

# The Financial Interconnectedness of Railroads and the Transmission of Financial Distress during the Great Depression

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## Abstract

This paper studies the systemic importance of railroads through the widespread holdings of their bonds by American fiduciary institutions during the Great Depression. We examine the impact of a series of large railroad bond prices shocks using a remarkable data set of the individual bonds held by each Massachusetts savings bank annually. We suggest that the shocks varied across banks for reasons that are largely random relative to the other factors affecting these banks businesses, first because strict regulation prevented bank managers from gambling on particularly risky bonds, and second because the railroads were located outside of Massachusetts. The results suggest that the bond price declines caused banks to engage in greater contraction of their real estate loans, especially if they were also experiencing liquidity problems from deposit withdrawals.

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## 1 Introduction

In the history of systemically important institutions, railroads figure prominently. During late 19th and early 20th century America, railroads not only held a central role as movers of goods and employers of vast numbers of people, they also interacted extensively with American financial institutions. Simply stated, railroads held a special place in the financial world in this era. By the 1920s, their bonds were the prime and most conservative investments of fiduciary institutions such as savings banks and life insurance companies. Railroad bonds were also an important source of liquidity to commercial banks during the 1920s. Railroads achieved this position based on their records as mature and closely regulated firms that had made reliable payments on extensive and well-secured debt structures built up over many decades.

The Great Depression severely undermined the volume of business on which railroads relied, leading to fears that railroads would default on their bonds. Eventually, the Reconstruction Finance Corporation bailed out many railroads to prevent such defaults. As these events unfolded, railroad bond prices fluctuated wildly, and American financial institutions that held those bonds were subjected to a series of downward and upward shocks to their investment accounts and to their liquidity positions. In this paper, we study the systemic fallout from these shocks using a remarkable data set of Massachusetts savings banks which details the individual railroad bond holdings of each of those banks, annually. Combining these data with bond prices from the *Commercial and Financial Chronicle*, we can calculate unrealized gains and losses on railroad bonds, on an annual basis from 1927 to 1936. Though railroad bonds largely avoided default, the scale of the shocks from price movements on the bonds was significant. We find that the value of the median bank's railroad bond portfolio declined by about 3-4 percent of assets during 1931 and 1932 combined, and then partially bounced back during the next few years.

In analyzing the effects of these railroad bond shocks, we suggest that the shocks varied across banks for reasons that are largely random, insofar as the severity of a bank's shock is unlikely to be correlated with other aspects of that bank's business. Two factors support this claim. First, savings bank managers could only buy bonds that were on a pre-approved list created by state regulators. Those pre-approved bonds were intended to be the safest subset out of the universe of railroad bonds, and railroad bonds in general were one of the most conservative classes of investment

in the high-flying investment market of the 1920s. As a result, there was little scope for, say, risk-loving managers to buy particularly risky and high-yielding bonds that other bank managers avoided. Instead, variation in the severity of banks' railroad bond shocks largely arises from larger investments by some banks in particularly hard-hit bonds that other banks were also invested in, but to a lesser degree. In fact, about 20 bonds account for half of the holdings of railroad bonds at these banks. Second, the large majority of railroad bonds were the obligation of out-of-state railroads, many west of the Mississippi. Whether a Massachusetts savings bank invested in, say, the debt of the Atcheson-Topeka-Santa Fe railroad is unlikely to be correlated with factors affecting its other business lines, such as demand from its customers from real estate loans, particularly since its real estate loans were confined geographically to Massachusetts.

We find evidence that banks with the largest unrealized losses from railroad bonds pulled back from real estate lending, which was the other main type of investment aside from bonds. In particular, banks with the largest losses tended to have greater rates of contraction in their outstanding real estate loans. However, we do not find strong evidence that such banks had lower rates of gross originations of new loans, suggesting that the margin of adjustment was through reductions in existing loans, either through sales, foreclosures, or paydowns. We also find that these effects are stronger at banks with lower rates of deposit growth, but no different at banks with smaller capital buffers, suggesting that the railroad bond shocks exacerbated liquidity problems but not necessarily solvency ones. This is consistent with the overall strong solvency record of these banks. Only a handful of the Massachusetts savings banks were forced to suspend operations in the 1930s despite major shocks to nearly all aspects of their businesses. Other fiduciary institutions across the northeast generally had similarly strong records. The outcome could have been much worse had these banks been forced to sell defaulted railroad bonds at fire sale prices, but bailouts from the Reconstruction Finance Corporation kept such defaults to a minimum.

In previous research, scholars have noted the disruptions caused by the fluctuations in the prices of railroad bonds. Milton Friedman and Anna Schwartz (1963, p. 319) suggested the decline in bond prices was caused by a liquidation of those bonds by commercial banks in a bid to increase liquidity, rather than a change in the perceptions by investors of the riskiness of those bonds. Peter Temin (1976, p. 105) suggests the opposite, however, noting that railroad bonds declined in price prior to the banking panic of 1930, and that rating agencies began downgrading bonds prior to the

sales by commercial banks. Eugene White (1984) discusses the evidence for whether holdings of bonds (of all classes) caused failures during the 1930 banking crisis.

All three of those studies focus on commercial banks, in line with the broader goals of their analyses, but do not discuss savings banks. Savings banks investments differed in important ways from commercial banks, however. Savings banks were far more constrained in the railroad bonds they could buy, and they were also more heavily invested in railroad bonds in general. In addition, Massachusetts savings banks generally did not engage in the fire sale of railroad bonds that Friedman and Schwartz describe commercial banks as having conducted. In fact, these savings banks tended to hold on to the worst-hit bonds for years rather than sell them at losses.

## **2 Background**

This section begins with a brief summary of the place of railroad bonds in the investment world of the 1920s. We establish two important facts. First, railroad bonds were widely held by financial institutions, resulting in the potential for the systemic fallout if railroads defaulted on those bonds. Second, railroad bonds were widely perceived as safe investments. We then review the business model and regulatory environment of Massachusetts savings banks, with a focus on the tightly prescribed nature of their railroad bond investments.

### **2.1 Systemic importance of railroads**

Mason and Schiffman (2004, p. 21) and Fuller (2012, pp. 54-55) discuss the systemic importance of railroad bonds for savings banks and other financial institutions. When contemporaries tried to describe the systemic importance of railroads during the early 20th century, they often used the metaphor of how railroads were the “backbone” of the economy. This importance was rooted both in railroads’ size and interconnectedness. In terms of size, railroads were the single largest industry in 1929, by employment and by output. In terms of interconnectedness, railroads interacted extensively with the real and financial economies. In the real economy, railroads were critical to the physical movement of goods, in a world before trucks and pipelines had yet captured a significant amount of interstate transport. In the financial economy, railroads had built up extensive debt structures to finance their investments in track and equipment, and those bonds were widely held

by fiduciary institutions. Indeed, savings banks and insurance companies together held 39 percent of outstanding railroad debt, in 1932 (Table 1). A host of other institutions, such as commercial banks and a variety of nonprofit institutions, also held these bonds.

During the 1920s in particular, the federal government ran a budget surplus, causing the stock of its debt to decrease and encouraging investors to seek out other safe and long-term assets. Clark (1933, p. 10) gathers data that show railroad bonds represented about 12 percent of all long-term debts in the US in 1929. Savings banks and life insurance companies generally sought investments with long terms, given that their funding consisted of savings deposits, which in practice were relatively long duration as well.

Potential for systemic disruption rose during late 1931 and 1932, when railroad bond prices crashed, as shown in Figure 1. Note that these bonds were largely unaffected during the stock market crash in 1929 two years prior. It is hard to conclusively attribute the decline in railroad bond prices to any particular factor. Certainly, railroads' financial positions deteriorated as the Depression undermined their volume of business, and the adjustment of their wages and prices was a topic of great debate. Yet, contemporaries also believed other, more financial, effects to also be at work. Some believed that the liquidation of railroad securities by commercial banks, embroiled in crises during 1930 and 1931, contributed to the fall in prices. Of course, the reverse causality could have been at work as well. In addition, others believed that fears that some railroad bonds would be removed from the list of those legal for purchase by fiduciary institutions—lists that will be described more below—led investors to lower prices in anticipation of the potential loss of a large portion of demand for the bonds (Moody's 1931, p. xxiii).

