

**The Effect of Reconstruction Finance Corporation
Assistance on Michigan's Banks in the 1930s**

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Abstract

This paper examines the effects of the Reconstruction Finance Corporation's (RFC) loan and preferred stock programs on bank failure rates during the banking crisis of 1933 and its aftermath. Using a new database on Michigan banks, we employ survival analysis to examine the effectiveness of the RFC's loan program and preferred stock purchases on bank failure rates. The loan program increased the failure rates of banks during the crisis by some combination of increasing the indebtedness of financial institutions and subordinating depositors. RFC's purchases of preferred stock increased the chances that a bank would survive the financial crisis.

Introduction: RFC Assistance to Banks During the Depression

This paper examines the effects of the Reconstruction Finance Corporation's (RFC) loan and preferred stock programs on bank failure rates during the crisis of 1933. Using a new database for Michigan banks collected from primary sources, we employ survival analysis to examine the effectiveness of the government's loan program and preferred stock purchases on bank survival and failure rates. Michigan banks were selected because the failure to stem Michigan's statewide banking crisis has been viewed by some historians of the Depression as a critical precipitator of the national financial crisis of 1933 (Kennedy 1973). The prevalence of bank failures in Michigan during the crisis provides a rich data set to examine the determinants of failure, and the potential salutary effects of government assistance.

The Reconstruction Finance Corporation (RFC) was a government-sponsored enterprise founded to stem bank failures and reduce the economic costs of financial disintermediation. The RFC was originally established to lend funds to troubled firms. However, after the crisis of 1933, the Corporation directly recapitalized banks by purchasing preferred stock. The program cost approximately \$200 billion in current U.S. dollars (Lohr 2008). When the RFC ceased operations in the early 1950s, the government-sponsored entity sold its preferred stock and recovered the funds provided by taxpayers.

Herbert Hoover established the RFC on February 2, 1932¹. The RFC was originally established to stimulate the economy by increasing liquidity in the financial system by loaning funds to troubled financial institutions. The RFC was an agency of the

¹ This history of the Reconstruction Finance Corporation is based on Mason (2001b).

executive branch of the federal government that had the ability to increase its lending capacity and oversight powers by executive order. Its operations did not depend on Congressional approval (Mason 2003).

During the Great Depression, the RFC conducted four major aid programs: a loan program for financial institutions, a preferred stock program for financial institutions, a railroad loan program, and a commercial and industrial loan program². The loan program for financial institutions was the first program initiated by the RFC, and it was largely replaced by a preferred stock program.

While the RFC charter permitted the Corporation to make loans with maturities of up to three years, most loans had maturities of less than six months. The threat of non-renewal was perceived as giving the RFC necessary influence over bank management practices. The RFC also demanded high-quality and liquid collateral for its loans, charged an interest rate higher than the rates charged on Federal Reserve loans, and required recipient banks to limit the salary of employees for the life of the loan.

The short duration, strict collateralization rules, and high interest of RFC loans may have protected the RFC from loss, but it also may have limited the effectiveness of RFC lending. Banks that received such assistance became more indebted as a

² The RFC's railroad loan program, like its bank loan program, was part of the original RFC Act. However, unlike its loans to banks, the RFC's railroad loans did not need to be fully secured. The RFC also lent to railroads at below market rates. As a result of these lax lending policies, the RFC's railroad loan program was abused, and funds were used for the benefit of railroad company insiders (Mason 2001b).

The commercial and industrial loan program was the final economic stimulation program undertaken by the RFC during the Great Depression. Because the banks had ceased lending, the RFC made loans directly to businesses. The RFC encouraged banks to purchase the right to participate in commercial and industrial loans instead of originating the loans themselves in order to stimulate private sector lending.

However, during the Great Depression, consumers were not increasing their demand for goods or services. As a result, no businesses needed to invest in additional capacity. The commercial and industrial loan program therefore had little impact on the economy.

consequence of it, and were not given much additional time to restore market confidence in their solvency. Because the RFC demanded high-quality collateral, the RFC's loan also effectively subordinated depositors – who retained general claims on the remaining assets of the bank, an asset pool of lower quality than RFC collateral. Increased leverage, short maturity, and the subordination of depositors increased the riskiness of borrowing banks' deposits, and may have encouraged depositor runs, as many critics of the RFC lending program contended (Olson 1977, Mason 2001a). The strict terms of RFC lending and the control the RFC exercised over bank management also seem to have discouraged financial institutions from using the RFC's loan program. According to Olson (1972), the RFC's loan conditions were generally perceived as bringing “more problems than solutions.” In Olson's (1972, p. 177) view, RFC loans “helped only those basically sound enterprises that needed temporary liquidity.” The only econometric analysis of the loan program's effectiveness, based on the failure experience of banks in the Chicago Federal Reserve District, suggests that the decision to borrow from the RFC did not prevent bank failures, and may have contributed to the risk of failure (Mason 2001a).

To correct the perceived flaws of the loan program, the RFC moved from a policy designed primarily to increase short-term liquidity to one that reduced the default risk of deposits by raising bank capital. On March 9, 1933, Congress passed the Emergency Banking Relief Act, altering the original mandate of the RFC to permit the government-sponsored entity to purchase preferred stock in financial institutions.³ RFC assistance was not available to all banks; only to those that were deemed sufficiently likely to survive as the result of receiving the assistance. Statistical analysis by Mason (2001a) of

³ Emergency Banking Relief Act, Section 304. 73rd Congress, 1933.

Chicago Fed District recipients indicates that the banks that issued preferred stock to the RFC were of middling risk compared to other banks at the time they received assistance.

RFC preferred stock was junior to deposits and other debts, but senior to common stock upon liquidation of a bank. After the issuance of the RFC's preferred stock, common stock dividends were strictly limited, and the RFC undertook additional measures to ensure that banks accumulated additional capital and did not abuse government protection (Upham and Lamke 1934, Cho 1953). RFC preferred stock carried voting rights that gave it the power to institute changes that would increase the solvency and profitability of a bank. The bank's earnings were placed in a retirement fund that would be used to buy back the RFC's preferred stock.

The RFC's rules and control rights over financial institutions that participated in the preferred stock program seems to have discouraged some banks from participating. Furthermore, banks were also worried that participating in the aid program would make them seem weak, causing depositors and shareholders to lose confidence and withdraw their funds from banks. As a result, widespread participation in the preferred stock program occurred only when the FDIC began backing the deposits in solvent banks in 1934. That process began only after many insolvent banks were closed in 1933, leaving the remaining banks to be insured and assisted.⁴ Managers of relatively strong and weak banks alike sold preferred stock to the RFC, purportedly to protect the identities of the institutions that were too weak to join the FDIC without additional investment. As a

⁴ According to Jesse Jones (1951), the chairman of the RFC, more than 5,000 banks which had previously claimed to be solvent "required considerable added capital to make them [sufficiently] sound" to join the FDIC (p. 27). Jones personally appealed to the managers of all banks to join the RFC's stock program "so that depositors would not be induced to switch out of ...banks when their names were published" (p. 26-27). Thanks to the preferred stock program, the weaker banks were adequately recapitalized and all but 141 of approximately 14,500 American banks joined the FDIC in 1934 (FDIC).

result, the RFC eventually owned more than one-third of the capital of American banks (Mason 2001b). Econometric analysis of Chicago Fed District banks suggests that recapitalizing the banks with preferred stock helped to stabilize the banking sector, although the program did not increase lending by those banks (Mason 2001a).

The ambitious programs and immense resources of the RFC subjected the agency to political pressure and public scrutiny. State and federal politicians, recognizing the benefits of RFC aid, often pressured the government-sponsored enterprise to grant assistance to their constituents. Concerns about the RFC's accountability ultimately led Congress to pass an amendment requiring the publication of the names of its aid beneficiaries.

