Did the Reserve Requirement Increments of 1936-1937 Reduce Bank Lending? Evidence from a Natural Experiment*

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Abstract

An extensive debate has ensued over whether the Federal Reserve's doubling of reserve requirements of 1936-1937 reduced lending and caused the recession of 1937-1938. In a natural experiment setting, we examine this issue by comparing the loan supply behaviors of member banks to that of nonmember banks. After implementing the difference-in-difference estimators, we find that the increases in reserve requirements of 1936-1938 did not create financing constraints for member banks and lead them to reduce loan supply. Therefore, the actions of the Federal Reserve concerning the required reserve ratios should not be blamed for instigating the economic downturn of 1937-38.

Keywords: bank lending channel, reserve requirements, monetary policy transmission, dual banking system

JEL Classification Numbers: E51, E58, G21, G28, N12, N22

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1 Introduction

The recession of 1937-1938 was one of the sharpest contractions in economic activity in the history of the U.S. This sharp, but short-lived, recession occurred while the U.S. economy was recovering from the Great Depression of 1929-1932. After expanding for 50 months, from March of 1933 to May 1937, real GDP fell by 11 percent from May 1937 to June 1938. Industrial production fell by a staggering 32 percent.

A leading explanation for the recession of 1937-1938 is increases in reserve requirements (Friedman and Schwartz, 1963). Between 1936 and 1937, the Federal Reserve doubled reserve requirements to reduce high levels of excess reserves. At the time, the Federal Reserve did not consider the increases in reserve requirements as contractionary monetary policy that would have any impact on bank lending because they viewed excess reserves as 'superfluous' balances. They undertook these monetary actions to prevent future inflation by placing them in a better position to use monetary policy tools for later use (Meltzer, 2003, pp. 495-96). However, due to the timing of reserve requirement increases and the recession, scholars debate whether the Federal Reserve's reserve requirement increases of 1936-37 reduced bank loan supply and thus engendered the economic recession of 1937-38. Some contend that the doubling of reserve requirements led member banks to hold more precautionary balances and subsequently reduced the availability of bank credit, causing the U.S. economy to relapse into recession. Others argue that the increase in reserve requirements had no effect and did not cause the recession.

The question of whether the increases in reserve requirements reduced bank lending remains unresolved because a lack of data has prevented scholars from designing a research framework that directly examines the effect of higher reserve requirements on bank lending. As a result, most empirical studies have relied on aggregated data and focused on reserves and securities rather than loans. Many studies examine the paths of the cash-deposit ratio to link the onset of the recession to a tightening of monetary policy (Friedman and Schwartz, 1963; Frederic Mishkin, 1989). Others use more disaggregated data, but compare the changes in composition of bank portfolios (Telser, 2001; Stauffer, 2002). The lack of an analysis at a disaggregated level makes it difficult to access the behavior of individual banks in response to the increase in reserve requirements. More recently, Calomiris, Mason, and Wheedlock (2011) break from that tradition and examine reserve demand

using bank-level data on Federal Reserve member banks. However, they examine the relationship between the doubling of reserve requirements and bank reserve demand rather than bank lending.

The goal of this paper is to examine the effect of an exogenous increase in reserve requirements. Our study utilizes a new micro-level dataset on all state-chartered commercial banks and trust companies in New York from 1935 through 1938. The dataset contains both pre- and post-intervention periods. For estimation, we employ a differences-in-differences estimation technique. When the Federal Reserve System was established in 1913, it permitted state-chartered banks to become Federal Reserve members if they met the standards of the Federal Reserve System. All state member banks in New York comprise our treatment group, and all state nonmember banks comprise our control group. If member banks faced a financing constraint due to the doubling of reserve requirements, the loan supply behavior of member banks would differ from that of nonmember banks.

We find that member banks did not contract bank lending in response to the increases in reserve requirements. In addition, the loan supply behavior of member banks did not differ from that of nonmember banks. Our results cast doubt on claims that the changes in reserve requirements contributed to the onset of the recession by creating financing constraints for member banks.

We contribute to the existing literature in two ways. First, our paper adds to the bank lending channel literature that analyzes the impact of liquidity shocks on the real economy. Identifying the bank lending channel has been difficult due to the complexity in controlling for loan demand and profitable investment opportunities. To alleviate identification concerns, recent empirical studies conduct research in natural experiments (Gan, 2006; Khwaja and Mian, 2005; Paravisini, 2008; Kim, 2012). In our paper, we isolate a loan supply channel from a loan demand channel by using reserve requirement increases as natural experiments.

Our paper also supplements the literature on the role of monetary policy and the recession of 1937-1938 by conducting a micro-level empirical study on the effect of higher reserve requirements on bank lending. After Friedman and Schwartz (1963) introduced the view that the Federal Reserve's doubling of reserve requirements has been considered a major policy mistake that caused the recession of 1937-1938, it was widely accepted among economists.[1] More recently, this view has

[1]Many scholars have blamed the premature tightening of monetary policy, fiscal policy, or both (Friedman and Schwartz, 1963; Romer, 1992; Eggertson, 2008; Velde, 2009; Irwin, 2011). On the monetary side, the Federal Reserve doubled reserve requirements, and the Treasury sterilized gold inflows from Europe to the U.S. On the fiscal

been criticized by scholars who have found conflicting evidence. For example, Telser (2011) shows that member banks were able to mitigate the contractionary effects of doubling reserve requirements by selling their government securities and conducted lending activity as usual. Irwin (2011) argues that reserve requirements were not binding during this period since member banks continued to contract lending after reserve requirements were relaxed in 1938. Calomiris, Mason, and Wheelock (2011) also find that the increase did not constrain lending, as the higher reserve requirements were not binding. Our results directly support the view that the increase in reserve requirements did not directly lead to the recession of 1937-38.

The remainder of this paper is organized as follows: Section 2 provides a review of the literature. Section 3 describes the regulatory structure in place in New York State during the 1930s. Section 4 describes our data sources and presents summary statistics of those data. Section 5 presents the methodology employed in interpreting that data. Section 6 discusses the results of those methods and Section 7 provides a conclusion.

2 Literature Review

In this section, we provide a brief review of the literature. Our research is related to two strands of literature: the bank lending channel and the historical debates about the reserve requirement increases of 1936-1937 and the recession of 1937-1938. We discuss these two literatures in turn.

2.1 Financial Constraints and Bank Lending Channel

The bank lending channel investigates the responsiveness of bank loan supply to changes in the stance of monetary policy. The lending channel theory assumes that contractionary monetary policy, which drains deposits from the banking system, causes banks to reduce investment and contract lending. Banks may not easily substitute a fall in deposits with other external funding, and thus face financing constraints. When banks reduce lending, bank-dependent firms may not easily substitute bank loans with other forms of finance. In this situation, a contraction in the total

side, the Roosevelt administration attempted to achieve a balanced budget by reducing the growth in government spending and increasing taxes. Other scholars have proposed alternative explanations, such as labor policies and a shift in expectations. Cole and Ohanian (2001, 2009) and Hausman (2012) argue that New Deal Industrial and labor policies, New Deal industrial and labor policies raised wages in the manufacturing sector and stunted economic recovery. Eggertsson (2008) argue that a shift in beliefs about future inflation and income caused the recession.

amount of financial intermediation might lead firms to liquidate long-term investment projects, reduce investment, and curtail new production. Hence, a reduction in bank lending may contract real economic activity.

Empirical evidence for the existence of a bank lending channel is not conclusive. A number of studies find evidence suggesting the presence of a bank lending channel and argue that the channel operates mainly through small, illiquid, and undercapitalized banks. Kashyap and Stein (2000) find that large banks with liquid asset bases have access to liquidity and collateral that smaller banks do not. In the presence of a contractionary monetary policy, these large, liquid banks were able to mitigate the effects of policy on lending. Kishan and Opiela, (2000) find this same effect of policy on banks with higher equity capital-to-assets ratios. Focusing on insured deposits, Jayaratne and Morgan (2000) find that only small banks experienced frictions between the supply of bank loans and insured deposits.

Other studies arrive at conclusions which are at odds with those results. Ashcraft (2006) finds that the bank lending channel is present but not important for monetary transmission for banks of all sizes. Instead of focusing on bank size, Ashcraft argues loan demand is homogenous across banks within the same bank holding group and that these groups are able to raise funds to offset contractionary monetary policy. Smaller banks that were not members of holding groups were unable to mitigate these effects and had to contract credit.

The inconsistencies of past studies may arise from the identification problem of isolating loan supply effects of monetary policy from loan demand effects. Deposit growth is often compounded by a change in the profitability of investment opportunities and, consequently, loan demand. This raises the possibility that the effects of policy changes on loan demand need to be disentangled from the effects on loan supply.

To overcome this identification issue, other empirical studies exploit cross-sectional variations in bank loan supply using size, bank capitalization, liquidity positions, and other observable bank characteristics (Kashyap and Stein, 2000; Kishan and Opiela, 2000; Jayaratne and Morgan, 2000). A more convincing approach is to adopt a natural experiment setting. One strand in this empirical literature uses the loan level data with matched borrowers and lenders to examine the change in the growth of bank loans from individual banks within matched firms' loan portfolios when banks experience different degrees of exogenous liquidity shocks (Gan, 2006; Khwaja and Mian, 2008).

