Liquidity Risk, Bank Networks, and the Value of Joining the Fed

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Abstract
Reducing systemic liquidity risk related to seasonal swings in loan demand was one reason for the founding of the Fed. Existing evidence on the post-Fed 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 Fed in its first decade. Some have speculated that non-members could avoid higher costs of Fed reserve requirements while still obtaining access indirectly to the Fed discount window through contacts with Fed 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 Fed. 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 Fed system and the effect of Fed membership on its lending behavior. We also find that indirect access to the Fed was not as good as direct access. Fed member banks saw a greater increase in lending than non-member banks.

January 2015

JEL Codes: G21, G28, N22

Keywords: Fed member banks, bank networks, liquidity risk

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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. But what if some market players – typically referred to as “shadow banks” – avoid regulation while still enjoying the benefits of protection?

This is not a new problem. The Federal Reserve System was founded in 1913 to stabilize the American banking system by offering banks access to its discount window. When the Federal Reserve System was created, the Fed imposed reserve requirements and other regulations on members to ensure that banks would not take advantage of systemic protection to take undo risks. But the Fed found that many banks chose not to join its system, precisely to avoid its regulatory requirements. Indeed, less than eight percent of all state-chartered banks (which had the option to remain outside the Fed system) chose to join the Fed during its first decade of operation.\(^1\) Many observers, including Fed officials, politicians, and scholars, speculated that non-Fed member state-chartered banks were able to enjoy the benefits of Fed liquidity provision through indirect pass-throughs of discount window lending within the interbank network. In that sense, the Fed membership problem of the early 20\(^{th}\) century is considered an early example of the moral hazard problem of shadow banking. However, prior to this study, there has been no quantitative analysis of the decisions by state-chartered banks to join or not join the Fed, or of the ability of non-Fed member banks to gain indirect access to the discount window through interbank lending.

\(^1\) 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 Fed as of the Annual Report of the Federal Reserve Board (1925).
The creation of the Fed was intended to resolve the instability of the American banking system. The pre-Fed era was characterized by high volatility of loan interest rates at seasonal frequency and frequent episodes of banking panics. Pre-Fed banking crises were not random, either from a cyclical or a seasonal perspective. All banking panics of the pre-Fed era occurred at seasonal loan-demand peaks (spring and fall) that were also near business cycle peaks (Calomiris and Gorton 1991). At moments of high seasonal demand for lending, banks were relatively highly levered and had larger than normal loan-to-asset ratios, both of which implied higher risks of insolvency and illiquidity. With respect to cyclical timing, the pre-Fed panics occurred whenever the quarterly (seasonally adjusted) liabilities of failed businesses equaled or exceeded 50% and the decline in stock prices equaled or exceeded about 8%. As contemporary observers recognized, banking panics in the U.S. were the result of the coincidence of sufficiently bad news about bank loan quality with sufficient bank balance sheet exposure to the insolvency and illiquidity risks implied by those prospective losses (seasonal highs in leverage and loan-to-asset ratios).

The National Monetary Commission— which was charged with developing a response to the problem of banking panics in the U.S. — commissioned studies of the banking system in the United States and other countries. Those clearly documented the greater instability of U.S. banking and specifically pointed to the fragmented nature of the U.S. "unit" (single-office)

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2 Calomiris and Gorton (1991) define six major panics that were large enough to generate information externalities and sufficient to motivate discussion of collective action by members of the New York Clearing House. Three of those six major banking crises (in 1873, 1893, and 1907) saw widespread suspension of the convertibility of deposits; the other three (in 1884, 1890, and 1896) saw banks contemplating or engaging in collective action to prevent potential suspension.

3 See Hanes and Rhode (2013) for an analysis of the crop cycles that accounted for the seasonal pattern of loan demand in the United States during this period.
banking system as a contributor to its vulnerability to cyclical and seasonal variation. But the Commission knew that the fragmented U.S. banking structure was politically untouchable. The Commission did, however, believe that it was possible to attenuate at least some of the liquidity risk that resulted from seasonal swings in loan demand, and this became a central motivation for the establishment of the Federal Reserve System.

As envisioned by the Fed’s founders, the Federal Reserve Banks would be reservoirs of member bank reserves during times of low demand for loans and money and a source of additional reserves (via either lending to members or buying assets from them) during periods of high demand for credit and currency. The option to borrow would flatten the loan-supply function at times of seasonal stress, resulting both in lowered liquidity risk and less of a seasonal swing in interest rates.

There was good reason to believe that the proposed Federal Reserve System would reduce liquidity risk and prevent disruptions of the financial system prior to founding the Fed. The shocks that triggered pre-Fed panics were moderate compared, for example, to the shocks suffered in 1837-1839 or the 1930s; panics spread due to uncertainty about banks’ exposure to shocks that could undermine individual institutions but that did not threaten the solvency of the

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4 For example, Canada, which was the subject of three National Monetary Commission volumes, was also an agricultural economy and displayed high variation in seasonal loan demand. But its system of nationwide banks managed cyclical and seasonal risks without ever suffering a panic (Bordo et al. 2014, Calomiris and Haber 2014, Chapter 9). Canadian banks were better diversified, and thus there was less opportunity for moderate shocks to threaten the solvency of a major bank. Furthermore, because Canadian banks operated nationwide networks of branches their western (agricultural) branches did not suffer the same seasonal liquidity risks of western and southern banks in the U.S. Finally, in Canada, when concerns about uncertainty of bank losses arose, the small number of nationwide banks was able to manage the uncertainty by coordinating actions (included two selective bailouts via the collective acquisition of the failed banks, orchestrated by the Bank of Montreal) to stem depositors’ concerns. In the U.S., agricultural banks had to rely on interbank networks of distant banks to provide liquidity, and when systemic problems arose it was virtually impossible to coordinate the resolution of the liquidity problems of separate banks across vast distances.

5 In the presence of the Fed, banks have a new means of reacting to shocks that raise liquidity risk other than recapitalization or loan liquidation. The banking system thus avoids magnifying loan loss risk by creating a scramble for liquidating assets at a time of high leverage. The flattening of the loan-supply function means that variation in loan demand, seasonally or cyclically, should result in greater variation in the quantity of lending and lower variation in interest rates.
aggregate financial system. While interest rates spiked and the payment system froze, few banks failed, and losses to creditors were small. The Panic of 1893 saw the worst depositor losses, which were roughly 0.10% of U.S. GDP. The depositor losses on average during each year of the Great Depression (1930-1933) were several times larger.⁶

Empirical evidence indicates that the Fed accomplished the central mission of increasing the seasonal elasticity of money and credit. Miron (1986) showed that the Fed’s founding was associated with reduced seasonal variability of interest rates and increased seasonal variability of lending.⁷ Bernstein et al. (2010) provide additional evidence that the Fed reduced seasonal liquidity risk. They compare the standard deviations of stock returns and short-term interest rates over time in the months of September and October (the two months of the year when markets were most vulnerable to a crash because of financial stringency from the harvest season) with the rest of the year before and after the establishment of the Fed. Stock volatility in those two months fell more than 40 percent and interest rate volatility more than 70 percent after the founding of the Fed. They also show that this result is driven by years in which business cycles peaked. In other words, the main risk that the Fed’s founding eliminated was associated with combined cyclical peaks in economic activity and seasonal peaks in lending – precisely the circumstances that had given rise to the panics of the pre-Fed era.

⁶ The 9,096 banks that failed during the years 1930–1933 represented 37 percent of the banks in existence at the end of 1929 and 14 percent of the average level of bank deposits over the years 1930–1933; losses borne by depositors in these failed banks were roughly $1.3 billion, representing 2.7 percent of the average amount of deposits in the banking system for the years 1930–1933, and 2 percent of average annual GNP for 1930–1933. (Deposits and failures data are from the Federal Reserve Board’s data in Banking and Monetary Statistics: 1914–1941 (1943), using suspensions as the measures of failures. Nominal GNP is from the U.S. Department of Commerce’s Historical Statistics of the United States, Vol. I, 1970.) From the perspective of these comparatively large losses, it is not surprising that the Fed was unable to prevent panics or massive bank failures during the Great Depression, many of which occurred in agricultural areas experiencing severe adverse loan losses. Of course, the worst macroeconomic shocks of the Depression reflected errors of monetary policy, which were themselves a product of the Fed. Furthermore, there is evidence that the Fed could have done more than it did to combat liquidity risk during the 1930s (see Richardson and Troost 2009, and Carlson, Mitchener and Richardson 2014).

