The Behavior of Excess Reserves in the Great Contraction: Evidence from the Central Money Market

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ABSTRACT

The banking industry experienced a significant amount of distress during the Great Contraction of 1929-1933. In response, banks were forced to adjust their portfolios with the changing economy. One aspect banks had control over was their reserves. While there has been extensive analysis of bank reserves after the bank holiday of 1933, little is known about bank-level reserve holdings during the Great Contraction. This paper exploits a unique data set of Federal Reserve member and nonmember banks in New York City during that period. My results show that nonmember banks increased their ratio of excess reserves to assets after the first banking panic compared to member banks. Macroeconomic variables strongly influenced reserve holdings. The interest rates on short-term, liquid securities had a negative correlation with reserves. Lastly, the discount rate, representing the price of liquidity, had a positive relationship with reserves. These results provide new evidence on how banks were allocating their portfolios during the Great Contraction.

1. Introduction

The Great Contraction of 1929-1933 marks the most chaotic economic era of the US economy. During this time, banks experienced large amounts of withdrawals and loan defaults that led to a rash of bank failures. In response to these pressures, banks began to alter the composition of their portfolios. One of the more important aspects of a banks portfolio is the level of excess reserves. This paper examines the excess reserve holdings of banks in the central money market of New York City during the Great Contraction of 1929–1933.

Monetary economists and economic historians have been interested in the variation of banks' excess reserves during the latter part 1930s for decades. The main focus of that interest is explaining why banks would want to hold such high levels of cash reserves instead of placing them into revenue-earning assets following the bank holiday in 1933. When banks increase their levels of excess reserves in a time of monetary expansion, it reduces the effectiveness of monetary policy. Friedman and Schwartz (1963) assign blame to the Federal Reserve for not operating a sufficiently expansionary monetary policy that would have steered the economy out of the Depression. Learning how banks manage their reserves in the Contraction would shed light on how effective this approach would have been in reducing the severity of the Great Depression.

Early research generated two conflicting explanations for the reserve accumulation. Friedman and Schwartz (1963) argue that banks desired a higher level of reserves following the panic periods of the early 1930s. Banks could no longer forecast how depositors might behave and sought increased protection against bank runs. Horwich (1963) hypothesizes that banks built up excess reserves because they had no profitable alternatives to holding cash. While these

studies have tried to explain reserve behavior *after* the Contraction, there has been little investigation of reserve behavior *during* the Contraction. How did banks choose their excess reserve levels? What macroeconomic, monetary, or regulatory issues affected reserve behavior? The existing literature does not provide comprehensive answers to these questions. Since the Federal Reserve has received much criticism for not expanding the money supply in the Contraction, improving our understanding of the cause of the reserve accumulation is important.

This study improves on the past literature in several ways. First, I use bank-level data on both member and nonmember banks. Filling a previous gap in the literature, this provides an account of bank behavior of banks falling under different regulatory agencies and requirements. Second, the bank-level data allows for the control of bank size and portfolio composition. Lindley, Mounts, and Sowell (2006) state that applying microeconomic portfolio theory to aggregate data can lead to inaccurate conclusions about bank behavior. Bank size and portfolio composition should be important factors in reserve decisions.

In an effort to answer this question and enhance the understanding of the behavior of banks in the Great Contraction, I investigate the factors that influenced a bank's decision to hold cash assets during the Great Contraction of 1929–1933. Using archival data from the New York State Banking Department, I compile a data set of all state banks and trust companies in New York from 1929–1932. I find that nonmember banks increased their share of assets in excess reserves after the first banking panic and held a higher ratio than member banks. I also find that the discount rate, or the premium for liquidity, was positively correlated with bank reserve levels. Finally, the yield on short-term investments, or the opportunity cost of holding cash, was negatively related to reserve holdings.

The paper is organized as follows: Section II provides a review of the competing explanations of the buildup of reserves following the bank holiday in 1933. Section III describes the different regulatory regimes governing banks and the structure of the banking industry in New York. Data sources and summary statistics are presented in Section IV and the econometric results are in Section V. Concluding remarks and a discussion of further extensions close the paper in Section VI.

2 PREVIOUS EXPLANATIONS OF RESERVE BEHAVIOR

There are two competing views of why banks accumulated excess reserves in the 1930s. Economists such as Friedman and Schwartz (1963) assert that reserve accumulation was an intentional response by banks to the banking panics of the Contraction. Others such as Bernanke (1983), Bernanke and Gertler (1990), and Lindley et al. (2001) suggest they were an unintentional consequence of the high risk and low returns of alternative assets. Lindley et al. (2001) recognize the importance of this distinction, stating that if excess reserves were desired by banks then expansionary monetary policy would have eventually increased the money supply. Specifically, once they achieved their target for precautionary reserves, banks would have begun to increase their lending to businesses and households. But, if the reserve accumulation was the result of high risk and low return of alternative assets, then no amount of monetary expansion could increase the money supply.

2.1 The Precautionary Demand View

The hypothesis that reserve behavior was driven by a precautionary motive has received the most attention in the literature. Two approaches involving this hypothesis have been adopted.

Friedman and Schwartz (1963) suggest that banks' precautionary demand for reserves was in response to the banking panics of the early 1930s. During the panics, banks were subject to a large outflow of deposits and nearly 40% of the banks in the US ceased operations.[1] In what came to be known as the "liquidity shock effect," banks were holding larger reserves after the bank holiday in 1933 in anticipation of future runs on deposits. Friedman and Schwartz contend that short-term interest rates could not explain the buildup of reserves after the holiday of 1933. As time went on and banks did not experience any large runs on deposits, banks should have let their reserves fall to lower levels. But a rise in the reserve requirements in 1936 and 1937, authorized by the Banking Act of 1935, further increased banks' demand for reserves. While the work of Friedman and Schwartz is considered seminal in the literature, their conclusions were drawn from aggregate figures and anecdotal evidence.

