. Some have speculated that nonmembers could avoid higher costs of the Federal Reserve's reserve requirements while still obtaining access indirectly to the Federal Reserve discount window through contacts with Federal Reserve members. We find that individual bank attributes related to the extent of banks' ability to mitigate seasonal loan demand variation predict banks' decisions to join the Federal Reserve. Consistent with the notion that banks could obtain indirect access to the discount window through interbank transfers, we find that a bank's position within the interbank network (as a user or provider of liquidity) predicts the timing of its entry into the Federal Reserve System and the effect of Federal Reserve membership on its lending behavior. We also find that indirect access to the Federal Reserve was not as good as direct access. Federal Reserve member banks saw a greater increase in lending than nonmember banks.

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I believe that, through the Federal Reserve Banks, ... the better shall we be equipped to cope with the problems ahead of us, of helping ourselves and of helping the world; I believe it to be the duty of every bank in the country to contribute its share in equipping our nation for this task; I believe that State institutions which are strong enough should come in now and do their share, no matter whether or not they are in full accord with every detail of the Federal Reserve machinery; I believe that, as we proceed and gain in experience, whatever may prove harmful will be remedied. ... I firmly believe that the future will belong to those banks—national or state—that are members of the Federal Reserve System.

Paul Warburg, Speech at the New York State Bankers' Association Convention, 9 June 1916.

The [Federal Reserve] Act as first passed in December, 1913, contained certain provisions which in our judgment from the standpoint of state banks and trust companies rendered membership in the System undesirable. ... As the Federal Reserve Act stands today, practically every serious objection to membership, which was evident at the time the law was passed has been removed, and therefore ... the Guaranty Trust Company of New York decided to apply for membership in the System.

Charles Sabin, President of the Guaranty Trust Company of New York, 4 October 1917.

1. Introduction

Lenders of last resort today face a common moral hazard problem: offering systemic protection without encouraging bad behavior by those who enjoy protection. Prudential regulation accompanies bank safety nets for precisely that reason, albeit not always successfully. But what if some market players — typically referred to as “shadow banks” — avoid regulation while still enjoying the benefits of protection? There is evidence from recent regulatory experience that stricter regulation of one group of banks tends to produce shifts in market share toward other, less strictly regulated banks (Aiyar, Calomiris, and Wieladek, 2014). The Federal Reserve's membership problem during its initial decades of operation is an early example of this moral hazard problem of shadow banking.

The Federal Reserve System was founded in 1913 to stabilize the American banking system by offering banks access to liquidity through its discount window. The Fed's founders understood that seasonal and cyclical illiquidity triggered many of the financial panics of the National Banking era (Calomiris and Gorton, 1991).¹ They designed the System to solve this problem and succeeded to an extent. Miron (1986) showed that the Federal Reserve's founding was associated with reduced seasonal variability of interest rates and increased seasonal variability of lending. Bernstein et al. (2010) provide additional evidence that the Federal Reserve reduced seasonal liquidity risk. Carlson, Mitchener, and Richardson (2011) show that the Federal Reserve Bank of Atlanta could, by credibly committing to inject liquidity, arrest panics flowing through the interbank network.

The United States was particularly prone to liquidity risk problems in its banking system because of its unit (single-office) banking structure, which gave rise to a unique pyramidal network of interbank relationships. The reserve pyramid connected country bank "respondents" that deposited funds in "correspondent" banks located in "reserve cities." Both reserve city and country banks deposited funds in the "central reserve cities" of New York City and Chicago.² Interbank connections within the network served to channel both interregional payments and interbank loans to fund seasonal peaks in local lending that exceeded local retail deposits. Liquidity risk, however, was an unintended byproduct of the network. Country banks suffered liquidity risk because their correspondent banks might suspend convertibility of deposits into cash, leaving the country banks without a means to fund their withdrawals. Central reserve city banks suffered liquidity risk because they might be faced with sudden demands for withdrawals

¹ Systemic liquidity crises may arise from the withdrawal of deposits by interior banks or unexpected financial shocks in financial centers (Wicker, 2000). At the time, policymakers were more concerned with the withdrawal of deposits by interior banks, which occurred due to harvest cycles.

² Prior to 1920, St. Louis was also a central reserve city.

of deposits by respondent banks. Reserve city correspondents suffered liquidity risk from both sides. The importance of the correspondent network for creating liquidity risk is illustrated by a comparison between the banking panic experiences of the United States and Canada during the National Banking Era. Canada – an agriculture-based economy with similar seasonal swings in borrowing – avoided banking crises. Its nationwide branching structure avoided network-related liquidity risks.

Despite the Fed’s success in reducing systemic liquidity risk, it was unable to achieve another of its founders’ goals: universal membership. The Fed’s founders hoped that all commercial banks would join the System, which would eliminate reserve pyramiding and the concentration of interbank balances in Chicago and New York City, but long-standing political coalitions compelled them to make membership optional for state-chartered banks (Calomiris and Haber, 2014). Less than 8 percent of all state-chartered banks chose to join the Federal Reserve during its first decade of operation.³ Recent research has shown that the failure to achieve universal membership reduced the Fed’s ability to limit systemic liquidity risk. As Mitchener and Richardson (2015) showed, the withdrawal pressures of nonmember banks on member banks magnified liquidity risk during the Depression. If all banks had been Fed members, systemic withdrawal pressures would have been substantially lower.⁴

The Federal Reserve’s leaders discussed their failure to recruit state banks in their writings and speeches. An example is Paul Warburg’s speech to the New York State Bankers’

³ According to the *All Banks Statistics United States 1896-1955* (1959), there were 20,323 commercial banks in 1924, yet only 1,604 were members of the Federal Reserve as of the *Annual Report of the Federal Reserve Board* (1925). If only considering banks with sufficient capital, the fraction rises to 10.4 percent. Even when national banks are added to the total, less than 40 percent of all banks were members of the Federal Reserve System.

⁴ There were other factors limiting Fed liquidity assistance to banks during the Depression. In particular, some Federal Reserve Banks were less willing to provide assistance than others (Friedman and Schwartz, 1963; Richardson and Troost, 2009). At the same time, the shocks of the Depression were much greater than those of the national banking era; it is unlikely that a combination of universal membership and activist Fed thinking would have been sufficient to forestall the waves of bank failure during the Depression (Calomiris and Mason, 2003).

Association, which emphasized efforts of the Federal Reserve Board and Bank of New York to amend the System to encourage state banks to join the System (Warburg, 1916, pp. 23-30). The Federal Reserve's research staff also studied the issue, and the System's leaders testified on the issue before Congress (Goldenweiser, 1925; United States Congress, 1923; United States Senate, 1920). Economists at the time and subsequently have studied the potential contributors to the low state bank membership rate (Tippetts, 1929; Federal Reserve Committee on Branch, Group, and Chain Banking, 1932; White, 1983). That research identifies features that limited state-chartered banks' interest in joining the Federal Reserve. Disincentives included the fact that the Federal Reserve faced higher reserve requirements, and members did not receive interest on their reserves, unlike money-center commercial banks in New York, Chicago, and elsewhere that paid about 2 percent.⁵ The Federal Reserve also did not begin operations with a fully functioning check-clearing system, and it prohibited members from imposing fees for check clearing, while many nonmember banks earned substantial revenue from charges on checks cleared through the post, clearing houses, or interbank networks. Finally, nonmember banks could indirectly benefit from the existence of the Federal Reserve without joining. Nonmember banks were able to access the Federal Reserve's discount window by passing their eligible paper through correspondent banks operating in reserve and central-reserve cities.

This paper provides the first detailed bank-level analysis of state banks' decisions whether to join the Fed in its first decade of its operation. In particular, we explore who joined and why. We show that banks had different reasons for joining the Fed and that the timing of a bank's membership choice differed depending on the motivation for joining. Large banks that occupied important positions in the interbank network as takers of deposits were among the first

⁵ Calomiris and Carlson (2015) find that commercial banks paid 2 percent interest on demand deposits and 5 percent interest on time deposits.

to join the Federal Reserve. They saw access to the discount window as a means of attracting the deposits of nonmember correspondent banks. Banks with highly seasonal loan-demand joined the Federal Reserve later in the decade, using the discount window to mitigate their own liquidity risk. Small banks with less seasonal loan variation, and those operating in close proximity to other Federal Reserve member banks, were less likely to join the Federal Reserve, most probably because they were able to gain easy indirect access to the Federal Reserve's discount window.

With respect to the consequences of chartering the Federal Reserve, we are able to measure the extent to which joining the Fed relaxed constraints on member banks' loan supply. We examine the changes in lending activities of banks before and after state-chartered banks became members of the Federal Reserve, thus distinguishing between the indirect advantage of operating in a banking system that included the Federal Reserve from the direct advantage of actually joining. Banks that joined out of a desire to mitigate the effects of seasonal liquidity risk substantially expanded their lending, whereas large banks that joined the Fed to expand their correspondent network became less cyclical in their own lending, consistent with their expanded role as liquidity providers.

The remainder of the paper is organized as follows. In Section 2, we review the details of the regulatory environment at the time of the Federal Reserve's founding with special emphasis on regulatory differences between the New York state banks that chose to join the Federal Reserve and those that did not. Section 3 describes in detail the data used in this study. Sections 4 and 5 present the empirical findings, which we divide into discussions of the determinants of membership and its consequences. Section 6 concludes.

2. Dual Banking, Federal Reserve Membership, and the Federal Reserve's Early Years

A dual banking system of state-chartered banks and national banks characterized the U.S. banking system after the National Banking Acts of 1863 and 1864. State banks and trust companies were regulated by state legislatures and had lower minimum capital and minimum reserve ratio requirements. Alternatively, national banks were regulated by the Comptroller of the Currency, but were the only type that could profitably issue bank notes (subject to holding Treasury securities as backing). Since banks in most states could not branch outside their local area, they corresponded with other banks across states via interbank deposit networks and borrowed from one another.

Tasked with studying banking systems around the world after the Panic of 1907, the National Monetary Commission's final report to Congress in 1912 focused on flaws in the dual-banking system. The report summarized 17 "principal defects in our banking system" (p. 6) of which 13 were related to what economists now refer to as liquidity risk. The Commission also highlighted the fragmented and inefficient U.S. banking system. The nation lacked an efficient means of routing payments — particularly checks — from one region to another and for accommodating large, seasonal flows of funds between regions. Clearing checks could be slow and expensive as many institutions charged fees for checks sent through the clearing system.

The structure of interbank liquidity provision reflected the structure of the payments system (James and Weiman, 2010). Clearinghouses in large cities cleared members' checks and held balances from members to facilitate these transactions (Cannon, 1910; Timberlake, 1984; Gorton, 1985). This ongoing relationship provided the foundation for the extension of liquidity to members through the collective issuance of debt during panics. Similarly, correspondent networks' primary function was clearing checks, but these relationships also provided the

foundation for the extension of credit during times of stress. Respondent banks (typically small, country banks) deposited funds in correspondents in reserve and central reserve cities.⁶ These deposits often served as part of their legal reserves, received interest, and enabled respondents to deposit checks for clearing. They also could withdraw their deposits or borrow from correspondents when liquidity was needed. During normal periods, the system efficiently allocated funds; however, during times of stringency, the interbank network would freeze up and transmit shocks across the nation.⁷

Based on the National Monetary Commission's reports, the Federal Reserve was created to operate a nationwide and more efficient payments system, as well as create an elastic currency, a market for banks' eligible assets, and a lender of last resort. The designers hoped to create a universal system but bowed to political realities. National banks were the only bank type that were required to join the Federal Reserve System. State-chartered banks and trust companies were permitted, but not required, to join the Fed.⁸ Member banks had to subject themselves to Federal Reserve regulatory requirements, most notably minimum bank size (capital) requirements (not to be confused with minimum capital ratio requirements that were introduced much later), zero-interest reserve requirements, and other requirements (such as purchasing stock in the Federal Reserve Bank and clearing checks at par).

The Federal Reserve Board expressed hope that it would develop a unified system of banking in which all banks – not just large city banks – would join the System:

⁶ Calomiris and Carlson (2015) find that in the 1890s national banks in the West and South held much more of their interbank deposits in New York City than did state-chartered banks, which held the vast majority of their reserves within their local regions.