A second strand examines how exogenous shocks affect one group of banks and induces deposit outflows, whereas the other group is left unaffected (Imai and Takarabe, 2011; Kim, 2011).

Our paper closely follows the latter. While changes in reserve requirements for Federal Reserve member banks did not induce deposit outflows from the banking system, they reduced the amount of available deposits that could be used for bank lending at those banks. Hence, we use the Federal Reserve's doubling of reserve requirements as an exogenous shock to member banks' loanable funds and examine whether a reduction in the availability of funds caused a reduction in the loan supply of member banks relative to nonmember banks.

2.2 The Federal Reserve's Reserve Requirement Increases and the Recession

We now turn to the literature concerning the role of the reserve requirement increases in generating the recession of 1937. In the mid-1930s, excess reserves in the U.S. banking system grew rapidly after the banking holiday in March 1933. The increase in excess reserves continued after the federal deposit insurance scheme was introduced with the Banking Act of 1935, coupled with an increase in gold inflows into the U.S. between 1934 and 1936. Banks accumulated abnormally large excess reserves due to a combination of low interest rates, government spending and borrowing, large gold inflows, and increased demand for liquidity after the banking panics of the early 1930s. Between the banking holiday in 1933 and September 1935, member banks experienced an $8 billion increase in demand deposits. Excess reserves peaked in the fourth quarter of 1936 and comprised more than 50 percent of total reserves.

Federal Reserve officials considered excess reserves a serious future inflationary threat. More specifically, they feared that gold inflows at the current levels of $1 billion per year would threaten their ability to control credit conditions if banks began to lend those funds. But the Federal Reserve felt it was in a disadvantageous position to reduce this threat. The tools typically used by the Federal Reserve -the discount rate and open-market operations- were likely to have little impact on the level of excess reserves. Raising the discount rate would not have been effective since banks were not borrowing from the discount-window at the time, even at low discount rates. Member banks were by and large out of debt to the Reserve banks in 1935 and 1936. The total amount of the Reserve System's earning assets, which they could have sold to contract the amount of credit in the banking system, was $2.5 billion. Due to low interest rates on these assets, nearly half of

that was needed to cover its expenses and dividends (Harrison papers, 1935). The Federal Reserve decided that if they were going to have any influence on the credit situation in the U.S., they would need "to bring the member banks into close contact with the Reserve Banks by removing the buffer of excess reserves and then to leave the Reserve Banks with a substantial portfolio for exerting further pressure." They decided to increase the reserve requirements for member banks in order to bring the member banks within the reach of the size of the Reserve System's portfolio.

Table 1 shows the changes in reserve requirements between 1936 and 1938. In order to reduce excess reserves in the banking system, the Federal Reserve doubled reserve requirements for its member banks, from 13 percent of demand deposits for banks in the principal financial centers of Chicago and New York City to 26 percent. This occurred in three stages: August 1936, March 1937, and May 1937. There were corresponding but smaller increases for banks in smaller reserve cities. Later in April 1938, the Federal Reserve reduced reserve requirements. The Federal Reserve considered the reserve requirement increments a preventive action rather than a change in the stance of monetary policy, as they viewed the large volume of excess reserves as superfluous balances due to a low demand for loans. They expected the reserve requirement increments to simply alter the relative shares of excess reserves and government securities in banks' portfolios, rather than have an impact on interest rates or reduce loan supply. Their objective was to make their traditional policy tools more effective for future use by lowering the volume of excess reserves.

[Table 1]

Scholars have debated the effect of this policy. Friedman and Schwartz (1963) argued that the Federal Reserve's doubling of reserve requirements was contractionary and caused the recession of 1937-1938. Consistent with their claim, the high level of excess reserves were not excess in the sense that these reserves reflected banks' desire to hold liquid assets and prepare for possible deposit withdrawals in the aftermath of the banking panics in the early 1930s. After reserve requirements were increased, member banks tried to restore their excess reserves and subsequently reduced lending. Friedman and Schwartz fault the Federal Reserve's focus on credit, not the behavior of high powered money, for the recession that followed. Their view was supported by other economists (Romer, 1992, 2009; Mishkin, 1989, pp. 399-400).

There are those, however, who contest this view. These scholars argue that reserve requirement

increases had a limited effect on the money multiplier and the supply of money and credit. For instance, Calomiris, Mason, and Wheelock (2011) find that the changes in reserve requirements were not an important factor in creating the downturn, as they did not increase banks' demand for reserves. Telser (2001) and Stauffer (2002) argue that member banks were able to mitigate the contractionary effects of the Fed's reserve requirement increments by substituting securities with loans. Irwin (2011) argues that higher reserve requirements had little effect on money supply and finds that the sterilization of gold inflows was a significant factor in creating the downturn by lowering equity prices and raising interest rates.

The conflicting nature of these previous studies originates from the fact that none examine the impact of the changes in reserve requirements on bank loan supply. In our paper, we examine this issue by directly comparing the loan supply behavior of member and nonmember banks after the doubling of reserve requirements.

3 Background

3.1 Dual Banking System and Federal Reserve Membership

In the U.S. banking system in the 1930s, there were distinct differences in the governing bodies of state banks that were members of the Federal Reserve System and state banks that were not. As this is central to our control and treatment groups, we provide a brief review of the development of that banking system and the regulations during the period under study.

Until 1864, bank chartering was solely a function of the states, and the level of regulation differed from state to state. With the passage of the National Banking Act of 1864, a federal role in the banking system was introduced. The intent of the legislation was to establish a system of national banks and assert federal control over the monetary system in an endeavor to create a uniform banking and currency system, facilitate a market for government bonds, and promote more commerce through a sound financial system. To supervise nationally chartered banks, the act created the Office of the Comptroller of the Currency (OCC).

After the National Banking Act was passed, commercial banks could choose to organize as either national banks with a federal charter or as state banks with a charter issued by state governments. The choice of charter dictated the law under which the bank would operate and the agency that

would act as the bank's supervisor. The decision to choose a federal or a state charter determined a bank's powers, capital requirements, and lending limits.

The National Banking Act failed to establish a banking system consisting of only federally chartered banks, as it did little to push state banks to convert to national banks or discourage the circulation of state bank notes. As of October of 1863, there were only 63 national banks chartered (Atack and Passell, 1994) and it little effect on the volume of state bank notes in circulation. In June of 1864, a revision of the act was passed to encourage more state banks to apply for a national bank charter. The revision imposed a tax on all bank notes issued by state banks of 2 percent, which was raised to 10 percent in March of 1865. After the revision, many state banks obtained a national charter. In 1868, the number of state banks decreased from 1,466 in 1863 to 247, while the number of national banks increased from 66 to 1,640. However, in the 1880s, this trend reversed because checks became more commonplace for commercial transactions and bank notes were used at a decreasing rate. State banks became increasingly more devoted to discount and deposit, and their numbers surged. By 1913, there were 16,841 state banks and 7,467 national banks in operation.

In 1913, Congress passed the Federal Reserve Act in part to bring state banks under a more unified system of regulation. Under the Act, national banks were required to become members of the Federal Reserve System; by contrast, state banks could choose whether or not to join. Becoming a member bank, however, meant becoming subject to both state and federal supervision. Accordingly, relatively few state banks chose to join. The act was modified in 1917 to make membership in the Federal Reserve System more attractive to state banks. By 1930, there were 7,247 national banks, 1,068 state banks with Federal Reserve membership, and 14,730 state banks without Federal Reserve membership. In total, roughly 30 percent of banks in the U.S. were held accountable to the regulatory requirements facing Federal Reserve member banks, and 64 percent were liable to the state requirements where they were chartered.

Table 2 presents the regulatory requirements facing Federal Reserve member banks and non-member banks in New York State in 1935. State members and nonmembers faced similar regulation concerning loans, stock purchases, and branching restrictions. While there were differing requirements concerning capital, the largest discrepancy between the two groups was in reserves against deposits. Not only were there differences in the required reserves on deposits, but also in the types of

deposits against which the two groups had to hold reserves. State nonmember banks were required to hold deposits against only demand deposits, up to a rate of 18 percent in 1935. Member banks began the period under study with a maximum reserve ratio of 13 percent on demand deposits, but also had to hold 3 percent reserves against their time deposits.

[Table 2]

3.2 Structure of New York's Commercial Banking System

We now turn to the structure of the dual banking system in New York State, and how the reserve requirement increase allows us to conduct a natural experiment that controls for many of the self-selection issues previous bank studies were unable to.

New York State was in itself a unique section of the banking industry. The state represented a large share of total loans in the U.S. As shown in Figure 1, during the 1935-1938 period, the state held an average of over 21 percent of all loans in the United States. Turning to Figure 2, national banks and state-chartered banks represented approximately 40 and 60 percent of total loans in New York State, respectively.[2]

[Figure 1]

[Figure 2]

The economic and demographic composition also lends to its strength as a viable testing ground for the effects of the reserve requirement increases on the U.S. economy. The state was home to the metropolis of New York City, which served as the central money market of the U.S., medium-sized cities with active manufacturing and industrial bases, and many small towns in rural areas.