Morrison (1966) focuses on "inertia effect," supposing that banks had adjusted their reserve behavior in response to the large deposit outflows of the early 1930s. However, this effect differs from the shock effect described by Friedman and Schwartz (1963). Under the inertia effect banks would only build up their excess reserves if there is a flow of deposits back into the system following the crisis, whereas the shock effect has banks building up reserves immediately following a banking panic. Morrison notes that reserves gradually built up over the years following the holiday in 1933. If banks were reacting simply to the banking crises in the manner that Friedman and Schwartz suggest, then the buildup would have been more severe immediately following the resumption of business in 1933. Morrison claims this gradual nature of the buildup of reserves beginning in 1933 supports his theory over that of Friedman and Schwartz.

[1] For a detailed account of bank failures in the Great Contraction, see Richardson (2006).

More recently Calomiris and Wilson (1996) suggest that banks desired higher level of reserves in order to signal liquidity to depositors and the banking system. Using a sample of large member banks in New York City, they find that banks could not issue capital to build up their cash reserves. In an effort to signal liquidity to the system, banks instead accumulated cash in lieu of issuing bank capital. Holding cash was risk-free and served as in insurance against any potential unexpected deposit outflows. But their sample of banks only included twenty-five of the larger banks in the New York City area. In doing so, they do not observe how smaller member banks or any of the nonmember banks were behaving.

The overall theme of this branch of literature is that banks built up their reserves as a precautionary response to a liquidity shock: the banking panics of the 1930s. While these studies offer an intuitive explanation to why banks would want to increase reserve levels, they do not distinguish the response difference between Federal Reserve member and nonmember banks. Also, the role of the opportunity costs of holding cash and monetary policy variables are discussed, but not extensively investigated empirically.

2.2 The Alternative Assets View

Perhaps the most referenced work on the effect of increased costs on reserve accumulation is Bernanke (1983). Citing the difficulty of monitoring and screening for the quality of loan applicants after the holiday, he suggested that banks could not distinguish “good” borrowers from “bad” borrowers. Following the bank holiday, nearly 40 % of the banks in business in 1929 were no longer operating. Since there was no central credit reporting agency during this time, the failed banks meant that information on past borrowers was lost. There was little that banks could do in this situation to overcome the issues of asymmetric information and

adverse selection. This discouraged banks from lending. When deposits began to return to the banking system following the banking holiday, the cost of credit intermediation had risen so high that the opportunity cost of holding cash assets became relatively low. In response, the excess reserves of the banking system grew steadily until the entry of the US into World War II.

Mounts, Sowell, and Saxena (2000) use aggregate data for country member banks in each Federal Reserve district and find that banks were unintentionally accumulating reserves due to high internal adjustment costs. While deposits flowed into the banking system after the Contraction, banks were limited in their ability to convert the new source of funds into revenue-producing assets. As will be shown later, using country banks as a gauge for the response of banks is not a useful measure of bank behavior in larger markets. Not only do country banks represent a small percentage of total assets in the US compared to reserve city banks, but they serve a much different market. If the majority of assets are held in banks that operate under different circumstances, then the implications of the findings on country banks are not indicative of those operating in the larger markets.

The literature supporting this theory of reserve accumulation mainly cites the increased costs of assets other than cash. This is in stark contrast with the precautionary theories of Friedman and Schwartz (1963) and Morrison (1966). Their theories stress that opportunity costs were largely secondary in explaining reserve accumulation. The Contraction offers for a unique setting to examine these competing views. There were not only several deposit shocks to the banking industry in this time, but the opportunity costs of holding cash to assets fell. Yields on short-term, liquid securities fell to extremely low levels, and the higher default rate of businesses meant that corporate bonds became riskier. In this environment, banks should have seen excess reserves as a riskless asset that could not only be used to meet depositor needs. Holding cash

assets also would have carried a lower opportunity cost relative to revenue-earning assets due to the low returns or high risk mentioned above.

The current literature is divided on the causes for the buildup of reserves following the bank holiday. Even the more recent literature of Calomiris and Wilson (1996) and Lindley et al. (2001) has come to differing conclusions using more disaggregated data than the previous work. The inconsistencies of these conclusions indicate there are not only regional differences amongst bank behavior, but that bank-level data should be used in order to accurately capture this behavior.

3 REGULATORY STRUCTURE IN NEW YORK STATE

New York was in itself a unique part of the banking industry. The access to local, national, and international markets meant that banks in New York City were not only privy to a wide array of customers, but susceptible to multiple pressures on deposits. This section describes how the banking sector of New York was divided amongst regulatory bodies and the requirements governing each group. Returning to the issue of nonmember banks, this section illustrates why nonmember banks might have exhibit a different pattern of behavior than member banks did.

3.1 Industry Structure in New York

By the late 1920's, New York City was undeniably the financial center of the US. While only 4.5% of all banks in the country were located in the state, nearly 29% of the total assets in banks in the US were in New York City.[2] Many banks in the interior of the country held deposits

[2] Sources: All Bank Statistics (1929) and Rand McNally (1929)

in banks in New York City in exchange for services these banks provided. These services included access to bond and securities markets as well as advice on other banking matters (Gregory, 1933). Based on a random sample of 5% of banks, 7,460 of the 25,568 banks did business in one form on another with a New York bank.[3] Therefore, banks in New York City were tied to not only local economic events but those affecting the banks in the rest of the country, as well.

Many national corporations were headquartered in New York City. These companies used banks in New York City to finance business activities through the debt and equity markets that the New York City banks provided easy access to. Approximately 23% of all loans in the country were in New York City.[4] Foreign governments also borrowed from banks in New York City. Both Germany and Austria sold large amounts of bonds to the larger banks there. This exposure to such a large 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.

New York was also one of the most heavily regulated states when it came to bank oversight and can be divided into several groups. Since different regulatory regimes required different levels of reserves and provided certain benefits, this distinction is important. Banks could be classified as either national or state banks. For national banks, Federal Reserve membership was compulsory. While regulation of national banks was technically administered by the Office of the Comptroller of the Currency, they were bound to the regulations and requirements of the Federal Reserve.