Econometric analysis of the identities and characteristics of the recipients of aid distributed by the RFC suggest that the Corporation was unbiased in its lending policies (Mason 2003). Political bias was mitigated by three main factors. First, the loans made by the RFC to financial institutions had to be fully and adequately secured.⁵ This restriction was also incorporated into the RFC's credit and capital programs, which ensured that aid recipients were good candidates for recovery. Second, the RFC was funded as a government-owned corporation with an initial appropriation from Congress and capital subsidies from the Treasury. The managers of the RFC relied upon this capital base rather than regular Congressional appropriations, which freed the RFC's managers from having to concern themselves about ongoing political pressure from Congress. Finally, RFC aid decisions were made at the regional level; each region's field office was largely independent from the others and appears to have been largely immune to political

⁵ The RFC did not specify the level of collateral that was necessary and only its staff could evaluate whether a bank had sufficient assets to secure a loan (Mason 2001b).

influences from Washington. Field offices were given a large degree of autonomy over assistance decisions, but also were held accountable to the central office if their decisions adversely affected RFC earnings (Delaney 1954).

Mason (2001a) and Calomiris and Mason (2004) conduct in-depth analyses of the operations of the RFC in the Chicago Federal Reserve District, distinguishing between the effects of RFC loans and preferred stock purchases on Chicago Federal Reserve member banks. The analysis suggests that as the RFC assumed greater default risk, its aid programs more successfully limited bank failures. RFC loans did not lower bank failure rates. In contrast, the preferred stock program helped prevent banks from failing. Mason suggests solvent banks could operate more efficiently and regain strength as a result of government infusions of capital stock.

While these findings are important and suggestive, it is not clear whether they apply to other regions of the country, which suffered different histories of bank distress during the Great Depression. In this study, we examine whether similar patterns can be discerned for Michigan banks. The timing and extent of Michigan banking distress perhaps most closely tracked the sudden and widespread panic that gripped the U.S. in early 1933, and therefore, provides an important further test of the effectiveness of RFC preferred stock assistance in reducing the costs of banking distress in 1933 and its aftermath.

Michigan Banks and the Nationwide Panic of 1933

The Great Depression saw the worst waves of banking distress that had gripped the country since the 1830s. Calomiris and Mason (2003a) review the history, and causal

influences, relating to the waves of failures that occurred from 1930 to 1933. From November 1932 to February 1933, banking distress accelerated, and systemwide banking crises gripped Nevada, Wisconsin, Pennsylvania, Minnesota, Tennessee, Ohio, Arkansas, Alabama, Missouri, Maryland, Louisiana, and Michigan. Calomiris and Mason (2003a) show that the nationwide panic of early 1933 differed from prior waves of bank failure; unlike prior episodes of distress, the probability of failure rose dramatically, not only for banks with weak fundamentals, but for all banks.

The banking crisis in Michigan in February 1933 was of particular importance; indeed, Kennedy (1973) describes the Michigan banking crisis as a “prelude to the national banking disaster three weeks thereafter.” The turmoil experienced in Michigan, the home of the American automobile industry, highlights the devastating effects of banking crises on the national economy.

In Detroit, significant amounts of money began to flow out of the largest banks with the onset of the Great Depression (Awalt 1969). The Detroit Bankers Company Group and the Union Guardian Group, the two major local bank holding companies, were under additional pressure because of their banks’ heavy investment in local real estate (*New York Times* 1933a).⁶ Between 1930 and February 1933, approximately \$250 million was withdrawn from the First National Bank of Detroit; its local competitors, the Union Guardian Trust Company and the Guardian National Bank of Detroit, also

⁶ The Detroit Banks Company Group held the First National Bank of Detroit, Peoples’ Wayne County Bank, Detroit Trust Company, eight suburban banks, and a local investment company, the First Detroit Company. The Union Guardian Group, also called the Ford Group, held the National Bank of Commerce, Guardian Union Trust Company, and other local banks (Awalt 350). First National Bank had book assets of \$485,846,627 and 146 branch offices outside of its main office in Detroit at the time of the crisis; the Guardian Union Group held book assets of \$432,797,434, nine bank components in Detroit and 11 bank branches in other Michigan cities (*New York Times* 1933b).

sustained massive withdrawals. By January 1933, these banks were losing between \$2.5 million and \$3 million in deposits each week (Awalt 1969).

To meet the demands of its depositors, the Guardian Trust Company requested additional funds from the RFC. Henry Ford had already attempted to bolster the bank's liquidity with a \$7 million deposit. With deposits of approximately \$32.5 million in the Guardian Banks and an additional \$18 million in the Detroit Bankers' group, Ford had a strong personal incentive to assist the local financial institutions (Awalt 1969). However, Ford's infusion of cash was not enough to sustain the Guardian Trust Company, and the bank requested an additional \$60 million from the RFC, which was already lending to a number of local banks (*New York Times* 1933a; *New York Times* 1933c).

As the RFC considered the application of the Guardian Trust Company, Michigan Senator James Couzens realized that the bank lacked sufficient collateral to justify a standard loan (*New York Times* 1933a).⁷ Couzens asked Henry Ford to grant the government a lien on his \$7 million deposit, subordinating his claim to that of the RFC. Ford rejected this plan and an alternative plan requiring him to sign a personal note for the difference between the bank's collateral and the amount to be loaned by the RFC. Contemporary sources indicate that the Ford family and company had already advanced local banks \$12 million and considered further efforts to save the banks futile (Awalt 1969). Angered by the increasing pressure from government officials to personally recapitalize the struggling banks, Ford threatened to withdraw \$25 million from the system at the first opportunity. Because such a withdrawal would cause a panic and

⁷ Couzens and Ford were former business partners in the Ford Motor Company. Couzens was also the chairman of the Senate committee responsible for investigating the RFC's loans, so his concerns about the need for proper collateralization were sufficient cause to block the Union Guardian Trust Company's aid package (*New York Times* 1933a).

threaten the survival of the local banks, Francis Awalt, acting Comptroller of the Currency at the US Treasury, felt compelled to prevent the national banks of Detroit from opening (Awalt 1969).

While Awalt recognized the need to keep all Michigan banks closed, he had no authority to do so. Instead, federal officials conferred with Michigan Governor William A. Comstock, who declared a statewide bank holiday on February 14, 1933. The holiday was originally intended to last eight days (Awalt 1969). However, the complex problems plaguing the financial system prompted officials to extend the holiday until March 6 (Awalt 1969).

On February 18, soon after the Michigan bank holiday was declared, news circulated of a potential merger of the Guardian Trust Company and the Central Hanover Bank and Trust Company of New York. However, “local pride” supposedly motivated Detroit bankers to reject the assistance of the New York banks. At the same time, local rivalries supposedly prevented the mergers of Detroit banks (*New York Times* 1933d). On February 24, Henry Ford and his son Edsel, a Chairman of the Union Guardian Trust Company, offered to provide capital for two new banks to help liquidate the assets of the distressed banks. The aid of the Ford family was offered on the condition that they could select the new bank directors and officers (Awalt 1969). Initially, it seemed that the Ford offer, accompanied by an additional \$20 million from New York bankers and an RFC pledge of \$54 million, would allow depositors to access at least 35 percent of their deposits immediately (*Los Angeles Times* 1933). However, the New York bankers withdrew their offer because of concerns that they might not have clear legal claim to the failing banks’ assets. The Ford family then withdrew its contribution, and the bailout

plan failed (*New York Times* 1933e). That helped to precipitate a panic across Michigan, which contributed to the panic gripping the rest of the country (Mason 2003, Butkiewicz 1995).

The effects of the financial crisis were felt acutely in the real economy during the weeks between the initial crisis in Detroit and President Roosevelt's inauguration. Detroit was threatened with a milk shortage and grocers were unable to sell food since they could not cash checks (*New York Times* 1933f; *New York Times* 1933g). Twenty-eight thousand local families supported by the Detroit Public Welfare Department were unable to use their aid checks from the city's accounts with the Guardian Group and First National; Wayne County, Michigan was unable to support 10,000 ill and insane patients because its deposits in the bank groups were unavailable (*New York Times* 1933g). In late February, the Detroit Clearing House Association considered issuing scrip⁸ to provide a medium of exchange during the banking emergency (*New York Times* 1933g).

The situation in Michigan and the concurrent exposure of allegedly disreputable business practices among New York bankers exacerbated financial instability across the country. The instability of the Detroit banking system worried officials in Washington, and the public withdrew deposits from banks nationwide. Over 5,500 banks with deposits totaling \$3.4 billion had temporarily closed by March 3. New York banks lost \$200 million in gold and \$150 million in currency; Chicago also lost \$100 million in gold the same day (Awalt 1969). The Federal Reserve banks admitted "they could not support member banks indefinitely, especially those drained by the troubles in Michigan, Maryland, and Ohio" (Kennedy 1973). However, outgoing President Hoover was

⁸ Scrip is a certificate of indebtedness issued as currency or in lieu of money (Oxford English Dictionary).

unwilling to declare a national bank holiday, so comptroller Awalt and other government officials pressured the governors of several states to declare state banking holidays and institute banking restrictions. On March 6, the first business day following President Roosevelt's inauguration, he declared a national bank holiday to try to stem the panic.