With the crash in prices, the extensive holdings of the bonds by financial institutions created a potential cascade of losses in the investment accounts of those institutions. The bond crisis also impaired those institutions' liquidity positions, as railroad bonds were a key source of liquidity in that era and institutions were reluctant to trade them in a volatile price environment. Banks relied on railroad bonds for liquidity in part because, the Treasury market was not as large as it is today, and though many bonds had been issued during World War I, the federal government ran a surplus throughout the 1920s, as noted above.

In 1932, top government officials widely noted the potential systemic fallout from railroad bond trouble. President Hoover described how the “investment in their securities, particularly their

bonds, by insurance companies, savings banks, [and others] reflect their partnership in the whole economic fabric.” Secretary of Treasury Mills asserted a “national necessity of maintaining the credit of the railroads.” Eugene Meyer, the head of the Federal Reserve Board, and the initial head of the Reconstruction Finance Corporation, stated “the fact that the credit position of the railroads is a very important item at the present time in the whole national financial structure.” Jesse Jones, the eventual long-time head of the RFC was satisfied that the RFC’s loans to railroads “benefited every American who had an insurance policy or an account in a savings banks.” Finally, Franklin Roosevelt (then Governor of New York) described how railroad bonds formed the “backbone of that form of wealth that seeks stable investment.”<sup>1</sup> Thus, the decline in railroad bond prices represented a systemic problem rather than a more idiosyncratic negative shock.

Private and public actors each coordinated to address the railroad bond crisis. Friedman and Schwartz (1963, p. 319) note an effort by the Federal Reserve Bank of New York to promote a railroad bond pool among commercial banks to purchase bonds and stabilize the values, but describes this as ineffectual. The creation of the Reconstruction Finance Corporation (RFC) in January 1932 was more consequential, and the clearest illustration of the widespread fear that railroad bond defaults would lead to systemic fallout. Charles Dawes (its first chief and a former diplomat and Vice President) explicitly made the connection between the RFC, railroad bonds, and the solvency of savings banks:

The reason why Congress authorized loans by the Reconstruction Finance Corporation to railroads . . . was not only for the protection of railroad corporations as the backbone of our transportation system and as employers of hundreds of thousands of men, but for the protection as well of the trustee institutions of this country, including insurance companies and savings banks, owning the securities of railroads, in which institutions and their normal functioning the great public has a direct interest. (*New York Times*, April 22, 1932, p. 2.)

The RFC’s loans were used by railroads to meet interest and sometimes principal payments on their bonds, thereby avoiding default. Clark (1933) emphasized the importance of these loans, writing

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<sup>1</sup>See *New York Times* December 8, 1931, p. 21 for Hoover’s statement; April 26, 1932, p. 17 for Mills’ statement; January 7, 1932, p. 20 for Roosevelt’s; Jones (1951, p. 106); and United States Senate (1932) p. 9 for Meyer’s statement.

that “A substantial proportion of the railway mileage of the country is essentially bankrupt and is saved from becoming technically so only by the government’s exercise of emergency remedies” (p. 97). Of course, the RFC was not created solely to aid railroads. Railroads received about one quarter of the RFC investments outstanding as of year-end 1932, while financial institutions accounted for the bulk of the remainder (Secretary of the Treasury, 1959, Appendix C).

## **2.2 Perceived safety of railroad bonds**

It is safe to say that railroad bonds were the prime investment securities of savings banks and other fiduciary institutions until the Depression (Clark 1933, p. 95; Welfling 1939, p. 114, Hickman 1954, p. 212). The elite status of railroad bonds was partly a function of the tangibility of their collateral, as the highest quality bonds were secured by each railroad’s most valuable tracks and equipment, and because railroads offered reliable interest payments from a mature industry. Investors also took some comfort in the strict regulation of the industry by the Interstate Commerce Commission (Wigmore 1985, pp. 34, 106, Welfling p. 114). The regulation covered not just wages and prices and the structure of the railroad industry, but also some oversight of debt issuance. This was unusual in a world before the existence of government institutions that oversaw the capital markets, like the Securities and Exchange Commission. Altogether, railroad bonds bore the lowest yields and carried the largest issuance volume among the major industrial borrowers.

For our purposes, it is important to understand the institutional context in which savings banks purchased railroad bonds. Savings bank managers were only allowed to buy railroad bonds that were included in a pre-approved list, known as the “legal list,” created by state regulators. As a result, not only were railroad bonds in general among the most conservative investment choices available during the 1920s, savings bank managers could only buy the highest quality railroad bonds. In that respect, savings bank managers had little scope to increase returns by taking on more risky railroad bonds, as all managers chose from a fairly limited list.

Inclusion of a bond on the legal list was the result a multi-faceted test of the bond’s collateral and the railroad’s size, earnings, dividend history, default history, and overall leverage. Hickman (1954, chapter 4) describes the legal lists in detail. The criteria used by Massachusetts regulators was particularly conservative, insofar as the size of the legal list did not expand much during the 1920s, in contrast to the lists created by other states with savings banks, such as New York. If a

bond was taken off the legal list, banks could not purchase additional amounts, but did not have to sell it unless the obligor defaulted. Importantly, during the early 1930s state legislators and regulators responded to the railroad bond crisis by placing moratoria on the rules governing the legal list. Typically, railroads' earnings after 1930 were excluded from the calculation, which prevented bonds from falling off the list (Hickman 1954, p. 226; Welfling 1939, p. 126; Steiner 1952, p. 90). This action in itself reflects the importance of railroad bonds to savings banks.

### **2.3 Business model of Massachusetts Savings Banks**

Massachusetts contained 196 mutual savings banks by the late 1920s, spread across 126 municipalities.<sup>2</sup> A brief analysis of these banks' aggregate balance sheet in Table 2 provides a simple window into their basic business model. Overall, this is the same basic balance sheet that would be seen at savings banks in other northeastern states. On the liability side, savings deposits, particularly from small depositors, were the exclusive source of funding. Importantly, savings banks were mutually owned by their depositors, as there was no separate class of nondeposit equity investors. This led to a special responsibility for these banks to invest in safe assets. A surplus account on the liability side served as a buffer for depositors instead of a separate class of equity like at commercial banks.

Their assets were heavily comprised of real estate loans and bonds, with railroad bonds in particular accounting for about 11 percent of aggregate assets. Outside of railroad bonds, savings banks also invested in government bonds and other corporate bonds selected from another legal list, such as utility bonds. But the largest single type of investment was real estate loans, and the laws governing real estate lending practices are also relevant for our purposes. The real estate collateral itself was required to be located either in Massachusetts or within 50 miles of the bank. The latter restriction helps bolster our identification strategy, as it reduces the likelihood of any connection between real estate and railroad bond investments. The demand for loans from a given bank of real estate loans within Massachusetts is not likely to be correlated with the particular portfolio of railroad bonds that the bank invested in, especially because the railroads are spread across the country outside of Massachusetts. Otherwise, real estate lending was also subject to prudential regulations which included a maximum loan-to-value of 50 percent, a limitation to first mortgages, and a cap on real estate loans to 65 percent of a savings bank's assets. Most properties lent against

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<sup>2</sup>These banks also had 36 branches. Branches were only permitted within the same county as the head office.

were single family residences, although some of the larger banks invested in apartment buildings and mixed use properties.

The record of Massachusetts savings banks during the Depression was superb, especially compared to the nation's commercial banks. Other savings banks and life insurance companies in the northeast generally matched this record. Only four of the Massachusetts savings banks ceased operations during the 1930s, all merging into other institutions. An additional two banks suspended operations for several months.