[3] The sample comes from the *Rand McNally Bankers Directory* (1929). For each bank, the directory reported the correspondent banks that they held deposits in. 5% of the total banks in the US were sampled and these correspondent banks recorded. The estimate comes from extrapolating the numbers in the sample to the total number of banks in the US.

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

State banks had the option to join the Federal Reserve System but were not required to do so. Those that became members of the Federal Reserve System had to meet the requirements of the Federal Reserve, unless the state requirements on the same issue were stricter. A state bank that did not become a Federal Reserve member operated under the regulations of the state banking regulatory agency.

Figure 1 provides the percentage of assets in New York City for national, state member, and nonmember banks. State banks that were Federal Reserve members comprised the largest group, holding more than 39% of total assets. State nonmembers and national banks each held nearly 30%. From this figure, it is evident that studies which exclude nonmember banks are effectively censoring a large part of the credit channel.

State member banks were also the largest banks with an average size twice that of national banks and three times the size of nonmember banks. The average state member bank in New York City had $157,000,000 in assets, nearly twice that of nonmember banks who had a mean asset total of $42,700,000.[5] With such a discrepancy in size, as well as regulation, it follows that member and nonmember banks might face different pressures in deposit and loan behavior.

Bank assets outside New York City were divided somewhat differently between the different bank memberships. As Figure 2 illustrates, the largest group of assets were held by state nonmember banks, which held 43% in 1929. National banks held 32 % and state member banks were last with 24%. Unlike the New York City, state nonmember banks constituted the largest part of the credit channel in the rural parts of the state. Even outside of New York City, nonmember banks make up a large portion of the assets in the banking sector.

[5] Some of the more notable and larger member banks were the Bankers Trust Company, Central Hanover Bank and Trust Company, Equitable Trust Company, Guaranty Trust Company of New York, and the Irving Trust Company, and the Bank of the United States.

3.2 Regulatory Requirements

As previously shown, banks in New York came under one of three regulatory regimes in the Contraction. This study focuses on Federal Reserve state member banks and nonmember banks. These two groups were subject to a different set of regulations concerning most aspects of operations. The most notable differences between the two groups were in the capital requirements, required reserve ratios, and access to the discount window.

Table 1 presents the regulatory requirements facing both Fed member banks and nonmember banks in New York State. State members and nonmembers faced similar regulation concerning loans, stock purchases, and branching restrictions. While there were slightly differing requirements concerning capital requirements, the largest difference between the two groups was in reserve requirements. Not only were the differences in the percentages of reserves to deposits, but also in the types of deposits against which the two groups had to hold reserves against. State nonmember banks were required to hold deposits against only demand deposits up to a rate of 18%. Member banks had a maximum reserve ratio of 15% on demand deposits, but also had to hold 3% reserves against their time deposits.

Another main difference between the two groups was access to the discount window. Federal Reserve members could borrow from the New York Federal Reserve if they found themselves in the midst of a liquidity crisis. Nonmember banks could not. While it is possible a nonmember bank might be able to borrow from a correspondent bank, there were no guarantees. If a nonmember bank was experiencing a liquidity crisis, the rest of the banking sector in New

York might be experiencing the same pressures. In this instance, a nonmember bank would have a low probability of finding another bank that would be willing to provide funds in a short-term loan. As a result, nonmember banks should exhibit a higher precautionary demand for reserves than Federal Reserve member banks.

Given the differences in regulatory requirements and the exclusivity of the discount window to member banks, we would expect differences in behavior between the two groups during the Great Contraction. Using a data set of member and nonmember banks will allow for the testing of not only this hypothesis, but the competing views of precautionary demand for reserves and weak alternative assets.

4 DATA

4.1 Data Sources

Data for this project were collected on all state banks and trust companies in New York from 1929–32. State banks and trust companies were audited quarterly every year beginning in 1907. The State of New York Banking Department conducted inspections of all financial intermediaries that held a state charter and the resulting information was published in the *Annual Report of the Superintendent of Banks*.

Private bankers are excluded from the analysis since they were not heavily regulated, were not serving as a main component of the credit channel, and often operated as "bootleg lenders." Also, we are interested in exploring the different manners in which Federal Reserve member and nonmember banks were responding to events surrounding the Contraction. The selection of state banks and trust companies provides a sample of both groups. The resulting data

set contains 401 banks and trust companies and 4,132 observations for the entire state. For banks in New York City, there are 72 banks with 946 observations.

In order to control for observable characteristics, data were collected from the Rand McNally *Banker's Directory*. The directory provided information on departments operated, membership information, and correspondents. The directory was published twice a year on June 30th and December 31st. Combining the two sets of data yields a quarterly record of all state banks and trust companies that contains both financial and operating characteristics that were updated semiannually. Referring back to the percentages of assets in each region, the data set permits us to evaluate the behavior of banks holding 70% of assets in New York City and 68% of those outside New York City.

4.2 Definition of Reserves

Using the reserve requirements in Table 1, we can calculate the reserves and excess reserves for both classes of banks in the state. For the purposes of this study, I actually calculate the "effective" excess reserves. Member banks could not technically count vault cash as part of their legal reserves during the Contraction. As Wilcox (1984) suggests, banks should have considered vault cash and other cash assets equally in forgone income when not investing. Furthermore, all cash assets above and beyond what banks were required to hold were technically funds that banks could have placed into revenue-earning assets.

For member and nonmember banks, effective excess reserves, *EER*, is calculated as:

$$EER_{it} = TER_{it} - RR_{it} \qquad (1)$$

where TER_{it} is the total effective reserves for bank *i* in period *t* and RR_{it} are the required reserves for bank *i* in period *t*. For both member and nonmember banks in New York, we can compute the TER_{it} in the following manner:

$$TER_{it} = Specie_{it} + Cash\ Items_{it} + Other\ Currency_{it} + NY\ Fed_{it} + Due\ Other_{it} \quad (2)$$

where *Specie* is the amount of coined money held, *Cash Items* is the amount of cash items in the process of collection, *Other Currency* is all other currency authorized by the US government, *NY Fed* is the amount on deposit at the Federal Reserve Bank of New York, and *Due Other* is the amount on deposit with other banks, bankers, and trust companies.