⁷ Paddrik, Park, and Wang (2015) examine bank networks before and after the National Banking Acts of 1863-1864 and find that bank networks became more robust against liquidity shocks in normal times but became more fragile in times of aggregate distress.

⁸ The requirement of membership for national banks was hotly contested. The *Annual Report* of the Federal Reserve Board (1915, p. 12) describes two lawsuits challenging the constitutionality of section 11 (k).

In this process of developing the reserve power, of cultivating good relations with member banks, of educating their members to a recognition of the true theory upon which the reserve system is founded, and of otherwise carrying on the larger purposes aimed at by the Federal Reserve Act, the Board has been mindful of the delicate and important duty of unifying, so far as possible, the banking system of the country—a duty plainly imposed upon it by the provisions of the statute (1915, p. 11).

As shown in Figure 1, however, only 37 of more than 8,500 state-chartered banks joined the Federal Reserve by the end of 1916, and most of those tended to be among the largest state banks operating in major cities. The number of state-chartered bank members grew during the next year, but it was not until 1918 that entry became substantial and more inclusive of country banks. The number of state bank members grew to 938 members by the end of 1918 and 1,486 by 1920. Even when adding in the national banks that were forced to join, less than 40 percent of all United States banks and 60 percent of all commercial bank assets were contained in the system.

Why did so few state-chartered banks join the Federal Reserve after it began operations in November 1914? First and foremost, many state regulations had to be adjusted in order to allow state banks to become members. Tippetts (1929) highlights that some existing regulations would not have counted cash deposited at the Federal Reserve as reserves, meaning state member banks would have had to separately meet the Federal Reserve's and the state's requirements. Moreover, other regulations also prohibited banks from sharing information with other regulatory bodies such as the Federal Reserve. In 1914, only 20 states would have allowed their state banks to become members without substantial costs (p. 86). While many of the states subsequently passed legislation, 16 states still had not passed sufficient enabling legislation by 1920.⁹

⁹ Alabama, Arizona, Arkansas, Colorado, Delaware, Illinois, Indiana, Kansas, Maryland, North Carolina, Oklahoma, Tennessee, Utah, Vermont, West Virginia, and Wyoming all did not pass enabling legislation until after 1919 (Tippetts, 1929; p. 118; White, 1983; p. 137).

Second, there were short-term operational problems at the time of the Federal Reserve's founding. World War I and the ensuing financial panic forced the Federal Reserve to begin operations months earlier than anticipated, under wartime conditions, and before the Federal Reserve had a chance to establish a check-clearing system. This exigency led to a prolonged period of initial adjustment, as the Federal Reserve struggled to get operations up to speed and the federal government imposed various wartime tasks upon the Federal Reserve.

Third, during World War I, another major attraction of Federal Reserve membership — access to the discount window — was not limited to Federal Reserve members. Congress amended the Federal Reserve Act to compel the Reserve Banks to accept war bonds as collateral for discount loans and enable nonmember banks to borrow directly from the discount window.¹⁰ It was not until after the war that member banks were given exclusive access to the discount window as originally envisioned.¹¹

That said, indirect access to the discount window continued after the war as well. For instance, a joint Congressional Committee organized in 1920 to investigate the low adoption rate of state banks identified three major reasons for the behavior (Congressional Quarterly, 1923).¹² Along with reserve requirements and the low return on Federal Reserve Stock, the committee found that banks did not join because they were able to circumvent the restrictions and access cash related to their seasonal or cyclical needs through correspondent banks that were members of the Federal Reserve System. Indeed, those very correspondent banks were exhorting their

¹⁰ During World War I, the seasonality of lending also diminished because of the issuance of war loans and contracts (foreign and domestic) and because of the rationing and price controls imposed by the federal government. This would have temporarily diminished the attractiveness of Federal Reserve membership.

¹¹ In addition, the discount window was not as effective as it could have been due to the “stigma problem.” The Fed emphasized that lending from the discount window should only be temporary, implying that a bank that borrowed from the discount window must be in trouble. See Gorton and Metrick (2013) and Anbil (2015).

¹² To a lesser degree, the committee also concluded that the lack of adoption might also have been influenced by the fear of changes in the attitude or regulations of the Federal Reserve Board.

respondents not to join the System (Tippetts, 1929, p. 71). Subsequently, the Federal Reserve Board took many steps to block nonmembers from indirectly accessing the window by charging fees and outright prohibiting member banks from bringing securities collateral to the window that had been originated by nonmember institutions. Money, however, is fungible, and there was little the Fed could do practically speaking to prevent correspondent banks from making advances to their respondents.

Fourth, state banks were concerned that the comptroller was given the right to examine and compel reports from any state member bank. This created additional potential regulatory red tape; the comptroller at the time, John Skelton Williams, was also regarded by state bankers as someone likely to persecute state banks simply for not being national banks (Tippetts, 1929, p.67-68). White (1983, p. 133) describes Williams as "arrogant and high-handed, belittling the state banks and pushing for forced nationalization of state banks."

Attempting to calm fears over additional regulation and to encourage Fed membership, Congress passed an important amendment to the Federal Reserve Act in June 1917. In addition to the lowering of reserve requirements discussed below, the amendment codified the Federal Reserve's administrative regulations concerning state bank members. Although the Board regarded the section as "practically an enactment of the Board's regulations on that subject already in effect," they hoped it would properly assure state banks that there would be "no interference with its charter and statutory rights, and that it may continue to exercise all powers granted to it under such charter" (Federal Reserve Board, 1917, p. 502). Paul Warburg stressed these points in his speech to the New York State Bankers' Association in 1916, immediately prior to the surge in state bank membership.

Not only did the 1917 legislation give state members the right to be examined by state regulators rather than by the Comptroller of the Currency, they were also permitted to retain state-authorized branches, to make loans on improved real estate, to retain directorships overlapping with other financial institutions, and to retain most other rights and powers of state-chartered banks. State members also received the right to withdraw from membership, should they decide to do so. The president of the Guaranty Trust Company of New York, Charles Sabin, who was one of the most prominent opponents of state-bank membership in 1915 and 1916, cited all of these changes in his public statement explaining his change of heart and Guaranty Trust's application to the System (Sabin, 1917).

Fifth, the original version of the Federal Reserve Act limited the benefits of joining the Fed through its narrow restrictions on the range of assets that banks could bring to the discount window. Here, too, subsequent reforms were important. Amendments and regulations subsequent to the 1913 Federal Reserve Act increased the benefits of Fed membership by authorizing members to discount a wider array of assets.

Sixth, the Federal Reserve maintained that member banks could not collect fees for routing checks, meaning member banks would have lost substantial streams of revenue.¹³ While this was an obstacle to membership initially, the Federal Reserve successfully forced all New York nonmember banks to clear checks at par by early 1917 and other banks quickly followed suit. The Federal Reserve achieved this by holding all checks drawn on nonpar institutions for several months and threatening to send an agent to present those checks at the banks' counters, where they had to be cleared immediately in cash at face value. Rather than hold large sums of

¹³ The Federal Reserve's founders envisioned the creation of a universal par check-clearing system. The Federal Reserve would absorb clearinghouses in the cities where it operated and would clear checks for all banks in the nation at face value.

cash in their vaults, banks relented and began clearing at par through the Federal Reserve System (White, 1983).

Finally, the Federal Reserve's reserve requirements also likely played a role in the low membership rates. For starters, many states required their state banks to hold deposits only against demand deposits, but state member banks were required to hold deposits against demand *and* time deposits (see Table 1). Member banks also were required to hold a portion of their reserves with the Federal Reserve instead of allowing them to be deposited with a qualified correspondent (typically earning 2 percent interest rather than zero). Requirements were lowered by the 1917 legislation. However, while the amended Federal Reserve Act made the total amount of reserves lower for member banks than for nonmember banks, it actually increased the relative cost per dollar of zero-interest reserves by requiring member banks to hold all reserves at the Federal Reserve. It is not possible to measure the consequences of joining the Fed with respect to the cost of each state bank's reserve requirement burden (owing to the absence of balance sheet reporting of the breakdown of deposits into demand and time deposit categories), but it is possible to say that, as a group, banks that chose to become members suffered less of an incremental reserve requirement cost from doing so.¹⁴

Capital requirements were not typically cited as a particular problem by contemporaries, especially for eastern states with relatively high capital requirements – although White (1983, p. 174) does find evidence for their empirical relevance. For example, Table 1 presents the capital

¹⁴ White (1983, p. 174) examines aggregate state-level data on the propensity of banks to join the Fed as a function of state-level regulatory attributes, including reserve requirements, and finds that reserve requirement differences were important. For our sample of New York banks (analyzed in detail below), under the assumption that all banks of a given type (country, reserve, or central reserve) had an equal proportion of demand to time deposits, we estimate that banks that chose to join the Fed suffered a much lower incremental reserve requirement cost from doing so than nonmembers, both before and after 1917. Here we define incremental reserve requirement cost as the increased proportion of assets held in zero-interest reserves. For member banks, both before and after 1917, this measure was roughly 2 percentage points lower than for nonmember banks.

requirements facing Federal Reserve state member banks (state banks and trust companies that voluntarily subjected themselves to the Federal Reserve's requirements) and nonmember New York state banks (state banks and trust companies that were under the state's requirements). Minimum capital requirements were higher for state member banks in the largest cities (over 50,000 people), but they were virtually the same for state member banks in locations with less than 6,000 people. Looking at the underlying data in the New York sample, many state banks were located in small cities, and banks in the biggest cities often had more capital than required.¹⁵ Indeed, over 90 percent of state banks in New York had sufficient capital to become a member in 1915.

Although evidence from surveys and aggregate statistics indicates that regulatory costs were major impediments to state bank membership in the Fed, other influences should also have mattered. For example, within a particular state, two banks facing similar incremental regulatory costs from joining the Fed may have made different decisions because they anticipated different benefits from Fed membership. In Section 3 below, we evaluate the importance of those benefits in the context of the membership choices made by New York state banks.

3. Data

We construct a new database containing the balance sheet items of each state bank and trust company in New York from 1912 to 1924. Balance sheets for all state banks and trust companies were published every year by the State of New York Banking Department, which conducted

¹⁵ In 1910, there were only nine urban locations with more than 50,000 people and two of those (Troy and Yonkers) were just outside of larger cities.

inspections of all financial intermediaries that held a state charter.¹⁶ The resulting information was published in the *Annual Report of the Superintendent of Banks*. To avoid potential endogeneity problems relating to entry in reaction to changes in regulation during our sample period, we limit the sample to the 190 banks and 77 trust companies that were present before the Federal Reserve was created. We treat banks that merge during the period of our study as single institutions, summing their balance sheets in the years before their merger.

There are clear reasons for focusing the analysis on a single state. The costs and benefits of Federal Reserve membership likely depended upon regulations under which state-chartered banks operated. For example, in places where state banks faced lower reserve requirements, the decision to become a Federal Reserve member would have been more costly. Focusing on one state avoids complications in the estimation of parameters that arise from multiple state-level regulatory regimes, particularly when unobserved heterogeneity in economic conditions could be correlated both with state regulations and economic outcomes. This study thus examines membership decisions within a single regulatory environment.

Given the desirability of focusing on a single state, studying New York has several advantages. First, New York state-chartered banks are sufficiently numerous, and the state's bank records are rich and accessible. Furthermore, banking in New York is diverse enough — as reflected in the variety of bank sizes, lending functions, and locations — to permit one to identify the full range of bank attributes likely to have mattered for understanding how different banks' circumstances affected state-chartered banks' decisions to join the Federal Reserve and the consequences of those decisions.

¹⁶ Similar to other publications of the time, the reports do not contain income statements. We, therefore, cannot examine interest or profit rates of the banks.