### 3 Data and measurement

Quantity data on railroad bond holdings come from the *Annual Reports* of the Massachusetts Commissioner of Banks, published each year with data as of October 31. These reports contain lists of the individual railroad bonds held by each bank, at par value. We have digitized 10 years of these holdings, from 1927 to 1936, and we have also digitized each bank's balance sheet for those 10 years.<sup>3</sup>

Railroad bonds constituted about 10 percent of the median saving bank's assets in 1929. On average, there were about 230 bonds, issued by about 150 railroads, held in each year, and the median bank held roughly 30 railroad bonds. However, railroad bond investments were concentrated in a relatively small amount of these bonds. For example, in 1929, 21 bonds accounted for 50 percent of the dollar amount held by each bank, on average, and 81 bonds accounted for 90 percent.

In terms of prices, the data from the annual reports contain the par value of the bonds held, and therefore do not reflect changes in the market prices of the bonds from year to year. We obtain price data for these railroad bonds from the *Commercial and Financial Chronicle (CFC)*, which published monthly beginning-of-month prices. We have digitized these data for each month from 1927 to 1936.<sup>4</sup> With these data, we match the bonds listed in the annual reports with those listed in the *CFC*, to compute the market value of each of a bank's railroad bonds in each annual statement.<sup>5</sup>

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<sup>3</sup>On their balance sheets, the banks also report aggregate railroad bond holdings at the price of acquisition. This figure does not change with market prices, and is not reported for individual railroad bonds, so it has limited use to us.

<sup>4</sup>The *CFC* reports both bid and ask prices. We use the bid prices rather than the ask prices or some mixture of the two, as the bid prices are usually available while the ask prices are less commonly available.

<sup>5</sup>For most bonds, it is easy to find the appropriate match among the bonds listed in the *CFC*. In some cases, since the annual reports give the name of the railroad and the coupon rate on the bond, ambiguity can arise when a railroad

In the analysis, we use prices from the beginning of November, to match the October 31st date of the annual reports.

To measure the losses incurred by a bank on its railroad bonds, our key valuation measure is the net unrealized gain or loss (NUG for short) incurred annually from October 31st of one year to the next. To calculate NUG, we identify the bonds a bank held in two consecutive annual reports, and calculate the market value of the railroad bond holdings at each date. The NUG is the difference in the market value over the year, divided by total assets at the beginning of the year.

As shown previously in Figure 1, railroad bond prices plunged during late 1931 and early 1932. This plunge corresponds with large and negative NUGs during 1931 and 1932, as shown in Figure 2, which displays the median NUG in each year, as well as the interquartile range. Over 1931 and 1932, the median NUGs together totaled about 3 percent of assets, which is a sizable shock to these banks. Naturally, there is variation around this median, with some of the hardest hit banks experiencing negative NUGs of around 5 percent of assets over 1931 and 1932.

Importantly, contemporaries noted how savings banks managers closely monitored the value of their railroad investments. Lintner (1948, p. 259) discusses how savings bank managers knew their competitors and customers could monitor those values too, specifically because of the lists of railroad bond investments published each year in the annual report of the state regulator (the very data source we use in this paper). This provides some credibility to the mechanism underlying our analysis below, in which we examine how savings bank balance sheets responded to changes in railroad bond prices.

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issued more than one bond with the same coupon rate. We used several factors to narrow down the match in such cases. First, if a bond listed in the *CFC* had never been on the legal list, then we rule it out as a match. Second, we examine the holdings history at each bank. We often find that banks bought bonds in the year that a particular series issued, and before other series with the same coupon rate were issued. Similarly, we find some bonds disappearing in a year that a certain series matured, suggesting a high probability of a match. We also take into account the size of the issuance. In some cases, railroads sold one large issuance at a certain coupon rate, and later issued small amounts of additional bonds at that rate. In these cases, chances are that the banks held the bonds from the largest issuance, especially since in some cases the total holdings of MA savings banks exceeded the issuance of size of the smaller issuances. Finally, we look at the risk rating assigned to the bonds in the Moody's manuals, on the assumption that these savings banks tended to buy the safer bonds. If ambiguity remained, it tended to be irrelevant, since two bonds with the same coupon rate, that were both on the legal list, issued around the same time, with similar issuance sizes and risk ratings, tended to be priced closely to each other.

#### 4 Bond turnover

The NUG calculation captures most of the railroad bond price changes experienced by banks. It will only miss the gains or losses incurred during the partial years when bonds enter or leave a balance sheet between the two annual report dates. For example, a bond purchased in July may have a gain or loss between July and October. Likewise, a bond sold in July may have had a gain or loss since the previous October. From a measurement point of view, we cannot accurately calculate these gains or losses since we do not observe the month in which the bonds were bought or sold, and therefore cannot calculate the price at the time of the purchase or sale.

Nevertheless, this is not too much of a concern for our analysis. The vast majority of bonds were held from year to year—only about 5-15 percent of the average bank's bonds were bought or sold in a given year between 1927 and 1936. Moreover, during the period of the most drastic price fluctuations, from 1931 to 1933, banks sold and purchased very few bonds, and as a result the NUG measure does especially well in capturing nearly all of the asset value shock from railroad bonds in those years. Indeed, the response to these price declines was a striking reduction in trading activity, as can be seen in Figure 3, which shows that these savings banks sold many fewer railroad bonds in 1932, in particular, compared to other years.

In general, these banks tended to trade bonds only when the market value of the bonds roughly equaled par value. This can be seen in Figure 4: each observation in the figure represents an individual bond held by at least 10 banks. The vertical axis measures the number of banks that sold the bond during the year, expressed as a percent of those that held the bond at the beginning of the year, and the horizontal axis measures the bond's bid price in each year. For example, of the small number of bonds that banks did sell during 1932 and 1933, Figure 4 shows that most were trading very close to the par value of 100.

Figure 3 also shows that Massachusetts savings banks essentially ceased new purchases of railroad bonds despite the low prices. The lack of new purchases likely reflects the general tendency toward liquidation of assets in these years, as the median bank lost 4 percent of deposits in 1932 and about 2 percent in 1933. The pressure from deposit outflows, though, does not appear to have led to sales of railroad bonds. Instead, banks appear to have sold off their holdings of state and local bonds, as well as US Treasury bonds. A simple OLS regression of the change in deposits

(as a percent of assets) on the change in government bond holdings (also as a percent of assets) in 1932 yields an R-squared of 0.39.

Over the medium term, savings banks did sell off some of their railroad bonds. However, some bonds never fully recovered their market values. Figure 6 shows that such bonds tended to remain on these banks' books relatively untouched up at least until 1936. In the figure, each observation again represents a bond that was held by at least ten banks. The horizontal axis measures the change in the bond's value from 1927 to 1936, while the vertical axis measures the percent of banks that never changed their holding of the bond from 1927 to 1936 – i.e. never sold any of their holdings, and never bought more either over the entire 9 year period. The figure shows a strong association, in which banks left untouched their holdings of avoided selling these bonds (at least until 1936).

These findings differ from the description of savings banks operations in Mason and Schiffman (2004), who state that changes in the legal lists led to “major selloffs of railroad bonds.” They state that this was the case particularly when a railroad failed to meet the earnings tests that were part of the legal list rules, even if the legal list did not necessarily require bonds to be sold in those situations (just not purchased anew). Mason and Schiffman focus on New York savings banks, and possibly those banks had such a selloff, but that development is not apparent in the data for Massachusetts savings banks.

