Monetary Policy Shocks and Financial Stability: Evidence from the Great Depression

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We examine how monetary tightening affected the health and lending of banks during one of the fastest and largest monetary tightening episodes in U.S. history: the Fed's rate hike in October 1931, following Britain's abandonment of the gold standard. We find this sudden, unanticipated, and sizeable reversal in monetary policy forced hundreds of banks out of business. Banks holding more bonds — once valued for their liquidity and safety — were more likely to close. Additionally, thousands of banks reduced lending to businesses. The banking retrenchment triggered declines in spending, investment, and construction, pushing the economy deeper into depression.

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1. Introduction

Monetary tightening by central banks affects the economy through several channels, notably by influencing commercial banks' health and their willingness to lend. The magnitude of this bank lending channel is subject to debate. Some studies conclude monetary tightening substantially reduces bank lending (e.g., Romer and Romer 1990, Bernanke and Blinder 1992, Kashyap and Stein 1995, 2000, Ashcraft 2006), while others doubt that a correlation exists between these two variables (e.g., Morris and Sellon 1995, Oliner and Rudebusch 1995). A similar debate concerns the impact of monetary tightening on financial stability. Some studies conclude that monetary tightening reduces asset values and banks' net capital and, if sufficiently large and sudden, can force some banks towards insolvency and precipitate runs (Haddad et al. 2023; De Marzo et al. 2024; English et al. 2018; Jiang et al. 2024). Drechsler et al. (2021), however, find that rising interest rates increase banks' revenue more than costs, and this increase in profitability offsets the short-run impact of monetary tightening on bank fundamentals.

Discerning the effects of central bank policy rates on bank lending and financial stability is challenging from a statistical inference perspective. The endogeneity of monetary policy, interest rates, and bank lending complicate efforts to generate unbiased causal estimates (English et al. 2018). So does bank size heterogeneity (Kashyap and Stein 1995) and the time-varying impact of monetary policy on bank health (Brunetti et al. 2023). The impact of monetary tightening on bank health also depends on the regulatory and monetary regime, the nature of the deposit franchise and bank lending, and the frictions underlying financial institutions and maturity transformation (De Marzo et al. 2024; Drechsler et al. 2017, 2021; Jiang et al. 2024). Our research, which examines a setting free from most of these threats to accurate inference, sheds light on the circumstances under which monetary shocks alter bank lending and health.

This paper examines the impact of an exogenous, unexpected, and extremely adverse interest-rate shock. In response to Britain's decision to abandon the gold standard in late September 1931, the New York Fed raised its discount rate by 200 basis points between October 9 and October 16. All other Federal Reserve banks followed New York's lead and raised rates. The discount rates of all the Federal Reserve Districts remained above their September 1931 values through the end of 1932. Following two years of reductions in policy rates, this rate reversal was one of the largest and most rapid interest-rate increases in the Fed's history. The rate hike was a direct response to exigent international monetary events and provides a laboratory free from endogeneity. We demonstrate that commercial banks did not anticipate this policy pivot, leaving them exposed to significant interest-rate risk. At that time and unlike today, it was considerably more difficult to hedge interest-rate risk due to the earlier era's limited financial technology, or to offset the shock by raising net-interest margins due to the competitiveness of local and national banking markets.

Using detailed weekly information on all U.S. commercial banks, Figure 1 shows that bank closures surged the week of the monetary policy shock and remained elevated for several weeks. A further increase in commercial bond yields in December 1931 was followed by another spike in closures. Roughly 28% of all banks that closed between July 1929 and December 1932 did so in the months immediately following this unanticipated monetary tightening (about 1,735 closures in the two quarters after the shock out to over 6,100). These closures were dispersed across the nation, a spatial pattern that differed from other surges in bank suspensions during the Depression, which were tightly clustered in both time and space (Mitchener and Richardson 2019). We show that regulators' official assessments of closures attribute a higher fraction of them to the depreciation in bond prices than at any other point in the Depression.

We begin our analysis of the 1931 monetary policy shock by examining high-frequency data on disaggregated bank and economic outcomes. These data allow us to analyze how banks' balance sheets responded to the monetary policy shock each week and how the shock impacted local economic conditions. Local-projections demonstrate that the interest-rate shock propagated rapidly to banks and then to the real economy. Within weeks, bank deposits and bond holdings fell by roughly 6 and 10 percent, respectively. Total loans declined by about 3% over somewhat longer horizons. Shortly after the rate reversal, bank closures also rose by between 1 and 2 per state per week. Commerce and construction were also impacted, with weekly bank debits and monthly building permits declining substantially after the monetary policy shock. Overall, the effects of the monetary tightening were swift and sizable, tracing a clear transmission from tighter financial conditions to bank closures, bank lending, and economic activity.

Next, we examine why banks closed in response to the monetary policy shock, focusing on whether bank closures resulted from declines in asset values. To test for this mechanism, we construct a comprehensive microeconomic database containing the annual balance sheets of *all* U.S. commercial banks from 1928 through 1932. Given banking practices at the time (particularly the short duration of bank loans and restrictions on holding corporate equity), each bank's bond portfolio contained most of its interest-rate risk. The security-to-asset ratio, therefore, serves as a proxy for an individual bank's exposure to monetary tightening. Our estimates indicate that when interest rates declined from 1929 through the summer of 1931, banks with higher securities-to-asset ratios were less likely to fail. The liquidity and rising prices (due to falling rates) of bonds protected banks. However, after the Fed district banks raised rates in October 1931 and bond values declined, banks holding a higher proportion of bonds in their portfolios closed at a higher frequency. The unexpected reversal in monetary policy turned safe portfolios into perilous ones.

Our paper relates to a fast-growing literature on interest-rate risk, particularly research written after the collapse of Silicon Valley Bank in 2023 (De Marzo et al. 2024; Drechsler et al. 2021; Jiang et al. 2024). This research indicates that, under a broad range of conditions, significant monetary tightening can impair the health of the banking system, perhaps enough to generate moderate contractions in lending and the failure of institutions. When local banking markets are less competitive and the deposit-franchise value is high, however, monetary tightening may have little impact on banks' health, and the banking channel of monetary policy transmission may be attenuated. Our research examines a setting where competition for deposits meant that franchise value was low for most banks. In this setting, we find substantial adverse impacts from monetary tightening.

Our research also relates to the large literature exploring how foreign monetary policy shocks and sensitivity to capital outflows can impact domestic monetary policy and financial conditions (Morais et al. 2019; Rey 2013; Miranda-Agrippino and Rey 2020; Kaminsky et al. 2004) as well as researchers who use foreign shocks to identify exogenous effects on domestic financial systems (Schnabl 2012).[1] In particular, our paper connects the international macroeconomics literature on interest-rate defense of a fixed exchange rate with the corporate finance literature on bank duration risk. As classic articles by Kaminsky and Reinhart (1999) and Lahiri and Végh (2003) illustrate, our setting is one where a domestic central bank is forced to hike policy rates to stem reserve outflows and defend a fixed exchange rate to the detriment of the domestic economy. We show that the Fed's exchange-rate defense in 1931 led to an unanticipated monetary policy reversal, which influenced the balance sheets of non-financial firms (as modeled

[1] In some instances, foreign shocks lead to domestic effects through direct balance-sheet exposure to the shock (e.g., Chava and Purnanandam 2011; Ongena, Peydró and van Horen 2015). However, this was not the case in 1931 as few banks had direct connections to foreign markets and none of those with substantial foreign exposure closed or substantially reduced lending (Richardson and Van Horn 2013).

in Aghion et al. 2004) and financial institutions through the reduction in the value of long duration assets (as modeled in Drechsler et al. 2018). In turn, intermediated lending declined and increased financial instability given the large size of the monetary policy shock.

Our analysis also expands the literature on financial stability during the 1930s. Existing scholarship has shown that waves of bank failures were synonymous with the severity of the Great Depression (Friedman and Schwartz 1963; Romer 1993; Wicker 2009). This paper identifies a new reason for a large temporal clustering of failures beginning in the fall of 1931 and continuing through the winter of 1932 (and only recently identified using statistical methods in Mitchener and Richardson 2025). Our analysis suggests that the cluster was caused by the sudden and unanticipated decision by the Fed to defend the gold standard without regard for the interest-rate risk in the commercial banking system. Some researchers have argued that the Fed's monetary policy response reduced aggregate investment and consumption, forcing the economy into renewed contraction (Temin 1993; Eichengreen 1992). By marrying the exchange-rate defense literature to bank-level data, our research demonstrates that the policy shock had an additional effect on the domestic economy: higher interest rates quickly led to more bank closures and thus amplified the downturn through declines in lending, investment, and transactions.

2. The Unanticipated Monetary Policy Reversal of 1931

The Federal Reserve System's response to the Great Depression initially focused on domestic concerns. The Fed steadily lowered interest rates, as seen in Figure 2.[2] Commercial banks responded to falling interest rates and deteriorating economic conditions by shifting their portfolios

[2] For example, the Federal Reserve Board (1931, p.6) wrote in its annual report, "The credit policy of the Federal reserve system in the first nine months of 1931 was directed toward the furtherance of easy credit conditions, as indicated by further reductions in rates on discounts and acceptances between January and May and by purchases of United States Government securities between May and September."

towards bonds, especially government bonds and high-grade corporate securities (see the bottom panel of Figure 3), which they could liquidate if needed due to gradual deposit drains and when depositors withdrew *en masse* (Edwards 1929; Mitchener and Richardson 2019, 2025).[3] The top panel of Figure 3 shows that the ratios of loans and securities to assets at national banks were stable until late 1929, when the loan-to-assets ratio started falling and the securities-to-assets ratio started rising. Trade publications encouraged bankers to purchase longer-term and liquid bonds when interest rates were declining (as they were before October 1931) to buttress their liquid reserves and benefit from capital gains but cautioned banks "to avoid too heavy a depreciation in investment holdings on the next upturn in money rates" (Gephardt 1929, p. 29; Edwards 1929, p. 516).

Bondholding created a problem for banks when the Fed's interest rate policy suddenly reversed due to unanticipated events abroad. In May 1931, the largest bank in Austria, the Credit-Anstalt, suddenly failed (Schubert 1991, Marcus 2018). Its failure undermined confidence in Central European financial institutions. In July 1931, runs on banks in Germany forced many to suspend operations (Blickle et al. 2024). The German crisis impacted merchant banks from the United Kingdom, which had loaned substantial funds to central European concerns. Distress among merchant banks and large outflows of funds from London banks led the Bank of England to lower its policy rate, support domestic banks, and abandon its gold peg on September 21, 1931 (Eichengreen 1992).[4] Within a week, Sweden, Norway, and Denmark also abandoned gold.

[3] Since branching restrictions, banking conventions, and government regulations largely limited bank lending to short-term loans made to firms in the region where banks operated, bankers used bonds for three purposes: (1) to diversify lending geographically and across industries; (2) to lend at longer terms and reap the financial rewards of maturity transformation; and (3) to establish a secondary liquidity reserve (Atkins 1930a, 1930b).

[4] The *Commercial and Financial Chronicle* (*CFC*), a leading business weekly, described the choice: "Mr. Snowden [Chancellor of the Exchequer] in his statement says that 'altogether during the last two months we lost in gold and in foreign exchange a sum of more than £200,000,000.' Plainly enough no banking system, nor any government, could long withstand a drain of such proportions...it would have been sheer folly to attempt to keep up the struggle any longer" (September 26, 1931, p. 1962). It further states that "The actual crisis started with the collapse of the chief bank of Austria last May and the critical situation which followed in Germany" (p. 1962).

After Britain abandoned gold, investors repatriated funds from the U.S. to Europe due to fears that the U.S. might devalue the value of the dollar in terms of gold and expectations that Britain's monetary expansion would initiate economic recovery. Gold outflows reduced the Fed's supply of monetary gold, which plummeted from more than $5 billion just before Britain abandoned gold to a low of about $4.2 billion a few weeks later (*Federal Reserve Bulletin*, Dec 1931, pp. 659-60). In addition to the external drain of specie, Britain's departure from gold appears to have precipitated flows of deposits out of U.S. commercial banks and "currency hoarding" (Federal Reserve Board 1931). By the end of 1931, the volume of currency held by the U.S. public rose to its highest level since the recession of 1920.

The *CFC* described these events in stark terms. On October 3, 1931, it reported "The reason for these huge withdrawals is not all together clear" (p. 2139). "Confusion prevailed everywhere" about the ultimate effects of England's surprise departure from the gold standard (p. 2143). Anticipation of Fed action caused investors "anxiety." The *Chronicle* observed that the Fed appeared to be attempting "to offset the loss of gold by expansion of Federal Reserve notes in circulation," raising concerns that it would embark upon "a new policy of inflation" (p. 2141). The *CFC's* observation turned out to be incorrect. Rather than expanding the money supply to lower interest rates and encourage domestic consumption and investment, the Fed did the opposite.

Fed officials feared that flows of funds abroad could reduce its holdings of gold below the statutory minimum required for backing the currency and deposits on its balance sheet. The Bank of England's departure from gold, therefore, put the Fed into a precarious policy position. Assuming the government did not impose capital controls (and there was no indication it would), the Fed could maintain its low-interest-rate policy but jeopardize its pegged exchange rate if international investors pulled funds from the U.S. and sold dollars (as they had done to the pound

sterling prior to its devaluation). Alternatively, the Fed could defend hard money, raise interest rates, and commit to keeping the value of the dollar fixed in terms of gold. The US thus faced the standard constraints imposed by the international monetary-policy trilemma (Obstfeld et al. 2004).

Ex ante, the choice that the Fed would make was not obvious. Its leaders disagreed on the best response (Chandler 1971; Friedman and Schwartz 1963). Some policymakers and prognosticators advocated for a strategy of monetary expansion (Fisher 1932; Senate 1935; Wheelock 1992). Policymakers of that era, however, associated devaluations and floating rates with the high inflation following World War I (Wandschneider 2008). Contemporaneous news accounts reported uncertainty about how the Fed would respond.