Second, the state-chartered banks in New York are largely representative of the banking system throughout the United States. New York contained all three layers of the reserve pyramid: country, reserve, and central reserve; a feature shared with only two other states. Our analysis indicates that banks in these layers responded differently to the creation of the Federal Reserve. This observation could not be made when studying most other states. Moreover, New York prohibited banks from branching outside their home towns, meaning that a large number of small banks served depositors and borrowers who lived in their vicinity.¹⁷ These country banks in turn held reserves at larger banks, generally Federal Reserve members after 1914, in what would eventually be the reserve cities of Albany, Brooklyn, Buffalo, and the Bronx, and the central reserve city of New York.

Third, New York City was the financial center of the United States, holding an average of over 40 percent of U.S. bank assets between 1912 and 1924. A change in the state's banks and trust companies thus represented a large change in the system as a whole.

Fourth, the state's wide range of economic and demographic areas provides sufficient sample size and variation to study all types of areas. The state was home to the metropolis of New York City, medium-sized cities with active manufacturing and industrial bases, and many small towns in rural and agricultural areas. New York state's overall Fed membership reflects differing membership rates across locations of higher or lower urbanization, such as New York City (where the membership rate is high), six medium-sized cities (where membership rates are moderate), and other locations (where membership rates are low).

The potential disadvantage of New York state is that New York City banks had different opportunities and regulations relative to other banks. Any analysis of New York banks' behavior

¹⁷ All country banks in our sample operated as unit banks. Only a small number of banks in reserve and central reserve cities had branches.

must take into account those differences. As a central reserve city, the city's banks became home to the vast majority of the nation's interbank deposits. The city's securities markets also could have yielded different portfolios than banks in other states. To capture these important differences, we employ location-specific controls.¹⁸ At the very least, Figure 1 shows that New York's membership adoption path does not look much different from those of other states, especially when New York City is removed. Keeping in mind that several states had not passed enabling legislation and thus had zero members, banks outside of New York City joined the Federal Reserve in a very similar pattern as banks in other states. Similarly, New York City's adoption is only slightly higher than state banks in cities such as Boston and Philadelphia.

We consult the *Annual Report of the Federal Reserve Board* to determine whether a bank was a member of the Federal Reserve. The report contains a list of all state member banks by district each year. Because the report does not contain the exact date of membership, we match these lists to the third quarter of the balance sheet data, creating a dummy variable for whether the bank was a member in the given year. It is worth noting that all the banks in our sample that became Federal Reserve members remained Federal Reserve members for the remainder of our sample period. Only two banks in New York adopted and then dropped their membership during the period. Neither of those banks existed in 1914, and so neither is in our sample.¹⁹

Figure 2 presents a map showing the locations of the 81 of 267 state-chartered institutions in the sample that joined the Federal Reserve System by 1924. The figure also shows that state member banks were spread out across the state, but were particularly attracted to the population centers along transportation lines. The line of members running east-west across the middle of

¹⁸ The econometric results are similar but less precisely estimated when dropping New York City banks from the sample. We provide these results in Table 5 and use those results to project how other states might have fared.

¹⁹ Four banks gained Federal Reserve membership by becoming national banks in our sample period. Two banks switched their charters from state to national banks, and two banks merged with national banks.

the state and down the east side follows the old Erie Canal and the railroads that later replaced it. Figure 3 displays the timing of new Federal Reserve members by year and location, showing that membership became more geographically dispersed over time.

We augment the state bank and trust company data in a variety of ways. First, we document the location of each bank's correspondents as listed in *the Rand McNally* or *Polk's Bankers Directories*. We document these in 1913, 1915, 1917, and 1920 and fill any data gaps with the preceding value. Second, we document whether the bank was a member of the local clearinghouse using the same two directories. Third, we obtain the location and balance sheet information of all national banks from Jaremski (2013). Finally, we add county-level Census information for 1920 from the database assembled by Haines (2004). Although we could have used values in 1910, the Census for that year did not tabulate manufacturing data, which is our reason for using later values.

4. Explaining Membership Choices of State-Chartered Banks

Section 2 reviewed how the regulatory costs and benefits of joining the Federal Reserve varied during its first decade, as the Federal Reserve altered policies to aid the war effort and promote membership. The costs and benefits of membership also varied across banks with different characteristics, including location and loan-demand seasonality. It is important that any model of Federal Reserve membership choice take account of these differences across time, location, and bank circumstances.

The first prominent explanation for joining the Federal Reserve is that membership gave banks access to seasonal liquidity. We measure the seasonal demand for liquidity using the average percent change in loans between the third and fourth quarters (the seasonal peak and

trough of lending) across 1912, 1913, and 1914.²⁰ The benefit of access to Federal Reserve liquidity, however, might have been smaller for banks that had alternative means of accessing liquidity. Banks could obtain liquidity from New York City correspondents, from correspondents in reserve cities or local towns, or by selling instruments such as banker's acceptances in the open market. Banks that had access to these options may have been less likely to join the Federal Reserve. We control for whether the share of a bank's correspondents in Manhattan to determine the extent that the bank could receive liquidity through existing relationships, as well as the amount of assets in local Federal Reserve banks and the relative size of the bank to capture a bank's ability to sell acceptances through the secondary market.

A major part of the attraction of Federal Reserve membership to correspondent banks in New York City and other money centers was the enhancement of their role in the correspondent network. They may have seen *greater* advantages from joining the Federal Reserve, in particular if they were able to act as intermediaries channeling the benefits of access to the Federal Reserve's discount window to nonmember country banks. It is thus important to consider how a bank's position as a "nodal correspondent" intermediary of interbank deposits (that is, a bank receiving substantial deposits from other respondent banks) affected its decision about Federal Reserve membership. A high proportion of balances due to respondent banks was highly correlated with clearinghouse membership in cities outside New York City and with large "due from" positions in New York City.

In light of these considerations about how the correspondent network affected banks' incentives to provide or receive pass-through discount window access, we devote considerable attention to determining each bank's position in New York's correspondent network. As Figure 4

²⁰ Although unreported, we find similar results using other measures of loan variations, such as the standard deviation of loans over four quarters and the average percent change in loans between the first and fourth quarters.

shows correspondent banks in 1915 were almost exclusively located in a handful of important cities in New York. Figure 5 shows the structure of the interbank network in 1920. Virtually all banks had a correspondent relationship with one or more banks in New York City. However, banks often had a correspondent in other significant New York cities (Albany, Buffalo, Rochester, Syracuse, and Troy), creating a visible hub and spoke pattern. Outside of these cities, there were only a handful of correspondents.

We measure the extent that a bank was a correspondent using a variety of different measures. First, we create an indicator variable denoting whether the bank was listed as a correspondent by one or more state-chartered banks operating in New York state.²¹ Second, we include the number of correspondents a bank listed in the bank directories. Third, we include a trust company indicator to control for the different type of corporate structure and investment strategy. Amongst state-chartered institutions, trust companies not only were large, but they also attracted a large number of interbank deposits and were themselves major depositors in other banks. Fourth, we include a clearinghouse membership indicator to control for the extent of existing interbank clearing relationships.²² Because clearinghouses provided check clearing services, clearinghouse banks often attracted more interbank deposits than other banks. Because clearinghouses provided liquidity to member banks during panics, the variable helps sort through opposing influences. If being a clearinghouse member makes banks more likely to adopt Federal Reserve membership, then interbank networks for discount window “pass-through” were an

²¹ We recognize that it is conceivable that some additional state-chartered banks in New York may only have been acting as nodal correspondent banks for banks outside of New York state, or only for national banks operating within New York. However, by limiting our analysis to state-chartered New York banks, we ensure that our identified nodal correspondent banks are playing an important role in the network in which New York’s state-chartered banks are operating. Even though the results are similar using the number of times a bank was listed as a correspondent, we have chosen to use a dummy variable because we do not have correspondent data for every bank in the United States.

²² Albany, Binghamton, Buffalo, New York, Rochester, and Syracuse had local clearinghouses.

important consideration. Alternatively, if clearinghouse membership makes banks less likely to adopt, that suggests a lesser role for pass-through, and the relative importance of access to emergency liquidity from the clearinghouse as a substitute for Federal Reserve membership.

While the discount window and correspondent network might be the more prominent explanations, there are many other factors that might have driven membership adoption that we take into account. The capacity of a bank to bear the fixed costs of becoming a Federal Reserve member also plays a role in its decision. First and foremost, we control for whether the bank had sufficient capital in all years to become a Federal Reserve Member. While New York state regulations were among the most stringent in the country, the Federal Reserve minimum capital requirements were still higher in some areas, and there were a few banks for which joining the Fed would have required them to raise additional capital. We also account for the potential that large banks would have been better able to shoulder the additional compliance burden of Federal Reserve membership by including the size of a bank's assets in our analysis. As noted, we must also control for location, which mattered for determining the costs of the reserve requirements of the Federal Reserve. Locational factors also likely influenced the adoption rate for other reasons, such as differences in the opportunity cost of lending, the mix of deposits and reserve requirement costs, or local political factors that favored or discouraged membership. We thus account for the location of a bank using county-level fixed effects.

The main factor that the model is not able to capture is the effect of reserve requirements. Reserve requirements were set differently for time and demand deposits, yet the New York state comptroller balance sheet data do not separate time from demand deposits. We thus cannot calculate the reserve burden of each bank and the inclusion of county-fixed effects would subsume all cross-sectional variation in the effect of reserve requirements.

Moreover, there are numerous unobservable cross-sectional differences in bank characteristics related to other regulatory changes in 1917 (e.g., the extent to which a nonmember bank cared about the threat of being regulated by the comptroller). Thus, even if we could measure the changes in the relative burdens of Fed reserve requirements in 1917, doing so would potentially conflate cross-sectional differences related to the observed effects of reserve requirements with the cross-sectional differences related to unobservable cross-sectional differences related to other regulatory changes that took place at the same time.

What we can do, however, is make use of the 1917 change to examine how this exogenous event increased the relative attractiveness of Fed membership through a variety of channels. We take advantage of this exogenous shift in 1917 in our empirical strategy by looking at how the motivations for some banks to join the Fed changed in intensity after 1917, as discussed below.

4.1. Empirical Specifications

Modeling a bank's decision to become a Federal Reserve member is fraught with potential endogeneity problems. In particular, it is tempting to include balance sheet measures that might capture relevant factors relating to costs or benefits of membership (e.g., a bank's exogenous willingness to lend more should be correlated with the profitability of lending, which could signal the costliness of higher zero-interest reserve requirements), but those balance sheet ratios may respond to the prospect of Federal Reserve membership. We take several steps to minimize this endogeneity problem. First, as noted above, we examine only state banks and trust companies that existed in 1914. This removes institutions whose entry might have been

influenced by the availability of Federal Reserve membership.²³ Second, with the exception of a relative asset variable, we use bank-specific balance sheet values from before 1915. Finally, our dependent variable is forward looking — whether the bank joined the Federal Reserve in the following year — and we drop observations after a bank became a Federal Reserve member in order to capture the membership decision and not changes made after the decision.

Our base-line specification uses a log-logistic survival model to examine the determinants of joining the Federal Reserve for the period 1915 to 1920.²⁴ Each bank enters the model in 1915 and exits when it became a Federal Reserve member. The approach explicitly models the probability of becoming a member for each year using a log-logistic function and identifies the coefficients from those institutions that became members faster or slower than predicted.²⁵ The model of Fed membership timing for our balanced sample of state banks is:

$$TimeUntilBecomeMember_{i,t} = fn(\beta_1 Z_{i,t} + \beta_2 BS_{i,1912-14} + C_i + e_{i,t}) \quad (1)$$

where $TimeUntilBecomeMember_{i,t}$ is a variable denoting the time until an institution decided to become a Federal Reserve member. Because we are concerned about changes in balance sheet characteristics of a bank after becoming a Fed member, we denote the timing of the Fed membership decision as the year before a bank becomes a member. $Z_{i,t}$ is a vector of bank-specific characteristics. $BS_{i,1912-14}$ is a vector of balance sheet items from the pre-Federal Reserve era. We estimate the model using county-fixed effects (C_i) to capture aspects of location

²³ For instance, several banks that entered after 1914 immediately adopted Federal Reserve membership.