⁷ For additional evidence relating to expectations and the term structure of interest rates, see Mankiw and Miron (1987).
Despite this success, the Fed was unable to accomplish some of the major objectives envisioned by its founders, namely, universal bank membership in the Fed and the elimination of interbank deposits and reserve pyramiding in New York City. The use of interbank deposits as bank reserves continued after the founding of the Fed, owing to features that limited state-chartered banks’ interest in joining the Federal Reserve. These disincentives included the fact that the Fed did not pay interest on bank deposits, unlike money-center commercial banks in New York, Chicago, and elsewhere that paid about 2%. In many states, the Fed also required higher reserve requirements than those imposed by state governments on non-Fed member banks. Further discouraging state banks from joining the Fed was the fact that non-member banks could indirectly benefit from the existence of the Fed without joining. Non-member banks were able to access the Fed’s discount window by passing their eligible paper through correspondent banks operating in reserve and central-reserve cities.

This paper seeks to understand why many state-chartered banks chose not to join the Fed during the first decade of the Fed’s operation, and in particular why some joined immediately while others waited several years. To our knowledge, there has been no micro-econometric analysis of the causes and consequences of state-chartered banks’ decisions to join, or not join, the Federal Reserve System. This paper provides such analysis, focusing on the decisions of state-chartered New York banks during the period 1915 to 1924.

We investigate whether and how banks whose characteristics differed in important ways (specifically with respect to banks’ exposures to liquidity risk, as well as their sizes, locations, and lending niches) had different propensities to join the Fed. Our empirical model identifies the extent to which banks differed with respect to the value of Fed membership. For example, we examine whether banks whose borrowers experienced high variation in seasonal loan demand
anticipated benefits of liquidity risk reduction from joining the Fed. We find that the banks with high loan-demand seasonality, which presumably stood to gain the most from joining the Fed, joined earlier than others.

We also investigate how differences in banks’ positions within the correspondent network affected their decisions to join the Fed. Some banks, by virtue of their size and geographic location, were positioned to be able to get easier access to the pass through of Fed liquidity without having to join the Fed. Small banks operating in close proximity to many Fed member banks thus should be less likely to join the Fed, ceteris paribus, because they were able to gain easy indirect access to the Fed’s discount window. Conversely, large banks that occupied important positions in the interbank network as takers of deposits should have seen Fed membership as particularly valuable means of attracting the deposits of non-member banks, and therefore, should have been among the first to join the Fed. Our empirical analysis supports all of these hypotheses.

With respect to the consequences of chartering the Fed, we are able to measure the extent to which member banks used the Fed’s facilities to meet their liquidity needs. We examine the changes in lending activities of banks, before and after the creation of the Fed, both for Fed members and non-members. In doing so, we are able to distinguish between the advantages of operating in a banking system that included the Fed from the advantage of actually joining the Fed. We find that non-Fed members were not able to enjoy all the benefits of access to the Fed’s discount window, as members saw greater increases in lending. Clearly, there were limits to the benefits that a non-member could obtain through indirect access to the discount window. In particular, we consider whether practical constraints limited the ability of member banks to pass through the benefits of access to the discount window. For example, we investigate whether a
small non-member bank located in a city populated by many large Fed member banks was able to enjoy greater pass through benefits than a large non-member bank (with consequently larger rediscounting needs) located far from member banks.

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 Fed’s founding with special emphasis on regulatory differences between New York state banks that chose to join the Fed 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 (Section 4) and its consequences (Section 5). Section 6 concludes.

2. Dual Banking, Fed Membership, and the Fed’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. By the time of the Federal Reserve Act, state-chartered and national banks had developed inter-connected networks of banks operating throughout the country. While banks in most states could not branch outside their local area, their networks linked banks across states through the correspondent network through which banks deposited reserves in each other and borrowed from one another.

State banks and trust companies were regulated by state legislatures. These institutions generally had lower minimum capital and minimum reserve ratio requirements than national banks, but did not issue bank notes due to a prohibitive tax of 10% per year on their outstanding bank notes. National banks were regulated by the Comptroller of the Currency. These banks had
relatively high requirements, could issue national bank notes (subject to holding Treasury securities as backing), but could not issue mortgage loans.\(^8\)

The National Monetary Commission’s final report focused on flaws in the dual-banking system. The letter transmitting the final report to Congress summarized seventeen “principal defects in our banking system (National Monetary Commission 1912 p. 6).” Thirteen of the seventeen defects related to what economists now refer to as liquidity risk.\(^9\) The Commission also highlighted the fragmented and inefficient U.S. banking system. The nation lacked 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. Many institutions charged fees for checks sent through the clearing system. These exchange charges provided substantial streams of revenue for many banks, particularly those operating in small towns and rural areas.

The Commission analyzed how banks could obtain liquidity. Banks had two options, but both were limited. First, they could obtain funds through membership at a nearby clearing house. Private clearing houses, however, were limited to individual cities, and only extended liquidity to members through the collective issuance of debt during panics (Cannon 1910, Timberlake 1984, Calomiris and Carlson (2014) show that national banks were able to issue substantial amounts of mortgage loans despite the prohibition by taking mortgages as secondary collateral after loan origination.

\(^8\) Calomiris and Carlson (2014) show that national banks were able to issue substantial amounts of mortgage loans despite the prohibition by taking mortgages as secondary collateral after loan origination.

\(^9\) The first defect was immobility of cash reserves in times of trouble. The fifth was the lack of an organization larger than a city clearing house which could coordinate actions “to prevent panics or avert calamitous disturbances affecting the country at large.” The sixth and seventh related to the lack of a lender of last resort which could shift reserves from one state to another to prevent “disastrous disruptions” of the payments system, or deal effectively with international gold and currency flows during financial crises. The eight through twelfth pointed to the illiquidity of financial assets, particularly short-term commercial paper, during periods of seasonal strain or financial crises. All of these points related to liquidity risks posed by periods when commercial banks could not access reserves, sell assets, cooperate effectively, counteract interregional or international flows, or rely on a lender of last resort. Some of those institutional flaws also prevented banks from meeting normal or unusual seasonal demands for cash and credit. This problem was the focus of the Commission’s third and fourth points (as well as points eight through fourteen), which described the inelasticity of the money supply, reflected in the lack of money supply variation in response to seasonal expansions and contractions of the economy.
Gorton 1985). Second, they could obtain funds from each other either through the sale of assets or via the correspondent network – that is, by withdrawing interbank deposits or by borrowing from one another. The National Banking Acts required national banks to hold a substantial fraction of their reserves in defined reserve and central reserve cities.\footnote{Country national banks had to hold a reserve of 15 percent of which three-fifths could be on deposit in a reserve city or central reserve city national bank. Reserve city national banks had to hold a reserve of 25 percent but again could deposit three-fifths in a central reserve city. Finally, central reserve cities had to hold a 25 percent reserve in vault cash. County banks were also required to redeem their notes at par in a reserve city and reserve city banks were required to redeem their notes in a central reserve city. Calomiris, Carlson, Jaremski, and Park (2014) 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.} Because the pyramid structure concentrated money in financial centers it magnified the extent to which regional and seasonal shocks spilled over to affect the entire country.

Liquidity provision was linked to the payments system. Clearing houses cleared members’ checks and held balances from members to facilitate these transactions. This ongoing relationship provided the foundation for the extension of credit during times of seasonal or cyclical stress. 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. These deposits served as part of their legal reserves, received interest (typically 2%), and enabled respondents to deposit checks for clearing.

The Federal Reserve was created to solve the problems identified by the National Monetary Commission. The Federal Reserve would operate a nation-wide and more efficient payments system, as well as create an elastic currency, a market for banks’ eligible assets, a money supply that expanded at seasonal peaks, 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 could be required to join the Fed. State-chartered banks and trust companies were
permitted, but not required, to join. To join the Fed, state-chartered banks and trusts had to subject themselves to Fed regulatory requirements, most notably minimum bank size (capital) requirements (not to be confused with minimum capital ratio requirements), zero-interest reserve requirements, purchase stock in the Federal Reserve Bank, and sundry other regulations (e.g., the requirement that member banks clear checks at par).

The Federal Reserve Board, however, expressed its hope that it would develop a unified system of banking:

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).

Despite that stated desire, state banks were slow to join. As shown in Figure 1, only 37 of the over 8,500 state-chartered banks joined the Federal Reserve by the end of 1916. The number of state-chartered bank members grew during the next year, but it was not until 1918 that entry became substantial. The number of state bank members grew to 938 members by the end of 1918 and 1,486 by 1920.

Why did so few state-chartered banks join the Fed after it began operations in November 1914? First, there were short-term operational problems at the time of the Fed’s founding. World War I and the ensuing financial panic forced the Fed to begin operations months earlier than anticipated, under wartime conditions, and before the Fed had a chance to establish a check-clearing system. This exigency led to a prolonged period of initial adjustment, as the Fed struggled to get operations up to speed and the Federal government imposed various wartime

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11 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).
tasks upon the Fed. During this shake-out period, most state banks adopted a wait and see approach, trying to judge the benefits versus the costs of membership and remaining unwilling to expend the fixed costs of membership.