On March 9, Congress passed the Emergency Banking Relief Act drafted by Roosevelt and his advisors. The Act granted the federal government power over the banking system.⁹ Under this act, the RFC would directly capitalize banks by purchasing preferred stock.

The Emergency Banking Act of 1933 is widely regarded as having helped to resolve the banking crisis. During the national holiday, government officials confirmed the solvency of national banks, which were gradually reopened to their depositors beginning March 13 (although many banks would remain suspended for a longer time, and some banks never were able to reopen their doors). Roosevelt's innovative banking plan and first "fireside chat" soothed depositors to such an extent that when banks reopened, deposits actually exceeded withdrawals. Five thousand three hundred eighty-seven of the Federal Reserve's 6,694 member banks reopened by the end of March; 7,654 of 11,455 state institutions also reopened during that time. By June, 91 percent of deposits in Federal Reserve member banks were available to the public. Confidence in the banking system encouraged stock market values to increase; the values of government bonds, corporate bonds and commodities also increased (Kennedy 1973).

⁹ The Act also contained provisions for reorganizing national banks and issuing preferred stock for banks. It formalized lending by the Federal Reserve to banks, and created a Presidential discretionary fund of \$2,000,000 to help carry out the Act.

After successfully reopening the first set of banks, Roosevelt's administration addressed the long-term capital needs of the banking system. Through investments made by local businessmen and the RFC, the government engineered the direct recapitalization of certain weak banks. The RFC invested more than \$1.2 billion in over 6,000 institutions during its 18 years of operations.¹⁰ Ultimately, the agency lost only \$13.7 million and only 206 of the banks that received RFC preferred stock investments were later forced to close (Kennedy 1973).¹¹

In Detroit, the RFC orchestrated a "Spokane sale" of the assets of the banks.¹² General Motors and the RFC announced the creation of a new bank on March 21. Half the capital for this new corporation was provided by the RFC, which received preferred stock. The other half of the necessary capital was provided by local interests, including General Motors and Chrysler, which were granted common stock in the company (*New York Times* 1933c). The RFC supervised the management of this new bank, the National Bank of Detroit.

The National Bank of Detroit immediately took control of the assets and liabilities of the Guardian group and the National group. On April 24, the National Bank of Detroit distributed 30 percent of its holdings to the old depositors and began liquidating the assets of the Guardian and National groups in May. The efficiency of the RFC's "Detroit plan" spurred numerous applications for reorganization in other communities. In total,

¹⁰ Equivalent to approximately \$19.5 billion in the year 2008 (Officer, 2009).

¹¹ Equivalent to approximately \$227 million in the year 2008 (Officer, 2009).

¹² "Spokane sales" were used to dissolve banks that provided valuable services to the community but whose assets covered less than half of their debt. Conservators arranged the sale of "desirable assets in bulk...to an existing bank or a bank newly organized for that purpose," and creditors were immediately paid from the revenue generated by the sale (Kennedy 1973). After the sale and allocation of the proceeds, the old banks could be dissolved.

the RFC and Treasury Department authorized 257 similar relief operations. These rehabilitations finished the repair begun with the passage of the Emergency Banking Act and allowed the financial system to rebuild on stronger foundations following the banking crisis of 1933.

Data and Methodology

The purpose of this analysis is to measure the effect of the RFC's loan and preferred stock programs on bank failure rates, after controlling for other factors. The models use a cross-sectional set of bank-level data describing RFC loans and preferred stock investments in each bank, local economic conditions, individual bank financial characteristics, and the incidence and timing of bank failure.

Individual bank financial data come from the Federal Reserve member bank *Reports of Condition and Income*. From 1929 to 1936, the regulators of state and national banks did not publish data on bank earnings and expenses. Bank-level earning and expense data are available in the *Reports of Condition and Income* of the Federal Reserve (Mason 2001a, 1998). This means that the sample is restricted to Federal Reserve member banks. Federal Reserve banks include all national banks and some (typically, the largest) state-chartered banks, which provides some institutional diversity in the sample. The sample of banks is restricted to the state of Michigan.

We collected detailed data on the individual characteristics of the troubled financial institutions during the financial crisis of 1933 in Detroit as well in the rest of the state. The database also includes data on the number and size of loans each bank received from the RFC. Michigan banks were also among the first to join the RFC's

preferred stock program. As a result, Michigan banks provide a rich data set to examine the impact of RFC assistance.

The sample includes data on 197 Michigan member banks in the Seventh Federal Reserve District. The bank failure data for the national banks are taken from the Comptroller of the Currency's *Annual Report*. The *Rand-McNally Bankers' Directory* provides the failure data for state banks. For the purposes of the analysis, receiverships and voluntary liquidations are treated as bank failures, though banks which reopen after receivership are not considered failed. Of the 197 banks in the sample, 82 (42 percent) failed between December 1929 and December 1936. Seventy-eight banks received RFC loans, 41 (53 percent) of which failed. Twenty (34 percent) of the 59 institutions participating in the preferred stock program failed.

RFC loans and preferred stock purchases were hand-coded from the monthly *Reports of Activities of the Reconstruction Finance Corporation*.¹³ The *Reports* include the amount of each loan and preferred stock purchase. Many banks received multiple loans or infusions of capital in the form of preferred stock. According to Mason (2001a), 32 percent of banks in the United States received more than one loan from the RFC and 12 percent borrowed from the government-sponsored entity more than twice. Previous studies have examined the average amount of each loan or preferred stock purchase by dividing the amount of each by the number of loans or preferred stock purchases (Friedman and Schwartz, 1963; Butkiewicz, 1995; Keehn and Smiley 1988, 1993).

¹³ These reports were published when Congress was in session after fall 1932. The reports were reproduced in the *Congressional Serial Set* and, until 1933, in the *Commercial and Financial Chronicle*. The Archive of the Clerk of the House of Representatives preserved the reports submitted while Congress was in recess and remains the only source for these reports.

Due to complications in obtaining the reports submitted while Congress was in recess, this analysis does not include data from September 1935. However, the limited RFC aid activity throughout the fall of 1935 suggests that the additional data would not have a material effect on the results of this analysis.

However, because so many banks received several loans or preferred stock purchases, the averages of RFC outlays may be biased downward. Correcting for the multiple-loan bias, Mason (2001a) shows that for Chicago banks involved in the 1932 banking crisis, the RFC's purchases of preferred stock appeared to have helped banks survive, but RFC loans did not.

Our analysis similarly examines whether RFC loans or preferred stock purchases increased the likelihood of survival for Michigan banks. Parametric and non-parametric survival analysis techniques illustrate trends in bank failures from December 31, 1929 to December 31, 1936.¹⁴ The Kaplan-Meier survivor functions depict bank failures over time. Smoothed hazard functions depict shifts in the probability of failure over time. Finally, a probit model and a log-logistic survivor model are employed to examine the effect of aid allocations on bank failure rates within a multiple regression framework. The formal econometric analysis suggests that RFC loans *decreased* the likelihood and duration of bank survival, whereas direct recapitalization *increased* the likelihood of bank survival.

Methods and Empirical Results

Survival analysis techniques are superior to Ordinary Least Squares (OLS) regressions or binary dependent variable regressions (logit and probit) at capturing the relationship between RFC aid allocations and failure rates over a specific time period. OLS produces misleading results when analyzing censored data, truncated data, or time-varying covariates (Jenkins 2005). Furthermore, OLS models do not express results in

¹⁴ Non-parametric means that “no prior assumptions are made about the shapes of the relevant functions” (Jenkins 2005).

terms of observed transitions between states or completed spells (Jenkins 2005). Binary dependent variable models, which address the censoring and structural issues introduced by OLS, do not address “the differences in time in which each person is at risk of experiencing the event” (Jenkins 2005). The statistical techniques used in survival analysis were developed to address “the sequential nature of the data, and are able to handle censoring and incorporate time-varying covariates” (Jenkins 2005). As a result, survival analysis allows us to incorporate the most information in our study of the relationship between RFC aid policies and bank failure rates.