Within the Fed, advocates for raising interest rates to defend the gold standard won out. On October 9, 1931, the New York Fed raised its rate from 1.5% to 2.5%. One week later, on October 16, it raised it again to 3.5%. The New York Fed rate increases were among the most rapid in Fed history (See the discussion in Appendix A). As displayed in Panel A of Figure 2, all the other Fed districts also raised their policy rates. Rates for all the Fed districts remained higher than they were in September 1931 through the end of 1932, despite some easing occurring in 1932. The rate increase achieved the Fed's primary goal. Flows of gold from the U.S. ceased, and the Fed defended its exchange-rate peg to gold.

The Fed's monetary tightening had a substantial impact on market interest rates. As shown in Figure 2, Panel B, a broad range of government and corporate bond yields rose and remained elevated through July of 1932.[5] Matching the qualitative evidence described above, the rapid rise

[5] We know of no coinciding policies or shocks that would have raised market rates. The House and Senate were in their autumn recess. On October 13, the Hoover administration announced the creation of the National Credit Corporation (NCC), a lending authority operated by nation's strongest banks to collectively extend loans to weaker banks that lacked access to the Fed's discount window. However, the NCC did not begin operations until mid-November, and its conservative lending policies limited its impact (Chandler 1971). If anything, the creation of the NCC should have raised bond prices, since it was intended to increase interbank lending and reduce sales of bonds.

in market interest rates indicates that the Fed's policy reversal was unanticipated (See Appendix C). That is, if market participants were forecasting that the Fed was planning to raise rates, then market interest rates would have moved in anticipation of those policy changes.[6] An example of this occurred in early 1929, when the Fed telegraphed its rate increases far in advance.[7] In 1929, the market's response to the Fed's policy rate was muted. Market rates for bonds rose, but the magnitude and speed of adjustment were much less than in 1931. The rate increase that occurred in 1929 suggests that endogeneity and anticipation could play a role in estimating monetary policy shocks on bank health in our sample period. Hence, our analysis focuses on the exogenous and unanticipated monetary policy shock of 1931.

In addition to influencing market rates on bonds, the Fed's monetary tightening in 1931 increased interest rates that commercial banks paid on time and demand deposits. These increases occurred due to two features of commercial banking at that time. First, local banking markets were competitive, with numerous banks competing for customers (see Figure 4). Most states prohibited branching, and those that permitted branching typically allowed it only in a single city or county containing a bank's headquarters. Travel and communications were costly, so most of a bank's customers came from the county in which the bank operated. This competition kept deposit rates near policy rates – a fact that market participants were aware of at the time. (For additional evidence and discussion, see Appendix B.) Second, clearing houses in the central money markets (New York and Chicago), major banking centers (e.g. Boston, Los Angeles, Pittsburgh, and San Francisco), and even country locations (e.g. Monmouth County, NJ) established maximum rates

[6] For further discussion and analysis of the market's response, see Appendix C.

[7] In 1929, the Fed's leaders – both at the Board in Washington, DC and in the Federal Reserve Districts– engaged in an extensive public discussion about reining in speculative investments. The New York Fed and other Fed banks repeatedly requested permission to raise their rates, which the Board repeatedly refused. After months of public discussion, the Board relented and allowed discount rates to rise.

that banks belonging to the organization could pay to depositors. During the 1920s and 1930s, these deposit-rate caps were a fixed markup over the discount rate of the nearest Federal Reserve bank (*Bankers Magazine* 1932; *Daily Boston Globe* 1932; *New York Herald Tribune* 1930, 1932a, 1932b; *New York Times* 1931a; *Wall Street Journal* 1931a, 1931b, 1932a, 1932b). For most of the Great Depression, therefore, deposit rates moved almost 1-for-1 with the Fed's policy rate, and commercial banks had little ability to keep their deposit rates low when the Fed System increased interest rates.[8]

The monetary policy shock and subsequent increase in interest rates put pressure on commercial banks. Figure 1 shows that bank closures spiked sharply following the Fed System's surprise increase in the discount rate. The week of the New York Fed's announcement registered among the most closures between 1929 and 1932. Closures remained elevated in subsequent weeks and months—many of which rank in the top decile of weekly closures during our period. Bank closures and bond prices briefly subsided in November 1931, but another surge in suspensions occurred in December 1931, when commercial bond yields rose once again. Taken together, the months following the Fed's unanticipated monetary tightening contain a disproportionate share of the highest-closure weeks through the end of 1932. To put this cataclysm in context, the post-October 1931 period features a higher rate of bank closures than the notorious so-called first banking panic occurring in the fall of 1930. Indeed, the 26-weeks after the monetary tightening contains 27.8 percent of all closures between July 1929 and December 1932 compared to 18.1 percent for the same span after the panic in the fall of 1930.

The spatial distribution of closures also warrants consideration. Figure 5 compares the distribution of closures during the initial banking panic (November–December 1930) with the

[8] Appendix B discusses how the cost of funds for Depression-era commercial banks responded differently to changes in policy rates in comparison to present-day commercial banks.

distribution during the weeks following the Fed's unexpected tightening in October 1931. While the panic in 1930 was concentrated in the South along the Mississippi River (Richardson and Troost 2009; Wicker 2000), the post-October-1931 surge in suspensions was far more dispersed across the country. The latter pattern appears consistent with an economy-wide shock rather than localized financial distress. Importantly, while a few New York City banks had exposure to the European banking turmoil, Richardson and Van Horn (2013) demonstrate that there was no direct transmission from Europe to these financial institutions. They not only survived, but expanded lending relative to other domestic banks after September 1931. This spatial pattern strengthens the interpretation that the rate hike exerted broad pressure on banks almost immediately, rather than simply amplifying pre-existing regional weaknesses or European links.

Regulators and other informed observers across the U.S. concluded that the depreciation of bond values forced many banks out of operations. A confidential memo dated December 8, 1931, and sent to the Board of Governors by New York Fed Governor, George L. Harrison, concluded that the situation was dire:

> "If the banks of this district were all examined today and their bonds revalued at today's market prices, it may be estimated conservatively that close to 500 of them would show losses, largely on bond account, equal or nearly equal to their total capital funds, and that probably 150 to 200 more banks would show some capital impairment. In other words, more than half of the member banks in this district have depreciation on their bond accounts at present market prices sufficient to cause capital impairment. While the banks have some losses from other causes, their principal difficulty lies in bond depreciation" (Harrison, 1931).

Indeed, the median ratio of securities to capital and surplus of banks in 1931 was over 1, and nearly 10 percent had a ratio over 4.

The OCC (1932, p.66) reported that after the Fed raised interest rates in the fall of 1931 "losses and depreciation charged off on securities" increased significantly, with annual total of charge offs rising from $61 million in 1930 to $119 million in 1931. Figure 11 shows that, after

Britain abandoned the gold standard and the Fed raised rates, not only did the number of bank suspensions that examiners attributed to slow, doubtful, or worthless assets rise, but more examiners also explicitly attributed it to bond depreciation. The increase in charge offs and danger due to the depreciation of bonds raised such concerns that the Fed and the OCC began practicing regulatory forbearance (Federal Reserve Board, "Meeting Minutes," 11 August 1931). Forbearance, however, did not prevent declines in asset prices from forcing many banks into insolvency.

This evidence motivates our empirical approach. It demonstrates the unanticipated monetary policy tightening preceded increases in interest rates, declines in bond prices, and increases in bank distress. Regulators who observed this sequence believed the chain of events was causal. Our statistical analysis tests the accuracy of that conclusion and asks how the monetary shock impacted commercial banks and the real economy.

3. Effects of Monetary Tightening on Banks and Broader Economic Activity

The exogenous and unexpected impetus for the Fed's policy change in October 1931 allows us to use the timing of this tightening to identify its effects on banks and broader economic activity. This section implements this strategy using panel local projections.

3.1 High-Frequency Data

We assemble high-frequency measures to pin down the timing and propagation of the interest-rate shock. The first ingredient is bank suspensions. Using the Federal Reserve's Division of Bank Operations St. 6386 forms spanning July 1929 to March 1933 (Richardson 2007), we identify the day each commercial bank suspended operations, the nature of the suspension (e.g. temporary suspension, liquidation/receivership, a merger under duress), and regulators'

conclusions about why each bank closed its doors to depositors. We aggregate this information to the frequency of the other data under analysis (typically weekly).

Second, we track changes in banks' balance sheets using data from the Federal Reserve's reporting banks. This weekly series covers large, reportedly representative institutions in roughly one hundred sizable cities, including all reserve and central reserve cities and reportedly all cities with clearing houses. The Federal Reserve Board published district-level weekly aggregates and also reported data for New York City and Chicago (i.e. the central reserve cities) separately from their districts. Given their size and status, very few weekly reporting banks closed before the end of 1932. Therefore, changes to these balance sheets represent dynamics within surviving banks rather than changes due to bank closures. We adjust the weekly-reporting series for sampling bias following Mitchener and Richardson (2025), providing weekly aggregates for 14 units (the 12 Federal Reserve-district and 2 central reserve cities) for bonds, loans, and total deposits.

Third, we observe local activity measures at the city level using weekly bank debits for 264 cities from Pedemonte (2024) and Candia and Pedemonte (2025). Bank debits scale with transactions activity and provide a timely proxy for local spending. Monthly building permit data for 229 U.S. cities are from Cortés and Weidenmier (2019). Following Cortés and LaPoint (2024), we view permits as a forward-looking indicator of local investment.

Finally, we capture changes in weekly interest rates with two measures. The first is the average of the discount rates of the 12 Federal Reserve Districts, which reflects the national stance of policy and the fact that many of the bonds on banks' balance sheets traded on national markets; so, their prices and yields would have been driven by national factors. (We consider the NY Fed discount rate as a national rate in the robustness Section 3.4.) The second is the Aaa corporate bond yield, which is a national rate closely tied to the value of bonds in banks' securities portfolios,

since regulations required banks to hold high-quality bonds. The Aaa corporate bond yield responded sharply to the October 1931 monetary tightening and comoved closely with yields on other bank-held debt instruments (Figure 2; Appendix Table A1). In June 1931, Fed member banks' security portfolios were concentrated in U.S. Treasuries (42%) and corporate bonds (32%), with additional holdings of state and municipal bonds (13%) and a small foreign share (3%).[9] Banks held corporate bonds that primarily consisted of investment-grade issues of large firms, railroads, and utilities (Atkins 1930b, p. 347; Edwards 1929, p. 514; Gephardt 1929, pp. 27–29). Banks also made loans on securities, so additional exposure to banks through bonds could come through falling collateral values. Most banks in our sample period did not hold corporate stocks (with national banks being legally prohibited from directly buying and selling them for their own accounts or their clients and only being able to deal in equities through securities affiliates).

These interest-rate series play complementary roles in our analysis. The sharp increase in the discount rate October 1931 cleanly anchors the timing of when the Fed reversed monetary policy, in response to Britain's departure from gold, allowing us to examine how this unexpected shock to monetary policy impacted the American economy. The Aaa yield captures the transmission of the policy shock through bond markets and the resulting repricing of bonds held by banks. Increases in the discount rate mattered for banks primarily through their effects on market yields and asset prices. Figure 2 shows these rates began to rise in October 1931, with discount rates remaining high through 1932, and Aaa yields declining later in the year.

[9] In 1930, the securities portfolio of all commercial banks consisted of U.S. Treasuries (26%), state, county, and municipal bonds (10%), railroad and public utility bonds (15%), and other bonds and stocks (49%). Compared with member banks, this composition suggests that nonmember banks held a smaller share of government securities.

We construct weekly and monthly versions of each of these interest rates so that their frequency aligns with our measured outcomes. We digitize weekly district discount rates from the *Annual Report of the Federal Reserve Board* and compute the discount rate averaged across districts each week. We digitize Moody's index of weekly Aaa corporate bond yields from the *Commercial and Financial Chronicle*. Because the weekly Aaa series begins in February 1930, our weekly panels start in that month. For the monthly outcomes, we compute within-month averages of the discount-rate series and use the monthly Aaa corporate bond yield series from the NBER Macrohistory Database.

These sources provide four distinct panel datasets that span February 1930 to December 1932. Merging the balance-sheet data with the interest-rate data produces a weekly panel at the Federal Reserve district and reserve city level. Merging the debits data with the interest-rate data produces a weekly panel at the city level. Merging the building permit data with the interest rate data produces a monthly panel at the city level. Lastly, we aggregate the closure data to the state-week level and merge it with interest rates to create a balanced state-level panel by week.

3.2 Local-Projection Methodology and Empirical Setup

Using the four high-frequency panels described above, we estimate dynamic responses to the interest-rate shock with local projections (Jordà 2005). All samples begin in February 1930, the date when the *CFC* first published Moody's *weekly* index of Aaa yields, and end in December 1932, when regulatory authorities, rather than bank's boards of directors or individual bank examiners, began shutting down banks in large groups by declaring local banking holidays in the run up to the national banking holiday that began in March 1933 (Jaremski et al. 2025).

For each horizon $h = 0, 1, \ldots, H$, we run separate regressions of the form:

$$(1)\ y_{i,t+h} = \alpha_h + \beta_h Rate_{i,t} + \sum_{l=1}^{L} \phi_{h,l}\, y_{i,t-l} + \sum_{l=1}^{L} \gamma_{h,l}\, Rate_{i,t-l} + \delta_i + \tau_{year(t)} + \varepsilon_{i,t+h},$$

where $y_{i,t}$ is the outcome for unit *i* at time *t*; $Rate_t$ is the Aaa yield or the average discount rate; δ_i and $\tau_{year(t)}$ denote unit and year fixed effects, respectively; and *L* lags of both the outcome and the shock are included. The coefficient β_h traces the impulse response *h* periods after a one-unit change in the interest rate at time *t*.

Specification choices follow the frequency and aggregation of each panel. For weekly panels (Federal Reserve-district plus New York and Chicago bonds, loans, and deposits; city debits; cumulative state closures), we use *H = 26* and *L = 4*. For the monthly building-permit panel, we use *H = 10* and *L = 2*. Because the average discount rate and Aaa yield are common across units, inference is based on a wild cluster bootstrap (clustered at the time level), where we report 95% confidence intervals from 500 replications.