Second, during World War I, another major attraction of Fed membership – access to the discount window – was not reserved only for Fed members. Congress amended the Federal Reserve Act to compel the Reserve Banks to accept war bonds as collateral for discount loans and to enable non-member banks to borrow directly from the discount window.\textsuperscript{12} After the war, member banks were given exclusive access to the discount window, as originally envisioned The Federal Reserve Board also tried to block non-members from indirectly accessing the window by prohibiting member banks from bringing loans to the window that had been originated by non-member institutions.

The Fed’s check clearing rules may have reduced banks’ gains from membership initially, but by early 1917, the Fed had successfully forced all New York banks – members and non-members alike – to clear checks at par, thus removing the cost of adhering to par check clearing regulation from the list of potential influences on the membership decision.\textsuperscript{13} The Fed forced banks to join the par system by holding all checks drawn on non-par institutions for several months. After accumulating checks worth substantial sums, the Fed sent an agent to

\textsuperscript{12}During World War 1, it was also the case that the seasonality of lending diminished because of the issuance of war loans and contracts (foreign and domestic), and due to the rationing and price controls imposed by the Federal government. This also temporarily diminished the attractiveness of Fed membership.

\textsuperscript{13} The Fed’s founders envisioned the creation of a universal par check-clearing system. The Fed would absorb clearing houses in the cities where it operated and would clear checks for all banks in the nation. The checks would clear at face value. Banks would not be permitted to deduct fees from checks routed through clearing houses or the mail, rather than presented at their counter. These exchange charges, however, were a substantial source of revenue for many state-chartered banks. Those banks did not want to forgo this profitable activity. In the Fed’s early years, it seemed as if they would not have to. Several banks in Manhattan, including the Guaranty Trust Company, offered to establish clearing accounts for country clients, pay 2 percent interest on the balances, and allow exchange charges. The Fed countered these plans, eventually promising to clear all checks for free, establishing programs to teach banks how to structure their fees to make up for lost exchange charges, and creating national and district par lists. The par lists indicated all banks that had agreed to forgo exchange charges, whether members of the system or not.
present those checks at the banks’ counters, where they had to be cleared immediately in cash at face value. This practice forced non-par banks to keep large sums of cash in their vaults. By July 1917, all banks in the district had joined the par list, eliminating exchange charges as a reason to eschew Fed membership. Other Federal Reserve Banks behaved similarly throughout the United States.

The Fed’s zero-interest reserve requirements were viewed as one of the primary factors in banks’ membership choices. Requirements were loosened by an amendment to the Federal Reserve Act passed in June of 1917, but remained costly for many banks in comparison to the zero-interest reserve requirement costs for non-member banks. The 1917 Amendment required member banks to hold all required reserves at the Fed, rather than only a fraction of required reserves under the prior requirements (see Table 1). At the same time, the 1917 Amendment reduced the value of required reserves on demand deposits by 5 percentage points, and on time deposits by 2 percentage points, across all banks. The 1917 Amendment also codified the Fed’s administrative regulations concerning state bank members. While the Board states the section was “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” (1917, p. 502).

Although membership increased a bit after 1917, Fed membership remained far from universal. As Figure 1 shows, even at its height, membership represented only a third of all the commercial banks in the nation and less than eight percent of banks that had the choice to join. The participation rate was particularly low for small country banks in agricultural regions. A joint Congressional Committee was, therefore, organized in 1920 to investigate the low adoption
rate. The committee identified three major reasons for the behavior. First, (as White 1983 would later echo), in spite of Fed efforts to limit indirect access to the discount window by non-members, banks were able to circumvent those limits and access cash related to their seasonal or cyclical needs through correspondent banks that were members of the Federal Reserve System, thus escaping the burdens of actual membership. Second, by keeping their reserves at a correspondent bank that paid interest rather than the Federal Reserve Banks that paid nothing, banks could turn a profit from reserves. Finally, the returns to stock investments in the Fed were not considered remunerative enough to induce small banks to join.

Table 1 presents the requirements facing Federal Reserve state member banks (i.e., state banks and trust companies that voluntarily subjected themselves to the Fed's requirements) and non-member New York state banks (i.e., state banks and trust companies that were under the state's requirements) in 1915 before the aforementioned Amendment of 1917. Minimum capital requirements were somewhat higher for state member banks in larger cities, but the constraint most often did not bind in those cities because of the economic advantages of larger bank size.

The most important discrepancy between the two sets of regulations seems to have been reserve requirements. For starters, state non-member banks were required to hold deposits against only demand deposits, whereas state member banks were required to hold deposits against demand and time deposits. The Fed also forced member banks to deposit reserves with the Fed instead of allowing them to be deposited with a qualified correspondent (typically earning 2% interest rather than zero).

The amount of required reserves for state member banks were generally lower than those for non-member state-chartered banks in New York, but the amount of zero-interest reserves (the

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14 Congressional Quarterly (1923). 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.
sum of required cash on hand plus reserves held at the Fed) generally were higher for member banks. For example, for a bank operating in a non-reserve city (such as Rochester) with $1 million in demand deposits and $200,000 in time deposits, its total zero-interest required reserves as a Fed member would be $(0.12)(1.00)\times1,000,000 + (0.05)(1.00)\times200,000 = $120,000 + $10,000 = $130,000$. For that same bank, its zero-interest required reserves as a non-member bank would be $(0.15)(0.40)\times1,000,000 = $60,000$. For a similarly situated bank in a reserve city (either Albany or Brooklyn prior to 1917, with the addition of Buffalo in that year), its zero-interest required reserves as a Fed member would be $(0.15)(1.00)\times1,000,000 + (0.05)(1.00)\times200,000 = $160,000$, whereas as a non-member its zero-interest required reserves would again be $60,000$. For that same bank operating in Manhattan (the only central reserve city), Fed membership would require it to hold zero-interest reserves equal to $(0.18)(1.00)\times1,000,000 + (0.05)(1.00)\times200,000 = $180,000 + $10,000 = $190,000$, compared to $(0.25)(0.60)\times1,000,000 = $150,000$ if it were a non-member bank. Thus, for most banks in New York, with the important exception of banks located in New York City, Fed reserve requirements were much more costly than those required by the state. In New York City, Fed zero-interest reserve requirements were greater, but not dramatically so.

The Amendment of 1917 lowered the zero-interest required reserves of banks – which presumably helped to spur the growth of membership in 1918-1920 shown in Figure 1– for most New York state-chartered banks located outside New York City; however, the Fed’s rules on zero-interest required reserves were still significantly more costly than the rules for non-member banks. For example, for the aforementioned bank operating in Albany, its zero-interest required reserves as a Fed member bank were now $(0.10)\times1,000,000 + (0.03)\times200,000 = $106,000$, which
is still substantially greater than the $60,000 zero-interest reserve it was required to maintain as a non-Fed member bank.

As a simple test of the importance of zero-interest reserve requirements in discouraging Fed membership, we estimated the amount in saved zero-interest required reserves relative to assets that each New York state-bank stood to gain from not becoming a Fed member in 1917 (before the Amendment) and in 1920. We define $\text{ResReqGain}$ as the difference between the amount of zero-interest required reserves a subject bank would have to hold as a Fed member and what it would have to hold as a non-member (note that for some banks, such as those in New York City after 1917, this could be a negative number). We then compute the estimated amount of $\text{ResReqGain}$ as a fraction of total assets for each bank, $\frac{\text{ResReqGain}}{\text{Assets}}$.$^{15}$ Finally, we compute the average of $\frac{\text{ResReqGain}}{\text{Assets}}$ for member banks and non-member banks. We find that the average value of that ratio for banks that had joined the Fed by 1917 is 2.21%, compared to 4.00% for banks that had not joined the Fed by that date. After 1917, $\frac{\text{ResReqGain}}{\text{Assets}}$ declined for all banks as a consequence of the Amendment. The average value for banks that had joined the Fed by 1920 is -1.15%, compared to 0.86% for banks that had not yet joined the Fed.$^{16}$ Clearly, on average, the banks that chose to remain outside the Fed stood to lose more from Fed requirements that forced them to hold zero-interest reserves than the banks that chose to join the Fed. The Amendment of 1917 reversed the relative costliness of Fed reserve requirements for some banks, many of whom chose to join the Fed. The effect on state-chartered banks in New York City was relatively strong. In New York City, 62% of state banks had joined the Fed by

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$^{15}$ To compute $\text{ResReqGain}$ we must impute total amounts of time and demand deposits for each bank. Bank records of individual banks only give total deposits, so we used the state-level aggregate amounts of time and demand deposits to estimate the amount of each for each bank.

$^{16}$ The values for 1918 and 1919 are nearly identical to those for 1920.
1920 (up from 2.7% in 1916), compared with only 23% of state banks outside New York City (up from 0% in 1916).

Although the cost of Fed reserve requirements was clearly a major contributor to state banks’ reluctance to join, it was only one side of banks’ cost-benefit analysis. Much of the variation in membership choice remains to be explained, both within the group of banks operating outside of New York City and within New York City banks. Presumably that variation in membership choice within groups of banks that faced similar reserve requirement tradeoffs largely reflected bank-specific differences in the benefits of Fed membership.  