The specification of survival models depends on whether the process occurs in continuous time, or in discrete time intervals. Most economic phenomena are observed in continuous time. However, the data describing spell lengths are likely presented in grouped form. For example, durations are expressed in days or hours, not as fractions thereof. The length of the intervals used relative to average spell length helps determine whether the data should be treated as discrete or continuous (Jenkins 2005). In the case of the bank survival times in this data set, duration is measured in days and the typical bank survives for a period of years. Therefore, the survival time data used in this analysis is treated as if it were continuous.

Both graphical and multiple regression techniques are used to analyze the failure rates of Michigan banks. Kaplan-Meier survivor functions and smoothed hazard functions graphically describe the failure rates of the entire sample of Michigan banks, and the failure rates of subgroups determined by aid type. We then present a probit model of bank failures as a straightforward introduction to the relationship between RFC aid allocations and failure rates. To demonstrate the specific effects of different

covariates on bank failure rates over time, we use a log-logistic survival model. The log-logistic parameterization assumes a specific shape for the survival function based on the history of bank failures during the Great Depression. This approach is similar to that taken by Calomiris and Mason (2003a).

Survivor and Hazard Functions

Figure 1 is an estimate of the survival function of all Michigan banks, derived by the Kaplan-Meier method (Appendix I).¹⁵ The Kaplan-Meier estimate of the survival function “is given by the product of one minus the number of exits divided by the number of [entities] at risk of exit” (Jenkins 2005).¹⁶ From the survival function, one can also estimate the integrated hazard and failure functions of a population. These functions are typically depicted as step functions, where the height of each step varies depending on the estimated survival function, and the width of each step varies depending on the times at which failures occurred. The shape of the function reflects the fact that the non-parametric Kaplan-Meier method depends on the dates of observed transitions between states and on the length of the largest non-censored survival time.¹⁷ Smoothing the function would demand additional assumptions about failure rates at dates between

¹⁵ In each of the estimated survival functions and estimated hazard functions, the population at risk is all banks in the sample.

¹⁶ The proportion of those entering a state who survive to the first observed survival time, t_1 , $S(t_1)$, is simply one minus the proportion who made a transition out of the state by that time, where the latter can be estimated by the number of exits divided by the number who were at risk of transition: $d_1/(d_1+m_1)=d_1/n_1$.

More generally, at survival time t_j ,
$$\hat{S}(t_j) = \prod_{j|t_j < t} \left(1 - \frac{d_j}{n_j}\right).$$
 (Jenkins 2005).

¹⁷ “A survival time is censored if all that is known is that it began or ended within some particular interval of time, and thus the total spell length (from entry time until transition) is not known exactly” (Jenkins 2005).

within-sample failure times and beyond the maximum observed failure time (Jenkins 2005).

Figure 1 shows the percentage of banks in business each day from December 31, 1929 to December 31, 1936. Figure 1 also indicates important historical events related to bank failure rates, including (1) the onset of the crisis of 1933, (2) the date when the RFC commenced operations, and (3) the beginning of the major bank liquidations caused by the crisis of 1933. The survivor function shows that bank liquidations increased dramatically following the crisis of 1933. Figure 1 shows that the RFC liquidated failed banks for eighteen months following the crisis. After 1934, liquidations virtually ceased. The smoothed hazard estimate in Figure 2 offers additional evidence that the Crisis of 1933 threatened banks across Michigan.¹⁸ The hazard ratio for bank failure reaches its highest point as the RFC completes the liquidations of banks that failed during the crisis of 1933.

Figures 3 and 4 divide the sample between banks that received RFC loans and banks in which the RFC bought preferred stock. Figure 3 shows that a greater proportion of the banks that received loans failed compared to banks that did not receive loans. In contrast, a greater proportion of the banks which received capital from the RFC survived,

¹⁸ The hazard function is estimated using “kernel-based smoothing of the...change in the cumulative hazard between successive failures. The smoothed value at a given time is based on a weighted average of the values in the neighborhood of that point” (Jenkins 2008).

The shape of the step function used in the Kaplan-Meier estimation means one cannot directly estimate the hazard function. As Jenkins explains, “trying to estimate the slope of the integrated hazard function at each of the observed survival times is equivalent to trying to find the slope at the corner of each of the steps. Clearly, the slope is not well-defined...nor [does it yield] a non-parametric estimate of the hazard rate” (Jenkins 2005). However, by smoothing the integrated hazard function, which can be derived from the Kaplan-Meier survivor function, one can derive the slope at any point. Smoothing the hazard function incorporates additional assumptions about the data; one must carefully consider the degree to which the function should be smoothed and select the smoothing bandwidth accordingly. In this analysis, the bandwidths are 28 days. Richardson and Troost (2006) suggest that “bandwidths of 28 days on graphs spanning...years...are wide enough to smooth daily volatility without obscuring [meaningful] shifts in the probability of failure.”

relative to banks which did not receive an infusion of funds through preferred stock. Figure 4 shows that if a bank received a loan and preferred stock, it was no more likely to survive the Great Depression than if it had received only a loan. Banks that received capital from the RFC were more likely to survive than the banks which received no aid. If the bank received a loan or a loan and stock, it was less likely to survive than those banks which received no aid. Table 1 illustrates these same results (Appendix II). Of all the aid groups, the banks which received capital and no loans from the RFC had the largest proportion of survivors by the end of 1936. Banks which received loans or a combination of loans and stock had fewer survivors than the banks which received capital.

The log-rank and Wilcoxon tests are used to test whether the subgroup differences observed in survivor functions are statistically significant (Jenkins 2008). The log-rank and Wilcoxon tests reject the null hypothesis that the survival function for banks which received loans equaled that for banks which did not receive loans at the 1 percent level. The tests are less robust for preferred stock purchases, however. The log-rank and Wilcoxon tests reject the null hypothesis that the survival function for banks which received preferred stock from the RFC equaled that of banks which did not receive a capital infusion from the RFC at the 15 percent level and 10 percent level, respectively. Finally, the log-rank and Wilcoxon tests reject the null hypothesis that the survival function for banks which received loans equaled that of banks which received preferred stock at the 1 percent level.

The graphs suggest that loans are associated with increased bank failure rates, while preferred stock purchases are associated with decreased bank failure rates. For an

intuitive examination of the effect of RFC loans and preferred stock purchases relative to other bank characteristics, we consider the results of the probit model.

Probit Model

A probit model is a normally-distributed discrete choice model used to examine the percentage of entities entering a state (Greene 1993). In Table 2, we examine the relationship between aid allocations, bank characteristics, and bank failures (Appendix II). RFC aid allocations are represented by binary variables.

The bank characteristics selected as determinants of failure have been widely analyzed in the literature (Alston et al. 1994; Calomiris and Mason 1997, 2000; Cole and Gunter 1995). Each bank characteristic is included at its value as of December 31, 1931.¹⁹ The ratio measuring capital adequacy (net worth/total assets) should be associated with lower failure risk. Conversely, the less liquid a bank's assets, the greater its risk of failure. Real estate owned and reported losses indicate the level of foreclosed and nonperforming assets on the balance sheet of the bank, and should be associated with higher failure risk. Bonds, stocks, and securities owned, and loans and discounts, suggest the possibility of increased credit risk and should be associated with increased risk of failure. Paper eligible for rediscount at the Federal Reserve indicates low credit risk assets and should be associated with a decreased risk of bank failure. Because interest and discount rates should be higher for riskier borrowers, interest and discount earnings should be positively related to failure risk, assuming the higher earnings are the result of higher interest rates charged by the banks. Also, since interest rates were generally

¹⁹ This analysis uses time-fixed covariates. Modeling these bank characteristics as time-varying covariates might better describe their effect on the likelihood of failure and bank failure rates.

declining during the Great Depression, interest rate risk on liabilities (bills payable and rediscounts) should have a positive relationship to failure rates. Finally, recoveries, which may capture a sudden recovery in bank asset values following a macroeconomic downturn, may also be positively associated with failure risk²⁰. Controlling for all of these bank characteristics allows us to isolate the effect of RFC loans and preferred stock purchases on bank failure rates (Mason 2001a).