We apply equation (1) to six outcomes, with the results presented in the following order to maintain a consistent narrative from banks' balance sheets to the broader economy: (1) logarithms of bonds, loans, and deposits at the Federal Reserve-district–week level; (2) bank closures (cumulative counts) at the state–week level;[10] (3) logarithms of bank debits at the city–week level; and (4) logarithms of building permits at the city–month level. Unless otherwise noted, for log outcomes, β_h is interpreted as the approximate percent change in the outcome following a 100-basis-point increase in the Aaa yield or average Fed discount rate. For closures, β_h is interpreted as the cumulative level change in weekly counts following a 100-basis-point increase in rates.

[10] We define cumulative exits as the running total of commercial bank exits within each state from the beginning of the sample through week *t*. The local projection results are similar when we instead use the weekly number of bank exits as the outcome.

3.3 Local Projection Results

The results for the Aaa bond yield and the average Federal Reserve discount rate appear in Figures 6 and 7 respectively. In each figure, each panel presents the response of the outcome variable to a 100-basis-point increase in the interest rate, which was roughly the magnitude of the change in the interest rate variables between August and December 1931.

Starting with Panel A (the top left panel in each figure), a shock to either interest rate series led to a rapid and pronounced decline in bond holdings reported on banks' balance sheets. This drop is visible at the time of the interest-rate shock. It continued to deepen in the first four weeks, hitting its nadir around the first quarter, and reverting over the following 10 weeks. At the trough, the decline in bond holdings by commercial banks was on the order of 12.5 percent for a 100-basis-point increase in Aaa yield and 10 percent for a 100-basis-point increase in the average Fed discount rate. The decline in bond holding likely reflects the fact that banks used bonds for liquidity management; banks often came up with the cash to cover depositor withdrawals by selling bonds.[11] As discussed in the background section and as we test in Panel C, deposits were also falling during the period, potentially forcing banks to liquidate and take losses on the depreciating bonds. These estimates provide evidence that a bank's bond exposure was a potential source of vulnerability arising from the 1931 tightening episode.

Panel B (the upper right panels in Figures 6 and 7) shows how lending responded to the interest-rate shock. The near-term response is modest, but loans reported on banks' balance sheets declined gradually four to eight weeks after the shock and remained depressed through the medium horizon. At the lowest point on the IRF, a 100-basis-point increase in rates reduced lending by 4 percent for the Aaa yield shock and by 3 percent for the average Fed discount rate shock. The

[11] Perhaps to a lesser extent, the persistent negative pattern also reflects that some state regulators required banks to mark bonds to market. Though evidence suggests that regulators did not enforce such rules during the period.

delayed effect on loans is consistent with the terms of loans during our sample period, i.e., banks could not immediately renegotiate them, so they would not be able to immediately change or decrease their lending. These estimates further suggest that the monetary-policy shock is associated with a tighter credit environment in response to rising borrowing costs and deteriorating economic conditions. This result is consistent with studies using data from more recent periods (Romer and Romer 1990; Bernanke and Blinder 1992; Kashyap and Stein 1995, 2000; Ashcraft 2006), and points to the potential for bond market stress to influence the real economy, a hypothesis we test in panels E and F.

Panel C reveals the interest-rate effects on total deposits, which is the sum of time and demand deposits. Total deposits declined at the time of the shock and then fell further in the middle horizons, followed by a partial recovery starting four months after the shock. At their trough, deposits fell by nearly 11 percent after the Aaa yield shock and 6 percent after the average Fed discount rate shock. Therefore, despite the rise in interest paid on deposits, depositors still worried enough about the health of their banks that they withdrew their funds. The decline in deposits closely coincides with the decline in bonds, which is consistent with historical reports that banks liquidated bond holdings to acquire cash to cover withdrawal requests.

Appendix Figure A6 disaggregates the deposit and loan responses. The deposit results show that the aggregate decline was broad-based. The rate increase moved time deposits, demand deposits of households and corporations, and interbank deposits (which were demand deposits placed by one commercial bank in another). The timing and magnitude differed, however, with demand and interbank deposits responding earlier and more sharply than time deposits. The loan disaggregation provides suggestive evidence on the mechanism. Loans secured by stocks and bonds, which consisted primarily of loans to brokers, declined immediately after the shock,

stabilized after several weeks, and did not recover within the horizon. By contrast, other loans, which more closely capture lending to commerce and industry, declined more gradually. This slower adjustment is consistent with those loans being less liquid and more relationship-based: banks may have been reluctant to call them quickly, both because they were more profitable and because doing so could impose severe costs on borrowers with whom the bank had a relationship.

Panel D shows that closures rise notably in the weeks following the shock, with the cumulative number of closures peaking at about 14 per state at short-to-medium horizons in the Aaa yield specification and about 10 per state in the average Fed discount rate specification. The peak increase is roughly 1–2 additional closures per state, per week – a front-loaded pattern consistent with vulnerable institutions closing as tighter funding conditions are realized. The trajectory echoes the descriptive evidence in Section 2: (1) the post-October 1931 months contain many of the highest-closure weeks of the Depression and (2) the closures were geographically dispersed rather than concentrated in a single region. The mid-horizon peak in closures also helps explain why the loan response is delayed and becomes more pronounced at later horizons. Following Bernanke (1983), bank closures raise the cost of credit intermediation, which in turn reduces lending activity.

Panels A through D in Figures 6 and 7 trace out a clear balance-sheet effect propagated in part by depositors' responses to the interest rate shock. The shock rapidly reduced deposits and bond holdings at commercial banks. The number of commercial bank closures rose. A gradual contraction in lending followed. These findings are also consistent with evidence indicating bank runs took place in October and November of 1931. For example, Wicker (2000) and Correia et al. (2025) document spikes in newspaper reports of bank runs and Richardson (2007) and Mitchener and Richardson (2019) report a simultaneous increase in bank examiners' reports of bank runs. It

thus seems that depositors put pressure on banks' liquid reserves after the monetary policy shock, potentially forcing them to realize losses on bond sales to remain in business and avoid suspending payments. Later in the paper, we examine whether closures were driven by balance-sheet distress above any common time-fixed effect by testing for a link between bond holdings and bank closures using panel data for all commercial banks in the US.

Finally, the city-level indicators point to transmission to the broader economy. Panel E shows the results for bank debits, a high-frequency proxy for local economic activity (Pedemonte 2024; Candia and Pedemonte 2025; Velde 2020). Debits decline on average after the shock, though the path is jagged in keeping with week-to-week volatility in payments data from this era. The middle horizon is well below the baseline (over 40 percent lower for both interest rate shocks), consistent with reduced local spending and liquidity as lending tightens. Panel F shows the results for building permits, which represents a forward-looking measure of investment. Permits fall sharply over the first three months, partially rebound, and then remain below pre-shock levels over the 10-month window displayed in the figures. At their lowest point, permits were 75 percent lower for the Aaa shock and 60 percent lower for the average Fed discount shock. The results indicate that tighter financial conditions and heightened uncertainty reduced expectations of future investment and building activity. This pattern highlights the sensitivity of forward-looking investment behavior as interest rates and financial conditions change.

Together, Figures 6 and 7 summarize the effects of the Fed System's unexpected policy reversal and rate hike. Local projection estimates show that a 100-basis-point rate shock delivers immediate declines in securities and deposits, which then propagates to loan supply. Closures also quickly spike as weaker banks are forced out; then local economic activity declines, first

transactions and followed by investment. The ordering and magnitudes across Panels A–F thus link the monetary tightening to balance-sheet adjustment and real outcomes within a few weeks.

Notably, even though each captures a different aspect of the tightening, Figures 6 and 7 suggest that the key findings are robust to whether we proxy the shock using market yields or the aggregate policy instrument. The Aaa yield provides richer time-series variation, with larger week-to-week movements than the policy rates and closely tracks the high-frequency repricing of market yields that mattered for banks' securities portfolios. The discount rate averaged across Federal Reserve districts summarizes the national stance of policy: all districts raised their discount rates in October 1931, so the average series reflects the coincidental rise in rates and persistence of system-wide tightening. The average Fed discount rate produces impulse responses that are slightly smaller than those for the Aaa bond yield but display similar patterns.

The effects of the monetary policy shock on economic outcomes are also consistent across the different panel datasets we analyze. We see the same qualitative patterns whether the unit of observation is the Federal Reserve district (weekly balance-sheet aggregates), the state (weekly bank closures), or the city (weekly debits and monthly building permits). This matters because each panel emphasizes different sources of heterogeneity and different parts of the economy: district panels capture regional variation in banks' portfolio responses; the state panels capture extensive-margin banking distress; and city panels capture local spending and investment. Despite differences in cross-sectional coverage, measurement, and aggregation, the estimated responses line up closely across samples and outcomes. This robustness suggests that the October 1931 tightening propagated broadly, showing up in banks' balance sheets, local activity, and bank distress rather than being driven by a particular dataset, geography, or level of aggregation.

Thus far, our analysis has utilized nationwide interest rates because banks typically held bonds that were traded in nationwide financial markets. Banks' bond portfolios, however, also exhibited some home bias; banks tended to disproportionately hold state and local bonds issued in their own state or locality. While the various Federal Reserve districts all increased their discount rates during October 1931, they did not all increase them by the same amount. We can therefore also examine the effects of differential monetary policy changes across Fed districts. To do so, Figure 8 augments the specification in equation (1) using the Federal Reserve district specific discount rates, adding cross-sectional variation to the policy shock measure while retaining its high-frequency timing. The results shown in Figure 8 are similar to those in Figures 6 and 7 in sign and significance, though the magnitudes are smaller. Specifically, a shock to a location's Federal Reserve discount rate leads to a quick decline in bonds and deposits, a rise in bank closures, and declines in bank debits and building permits. The only IRF result that does not carry through when using the cross-sectional variation in the policy rate is the contraction in lending.

3.4 Robustness of the Local Projection Results

This section reports several robustness exercises that examine whether the local projection results are sensitive to sample composition, the treatment of common time variation, or the single-equation structure of the baseline specifications. Overall, the robustness exercises reinforce the interpretation that the October 1931 tightening placed pressure on banks' balance sheets, which was followed by a contraction in credit and local economic activity.

First, we examine whether the results are robust to using the New York Fed discount rate as the policy-rate shock. The baseline specification uses the average Federal Reserve discount rate to summarize the national stance of policy, but New York was the principal money market, and bond market participants might have responded more to it than other districts, given many large

investment firms were based in New York City and were connected directly or indirectly to the New York Fed, and given that almost all commercial banks had a correspondent in New York City through which they bought and sold bonds in New York markets. Moreover, since the New York Fed initiated the October rate increases, other Federal Reserve banks followed its lead. For this reason, the New York Fed discount rate provides a natural alternative measure of the policy shock. We re-estimate the local projections using the New York Fed discount rate while preserving the same lag structure, horizons, fixed effects, and bootstrap inference as in the baseline specifications. The results in Appendix Figure A2 are broadly consistent with the main estimates. Bond holdings and deposits fall after the New York Fed discount-rate shock, loans decline more gradually, and cumulative exits rise over the middle horizons.

Second, we examine whether the results are driven by the largest financial centers, New York City and Chicago, which are separated from their districts and treated as separate units. Preserving the same local-projection structure as our baseline Aaa specification, we re-estimate the Aaa-yield specification but exclude the largest financial-center observations from each relevant panel. In the balance-sheet data, we drop the Second and Seventh Federal Reserve districts, as well as the central reserve cities. In the state-level closure panel, we drop New York and Illinois. In the city-level debits and building-permit panels, we drop New York City and Chicago. The resulting estimates in Appendix Figure A3 show that the main balance-sheet patterns and bank closure results are not driven solely by New York and Chicago. The real-activity responses are noisier in this restricted sample but move in the same direction and are statistically significant at most of the same horizons.

Third, we test whether the Aaa-yield results are sensitive to a more saturated treatment of common time variation. The baseline high-frequency specifications include unit-fixed effects and

year-fixed effects. We re-estimate the Aaa-yield local projections after adding quarterly fixed effects. This specification examines whether the dynamic responses remain after absorbing common differences across quarters. It is a demanding robustness check because adding quarter fixed effects removes some of the time-series variation that helps identify the baseline responses. The quarter-fixed-effect estimates in Appendix Figure A4 nevertheless remain broadly consistent with our baseline results. Only the building permit outcome is less precisely estimated in this specification, but this is expected because the building permit panel is monthly, as opposed to weekly like the others, thus reducing identifying variation in the data.

Fourth, we estimate an augmented local projection with lagged balance sheet and closure controls. The baseline local projections estimate separate equations for bonds, loans, deposits, and closures with lags of the dependent variable and lags of the interest-rate shock. This approach is useful for tracing outcome-specific responses but these outcomes are dynamically related. Deposit withdrawals may force banks to liquidate securities, changes in securities values and liquidity may affect subsequent lending, and rising closures may signal broader banking distress that feeds back into the balance sheets of surviving banks. To account for this joint structure, we re-estimate the Federal Reserve district-level specifications after including lags of all four variables—bonds, loans, deposits, and cumulative closures—in each equation. For this exercise, cumulative closures are aggregated to the Federal Reserve district-week level. The results of the augmented model in Appendix Figure A5 with full balance sheet and closure controls reinforce the main Aaa-yield findings. The balance sheet responses remain negative while the closures remain positive, indicating that the baseline results are not simply capturing omitted lagged movements in other balance sheet categories or by lagged banking distress. They also support the ordering emphasized

in the baseline results: the monetary tightening first placed pressure on securities and deposits, with lending and closures adjusting over subsequent weeks.

4. Testing for a Mechanism Using Individual Bank Data

The high-frequency analysis in the previous section shows the monetary tightening of 1931 impacted the balance sheets of commercial banks and forced hundreds out of business. We now examine the mechanisms underlying those impacts. In particular, we examine whether the reversal in monetary policy affected all banks equally or whether it disproportionally impacted banks with more bonds and hence more exposure to interest-rate risk. To test for this, we isolate the effect of the monetary policy shock operating through asset-price depreciation from the shock common to all banks. This approach allows us not only to examine the mechanism by which banks were forced out of operations, but also to introduce additional controls and robustness checks at the bank-level of analysis.