We explore those in Section 4 below.

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 inspections of all financial intermediaries that held a state charter. 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 which were present before the Federal Reserve was created.

There are clear reasons for focusing the analysis on a single state. The costs and benefits of Fed membership likely depended upon regulations under which state-chartered banks

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17 We recognize, of course, that the costliness of reserve requirements may also have varied within the bank groups as a consequence of their lending opportunities: banks with more profitable lending opportunities would have found zero-interest reserve requirements more of a burden. Consistent with that view, as shown in Table 2, banks that were among the first to join the Fed (by 1915) tended to have lower loan-to-asset ratios in 1914 than those that chose not to join the Fed.
operated. For example, where state banks faced lower reserve requirements, then the decision to become a Fed 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.

Given the advantages 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 that are likely to have mattered for understanding how different banks’ circumstances affected state-chartered banks’ decisions to join the Fed, and the consequences of those decisions.

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 one other state. 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. These country banks in turn held reserves at larger banks, generally Fed 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 was the financial center in 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.

Fifth, the correspondent network of New York is more accurately estimated than the networks of the other states. Lacking information on the specific balances that each bank kept at other banks, most studies use the list of correspondents drawn from the various bank directories of the times. While listed banks were almost always accurate, the directories tended to list New York City banks ahead of others and often could not include all correspondents due to space constraints. That biases the picture of interbank networks in most states. For example, in the case of Illinois, where the preservation of state examination reports permits us to examine correspondent balances, banks kept the majority of funds in the nearest reserve city. However, this problem does not arise for New York state; because New York was the nearest reserve city for all banks in the state, bank directories should generally provide a complete picture of the structure of New York banks’ correspondent relationships.

The potential disadvantage of New York is that New York City banks had different opportunities and regulations relative to other banks. Any analysis of New York banks’ behavior thus 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 importance
differences, we employ location-specific controls in some specifications, and in others, we split the sample to distinguish between those located in and outside New York City.

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. We then matched these lists to the balance sheet data, creating a dummy variable for whether the bank was a member in the given year. Figure 2 presents a map showing the locations of the 81 of 267 state-chartered institutions in the sample that joined the Fed 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 the state and down the East side follows the old Erie Canal and the later railroads that replaced it. Figure 3 displays the timing of new Fed 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 clearing house 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). While 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 costs and benefits of joining the Fed varied during its first decade, as the Fed altered policies to aid the war effort and promote membership. Key changes occurred in 1917, when the Fed imposed the par clearing system and lowered member bank reserve requirements, and at the end of the war, when the Fed closed the discount window to non-members and adopted policies that impeded correspondents from discounting paper originated by non-member banks. The costs and benefits of membership also varied across banks with different characteristics, including location. It is important that any model of Fed membership choice take account of differences across time, location, and bank circumstances.

The first prominent explanation for joining the Fed 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 across 1912, 1913, and 1914.\(^{18}\) The benefit of access to Fed 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 Fed. We thus control for whether the bank was a member of the local clearing house and 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 Fed banks and the relative size of the bank to capture a bank’s ability to sell acceptances through the secondary market. Note that clearing houses also offered a source of liquidity, which might have reduced the benefits of Fed membership, making clearing-house members less likely to join the

\(^{18}\) While 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.
Fed. But, throughout the United States and in New York in particularly, clearing-houses supported the creation of the Federal Reserve, urged members to join, and in New York City, eventually transferred many of their functions to the Federal Reserve Banks.

A major part of the attraction of Fed membership to clearing house members in New York City and other money centers was that Fed membership enhanced the role that these banks could play as nodes in the correspondent network. As such they may have seen greater advantages from joining the Fed, in particular if they were able to act as intermediaries channeling the benefits of access to the Fed’s discount window to non-member country banks. Thus, it is important to consider how a bank’s position as a “due-to” intermediary of interbank deposits (that is, a bank receiving substantial deposits from other banks) affected its decision about Fed membership. A high proportion of “due-to” balances was highly correlated with clearing house 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-throughs of discount window access, we devote considerable attention to determining each bank’s position in New York’s correspondent network. As Figure 4 shows, as of 1915, correspondent banks were almost exclusively located in a handful of important cities in New York. Figure 5 shows the structure of the interbank network as of 1920. Virtually all banks had a correspondent relationship with one or more banks in New York City (Panel A). In other significant New York cities (Albany, Buffalo, Rochester, Syracuse, and Troy) a hub and spoke pattern in visible, where “due-to” banks had correspondents within their regions. In some other cities, “due-to” banks had one or two correspondent relationships with nearby banks.
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 of another bank in the state.\footnote{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.} 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 clearing house membership indicator to control for the extent of existing interbank clearing relationships. Because clearing houses provided emergency liquidity and check clearing services, clearing house banks often attracted more interbank deposits than other banks. The clearing house variable thus captures opposing influences. If being a clearing house member makes banks more likely to adopt Fed membership, that evidence suggests that interbank networks for discount window “pass-through” were an important consideration. Alternatively, if clearing house membership makes banks less likely to adopt, that evidence suggests a lesser role for pass-through, and the relative importance of access to emergency liquidity from the clearing house as a substitute for Fed 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 which we take into account. The capacity of a bank to bear the fixed costs of becoming a Fed member also plays a role in its decision. While New York State regulations were amongst the most stringent in the country, adoption of a membership still came with additional compliance costs. Large banks would have been better able to shoulder the additional compliance burden of Fed
membership, implying that size per se should be correlated with Fed membership. As noted above, we must also control for location, which mattered for determining the costs of Fed reserve requirements. Locational factors also likely influenced the adoption rate for other reasons (e.g., differences in the opportunity cost of lending, the mix of deposits and hence reserve requirement costs, or local political factors that favored/discouraged membership).

4.1. Empirical Specifications

Modeling a bank's decision to become a Fed 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 Fed membership. We take several steps to minimize this endogeneity problem. First, as noted above, we examine only state banks and trust companies that were in existence in 1914. This removes institutions whose entry might have been influenced by the availability of Fed membership. 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 Fed in the following year – and we drop observations after a bank became a Fed member in order to capture the membership decision and not changes made after the decision.

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20 For instance, several banks that entered after 1914 immediately adopted Fed membership.
21 It is worth noting that all the banks in our sample that became Fed members remained Fed members for the remainder of our sample period. Only two banks in New York adopted and then dropped their membership in New York during the period. Neither of those banks were in existence in 1914 and so neither is in our sample.
Our base-line specification uses a log-logistic survival model to examine the determinants of joining the Fed for the period 1915-1920. Each bank enters the model in 1915 and exits when it became a Fed 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. The model has the function of:

\[ \text{BecomeMember}_{i,t} = fn(\beta_1 Z_{i,t} + \beta_2 X_{i,1920} + \beta_3 BS_{i,1912-14} + e_{i,t}) \] (1)

where \( \text{BecomeMember}_{i,t} \) is a dummy variable denoting whether the institution became a Fed member in the subsequent year, \( Z_{i,t} \) is a vector of bank-specific characteristics, \( X_{i,1920} \) is a vector of county-characteristics taken from the Census in 1920, \( BS_{i,1912-14} \) is a vector of balance sheet items from the pre-Fed era. We estimate the model alternating between including the county-characteristics and county-fixed effects. 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 Fed members before 1920.

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 clearing house member, the number of miles the bank was from a Fed district bank, the number of correspondents listed in the bankers directories, the share of listed correspondents of the subject bank in Manhattan, an indicator

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22 While we have membership and balance sheet data through 1924, only one state bank in existence in 1914 became a Fed member between 1920 and 1924. Rather than attach excessive weight to this single observation, we drop the remaining years from the sample.

23 The dates for the variables included in the \( BS_{i,1912-14} \) vector vary. Assets are measured in 1914. Loans/assets and seasonal loan swing are averages for the period.

24 We allow the distance to adjust when Buffalo gains a branch in 1919.
variable denoting whether the bank was listed as correspondent of another bank, the logarithm of all Fed member banks’ assets within 25 miles of the subject bank, and the ratio of the bank’s assets to the assets of Fed member banks within 25 miles of the subject bank.

*County-specific characteristics* – To further capture aspects of location that may have affected the degree of bank isolation or the profitability of lending we include the logarithm of population, the fraction of the population located in urban areas, the fraction that is illiterate, the logarithm of farm 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 are measured in 1920.