4.3 Required Reserve Calculations

For nonmember banks, the required reserves were:

$$RR_{it}^{N} = (ResRatio) \times (DD_{it}) \quad (3)$$

where *ResRatio* was the required reserve ratio and *DD* the amount of demand deposits. The reserve ratio would have been 12, 15, or 18% depending on the population of the town the bank was resided in. Nonmember banks were not required to hold reserves against time deposits.

Member banks were required to hold reserves against both time and demand deposits, and their required reserves would have been:

$$RR_{it}^{M} = (ResRatio) \times (DD) + (0.03) \times (TD) \qquad (4)$$

The ratio for time deposits did not vary by town size, and was set at 3% for the time period under study. The reserve ratio for demand deposits could have been 7, 10, or 13% depending on the population of the town or city the bank was located in.

4.4 Estimation of Deposits

As noted above, both demand and time deposits must be known to calculate required reserves. Table 2 contains the detailed summary of balance sheet items reported. Demand and time deposits were only reported for the years 1930 and later. Prior to 1930, the only customer deposits reported were "preferred" and "not preferred." Therefore demand and time deposits must be estimated for the year of 1929.

The estimates for each deposit type are estimated backwards using aggregate figures for members and nonmembers. Friedman and Schwartz (1963) provide quarterly, aggregate time and demand deposit figures for member and nonmember banks in New York State. While the totals for New York City are not provided, the state aggregate figures provide a reasonable basis for the estimation. As shown in Figure 3, 80% of all bank assets in the state were in New York City. Any changes in deposit structure in New York City should be largely reflected in the state aggregate numbers for New York.

Using the Friedman and Schwartz figures, I calculate the percentage of deposits for the quarters in 1929 relative to that in March of 1930. That percentage is then multiplied by the total deposits reported for each bank in the *Annual Report* to obtain the estimates of time and demand deposits. The resulting data set contains time and demand deposits for all banks from 1929 through 1932 and we can calculate the required reserves using equations (3) and (4).

4.5 Results from Calculating Excess Reserves

Figure 4 contains the results of the excess reserves to assets calculations. Banks are disaggregated by region and membership for comparison. Nonmember and member banks in New York City held relatively the same level of excess reserves to assets before and after the stock market crash in October 1929, what most consider to be the onset of the Great Depression. Beginning in mid-1930, however, nonmember banks began to hold higher levels. The difference remains for the entirety of the Depression, with the increase in excess reserves to assets for nonmembers coming before the onset of the first banking panic in December of 1930.

This last graph has important implications about the precautionary demand for reserves that Friedman and Schwartz suggest. As the Depression grew worse and banks could not ascertain how depositors would act, there arose a need for higher bank liquidity. Following the onset of the first banking panic, we see a distinct difference in the behavior of excess reserves between Federal Reserve member and nonmember banks in the central money market. As this was a period when deposits were flowing out of the banking system and bank liquidity was a concern, there is evidence that nonmember banks were building higher levels of precautionary reserves. Federal Reserve member banks, on the other hand, held lower levels of excess reserves.

5 ECONOMETRIC METHODS

5.1 The Model

The evidence so far suggests that Federal Reserve members held lower levels of excess reserves relative to nonmember banks in New York City. We are now interested in checking for the robustness of this pattern of behavior. We are also interested in testing for other variables that might be factoring in to a bank's decision regarding excess reserves besides membership. It is possible that the low value of alternative investments were also factoring in to banks' reserve decisions. In order to capture these effects on banks, I include macroeconomic and monetary variables along with a measure of bank membership over the Contraction in a fixed effects regression.

The share of a bank's assets in reserves can be written as

$$y_{it} = \alpha + X_{it}\beta + u_i + \varepsilon_{it} \tag{5}$$

where y_{it} is the percentage of assets held in effective excess reserves, X_{it} is a vector of macroeconomic, monetary, and bank variables affecting a bank's demand for excess reserves, u_i is a bank fixed effect, and ε_{it} is an error term.

I expand the model to accurately estimate the decisions of banks regarding reserves by including balance sheet, macroeconomic, and monetary variables. We can now formally write equation (5) as:

$$\begin{aligned} y_{it} = \alpha &+ \beta_1 Mem{*}Panic_{it} + \beta_2 Assets_{it} + \beta_3 Interbank_{it} + \beta_4 Treas_t + \beta_5 Baa_t + \beta_6 Disc_t \\ &+ \beta_6 MS_t + \beta_7 Dow_t + \beta_8 IIP_t + \beta_9 Gold_t + \beta_{10} Clearings_t + \beta_{11} SuspDep_t + u_i + \varepsilon_{it} \end{aligned} \tag{6}$$

The variable *Mem* is a dummy that indicates if the bank was a Federal Reserve member or not. A problem arises in controlling for bank membership in this manner in a fixed effects model. For the most part, bank membership is constant over the time period studied. Banks are not frequently entering or exiting the Federal Reserve System. To remedy this problem, the membership variable is interacted with a time-varying dummy variable, *Panic*. The dummy variable is assigned a zero if the observation is before the first banking panic and a one afterwards. The resulting variable $Mem*Panic_{it}$ indicates if the bank was a Federal Reserve member bank in a period after the first banking panic. This stems from the assumption that banks under different regulation would have reacted differently in a period of depositor uncertainty. Banks that were not members of the Federal Reserve System did not have had access to the discount window if there was a run on deposits. It is reasonable to expect that after the onset of the first banking panic, nonmember banks would alter their excess reserves differently than member banks in order to insure against a run. The interaction of the time variable and the Fed membership variable should provide an estimate of this impact. If nonmember banks were holding higher levels of reserves after the first banking panic, even after controlling for other factors, we would expect the coefficient on the interaction term to be negative.