The relationship between illiquid assets and bank failure rates is positive, as expected, and significant in all of the probit regressions in Table 2. Real estate owned is also associated with an increased risk of bank failure and is statistically significant in regressions (1), (3), and (4). None of the other bank characteristics show a significant relationship to bank failure rates, though the signs on the coefficients of net worth, bills payable and rediscounts, and interest and discount on loans are as expected.

RFC loans are positively and significantly related to bank failure. Preferred stock purchases are negatively related to bank failure. When the banks receive only a direct capital infusion from the RFC and do not receive loans (regression 5), the coefficient is negative and statistically significant. Though direct recapitalization does not have a statistically significant effect on the likelihood of failure in regressions (2), (3), and (6), the coefficient on preferred stock purchases is always negative. When both types of RFC aid are included in the regression, the variables are not statistically significant. However, the coefficients still indicate a positive relationship between RFC loans and failure, and a negative relationship between RFC preferred stock purchases and failure. When the

²⁰ Mason (2001a) notes, “recoveries may be positively associated with failure risk, if they capture a rebound in bank asset values following a trough.”

variables are examined using a Wald test, we find that the loan and preferred stock purchase variables are jointly significant.

Table 3 shows the marginal effects of RFC loans and preferred stock purchases. Banks receiving loans are approximately 25% more likely to fail, holding other characteristics constant (regressions 1 and 3). However, banks in which the RFC purchased preferred stock are less likely to fail. A bank receiving only stock, and no loan from the RFC (regression 5), has a 27% lower risk of failure.

While the probit model allows us to examine the relationship between bank characteristics, RFC aid allocations, and the probability of bank failure, it is not sensitive to the timing of bank failure rates and leads to inaccurate results. We are interested in when banks failed; therefore, we estimate an accelerated failure time model to examine the effect of RFC aid on bank failure rates.

Accelerated Failure Time Model

In contrast to a probit model, which represents only whether banks failed, a model of accelerated failure time uses the time before failure as the dependent variable. These survival models therefore measure how covariates “affect the incidence of failure... [and] the length of time elapsed before failure” (Mason 2001a). Also, survival models, which measure the conditional probability of failure, adjust for the survivorship bias inherent in the unconditional probabilities of failure estimated by probit models (Kiefer 1988). The survival model selected for this analysis uses the log-logistic function to parameterize the model. This parameterization was selected because its non-monotonic hazard function accurately describes the expected shape of the baseline survival rate of the sample over

time. We expect the rate of bank failures to increase initially because of the repeated financial crises which occurred between 1930 and 1933. Following the crisis of 1933, the rate of bank failures should decrease.

Table 4 summarizes the accelerated failure time models used to examine the relationship between binary variables representing RFC aid, bank characteristics, and survival time (Appendix II). The unit of observation is the individual bank, and duration is measured in days. Banks are observed from December 31, 1929 until December 31, 1936. The coefficients on each covariate are time ratios. Time ratios less than 1 are associated with a shorter estimated survival time; time ratios greater than 1 are associated with a longer estimated survival time. The bank characteristics modeled are the same as those used in the probit analysis.

As in the probit analysis, illiquid assets are significantly negatively related to survival time. None of the other bank characteristics demonstrate a significant effect on survival time; however, the sign of the coefficients of certain variables supports our earlier hypotheses. Bonds, stocks, and securities owned are associated with shorter survival time. Bills payable and rediscounts and interest and discount on loans are also associated with a shorter estimated survival time. Bank size (net worth) is associated with a longer estimated survival time.

RFC loans and preferred stock purchases are significant in every regression. RFC loans are associated with shorter estimated survival times, while preferred stock purchases are associated with longer survival times. A bank receiving only preferred stock, and no RFC loans, has the longest estimated survival time. While the time ratios are significant at the 10 percent level or higher for every aid variable, the Wald test for

joint significance suggests that the relationship between RFC loans and RFC preferred stock purchases could be even stronger than our regression results imply.

The results of the log-logistic regressions correspond with the results of the non-parametric survival analysis and the results of the probit model. In each case, RFC loans are associated with decreased survival. In contrast, RFC preferred stock purchases are associated with increased survival. Mason (2001a) suggests the negative relationship between loans and bank survival is due to the RFC's onerous collateral requirements. Historians corroborate this interpretation. James notes:

High collateral requirements forced [banks] to isolate their most liquid assets as security for RFC loans. In April 1932, for example, the Reconstruction Finance Corporation loaned the Reno National Bank over \$1,100,000, but in the process took as collateral over \$3,000,000 of the bank's best securities. This in itself left the bank unable to meet any future emergency demands for funds by depositors (1938).

The banks subordinated the interests of their shareholders to the government when they obtained a RFC loan. Mason (2001a) hypothesizes that investors might have chosen to close the bank in order to reduce their losses. He also suggests that depositors could have run on the banks in hopes of keeping their assets from the RFC.

Preferred stock purchases of the RFC carried no collateral requirements. The government bore a considerable share of the risk of bank failure, and it did not subordinate the claims of existing creditors or equity holders. The positive relationship between preferred stock purchases and bank survival supports the idea that high collateral

requirements and the subordination of other stakeholders caused the loan program to fail in its objective of helping banks.

While this analysis did not find bank characteristics to have a significant effect on survival, these characteristics were entered as time-fixed covariates²¹. If they were tracked over time, prior research indicates they would prove significant (Calomiris and Mason 2003a, Mason 2001a).

Conclusion

The operations of the Reconstruction Finance Corporation in Michigan during the Great Depression provide an opportunity to investigate the effects of government loan and preferred stock programs on distressed financial institutions in the midst of a widespread nationwide panic.

The empirical analysis suggests that collateralized short-term loans from the RFC made bank failure more likely, while direct recapitalizations in the form of preferred stock injections increased the likelihood of bank survival. The preferred stock program owed its success to several factors: (1) It did not burden the bank with increased debt, increased liquidity risk, or collateral requirements that subordinated the claims of depositors, (2) the RFC was selective, and apparently chose viable cases, not basket cases, when granting assistance, and (3) the RFC implemented effective measures to ensure that government assistance was not abused by banks receiving assistance. These results suggest that during a banking crisis, effective assistance requires the government to assume a significant share of the risk of bank failure.

²¹ Bank characteristics were analyzed as of December 31, 1931.

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Appendix I: Figures

Figure 1. Kaplan-Meier estimated survival function

This model represents the percentage of banks in business in Michigan between December 31, 1929 and December 31, 1936. Bank failure data are from the Comptroller of the Currency's *Annual Report* and the *Rand-McNally Bankers' Directory*.