*Balance sheet characteristics* – We include the logarithm of total assets in 1914, which should matter either because of the fixed costs of regulatory compliance, or through the relative ability of smaller banks to access local pass-throughs without joining the Fed. We also include the average ratio of loans to assets between 1912 and 1914. This variable could capture opposing influences on Fed membership. On the one hand, it may capture the extent to which lending is profitable, and therefore, the extent to which zero-interest reserve requirements of the Fed are a burden. From that perspective, one would expect a higher loan ratio to be a negative predictor of membership. Alternatively, the loan ratio could capture the extent to which the bank expects to benefit from liquidity risk reduction from obtaining access to the discount window, which would imply an opposite, positive coefficient. A more unambiguous measure of the benefits of Fed membership is the extent to which lending varies across seasons, which – as noted in the Introduction – was an important source of systemic liquidity risk. We expect this measure of seasonality in lending to be positively associated with choosing to join the Fed. We measure the seasonality of loan demand as the absolute value of the average change between a bank’s loans in
the third and fourth quarters (the seasonal peak and trough of lending) in the years 1912 through 1914.  

In Table 3, we present three sets of specification. The first is a parsimonious specification that does not include indicator variables for whether the institution was a trust company or a clearing house member. That specification considers whether banks that were listed by other banks as correspondents tended to join the Fed relatively quickly. Because 25 of the 28 (“due-to”) correspondent banks were either trust companies and/or clearing house members, we first drop the extra indicators for those attributes when considering whether due-to designation matters for Fed membership. The second specification adds the trust company and clearing house 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 Fed members. The coefficient on due-to correspondents is only statistically significant when the trust company and clearing house indicators are excluded (reflecting the substantial overlap between these groups of banks). As noted before, trust companies and clearing house members were among the most likely to be holding significant interbank deposits, and it was these characteristics that likely encouraged early Fed membership. In column (6) for instance, the effect of being a due-to correspondent actually increases the time it takes until membership by 31 percent, whereas being a trust company or a clearing house member decrease

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25 We could not go further back in time than 1912 because trust company data is not reported in the Annual Report before that date. The results are similar but smaller if we use the average percentage change in loans from the first quarter to the fourth quarter.

26 We identify due-to banks as banks listed as correspondents by one or more state-chartered banks operating in New York state. We recognize that it is conceivable that some additional state-chartered banks in New York may only have been acting as due-to 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 due-to banks are playing an important role in the network in which New York’s state-chartered banks are operating.
it by 22 and 34 percent, respectively. The effect of the bank's location in the correspondent network thus played a significant role in determining the speed of adoption.

We also find evidence that, in spite of Fed efforts to limit pass-throughs, banks seeking to avoid the costs of Fed membership were able to obtain pass-throughs of discount window access from surrounding Fed member banks. We find that the composition, and not the number, of a bank's due-from correspondents has a meaningful effect on the decision to become a member. Banks that joined the Fed had fewer Manhattan correspondents yet did not have significantly more total correspondents. In column (6), each extra correspondent only increased the time until membership by 2.5 percent, yet each 25 percentage point increase in the Manhattan share (i.e., about one more Manhattan correspondent) slowed adoption by 12.5 percent. Moreover, being surrounded by large Fed member banks discouraged banks from becoming members. A bank with a standard deviation more assets in surrounding Fed banks (2.44) took 53 percent longer to become a member. The coefficient for being around large Fed banks is only significant when including county-fixed effects suggesting that banks in a county's largest city were the most likely to join the Fed. This finding matches the distribution of state bank members in New York State, as many counties only had one state-chartered member bank and it was not often located in the city with the largest national bank population. Overall, our results strongly support the proposition that non-member banks used their Fed-member neighbors and correspondents as substitutes for joining the Fed.

When added to the model, a bank's size and its loan variation are significant determinants of membership. A large bank, or a bank with greater seasonal loan variation, was significantly

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

28 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.
more likely to become members even controlling for the bank’s correspondent status. Using the county-fixed effect coefficients, a bank was 36.9 percent faster to adopt membership for every standard deviation increase in Assets (1.5), and was 5.7 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 Fed membership, and perhaps too large to rely on local Fed members for pass-through lending, found greater net value in Fed membership. The loan seasonality effect provides clear evidence that banks expected to gain advantages related to liquidity risk reduction from joining the Fed.

4.2. Additional Specifications

Here we examine several additional specifications. While the inclusion of due-to correspondent banks expands our sample size and variation, and permits us to explore particular aspects of the correspondent network that are relevant for Fed 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 due-to banks.

In Table 4, we drop the 28 banks that were listed as a due-to correspondent from the sample and re-estimate the survival model.29 Here we see that the results are very similar to those in Table 3, particularly for the model with bank fixed effects, although the levels of statistical significance are understandably a bit lower for the clearing house and trust company indicator variables.

Table 5 reports another robustness check. Here we drop all New York City banks from the sample to make sure that our results are not driven by unusual circumstances relating to New

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29 Note that we have to drop the distance to the nearest Fed 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.
York City banks that were not due-to correspondents (which, like other New York City banks, operated under unique reserve requirement laws). Coefficient values are very similar to those in Tables 3 and 4.

The results in Tables 3-5 indicate that due-to correspondent banks adopted memberships for different reasons than non-correspondent banks. Non-correspondent banks often responded to their need for liquidity by accessing pass-throughs from surrounding Fed members, whereas correspondent banks (consisting almost entirely of trust companies and clearing house members) joined the Fed to expand their network.

The estimates in Tables 3 to 5 assume that 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 Fed, since they would have lost the benefit of exchange charges and received no interest on large required reserves. These concerns probably eased after the Fed imposed par clearing in 1916 and eased reserve requirements in 1917. Banks whose lending exhibited large seasonal swings in peacetime may have had little incentive to join the Fed during the war, when war programs overrode seasonal cycles and the Fed opened its discount window to all banks holding war bonds (i.e. essentially all banks). To determine whether the impact of our explanatory variables changed over time, we estimate three separate logit regressions.

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 1915/1916, 1917, and 1918/1919/1920, because during these periods, banks faced relatively
stable costs and benefits, as discussed in Section 2. A positive coefficient implies the institution was more likely to become a member.

Table 6 shows how different factors mattered more or less at different times. Being a clearing house 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 Fed. The share of Manhattan correspondents also mattered in early years, when country banks continued to profit from exchange charges. This variable ceased to be important after 1916, when the Fed imposed par clearing throughout New York State, when country banks ceased to earn exchange charges, and when the Fed eased reserve requirements for state-chartered banks. Large correspondent banks made their decisions about the Fed very quickly, whereas non-correspondent banks made their decisions to join the Fed after 1917. As such, the "due to" banks seem to have joined to grow their network, while other banks joined the Fed to mitigate the risks associated with large seasonal fluctuations in loan demand once the lay of the land in the due-to banks’ decisions had already been made, and the regulatory costs of Fed membership had declined sufficiently.

The raw data on the growth in the number of correspondent relationships of “due-to” banks confirms the role of Fed 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, Fed member banks that already had correspondent banks as of 1915 saw the average number of correspondents increase from 2.3 in 1915 to 3.8 in 1920. Only two non-Fed member 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

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30 There were 28 adoptions in 1915/1916, 34 adoptions in 1917, and 11 adoptions in 1918/1919/1920.
locations, for member banks that had no correspondents in 1915, the number of correspondents in 1920 rose to roughly one for every eight Fed member banks. Within New York City, Fed member “due-to” 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 non-member 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 1 – was uncorrelated 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 non-member banks to access the discount window during that time. These policies changed after the war, when the Fed ceased lending to non-members and adopted rules (fully implemented in 1919) attempting to prohibit the pass-through of eligible paper originated by non-members.

As a further robustness check, in Table 7 we estimate a logit regression where the dependent variable is whether the bank became a Fed 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 Fed 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 3-6) to gauge the relative strength of the subject bank’s interest in membership.
5. The Consequences of Joining the Fed

The previous section analyzed the decision of state-chartered New York banks whether to become Fed members; in this section, we examine how membership changed banks’ behavior over the sample period of 1915-1924.

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 Fed 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 effects rather than a continuous change 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.\(^{31}\)

The model takes the form:

\[
Y_{i,t} = a + \beta_1 MemberBy1924_i + \beta_2 Member_i,t + \beta_3 Z_{i,t} + \beta_4 X_{i,1920} + \beta_5 BS_{i,1912-14} + t_t + e_{i,t} \tag{2}
\]

where \(Y_{i,t}\) is any of the aforementioned dependent variables, \(MemberBy1924_i\) is an indicator variable denoting whether the bank joined the Fed at any time before 1924, \(Member_i,t\) is a dummy variable denoting whether the bank was a member of the Fed in that particular year, \(t_t\) is a vector of year fixed effects, and the rest of the variables retain their previous definitions. The model measures whether the observed variables were higher or lower after the bank joined the Fed. \(MemberBy1924_i\) controls for constant differences between institutions that joined the Fed and those that did not change across the entire period, while \(Member_i,t\) captures the specific

\(^{31}\) That being said, we also find differences in rates of change in these dependent variables when we control for convergence effects with lagged levels of dependent variables.
effect that becoming a member had on the institution. In order 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.