$Assets_{it}$ is the log of total assets for bank *I* in period *t*, which controls for bank size. Larger banks have the risk of larger runs on deposits in absolute terms and thus have a higher risk of not meeting reserve requirements. $Assets_{it}$ captures this aspect and we expect the coefficient to be positive. The variable $Interbank_{it}$ is the percentage of interbank balances on deposit at the bank to total deposits. As mentioned earlier, many banks held balances in banks in New York in exchange for services the New York bank provided. As banks in the interior were

experiencing runs on deposits, we would expect them to withdraw from their accounts in New York to meet the depositor demand. The higher percentage of total deposits that were due to other banks should have reduced the amount of excess reserves a bank would have held, and the coefficient is expected to be negative.

For the macroeconomic and monetary variables, I include variables that the two competing theories of excess reserves stress. $Treas_{it}$ is the interest rate on short-term US Treasury notes and bills and BAA_t is the interest rate on BAA grade corporate bonds. These two interest rates should measure the opportunity cost of holding cash relative to short-term investments. We would expect the coefficients to be negative, as low interest rates would induce banks to hold assets in cash instead of investing in a period of higher probability of bank runs.

$Disc_t$ is the discount rate at the New York Federal Reserve Bank closest to the date of the balance sheet figures. The expected coefficient is positive, since as the discount rate is rises it becomes more expensive for banks to borrow from the Fed. A higher discount rate might also indicate a lower likelihood of a bank securing a loan from the Fed or another bank. Under these circumstances banks would increase their excess reserve ratio if they are concerned with liquidity.

MS_t is the seasonally adjusted money stock in quarter *t* and we would expect it to have a positive coefficient. IIP_t is the index of industrial production in quarter *t*, which serves as a measure of the change in loan demand by firms and individuals.

The change in gold at the New York Federal Reserve Bank, $Gold_t$, measures the foreign demand for liquidity. Large outflows of gold at the Fed would signal an increase in demand for liquidity in foreign markets. Since many of the banks in Europe held deposits in banks in New York City, it follows that excess reserves would fall and that the coefficient would be positive.

$Clearings_t$ is the quarterly total of the amount of bank clearings in New York City. An increase in bank clearings should indicate an increase in demand for deposits and reduce the amount of bank reserves. As a result, we expect the coefficient on *Clearings* to be negative. In order to measure the impact of each banking panic, $SuspDep_t$ is the log quarterly total of deposits in suspended banks. We would expect that the coefficient for this would be negative. Lastly, u_i is a bank fixed effect and ε_{it} is the error term.

5.2 The Issue of Attrition

Admittedly, the data set suffers from attrition. Banks in the central money market of New York City exit the industry over the span of the Contraction.[6] A bank exits the data set due to liquidation, consolidation, or a merger. The concern arises that biased estimates might result from the banks leaving the data set. Figure 7 contains the survival rate of each group of banks in New York City and Table 4 contains the figures of attrition. Banks that exit the data set could be banks that are maintaining a lower level of excess reserves and therefore might be biasing the estimates.

6 EMPIRICAL RESULTS

The regression results from the fixed effects model reinforce the initial observation that nonmember banks held higher levels of excess reserves compared to member banks. Table 5 reports the regression results for various specifications of equation (6). The results in Column 1 contain just the membership and panic interaction. Column 2 has only the macroeconomic and

[6] For a detailed account of bank exit in New York during the Depression, see Van Horn (2006).

monetary variables. Column 3 contains only the bank-specific characteristics and Column 4 includes all of the variables considered.

Federal Reserve members hold lower ratios of excess reserves to assets after the onset of the first banking panic. This is expected, as member banks had access to the discount window. Also, member banks might have made higher quality loans and investments in the economic boom of the 1920s. Both of these factors might explain the difference in reserve levels between the two groups. However, this result supports the Friedman and Schwartz hypothesis that, at least for nonmember banks, there was an increased demand for precautionary reserves. Nonmember banks did not have access to a lender of last resort and as a result they would desire a higher level of precautionary reserves in a time of heightened probability of bank runs.

The yield on short-term Treasury notes and certificates, or the opportunity cost of holding cash, had a negative and statistically significant impact on excess reserves to assets. As the yield on liquid alternative investments fell, so did the opportunity costs of holding cash. Faced with low yielding investments and economic uncertainty, banks were placing their assets into cash instead of investing it.

The coefficient for the discount rate at the New York Federal Reserve Bank, *Disc*, was estimated to be 0.17 at the 99% significance level. This implies that increasing the price of liquidity, or the discount rate, had a positive effect on the excess reserve to assets ratio of banks in both groups. When the New York Fed raised the discount rate, it made the option of using the discount window more expensive. In turn, banks increased their excess reserves levels since this was cheaper to them instead of borrowing from the Federal Reserve or another bank if they were unable to meet their deposit needs.

Not surprisingly the coefficient for the money stock, *MS*, was positive yet only significant at the 90% level. As the money supply shrank in the Contraction, banks would have found it harder to hold higher levels of excess reserves.

Another measure of alternatives to cash, the coefficient for the Dow Jones Stock Index, *Dow*, was negative and significant at the 99% level. As the stock market dipped lower and lower, banks were unsure about the future returns that stocks could offer. Much like in the case of the short-term Treasury securities, this would increase a bank's desire to hold cash instead of investing in the stock market.

Lastly, the level of production, *IIP*, was positively correlated with excess reserves. When production drops, banks might experience a drop in deposits as customers and businesses rely on deposits to replace lost income. In this circumstance, there is a drain on deposits as well as excess reserves as banks lose part of their cash reserves in a deposit drain.

Overall, the results from the fixed effects regression are consistent with the hypothesis that nonmember banks held a higher level of reserves during the Contraction. Even controlling for other bank characteristics, macroeconomic conditions, and monetary variables, the difference remains statistically significant between Federal Reserve member and nonmember banks.