4.1 Sources and Methods

To obtain each bank's portfolio position, we collected, compiled, and digitized the balance sheets for each U.S. commercial bank at the June call in 1928, 1929, 1930, 1931, and 1932 from *Rand McNally's Bankers Directory* published in July of each year. This directory was the most widely used compendium of banks' balance sheets available to the public during the 1930s and contains information on broad balance sheet categories (e.g., total loans, total deposits, etc.).[12] We drop branches, private banks, cash depositories, and mutual savings banks as defined in *Rand*

[12] Staff of the Federal Reserve Board's Division of Bank Operations frequently consulted *Rand McNally* for balance sheet data. Neither it nor other contemporary sources such as the Federal Reserve's call reports provide information on underperforming loans or management quality. We drop all banks whose total liabilities total were 5% larger or smaller than its assets, as those banks likely had other assets or liabilities that were not reported in *Rand McNally*.

McNally, and determine which state banks were Fed members using data from *Rand McNally* and the *Annual Report of the Federal Reserve Board*. We then generate a quarterly panel for each commercial bank from July 1928 through December 1932 and allow each bank's balance sheet to adjust when additional information is available.

A main variable of interest in our analysis is a bank's asset exposure to changes in interest rates. A bank's securities holdings contained most of its interest-rate risk, because lending to businesses during this era was typically short-term, with maturities always under one year and frequently as short as 90 days.[13] Although *Rand McNally* does not provide a detailed breakdown of a bank's securities portfolio, other contemporary sources suggest that security portfolios were typically made up of long-term bonds. The average maturity of corporate bonds between 1925 and 1930 was between 26 and 29 years (Ghaderi et. al., 2026), and the average maturity of US Treasury bonds was also over 10 years. The ratio of total securities to assets thus reliably measures a bank's exposure to interest rates on the asset-side of its balance sheet during our sample period.

Holding more bonds when interest rates were low and declining substantially has been shown to increase banks' chances of survival. However, holding more bonds when interest rates were increasing lowers a bank's chances of survival for many reasons, especially during our sample period. First, in the 1930s, banks had limited ability to hedge interest-rate risk through financial instruments. Second, many banks were forced to sell bonds when deposits declined in order to obtain liquidity. If they sold bonds to raise cash, they would obviously do so at the market price. Third, some banks had to mark their bonds to market and hold reserves against bonds whose values declined. Fourth, many banks that wanted to borrow against their bonds also faced

[13] Federal Reserve data show that banks discounted paper that was short term, with roughly 70% of the bills discounted by the Fed maturing in less than 30 days and only 1% had maturing in more than 6 months (Federal Reserve Bulletin, March 1931, p.171).

constraints from their correspondents or the Fed, which would only loan or discount an amount up to the market value of their bonds rather than the book or face value. In summary, the decline in the value of bonds reduced the cash the bonds could raise if sold on the open market, used as collateral for an interbank loan from a money-center bank, or used as collateral for a loan from the Fed or a correspondent.[14]

In the bank-level analysis, we include fixed effects for each quarter to capture the effect of interest rates on all banks and interact each bank's securities ratio with either the average Fed discount rate each quarter across all districts or the Aaa corporate bond yield in the same quarter to proxy for interest-rate risk. This interaction term allows the effect of bond holdings to vary with the prevailing interest rate. In particular, it allows us to assess whether the impact of holding a large portfolio of bonds during periods of declining interest rates (e.g. summer 1929 to Fall 1931), when bonds' values and liquidity rose, differed from the impact of holding bonds during a period of rapidly increasing interest rates (i.e. October 1931 onwards), when bonds' values and liquidity fell.

We use market- and bank-specific characteristics as controls for other factors that could have led to a bank's closure. Characteristics measured at the bank level include the bank's age as well as balance-sheet items and ratios shown to be predictors bank survivorship in this era (White 1984; Richardson and Troost 2009; Calomiris and Mason 2003) and similar to those used by modern-day bank regulators: the logarithm of total assets; loans to assets; paid-in capital, surplus; and undivided profits to assets; and surplus and undivided profits to paid-in capital, surplus, and

[14] The Federal Reserve banks may have discounted US government debt at face value even when this exceeded its market value, but the Federal Reserve banks in general assessed the value of all collateral offered at the discount window and extended loans only up to the market value of collateral.

undivided profits.[15] We also include the annual (log) change in deposits to capture pre-trends in bank performance. While the number of banks in most counties limits the amount of franchise value possible, we include two variables to control for any spatial variation in market power across local banking markets: (1) the Herfindahl-Hirschman Index of deposits for the bank's local market (county) and (2) each bank's share of total deposits in that market. Finally, we include indicators as to whether a bank was: (1) a national bank or a state Fed member bank (with state non-member banks as the excluded group) to capture differences in regulation and access to the Fed's discount window; (2) located in a city designated as a Central Reserve City or Reserve City; and (3) located in a city with a clearinghouse. These regulatory and supervisory differences have been shown to be important for explaining bank survival rates during the Depression (Carlson 2004; Mitchener 2005, 2007; Carlson and Mitchener 2006, 2009).

County-level census data from Haines (2008), Haines et al. (2018), and Fishback et al. (2005) allow us to control for the characteristics of the counties in which each bank operated.[16] These measures, which capture differences in markets and customers, include the logarithm of population in 1929, the fraction of the county living in an urban location of 2,500 or more people in 1929, the fraction of the adult population that was illiterate in 1929, the fraction of the population that was non-white in 1929, the number of farms per capita, the number of manufacturing establishments per capita, and the logarithm of retail sales in 1929.

Finally, we include state-fixed effects to account for differences in regulatory regimes and risk preferences across states, since these variables predict state-level bank failure rates in this

[15] We include loans to assets instead of cash to assets because we want to compare bank's risky assets in the model and including all three would lead to a problem of perfect collinearity given banks had very few "other assets" on their portfolio in our sample period. Appendix Table A3 shows the results do not change if we drop loans to assets or replace it with either cash to assets or cash to deposits.

[16] These data are at:
https://eller.arizona.edu/sites/default/files/Datasets%20Available%20on%20OPENICPSR_0.pdf.

period (Mitchener 2005, 2007). Our analysis thus focuses on variation in bank outcomes within the same state over time.

We model the probability of closure using a linear probability framework and estimate it using ordinary least squares:

$$(2)\ Closed_{i,t} = a + Securities_{i,t}\beta_1 + (Securities_{i,t} * Rate_t)\beta_2 + BalanceSheet_{i,t}'\beta_3 + OtherBanks_{i,t}'\beta_4 + County_i'\beta_5 + State_i'\beta_6 + \tau_{quarter(t)} + \epsilon_{i,t}$$

where $Closed_{i,t}$ is an indicator for whether bank *i* closed in quarter *t*, $Securities_{i,t}$ is the ratio of total securities to assets of bank *i* which is updated each June, $Rate_t$ is the average Aaa corporate bond yield or average Fed discount rate for quarter *t*, $BalanceSheet_{i,t}$ is a vector of other balance sheet measures, the logarithm of bank age, and the change in the logarithms of deposits of bank *i* all of which are updated each June. $OtherBanks_{i,t}$ is a vector that controls for HHI of deposits in bank *i*'s county in quarter *t*, as well as the share of deposits in that county specifically held by bank *i*. $County_i$ is a vector of county demographic and locational controls in 1929 described above, $State_i$ is a vector of state fixed effects, and $\epsilon_{i,t}$ is the error term which is clustered by county. Time-fixed effects, $\tau_{quarter(t)}$, fully absorb the effect of $Rate_t$ on all banks each quarter and thus it does not enter into the regression separately.

4.2 Bank-Level Estimates

Table 1 reports the estimates of equation (2). The table starts with regressions that do not include the interaction between the securities ratio and the interest rates. The results show that, during the Great Depression, the coefficient on the securities ratio is negative and statistically different from zero. This result is consistent with research showing that bond portfolios are beneficial when interest rates are generally declining as it raises bank profits. The magnitude of

the negative coefficient on the securities ratio increases substantially when the model also includes this variable interacted with the interest rate in the regression specification. The interaction coefficients are positive and statistically significant regardless of using the Aaa yield or average Fed discount rate.

Compared to a mean quarterly closure rate of 1.7 percent, the magnitude of the effect of interest rates on closures was substantial. In August 1931, when interest rates were low and had declined steadily over the previous two years, a one-standard-deviation increase in the securities ratio (i.e., 17 percentage points) decreased the probability of closure by 0.25 percentage points per quarter when using the Aaa yield interaction. In December 1932, a few months after the monetary tightening, however, the same one-standard-deviation percentage point increase in the securities ratio raised the probability of closure by 0.104 percentage points per quarter when using the Aaa yield interaction. The estimated 0.354 percentage-point increase in the closure rate is economically significant relative to the mean quarterly closure rate of 1.7 percent, especially since the model is saturated with control variables. Put differently, at the pre-shock Aaa yield of 4.4 percent, the securities-to-assets ratio is negatively associated with bank closure, with an estimated effect of −0.014. After the rate increase, when the Aaa yield rose to 5.4 percent, the association reversed: the securities-to-assets ratio is positively associated with closure, with an estimated effect of 0.006. In summary, holding securities reduced the likelihood of closure during periods of steady or declining interest rates, but this salutary effect was reversed during high-rate periods.

A way to visualize this result is to estimate the regression in Table 1, column 1, separately for each quarter. This repeated cross-section approach allows all coefficients to adjust in each quarter. Figure 9 reports the coefficient and two standard-error bands for the securities-to-asset ratio for each quarterly cross-section. This coefficient reveals the relationship between bond

holding and the probability of bank closure within the specified quarter. In most quarters, including all the quarters from 1929 through 1931 when interest rates were declining, the coefficient on the securities ratio is negative or zero indicating that banks with large securities ratios closed at lower rates than banks with smaller securities ratios. However, during the two quarters following the Fed's monetary tightening at the end of 1931, and only during those two quarters, the coefficient on the securities ratio was positive. This indicates that in the two quarters after the Fed's policy reversal, banks that held more bonds as a proportion of their asset portfolio closed at higher rates than banks which held less. In the summer of 1932, when the New York and Chicago Fed lowered their discount rates and market rates on securities began to fall, the point estimate on the coefficient fell towards zero and then returned to being negative, although the estimate is not statistically different from zero.

4.3 Robustness and Intensive Margin

Both our high-frequency and bank-level analyses utilize the Aaa corporate bond yield as representative of the long-term securities that most banks held and the average Fed discount rate as representative of the monetary policy shock. Within the lower-frequency, bank-level panel, we can test whether our results are sensitive to this choice. We estimate equation (2) for other market interest rates that are available at the monthly level. Figure 10 reports the coefficients on the interaction between the securities ratio and each interest rate series. The figure shows the interaction coefficient for Aaa corporate bonds and average Fed discount rate (baseline results), high grade corporate bonds, railroad bonds, utility bonds, industrial bonds, Bbb corporate bonds, junk bonds, long-term and short-term US bonds, municipal bonds, the average interest rate on consumer loans in New York City, the average interest rate on consumer loans in other Northern

and Western cities, and the average rate on consumer loans in other Southern and Western cities, with sources described in Appendix Table A2,. Nearly all the interest rates produce positive and statistically significant interactions but with varying magnitudes. The only interest rate interactions that are insignificant are the Bbb rate, the junk bond rate, and short-term US notes. Given that most banks did not hold risky corporate bonds or short-term government bonds, the general findings of statistical significance on the interaction terms using all other series match the asset holdings common to banks during our sample period.

As in Section 3, we can also utilize the cross-sectional variation in Federal Reserve discount-rate changes. This approach allows us to explore the intensive margin and see if banks that held more bonds were more likely to close in those places that changed their policy rates by more. Table 2 displays the results of equation (2) using the district-specific discount rates. Given Fed district-level variation, we can include the discount rate as a separate regressor. By itself, the discount rate coefficient is not statistically different from zero; however, the interaction of the discount rate with the securities ratio is positive and statistically significant. Additionally, when we include state-by-quarter fixed effects in the model, the interaction term maintains its positive sign and statistical significance. Moreover, the magnitude of the coefficient increases, indicating that, after the twelve Fed banks raised discount rates in the fall of 1931, commercial banks with more bonds in their portfolios closed at higher rates in Fed districts that raised their discount rates by more.

We construct placebo tests using interest-rate changes over other intervals. Our baseline analysis was contemporaneous in that we matched whether a bank closed in the first quarter of 1932 with the average Aaa yield across January, February, and March of 1932. We can also estimate the specification in column 2 of Table 1 using a variety of leads or lags and display the

results in Figure A1. For instance, we can match whether a bank closed in the first quarter of 1932 with the average Aaa bond yield across October, November, and December 1931 (a one-quarter lag) or the average yield across July, August, and September 1931 (a two-quarter lag). The results show that the positive coefficient disappears when looking at interest rates beyond the closure window or more than three quarters before the closure window. The largest coefficient on the interaction is the one-quarter lag (i.e., the quarter before the closure window).

The Appendix contains a variety of additional robustness checks (see Appendix Table A4). First, we show the results are not being driven by banks in the largest financial centers. Second, we show the results are robust to using each bank's security ratio in 1929 instead of their contemporaneous one. Finally, we show the largest effects are for involuntary closures.

The results using bank-level data show that the monetary policy shock was working through changes in asset values and that many of the closures in our sample period were likely a result of the depreciation of bond prices. Moreover, it suggests that the closures after the shock were not necessarily due to poor initial bank fundamentals, nor were they clustered in particular areas. Rather they arose from the depreciation of long-term assets that had been helpful for surviving the economic downturn beginning in 1929 and the initial banking panics.