Table 8 shows that banks altered their behavior after becoming Fed members.
Membership decreased a bank’s seasonal loan variation. A bank that became a member saw its
loan swing decrease between 1.5 and 1.9 percent. The coefficient is larger when county-fixed
effects are included, suggesting that the change is driven by within-bank change over time. It is
also important to note that the average loan swing for the pre-Fed period is highly positively
correlated with the loan swing of each particular year in the sample. In other words, banks that
had highly variable loans and did not join the Fed continued to have similarly variable loans.
This result shows that the New York Fed was “accommodating commerce and business” by
discounting and purchasing large quantities of bank loans during the fourth quarter, as noted by
this activity. In 1924, for example, the New York Fed 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, which was nearly double the quantity of loans held
at the end of the third quarter (FRB NY 1924).

Table 8 also shows that after becoming Fed members, banks changed the composition of
their cash assets. This is not surprising. After 1917, regulations required member banks to hold
all of their required reserves at the Federal Reserve. Columns (3) through (6) illustrate this shift.
The ratio of cash to assets decreases by 1.5 percent; the ratio of due from banks and the Fed to assets increases by 1.8 to 2.0 percent. These increases are substantial in magnitude and statistically significant. The Federal Reserve noted this phenomenon in a statement which it released to the press in November 1917 summarizing changes in the Fed’s balance sheet in preceding months (Federal Reserve Board 1917).

After joining the Fed, banks’ ratio of loans to assets also increased. The ratio rose from 4.2 to 4.6 percent. This rise suggests that membership in the Fed 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 8, but we divide banks into non-correspondent banks (in the top panel) and due-to correspondent banks (in the bottom panel). To conserve on space, we only report the coefficients relating to Fed membership. Interestingly, the two types of banks display important differences in their reactions to Fed membership. Non-correspondents 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. Due-to correspondent banks that joined the Fed, in contrast, saw a large and significant decline in their loan swing, and no change in their loans-to-assets. The results confirm our previous findings about the role of due-to correspondent member banks as liquidity providers to the network. After the founding of the Fed, 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 Fed member banks indicates that non-correspondent member banks expanded their loans and due-to correspondent member banks reduced their seasonal swing upon joining the Fed. However, the results in Tables 8 and 9 do not show the speed with which those changes took place. We address that question in Table 10 by creating a series of indicator variables that capture behavioral changes according to how many years a member bank had been a Fed member, compared to banks that had never been a Fed member. To avoid attempting to identify coefficients on a couple of banks, we drop banks when they were Fed members for more than five years.

The results in Table 10 show that the change in loan swing (driven by the behavior of due-to correspondent member banks) was not immediate. The effect did not become statistically significant until the third year. This suggests that the effects of Fed membership in building the due-to correspondent banks’ networks were gradual. In contrast, the effect on loans to assets (driven by the behavior of non-correspondent banks) shows a sudden jump upon joining the Fed. Adjustments of cash and reserves at the Fed 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 Fed members. Even as late as the mid-1920s less than a third of the banks had become Fed members. This variation in membership choice allows us to examine the factors than influenced membership.

Data for New York suggest that the decision to adopt was based on several factors. The costs of zero-interest Fed reserve requirements appears to have been an important impediment,
especially for banks outside of New York, even after reforms to reserve requirement rules in 1917. But other factors were more important in explaining why some banks within different geographic groupings (for example, banks located outside New York City) chose to become Fed members while others did not.

Access to the Fed’s discount window – and the greater ability to reduce liquidity risk that such access entailed – seems to have been recognized by state-chartered banks as the primary attraction of joining the Fed. 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 Fed membership. Small banks located close to a sufficient number of Fed member banks were less likely to join the Fed, ceteris paribus, presumably because they could obtain pass-throughs of Fed 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 Fed improved their importance as conduits of liquidity to other banks.

We also examine the effects of Fed membership on lending. These differed for due-to correspondent banks and other banks. For due-to correspondent banks, Fed 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, as it depended on the effect of Fed membership on the growth of the bank’s network. For other banks, joining the Fed had no effect on the seasonality of lending, but increased the amount of lending. Thus, although non-member banks could achieve some of the benefits of reduced liquidity risk through pass-throughs from due-to correspondents, indirect access to the discount window was not a perfect substitute for direct access through Fed membership.
Our results both on the determinants of Fed membership and its consequences suggest that, consistent with the motives for establishing the Fed, 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 Fed’s discount window, and the costs that smaller banks faced in joining the Fed, 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 Fed era. Many state-chartered banks managed to gain access indirectly to the Fed’s discount window while avoiding Fed reserve requirements – the regulations that were most important in preventing excess risk taking by banks with access to the discount window.
References


Figure 1: Number of State Member Banks (1915-1924)

Notes: Figure displays the number of Federal Reserve state members in each year. Membership rolls obtained from the Annual Report of the Federal Reserve Board of each year.
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 Fed before 1924. County boundaries obtained from Minnesota Population Center (2004).
Figure 3: Locations of New Fed 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. County boundaries obtained from Minnesota Population Center (2004).
Figure 4: Locations of Due-To 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).
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 banker’s directory in 1920. County boundaries obtained from Minnesota Population Center (2004).
<table>
<thead>
<tr>
<th>Table 1: Regulatory Requirements, New York State Fed Member and Nonmember Banks In 1915</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State Members</strong></td>
</tr>
<tr>
<td>Capital Stock</td>
</tr>
<tr>
<td>Town Population more than 50,000:</td>
</tr>
<tr>
<td>$200,000</td>
</tr>
<tr>
<td>Town Population greater than 6,000 but less than 50,000:</td>
</tr>
<tr>
<td>$100,000</td>
</tr>
<tr>
<td>Town Population greater than 3,000 but less than 6,000:</td>
</tr>
<tr>
<td>$50,000</td>
</tr>
<tr>
<td>Town Population less than 3,000:</td>
</tr>
<tr>
<td>$25,000</td>
</tr>
<tr>
<td>Reserves against Deposits</td>
</tr>
<tr>
<td>If in a central reserve city: 18% demand deposits and 5% time</td>
</tr>
<tr>
<td>deposits with at least 6/18 on hand and at least 7/18 at Fed</td>
</tr>
<tr>
<td>If in a reserve city: 15% demand deposits and 5% time deposits</td>
</tr>
<tr>
<td>with at least 5/15 on hand and at least 6/15 at Fed</td>
</tr>
<tr>
<td>If not in a reserve or central reserve city: 12% demand</td>
</tr>
<tr>
<td>deposits and 5% time deposits with at least 4/12 on hand</td>
</tr>
<tr>
<td>and at least 5/12 at Fed</td>
</tr>
<tr>
<td>Surplus Fund</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>Amount to be loaned to one individual or company</td>
</tr>
<tr>
<td>Not more than 25% of Paid-up Capital and Surplus</td>
</tr>
<tr>
<td>Amount to be loaned to any entity outside of NY State, if</td>
</tr>
<tr>
<td>bank is in NYC</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>Amount to be loaned to any entity outside of NY State, if</td>
</tr>
<tr>
<td>bank is outside NYC</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>Not more than 10% of the Capital Stock of the Other Corporation</td>
</tr>
<tr>
<td>Can operate branches?</td>
</tr>
<tr>
<td>Yes, as long as it is in the same town as the main office.</td>
</tr>
</tbody>
</table>