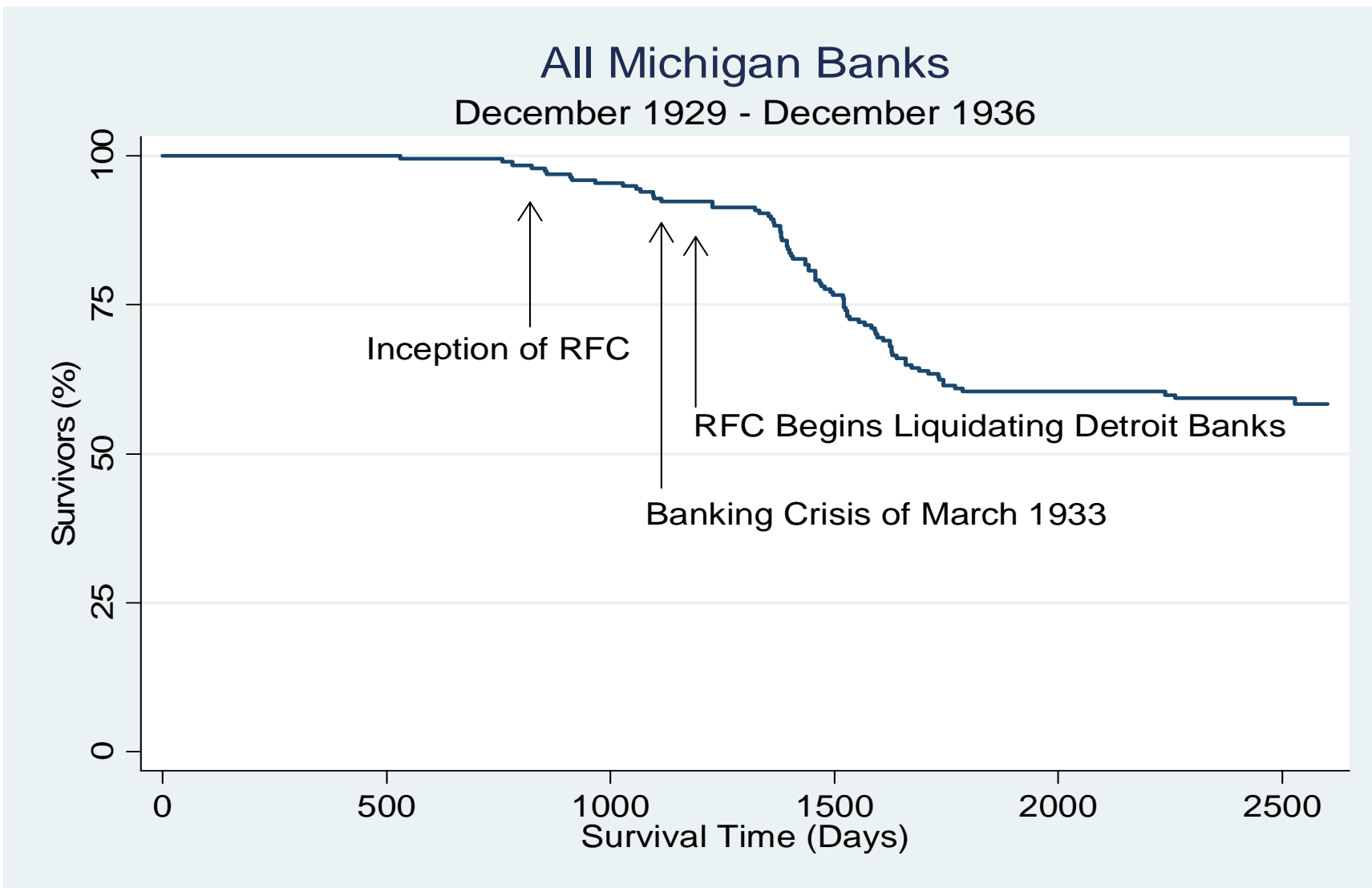


Figure 2. Smoothed hazard estimate of all Michigan banks

This model represents the hazard ratio at a given point in time, derived by calculating the change in the cumulative hazard between successive failures. Bank failure data are from the Comptroller of the Currency's *Annual Report* and the *Rand-McNally Bankers' Directory*.

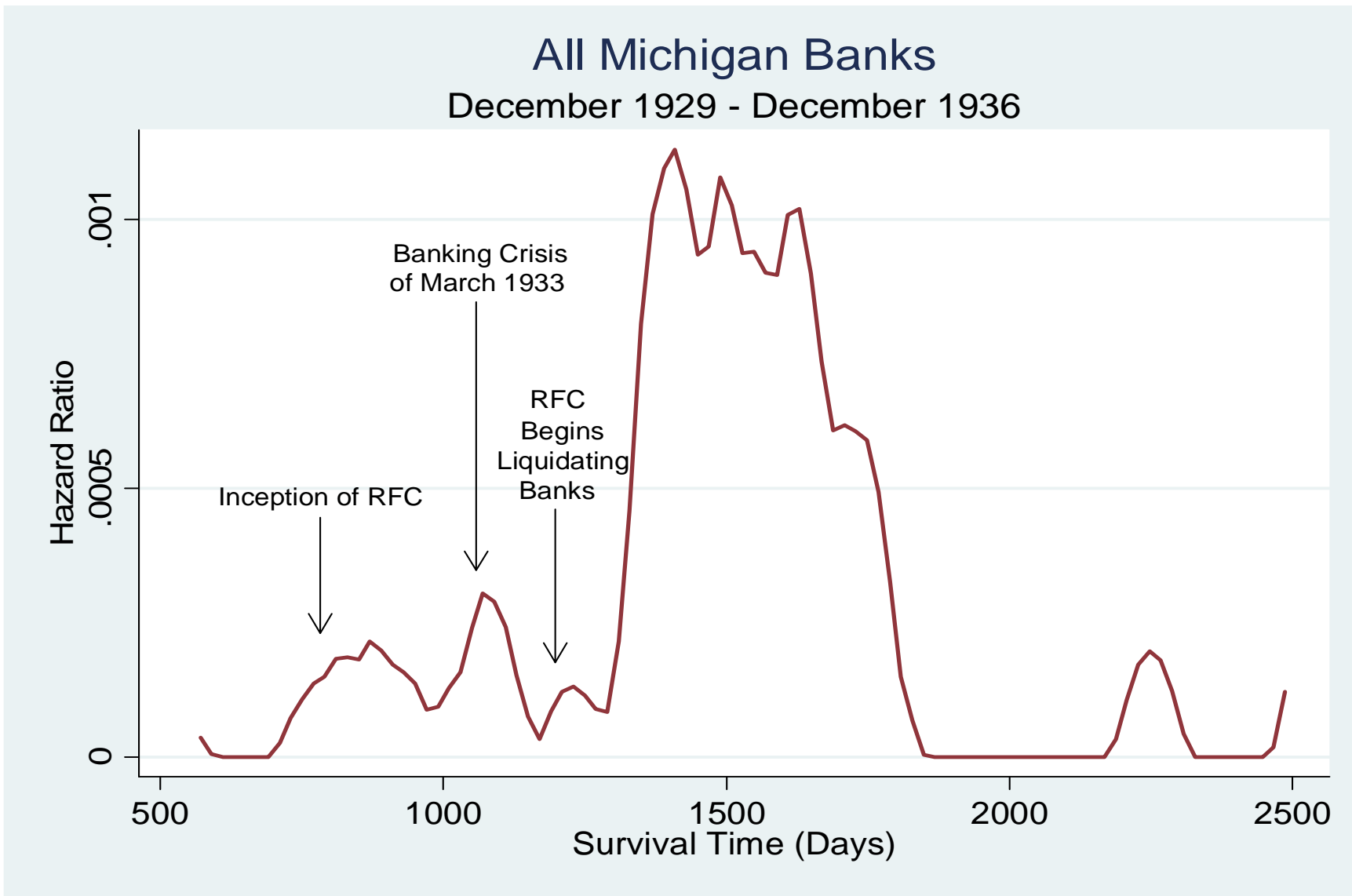


Figure 3. Kaplan-Meier estimated survival function for sample subgroups

This model represents the percentage of banks in business, stratified by the type of aid received. Bank failures are measured between December 31, 1929 and December 31, 1936. Bank failure data are from the Comptroller of the Currency's *Annual Report* and the *Rand-McNally Bankers' Directory*.