## 5 Effects of railroad bond shocks on real estate lending

To examine the effects of railroad bond valuation shocks, we focus on real estate lending, since such lending was the main alternative form of investment for these banks outside of bonds. We specify the following model:

$$y_{i,t} = \alpha + \beta NUG_{i,t} + \mathbf{X}'_{i,t-1}\gamma + \eta_i + \lambda_{c,t} + \epsilon_{i,t}$$

where  $i$  indexes banks,  $t$  indexes years from 1927 to 1936, and  $c$  indexes the counties in which the banks operate. Therefore,  $\eta_i$  represents a set of bank fixed effects and  $\lambda_{c,t}$  a set of county-year fixed effects. The key outcome variable  $y$  is the change real estate loans, divided by beginning-of-year assets. The control variables in  $X$  are those listed in the summary statistics in Table 3. They

include the following, each scaled by beginning-of-year assets: railroad bond holdings (by par value), holdings of non-real estate and non-railroad investments, foreclosed real estate holdings, the size of the surplus on the liability side, gross income over the year, and change in deposits from the prior year. The bank fixed effects should capture a wide variety of bank-specific time invariant attributes, and the county-year fixed effects should account for changes in time and space in the demand for real estate loans. The scaling of each variable by assets can be thought of as a heteroskedasticity correction, since balance sheet sizes varied widely in size across banks. Finally, we cluster the standard errors by bank.

The main identification assumption is that  $NUG_{i,t}$  is not correlated with other factors in  $\epsilon_{i,t}$  that affect real estate loan growth, such as changes in demand. For this to be false, banks that invested in particularly hard-hit railroad bonds would also need to have been subjected to, say, more contraction in demand. There is little reason to believe that banks' railroad bond investments would be directly connected to their residential real estate loan businesses. This is particularly true since most of the railroads operated outside of the state of Massachusetts, while real estate lending was confined to Massachusetts (and we report a specification below in which we exclude railroads that operated in Massachusetts). Even if the railroad and real estate businesses were both affected by general economic activity, that would not produce a cross sectional correlation between a bank's specific railroad bonds and the demand it faces for real estate.

A different identification concern might arise if  $\epsilon_{i,t}$  contained characteristics of a bank's management that affected both its railroad and real estate businesses. However, the institutional context in which the railroad bonds were bought mitigates this concern. As described in section 2, banks could only buy the safest railroad bonds that were on a pre-approved list created by state regulators. This greatly limits the extent to which, for example, a risk-loving manager could have gambled on particularly risky bonds, since the manager selected the investments from a common pool. This is particularly true since, as noted above, railroad bond investments tended to be concentrated in a relatively small number of bonds. Because 21 bonds accounted for 50 percent of the dollar amount held by each bank, on average in 1929, some banks had larger shocks than other because they were more heavily invested in certain bonds in which other banks had invested smaller amounts.

Table 4 displays the results of estimating this model via OLS. The coefficient on NUG in column (1) is positive, indicating that higher values of NUG—corresponding to better experiences

with railroad bonds—are associated with higher values of real estate loan growth. Since the standard deviation of NUG is roughly equal to one, it is easy to interpret the magnitude of the coefficient. The coefficient of 0.224 implies that a one standard deviation higher NUG adds 0.224 percentage points to real estate loan growth, which is equal to about one-tenth of the standard deviation of loan growth. Therefore, the magnitude is small but nontrivial.

The remaining columns in Table 4 revisit this result by interacting NUG with other characteristics of the safety and soundness of each savings bank. Column (2) interacts NUG with deposit growth over the past year, which allows the effect of NUG to differ depending on the pace of deposit withdrawals. The results, with a negative coefficient on the interaction, indicate that banks with higher deposit growth are less affected by railroad bond shocks. In terms of the magnitude of the coefficient, if banks recorded deposit growth at the 25th percentile (a contraction of -1.22 percent), then the effect of a one standard deviation change in NUG is 0.290, slightly higher than in column (1) without the interaction, and statistically significantly different from zero. In contrast, if banks recorded deposit growth at the 75th percentile (a growth rate of 3.79 percent), then the effect of a one standard deviation change in NUG is 0.092, or close to zero, without statistical significance. In other words, the effect of NUG disappears for banks with better deposit growth. This suggests that railroad bond shocks exacerbated liquidity problems, which is plausible if these banks felt they should not liquidate railroad bonds at fire sale prices in order to meet deposit outflows or free up funds for other activities.

In contrast, the interaction effect with the amount of capital surplus is not statistically significant, and in fact is the opposite sign from what would be expected. One concern with this measure is that Massachusetts savings banks were given a certain amount of forbearance in marking down the value of their assets (Lintner 1948, p. 258). This may worsen the information content of this surplus measure. As an alternate gauge of solvency problems, therefore, column (4) interacts NUG with the amount of foreclosed real estate (real estate owned or REO in the parlance of the banking world). The coefficient is negative but still not statistically significant. Altogether, these interactions suggest that the railroad bond price fluctuations may have affected banks through a liquidity channel rather than a solvency channel. This is also consistent with the fact that very few of these banks were forced to suspend operations during the 1930s.

Table 5 conducts a similar analysis, except the dependent variable is the gross flow of real

estate loan originations (which the savings banks in Massachusetts reported each year in the annual reports) rather than the net change in real estate loans outstanding. The baseline results in column (1) find no effect of NUG on originations, but the interaction with deposit growth in column (2) does indicate that banks with lower deposit growth tended to react to low values of NUG with lower originations. These results may indicate that some of the effect on net real estate loan growth, in the previous table, may be due to higher rates of contraction of existing loans, rather than through originations of new loans. Such contraction could take place through real estate sales, paydowns, or foreclosures, but unfortunately we do not observe data on these types of gross flows like we do for originations.

Table 6 explores alternate specifications for the model. Column (1) allows the effect of the NUG shock to differ depending on whether the NUG is positive or negative. The two coefficients are jointly significant with a p value on the F statistic equaling roughly 6 percent; however, individually only the positive coefficient retains significance at the lower range of traditional significance tests. This may indicate that some of the effect of NUG is a function of the differences between banks with positive and negative NUGs rather than differences within groups that have positive or negative NUGs. Column (2) shows that the results when bonds of railroad that operate in Massachusetts are excluded, the results change very little. This bolsters our identification strategy: if somehow banks that had invested in the bonds of Massachusetts railroads also experienced correlated shocks to their real estate lending businesses in the same state, such an effect is much less likely to be present for out-of-state railroad investments. Column (3) indicates nonlinearity may characterize the relationship between NUG and the change in real estate loans, as the coefficients on both NUG and its square are positive and statistically significant. Column (4) looks into whether the lagged value of NUG affects loan growth and finds little statistical relationship with lagged values.

The last column of Table 6 focuses on the years 1931 and 1932, which were the years in which railroad bond prices plunged and therefore the years perhaps of greatest interest. To that end, we interact the NUG variable with a dummy for the years 1931 or 1932, and we also interact all of the control variables with the same dummy (not shown in the table). The interaction term on the NUG variable is not statistically significant, which indicates that the marginal effect of a change in NUG is the same in those years as it is in other years, though presumably the total effect is larger

in those years because the magnitude of the NUG variables is larger in those years. We have done a similar exercise in which we used interactions with a dummy variable indicating the years 1931-1933 in order to also include the year 1933, which had a large increase in railroad bond prices. That estimation has the same result, with the effect of NUG being no different in those years than in the baseline result.

Table 7 continues the focus on the years 1931 and 1932, by restricting the sample to just those two years of data. With just two years of data, we do not use bank fixed effects. Instead, we use a larger set of control variables that include characteristics of bank operations in 1930. These control variables include some bank characteristics that change only very slowly over time, such as log assets, that we did not include in earlier specifications because the bank fixed effects would likely nearly entirely capture their impact. The results, with changes in real estate loans as the dependent variable, show a coefficient on NUG that is roughly the same as in previous tables, though not statistically significant. Similarly, the interaction with changes in deposits in column (2) is not significantly different from zero.