New York City was the financial center of the U.S. and a central reserve city for the Federal Reserve and national banking system. National banking law required banks in a central reserve city to hold 15 percent of deposits as reserves. The banks held these reserves either as cash in their vaults or, for member banks, as deposits at the Federal Reserve Bank of New York. Albany and Buffalo were designated as reserve cities. Banks in reserve cities had to hold 12 percent of deposits as

[2]Sources: National figures come from *All Bank Statistics* and New York figures come from *Rand McNally Bankers Directory*.

reserves, but could hold those reserves either as cash in their vaults, deposits at the Fed, or deposits in banks in central reserve cities. Banks outside of reserve cities were collectively referred to as "country banks." These banks were required to hold 10 percent of deposits as reserves, and could hold those reserves either as cash in their vault or deposits in banks in reserve or central reserve cities.[3] These legal-reserve requirements reinforced and reflected a reserve pyramid in which country banks around the U.S. deposited reserves in banks in reserve cities, which in turn deposited reserves in New York City, which served as the central money market for financial institutions throughout the U.S. This long-standing structure shaped the clientele of banks in different locations and the structure of their balance sheets.

For reasons just discussed, banks in New York State fall into three classification categories based on location. However, for our study we separate banks in the state into two regional groups: banks in New York City and banks outside New York City. Three facts specific to the baking structure of New York State motivate this choice. First, there were a smaller number of large banks located within New York City, and a larger number of small banks outside the city. Second, due to the difference in clients between banks in and out of New York City, banks in New York City were more likely to be influenced by a wide array of factors, whereas banks outside New York City were much more likely to be affected by local market conditions. Last, but most importantly, state banking authorities classified state banks and trust companies under their supervision as 'state banks and trust companies in Greater New York' and 'state banks and trust companies outside Grater New York' in their official reports. Clearly, the banking authorities of the state found it prudent to classify banks in the same manner as we do.

New York City held 65 percent of total loans in New York. In New York City, state-chartered banks that were Federal Reserve members held the largest amount of bank assets, accounting for 53 percent. Nationally chartered banks were next, and held 37 percent of the loans in the city. Finally, state nonmember banks were the smallest group, with 10 percent. In comparison, over 22 percent of the total loans in New York State resided in state banks outside of New York City. State member banks in these areas held 32 percent of those assets, with state nonmember banks holding 25 percent and national banks holding 43 percent. In total, state banks (both member and

[3]The small percentage of country banks that joined the Federal Reserve System held their reserves as deposits at the Fed.

nonmember) account for over 55 percent of all bank assets held outside New York City, a sizeable portion of the credit channel in that region.

The banks that operated in New York City served local, national, and international markets. Many interior banks in the U.S. maintained deposits in banks in New York City in exchange for the services these banks provided, including access to bond and securities markets as well as advice on other banking matters (Gregory, 1933). Based on a random sample of 5 percent of all banks in the U.S., 29 percent conducted business in one form or another with a New York City bank.[4] In addition, banks in New York City served many national corporations, which used these banks to finance business activities through their easy access to debt and equity markets. On the international front, foreign governments and municipalities also borrowed from banks in New York City (Gary Richardson and Patrick Van Horn, 2009, 2012). The international money center aspect is an important one when considering the ability of banks to mitigate the increase in reserve requirements. Banks in New York City had the opportunity to offset the increase in reserve requirements by raising capital funds from international sources or from sources in other parts of the country. A large percentage of correspondence with banks outside the city and such a diverse pool of potential borrowers meant that banks in New York City had the opportunity to diversify their portfolios with domestic as well as international investments. Turning to the importance of a contraction in loan supply from these banks, the activities of banks in New York City would have an impact on economic activity not only in the Northeast, but across the country through their correspondent relationships.

By contrast, banks outside the city of New York had a vastly different clientele. These banks served a variety of potential borrowers that ranged from manufacturing companies in smaller cities such as Buffalo to orchard farmers in the northwestern part of the state. Agriculture was an important part of the state economy outside of New York City. Thirty-five of the sixty-two counties in New York State had more than fifty percent of their populations in rural settings. These counties accounted for more than seventy percent of the total agricultural goods produced in the state.[5] It is reasonable to assume that banks in these regions served smaller depositors than those in New York

[4]The sample comes from the *Rand McNally Bankers Directory* (1929). For each bank, the directory reported the correspondent banks that they held deposits with. Five percent of the total banks in the United States were sampled and the correspondent banks recorded. The estimate comes from extrapolating the numbers in the sample to the total number of banks in the United States.

[5]Data for the total value of farm goods comes from the 1930 Census.

City, and faced different loan demand schedules due to the different local economic conditions.

4 Data

Data for this project was collected on all state banks and trust companies in New York from 1935 to 1938. Quarterly 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*. We computerized this data for the years relevant to our study.

The structure of state banks and trust companies in New York provides a unique dataset that contains both banks affected by higher reserve requirements and unaffected banks. Our micro-sample consists of data on 291 state-chartered banks and trust companies, 183 of which are non-member banks and 108 are member banks.[6] While over 50 percent of the sample consists of nonmember banks, those banks are much smaller than member banks, averaging almost 60 million in assets versus just over 1 million in assets for nonmember banks. Our data on state-chartered banks represents a large share of all loans in the state of New York. Returning to Figure 2, we see that state-charted banks were important financial intermediaries in New York during this period; they represented 60 percent of total loans.

Table 3 displays the aggregate balance sheet of state commercial banks in 1935. On the asset side, we focus on four types of asset categories that represent loans. The first category is 'mortgages owned,' which are loans on real estate secured.[7] Banks were allowed to make mortgage loans for farmland within one hundred miles of the city, though these mortgage loans accompanied several restrictions. The second category is 'loans and discounts secured by bond and mortgage, deed and other real estate collateral,' which are loans backed by mortgage security and deeds. However, a deed was taken as a mortgage, but not an absolute transfer of ownership. Moreover, well-managed banks avoided deeds. The third category is 'loans and discounts secured by other collateral.' These are loans secured by anything except for real estate security, Liberty Bonds, stocks and bonds listed on the stock exchanges, and unlisted securities. The fourth category is 'loans, discounts, and bills

[6] We have removed 10 banks that switched their membership status.

[7] National banks were prevented from making mortgage loans until the passage of the Federal Reserve Act.

purchased not secured by collateral'. These are loans represented by promissory notes.

On the liability side, we use four types of liability categories that represent deposits: preferred demand deposits, preferred time deposits, regular demand deposits, and regular time deposits. In order to calculate reserves required on demand deposits, we add preferred demand deposits and regular demand deposits. Similarly, in order to calculate reserves required on time deposits, we add preferred time deposits and regular time deposits.

[Table 3]

Table 4 contains sample means and standard deviations for member and nonmember banks before and after the Federal Reserve's adjustments in reserve requirements in 1936. Because the difference-in-difference estimation we later employ uses member banks as a treatment group and nonmember banks as a control group, it is important that banks in both groups have similar characteristics. Overall, the summary statistics confirm that member and nonmember banks are on average relatively similar. In particular, banks in both groups hold similar levels of loan-deposit ratios of approximately 50 percent before the increases in reserve requirements. We observe similar patterns for cash-deposit ratios and securities-deposit ratios. In general, member banks held more cash reserves while nonmember banks held more securities. However, the mean values for both ratios are not significantly different.

[Table 4]

5 Econometric Methodology

In this section, we outline the methods we use to compare bank lending responses to the exogenous increase in reserve requirements. First, we address the issue of selection bias in regards to Federal Reserve membership. We then develop the regression models that underlie our core results.

5.1 Selection Bias

A potential pitfall for this analysis is that the non-random nature of Federal Reserve membership may bias the effect of reserve requirement increases on banks' loan supply schedules. Since

commercial banks are not randomly assigned to membership in the Federal Reserve System, this could create a selection bias issue. We address three main areas of concern in this regard. The first relates to the idea that banks not opting for membership would do so in order to issue riskier loans that member banks could not. Second, we might expect reserve demand to differ for nonmember banks relative to member banks. Finally, if nonmember banks faced different loan demand schedules than member banks, our results would not accurately reflect the effects of an increase I reserve requirements.

If banks not electing membership into the Federal Reserve System did so in order to issue riskier loans than member banks, this would bias our loan growth estimation. However, the regulatory environment in New York State also would have prevented this. The loan regulations listed in Table 2 contain the restrictions on loans that state nonmember banks had to abide by, which restricted the relative amount those banks could loan to one entity either in or outside the state, as well as what could be taken as collateral. Furthermore, as Mitchener (2007) finds, New York State was one of the most stringent state banking authorities and experienced one of the lowest failure rates of any state in the 1929-1933 period. When considering these stringent regulations facing nonmember banks in New York, it is not apparent that banks would sort into member or nonmember status to take advantage of lenient or lax rules regarding loans or reserves against deposits.