7 CONCLUSION

This paper finds statistically significant evidence that during the Great Contraction of 1929–1933, Federal Reserve nonmember banks held higher levels of excess reserves to assets after the first banking panic. When nonmember banks became concerned with liquidity, they increased the share of their assets in excess reserves. The higher precautionary demand is

consistent with the intentional accumulation theory of Friedman and Schwartz (1963), although their hypothesis concerned banks after the holiday ended in March 1933.

I also find that nonmember banks held higher levels of excess reserves to assets than Federal Reserve state member banks did. Past studies that included only member banks might be misreporting the overall behavior of the banking sector in regards to reserve behavior in the 1930's. Also, the suggestion of Friedman and Schwartz (1963) that the Federal Reserve might have mitigated the later stages of the Depression might have been overstated as nonmember banks represented a large portion of the credit channel.

This result has important policy implications. If excess reserves increase during a time of monetary expansion, part of that expansion is absorbed in the higher levels of excess reserves. When Federal Reserve membership is not compulsory, then in times of financial distress nonmember banks absorb more of that expansion than member banks would. In a scenario such as the Great Depression, compulsory membership would have made a monetary expansion more effective.

I also find evidence of the role of opportunity costs proposed by Mounts et al. (2000). When the opportunity costs of holding cash assets fell, banks held higher levels of excess reserves to assets. These findings call into question the approach and methods of past research. First, by not including nonmember banks in their analysis, past researchers are removing a large portion of the credit channel from their studies. Based on the difference in behavior show here, doing so might not yield an accurate conclusion. Next, I find support for both of the competing theories of reserve accumulation of past research. While it is possible that bank behavior changes considerably after the Depression due to the reduced fear of bank runs and economic growth, it is interesting that past researchers find support for one theory or the other.

Based on the findings of this paper, future research should be directed at examining the behavior of nonmember banks relative to member banks in the banking panics of the Great Contraction. The current literature has made extensive use of member and national bank data, but there is little work on nonmember banks. Given that nonmember banks represented a large amount of the assets in banks and therefore the credit channel, research utilizing data on both Federal Reserve member and nonmember banks might yield new insight into the behavior of banks during this time.

Also, the assessment of bank reserves following the bank holiday in 1933 should be revisited using bank-level data on member and nonmember banks. The results here and the literature on bank behavior after the holiday suggest that banks were operating differently during the Contraction as opposed to after. Was the change in reserve requirements that occurred in 1935 really responsible for the prolonged buildup? Extending the sample of member and nonmember banks used here for the years following the holiday would provide a viable avenue for investigating these issues in a more thorough manner than previous studies have offered.

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Table 1: Regulatory Requirements, Federal Reserve Member and Nonmember Banks, New York State Banks and Trust Companies

	State Members	*State Nonmembers*
Capital Stock	Population less than 3,000 : $25,000 Population greater than 3,000 but less than 6,000 : $50,000 Population greater than 6,000 but less than 50,000 : $100,000 Population more than 50,000 : $200,000 In an outlying district of a city with a population more than 50,000 : $100,000	Population less than 2,000 : $25,000 Population greater than 2,000 and less than 30,000 : $50,000 Population over 30,000 : $100,000
Reserves against Deposits	If not in a reserve or central reserve city: 7% demand deposits and 3% 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 less than 1,000,000 : 12% of demand deposits with 4% on hand Population over 1,000,000 but less than 1,500,000 : 15% of demand deposits with 10% on hand Population 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 US Govt.?	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 New York 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 New York State, if bank is outside NYC	NA	Not more than 40% of Paid-up Capital and Surplus
Highest Amount A Bank Can Hold of Capital Stock in Another Corporation as Collateral for Loans	NA	Not more than 10% of the Capital Stock of the Other Corporation
Can operate branches?	Yes, as long as it conforms to the state branching laws.	Yes, as long as it is in the same city 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 2: Characteristics of New York City Banks, Quarterly, 1929 to 1932

		Excess Reserves to Total Assets				Interbank Balances to Total Deposits				Total Assets ($1,000)			
		State Nonmember Banks		State Member Banks		State Nonmember Banks		State Member Banks		State Nonmember Banks		State Member Banks	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Mar	1929	0.115	0.060	0.125	0.071	0.073	0.201	0.043	0.053	36,700	93,900	135,000	216,000
June	1929	0.123	0.054	0.102	0.039	0.077	0.194	0.053	0.082	42,700	104,000	157,000	299,000
Sept	1929	0.116	0.063	0.155	0.085	0.064	0.189	0.044	0.067	42,500	104,000	190,000	355,000
Dec	1929	0.145	0.086	0.158	0.085	0.063	0.180	0.052	0.072	43,400	112,000	222,000	413,000
Mar	1930	0.127	0.092	0.125	0.056	0.074	0.206	0.047	0.073	38,600	98,800	208,000	368,000
June	1930	0.151	0.103	0.172	0.075	0.075	0.209	0.052	0.080	42,300	116,000	217,000	416,000
Sept	1930	0.136	0.079	0.109	0.079	0.067	0.184	0.055	0.095	37,400	99,500	195,000	367,000
Dec	1930	0.187	0.086	0.146	0.067	0.080	0.186	0.063	0.097	38,900	99,900	226,000	434,000
Mar	1931	0.160	0.080	0.099	0.073	0.078	0.186	0.057	0.095	37,900	95,400	202,000	384,000
June	1931	0.177	0.092	0.139	0.066	0.077	0.184	0.060	0.095	43,300	110,000	203,000	393,000
Sept	1931	0.177	0.097	0.162	0.066	0.083	0.195	0.079	0.105	44,200	106,000	245,000	404,000
Dec	1931	0.191	0.079	0.136	0.042	0.084	0.210	0.064	0.076	45,300	105,000	236,000	366,000
Mar	1932	0.141	0.070	0.091	0.038	0.083	0.204	0.056	0.069	48,800	120,000	196,000	306,000
June	1932	0.183	0.088	0.151	0.058	0.083	0.201	0.070	0.075	49,300	121,000	198,000	307,000
Sept	1932	0.207	0.098	0.138	0.076	0.082	0.203	0.077	0.088	49,500	121,000	210,000	330,000
Dec	1932	0.200	0.075	0.161	0.083	0.092	0.209	0.080	0.094	51,400	128,000	197,000	342,000

Source: New Yok State Banking Department (1929-1932).