5. Conclusion

While monetary tightening by central banks has the potential to impact commercial banks' health and their willingness to lend, the endogeneity of bank lending and monetary policy has led to considerable debate on the exact magnitudes and the channels through which these effects operate. We shed light on these issues by examining one of the largest and most rapid monetary policy reversals in U.S. history: the Federal Reserve's unanticipated discount-rate increases of

October 1931 following Britain's abandonment of the gold standard. The effects of the shock were felt quickly by banks. The value of long-duration bonds declined in response to rising interest rates, and local projections estimates based on weekly data show that banks' balance sheets quickly adjusted in response to this sudden, sizeable, and unexpected monetary policy shock. Most banks were unable to hedge the increase in interest-rate risk and some could not adjust to regulators who marked their bond values to market. Consequently, hundreds of banks were forced out of business in the weeks following and thousands more to cut lending. We show that banks with more bonds on their balance sheets bore the brunt of this policy shock.

Impulse response functions on high-frequency data further show that the monetary policy shock also spilled over to the real economy. Measures of economic conditions at the city level (i.e., bank debits and building permits) fell and remained low for many months after the large reversal in monetary policy, exacerbating the Great Depression.

One can ask why banks in our sample period appear to have been caught off guard. As we discuss, given the preceding year and a half was marked by steady depositor withdrawals and bank runs, banks may have rationally moved out of loans and into more liquid securities as a form of liquidity insurance, especially since there was no federal deposit insurance. It is interesting to note that a similar policy reversal surprised some banks in 2023, and once again led to banking turmoil in the American banking system (albeit more limited in nature, in part due to ex post deposit guarantees by the US Treasury and special Fed standing facilities for removing interest-rate risk from banks' balance sheets). On the one hand, Fed supervisors did not explicitly signal to banks that they were intending to raise rates and that they should prepare for this potential outcome by adjusting their asset portfolios accordingly, i.e., the Fed did not request a stress-test scenario that involved a rapid policy rate increase. On the other hand, given the Fed's monetary policy reaction

function suggested that it would respond to rising inflation by raising rates, it is somewhat surprising that some medium-sized banks eventually found themselves in trouble for failing to hedge these risks, given they had the financial instruments to do so.

But the parallels are not identical, at least not yet. In the more recent period, many banks benefitted from rising franchise values, given the stickiness of depositor rates in the modern period, insulating them from the balance-sheet effects that led to bank closures in late 1931 and early 1932. In our period, given a much higher degree of bank competition, depositor rates tended to rise one-for-one with the policy rate. Interestingly, the competitive environment in our historical setting appears to be re-emerging today as the fintech industry expands its market share and competition for deposits increases. Innovation's potential to erode the market power and depositor base of commercial banks suggests that our findings' relevance may grow in the future.

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Appendix A: The Magnitude of the Shock

The New York Fed's interest rate increases in October 1931 were sudden, sizeable, and by most people, unanticipated. On some dimensions, they could be characterized as the largest policy rate increases in the history of the Federal Reserve System, although from some perspectives, they might be classified as among the largest increases ever but not the maximum.

The New York Fed's October surprises were clearly the largest percent increase in the discount rate in a single day or over a span of eight days. On October 9, the NY Fed raised its discount rate from 1.5% to 2.5%, an increase of 66 percent (i.e. (2.5-1.5)/1.5). On October 16, the New York Fed raised its discount rate from 2.5% to 3.5%, an increase of 40 percent. The numerator in this calculation is not unique. Federal Reserve banks raised interest rates by increments of 1% (i.e. 100 basis points) or more on numerous occasions. The denominator, however, is unique. Never before and never since did the Fed raise discount rates so much when the discount rate was so close to zero.

The New York Fed's 100-basis-point discount rate increases on October 9 and 16 were not the largest single-day percentage point increases in the discount rate in Fed history. The rate increases in January 1920 may hold this title. On 23 January 1920, the Boston, New York, Philadelphia, and Richmond Feds raised their discount rates by 125 basis points. The next day, the Chicago and St. Louis Feds also raised their rates by 125 basis points. Two days later, the Atlanta and Minneapolis Fed's followed suit.

Other candidates for the largest single-day discount rate increase come from the Volcker era. On 14 November 1980, the Federal Open Market Committee (FOMC) announced "an increase in Federal Reserve discount rates from 11 to 12 per cent and a surcharge of 2 percentage points on frequent borrowing of large institutions (FOMC RPA 1980)." On December 5, the Federal Reserve

announced another discount rate increase of 1% and an additional surcharge of 1% for large banks. The surcharge applied to the largest banks in the United States, which operated in New York City, for whom the discount rate rose 5% over 21 days. The surge in the surcharge rate should be compared to the New York Fed's discount rate increases in 1931, 2% over 8 days, which only applied to discount lending by the New York Fed. The New York Fed's action in 1931 increased the discount rate by a higher percent (66% on the first day and 133% over 8 days) but the Volcker era increases were higher percentage-point or basis-point increases (3% or 300 basis points on the first day and 5% or 500 basis points over 21 days).

Comparing discount rates may not be the best measure of changes in policy rates. In the 1930s, the discount rate was the Fed's principal policy rate. By the 1970s, however, the Fed funds rate was a better measure of the Fed's policy stance. By the 1990s, the Fed had learned change the funds rate gradually, particularly in the upward direction. The largest rate increase since 1993 appears to be the 75-basis point increase to 5.5% on 15 November 1994.

In the late 1970s and early 1980s, rather than targeting the Fed funds rate, as the Fed had done in the past, the Fed adopted new operating procedures, which Volcker announced in October 1979. The procedures focused on controlling the quantity of nonborrowed reserves in order to limit the growth of the money supply and inflation. With these procedures, the Fed set the quantity of nonborrowed reserves and let the market set the price of borrowed reserves (i.e. the Fed funds rate). In the two years after adopting these procedures, the Fed funds rate gyrated, with numerous daily increases exceeding 100 basis points and at least six exceeding 200 basis points. The largest increases appear to have occurred on 30 December 1980, when the Fed funds rate climbed 296 basis points in a single day.

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Appendix B: *Commercial Banking in the 1920s and 1930s*

Historically, American banking was atomistic. Roughly 25,000 commercial banks were in operation in 1929, and most of them operated out of a single building in a single city. Some states permitted branching within the city or county of the headquarters but only a few permitted branching statewide. Interstate branching was prohibited throughout the country (Carlson 2004; Mitchener 2005, 2007; Rajan and Ramcharan 2016). Communication and transportation improvements, such as the automobile and telephone, had widened the reach of banks, but most of their depositors and borrowers still came from the city and county in which they operated. As shown in Figure 4, most counties across the U.S. had competitive banking markets where multiple banks competed over deposits and customers, especially in urban areas. The south and northwest were particularly thick banking markets (Lee 1930), while the few counties with only one or two banks were typically in rural areas, such as Nevada and New Mexico.

Bankers and regulators of that time believed that many local communities had an "excessive" number of banks, with "overbanked' conditions leading to vigorous competition for deposits. Hence, deposit rates were quite competitive. The Comptroller of Currency testified to the U.S. Senate that "overbanking" had raised financial institutions' costs and increased financial fragility, since competition for deposits had led to "speculative and destructive practices in an effort to earn sufficient income to pay expenses" (United States Senate 1935, p. 31-2). After the banking crisis of the Great Depression, Congress concluded deposit competition was a contributing factor to thousands of bank failures during the early 1930s and prohibited the payment of interest on demand deposits in the Banking Act of 1933. The Act reduced banks' average annual interest payments by about $1.05 per $100 in deposits within six months of its passage (United States Senate 1935, pp. 30, 47).

In our sample period, market rates on banks' liabilities and assets of commercial banks moved in tandem with changes in Federal Reserve district banks' discount rates, a fact that market participants were aware of at the time. Deposit rate movements were particularly tightly linked to policy rates (a setting very different from today). From 1929 to 1931, interest rates paid to depositors fell sharply, as the Federal Reserve banks reduced their discount rates. For example, *Bankers Magazine* reported that "as a result of the rapid reduction of the" central bank policy rate, "there is a fair amount of discontent among business firms against the banks on the ground that while deposit rates kept pace with the reduction of the bank rate, the rates of interest on loans did not change in sympathy with the official rediscount rate" (Einzig 1930a, p. 102).

This discussion indicates that the cost of funds for Depression-era banks responded to changes in policy rates differently than commercial banks operating from the 1970s through the early 2020s. For modern era banks, most of which have far larger market shares than banks in our sample period (e.g., the largest U.S. bank in 1929 held less than 3.5% of all bank assets whereas the largest today holds over 14%), changes in policy rates have limited effects on the cost of funds including deposits (Hoffmann et al. 2019; Luck et al. 2023; Greenwald et al. 2023; Metrick 2024; Bolton et al. 2023).

While the response of deposit rates to changes in Fed policy rates differed between the 1930s and the present, the response of lending rates in the 1930s resembles the response in recent decades. For modern banks, lending rates respond rapidly to changes in the Fed's policy rate. For Depression-era banks, monthly data on bank assets also indicate a tight, positive correlation between the policy rate and lending rate.[17] Rates on brokers' loans and commercial paper were

[17] The Federal Reserve Act prohibited Fed banks from discounting or purchasing commercial bank loans with maturities longer than 90 days (or 180 days for agricultural paper). Fed bank examiners discouraged banks from making longer-term loans, as did regulators in most states, who discouraged (and in many cases prohibited) banks from extending mortgage loans.

quite responsive to changes in the discount rate: a 100-basis-point increase in the policy rate raised rates on those loans by roughly 85 basis points within two months. Rates on commercial loans responded more slowly, with a 100-basis-point increase in the policy rate raising commercial loan rates by approximately 40-50 basis points over a four-month horizon (Cohen et al. 2021).

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Appendix C: Market's Reaction to Federal Reserve Discount Rate Shock

The paper argues that the Federal Reserve Banks' decision to raise discount rates in October 1931 was largely unanticipated by market participants. In this appendix, we present both narrative and empirical evidence in support of this claim.

As the leading financial publication in the United States during this period, the *Commercial and Financial Chronicle* (CFC) provides valuable insight into the expectations of contemporary market observers. We therefore examined issues published in the weeks preceding the Federal Reserve Bank of New York's decision to raise its discount rate on October 9, 1931, to determine whether financial commentators were discussing the possibility of a policy response to Great Britain's departure from the gold standard.

The evidence indicates that concerns regarding Britain's abandonment of gold were widespread. In its October 3 issue—the final publication before the discount rate increase—the *Chronicle* devoted extensive attention to the resulting gold outflows from the United States. Yet despite acknowledging these developments, the publication repeatedly emphasized the country's substantial gold reserves and its capacity to withstand moderate losses. As the editors noted, "it is fortunate that we possess an abundance of the metal and can spare a considerable amount of it" (p. 2139) and

> But at least these huge depletions of the American stock of the metal, which we have been told over and over again were excessive—Snowden, the British Chancellor of the Exchequer having taken occasion, in his address last week to remark that the United States held one-half the entire stock of the metal in the world—have served to dispel some serious illusions with respect to the distribution of gold" (p.2139)

This assessment suggests that, while observers viewed Britain's departure from gold as an important development, they did not regard the resulting gold movements as sufficiently severe to necessitate an immediate increase in discount rates.

In this context, the only mention of bond price declines is due to the anticipation of more government borrowing rather than potential Fed action: "United States Government securities are suffering from the general depression and also by reason of the knowledge that owing to the growing deficit in Government revenues further issues of new Government obligations are a certainty (p.2140-2141). We note that this bond decline is not in response to Britain or the gold drain but rather to the continued economic decline in the Great Depression. They do not express any worry that falling bond prices could put banks at risk. Britain going off gold (and the resulting gold outflows) was a major event that disrupted markets and introduced uncertainty, but the potential for a discount rate increase was not suggested by the CFC writers.

Their summary of the Federal Reserve's position is one of concern for expansionary monetary policy:

> The anxiety arises out of the fact that the Federal Reserve banks, as a result of these large losses of gold, are embarking upon a new policy of inflation—a policy which is exceedingly perilous in times of stock market inflation, and is far from yielding beneficial results in a period of great industrial and financial depression like the present, being calculated to prolong such depression rather than to bring it to a close. What the Reserve banks are now doing is to offset the loss of gold by expansion in the volume of Federal Reserve notes in circulation. These Reserve note issues have been almost uninterruptedly increasing for a long period (even before the present gold movement out of the country)" (p. 2141).

This type of policy is essentially the opposite of a discount rate increase. By increasing the money supply rather than decreasing it, the policy would have increased economic activity and thus bond prices rather than decreasing them.

The narrative was one of steady stock market decline, starting even before Britain's decision to go off gold. On Oct 3rd, "The stock market continued extremely depressed during the week, and prices tumbled lower and still lower, with only feeble rallies from time to time. Traders took gloomy views of the future, and also did the vast body of their clients, as well as the speculative fraternity generally" (p. 2142). The description on Sept. 26th was similar: "The stock

market has been through a troublous time this week, and the chief unsettling influence has, of course, been the action of Great Britain in suspending gold payments, though there have been many other contributing influences of a disturbing character" (p. 1965). As was the one on September 19, 1931, several days before Britain went off gold:

> The stock market has had another bad week. It was depressed and lower at the half-day session on Saturday last, and has suffered successive bad breaks day by day the present week, with no recoveries of any great consequence until the rally which occurred late on Thursday, but which was lost on Friday, when prices took the sharpest plunge downward of the whole week. There has been apparently much forced selling and probably more or less short selling in the case of stocks whose future is not entirely clear, owing to the steady shrinkage in earnings and profits or because the stocks are held in large blocks and there is doubt whether these holders will be able to protect them under the constant shrinkage in values. The most unfavorable feature continues to be the steady decline in many bond issues. Where there is much selling, either to realize cash or to protect weekly margined stock accounts, bonds decline much faster than stocks, because necessarily there is a much narrower market for bonds at all times than for stocks (p. 1803)

As we discuss below, the decline in securities prices thus was across both stock and bond market and was not necessarily driven by the events leading up to the Fed's discount rate change.

Building on the narrative evidence, we collected daily bond and stock price data reported in contemporary newspapers from August 1 through December 31, 1931. Consistent with the historical accounts, both bond and equity prices declined steadily throughout September. Importantly there is no more than a brief upward movement following Britain's departure from the gold standard, indicating that the event did not fundamentally alter market expectations or investor behavior. If anything, increased immediately before and during the period in which the Federal Reserve Bank of New York raised its discount rate. This suggests that market participants did not view the policy change as contractionary. To the extent that investors anticipated the rate increase, the evidence implies that they expected it to have a favorable effect on economic or financial conditions.