The second issue is that banks may have had different reserve demand. In this case, banks would choose to elect membership in the Federal Reserve System in order to access to the discount window and supply credit. While discounting was supposed to attract state-chartered banks to the federal system, White (1983) finds that access to the discount window did not draw state banks into the Federal Reserve System. Instead, nonmember banks could rely on a correspondent network instead of the discount window for additional liquidity needs. As a result, nonmember banks did not have problems accessing funds to meet their reserve demands and thus did not face difficulty in loan supply.

In addition, member and nonmember banks may have faced different loan demand schedules. However, this should not bias our results as joining the Federal Reserve System may have changed the incentives of bank managers, share-holders, and depositors, but not borrowers. As shown in Table 2, the membership status affected capital and reserve requirements. Since both member and nonmember banks were regulated by state-authorities, borrowers would face the same requirements

by banks if they sought loans. Moreover, regulatory structure ensured the two types of banks would face homogenous borrowers. State banking law in New York specified that banks could only operate branches within the town the main office was located. For example, a bank in Buffalo could own and operate branches within the city of Buffalo, but not the nearby town of Tonawanda. Banks in New York City were permitted to operate branches in the city and the surrounding boroughs, as long as the branch resided in the same county as the main office. In this type of an environment, both member and nonmember banks should experience the same loan demand as borrowers should not discriminate amongst state banks based on membership when deciding whom to borrow from.

While we are able to observe bank characteristic such as Federal Reserve membership, town or city, and a host of other traits, there are admittedly some characteristics we do not observe. The advantage of the differences-in-differences empirical strategy is that it ensures any unobserved characteristics that remain constant over time and are correlated with the selection decision and bank loan supply will not bias the estimated effect. The unobservable characteristics are simply differenced out.

Figures 3 and 4 illustrate the movement of loans in New York. Figure 3 examines the trends for the composition of loan portfolios by membership status. The composition of loan portfolios between member and nonmember banks was similar: loans secured by other types of collateral and unsecured loans comprise the majority of loans. Together, these two types of loans comprised over 80 percent of total loans. Bonds and mortgages owned and loans secured by bond, mortgage, or deed comprised less than 10 percent of total loans. While the loan composition varies across regions, it does not vary across membership status.

The similarity between the behavior of member and nonmember banks is also found in the trend behavior of loans from 1935Q1 to 1938Q4 in Figure 4. Two distinct patterns emerge. First, growth in loans for member and nonmember banks followed a similar pattern. Second, bank lending actually increased due to the rise in the amount of loans secured by other and unsecured loans. Not until 1937Q4, well after the final increase in reserve requirements and the start of the recession, does bank lending begin to decline.

As shown in Figures 3 and 4, the paths of loans are similar for member and nonmember banks prior to the increase in reserve requirements for member banks. Since the pre-trends are the same, we focus on the loan supply behavior of the control and treatment groups before and after the

increases in reserve requirements. In the following section, we implement a differences-in-differences estimation technique to assess the impact of higher reserve requirements.

[Figure 3]

[Figure 4]

5.2 Difference-in-Difference Identification

In applying a difference-in-difference estimation technique, we estimate whether higher reserve requirements reduced bank lending. We include time fixed effects that control for any aggregate shocks in the evolution of bank loan supply and bank fixed effects that control for time-invariant influences. Controlling for time and individual effects, our difference-in-difference estimators measuring the effect of higher reserve requirements on bank lending are obtained using the following model:

$$\begin{aligned}\Delta ln(L_{i,t}) = {} & \beta_1 \Delta ln(D_{i,t}) + \beta_2 CHANGE_t + \beta_3 \Delta ln(D_{i,t}) * MEMBER_i \\ & + \beta_4 \Delta ln(D_{i,t}) * CHANGE_t + \beta_5 ln(D_{i,t}) * MEMBER_i * CHANGE_t \\ & + Z + \mu_{i,t}\end{aligned} \tag{1}$$

where the dependent variable is the growth rate of loans for bank i located at time period t. $\Delta ln(L_{i,t})$ represents each of the dependent variables: the growth rate of total loans, the growth rate of loans secured by bonds, the growth rate of loans secured by mortgage, the growth rate of loans secured by other, and the growth rate of unsecured loans. The dummy variable, $Member_i$, takes on the value of one if the observation is for member banks. The other dummy variable, $Change_t$, takes on the value of one if the observation is recorded after the increase in reserve requirements. The vector of controls Z includes time dummies and bank-specific fixed effects to control for unobserved heterogeneity at the bank level.

For robustness, we re-estimate our baseline estimation with two variations. First, we estimate Equation (1) without bank fixed effects. The variable $Member_i$ otherwise interferes with bank fixed effects that enters the equation. Second, we estimate Equation (3) with additional variables to control for balance sheet characteristics that vary over time and across banks. These include the capitalization ratio, loan-to-deposit ratio, loan quality, and log of asset size. The additional

repressors are designed to capture a number of factors that can potentially bias the deposit growth coefficient.

A natural question with respect to our empirical approach is how member banks responded to the new reserve requirements since they were adjusted on three different occasions. In 1936, the Fed raised reserve requirements of member banks on both demand and time deposits by 50 percent. In 1937 it further raised the requirements on demand and time deposits by another 33 percent, thus doubling them from their 1935 level. Lastly, in April 1938 the Federal Reserve relaxed reserve requirements on demand deposits by about 13 percent and on time deposits by 17 percent. However, the 1938 level was still 71 percent higher than the 1935 level. The following regression captures how the changes in reserve requirements affected member banks' loan supply behavior:

$$\begin{aligned}\Delta ln(L_{i,t}) = {} & \beta_1 \Delta ln(D_{i,t}) + \beta_2 CHANGE1_t + \beta_3 CHANGE2_t + \beta_4 CHANGE3_t \\ & + \beta_5 \Delta ln(D_{i,t}) * MEMBER_i + \beta_6 \Delta ln(D_{i,t}) * CHANGE1_t \\ & + \beta_7 ln(D_{i,t}) * MEMBER_i * CHANGE1_t + \beta_8 \Delta ln(D_{i,t}) * CHANGE2_t \\ & + \beta_9 ln(D_{i,t}) * MEMBER_i * CHANGE2_t + \beta_{10} \Delta ln(D_{i,t}) * CHANGE3_t \\ & + \beta_{11} ln(D_{i,t}) * MEMBER_i * CHANGE3_t + Z + \mu_{i,t}\end{aligned} \tag{2}$$

where the variable Change1t is a time dummy with a value of zero for all quarters before the increases in reserve requirement (t $\leq$ Q2 1936) and a value of one for all quarters after the first increase in reserve requirement (Q3 1936 $\leq$ t $\leq$ Q1 1937). Similarly, Change2t and Change3t indicate time dummies that take a value of one for all quarters after the second increase in reserve requirements (Q2 1937 $\leq$ t $\leq$ Q2 1938) and relaxation in reserve requirements (Q3 1938 $\leq$ t $\leq$ Q4 1938), respectively. The coefficients β_7, β_9, and β_{11} represent the difference?in?difference estimates of the effect of reserve requirement increments. If member banks reduced loan supply because reserve requirements were binding for them, their loan supply would have been less than nonmember banks. As a result, we would expect the coefficients on deposit growth to have negative signs.

6 Empirical Results

In Table 5, we report the difference-in-difference estimation after simply dividing the sample period before and after the change in reserve requirements, as illustrated in Equation (1). Column

1 shows the difference-in-difference estimation without bank fixed effects. Column 2 reports results with bank fixed effects, and column 3 reports results with bank characteristics that are regarded as relevant for bank loan supply. With regard to our main variable of interest, the interaction term $\Delta Total\ deposits * Member_i * Change_t$, we find the coefficient to be statistically insignificant in all three columns. These results suggest that the changes in reserve requirements did not cause member banks to contract their loan supply.

[Table 5]

Next, we rerun our models to investigate whether the loan supply behavior of member banks changed when the Federal Reserve changed reserve requirements in three stages between 1936 and 1938. In Table 6, we report the results that examine whether the loan supply behavior of member banks changed after each time the Federal Reserve changed reserve requirements. Results in Table 6 are similar to those in Table 5. Our main variable of interest, interaction terms $\Delta Total\ deposits * Member_i * Change1_t$, $\Delta Total\ deposits * Member_i * Change2_t$, and $\Delta Total\ deposits * Member_i * Change3_t$ are insignificant in all regressions. As shown in columns 2 and 3, including bank specific dummies and bank characteristics adds some explanation to our regression, but does not change the effect of the interaction terms. Taken together, these results suggest that the changes in reserve requirements did not cause member banks to reduce the supply of loans.

[Table 6]

This first set of results strongly advocates that member banks did not reduce loan supply after the Federal Reserve manipulated reserve requirements on three different occasions. The loan supply behavior of member banks was not statistically different from that of nonmember banks, which confirms the suggestion that member banks did not face financing constraints after the Federal Reserve raised reserve requirements. This finding is in line with Calomiris, Mason, and Wheelock (2011) who suggest that increases in reserve requirements had little impact on member banks because they held abundant excess reserves. According to their results, banks did not increase their reserve demand after the new requirements took effect. Our results, which instead focus on loan supply, strongly support their findings that increases in reserve requirements did not cause the recession.