Table 2: Assets and Liabilities Reported, 1929

Assets	Liabilities
Specie	Capital
Other currency authorized by the US government	Surplus, including all undivided profits
Cash Items	Preferred deposits, viz:
Due from NY Federal Reserve Bank, less offsets	Due New York State savings banks
Due from other approved reserve depositories, less offsets	Due New York State savings and loan associations, credit unions, and land bank
Due from other banks, bankers, and trust companies	Deposits by the State of New York
Stocks and bond investments	Other deposits secured by the pledge of assets
Loans and discounts secured by bond, mortage, deed, or other real estate collateral	Deposits otherwise preferred
Loans and discounts secured by other collateral	Due depositors, not preferred
Loans, discounts, and bills purchased but not secured by collateral	Due trust companies, banks, and bankers
Own acceptances purchased	Bills payable
Overdrafts	Rediscounts
Bonds and mortgages owned	Acceptances of drafts payable at a future date or authorized by commercial lines of credit
Real estate	Other liabilities
Customers' liability on acceptances (per contra, see liabilities)	
Other assets	

Source: New York State Banking Department (1929).

Table 3: Assets and Liabilities Reported, 1930–1932

Assets	Liabilities
Specie	Capital
Other currency authorized by the US 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).

Table 4: Survival Rates, New York City Banks, 1929–1932

Year	Quarter	State Nonmember Banks	Survival Rate	State Member Banks	Survival Rate
1929	Mar	35	100.00%	37	100.00%
1929	Jun	35	100.00%	37	100.00%
1929	Sep	35	100.00%	36	97.30%
1929	Dec	35	100.00%	36	97.30%
1930	Mar	35	100.00%	34	91.89%
1930	Jun	35	100.00%	32	86.49%
1930	Sep	35	100.00%	32	86.49%
1930	Dec	32	91.43%	30	81.08%
1931	Mar	31	88.57%	31	83.78%
1931	Jun	30	85.71%	32	86.49%
1931	Sep	27	77.14%	25	67.57%
1931	Dec	25	71.43%	23	62.16%
1932	Mar	24	68.57%	24	64.86%
1932	Jun	24	68.57%	24	64.86%
1932	Sep	24	68.57%	24	64.86%
1932	Dec	24	68.57%	24	64.86%

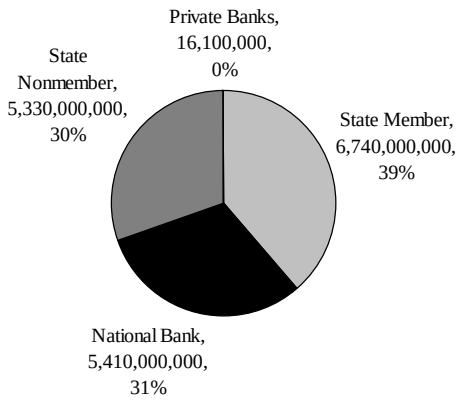
Source: New York State Banking Department (1929–1932)

Table 5: Fixed Effects Regression, Excess Reserves to Assets on Bank Characteristics and Macroeconomic Conditions, New York City, 1929–1932

Variables	Excess Reserves to Assets (1)	Excess Reserves to Assets (2)	Excess Reserves to Assets (3)	Excess Reserves to Assets (4)
Federal Reserve Member x After First Banking Panic	-0.052 [0.008]***		-0.046 [0.008]***	-0.051 [0.012]***
Log of Total Assets			0.006 [0.009]	0.01 [0.010]
Interbank Deposits to Total Deposits			-0.093 [0.100]	-0.149 [0.115]
Yield on U.S. Treasury Notes and Certificates, 3–6 Months		-0.24 [0.098]**		-0.189 [0.076]**
Yield on Corporate Bonds, Baa Grade		-0.053 [0.035]		-0.026 [0.026]
Discount Rate of the New York Federal Reserve Bank		0.201 [0.081]**		0.17 [0.062]***
Money Stock		0.046 [0.027]*		0.04 [0.021]*
Stock Price Index, Dow Jones		-0.004 [0.001]**		-0.003 [0.001]***
Index of Industrial Production		0.022 [0.009]**		0.017 [0.007]**
Change in NY Fed Gold Holdings, Quarterly, In Millions		0.08 [0.053]		0.062 [0.040]
Log Bank Clearings in New York City, Quarterly Total		-0.216 [0.177]		-0.136 [0.145]
Log of Deposits in Suspended Banks		-0.02 [0.025]		-0.018 [0.020]
Bank Fixed Effects	X	X	X	X
Observations	946	946	946	946
Individual Banks	72	72	72	72
R-squared	0.04	0.06	0.05	0.14

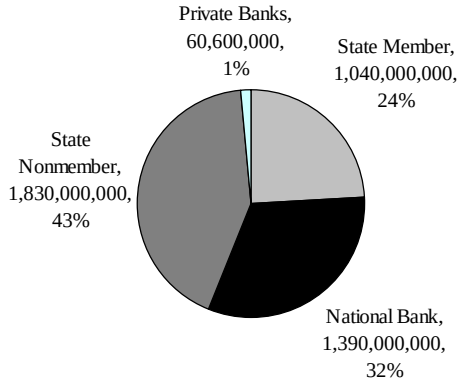
Notes:
a) Robust standard errors are in brackets.
b) Asterisks indicate significance in the following manner: * significant at 10%; ** significant at 5%; *** significant at 1%
c) The sample consists of all state banks and trust companies in New York City reporting to the New York State Banking Department from 1929–1932.