²⁴ The results are similar for other hazard function distributions or a Cox proportional hazard model. The results also hold when reducing the model to a logit or probit. Although we have membership and balance sheet data through 1924, only one state bank in existence in 1914 became a Federal Reserve member between 1920 and 1924. Rather than attach excessive weight to this single observation, we drop the remaining years from the sample.

²⁵ The data's implied unconditional survival functions suggest that the choice to become a member for 1914 incumbents was generally made in the first six years (by around 1920). The choice of joining the Fed for new bank entrants (which are not included in our sample here) generally was made within the first two years of entry as new state banks.

that may have affected the degree of bank isolation or the profitability of lending.²⁶ While county-fixed effects offer the best control for local effects, their inclusion necessitates that we drop banks that were in a county where no banks chose to become Federal Reserve members before 1920. Finally, $e_{i,t}$ is the robust error term.²⁷ The summary statistics of these variables are included in Table 2.

In summary, the vector of characteristics included in our empirical estimation was chosen based on the factors described above, and include the following sets of characteristics:

Bank-specific characteristics — An indicator variable denoting whether the bank was a trust company, another denoting whether the bank was a clearinghouse member, the number of miles the bank was from a Federal Reserve district bank²⁸, the number of correspondents listed in the banker directories, the share of listed correspondents of the subject bank in Manhattan, an indicator variable denoting whether the bank was listed as correspondent of another bank (i.e., had a respondent bank), the logarithm of all Federal Reserve member banks' assets within 25 miles of the subject bank, the ratio of the bank's assets to the assets of Federal Reserve member banks within 25 miles of the subject bank, and an indicator variable denoting whether the bank had sufficient capital in all years to satisfy the minimum capital requirement for a Fed member.

Balance-sheet characteristics — The logarithm of total assets in 1914 (capturing fixed costs of regulatory compliance, or through the relative ability of smaller banks to access local pass-throughs without joining the Federal Reserve), the ratio of loans to assets in 1914 (capturing

²⁶ The results are similar when we drop the county-level fixed effects and add county-level control variables including the logarithm of population, the fraction of the population located in urban areas, the fraction that is illiterate, the logarithm of crop output per capita, the logarithm of manufacturing output per capita, the number of acres in cereal production, and the logarithm of the number of fruit trees, all of which were measured in 1920.

²⁷ When we cluster errors at the bank level to account for any residual correlation over time, the standard errors rise slightly, but the statistical significance of our main variables remains.

²⁸ We allow the distance to adjust when Buffalo gained a branch in 1919.

either the extent to which lending is profitable and zero-interest reserve requirements of the Federal Reserve are a burden or extent to which the bank expects to benefit from liquidity risk reduction from obtaining access to the discount window), and the absolute value of the average change between a bank's loans in the third and fourth quarters in the years 1912 through 1914 (capturing seasonal loan demand).²⁹

In Table 3, we present three sets of specifications. The first is a parsimonious specification that does not include indicator variables for whether the institution was a trust company or a clearinghouse member. That specification considers whether banks that had respondent banks tended to join the Federal Reserve relatively quickly. Because 25 of the 28 nodal correspondent banks (that is, banks receiving substantial deposits from other respondent banks) were either trust companies or clearinghouse members or both, we first drop the extra indicators for those attributes when considering whether a bank having respondent connections mattered for Federal Reserve membership. The second specification adds the trust company and clearinghouse member indicators for comparison. The final specification adds the pre-1915 balance sheet characteristics.

As shown in Table 3, institutions that were listed as correspondents were much more likely to become Federal Reserve members. The coefficient on having respondent connections is only statistically significant when the trust company and clearinghouse indicators are excluded (reflecting the substantial overlap between these groups of banks). As noted before, trust companies and clearinghouse members were among the most likely to be holding significant interbank deposits, and it was these characteristics that likely encouraged early Federal Reserve membership. In column (3) for instance, the effect of being a due to correspondent actually

²⁹ We could not go further back in time than 1912 because trust company data is not reported in the *Annual Report* before that date.

increases the time it takes until membership by 37 percent, but being a trust company or a clearinghouse member decreases it by 17 and 34 percent, respectively.³⁰ Even though the effect of being a trust company remains economically large, the statistical significance drops once the balance sheet variables are included, given the covariance between bank size and trust company status. The effect of the bank's location in the correspondent network played a significant role in determining the speed of adoption.

We also find evidence that, in spite of Federal Reserve efforts to limit pass-throughs, banks seeking to avoid the costs of Federal Reserve membership were able to obtain pass-throughs of discount window access from surrounding Federal Reserve member banks. We find that the composition, not the number, of a bank's correspondents has a meaningful effect on the decision to become a member. Banks that joined the Federal Reserve had fewer Manhattan correspondents yet did not have significantly more total correspondents. In column (3), each extra correspondent only increased the time until membership by 2.1 percent, yet each 25 percentage point increase in the Manhattan share (i.e., about one more Manhattan correspondent) slowed adoption by 12.8 percent.³¹ Moreover, being surrounded by large Federal Reserve member banks discouraged banks from becoming members. A bank with a standard deviation more assets in surrounding Federal Reserve banks (2.44) took 48.7 percent longer to become a member. Overall, our results strongly support the proposition that nonmember banks used their Federal Reserve member neighbors and correspondents as substitutes for joining the Federal Reserve.

³⁰ We translate the coefficients into percentage change in time until membership using the following formula: $100[\exp(\beta)-1]$.

³¹ Both values are actually close to being one standard deviation. The standard deviation of the number of correspondents is 1.35 and the standard deviation of the share of correspondents in Manhattan is 0.26.

When added to the model, a bank's size, capital sufficiency, and its loan variation all are significant determinants of membership. Even controlling for the bank's correspondent status, a bank was 36.9 percent faster to adopt membership for every standard deviation increase in Assets (1.5), was 35.8 percent faster if it had sufficient capital, and was 5.4 percent faster for every standard deviation increase in loan swing (0.087). These findings support the view that banks that were large enough to absorb the compliance costs of Federal Reserve membership, but perhaps too large to rely on local Federal Reserve members for pass-through lending, found greater net value in Federal Reserve membership. The loan seasonality effect provides clear evidence that banks expected to gain advantages related to liquidity risk reduction from joining the Federal Reserve.

4.2. Additional Specifications

Here we examine several additional specifications.

Although including nodal correspondent banks expands our sample size and variation, and permits us to explore particular aspects of the correspondent network relevant for Federal Reserve membership choice, there are also advantages of restricting the sample to exclude these banks. As a result of their quick adoption, there are too few observations to study only the sample of nodal correspondent banks. In Table 4, we drop the 28 banks listed as nodal correspondents from the sample and re-estimate the survival model.³² Here we see that the results are very similar to those in Table 3. The coefficients suggest that the ability to the pass-through and the need for seasonal lending are even more important, and the effect of being a nodal bank are slightly less important, when we restrict the sample.

³² Note that we have to drop the distance to the nearest Federal Reserve city from the hazard due to lack of variation. We also cannot include county-fixed effects because all of the institutions are in the same county.

The results in Tables 3 and 4 indicate that nodal correspondent banks adopted memberships for different reasons than noncorrespondent banks. Noncorrespondent banks often responded to their need for liquidity by accessing pass-throughs from surrounding Federal Reserve members, but correspondent banks (consisting almost entirely of trust companies and clearinghouse members) joined the Federal Reserve to expand their network and act as liquidity providers. The models, however, assumed that the coefficients on explanatory variables remained constant over time. Section 2 presented historical information, which suggests the influence of some of these variables may have varied over time. For example, banks whose Manhattan correspondents cleared checks for them may have been initially reluctant to join the Federal Reserve, since they would have lost the benefit of exchange charges and received no interest on large required reserves. These concerns probably eased after the Federal Reserve imposed par clearing in 1916 and eased a large number of requirements in 1917. Banks whose lending exhibited large seasonal swings in peacetime may have had little incentive to join the Federal Reserve during the war, when war programs overrode seasonal cycles and the Federal Reserve opened its discount window to all banks holding war bonds — essentially all banks. To determine whether the impact of our explanatory variables changed over time, we estimate three separate logit regressions, where the dependent variable is a dummy variable that denotes whether the bank became a member in the following years.

Each regression examines whether a bank adopted membership during the defined period given the value of the variables at the beginning of the period. We define these periods as 1915-16, 1917, and 1918-20, because during these periods banks faced relatively stable costs and benefits, as discussed in Section 2.³³ A positive coefficient implies the institution was more likely

³³ There were 28 adoptions in 1915/1916, 34 adoptions in 1917, and 11 adoptions in 1918/1919/1920.

to become a member. Because we are unable to include county fixed effects in these models, we include a variety of county-level controls from the 1920 Census in order to account for the underlying economic and demographics of each bank's location. These controls include the logarithm of population, the fraction of the population located in urban areas, the fraction that is illiterate, the logarithm of crop output per capita, the logarithm of manufacturing output per capita, the number of acres in cereal production, and the logarithm of the number of fruit trees, all of which were measured in 1920.

As previously discussed, the presence of New York City in the sample might affect the representativeness of our results for various reasons relating to New York City's unique characteristics. Table 5 reports another robustness check that drops all New York City banks. Trust companies and banks with sufficient capital and large loan swings were the quickest to become members. Being a clearinghouse member also remains statistically significant until the balance sheet variables are included. The effect of having correspondents in New York City loses its statistical significance, but this coefficient in column (3) is similar to column (3) in Table 3. The fact that the share of correspondents in Manhattan is not significant likely reflects less variation in this variable for the sample that excludes New York City.

Table 5 not only shows that our results hold outside of New York City, it also is useful as a more nationally representative set of estimates for the various effects in our model. The banks of upstate New York display a range of characteristics similar to banks in other regions of the country. We would thus expect that outside of New York state, trust companies, clearinghouse members, and large correspondent banks are similarly likely to have converted to Fed members relatively quickly, while we would expect smaller and more rural banks located outside of New

York state with sufficient capital, high loan swings, and no large Fed correspondent would be more likely to become a member between 1918 and 1920.³⁴

Table 6 shows how different factors mattered more or less at different times. Being a clearinghouse member mattered most during the early years of the Federal Reserve. This makes intuitive sense, because the New York Clearing House encouraged all of its members to join the Federal Reserve. Large and particularly well-capitalized correspondent banks made their decisions about the Federal Reserve very quickly. For instance, the sufficient capital variable cannot even be included in the model because no bank with insufficient capital became a member in 1915 or 1916, yet the variable is not significant in any other specification. Alternatively, noncorrespondent banks mainly made their decisions to join the Federal Reserve after 1917. Correspondent banks, which joined relatively early, seem to have joined to grow their network, while other banks joined the Federal Reserve to mitigate the risks associated with large seasonal fluctuations in loan demand once the lay of the land in the nodal correspondent banks' decisions had already been made and the regulatory costs of Federal Reserve membership had declined sufficiently.

The data also suggest that banks with greater pass-through access to the Federal Reserve (through other Fed members) were always less likely to become members. In particular, the share of Manhattan correspondents matters even after the Federal Reserve imposed par clearing throughout New York state and eased for state-chartered banks. Alternatively, the distance to the nearest Federal Reserve Bank reduces the probability of becoming a member in 1917 but actually increases it in 1918, 1919, and 1920. After the law changes, banks that were farther from

³⁴ It is worth noting that the lists of Fed members displayed in annual Fed Reports corroborate this view. Clearinghouse members and trust companies made up much of the state bank membership lists.

the discount window thus were more likely to desire a direct connection to it rather than indirect access through correspondents.

The raw data on the growth in the number of correspondent relationships of nodal correspondent banks confirms the role of Federal Reserve membership in promoting the growth of member banks' networks. This pattern is particularly visible outside New York City. In cities such as Albany, Buffalo, Rochester, Syracuse, and Troy, Federal Reserve member banks that already had correspondent banks in 1915 saw the average number of correspondents increase from 2.3 in 1915 to 3.8 in 1920. Only two nonmember banks in those cities had any correspondents in 1915, and their average number of correspondents declined from 3 in 1915 to 2.8 by 1920. In those same locations, for member banks that had no correspondents in 1915, the number of correspondents in 1920 rose to roughly one for every eight Federal Reserve member banks. Within New York City, Federal Reserve member nodal correspondent banks also saw absolute and relative growth in their networks — increasing from an average of 6.3 correspondents in 1915 to an average of 8.5 in 1920. For nonmember banks in New York City, the average number of correspondents increased less, from 2.3 to 2.7.