However, there are other possible effects that the increase in reserve requirements could have on bank behavior than simply reducing loan supply. Perhaps it was not the total loan supply that changes after the reserve requirement increases, but the composition of member banks' loan portfolios. Member banks might have reduced the supply of one type of loan and substituted it with a different type of loan, with the total amount of loans outstanding constant. Simply focusing on the aggregate amount of loans at each bank would not allow us to rule out the possibility that these coefficients are hiding the changes in the composition of loan portfolios. The detailed structure of our bank data allows us to investigate this issue. To mitigate such concerns, we compare whether the supply of different types of loans differ between member and nonmember banks. In particular, we consolidate data for loans secured by bonds, loans secured by mortgage, loans secured by other and unsecured loans.

Table 7 presents regression results for the collapsed sample for different loan categories. Table 7 is quantitatively similar to those in Table 6. The coefficients on the interaction terms, $\Delta Total\ deposits * Member_i * Change1_t$, $\Delta Total\ deposits * Member_i * Change2_t$, and $\Delta Total\ deposits * Member_i * Change3_t$ are statistically insignificant for all regressions when we separately run the estimation for different types of loans. Moreover, in Table 7, the coefficient on $\Delta Total\ deposits$ is insignificant for all regressions, whereas in Table 6, the coefficient is significant. These results imply that the banks' loan supply decisions were based on the total outstanding amount of loans rather than the amount of particular types of loans. Nonetheless, these results reinforce our conclusions that the change in reserve requirements did not alter member banks' loan supply behavior.

[Table 7]

A similar concern arises for the categories of deposits. Recall that time deposits and demand deposits were subject to differing reserve requirements for both member and nonmember banks. To compensate for this difference, we rerun equation (2) using demand and time deposits instead of using total deposits. While previous empirical research on the bank lending channel investigates the effect of a short fall in demand deposits on bank lending, our study investigates the effect of a short fall in total deposits because the Federal Reserve increased reserve requirements for both demand and time deposits. However, since demand deposits constitute the majority of total bank deposits and are subject to immediate withdrawal, banks' ability to mitigate shocks to demand

deposits differs from their ability to mitigate shocks to time deposits.

The estimates in Tables 8 and 9 again support our previous results that changes in reserve requirements did not cause a contraction in bank loan supply. While some coefficients on the interaction terms are significant, most of them are insignificant. These results reinforce our findings in Table 6, which show that the change in reserve requirements did not cause a contraction in member banks' loan supply. In addition, we find that the coefficient on $\Delta Demand\ deposits$ and $\Delta Time\ deposits$ in Tables 8 and 9 are insignificant, whereas the coefficient on $\Delta Total\ deposits$ in Table 6 is significant. This implies that banks made their loan supply decisions contingent on the amount of total deposits rather than demand or time deposits.

[Table 8]

[Table 9]

Next, we investigate whether responses of large banks differed from those of small banks. Our results on the difference between member and non-member banks cannot be robust without controlling for their size differences. If the main results are largely driven by the small five banks, the effect on higher reserve requirements on bank lending may be overestimated. Thus, we examine sub-samples of large and small banks separately. Another role that bank size might play in the transmission of policy effects could be that large banks were more able to raise external funds than smaller banks were. Large banks had access to equity markets and other sources of external funding that smaller banks did not. In this scenario, large banks were able to maintain levels of credit while small banks were not and were forced to reduce loan supply. This would be similar to the results that Ashcraft (2006) found for banks that were members of a bank-holding group. Following Cetorelli and Goldberg (2012), we define a large bank as any bank that is in the 90th percentile or higher of banks sorted by asset size, and a small bank as any bank that is in the 90th percentile or lower.[8]

Table 10 shows that, after controlling for bank size, our results are consistent with our earlier findings. We find that most coefficients on interaction terms are insignificant. For big banks,

[8] Cetorelli and Goldberg (2012) define a large bank as any bank that is in the 95th percentile or higher of banks sorted by asset size, and a small bank as any bank that is in the 90th percentile or lower. They create a gap between the two in order to make the distinction between the two types of banks more clear.

the coefficient on $\Delta Total\ deposits * Member_i * Change3_t$ is significant for total loans and loans secured by other at the 10 percent level. Hence, member banks' loan supply did not decrease until after 1938Q2 after the final adjustment in reserve requirements and the start of the recession. In comparison, for small banks, coefficient on $\Delta Total\ deposits * Member_i * Change1_t$ is significant for unsecured loans at the 10 percent level. While this result may be taken as weak evidence of Ashcrafts (2006) results that small member banks reduced bank lending after the first increase in reserve requirement, the amount of bank lending conducted by small banks is not significant to have a large impact on aggregate bank lending. In addition, note that the regression model explains much of the variation in loan growth for the large banks' sample, whereas it does not explain as much for the small banks' sample. This suggests that unobserved time-invariant bank-specific factors are more important for large banks than small banks. Overall, we interpret the results in Table 10 to indicate that our results are not driven by the behavior of small banks.

[Table 10]

Finally, we compare the loan supply behavior of banks located in New York City and banks located outside New York City. As noted by Velde (2009), banks in New York City held a high proportion of required banks out of total reserves than banks outside New York City, and the reaction of member banks in New York City was markedly different from that of the banking system overall. And as with the distinction between large and small banks, it is also possible that banks in New York City had access to external funds that banks outside of the city did not. Finally, returning to our discussion in Section 3.2, we expect the customer base for banks in each region to differ due to the nature of the economic and demographic structure in each respective area. This allows us to control for factors affecting loan demand that varied by region.

[Table 11]

Table 11 indicates that the member banks' lending behavior did not change after the increases in reserve requirements, regardless of the location of member banks. In most cases the coefficient on interaction terms is insignificant, suggesting that member banks did not reduce lending after the increases in reserve requirements. While some coefficients suggest that member banks reduced lending after the first increase in reserve requirements, they are significant only at the 10 percent

level. More importantly, for both banks in New York City and banks outside New York City we do not find any evidence that member banks reduced the total amount of loans after higher reserve requirements were imposed. This result has important implications for the effect of the reserve requirement increases on loan supply of U.S. banks that are located in areas with large populations. Banks in areas that had high levels of urban residents, large corporate customers, and international borrowers exhibited the same behavior in regards to loan supply as banks in rural areas where agriculture and small individual customers after the reserve requirement increases. This suggests that banks in other areas of the U.S., whether in large urban centers or rural agricultural regions, also did not contract loan supply and incite the recession that followed.

7 Conclusion

Scholars have debated on the impact of the increases in reserve requirements that began in 1936. The Federal Reserve, concerned with growing levels of excess reserves and their ability to control credit, assumed that raising required reserve levels would enable the usual policy tools of the discount window and open market operations to be more effective. Extensive discussions within the Fed indicate policymakers did not believe higher reserve ratios would seriously reduce loan supply and the availability of credit. Friedman and Schwartz (1963) contested this view, arguing the Federal Reserve's actions in 1936 and 1937 reduced high-powered money and the supply of credit, which led to the recession of 1937-38. Recently, the Friedman and Schwartz (1963) view of the origins of the recession of 1937-1938 has been challenged. Currie (1980), Calomiris and Wheelock (1998), Calomiris, Mason, and Wheelock (2012) and Irwin (2012) have argued that the increase in reserve requirements did not case the recession.

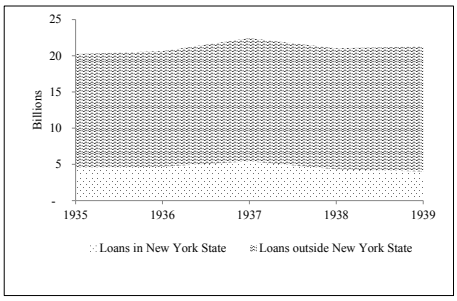
This paper is the first study to examine bank loan supply at a disaggregated level to examine if Federal Reserve member banks reduced their loan supply in response to the increases in reserve requirements. We assembled a unique dataset on the state-chartered banks and trust companies in the state of New York from 1935 to 1938 to compare the loan supply of member banks to that of nonmember banks. Previous studies were unable to address this issue from the perspective of loan supply due to the lack of availability of a control group as we do in the 1930s.

Our findings indicate that bank lending did not contract after reserve requirements were raised,

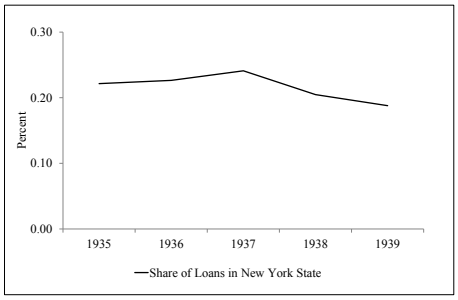
and the loan supply behavior of member banks is indistinguishable from that of nonmember banks. Our results confirm the conclusions of Calomiris, Mason, and Wheelock (2011) and Irwin (2012). The explanation offered by Friedman and Schwartz finds no empirical support in our study. As this was one of the more important events of the Great Depression and largely an unsettled issue amongst academics, our study offers strong support that Federal Reserve officials were correct in their assessment of credit conditions and policy effects surrounding the reserve requirement increase. Since the actions of the Federal Reserve are often cited as a catalyst for much of the turmoil in the banking system after 1930, and some of it deservedly so, their decision to increase reserve requirements does not deserve to be grouped into that category. Instead, their decision to pull member banks within arm's reach of the open market policy tools available to them appears to be a decision made on sound policy considerations.