Figure 1: Total Assets by Bank Membership
Banks in New York City, 1 July 1929



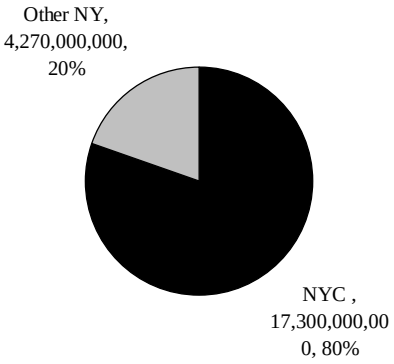
Source: Rand McNally (1929)

Figure 2: Total Assets by Bank Membership
Banks outside New York City, 1 July 1929



Source: Rand McNally (1929)

Figure 3: Total Assets by Region
New York State, 1 July 1929



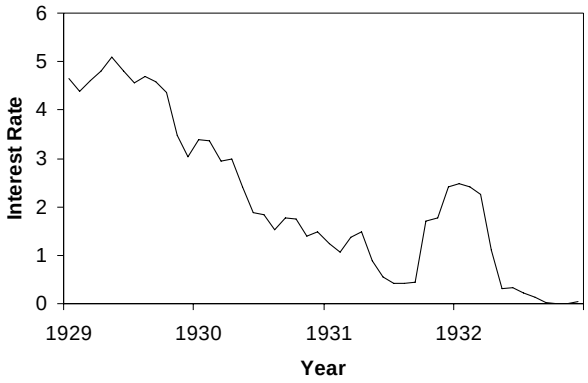
Source: Rand McNally (1929)

**Figure 4: Ratio of Excess Reserves to Total Assets,
By Location and Federal Reserve Membership
State Banks and Trust Companies, 1929–1932**

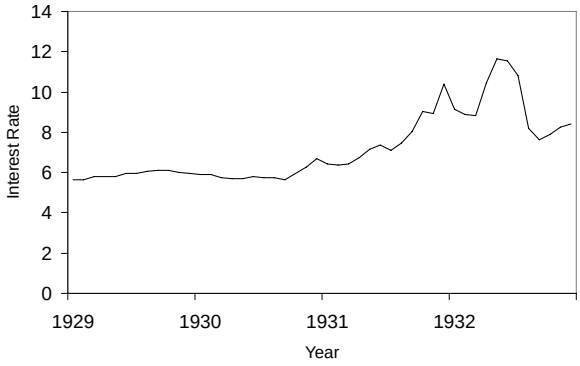
Source: Author's calculations.

Figure 5: Monthly Data Series for Macroeconomic and Monetary Variables, 1929–1932

5.1 Yield on Treasury Notes and Bills, 3–6 Months

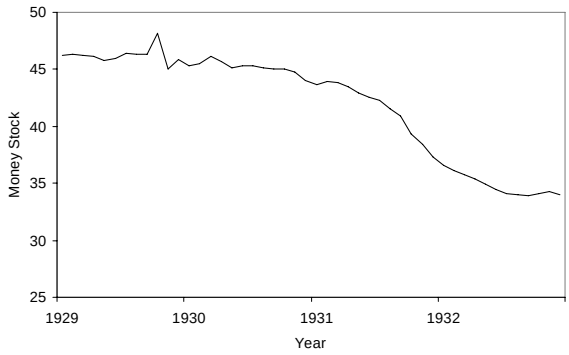


5.2 Yield on Corporate Bonds, Baa Grade

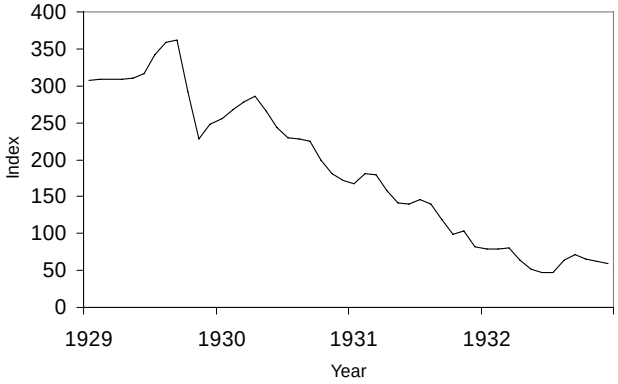


5.3 Discount Rate New York Federal Reserve Bank

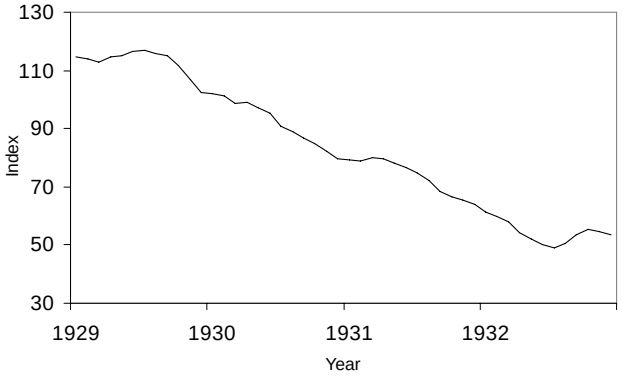
5.4 Money Stock



5.5 Dow Jones Stock Index



5.6 Index of Industrial Production



5.7 Bank Clearings in New York City

5.8 Suspended Deposits, All US Banks

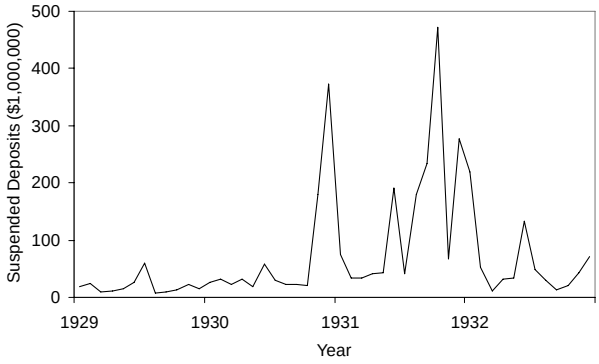


Figure 6: Survival Rates, New York City Banks, 1929–1932

Sources: New York State Banking Department (1929–1932)