Table 6 shows that the seasonality of a bank's lending, as measured by the seasonal swing in the three years preceding World War I, was not correlated with decisions to join the Federal Reserve in 1915, 1916, and 1917. The early insignificance of this coefficient likely reflects the combination of higher regulatory costs of membership, the low seasonality of lending during the war years, and the ability of nonmember banks to access the discount window during that time. These policies changed after the war, when the Federal Reserve ceased lending to nonmembers and adopted rules (fully implemented in 1919) attempting to prohibit the pass-through of eligible paper originated by nonmembers.

As a further robustness check, in Table 7 we estimate a logit regression where the dependent variable is whether the bank became a Federal Reserve member by 1920. The independent variables enter with their 1915 values. The results are similar (with opposite signs) to the previous survival models. The size of loan seasonal variation, value of assets, and share of non-Manhattan correspondents consistently increase the probability of Federal Reserve membership. The effects of most other variables retain their direction but lose some statistical significance, which is not surprising given the loss in information associated with combining all the years rather than distinguishing among various timings of membership choice (as in tables 3 through 5) to gauge the relative strength of the subject bank's interest in membership. In particular, the survival models place additional importance on the factors that were more relevant for early adoption whereas the logit essentially takes the average of all years. Therefore variables that mattered only for early adoption (i.e., having sufficient capital, being a clearinghouse member or being a trust company) are expected to be less significant.

5. The Consequences of Joining the Federal Reserve

The previous section analyzed the decision of state-chartered New York banks whether to become a Federal Reserve member; in this section, we examine how membership changed banks' behavior over the sample period of 1915-24.

We consider four measures of banks' behavior: the percentage seasonal swing in lending, the ratio of cash (defined as vault cash plus cash items) relative to total assets, the ratio of the amount due-from banks plus due-from the Federal Reserve relative to total assets, and loans relative to total assets. We consider changes in the levels of these because we expect membership to be associated with a one-time level effect rather than continuous changes over time. For

instance, if the discount window eliminated all loan variation for members, the change in variation would be negative for one period and close to zero every period thereafter.³⁵

The model takes the form:

$$Y_{i,t} = a + \beta_1 Member_{i,t} + \beta_2 Z_{i,t} + u_i + t_t + e_{i,t} \quad (2)$$

where $Y_{i,t}$ is any of the previously mentioned dependent variables, $Member_{i,t}$ is a dummy variable denoting whether the bank was a member of the Federal Reserve in that particular year, u_i is a vector of bank-level effects, t_t is a vector of year fixed effects, and the rest of the variables retain their previous definitions. After controlling for constant differences across banks using fixed effects, the model measures whether the observed variables were higher or lower after the bank joined the Federal Reserve.³⁶ To further control for potential differences between banks, we separately estimate the specification with the county-level variables or with bank fixed effects. The county-characteristics model effectively looks at whether a bank changed relative to other banks *and* relative to its own history (after controlling for county characteristics), while the bank-fixed effects model effectively *only* looks at within-bank variation over time.

The 1917 amendments provide a source of exogenous variation that shifts the relative benefit-cost ratio of joining the Fed, which permits us to measure the consequences of that shift for lending by new member banks. Nevertheless, our coefficients should be interpreted as measuring the effect of treatment (i.e., membership) on those who chose to join the Fed, which is not a random sample of banks. For that reason, our estimated coefficients may overstate what the counterfactual effect on lending would have been from requiring all banks to become members.

³⁵ We also find differences in rates of change in these dependent variables when we control for convergence effects with lagged levels of dependent variables.

³⁶ While unreported, we estimated the specification with county-fixed effects and the additional constant bank balance sheet controls (e.g., trust company, loan swing, assets in 1914, etc.) as well as whether an indicator variable for whether the bank ever became a Federal Reserve member. The results are quantitatively similar.

The approach, however, also has the benefit of allowing us a glimpse into the factors that may have driven banks to adopt membership in the first place.

Table 8 shows that banks altered their behavior after becoming Federal Reserve members. Membership decreased a bank's seasonal loan variation. A bank that became a member saw its loan swing *decrease* by 1.9 percent. In other words, banks that had highly variable loans and did not join the Federal Reserve continued to have similarly variable loans. This result shows that the Federal Reserve Bank of New York was "accommodating commerce and business" by discounting and purchasing large quantities of bank loans during the fourth quarter, as noted by Miron (1986). The balance sheet of the Federal Reserve Bank of New York clearly documents this activity. In 1924, for example, the New York Federal Reserve held nearly \$200 million of commercial bank loans on its books, which it acquired as collateral for discount loans or purchases in the open market, at the end of the fourth quarter, nearly double the quantity of loans held at the end of the third quarter (FRB NY, 1924).

Table 8 also shows that after becoming Federal Reserve members, banks changed the composition of their cash assets, which is not surprising. After 1917, regulations required member banks to hold all of their required reserves at the Federal Reserve. Columns (2) and (3) illustrate this shift. The ratio of cash to assets decreases by 1.5 percent; the ratio of due from banks and the Federal Reserve to assets increases by 2 percent. These increases are substantial in magnitude and statistically significant but essentially cancel each other out with respect to their effects on total reserves. The Federal Reserve noted this phenomenon in a statement it released to the press in November 1917 summarizing changes in the Federal Reserve's balance sheet in preceding months (Federal Reserve Board, 1917).

After joining the Federal Reserve, banks' ratio of loans to assets also increased. The ratio rose from 4.2 percent, suggesting that membership in the Federal Reserve reduced the liquidity risk of greater lending. The diminished loan swing apparent in Table 8 reflects the behavior of banks serving as correspondents for other institutions, primarily in the central reserve city of New York, but also in other major New York cities

In Table 9, we consider the same dependent variables as in Table 7, but we divide banks into noncorrespondent banks (in the top panel) and nodal correspondent banks (in the bottom panel). To conserve space, we only report the coefficients relating to Federal Reserve membership. Interestingly, the two types of banks display important differences in their reactions to Federal Reserve membership. Noncorrespondents greatly increased their loans-to-assets and displayed *no change* in their loan seasonality. Lending increased because the Federal Reserve reduced the risks associated with periodic liquidity strains in money markets, allowing commercial banks to accommodate the seasonal demands of their commercial and industrial customers. Nodal correspondent banks that joined the Federal Reserve, in contrast, saw a large and significant decline in their loan swing and no change in their loan-to-asset ratios. The results confirm our previous findings about the role of nodal correspondent member banks as liquidity providers to the network. After the founding of the Federal Reserve, their role as liquidity providers increased, which required them to reduce their liquidity risk, which explains why *their own seasonal lending swing diminished*.

The evidence on changes in the lending behavior of Federal Reserve member banks indicates that noncorrespondent member banks expanded their loans and nodal correspondent member banks reduced their seasonal swing upon joining the Federal Reserve. However, the results in Tables 7 and 8 do not show the speed of those changes. We address that question in

Table 9 by creating a series of indicator variables that capture behavioral changes according to how many years a member bank had been a Federal Reserve member, compared to banks that had never been a Federal Reserve member. To avoid attempting to identify coefficients on a couple of banks, we drop banks when they were Federal Reserve members for more than five years.

The results in Table 10 show that the change in loan swing (driven by the behavior of nodal correspondent member banks) was not immediate. The effect did not become statistically significant until the third year. This suggests that the effects of Federal Reserve membership in building the nodal correspondent banks' networks were gradual. In contrast, the effect on loans to assets (driven by the behavior of noncorrespondent banks) shows a sudden jump on joining the Federal Reserve. Adjustments of cash and reserves at the Federal Reserve are also quite rapid.

6. Conclusion

We study the slow response of state-chartered banks to the opportunity to join the Federal Reserve System, which began operation in 1914. Initially, very few state banks and trust companies chose to become Federal Reserve members. Even as late as the mid-1920s less than a third of the banks had become Federal Reserve members. This variation in membership choice allows us to examine the factors that influenced membership. The evidence for New York suggests that the decision to adopt was based on several factors.

Access to the Federal Reserve's discount window — and the greater ability to reduce liquidity risk that such access afforded — seems to have been recognized by state-chartered banks as the primary attraction of joining the Federal Reserve. Banks with relatively high

seasonality in their loan demand (and consequently greater liquidity risk) were more likely to join. At the same time, the position of a bank in the correspondent network substantially influenced this benefit of Federal Reserve membership. All other things being equal, small banks located close to a sufficient number of Federal Reserve member banks were less likely to join the Federal Reserve, presumably because they could obtain pass-throughs of Federal Reserve discounting from member banks. Conversely, large banks that occupied important positions in the interbank network were especially willing to become members because access to the Federal Reserve improved their importance as conduits of liquidity to other banks.

We also examine the effects of Federal Reserve membership on lending. These differed for nodal correspondent banks and other banks. For nodal correspondent banks, Federal Reserve membership produced a decrease in the bank's yearly loan variation, consistent with these banks role as liquidity providers. This effect took time to materialize, because it depended on the effect of Federal Reserve membership on the growth of the bank's network. For other banks, joining the Federal Reserve had no effect on the seasonality of lending, but increased the amount of lending. So although nonmember banks could achieve some of the benefits of reduced liquidity risk through pass-throughs from nodal correspondents, indirect access to the discount window was not a perfect substitute for direct access through Federal Reserve membership.

Our results both on the determinants of Federal Reserve membership and its consequences suggest that, consistent with the motives for establishing the system, it was seen by prospective members as an effective means of reducing seasonal liquidity risk and it did, in fact, achieve that end. The data also show that some banks used their access to the discount window and the costs that smaller banks faced in joining the Federal Reserve, as a means of expanding their own role as liquidity providers in the network. Finally, our paper demonstrates that the

moral hazard problem of shadow banking was present during the early Federal Reserve era. Many state-chartered banks managed to gain access indirectly to the Federal Reserve's discount window while avoiding the reserve requirements of the Federal Reserve — the regulations that were most important in preventing excess risk-taking by banks with access to the discount window.

The leaders of the Federal Reserve Bank of New York appear to have been aware of these issues, especially the need to ensure widespread membership, the need to deal with seasonal variation in lending, and the prospective risks of making access to the discount window too easy. During their first decade in operation, their annual reports and circular announcements describe programs designed to encourage nonmembers to join the System. Their annual report for 1926 discusses the strong seasonality of lending in their district and throughout the nation and discount operations that accommodated these patterns (FRB NY, 1927, p. 9). Their annual report for 1928 discusses their efforts to restrict the rapid expansion of credit in securities markets without

unduly penalizing business enterprise. This problem became more pressing in the autumn when the beginning of the usual autumn demand for funds found interest rates firm and tending higher. To prevent too great credit stringency at that time, the Reserve Banks avoided advances in their buying rates for bankers acceptances, such as are frequently made during the autumn season, and purchased acceptances in a volume which was more than sufficient to provide the additional Federal Reserve funds needed to meet seasonal requirements without further credit strain (FRB NY, 1929, p. 17).

These issues remain relevant. Today, as in the past, Fed membership is voluntary. Changes in the costs and benefits of membership alter financial institutions' decisions about joining the System. Legislation proposed in the summer of 2015, for example, would reduce to 1.5 percent from 6 percent the dividend that member banks with assets over \$1 billion receive on their stock in the Federal Reserve. In testimony before Congress, the chair of the Board of

Governors, Janet Yellen, argued that “reducing the dividend could have unintended consequences for banks' willingness to be part of the Federal Reserve (Yellen, 2015).” The chairman of the Financial Services Committee requested a study of “the historic rationale for requiring member banks to hold Federal Reserve Bank stock ... and broader questions such as whether member bank ownership of Federal Reserve Bank stock should be voluntary rather than mandatory and whether the stock itself should be permanently retired.” Our paper provides a part of this history and a foundation for determining how changes in laws and policies influenced Fed membership over the last century.