Turning to a more contemporary interpretation of our results, the Federal Reserve's policy concerning reserve requirements in 1936-1937 has an important implication for monetary policy today. Following multiple rounds of successive quantitative easing, excess reserves increased dramatically in the U.S. banking system beginning at the end of 2008. Currently, excess reserves in U.S. banks total over $1.6 trillion. Recent statements by Chairman Ben Bernanke indicate the Fed might choose to hold certain assets that the Federal Reserve has purchased for an extended period of time, reducing the available portion of the Fed's balance sheet that it could use in an exit strategy from current policies. Two available policy options in such an environment are raising interest payments on excess reserves, and increasing reserve requirements against deposits. While the effectiveness of the former depends on the Federal Reserve's ability to gauge the interest elasticity of reserve demand and raise interest rates accordingly, the latter can immediately affect excess reserves. While we are not suggesting that raising reserve requirements is a specific step the Fed should take, we do suggest that in certain environments it is a policy tool that can control excess reserves without immediately reducing the loan supply of a banking system.

Figure 1: Loan Totals, New York State and Rest of the U.S., 1935-1939.



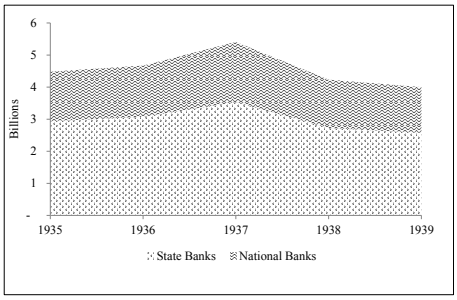
(a) Total Volume



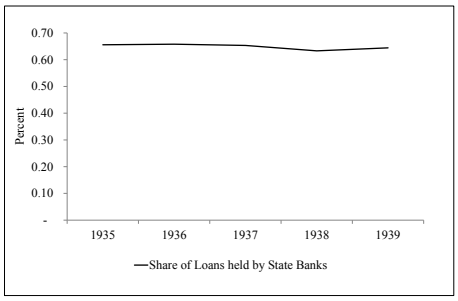
(b) Percentage

Source: All Bank Statistics, 1896-1955.

Figure 2: Loan Totals, by Bank Charter New York State, 1935-1939.



(a) Total Volume

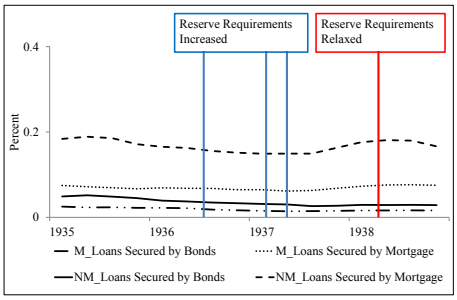


(b) Percentage

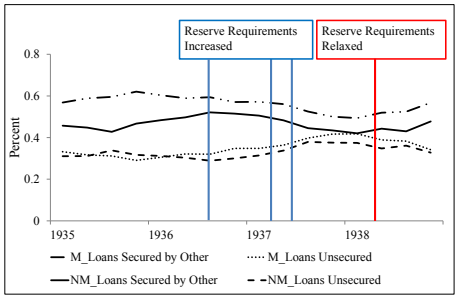
Source: All Bank Statistics, 1896-1955.

Figure 3: Percent of Total Loans in Each Category, by Federal Reserve Membership and Location, 1935-1938.

Panel A. All Banks in New York State

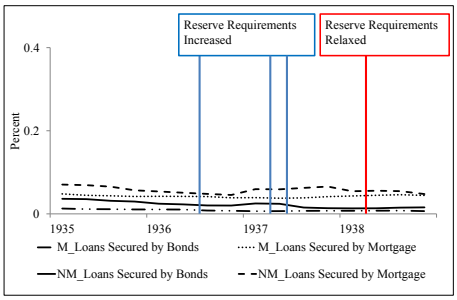


(a) Loans Secured by Bonds and Loans Secured by Mortgage

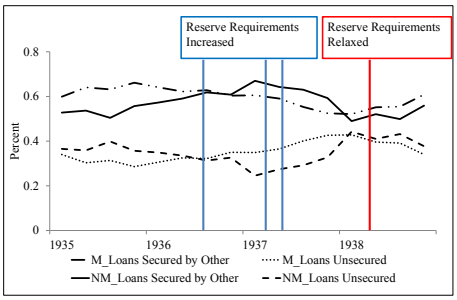


(b) Loans Secured by Other and Loans Unsecured

Panel B. All Banks in New York City

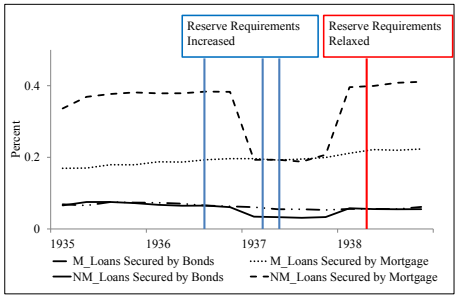


(c) Loans Secured by Bonds and Loans Secured by Mortgage

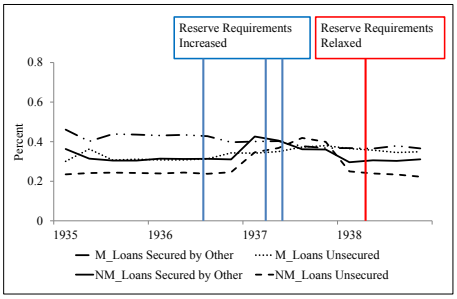


(d) Loans Secured by Other and Loans Unsecured

Panel C. All Banks outside New York City



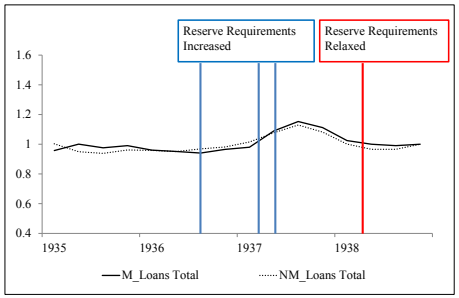
(e) Loans Secured by Bonds and Loans Secured by Mortgage



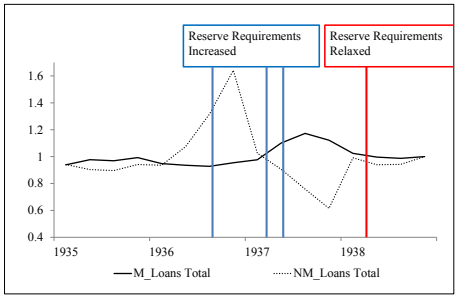
(f) Loans Secured by Other and Loans Unsecured

Source: Authors' calculations.

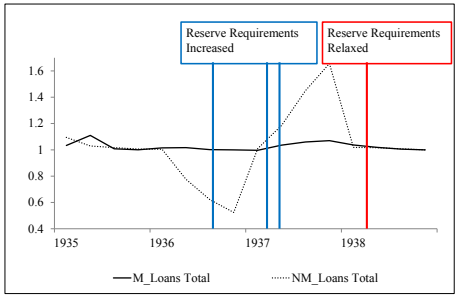
Figure 4: Loan Activity Indexed to Average of 1935, State Banks in New York State, 1935-1938.



(a) All Banks in New York State



(b) All Banks in New York City



(c) All Banks outside New York City

Source: Authors' calculations.

Table 1: Federal Reserve Member Bank Reserve Requirements Against Deposits, June 21, 1917 - October 31, 1941.

Class of Deposits and Bank (Percent of Deposits)	June 21, 1917 - Aug. 15, 1936	Aug. 16, 1936 - Feb. 28, 1937	Mar. 1, 1937 - Apr. 30, 1937	May 1, 1937 - Apr. 15, 1938	Apr. 16, 1938 - Oct. 31, 1941
Net Demand Deposits:					
Central reserve city	13	19.5	22.75	26	22.75
Reserve city	10	15	17.5	20	17.5
Country	7	10.5	12.25	14	12
Time Deposits:					
All member banks	3	4.5	5.25	6	5

Source: Board of Governors of the Federal Reserve System (1943). *Banking and Monetary Statistics*, 1914-41. Washington, DC.

Table 2: Regulatory Requirements, New York State Federal Reserve Member and Nonmember Banks.