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 Banks in 1915

<table>
<thead>
<tr>
<th></th>
<th>Listed As Correspondent of State Bank</th>
<th>Not Listed As Correspondent of State Bank</th>
<th>Became Member</th>
<th>Did Not Become Member</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New York City</td>
<td>Non-New York City</td>
<td>New York City</td>
<td>Non-New York City</td>
</tr>
<tr>
<td># of Banks</td>
<td>19</td>
<td>9</td>
<td>32</td>
<td>172</td>
</tr>
<tr>
<td>% Fed Member by 1920</td>
<td>78.9%</td>
<td>44.4%</td>
<td>56.3%</td>
<td>21.5%</td>
</tr>
<tr>
<td>Years Until Fed Member</td>
<td>3.0</td>
<td>4.8</td>
<td>4.4</td>
<td>5.4</td>
</tr>
<tr>
<td>% Trust Companies</td>
<td>63.2%</td>
<td>44.4%</td>
<td>31.3%</td>
<td>22.1%</td>
</tr>
<tr>
<td>% Clearing house Members</td>
<td>57.9%</td>
<td>88.9%</td>
<td>37.5%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Distance to Reserve City</td>
<td>1</td>
<td>220</td>
<td>1</td>
<td>175</td>
</tr>
<tr>
<td>Assets/Assets in Fed Banks Within 25 Miles</td>
<td>3.7%</td>
<td>13.4%</td>
<td>0.5%</td>
<td>6.9%</td>
</tr>
<tr>
<td>County Population</td>
<td>5,620,048</td>
<td>414,686</td>
<td>5,620,048</td>
<td>137,333</td>
</tr>
<tr>
<td>% Urban</td>
<td>100.0%</td>
<td>85.9%</td>
<td>100.0%</td>
<td>49.0%</td>
</tr>
<tr>
<td># of Due from Correspondents</td>
<td>3.6</td>
<td>3.7</td>
<td>3.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Share of Due From Corresp. In Manhattan</td>
<td>32.5%</td>
<td>41.1%</td>
<td>45.5%</td>
<td>58.5%</td>
</tr>
<tr>
<td># of Due to Correspondents</td>
<td>4.9</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Due From Banks in 1914</td>
<td>6,164,052</td>
<td>761,280</td>
<td>938,752</td>
<td>138,904</td>
</tr>
<tr>
<td>Due From/Assets in 1914</td>
<td>9.1%</td>
<td>10.2%</td>
<td>9.1%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Due to Banks in 1914</td>
<td>6,202,704</td>
<td>345,757</td>
<td>215,636</td>
<td>12,809</td>
</tr>
<tr>
<td>Due to/Assets in 1914</td>
<td>8.7%</td>
<td>3.8%</td>
<td>1.0%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Due to Banks + Due From Banks in 1914</td>
<td>12,400,000</td>
<td>1,107,038</td>
<td>1,154,387</td>
<td>151,713</td>
</tr>
<tr>
<td>Due to/(Due to + due from banks)</td>
<td>42.9%</td>
<td>22.6%</td>
<td>9.7%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Assets in 1914</td>
<td>69,381,593</td>
<td>7,254,469</td>
<td>11,217,858</td>
<td>1,496,527</td>
</tr>
<tr>
<td>Loans/Assets in 1914</td>
<td>54.1%</td>
<td>58.2%</td>
<td>53.7%</td>
<td>57.8%</td>
</tr>
<tr>
<td>Percentage Loan Swing Q3-Q4 1912-1914</td>
<td>15.7%</td>
<td>9.7%</td>
<td>8.6%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Median Assets in 1914</td>
<td>56,500,000</td>
<td>7,294,887</td>
<td>5,721,910</td>
<td>606,623</td>
</tr>
</tbody>
</table>

Notes: Tables contains summary statistics for the group of banks listed in the column heading.
Table 3: LogLogistic Survival Model of Determents of Joining the Fed (1915-1920)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
<td>Became Fed Member In Following Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust Company</td>
<td>-0.360***</td>
<td>-0.446***</td>
<td>-0.215*</td>
<td>-0.250*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.114]</td>
<td>[0.131]</td>
<td>[0.125]</td>
<td>[0.152]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearing house Member</td>
<td>-0.300**</td>
<td>-0.585***</td>
<td>-0.177</td>
<td>-0.418**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.140]</td>
<td>[0.193]</td>
<td>[0.133]</td>
<td>[0.171]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to Nearest Fed</td>
<td>0.002**</td>
<td>-0.002</td>
<td>0.001*</td>
<td>-0.002</td>
<td>0.001</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
<td>[0.002]</td>
<td>[0.001]</td>
<td>[0.002]</td>
<td>[0.001]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Ln(Assets in Fed Banks)</td>
<td>-0.099</td>
<td>0.130*</td>
<td>0.005</td>
<td>0.145**</td>
<td>0.050</td>
<td>0.197***</td>
</tr>
<tr>
<td>Within 25 Miles</td>
<td>[0.052]</td>
<td>[0.077]</td>
<td>[0.050]</td>
<td>[0.062]</td>
<td>[0.054]</td>
<td>[0.058]</td>
</tr>
<tr>
<td>Assets/Assets in Fed</td>
<td>-1.331**</td>
<td>-1.633**</td>
<td>-0.379</td>
<td>-0.020</td>
<td>0.564</td>
<td>2.036*</td>
</tr>
<tr>
<td>Banks Within 25 Miles</td>
<td>[0.529]</td>
<td>[0.704]</td>
<td>[0.629]</td>
<td>[0.741]</td>
<td>[0.806]</td>
<td>[1.130]</td>
</tr>
<tr>
<td># of Due from Correspondents</td>
<td>-0.027</td>
<td>-0.025</td>
<td>0.014</td>
<td>0.037</td>
<td>0.006</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>[0.021]</td>
<td>[0.031]</td>
<td>[0.028]</td>
<td>[0.041]</td>
<td>[0.028]</td>
<td>[0.039]</td>
</tr>
<tr>
<td>Share of Due From Corresp.</td>
<td>0.316*</td>
<td>0.604**</td>
<td>0.318*</td>
<td>0.487**</td>
<td>0.311*</td>
<td>0.410*</td>
</tr>
<tr>
<td>in Manhattan</td>
<td>[0.164]</td>
<td>[0.261]</td>
<td>[0.171]</td>
<td>[0.234]</td>
<td>[0.163]</td>
<td>[0.226]</td>
</tr>
<tr>
<td>Any Due to Correspondents</td>
<td>-0.195*</td>
<td>-0.282*</td>
<td>-0.049</td>
<td>-0.038</td>
<td>0.080</td>
<td>0.272</td>
</tr>
<tr>
<td></td>
<td>[0.107]</td>
<td>[0.169]</td>
<td>[0.111]</td>
<td>[0.138]</td>
<td>[0.126]</td>
<td>[0.168]</td>
</tr>
<tr>
<td>Ln(Assets in 1914)</td>
<td>-0.149***</td>
<td>-0.282***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.058]</td>
<td>[0.084]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg Loans/Assets 1912-1914</td>
<td>0.439</td>
<td>-0.093</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.413]</td>
<td>[0.535]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg Percentage Loan</td>
<td>-0.614**</td>
<td>-1.082***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swing Q3-Q4 1912-1914</td>
<td>[0.284]</td>
<td>[0.314]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County Values in 1920</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>County Fixed Effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,162</td>
<td>826</td>
<td>1,162</td>
<td>826</td>
<td>1,162</td>
<td>826</td>
</tr>
</tbody>
</table>

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 Fed membership in the subsequent year. Banks in the sample were all present in 1914 and drop out of the model once they become members. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
Table 4: LogLogistic Survival Model of Joining Fed For Banks Not Listed as Correspondent (1915-1920)

<table>
<thead>
<tr>
<th></th>
<th>Dependent Variable = Became Fed Member In Following Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Trust Company</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.440***</td>
</tr>
<tr>
<td></td>
<td>[0.157]</td>
</tr>
<tr>
<td>Clearing house Member</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>-0.260</td>
</tr>
<tr>
<td></td>
<td>[0.199]</td>
</tr>
<tr>
<td>Distance to Nearest Fed</td>
<td></td>
</tr>
<tr>
<td>0.002**</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>Ln(Assets in Fed Banks</td>
<td>-0.001</td>
</tr>
<tr>
<td>Within 25 Miles)</td>
<td>[0.057]</td>
</tr>
<tr>
<td>Assets/Assets in Fed</td>
<td>-1.501**</td>
</tr>
<tr>
<td>Banks Within 25 Miles</td>
<td>[0.617]</td>
</tr>
<tr>
<td># of Due from Correspondents</td>
<td>-0.050</td>
</tr>
<tr>
<td></td>
<td>[0.039]</td>
</tr>
<tr>
<td>Share of Due From Corresp. in Manhattan</td>
<td>0.333</td>
</tr>
<tr>
<td>Ln(Assets in 1914)</td>
<td></td>
</tr>
<tr>
<td>-0.137*</td>
<td>-0.257***</td>
</tr>
<tr>
<td></td>
<td>[0.075]</td>
</tr>
<tr>
<td>Avg Loans/Assets 1912-1914</td>
<td>0.497</td>
</tr>
<tr>
<td></td>
<td>[0.536]</td>
</tr>
<tr>
<td>Avg Percentage Loan</td>
<td>-0.651*</td>
</tr>
<tr>
<td>Swing Q3-Q4 1911-1914</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.369]</td>
</tr>
<tr>
<td>County Values in 1920</td>
<td>Yes</td>
</tr>
<tr>
<td>County Fixed Effects</td>
<td>No</td>
</tr>
<tr>
<td>Observations</td>
<td>1,057</td>
</tr>
</tbody>
</table>

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 Fed membership in the subsequent year. Banks in the sample were all present in 1914 and drop out of the model once they become members. The sample also drops out banks that were listed as another bank’s correspondent. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
## Table 5: LogLogistic Survival Model of Joining Fed For Banks Not in Manhattan (1915-1920)