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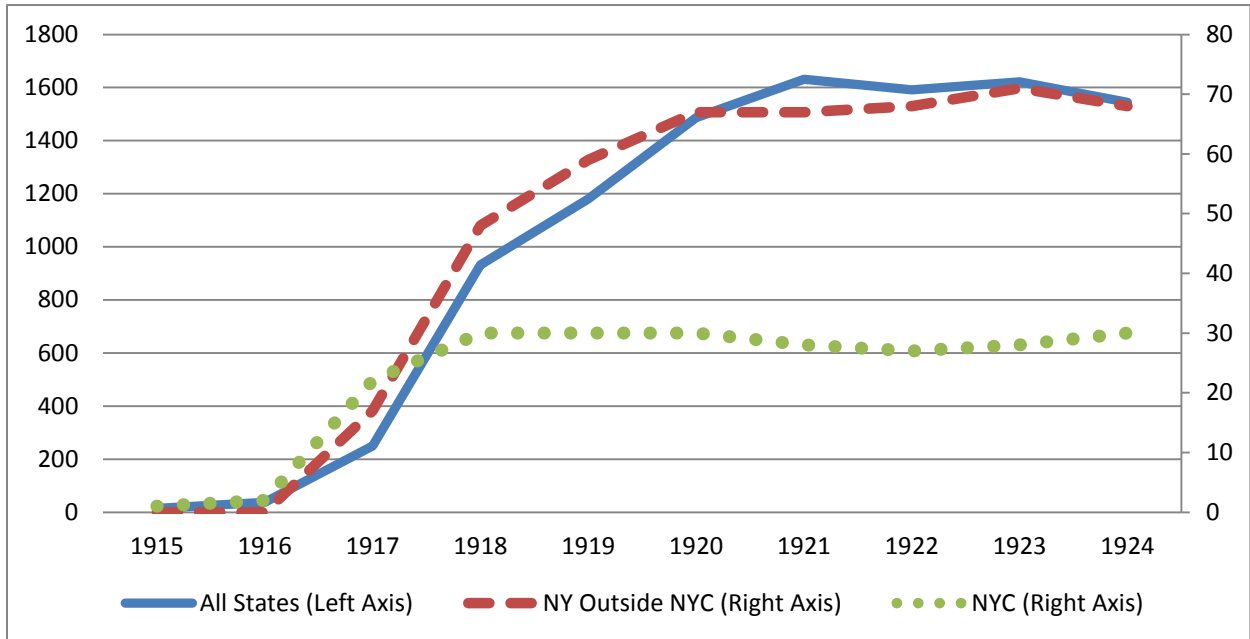
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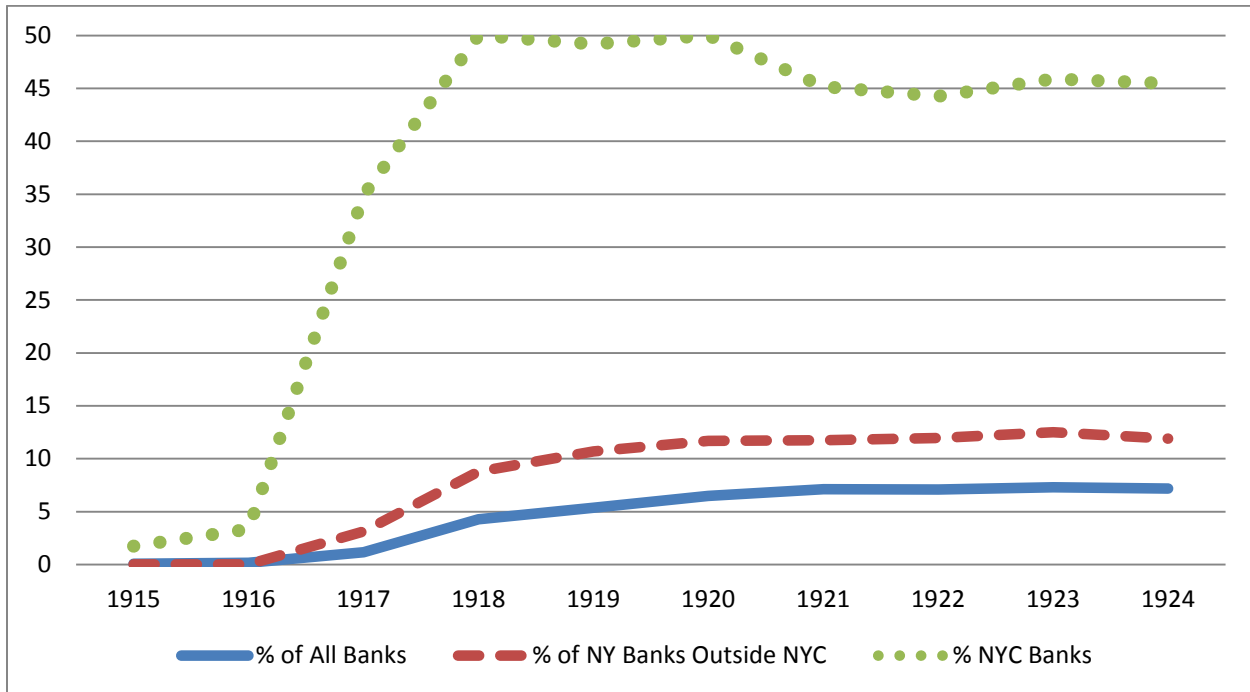
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Figure 1: Adoption of Membership by State Banks (1915-1924)

Panel A: Number of State Bank Members

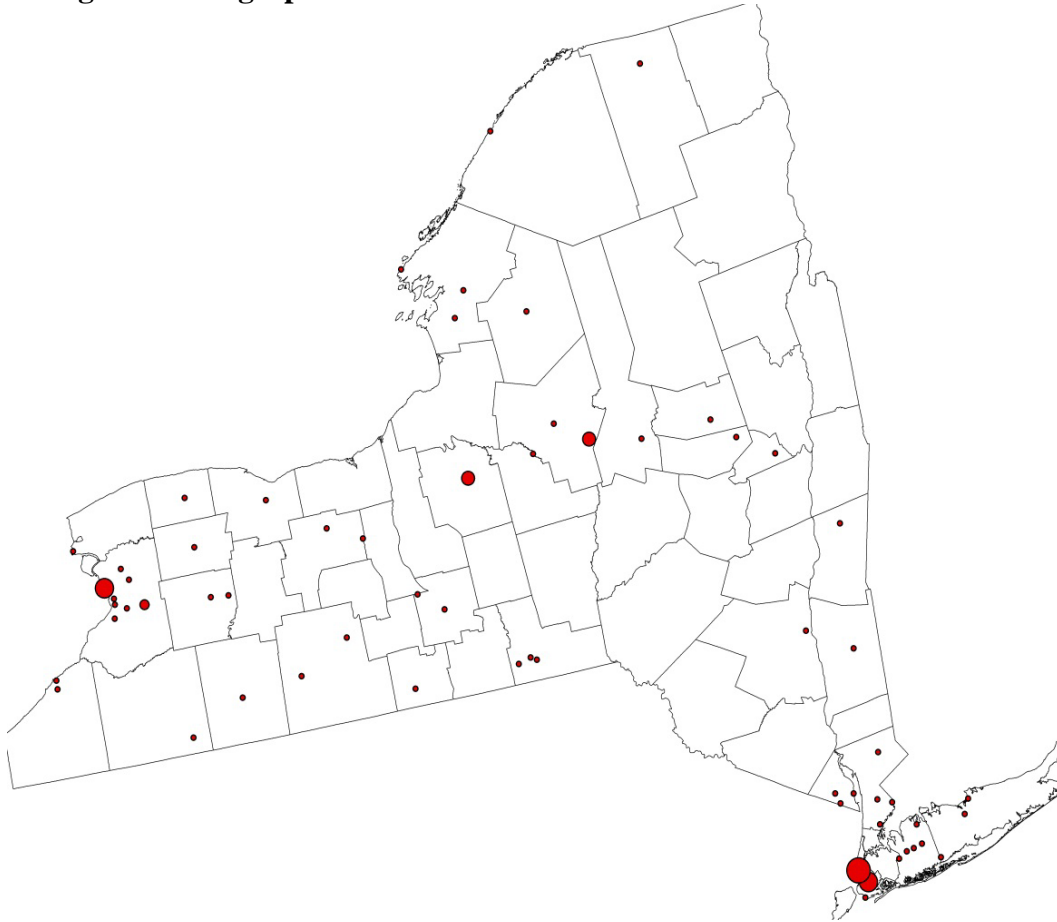


Panel B: Percent of State Banks that Are Members



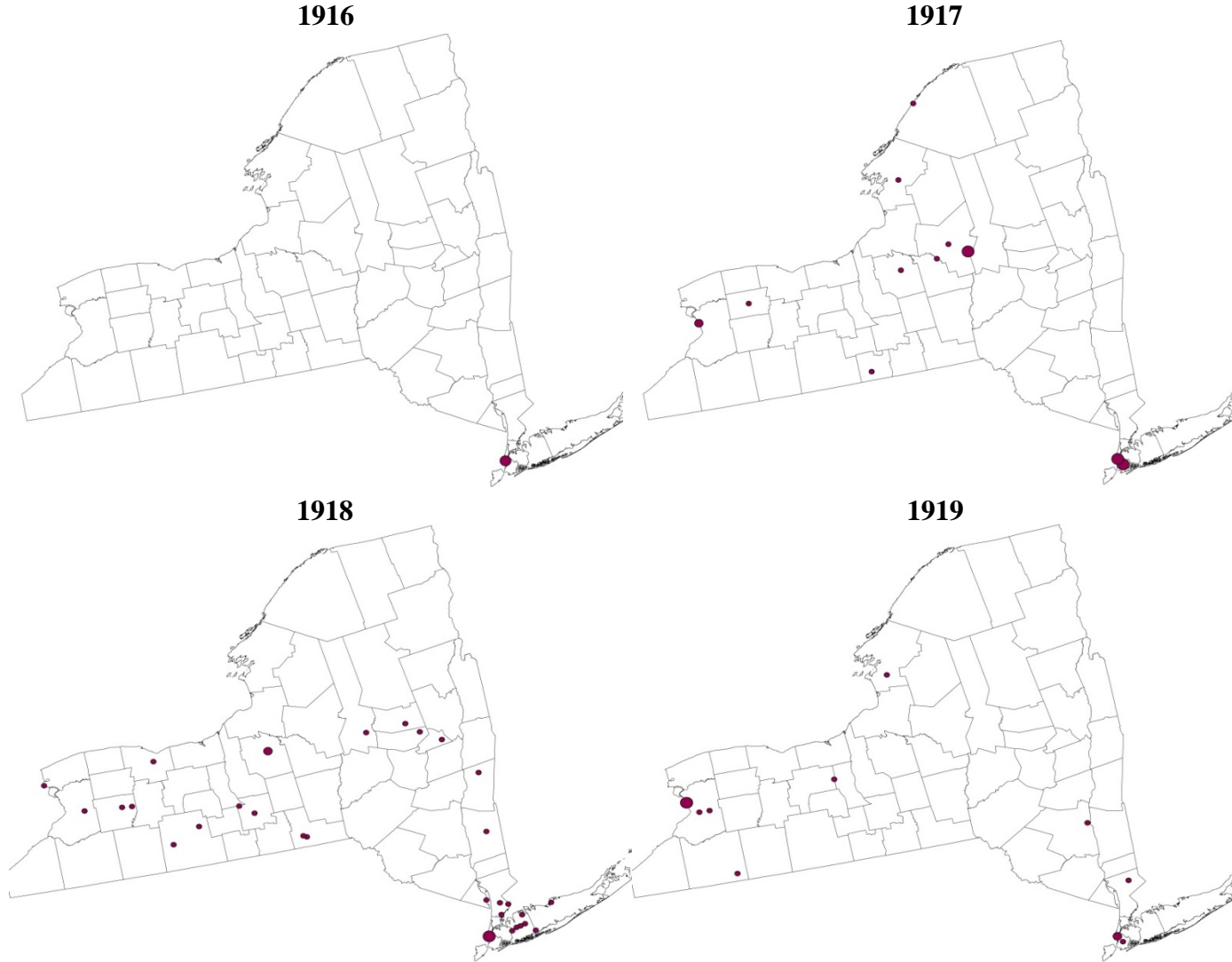
Notes: Figures display the number and fraction of Federal Reserve state members in each year. Membership rolls obtained from the *Annual Report* of the Federal Reserve Board of each year. The total numbers of banks are obtained from *All Bank Statistics* (1954).