Finally, Table 8 examines an alternate set of dependent variables: change in cash, change in government securities holdings, sales of railroad bonds (by par value), purchases of railroad bonds (also by par value), and dividend rates. Each is scaled by beginning-of-year assets (except for dividends which are reported by banks as a percent return on deposits). The first two columns are designed to see if banks substituted other sources of liquidity for railroad bonds after experiencing negative shocks to those bonds' market values. While the analysis finds no effect on government securities holdings, there is some evidence that banks increased cash holdings after recording low NUGs. In column (3), we find that banks with better performing railroad bonds were more likely to sell those bonds, which is consistent with the result discussed above in which banks tended to only trade bonds that were priced near par. The analysis finds no impact on railroad bond purchases or on dividend rates.

## **6 Conclusion**

Underlying the episode discussed in this paper was a strong demand for railroad bonds by savings banks and other fiduciary institutions, present for at least a few decades prior to the Depression.

This demand can be seen as part of a larger phenomenon in which some financial market participants desire to hold particularly safe assets. In this case, the fiduciary obligations of these institutions appears to have had a central role in driving their demand of such assets. However, the savings banks studied in this paper did not seek out these safe assets suddenly during a crisis, and did not liquidate other assets in order to obtain them. Rather, safe assets were the core of their investment strategies. Like other financial crisis episodes, however, these financial institutions were surprised to discover their assets to not be as safe as they had anticipated.

One widespread fear was that a flight from railroad bonds into safer assets could have emerged in 1931 and 1932, if savings banks had been forced to divest themselves of defaulted railroad bonds by state law. Of course, it is also possible that savings bank managers might have rushed to liquidate defaulted bonds regardless of the legal requirements, but we do not observe much liquidation at fire sale prices in practice as events played out. More broadly, though, if railroad bonds had widely defaulted or their bonds permanently lost a substantial part of their values, what was truly at stake was the savings of large numbers of ordinary Americans, who had placed those savings not in one of the many tantalizing investment venues available during the 1920s but in sedate fiduciary institutions.

Though the shoe did not fully drop in this episode, as railroad bonds were spared from the worst-case outcome of widespread default and savings banks largely avoided suspending operations, the dramatic price fluctuations during the early 1930s left an imprint on savings bank operations. We find that the hardest hit institutions tended to contract their real estate loan portfolios more than others, particularly if they were also experiencing liquidity problems from deposit outflows. In this way, it appears that these bonds added to the other factors that led to contraction of real estate loan portfolios in the 1930s. In the words of Hoover, railroads were indeed part of the whole economic fabric of the country, in this case through a financial channel.

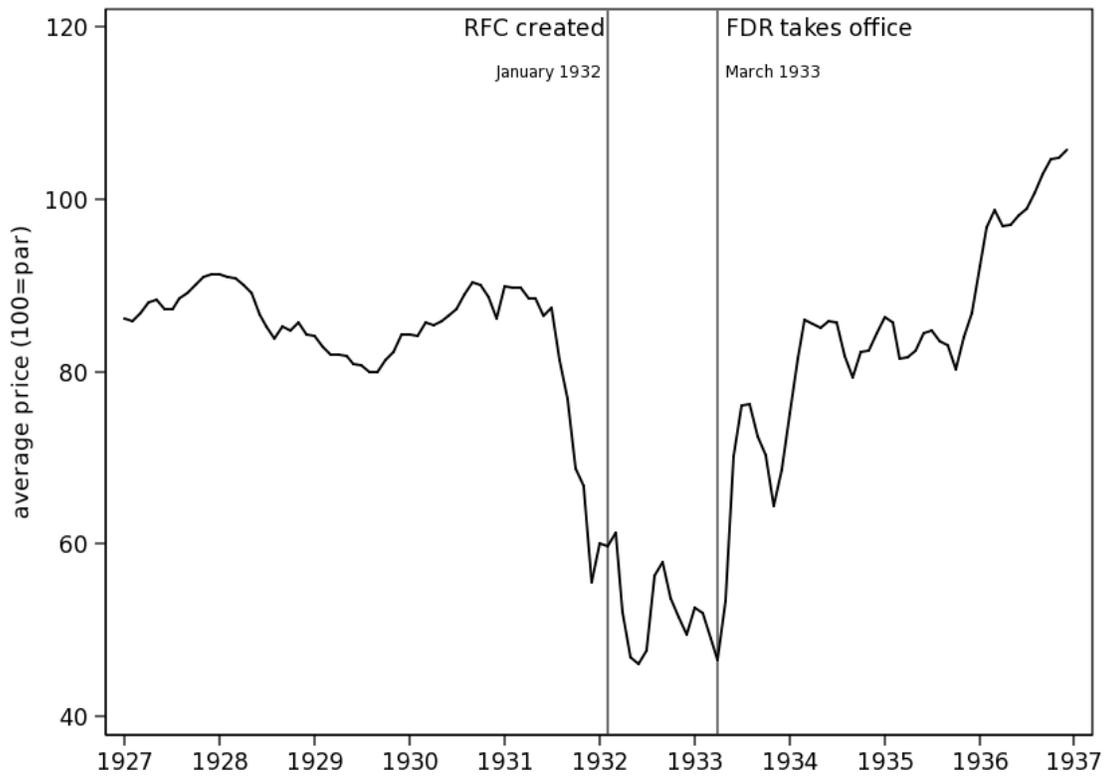
The paper also raises the question of why these savings banks, in Massachusetts and elsewhere, survived the Depression so well despite the large shocks to so many aspects of their operations. Indeed, only a handful were forced to suspend operations, encouraging many scholars to maintain a focus on commercial banks since savings banks operations “maintained something close to normal operations” (Bernanke 1983, p. 259). In addition, commercial banks as a whole were larger, together owning roughly five times the assets of savings banks, although commercial banks may

not have been as important for household savers. Regardless, the experience of savings banks during the Depression merits study. Savings banks survived the Depression despite having no direct access to a central bank and not possessing the type of branching network that has been credited in other countries such as Canada for the relatively strong record of their banks during the Depression. Though these banks were partially protected from deposit withdrawals as they could restrict withdrawals if necessary, it is hard to credit such restrictions too much in light of the experience of building and loan associations during the 1930s, for whom withdrawal restrictions created a public relations disaster and financial quagmire. Understanding the success of savings banks in weathering the Depression's shocks, while so many other financial institutions faltered, would be an important step in understanding the causes of financial stability and instability in these years.

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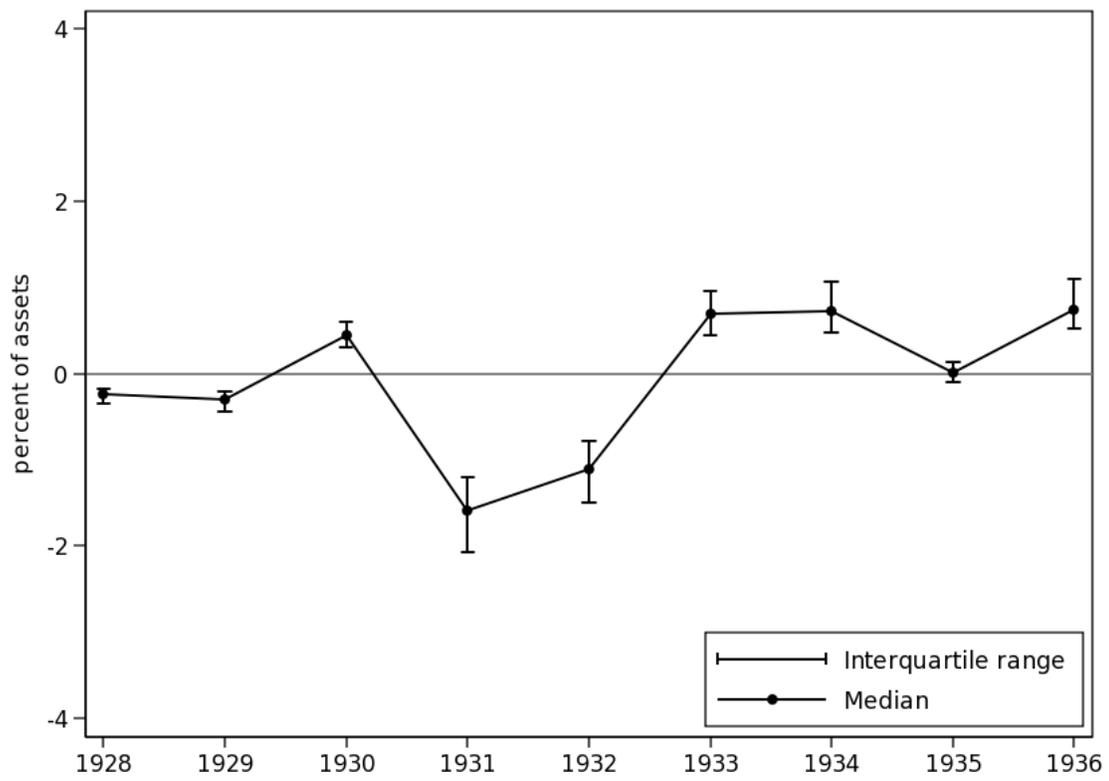
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Figure 1: Index of railroad bond prices, 1927-1936