We further investigate stock price movements by examining whether the rate increase had heterogeneous effects across industries. In particular, we compare the performance of the banking sector to that of other industries using a cumulative abnormal returns (CAR) framework. To do so, we collect daily industry-level return data from Kenneth French's online data library. These data assign all CRSP-listed NYSE, AMEX, and NASDAQ firms to industry portfolios and report the daily return of each portfolio. We also obtain the daily return on the market portfolio from the same source.

Daily abnormal returns are calculated using the standard market model:

$$R_{i,t} = \alpha_i + \beta_i R_t^m + e_{i,t} \quad (3)$$

where $R_{i,t}$ is the return of industry *i* on day *t*, R_t^m is the return of the market portfolio on day *t*, and $e_{i,t}$ is the error term for industry *i*. After estimating α_i and β_i for each industry for the 30-250 days before the Fed rate hike on October 9th, we then calculate the abnormal return for each day as:

$$AR_{i,t} = R_t - \hat{\alpha}_i - \hat{\beta}_i R_t^m \quad (4)$$

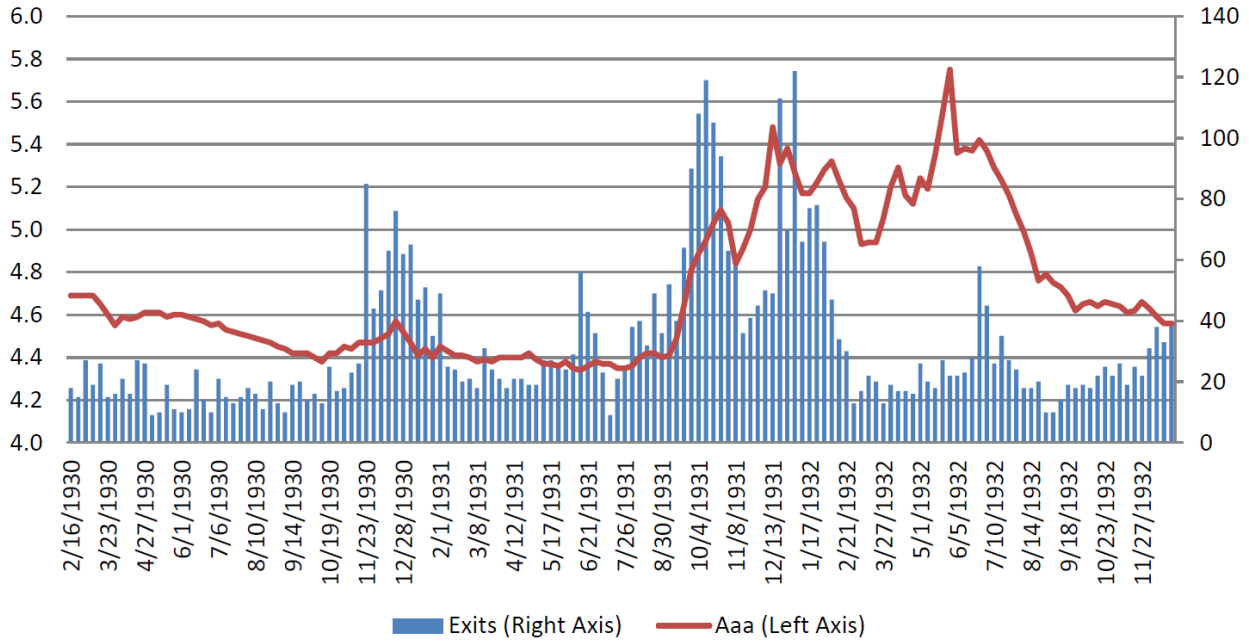
where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the coefficient estimates from industry *i* from equation (3). Finally, we aggregate the abnormal returns within particular time windows around the event day (t=0). Specifically, we calculate the CAR for [-30,-1] days, [-20,-1] days, [-10,-1] days, [-2,-1] days, (-1,1] days, (-1,10] days, (-1,20] days, and (-1,30] days in Table A1.

The banking industry exhibits little evidence of abnormal performance prior to the discount rate increase in Table C1. Cumulative abnormal returns are close to zero across all pre-event windows, and even the immediate event window, (t=(-1,1]), yields a relatively modest CAR of 2.3 percent. In the weeks following the policy change, however, banking stocks substantially outperformed expectations. The sector's CAR rises steadily, reaching 16.6 percent by day 30. Notably, this appreciation continues through the New York Fed's second discount rate increase on

October 16. To place these results in context, Table C1 also provides the CARs of several large industries in the French data. Banking-sector performance was generally unremarkable relative to other industries before the rate increase and only begins to distinguish itself afterward.

Taken together, these patterns suggest that investors did not anticipate the adverse consequences that higher interest rates would ultimately have for the banking system. Although the initial rate increase appears to have been somewhat unexpected, market participants subsequently bid up bank stock prices relative to those of firms in most other industries. The positive abnormal performance of banking stocks is therefore difficult to reconcile with expectations of imminent financial distress and instead suggests that investors initially viewed the policy change as beneficial for the banking sector.

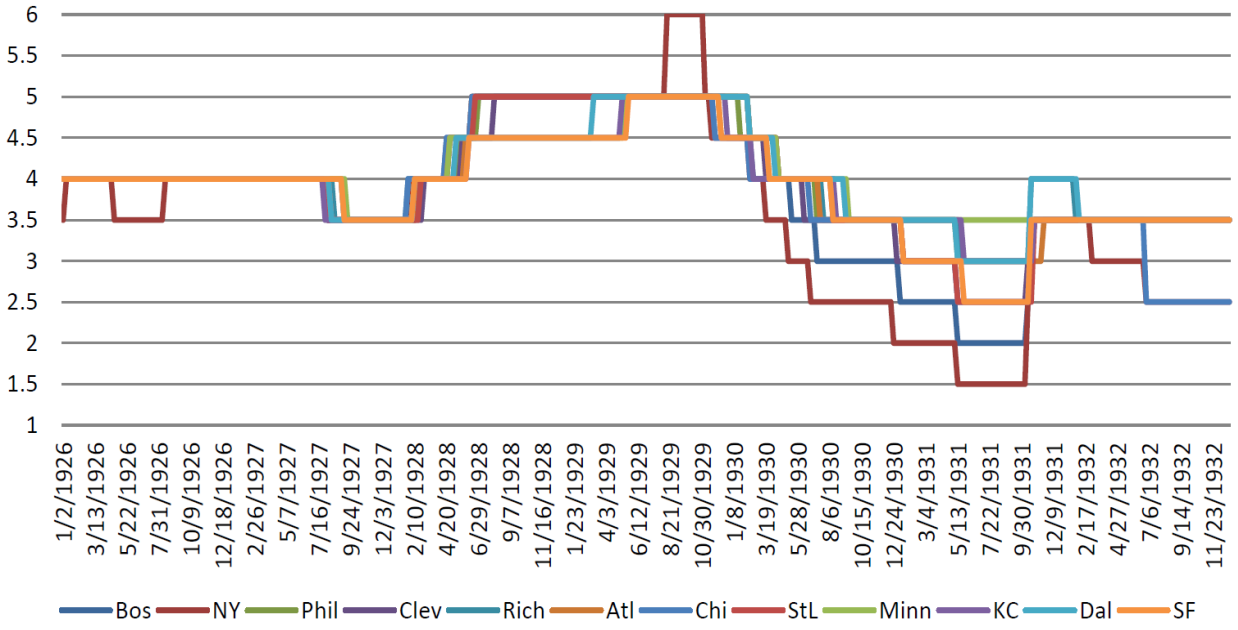
Figure 1: Bank Closures and Aaa Bond Yields by Week



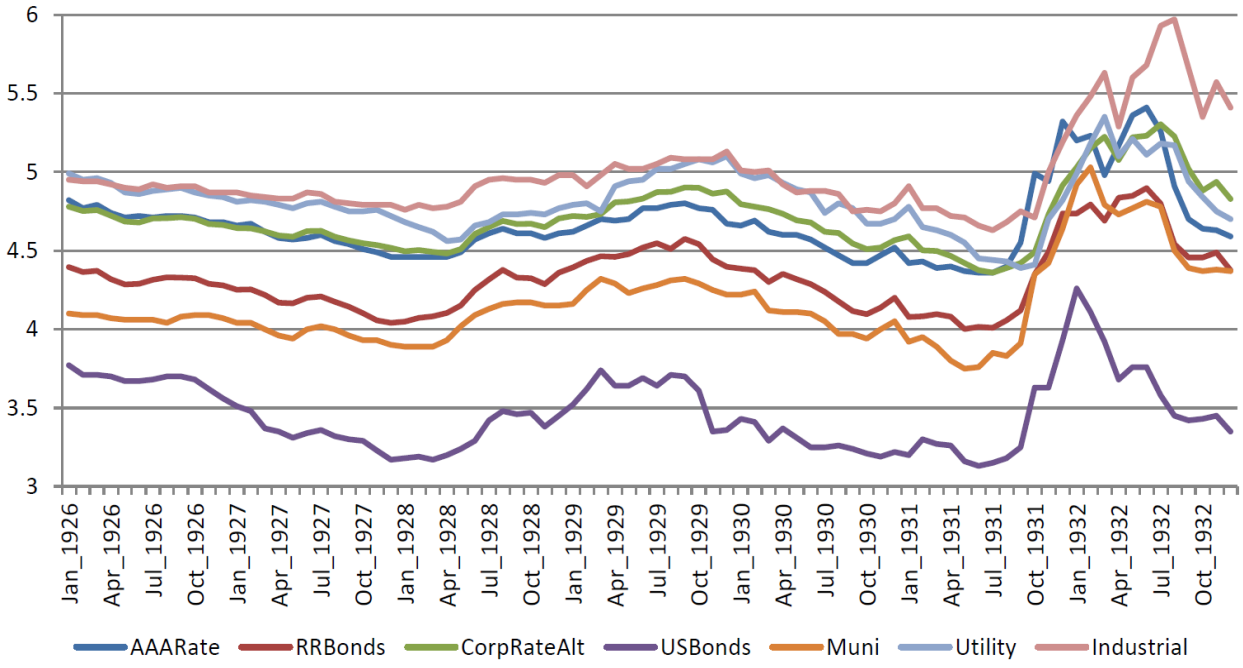
Notes: Figure provides the number of US commercial banks that closed and the Aaa commercial bond yield in each week.

Figure 2: Interest Rates (1926-1932)

Panel A: Weekly Discount Rates by Fed Reserve Bank



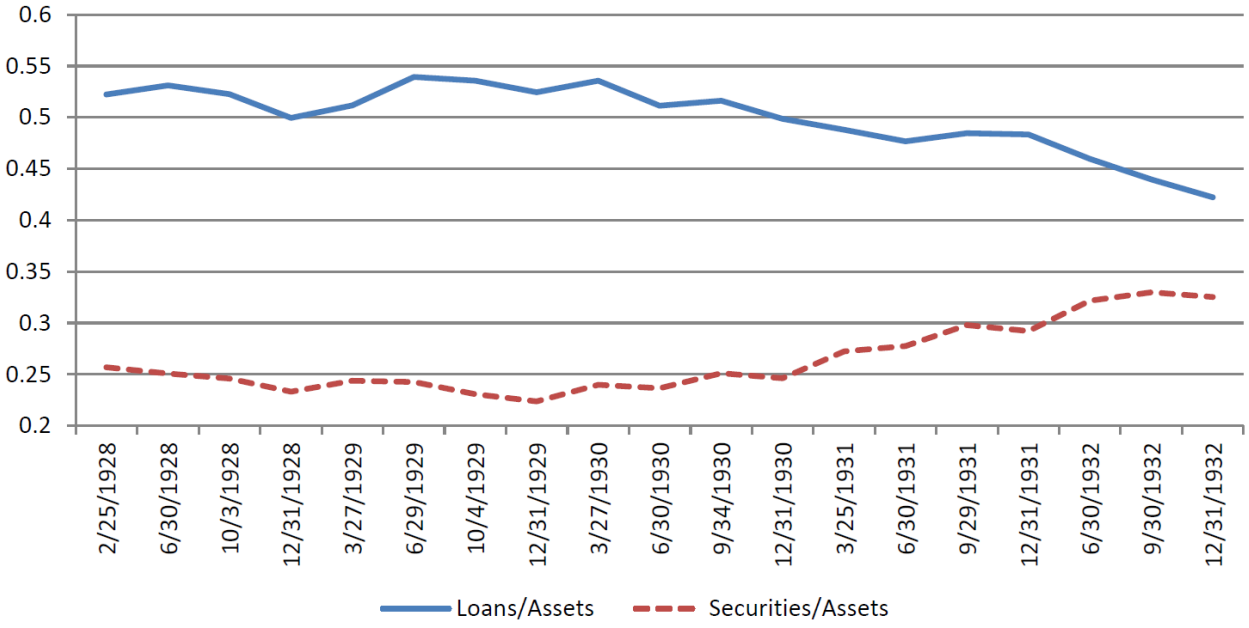
Panel B: Monthly Bond Yields



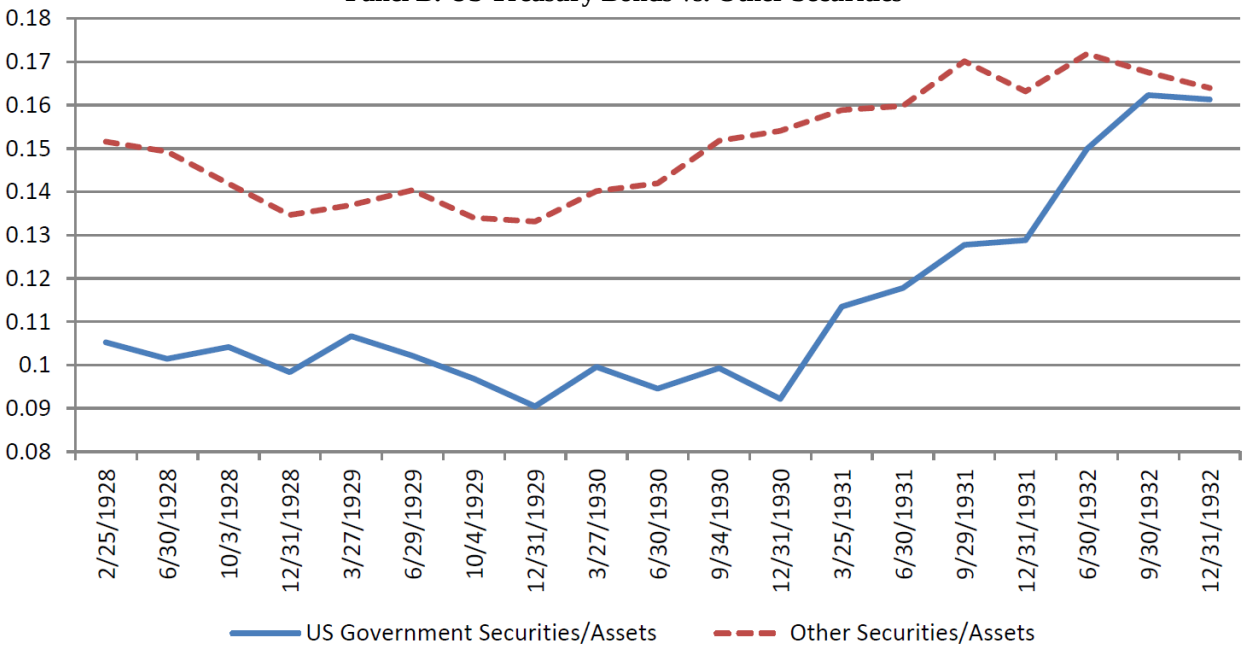
Notes: Figures present interest rate data. The top panel contains the weekly discount rate for each of the Federal Reserve Banks. The bottom panel contains the average monthly yield on various corporate and government bonds.