<table>
<thead>
<tr>
<th>Dependent Variable = Became Fed Member In Following Year</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust Company</td>
<td>-0.530***</td>
<td>-0.572***</td>
<td>-0.434**</td>
<td>-0.522***</td>
<td>[0.151]</td>
<td>[0.161]</td>
</tr>
<tr>
<td>Clearing house Member</td>
<td>-0.300</td>
<td>-0.703**</td>
<td>-0.132</td>
<td>-0.422</td>
<td>[0.241]</td>
<td>[0.308]</td>
</tr>
<tr>
<td>Distance to Nearest Fed City</td>
<td>0.001</td>
<td>-0.002</td>
<td>0.000</td>
<td>-0.002</td>
<td>0.000</td>
<td>-0.002</td>
</tr>
<tr>
<td>Ln(Assets in Fed Banks Within 25 Miles)</td>
<td>-0.012</td>
<td>0.101</td>
<td>0.011</td>
<td>0.132**</td>
<td>0.043</td>
<td>0.177***</td>
</tr>
<tr>
<td>Assets/Assets in Fed Banks Within 25 Miles</td>
<td>-1.086</td>
<td>-0.895</td>
<td>0.031</td>
<td>0.846</td>
<td>0.447</td>
<td>2.213*</td>
</tr>
<tr>
<td># of Due from Correspondents</td>
<td>-0.130***</td>
<td>-0.181***</td>
<td>-0.073*</td>
<td>-0.088</td>
<td>-0.064</td>
<td>-0.076</td>
</tr>
<tr>
<td>Share of Due From Corresp. in Manhattan</td>
<td>0.109</td>
<td>0.159</td>
<td>0.345</td>
<td>0.396</td>
<td>0.395</td>
<td>0.472</td>
</tr>
<tr>
<td>Any Due to Correspondents</td>
<td>-0.093</td>
<td>-0.092</td>
<td>0.114</td>
<td>0.260</td>
<td>0.057</td>
<td>0.284</td>
</tr>
<tr>
<td>Ln(Assets in 1914)</td>
<td>-0.085</td>
<td>-0.192</td>
<td>[0.095]</td>
<td>[0.126]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg Loans/Assets 1912-1914</td>
<td>0.823</td>
<td>0.343</td>
<td>[0.567]</td>
<td>[0.623]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg Percentage Loan Swing Q3-Q4 1911-1914</td>
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Notes: Table contains the results of a loglogistic survival duration model. The dependent variable is whether the state bank or trust company adopted a Fed membership in the subsequent year. Banks in the sample were all present in 1914 and drop out of the model once they become members. The sample also drops out banks that operated in Manhattan. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
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<td>Yes</td>
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</table>

Notes: Table contains the results of cross-sections logit models. The dependent variable is whether the state bank or trust company adopted a Fed 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. Banks in the sample were all were present in 1914 and drop out of the model once they become members. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
Table 7: Logit Regression of Determinants of Joining the Fed Using 1915 Cross-section

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<td>-1.657**</td>
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Notes: Table contains the results of cross-sectional logit models. The dependent variable is whether the state bank or trust company adopted a Fed membership by 1920. Each bank only enters the model once with its values in 1915. Banks in the sample were all were present in 1914. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
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<th>(Due from Banks + Due from Fed)/Assets</th>
<th>Loans/assets</th>
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<tr>
<td></td>
<td>0.001</td>
<td>0.002</td>
<td>0.003*</td>
<td>-0.005**</td>
</tr>
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<td>[0.001]</td>
<td>[0.002]</td>
<td>[0.004]</td>
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<td>Share of Due From Corresp in Manhattan</td>
<td>0.011</td>
<td>0.015</td>
<td>-0.006</td>
<td>0.002</td>
</tr>
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<td></td>
<td>[0.010]</td>
<td>[0.022]</td>
<td>[0.004]</td>
<td>[0.007]</td>
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<td></td>
<td>-0.007</td>
<td>0.002</td>
<td>-0.007</td>
<td>0.014</td>
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<td></td>
<td>[0.004]</td>
<td>[0.006]</td>
<td>[0.013]</td>
<td>[0.024]</td>
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<tr>
<td>Any Due to Correspondents</td>
<td>0.032***</td>
<td>0.000</td>
<td>0.009</td>
<td>0.026***</td>
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<td>[0.009]</td>
<td>[0.000]</td>
<td>[0.011]</td>
<td>[0.009]</td>
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<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.031*</td>
</tr>
<tr>
<td></td>
<td>[0.009]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.019]</td>
</tr>
<tr>
<td>Ln(Assets in 1914)</td>
<td>-0.009*</td>
<td>0.001</td>
<td>-0.002</td>
<td>0.014*</td>
</tr>
<tr>
<td></td>
<td>[0.004]</td>
<td>[0.002]</td>
<td>[0.003]</td>
<td>[0.007]</td>
</tr>
<tr>
<td>Avg Loans/Assets</td>
<td>-0.057***</td>
<td>0.003</td>
<td>-0.032*</td>
<td>0.713***</td>
</tr>
<tr>
<td>1912-1914</td>
<td>[0.026]</td>
<td>[0.011]</td>
<td>[0.019]</td>
<td>[0.048]</td>
</tr>
<tr>
<td>Avg Percentage Loan</td>
<td>0.262***</td>
<td>-0.033</td>
<td>0.035</td>
<td>0.020</td>
</tr>
<tr>
<td>Swing Q3-Q4 1912-1914</td>
<td>[0.054]</td>
<td>[0.030]</td>
<td>[0.032]</td>
<td>[0.093]</td>
</tr>
<tr>
<td>Bank Fixed Effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Year Fixed Effects</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>County Values in 1920</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>County Fixed Effects</td>
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<td>Yes</td>
<td>No</td>
<td>Yes</td>
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</table>

Notes: Table contains the results of an OLS model. The dependent variable is defined in the head of each column. Banks in the sample were all were present in 1914. Counties that did not have any members created are dropped from the sample with 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 ten-percent, five-percent, and one-percent levels, respectively.
### Table 9: The Effects of Becoming a Fed Member On Correspondent Banks and Non-Correspondent Banks (1915-1924)

**Not Listed in Rand McNally As Correspondent of State Bank**

<table>
<thead>
<tr>
<th>Percentage Loan Swing Q3-Q4</th>
<th>(Due from Banks + Fed)/Assets</th>
<th>Loans/Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Fed Member By 1924</td>
<td>0.010</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.006]</td>
</tr>
<tr>
<td>Fed Member In Year</td>
<td>-0.005</td>
<td>-0.008</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.010]</td>
</tr>
<tr>
<td>Bank and Bal. Sheet</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bank Fixed Effects</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>County Values in 1920</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>County Fixed Effects</td>
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<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,940</td>
<td>1,940</td>
</tr>
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</table>

**Listed in Rand McNally As Correspondent of State Bank**

<table>
<thead>
<tr>
<th>Percentage Loan Swing Q3-Q4</th>
<th>(Due from Banks + Fed)/Assets</th>
<th>Loans/Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Fed Member By 1924</td>
<td>0.044</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>[0.029]</td>
<td>[0.035]</td>
</tr>
<tr>
<td>Fed Member In Year</td>
<td>-0.046**</td>
<td>-0.052***</td>
</tr>
<tr>
<td></td>
<td>[0.021]</td>
<td>[0.019]</td>
</tr>
<tr>
<td>Bank and Bal. Sheet</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bank Fixed Effects</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>County Values in 1920</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>County Fixed Effects</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Membership</th>
<th>Percentage Loan Swing Q3-Q4 (1)</th>
<th>Cash/Assets (2)</th>
<th>(Due from Banks + Due from Fed)/Assets (3)</th>
<th>Loans/Assets (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fed Member By 1924</td>
<td>0.018** ([0.008])</td>
<td>0.010</td>
<td>-0.014** ([0.006])</td>
<td>-0.035*** ([0.013])</td>
</tr>
<tr>
<td>First Year of Fed Membership</td>
<td>0.003 ([0.016])</td>
<td>-0.001</td>
<td>-0.013*** ([0.004])</td>
<td>0.005 ([0.005])</td>
</tr>
<tr>
<td>Second Year of Fed Membership</td>
<td>-0.014 ([0.012])</td>
<td>-0.018</td>
<td>-0.019*** ([0.005])</td>
<td>0.005 ([0.005])</td>
</tr>
<tr>
<td>Third Year of Fed Membership</td>
<td>-0.032*** ([0.010])</td>
<td>-0.037*** ([0.011])</td>
<td>-0.015*** ([0.005])</td>
<td>0.005 ([0.005])</td>
</tr>
<tr>
<td>Fourth Year of Fed Membership</td>
<td>-0.035*** ([0.011])</td>
<td>-0.039*** ([0.014])</td>
<td>-0.012*** ([0.003])</td>
<td>0.005 ([0.003])</td>
</tr>
<tr>
<td>Fifth Year of Fed Membership</td>
<td>-0.025** ([0.013])</td>
<td>-0.030** ([0.014])</td>
<td>-0.015*** ([0.004])</td>
<td>0.005 ([0.004])</td>
</tr>
</tbody>
</table>

Bank and Bal. Sheet Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Fixed Effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>County Values in 1920</td>
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<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>County Fixed Effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
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<td>2.050</td>
<td>2.050</td>
<td>2.050</td>
<td>2.050</td>
<td>2.050</td>
<td>2.050</td>
<td>2.050</td>
</tr>
</tbody>
</table>

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