	State Members	***State Nonmembers***
Capital Stock	Population of town less than 3,000 : $25,000 Population of town greater than 3,000 but less than 6,000 : $50,000 Population of town greater than 6,000 but less than 50,000 : $100,000 Population of town more than 50,000 : $200,000 In an outlying district of a town with a population more than 50,000 : $100,000	Population of town less than 2,000 : $25,000 Population of town greater than 2,000 and less than 30,000 : $50,000 Population of town over 30,000 : $100,000
Reserves against Deposits	If not in a reserve or central reserve city: 7% demand deposits and 3 percent time deposits If in a reserve city: 10 % demand deposits and 3 % time deposits If in a central reserve city: 13 % demand deposits and 3 % time deposits (Banks were allowed to count interbank balances as part of their reserves.)	Population of town less than 1,000,000 : 12% of demand deposits with 4 % on hand Population of town over 1,000,000 but less than 1,500,000 : 15 % of demand deposits with 10 % on hand Population of town over 1,500,000 : 18% of demand deposits with 12 % on hand
Surplus Fund	NA	Up to 20% of the value of capital stock can be used to pay losses.
Can hold stocks or bonds from United States Government?	Yes	Yes
Can hold stocks or bonds from State of NY?	Yes	Yes
Amount to be loaned to one individual or company	NA	Not more than 10% of Paid-up Capital and Surplus.
Amount to be loaned to any entity outside of NY State, if bank is in NYC	NA	Not more than 25% of Paid-up Capital and Surplus
Amount to be loaned to any entity outside of NY State, if bank is outside NYC	NA	Not more than 40% of Paid-up Capital and Surplus
Highest Amount Bank Can Hold of Capital Stock in Another Corporation as Loan Collateral	NA	Not more than 10% of the Capital Stock of the Other Corporation
Can operate branches?	Yes, as long as it is in the same town as the main office.	Yes, as long as it is in the same town as the main office.

Sources: Data for Federal Reserve members come from the *Federal Reserve Bulletins*. Data for the New York State requirements come from the New York State Banking Department (1930).

Table 3: Assets and Liabilities Reported, 1930-1932 and 1935-1938.

Assets	Liabilities
Specie	Capital
Other currency authorized by the United States government	Surplus, including all undivided profits
Cash Items	Reserves for taxes, expenses, contingencies, etc.
Due from NY Federal Reserve Bank, less offsets	Deposits
Due from other approved reserve depositories, less offsets	Preferred
Due from other banks, bankers, and trust companies	Demand
Stocks and bond investments	Time
Loans and discounts secured by bond, mortgage, deed, or other real estate collateral	Not preferred
Loans and discounts secured by other collateral	Demand
Loans, discounts, and bills purchased but not secured by collateral	Time
Own acceptances purchased	Due trust companies, banks, and bankers
Overdrafts	Bills payable
Bonds and mortgages owned	Rediscounts
Real estate	Acceptances of drafts payable at a future date or authorized by commercial letters of credit
Customers liability on acceptances (per contra, see liabilities)	Bills purchased sold with endorsement
Customers liability on bills purchased and sold with endorsement	Other liabilities
Other Assets	

Source: New York State Banking Department (1930-1932, 1935-1938).

Table 4: Summary Statistics, New York State Banks, Before and After the Reserve Requirement Increases.

	Member Banks		Non-member Banks	
	Before	After	Before	After
Cash-Deposit Ratio	0.22	0.27	0.18	0.19
	[0.12]	[0.13]	[0.11]	[0.11]
Securities-Deposit Ratio	0.48	0.47	0.51	0.51
	[0.16]	[0.15]	[0.19]	[0.17]
Loan-Deposit Ratio	0.46	0.41	0.5	0.46
	[0.15]	[0.13]	[0.19]	[0.16]
Capitalization Ratio	0.16	0.14	0.19	0.16
	[0.05]	[0.05]	[0.06]	[0.05]
Asset	69,900,000	75,800,000	9550479	10700000
	[235,000,000]	[253,000,000]	[43600000]	[48500000]
Cash	16,200,000	23,100,000	2088046	2919995
	[60,200,000]	[81,900,000]	[11600000]	[16300000]
Total Excess Reserves	10,800,000	12,700,000	1190048	1891652
	[42,700,000]	[48,400,000]	[6621999]	[10500000]
Total Loans	20,700,000	21,900,000	3349137	3661635
	[68,600,000]	[75,200,000]	[15900000]	[18700000]
Loans Secured	472,879	345,742	150193	109535
	[1,330,275]	[876,396]	[496102]	[311017]
Loans Secured by Mortgage	1,445,165	1,499,865	589861	590008
	[3,543,674]	[3,559,219]	[2287623]	[2226214]
Loans Secured by Other	12,300,000	11,900,000	1553939	1718356
	[45,900,000]	[46,900,000]	[7884884]	[9407798]
Loans Unsecured	6,461,582	8,161,744	1055143	1243736
	[21,600,000]	[27,900,000]	[6993760]	[8686430]
Securities	29,800,000	27,400,000	3428578	3483557
	[102,000,000]	[91,500,000]	[14000000]	[12500000]
Total Deposits	47,100,000	51,600,000	7155224	8222568
	[148,000,000]	[62,000,000]	[31800000]	[36300000]
Demand Deposits	40,700,000	44,100,000	5369336	5966884
	[140,00,000]	[151,000,000]	[29400000]	[32800000]
Time Deposits	6,365,792	7,503,738	1785888	2255684
	[13,500,000]	[15,700,000]	[4247002]	[5652012]

Notes: Authors' calculations. 'Before' and 'After' are defined as the periods 1935Q1-1936Q2 and 1936Q3-1938Q4, respectively.

Table 5: Effects of Reserve Requirement Increase on Total Bank Loans, State Banks in New York State.

	(1) Δ Total loans	(2) Δ Total loans	(3) Δ Total loans
Δ Total deposits	0.10**	0.07	0.09*
	(0.045)	(0.046)	(0.048)
Δ Total deposits*Member	-0.05	-0.05	-0.02
	(0.081)	(0.085)	(0.083)
Δ Total deposits*Change	-0.02	-0.01	0.04
	(0.061)	(0.063)	(0.06)
Δ Total deposits*Change*Member	-0.07	-0.06	-0.09
	(0.105)	(0.11)	(0.105)
Loans to assets$_{t-1}$			-0.67***
			(0.042)
Capital to assets$_{t-1}$			0.07
			(0.093)
Ln(Asset)$_{t-1}$			-0.06**
			(0.03)
Loan quality$_{t-1}$			0.10**
			(0.04)
Bank FE	No	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	4,283	4,283	4,283
R-squared	0.018	0.085	0.186

Notes: This table shows results for the regressions of Equation (1) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change is a dummy variable that is zero for the pre-reserve requirement increments period and one after the reserve requirement increments. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 6: Effects of Each Reserve Requirement Increase on Total Bank Loans, State Banks in New York State.

	(1)	(2)	(3)
	Δ Total loans	Δ Total loans	Δ Total loans
Δ Total deposits	0.10**	0.07	0.09*
	(0.045)	(0.046)	(0.048)
Δ Total deposits*Member	-0.05	-0.05	-0.03
	(0.081)	(0.085)	(0.083)
Δ Total deposits*Change 1	-0.03	-0.02	0.02
	(0.086)	(0.089)	(0.085)
Δ Total deposits*Change 1*Member	-0.17	-0.17	-0.16
	(0.147)	(0.156)	(0.143)
Δ Total deposits*Change 2	-0.02	-0.01	0.04
	(0.077)	(0.079)	(0.072)
Δ Total deposits*Change 2*Member	0.03	0.04	-0.02
	(0.122)	(0.126)	(0.119)
Δ Total deposits*Change 3	0	0.01	0.06
	(0.091)	(0.092)	(0.095)
Δ Total deposits*Change 3*Member	-0.17	-0.15	-0.2
	(0.18)	(0.193)	(0.175)
Loans to assets$_{t-1}$			-0.67***
			(0.042)
Capital to assets$_{t-1}$			0.07
			(0.093)
Ln(Asset$_{t-1}$			-0.06**
			(0.03)
Loan quality$_{t-1}$			0.10**
			(0.04)
Bank FE	No	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	4,283	4,283	4,283
R-squared	0.02	0.086	0.187

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment periods and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the third reserve requirement increment 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 7: Effects of Reserve Requirement Increases on Bank Loans by Loan Type, State Banks in New York State.

	(1) Δ Loans secured by bonds	(2) Δ Loans secured by mortgage	(3) Δ Loans secured by other	(4) Δ Loans unsecured
Δ Total deposits	0.10	-0.10	-0.05	0.13
	(0.184)	(0.072)	(0.147)	(0.126)
Δ Total deposits*Member	-0.06	0.12	0.04	-0.08
	(0.237)	(0.081)	(0.166)	(0.198)
Δ Total deposits*Change 1	-0.18	-0.06	0.33	0.29
	(0.287)	(0.102)	(0.229)	(0.287)
Δ Total deposits*Change 1*Member	0.28	0.12	-0.21	-0.52
	(0.376)	(0.137)	(0.267)	(0.376)
Δ Total deposits*Change 2	-0.27	0.01	0.04	0.00
	(0.233)	(0.144)	(0.202)	(0.183)
Δ Total deposits*Change 2*Member	0.24	0.00	0.08	0.11
	(0.364)	(0.178)	(0.236)	(0.267)
Δ Total deposits*Change 3	0.06	0.20	0.01	0.12
	(0.428)	(0.138)	(0.246)	(0.209)
Δ Total deposits*Change 3*Member	0.34	0.01	-0.13	-0.25
	-0.535	-0.159	-0.327	-0.349
Balance Sheet Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	3,942	4,082	4,291	4,272
R-squared	0.075	0.121	0.114	0.175

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment periods and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the third reserve requirement relaxation 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 8: Effects of Reserve Requirement Increases in Demand Deposits on Total Bank Loans.