Figure 3: Commercial Bank Investment Compositions

Panel A: Loans vs. Securities

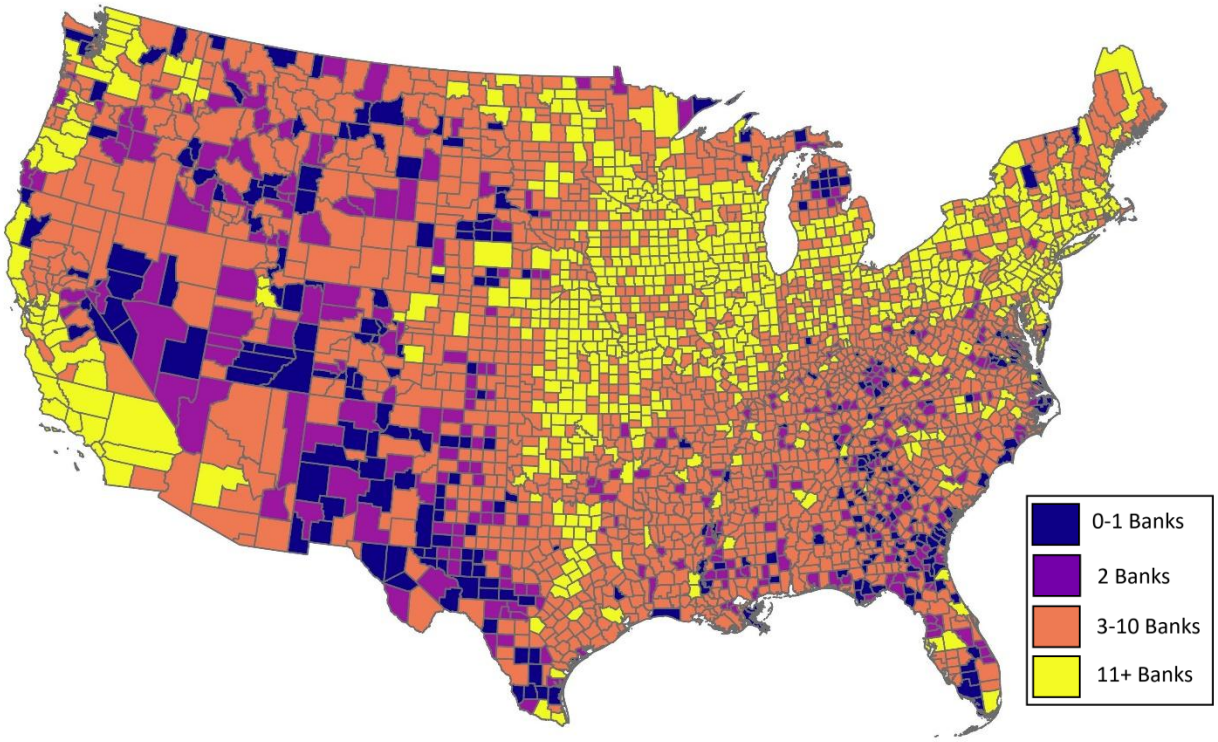


Panel B: US Treasury Bonds vs. Other Securities



Notes: Figures present aggregate ratios for all national banks. The top panel contains the ratios of loans and securities relative to assets. The bottom panel contains the ratio of US Treasury bonds and other securities to total assets. Data were obtained from the Office of the Comptroller of the Currency's *Annual Report*.

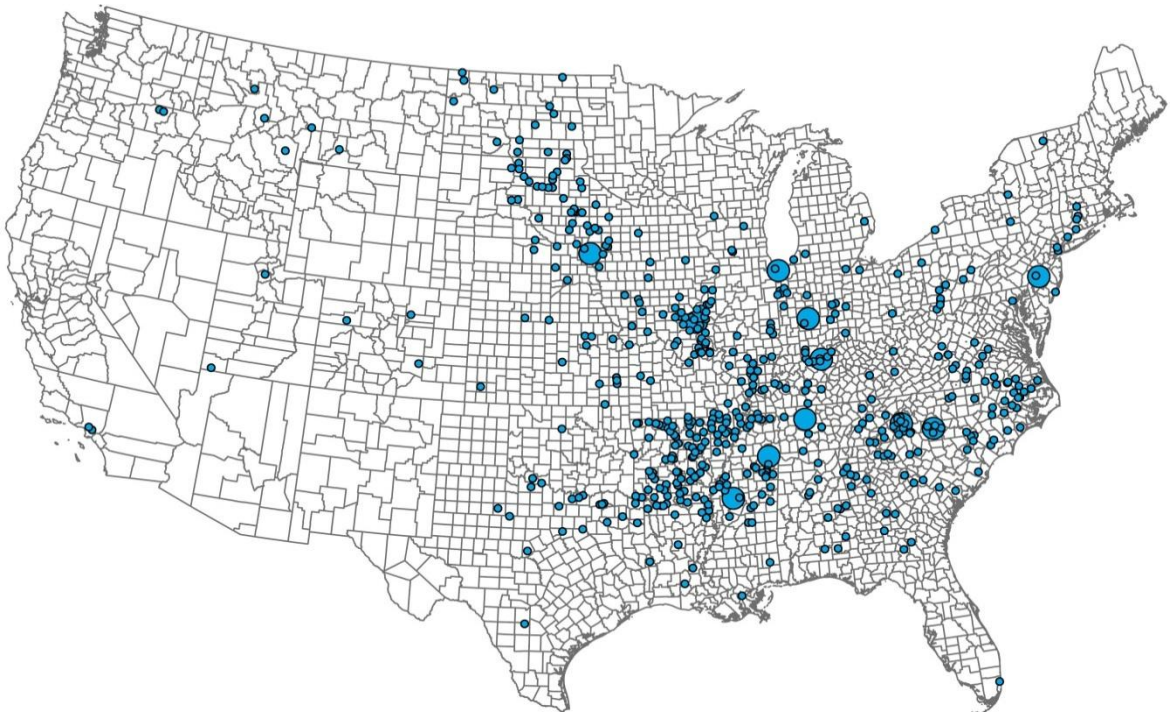
Figure 4: Number of Banks by County in 1929



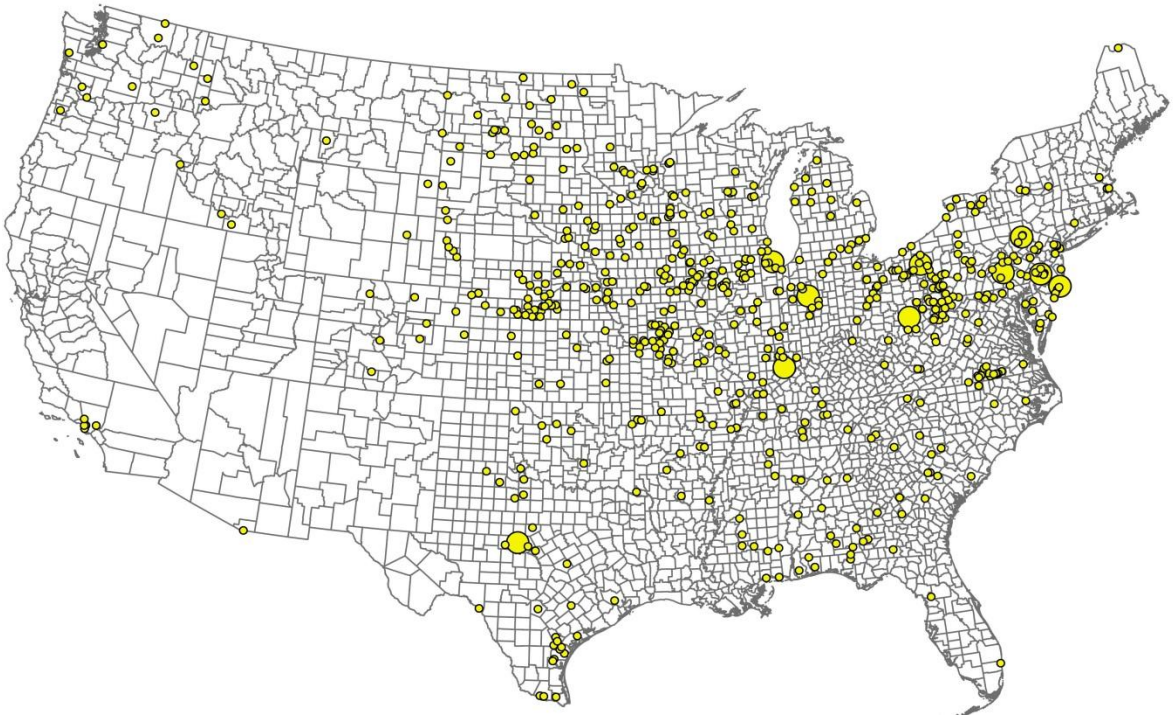
Notes: The map is colored based on the number of banks in each county (with darker colors indicating fewer total banks and lighter ones more). The categories are 0-1 banks (dark blue), 2 banks (purple), 3-10 banks (orange), 11+ banks (yellow). The number of banks was obtained from the January 1929 edition of *Rand McNally Bankers Directory*.

Figure 5: Geographic Distribution of Bank Closures

Panel A: November and December 1930 (Caldwell Panic)

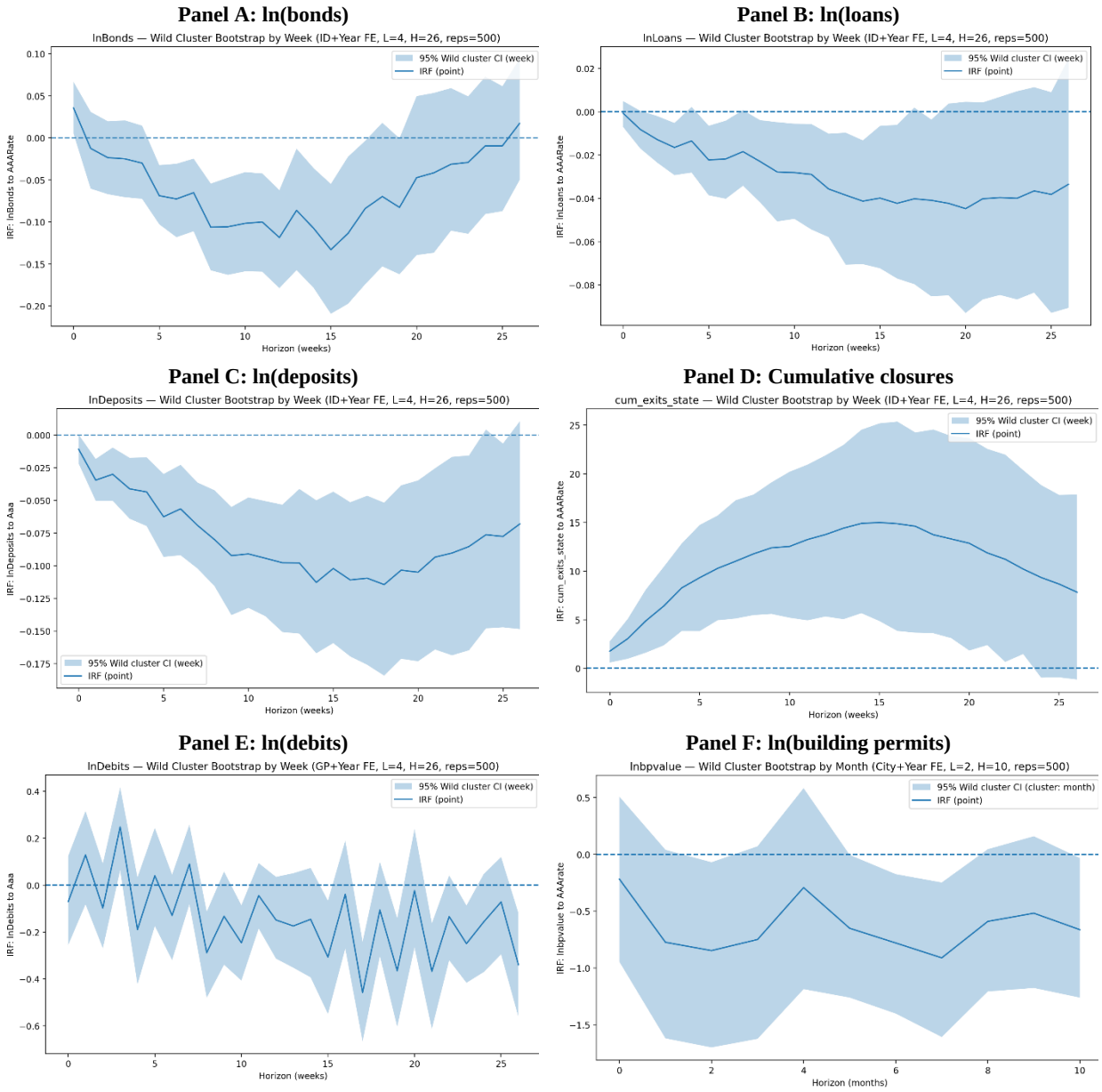


Panel B: October and November 1931 (Monetary Policy Shock)



Notes: The maps display bank closures by location. Larger circles denote locations with more than two closures. The top panel displays closures in November and December 1930, after the "Caldwell Panic." The bottom panel displays closures in October and November 1931, after the Fed's unexpected policy rate reversal.