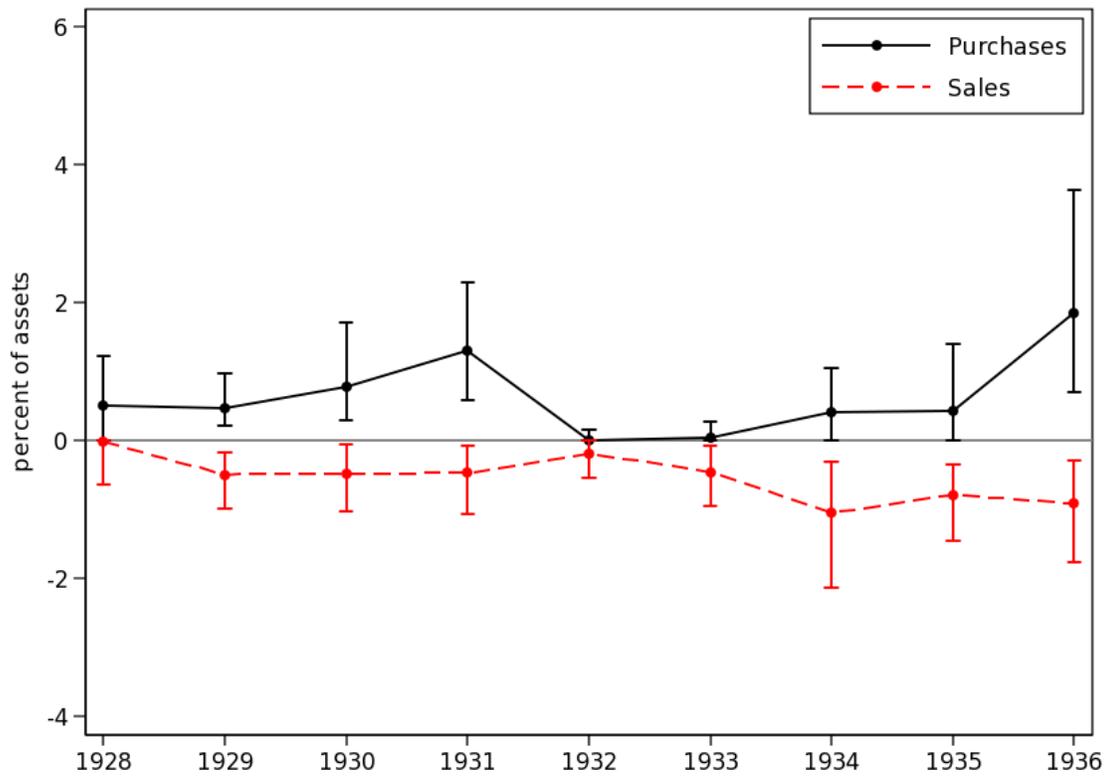
Notes: Average price of railroad bonds in the Dow Jones 20 railroad bond index. Source: Moody's Steam Railroad Manual, 1937, p. A4.

Figure 2: Railroad bond value shocks at Massachusetts savings banks, 1928-1936



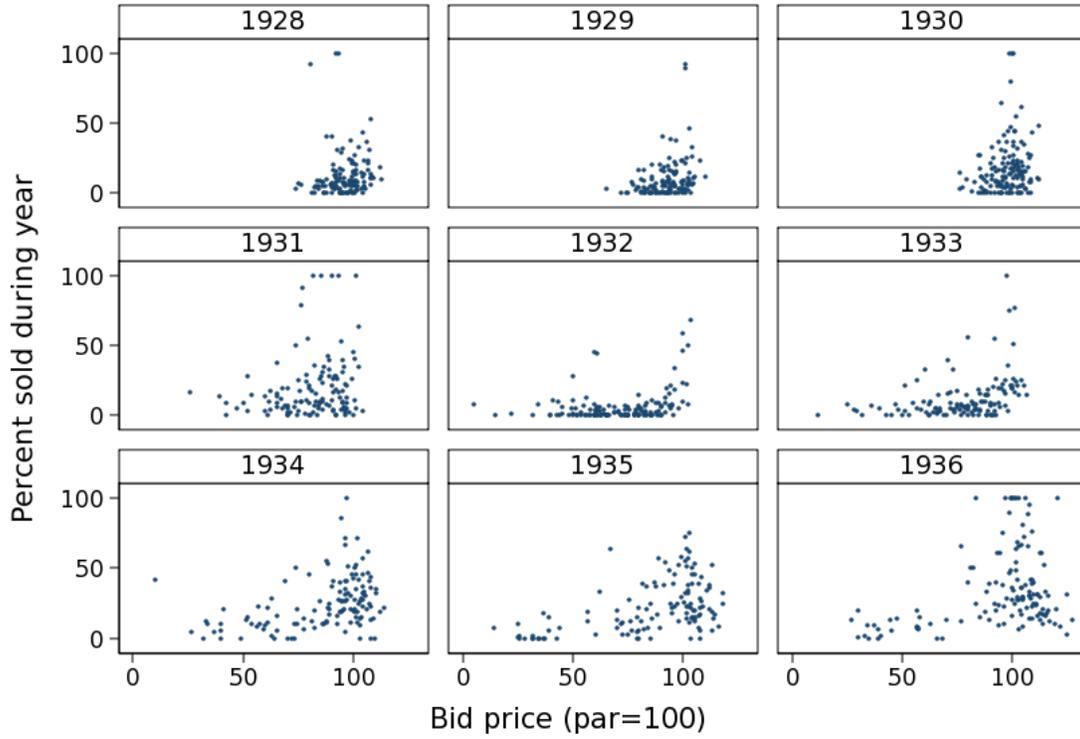
Notes:

Figure 3: Railroad bond purchases and sales at Massachusetts savings banks, 1928-1936