Figure 2: Geographic Distribution of State Member Banks Before 1924



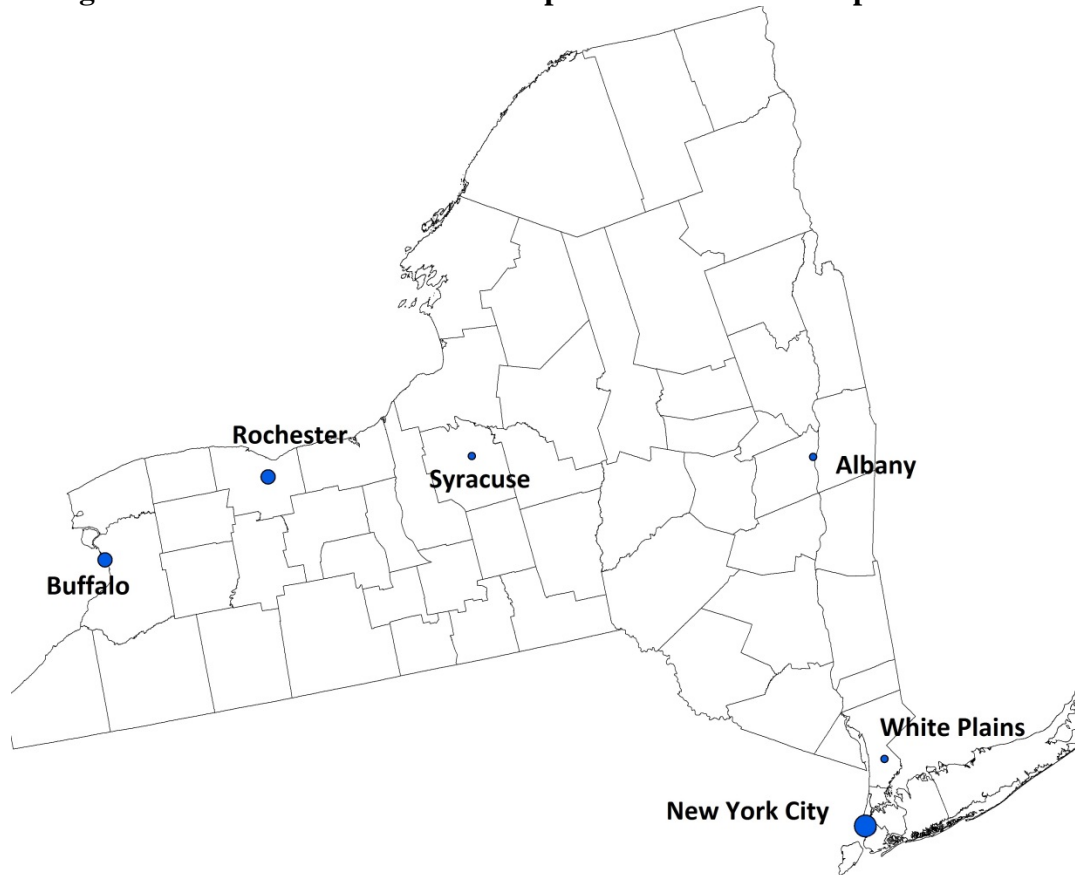
Notes: Figure contains a map of all state banks and trust companies that became members of the Federal Reserve before 1924. County boundaries obtained from Minnesota Population Center (2004). The size of the dot denotes the number of member banks in the city.

Figure 3: Locations of New Federal Reserve Members in Sample by Year (1916-1919)



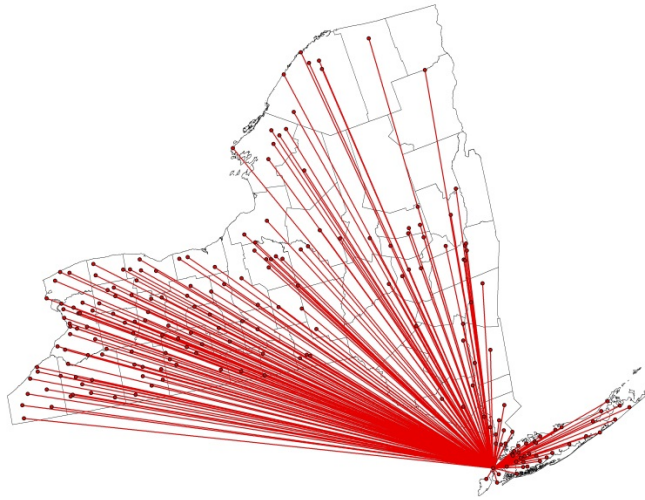
Notes: Displays the locations of new members across the period where the size of the dot denotes the number of banks in the city. County boundaries obtained from Minnesota Population Center (2004).

Figure 4: Locations of Nodal Correspondent Banks in Sample as of 1915



Notes: Figure contains a map of all state banks and trust companies that were listed as the correspondent of another bank. County boundaries obtained from Minnesota Population Center (2004). The size of the dot denotes the number of member banks in the city.

Figure 5: Correspondent Links in 1920
Panel A: Links to New York City



Panel B: Links to Albany, Buffalo, Syracuse, Troy, and Rochester



Panel C: Links to Other Cities



Notes: Figure contains a map of all state banks and trust company correspondent relationships that were listed in the bankers' directory in 1920. County boundaries obtained from Minnesota Population Center (2004).

Table 1: Regulatory Requirements, New York State Fed Member and Nonmember Banks in 1915

	<i>State Members Before 1917</i>	<i>State Members After 1917</i>	<i>State Nonmembers</i>
Capital stock	Town population more than 50,000: \$200,000	Town population more than 50,000: \$200,000	Town population over 30,000: \$100,000
	Town population greater than 6,000 but less than 50,000: \$100,000	Town population greater than 6,000 but less than 50,000: \$100,000	Town population greater than 2,000 and less than 30,000: \$50,000
	Town population greater than 3,000 but less than 6,000: \$50,000	Town population greater than 3,000 but less than 6,000: \$50,000	Town population less than 2,000: \$25,000
	Town population less than 3,000: \$25,000	Town population less than 3,000: \$25,000	
Reserves against deposits	If in a central reserve city: 18% demand deposits and 5% time deposits with at least 6/18 on hand and at least 7/18 at Federal Reserve	If in a central reserve city: 13% demand deposits and 3% time deposits at Federal Reserve	In Manhattan: 25% of demand deposits with at least 3/5 on hand and rest on deposit with large reserve city bank
	If in a reserve city: 15 % demand deposits and 5% time deposits with at least 5/15 on hand and at least 6/15 at Federal Reserve	If in a reserve city: 10 % demand deposits and 3% time deposits at Federal Reserve	In Brooklyn: 20% of demand deposits with at least 1/2 on hand and rest on deposit with large reserve city bank
	If not in a reserve or central reserve city: 12% demand deposits and 5% time deposits with at least 4/12 on hand and at least 5/12 at Federal Reserve	If not in a reserve or central reserve city: 17% demand deposits and 3% time at Federal Reserve	If not in Manhattan or Brooklyn: 15% of demand deposits with at least 2/5 on hand and rest on deposit with large reserve city bank
Surplus fund	NA	NA	Up to 20% of the value of capital stock can be used to pay losses.
Amount to be loaned to one individual or company	NA	NA	Not more than 10% of paid-up capital and surplus.
Amount to be loaned to any entity outside of New York state	NA	NA	Not more than 25% of paid-up capital and surplus in in Manhattan, or 40% if in other locations
Can operate branches?	Yes, as long as it is in the same town as the main office.	Yes, as long as it is in the same town as the main office.	Yes, as long as it is in the same town as the main office.

Sources: Data for Federal Reserve members come from Federal Reserve Act of 1913. Data for the New York State requirements come from the Rand McNally *Bankers' Directory* (1914).

Table 2: Summary Statistics of All New York State Banks and Trust Companies

	Listed As Correspondent of State Bank in 1915		Not Listed As Correspondent of State Bank in 1915		Became Member By 1920	Did Not Become Member By 1920
	New York City	Non-New York City	New York City	Non-New York City		
Number of Banks	19	9	32	172	74	158
Percent Federal Reserve Membership by 1920	78.9%	44.4%	56.3%	21.5%	100.0%	0.0%
Years Until Federal Reserve Member	3.0	4.8	4.4	5.4	2.9	6.0
Percent Trust Companies	63.2%	44.4%	31.3%	22.1%	48.6%	17.7%
Percent Clearinghouse Members	57.9%	88.9%	37.5%	4.7%	35.1%	8.2%
Distance to Reserve City in 1915	1	220	1	175	93	159
Assets/Assets in Member Banks Within 25 Miles in 1915	3.7%	13.4%	0.5%	6.9%	6.6%	5.7%
County Population in 1910	5,620,048	414,686	5,620,048	137,333	1,459,215	463,251
Percent Urban in 1910	100.0%	85.9%	100.0%	49.0%	76.8%	54.5%
Number of Correspondents in 1915	3.6	3.7	3.6	2.6	3.5	2.6
Share of Correspondents in Manhattan in 1915	32.5%	41.1%	45.5%	58.5%	41.7%	54.2%
Avg. Number of Respondents in 1915	4.9	3.0	0.0	0.0	1.3	0.2
Due-from Banks in 1914	6,164,052	761,280	938,752	138,904	1,931,419	221,361
Due-from/Assets in 1914	9.1%	10.2%	9.1%	10.8%	9.3%	10.9%
Due-to Banks in 1914	6,202,704	345,757	215,636	12,809	1,640,223	55,001
Due-to-Banks/Assets in 1914	8.7%	3.8%	1.0%	0.6%	2.8%	0.8%
Banks + Due-from Banks in 1914	12,400,000	1,107,038	1,154,387	151,713	3,571,642	276,363
Due-to/(Due-to banks + due-from banks) in 1914	42.9%	22.6%	9.7%	4.8%	16.5%	5.9%
Assets in 1914	69,381,593	7,254,469	11,217,858	1,496,527	21,785,822	2,454,201
Sufficient Capital	100%	100%	78.1%	94.2%	95.9%	91.1%
Loans/Assets in 1914	54.1%	58.2%	53.7%	57.8%	53.4%	58.6%
Percentage Loan Swing Q3-Q4 1912-1914	15.7%	9.7%	8.6%	7.0%	10.6%	6.9%
Median Assets in 1914	56,500,000	7,294,887	5,721,910	606,623	5,445,208	681,979

Notes: Tables contains summary statistics for the group of banks listed in the column heading.