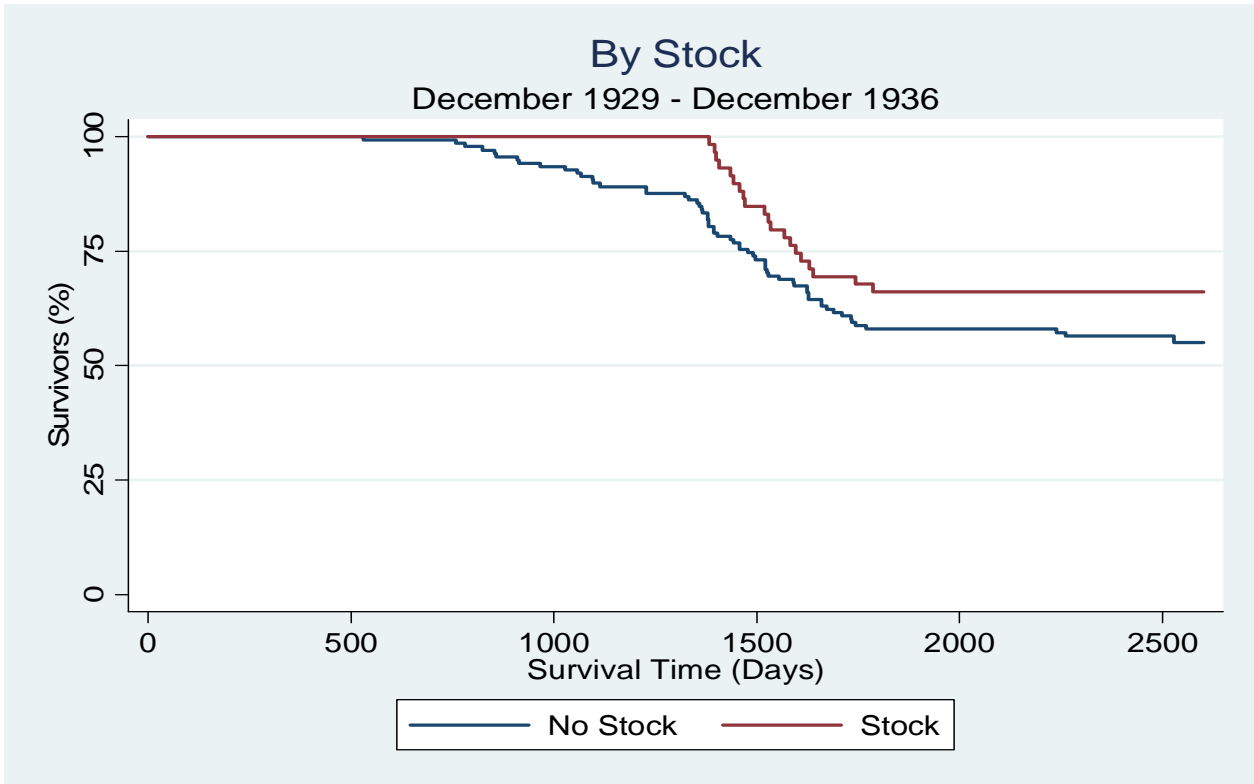
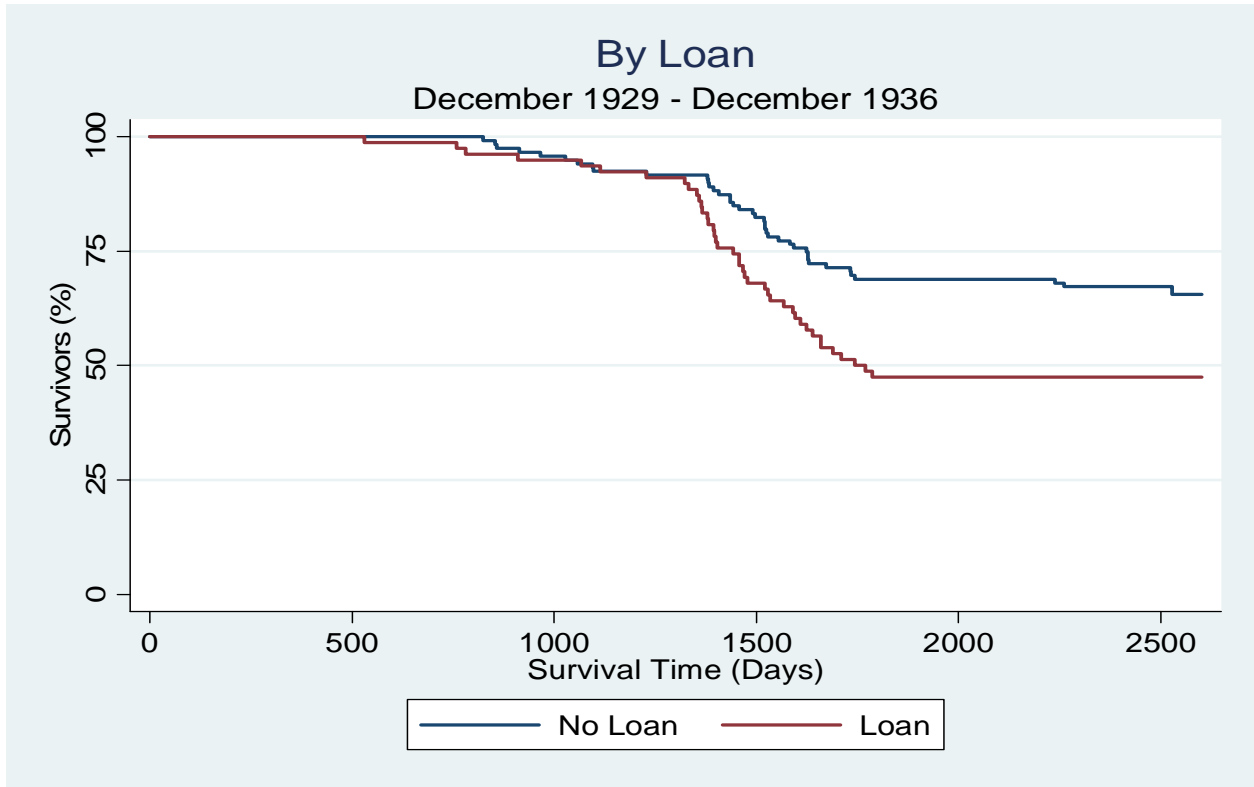
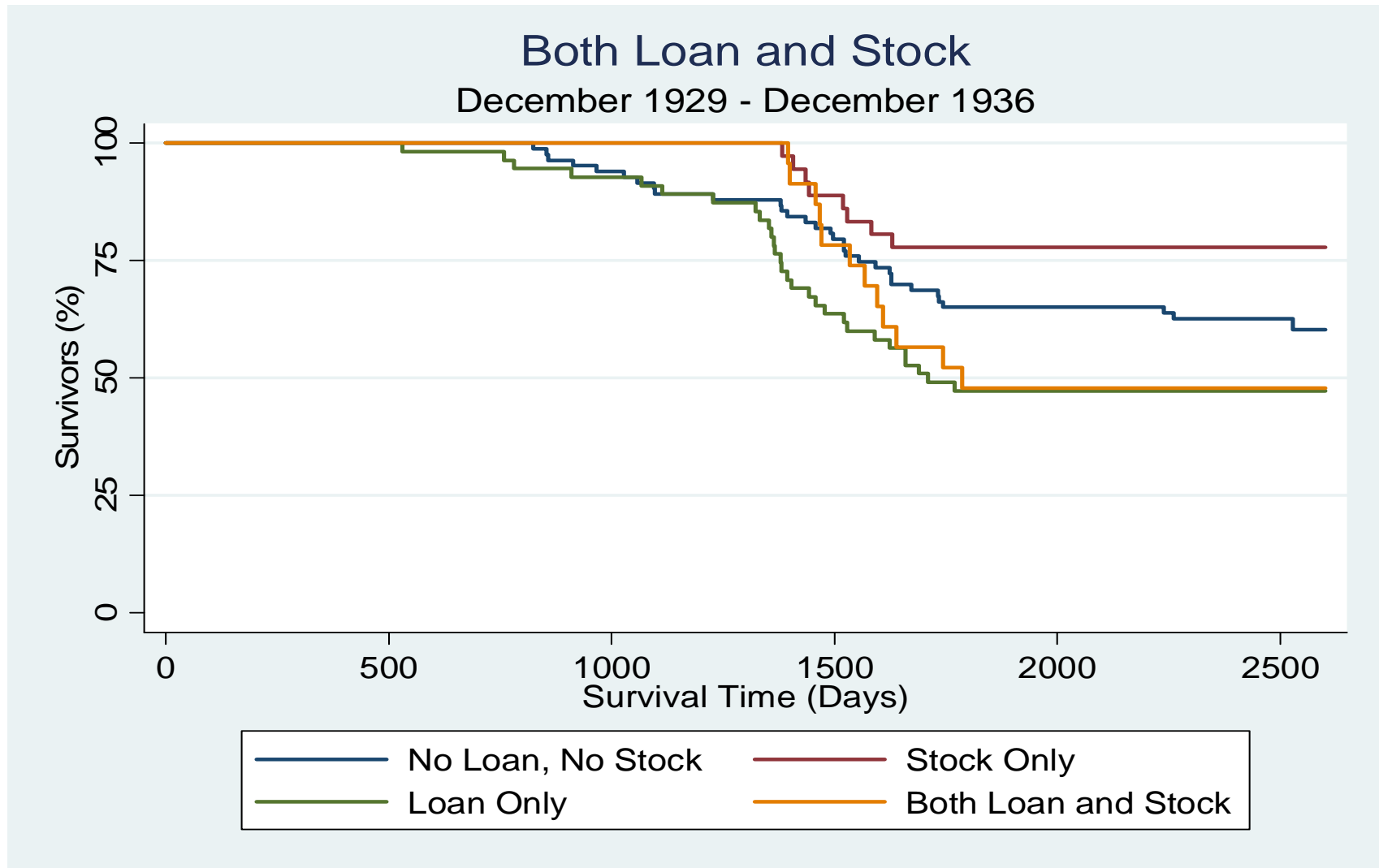


Figure 4. Kaplan-Meier estimated survival function for sample subgroups

This model represents the percentage of banks in business, stratified by the type of aid received. The banks which received RFC loans, the banks in which the RFC purchased preferred stock, and the banks which received loans and direct capital infusions via preferred stock are shown on the same graph for comparison. Bank failures are measured between December 31, 1929 and December 31, 1936. Bank failure data are from the Comptroller of the Currency's *Annual Report* and the *Rand McNally Bankers' Directory*.