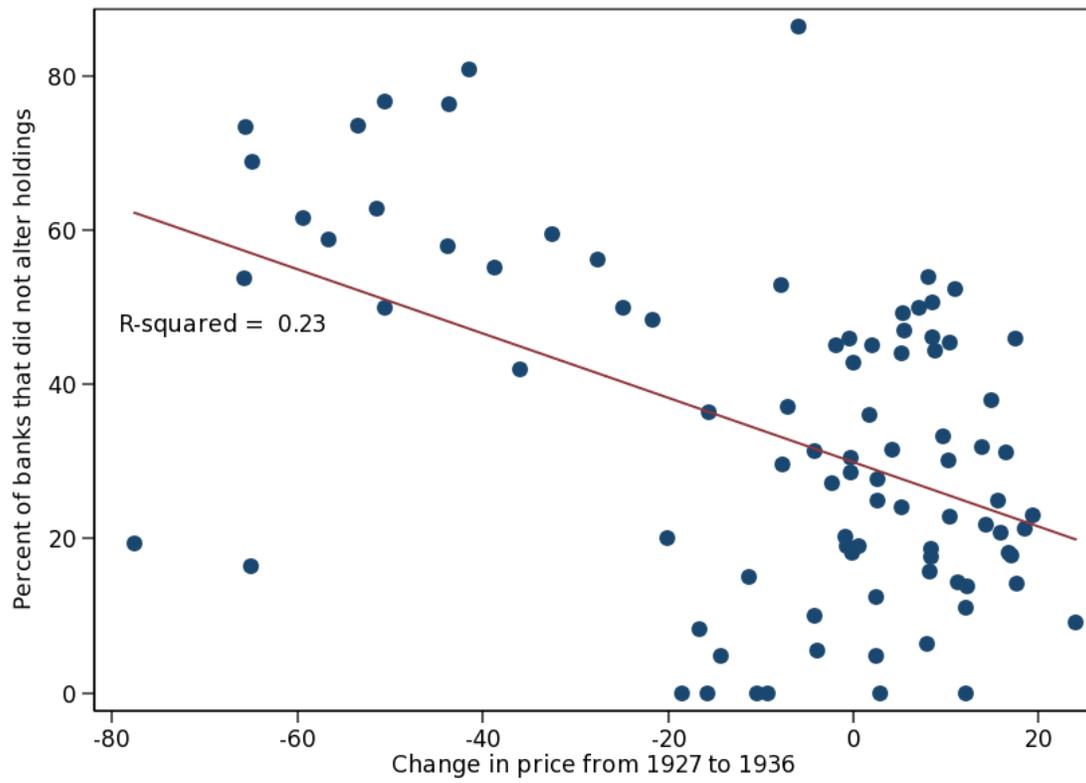
Notes: The dots denote the medians and the brackets denote interquartile ranges.

Figure 4: Railroad bond sales, 1928-1936



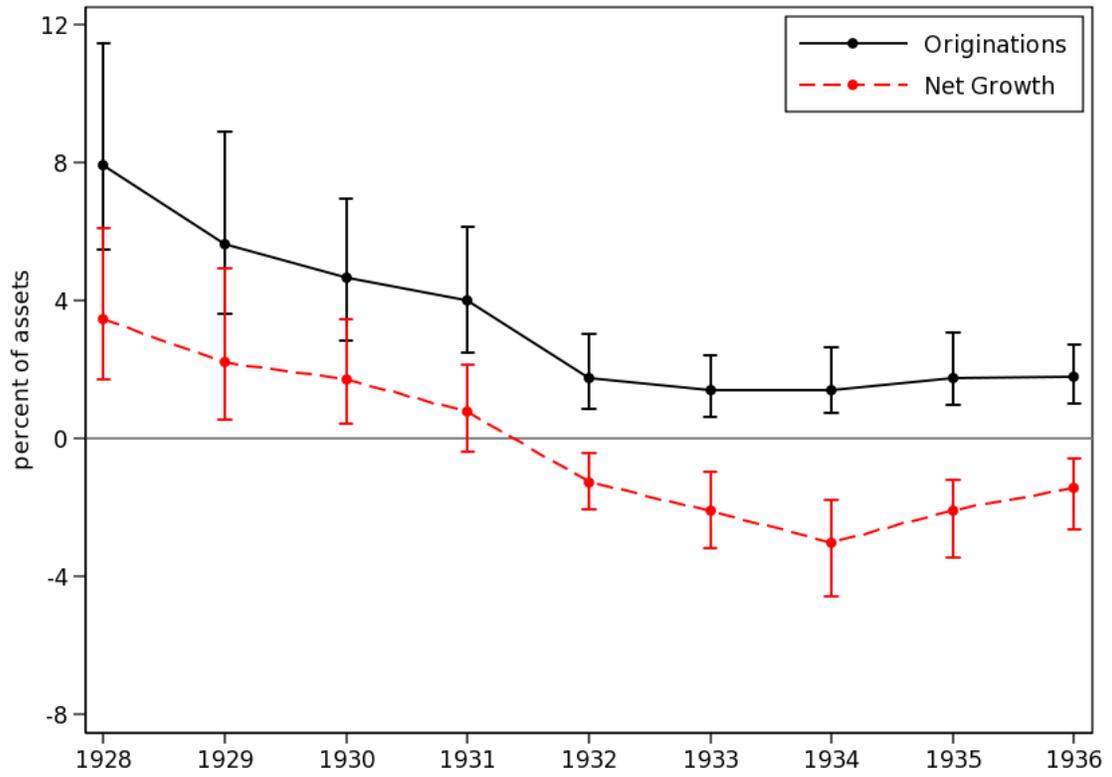
Notes: The figure includes bonds held by at least 10 banks at the beginning of the year.

Figure 5: Long run holdings of bonds



Notes: The figure includes bonds held by at least 10 banks at the beginning of the year.

Figure 6: Real estate loan originations and net changes, 1927-1936



Notes: The dots denote the medians and the brackets denote interquartile ranges

Table 1: Holders of railroad bonds

Institutions that owned railroad debt, 1932	Amount owned (\$ million)	Percent
Life insurance companies (legal reserve)	3,110	23.3
Individual trust accounts	1,600	12.0
Mutual savings banks	1,593	11.9
Railways other than the issuing company	1,009	7.6
National banks	653	4.9
Other insurance companies	506	3.8
Other banks	375	2.8
Public welfare foundations	300	2.2
Educational institutions	250	1.9
Subtotal	9,396	70.4
Others (individuals, foreigners, charities, religious institutions, fraternal organizations, others)	3,951	29.6
Total	13,347	100.0

Source: US Commerce Department (1937) p. 52.

Table 2: Aggregate balance sheet of Massachusetts savings banks

Assets		Liabilities	
Securities		Deposits	91.2
US, State, and Local Bonds	11.4	Surplus	7.7
Railroad Bonds	10.6	Interest payable	0.9
Gas, Electric, Water, and Telephone Co. Bonds	8.6	Reserves	0.1
Other Bonds	1.9	Unearned interest	0.1
Bank and Trust Company Stocks	1.5	Other	0.0
Real Estate Loans	53.7		
Foreclosed Real Estate	0.4		
Loans on personal security	9.7		
Building, Furniture, and Fixtures	0.9		
Cash; Amounts Due from Banks and Trust Companies; Acceptances	1.0		
Other	0.2		
<b>Total</b>	<b>100.0</b>	<b>Total</b>	<b>100.0</b>

Notes: Each item is expressed as a percent of total assets. This is the aggregate balance sheet as of October 31, 1929. The “other bonds” category includes bonds of banks and trust companies, federal land banks, and street railway companies.

Table 3: Summary statistics

	1929-1937				1931-1932			
	N	Median	Mean	SD	N	Median	Mean	SD
REChange	1524	-0.92	-0.54	3.04	383	-0.40	-0.17	2.12
Orig	1524	2.44	3.36	3.04	383	2.80	3.31	2.48
NUG	1524	0.17	-0.05	1.03	383	-1.34	-1.47	0.77
RR	1524	9.39	10.41	5.22	383	9.66	10.77	5.23
OtherAssets	1524	30.43	31.45	7.47	383	31.00	31.98	6.34
REO	1524	1.25	2.71	3.80	383	0.45	0.90	1.16
CapitalSurplus	1524	8.16	7.96	1.32	383	8.20	7.92	1.19
GrossIncome	1524	5.09	4.98	0.47	383	5.26	5.25	0.22
DepChange	1524	1.23	1.25	4.33	383	2.52	2.41	2.86

Variable definitions

REChange	Change in real estate loans (flow during year)
Orig	Real estate loan originations (flow during year)
NUG	Net unrealized gain or loss on railroad bonds (flow during year)
RR	Railroad bonds, measured by par value (stock, end-of-year)
OtherAssets	Non-railroad, non-real estate assets (stock, end-of-year)
REO	Real estate owned (stock, end-of-year)
CapitalSurplus	Capital surplus (stock, end-of-year)
GrossIncome	Gross income (flow during year)
DepChange	Change in deposits (flow during year)

Notes: All variables are expressed as a percent of total assets.