Table 3: Log Logistic Survival Model of Determents of Joining the Federal Reserve (1915-1920)

	Dependent Variable = Time Until Become a Federal Reserve Member		
	(1)	(2)	(3)
Trust Company		-0.446*** [0.131]	-0.197 [0.157]
Clearinghouse Member		-0.585*** [0.193]	-0.420** [0.169]
Distance to Nearest Federal Reserve City	-0.002 [0.002]	-0.002 [0.002]	-0.002 [0.001]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	0.130* [0.077]	0.145** [0.062]	0.182*** [0.060]
Assets/Assets in Member Banks Within 25 Miles	-1.633** [0.704]	-0.020 [0.741]	1.869* [1.102]
Number of Correspondents	-0.025 [0.031]	0.037 [0.041]	0.021 [0.037]
Share of Correspondents in Manhattan	0.604** [0.261]	0.487** [0.234]	0.413* [0.226]
Any Respondents in 1915	-0.282* [0.169]	-0.038 [0.138]	0.318* [0.176]
Ln(Assets in 1914)			-0.283*** [0.084]
Sufficient Capital			-0.444** [0.216]
Loans/Assets in 1914			-0.088 [0.560]
Avg Percentage Loan Swing Q3-Q4 1912-1914			-0.976*** [0.330]
County Fixed Effects	Yes	Yes	Yes
Observations	826	826	826

Notes: Table contains the results of a log logistic survival duration model. The dependent variable is whether the state bank or trust company adopted a Federal Reserve membership in the subsequent year. All banks in the sample existed in 1914 and did not close before 1925. Counties that did not have any incumbent banks joining are dropped from the sample because county-fixed effects are included. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 4: Log Logistic Survival Model of Joining Federal Reserve for Banks Not Listed as Correspondent (1915-1920)

	Dependent Variable = Time Until Become a Federal Reserve Member		
	(1)	(2)	(3)
Trust Company		-0.419** [0.189]	-0.168 [0.213]
Clearinghouse Member		-0.548** [0.247]	-0.384* [0.222]
Distance to Nearest Federal Reserve City	-0.002 [0.002]	-0.002 [0.002]	-0.002 [0.002]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	0.127* [0.071]	0.138** [0.063]	0.167*** [0.063]
Assets/Assets in Member Banks Within 25 Miles	-1.306* [0.776]	-0.099 [0.846]	1.381 [1.164]
Number of Correspondents	-0.056 [0.058]	0.029 [0.068]	0.026 [0.061]
Share of Correspondents in Manhattan	0.633* [0.337]	0.561* [0.312]	0.582* [0.314]
Ln(Assets in 1914)			-0.261*** [0.096]
Sufficient Capital			-0.487** [0.232]
Loans/Assets in 1914			0.001 [0.667]
Avg Percentage Loan Swing Q3-Q4 1911-1914			-0.983** [0.417]
County Fixed Effects	Yes	Yes	Yes
Observations	727	727	727

Notes: Table contains the results of a log logistic survival duration model. The dependent variable is whether the state bank or trust company adopted a Federal Reserve membership in the subsequent year. All banks in the sample existed in 1914 and did not close before 1925. Counties that did not have any incumbent banks joining are dropped from the sample because county-fixed effects are included. The sample is the same as that used in Table 3 except that, as a robustness check, we also drop banks listed as another bank's correspondent. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 5: Log Logistic Survival Model of Joining Federal Reserve for Banks Not in Manhattan (1915-1920)

	Dependent Variable = Became Federal Reserve Member In Following Year		
	(1)	(2)	(3)
Trust Company		-0.572*** [0.161]	-0.497*** [0.181]
Clearinghouse Member		-0.703** [0.308]	-0.374 [0.332]
Distance to Nearest Federal Reserve City	-0.002 [0.002]	-0.002 [0.001]	-0.002* [0.001]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	0.101 [0.068]	0.132** [0.059]	0.162** [0.064]
Assets/Assets in Member Banks Within 25 Miles	-0.895 [0.734]	0.846 [0.841]	2.086 [1.274]
Number of Correspondents	-0.181*** [0.068]	-0.088 [0.062]	-0.084 [0.069]
Share of Correspondents in Manhattan	0.159 [0.479]	0.396 [0.387]	0.432 [0.372]
Any Respondents in 1915	-0.092 [0.266]	0.260 [0.225]	0.262 [0.254]
Ln(Assets in 1914)			-0.196 [0.125]
Sufficient Capital			-4.780*** [0.522]
Loans/Assets in 1914			0.333 [0.641]
Avg Percentage Loan Swing Q3-Q4 1912-1914			-1.014** [0.400]
County Fixed Effects	Yes	Yes	Yes
Observations	668	668	668

Notes: Table contains the results of a log logistic survival duration model. The dependent variable is whether the state bank or trust company adopted a Federal Reserve membership in the subsequent year. All banks in the sample existed in 1914 and did not close before 1925. Counties that did not have any incumbent banks joining are dropped from the sample because county-fixed effects are included. The sample is the same as that used in Table 3 except that, as a robustness check, we also drop banks located in Manhattan. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels,

Table 6: Cross-Section Logits Using Initial Values

	Dependent Variable = Became Federal Reserve Member In Specified Year					
	1915/1916		1917		1918/1919/1920	
	(1)	(2)	(3)	(4)	(5)	(6)
Trust Company	2.295*** [0.702]	2.348** [0.953]	1.023 [0.657]	0.606 [0.731]	-0.067 [1.250]	1.259 [2.037]
Clearinghouse Member	1.778** [0.739]	2.091** [0.971]	1.505* [0.769]	1.013 [0.896]	0.121 [1.125]	0.817 [2.273]
Distance to Nearest Federal Reserve City	0.009 [0.011]	0.009 [0.009]	-0.013*** [0.005]	-0.013*** [0.005]	0.258* [0.154]	0.219 [0.204]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	0.009 [0.471]	-0.162 [0.467]	-0.076 [0.145]	-0.171 [0.175]	6.311 [4.078]	4.953 [5.261]
Assets/Assets in Member Banks Within 25 Miles	4.270 [3.572]	1.774 [4.567]	1.509 [2.254]	-0.888 [2.855]	23.648 [15.916]	16.279 [28.945]
Number of Correspondents	-0.075 [0.189]	-0.155 [0.199]	-0.124 [0.214]	-0.218 [0.227]	-0.548 [0.538]	-0.651 [0.573]
Share of Correspondents in Manhattan	-1.770* [0.927]	-2.049** [0.929]	-1.250 [0.877]	-1.597* [0.917]	-2.637 [1.967]	-4.545* [2.394]
Any Respondents in 1915	0.999 [0.684]	-0.172 [1.101]	-0.700 [0.776]	-1.374 [0.914]	-0.122 [0.949]	1.403 [2.227]
Ln(Assets in 1914)		0.695 [0.520]		0.603 [0.398]		0.344 [0.995]
Sufficient Capital		-		0.624 [0.725]		-1.836 [2.512]
Loans/Assets in 1914		8.171** [3.457]		-1.505 [1.797]		5.271 [7.690]
Avg Percentage Loan Swing Q3-Q4 1912-1914		-5.292 [6.301]		0.597 [2.147]		20.107** [8.490]
County Values in 1920	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	No	No	No	No	No	No
Observations	232	232	204	204	170	170

Notes: Table contains the results of cross-sections logit models. The dependent variable is whether the state bank or trust company adopted a Federal Reserve membership in years listed in the column heading. The explanatory variables are then defined at the beginning of the specified period. For example, the values for the 1915/1916 column would be for 1915. All banks in the sample existed in 1914 and did not close before 1925. The sufficient capital variable cannot be included in 1915 because all banks had sufficient capital that converted. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 7: Logit Regression of Determinants of Joining the Federal Reserve Using 1915 Cross-section

	Dependent Variable = Became Federal Reserve Member By 1920		
	(1)	(2)	(3)
Trust Company		1.157** [0.525]	0.474 [0.579]
Clearinghouse Member		1.308* [0.728]	0.131 [0.790]
Distance to Nearest Federal Reserve City	-0.016 [0.027]	-0.017 [0.027]	-0.019 [0.027]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	-0.050 [0.233]	-0.168 [0.220]	-0.530* [0.301]
Assets/Assets in Member Banks Within 25 Miles	3.731 [2.462]	0.224 [2.769]	-9.836** [4.942]
Number of Correspondents	0.178 [0.150]	0.012 [0.185]	-0.022 [0.198]
Share of Correspondents in Manhattan	-1.217* [0.677]	-1.281 [0.798]	-1.618* [0.944]
Any Respondents in 1915	0.985* [0.557]	0.459 [0.600]	-0.992 [0.897]
Ln(Assets in 1914)			1.435*** [0.505]
Sufficient Capital			0.872 [0.759]
Loans/Assets in 1914			-0.830 [1.830]
Avg Percentage Loan Swing Q3-Q4 1912-1914			8.274** [3.767]
County Fixed Effects	Yes	Yes	Yes
Observations	170	170	170

Notes: Table contains the results of cross-sectional logit models. The dependent variable is whether the state bank or trust company adopted a Federal Reserve membership by 1920. Each bank only enters the model once with its values in 1915. All banks in the sample existed in 1914 and did not close before 1925. Counties that did not have any members created are dropped from the sample because county-fixed effects are included. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 8: The Effects of Becoming a Federal Reserve Member (1915-1924)

	Percentage Loan Swing Q3-Q4	Cash/Assets	(Due-from Banks + Due- from Fed)/ Assets	Loans/Assets
	(1)	(2)	(3)	(4)
Federal Reserve Member in Year	-0.019** [0.009]	-0.015*** [0.003]	0.020*** [0.006]	0.042*** [0.014]
Clearinghouse Member	0.025** [0.010]	0.004 [0.004]	-0.012* [0.006]	-0.001 [0.015]
Distance to Nearest Federal Reserve City	-0.001 [0.001]	-0.001 [0.001]	-0.001 [0.001]	0.001 [0.001]
Ln(Assets in Federal Reserve Banks Within 25 Miles)	0.004 [0.012]	-0.003 [0.003]	-0.026*** [0.009]	0.018 [0.019]
Assets/Assets in Member Banks Within 25 Miles	-0.020 [0.046]	-0.033** [0.017]	-0.102** [0.050]	-0.120 [0.099]
Number of Correspondents	-0.005* [0.003]	0.002 [0.002]	0.003 [0.002]	-0.011*** [0.004]
Share of Correspondents in Manhattan	0.015 [0.022]	0.002 [0.006]	-0.008 [0.013]	0.023 [0.024]
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,200	2,200	2,200	2,200

Notes: Table contains the results of an OLS model. The dependent variable is defined in the head of each column. All banks in the sample existed in 1914 and did not close before 1925. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 9: The Effects of Becoming a Federal Reserve Member on Correspondent Banks and Noncorrespondent Banks (1915-1924)

	Not Listed in Rand McNally as Correspondent of State Bank			
	Percentage Loan Swing Q3-Q4	Cash/Assets	(Due-from Banks + Due-from Federal Reserve)/ Assets	Loans/Assets
	(1)	(2)	(3)	(4)
Federal Reserve Member in Year	-0.008 [0.010]	-0.016*** [0.004]	0.020*** [0.006]	0.048*** [0.015]
Bank and Balance Sheet Characteristics	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,940	1,940	1,940	1,940
	Listed in Rand McNally as Correspondent of State Bank			
	Percentage Loan Swing Q3-Q4	Cash/Assets	(Due-from Banks + Due-from Federal Reserve)/Assets	Loans/Assets
	(1)	(2)	(3)	(4)
Federal Reserve Member in Year	-0.052*** [0.018]	-0.006 [0.013]	0.018 [0.017]	-0.022 [0.025]
Bank Characteristics	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	260	260	260	260

Notes: Table contains the results of an OLS model. The dependent variable is defined in the head of each column. All banks in the sample existed in 1914 and did not close before 1925. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels, respectively.

Table 10: The Effects of Becoming a Federal Reserve Member (1915-1924)

	Percentage Loan Swing Q3-Q4	Cash/Assets	(Due-from Banks + Due-from Federal Reserve)/Assets	Loans/Assets
	(1)	(2)	(3)	(4)
First Year of Fed Membership	-0.001 [0.017]	-0.013** [0.005]	0.001 [0.006]	0.042*** [0.013]
Second Year of Fed Membership	-0.018 [0.011]	-0.019*** [0.005]	0.011* [0.006]	0.059*** [0.016]
Third Year of Fed Membership	-0.037*** [0.011]	-0.016*** [0.005]	0.021*** [0.006]	0.059*** [0.017]
Fourth Year of Fed Membership	-0.039*** [0.014]	-0.012*** [0.003]	0.027*** [0.007]	0.048*** [0.016]
Fifth Year of Fed Membership	-0.030** [0.014]	-0.016*** [0.004]	0.031*** [0.007]	0.028* [0.016]
Bank Characteristics	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,050	2,050	2,050	2,050

Notes: Table contains the results of an OLS model. The dependent variable is defined in the head of each column. All banks in the sample existed in 1914 and did not close before 1925. Banks are dropped when they have been a Federal Reserve member for more than five years. Dollar values are deflated to 1920 using Officer (2008). Robust standard errors appear in brackets beneath the coefficients. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent levels.