	(1) Δ Total Loans	(2) Δ Loans secured by bonds	(3) Δ Loans secured by mortgage	(4) Δ Loans secured by other	(5) Δ Loans unsecured
Δ Demand deposits	0.03	0.12	-0.01	-0.02	0.07
	(0.021)	(0.082)	(0.027)	(0.051)	(0.052)
Δ Demand deposits*Member	0.01	-0.11	0.03	0.14*	-0.01
	(0.032)	(0.102)	(0.032)	(0.076)	(0.084)
Δ Demand deposits*Change 1	0.02	-0.18	-0.04	0.19*	-0.03
	(0.036)	(0.114)	(0.039)	(0.098)	(0.106)
Δ Demand deposits*Change 1*Member	-0.09	0.23	0.02	-0.28**	-0.15
	(0.063)	(0.152)	(0.056)	(0.131)	(0.161)
Δ Demand deposits*Change 2	0.00	-0.19*	-0.02	0.04	0.00
	(0.033)	(0.106)	(0.052)	(0.080)	(0.072)
Δ Demand deposits*Change 2*Member	0.00	0.14	0.04	-0.10	0.03
	(0.051)	(0.164)	(0.074)	(0.111)	(0.121)
Δ Demand deposits*Change 3	0.03	0.09	0.04	0.02	0.07
	(0.037)	(0.167)	(0.040)	(0.092)	(0.096)
Δ Demand deposits*Change 3*Member	-0.07	0.10	-0.01	-0.16	-0.09
	(0.062)	(0.208)	(0.055)	(0.140)	(0.155)
Balance Sheet Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	4,279	3,937	4,079	4,265	4,265
R-squared	0.182	0.077	0.120	0.117	0.171

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment periods and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the third reserve requirement relaxation 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 9: Effects of Reserve Requirement Increases in Time Deposits on Total Bank Loans.

	(1) Δ Total Loans	(2) Δ Loans secured by bonds	(3) Δ Loans secured by mortgage	(4) Δ Loans secured by other	(5) Δ Loans unsecured
Δ Time deposits	-0.01	0.01	-0.05*	0.10	-0.15
	(0.034)	(0.095)	(0.030)	(0.064)	(0.126)
Δ Time deposits*Member	-0.00	-0.05	0.08**	-0.14**	0.23*
	(0.039)	(0.107)	(0.037)	(0.066)	(0.134)
Δ Time deposits*Change 1	0.07	-0.27	0.06	-0.08	0.30*
	(0.057)	(0.195)	(0.049)	(0.073)	(0.173)
Δ Time deposits*Change 1*Member	-0.05	0.31	-0.01	0.12	-0.39**
	(0.066)	(0.203)	(0.085)	(0.076)	(0.182)
Δ Time deposits*Change 2	0.02	-0.05	0.06	-0.05	0.18
	(0.041)	(0.143)	(0.037)	(0.076)	(0.149)
Δ Time deposits*Change 2*Member	0.02	0.30	0.07	0.06	-0.35*
	(0.061)	(0.209)	(0.081)	(0.081)	(0.201)
Δ Time deposits*Change 3	0.03	-0.28	0.11	-0.14	0.30
	(0.060)	(0.306)	(0.132)	(0.109)	(0.182)
Δ Time deposits*Change 3*Member	-0.10	0.36	0.04	0.20	-0.59**
	(0.115)	(0.432)	(0.168)	(0.188)	(0.259)
Balance Sheet Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	4,228	3,945	4,060	4,272	4,240
R-squared	0.181	0.075	0.122	0.116	0.174

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment periods and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the reserve requirement relaxation period 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 10: Effects of Reserve Requirement Increases on Total Bank Loans, By Bank Size, State Banks in New York State.

	(1)	(2)	(3)	(4)	(5)	(6)
	Big Banks			Small Banks		
	Δ Total loans	Δ Loans secured by other	Δ Loans unsecured	Δ Total loans	Δ Loans secured by other	Δ Loans unsecured
Δ Total deposits	0.25**	0.28*	-0.23	0.07	-0.07	0.18
	(0.122)	(0.154)	(0.664)	(0.052)	(0.152)	(0.126)
Δ Total deposits*Member	-0.07	-0.44***	-0.26	-0.07	0.11	0.01
	(0.144)	(0.154)	(0.735)	(0.098)	(0.191)	(0.202)
Δ Total deposits*Change 1	0.07	0.36	0.30	0.01	0.30	0.25
	(0.188)	(0.780)	(0.767)	(0.090)	(0.236)	(0.303)
Δ Total deposits*Change 1*Member	-0.16	-0.25	-0.00	-0.19	-0.19	-0.72*
	(0.224)	(0.711)	(0.864)	(0.177)	(0.316)	(0.420)
Δ Total deposits*Change 2	0.02	0.00	0.02	0.06	0.05	0.00
	(0.167)	(0.269)	(0.691)	(0.078)	(0.213)	(0.192)
Δ Total deposits*Change 2*Member	-0.08	0.24	0.63	0.03	0.02	-0.03
	(0.211)	(0.300)	(0.875)	(0.139)	(0.266)	(0.274)
Δ Total deposits*Change 3	0.31	0.40	-0.20	0.06	-0.00	0.07
	(0.347)	(0.660)	(0.920)	(0.097)	(0.253)	(0.212)
Δ Total deposits*Change 3*Member	-0.72*	-1.22*	0.67	-0.14	-0.10	-0.39
	(0.373)	(0.677)	(1.198)	(0.199)	(0.359)	(0.368)
Balance Sheet Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	434	433	428	3,849	3,858	3,844
R-squared	0.432	0.263	0.249	0.179	0.117	0.176

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment period and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the reserve requirement relaxation period 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

Table 11: Effects of Reserve Requirement Increases on Total Bank Loans and Loan Categories, By Location, State Banks in New York State.

	(1)	(2)	(3)	(4)	(5)	(6)
	Banks in New York City			Banks Outside New York City		
	Δ Total loans	Δ Loans secured by other	Δ Loans unsecured	Δ Total loans	Δ Loans secured by other	Δ Loans unsecured
Δ Total deposits	0.37***	0.32*	0.45	0.00	0.02	-0.02
	(0.141)	(0.177)	(0.370)	(0.047)	(0.132)	(0.110)
Δ Total deposits*Member	-0.44	-0.05	-0.88*	0.10*	-0.01	0.17
	(0.270)	(0.223)	(0.480)	(0.061)	(0.203)	(0.163)
Δ Total deposits*Change 1	-0.14	-0.04	0.08	0.02	0.18	0.12
	(0.248)	(0.248)	(0.498)	(0.078)	(0.265)	(0.191)
Δ Total deposits*Change 1*Member	-0.17	-0.55*	0.24	-0.15	-0.04	-0.45*
	(0.429)	(0.318)	(0.671)	(0.120)	(0.341)	(0.268)
Δ Total deposits*Change 2	-0.32	-0.22	-0.35	0.11	0.02	0.16
	(0.224)	(0.253)	(0.424)	(0.074)	(0.204)	(0.165)
Δ Total deposits*Change 2*Member	0.35	0.03	0.43	-0.14	0.02	-0.28
	(0.350)	(0.337)	(0.646)	(0.098)	(0.276)	(0.233)
Δ Total deposits*Change 3	0.07	-0.57	1.50**	0.07	-0.11	0.12
	(0.321)	(0.371)	(0.757)	(0.089)	(0.243)	(0.196)
Δ Total deposits*Change 3*Member	-0.63	0.51	-1.66	-0.12	-0.06	-0.23
	(0.645)	(0.518)	(1.069)	(0.123)	(0.367)	(0.309)
Balance Sheet Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	501	489	486	3,771	3,771	3,758
R-squared	0.296	0.333	0.397	0.187	0.105	0.190

Notes: This table shows results for the regressions of Equation (2) in which the change in the average stock of loans is the dependent variable. The sample includes all state-chartered banks and trust companies in New York. The regression examines the marginal impact of reserve requirement changes implemented on three different occasions. Change 1 is a dummy variable that is zero for the pre-reserve requirement increments period and one after the first increment period 1936Q3-1937Q1. Change 2 is a dummy variable that is zero for the pre-requirement increment and the first reserve requirement increment periods and one after the second reserve requirement increment period 1937Q2-1938Q2. Change 3 is a dummy variable that is zero for the pre-reserve requirement increment period, first reserve requirement increment period, and second reserve requirement increment period and one after the third reserve requirement relaxation 1938Q3-1938Q4. Loans to assets and Capital to assets are the ratios of loans and capital, for each bank, relative to its total assets. Ln(Asset) is the natural logarithm of each bank's total assets. Loan quality is the ratio of safe loans (loans secured by bonds and loans secured by mortgage) relative to total loans. We also include bank fixed effects and time dummies in the regressions. We show clustered standard errors on bank and time levels in parenthesis. Statistical significance levels of 10 percent, 5 percent, and 1 percent are denoted by ***, **, and *, respectively.

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