Appendix II: Tables

Table 1. Survivor estimates, stratified by subgroup

This table lists the survivor function estimates for each RFC aid subgroup. Survivor rates are expressed as percentages.

Time (Days)	Preferred stock only	Preferred stock	Loan	Loan only	No Aid
531	100	100	99	98	100
789	100	100	96	95	99
1047	100	100	95	92	92
1305	100	100	91	87	89
1563	83	80	64	60	82
1821	78	66	47	47	72
2079	78	66	47	47	72
2337	78	66	47	47	71
2595	78	66	47	47	70

Table 2. Probit model of RFC discount loans and preferred stock purchases

Each model estimates the determinants of bank failure from December 31, 1929 to December 31, 1936. Bank financial data are from Federal Reserve *Reports of Condition and Income*. RFC loan and preferred stock data are from monthly *Reports of Activity of the RFC*. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Bank failure equation</i>						
Constant	-2.943 (0.25)	-2.178 (1.95)	-2.804 (2.03)	-2.370 (1.97)	-2.621 (1.99)	-2.602 (2.01)
Loan binary	0.652** (0.48)	---	0.672** (0.30)	---	---	---
Preferred stock binary	---	-3.128 (0.30)	-0.356 (0.31)	---	---	---
Loan only binary	---	---	---	0.659* (0.344)	---	0.511 (0.36)
Preferred stock only binary	---	---	---	---	-0.697** (0.37)	-0.536 (0.38)
Illiquid assets/total assets	4.159* (2.22)	4.445** (2.22)	4.318* (2.26)	3.882* (2.21)	4.931** (2.30)	4.459* (2.32)
Bonds, stocks, and securities owned/illiquid assets	-0.537 (1.40)	-0.982 (1.39)	-0.690 (1.41)	-0.720 (1.39)	-0.970 (1.39)	-0.842 (1.40)
Real estate owned/illiquid assets	24.430* (14.34)	17.772 (12.97)	23.893* (13.99)	23.423* (13.88)	18.090 (13.06)	22.067 (13.63)
Loans and discounts/illiquid assets	-0.377 (0.95)	-0.580 (0.93)	-0.440 (0.97)	-0.499 (0.95)	-0.535 (0.945)	-0.508 (0.96)
Paper eligible for rediscount at the Fed/loans and discounts	0.369 (1.19)	0.282 (1.17)	0.213 (1.20)	0.183 (1.18)	0.313 (1.18)	0.159 (1.19)
Net worth/total assets	-3.492 (4.08)	-5.249 (3.98)	-3.759 (4.12)	-4.109 (4.04)	-4.951 (4.00)	-4.275 (4.07)
Bills payable and rediscounts/debt	2.973 (3.92)	2.110 (4.01)	1.800 (4.07)	1.891 (3.95)	2.054 (3.98)	1.315 (4.01)
Interest and discount on loans/total earnings	0.083 (1.08)	0.093 (1.10)	0.194 (1.08)	0.122 (1.09)	0.167 (1.10)	0.227 (1.09)
Recoveries/total earnings	-0.203 (2.91)	-0.321 (2.95)	-0.439 (2.95)	-0.135 (2.96)	-0.584 (2.92)	-0.534 (2.97)
Losses/total expenses	-0.119 (0.77)	-0.030 (0.75)	-0.096 (0.77)	-0.008 (0.77)	-0.123 (0.75)	-0.066 (0.77)
Log-likelihood	-54.39	-56.39	-53.72	-55.03	-55.05	-54.02
Chi-squared (k-1 df)	20.47**	16.47	21.80**	19.19*	19.15*	21.21**
Number of banks with RFC authorization of each type	41	38	---	23	20	---
Wald test for joint significance	---	---	6.13**	---	---	5.55*
Number of observations (banks)	94					
Number of failures	52					

*, **, *** Statistically significant at the 10%, 5%, 1% level.

Table 3. Marginal effects of RFC discount loans and preferred stock purchases in probit model

RFC loan and preferred stock data coefficients express the percentage change in the likelihood of failure when aid is received. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Marginal effects</i>						
Loan binary	0.250** (0.11)	---	0.257** (0.11)	---	---	---
Preferred stock binary	---	-0.123 (0.12)	-0.140 (0.12)	---	---	---
Loan only binary	---	---	---	0.244** (0.12)	---	0.193 (0.13)
Preferred stock only binary	---	---	---	---	-0.272** (0.14)	-0.211 (0.15)
Log-likelihood	-54.39	-56.39	-53.72	-55.03	-55.05	-54.02
Chi-squared (k-1 df)	20.47**	16.47	21.80**	19.19*	19.15*	21.21**
Number of banks with RFC authorization of each type	41	38	---	23	20	---
Wald test for joint significance	---	---	6.13**	---	---	5.55*
Number of observations (banks)	94					
Number of failures	52					

*, **, *** Statistically significant at the 10%, 5%, 1% level.

Table 4. Accelerated failure time models with RFC loans and preferred stock purchases

Each model measures the determinants of log survival time, measured in days, from December 31, 1929 to December 31, 1936. All survival models use a log-logistic parameterization. Time ratios less than one are associated with a shorter estimated survival time; time ratios greater than one are associated with a longer estimated survival time. Bank financial data are from the Federal Reserve Reports of Condition and Income. RFC loan and preferred stock information are from monthly Reports of Activity of the RFC. Standard errors are in parentheses.

	(1)	(2)	(3)	(4)
<i>Time Ratio</i>				
Loan binary	0.783** (0.48)	---	0.777*** (0.81)	---
Preferred stock binary	---	1.217* (0.14)	1.232* (0.14)	
Loan only binary	---	---	---	0.795** (0.10)
Preferred stock only binary	---	---	---	1.267* (0.17)
Illiquid assets/total assets	0.124*** (0.11)	0.118*** (0.10)	0.117*** (0.10)	0.116*** (0.10)
Bonds, stocks, and securities owned/illiquid assets	1.041 (0.56)	1.189 (0.64)	1.045 (0.55)	1.055 (0.55)
Real estate owned/illiquid assets	0.024 (0.08)	0.019 (0.07)	0.021 (0.07)	0.020 (0.07)
Loans and discounts/illiquid assets	1.175 (0.43)	1.2655 (0.45)	1.251 (0.44)	1.262 (0.44)
Paper eligible for rediscount at the Fed/loans and discounts	0.941 (0.43)	0.975 (0.45)	1.045 (0.46)	1.053 (0.47)
Net worth/total assets	8.114 (13.72)	17.132 (29.31)	9.909 (16.38)	10.648 (17.45)
Bills payable and rediscounts/debt	0.098 (0.17)	0.195 (0.33)	0.176 (0.30)	0.191 (0.32)
Interest and discount on loans/total earnings	0.802 (0.36)	0.775 (0.34)	0.727 (0.32)	0.721 (0.317)
Recoveries/total earnings	1.089 (1.31)	1.224 (1.59)	1.218 (1.45)	1.236 (1.48)
Losses/total expenses	1.071 (0.30)	1.002 (0.29)	1.072 (0.29)	1.068 (0.30)
Log-likelihood	-64.69	-65.81	-62.93	-62.98
Chi-squared (k-1 df)	24.10***	21.87**	27.62***	27.53***
Number of banks with RFC authorization of each type	41	38	---	Loans: 23 Stock: 20
Wald test for joint significance	---	---	8.83***	8.71***
Number of observations (banks)	94			
Number of failures	52			

*, **, *** Statistically significant at the 10%, 5%, 1% level.