Table 4: Effect on the change in real estate loans, 1929-1937

Dependent variable: REChange				
	(1)	(2)	(3)	(4)
NUG	0.224** (0.0989)	0.241** (0.101)	-0.213 (0.388)	0.238** (0.103)
NUG * DepChange		-0.0401** (0.0181)		
NUG * CapitalSurplus			0.0529 (0.0442)	
NUG * REO				-0.00855 (0.0267)
RR	0.273*** (0.0583)	0.274*** (0.0579)	0.276*** (0.0583)	0.274*** (0.0587)
OtherAssets	0.184*** (0.0321)	0.190*** (0.0321)	0.185*** (0.0321)	0.184*** (0.0320)
REO	0.196*** (0.0417)	0.192*** (0.0416)	0.197*** (0.0419)	0.200*** (0.0465)
CapitalSurplus	0.303** (0.117)	0.297** (0.116)	0.293** (0.117)	0.303** (0.117)
GrossIncome	-0.584* (0.351)	-0.540 (0.352)	-0.577* (0.349)	-0.586* (0.352)
DepChange	0.144*** (0.0306)	0.141*** (0.0308)	0.144*** (0.0305)	0.143*** (0.0307)
Observations	1524	1524	1524	1524
R-squared	0.640	0.641	0.640	0.640
F-stat for county-year FE	106.3***	74.34***	153.2***	94.61***

Notes: Each regression includes county-year fixed effects and bank fixed effects. Standard errors are clustered at the bank level. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10 percent levels.

Table 5: Effect on real estate loan originations, 1929-1937

Dependent variable: Orig				
	(1)	(2)	(3)	(4)
NUG	-0.0626 (0.0963)	-0.0464 (0.0992)	-0.376 (0.382)	-0.0126 (0.0954)
NUG * DepChange		-0.0396** (0.0199)		
NUG * CapitalSurplus			0.0379 (0.0439)	
NUG * REO				-0.0307 (0.0260)
RR	0.175*** (0.0625)	0.177*** (0.0621)	0.177*** (0.0626)	0.178*** (0.0627)
OtherAssets	0.112*** (0.0318)	0.118*** (0.0323)	0.112*** (0.0319)	0.110*** (0.0320)
REO	0.0994** (0.0495)	0.0954* (0.0497)	0.101** (0.0495)	0.115** (0.0515)
CapitalSurplus	0.167 (0.111)	0.161 (0.110)	0.160 (0.112)	0.165 (0.111)
GrossIncome	-0.454 (0.379)	-0.410 (0.382)	-0.448 (0.377)	-0.458 (0.378)
DepChange	0.118*** (0.0297)	0.115*** (0.0297)	0.118*** (0.0295)	0.117*** (0.0298)
Observations	1524	1524	1524	1524
R-squared	0.640	0.641	0.640	0.640
F-stat for county-year FE	178.7***	582.4***	151.2***	402.3***

Notes: Each regression includes county-year fixed effects and bank fixed effects. Standard errors are clustered at the bank level. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10 percent levels.

Table 6: Alternate specifications

Dependent variable: REChange					
	(1)	(2)	(3)	(4)	(5)
NUG * 1(NUG > 0)	0.383*				
	(0.223)				
NUG * 1(NUG < 0)	0.121				
	(0.163)				
NUG excluding MA rail bonds		0.254**			
		(0.117)			
NUG			0.351***	0.260**	0.635***
			(0.118)	(0.101)	(0.203)
NUG <sup>2</sup>			7.916**		
			(3.731)		
NUG lag				0.0532	
				(0.0933)	
NUG * 1(Year=1931 or 1932)					-0.318
					(0.315)
Observations	1524	1524	1524	1517	1524
R-squared	0.640	0.641	0.640	0.640	0.642
F-stat for county-year FE	86.46***	94.49***	77.40***	107.7***	105.5***

Notes: Each regression includes the control variables that are used in the regressions displayed in Table 4, as well as the same county-year fixed effects and bank fixed effects. Column (5) also includes a set of interactions between the control variables and a dummy for the year equaling 1931 or 1932. Standard errors are clustered at the bank level. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10 percent levels.

Table 7: Restricting the sample to 1931 and 1932

Dependent variable:	REChange (1)	REChange (2)	Orig (3)	Orig (4)
NUG	0.258 (0.238)	0.368 (0.246)	-0.240 (0.252)	-0.211 (0.268)
NUG * DepChange30		-0.0458 (0.0468)		-0.0119 (0.0486)
RR30	0.0611* (0.0322)	0.0635** (0.0321)	-0.0834** (0.0373)	-0.0828** (0.0370)
OtherAssets30	0.0228 (0.0155)	0.0245 (0.0151)	-0.0463** (0.0189)	-0.0459** (0.0189)
REO30	-0.148 (0.107)	-0.136 (0.108)	0.166 (0.138)	0.170 (0.138)
CapitalSurplus30	0.0594 (0.0993)	0.0555 (0.0996)	0.0595 (0.103)	0.0585 (0.103)
GrossIncome30	0.119 (0.556)	0.117 (0.548)	1.088* (0.581)	1.087* (0.582)
DepChange30	0.228*** (0.0351)	0.164** (0.0777)	0.184*** (0.0365)	0.167** (0.0719)
Log(Assets30)	-0.127 (0.134)	-0.126 (0.134)	-0.342** (0.147)	-0.342** (0.147)
Log(AveDeposit30)	-0.411 (0.298)	-0.395 (0.300)	0.400 (0.373)	0.404 (0.374)
Log(AveREsize30)	0.563** (0.241)	0.579** (0.240)	1.136*** (0.308)	1.140*** (0.309)
Dividend30	1.092** (0.430)	1.119** (0.432)	0.453 (0.507)	0.460 (0.509)
Observations	383	383	383	383
R-squared	0.466	0.468	0.466	0.466

Notes: Each regression includes county-year fixed effects. Robust standard errors are used. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10 percent levels.

Table 8: Alternate dependent variables

Dependent variable:	GovSecChange	Cash Change	RRsales	RRpurchases	Dividend
	(1)	(2)	(3)	(4)	(5)
NUG	-0.0835 (0.117)	-0.117* (0.0673)	0.0849* (0.0501)	0.0938 (0.0740)	-0.0107 (0.0106)
RR	-0.0147 (0.0513)	-0.0123 (0.0194)	0.113*** (0.0367)	-0.0601** (0.0280)	0.00150 (0.00433)
OtherAssets	-0.0458 (0.0296)	-0.0317*** (0.0109)	0.00253 (0.0163)	-0.0171 (0.0172)	0.00109 (0.00210)
REO	-0.103*** (0.0391)	0.0282* (0.0150)	-0.0159 (0.0223)	-0.0108 (0.0222)	-0.00516** (0.00258)
CapitalSurplus	0.0846 (0.113)	-0.145*** (0.0483)	0.0297 (0.0487)	0.0287 (0.0611)	0.0472*** (0.0109)
GrossIncome	1.620*** (0.358)	0.396** (0.164)	0.180 (0.172)	0.240 (0.193)	0.0988*** (0.0268)
DepChange	0.167*** (0.0396)	-0.00367 (0.0149)	-0.0200 (0.0129)	0.0147 (0.0130)	0.00380 (0.00272)
Observations	1524	1520	1524	1524	1524
R-squared	0.491	0.154	0.237	0.394	0.965

Notes: Each regression includes the control variables that are used in the regressions displayed in Table 4, as well as the same county-year fixed effects and bank fixed effects. Standard errors are clustered at the bank level. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1, 5, and 10 percent levels.