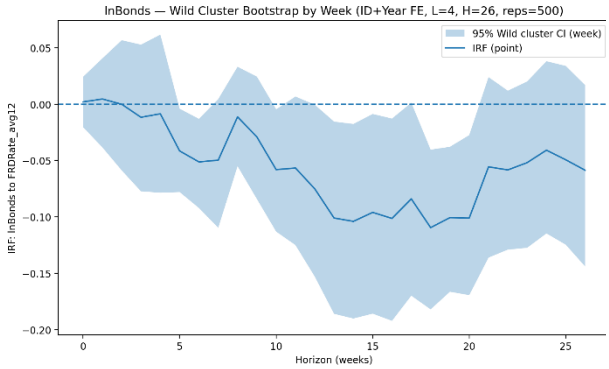
Figure 6: Impulse Responses due to a Positive Aaa Yield Shock



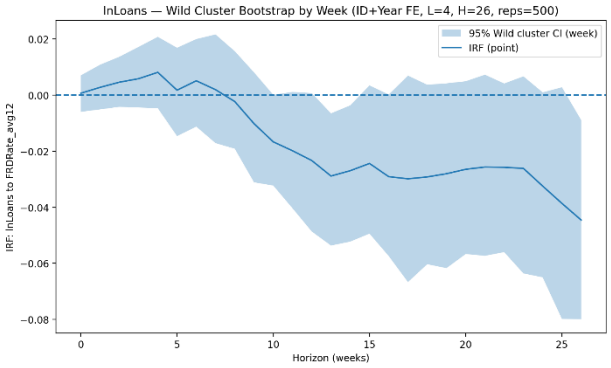
Notes: The six panels display the estimated response of the specified variable to a 100 basis point increase in the Aaa corporate bond yield. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure 7: Impulse Responses due to a Positive Avg. Fed Discount Rate Shock

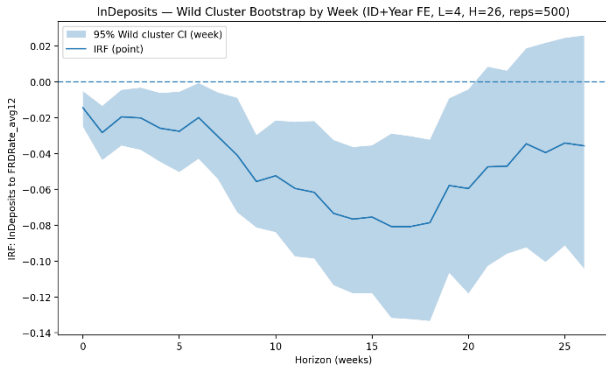
Panel A: ln(bonds)



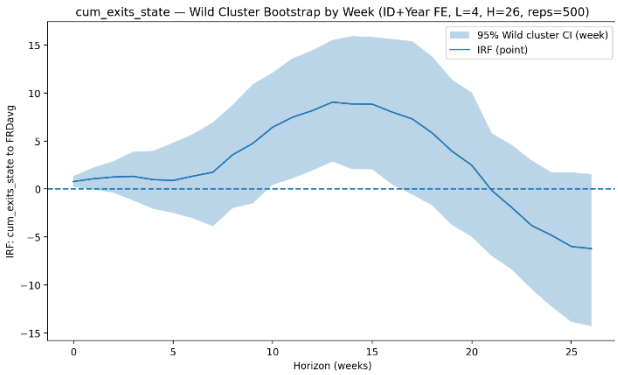
Panel B: ln(loans)



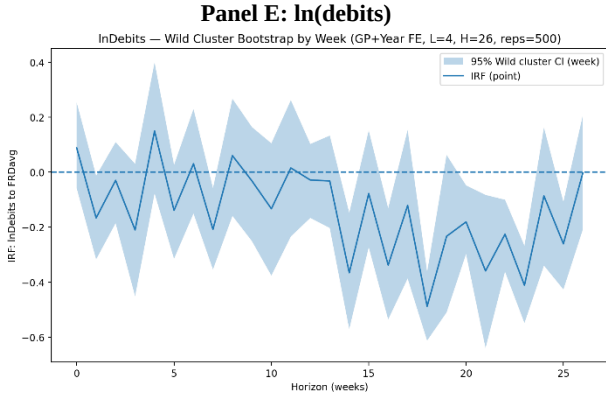
Panel C: ln(deposits)



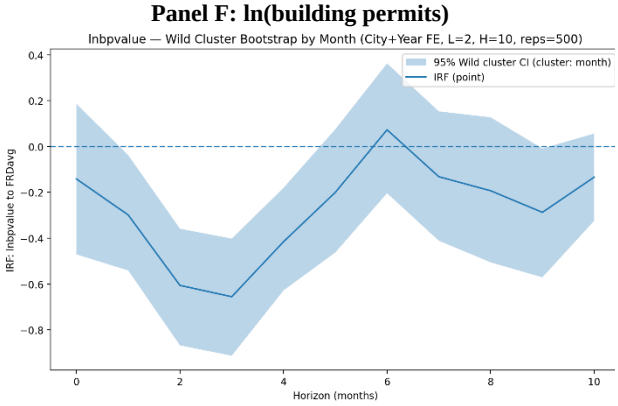
Panel D: Cumulative closures



Panel E: ln(debits)



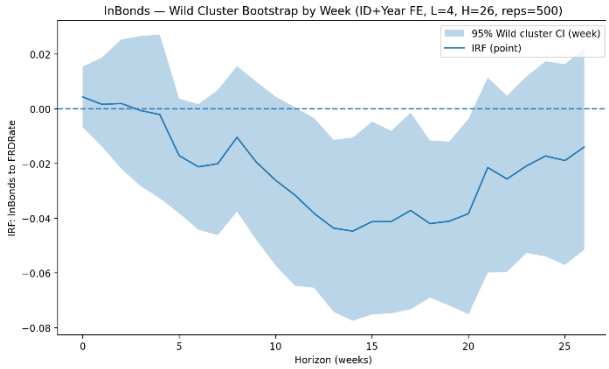
Panel F: ln(building permits)



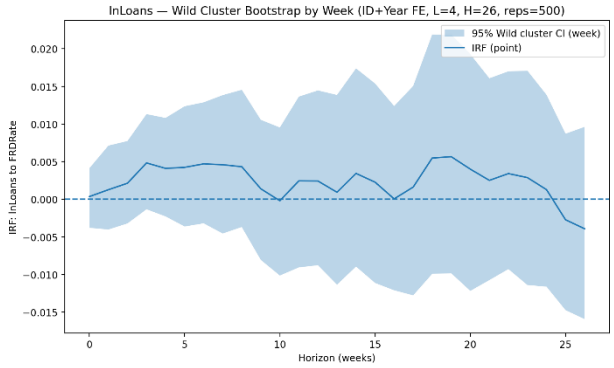
Notes: The six panels display the estimated response of the specified variable to a 100 basis point increase in the average Fed discount rate. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure 8: Impulse Responses due to a Positive Federal Reserve Specific Discount Rate Shock

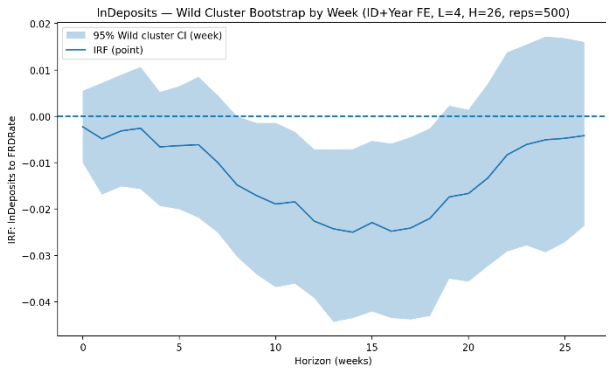
Panel A: ln(bonds)



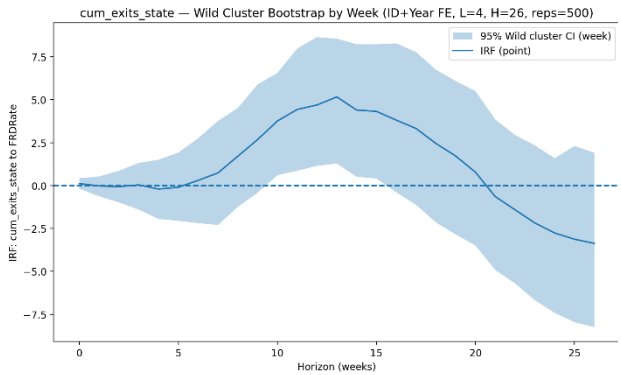
Panel B: ln(loans)



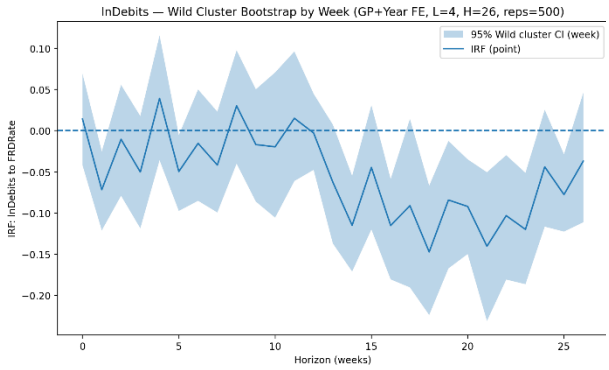
Panel C: ln(deposits)



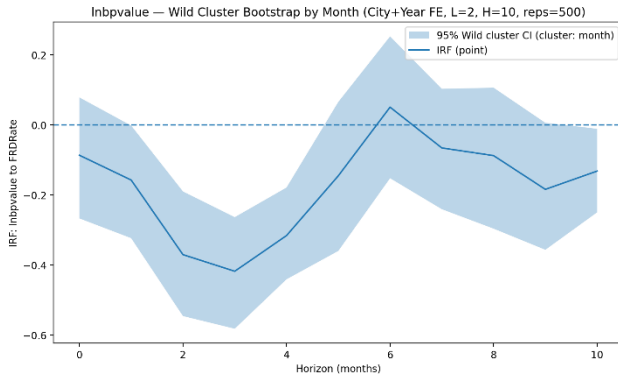
Panel D: Cumulative closures



Panel E: ln(debits)

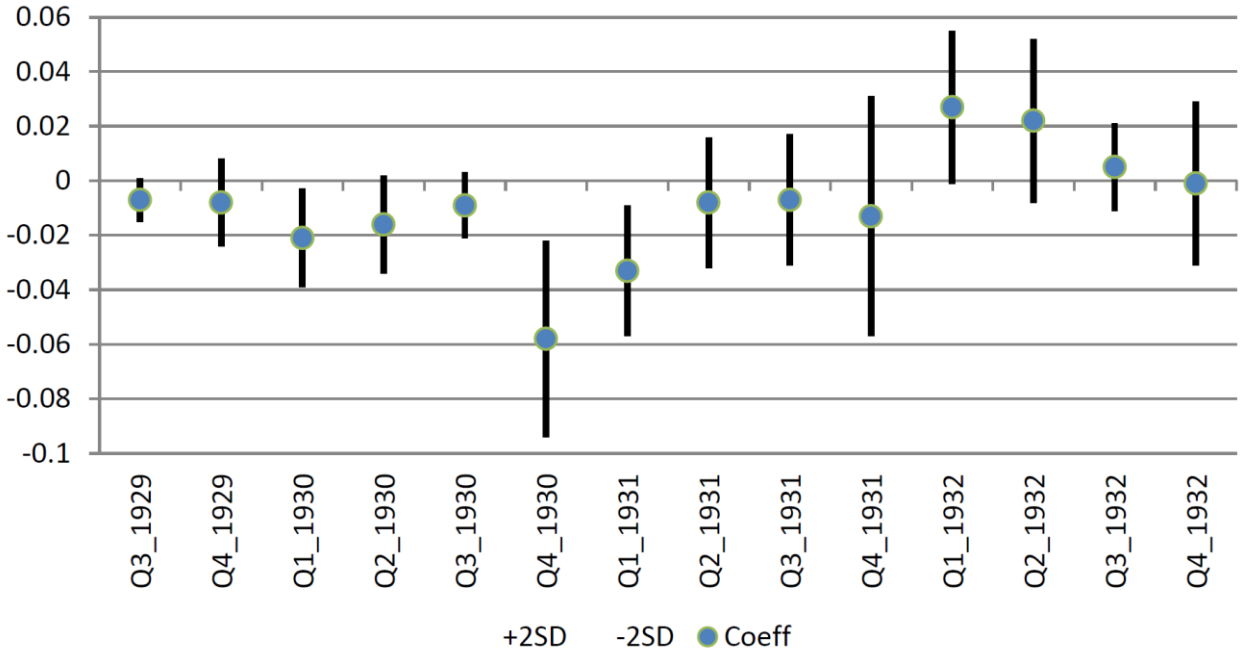


Panel F: ln(building permits)



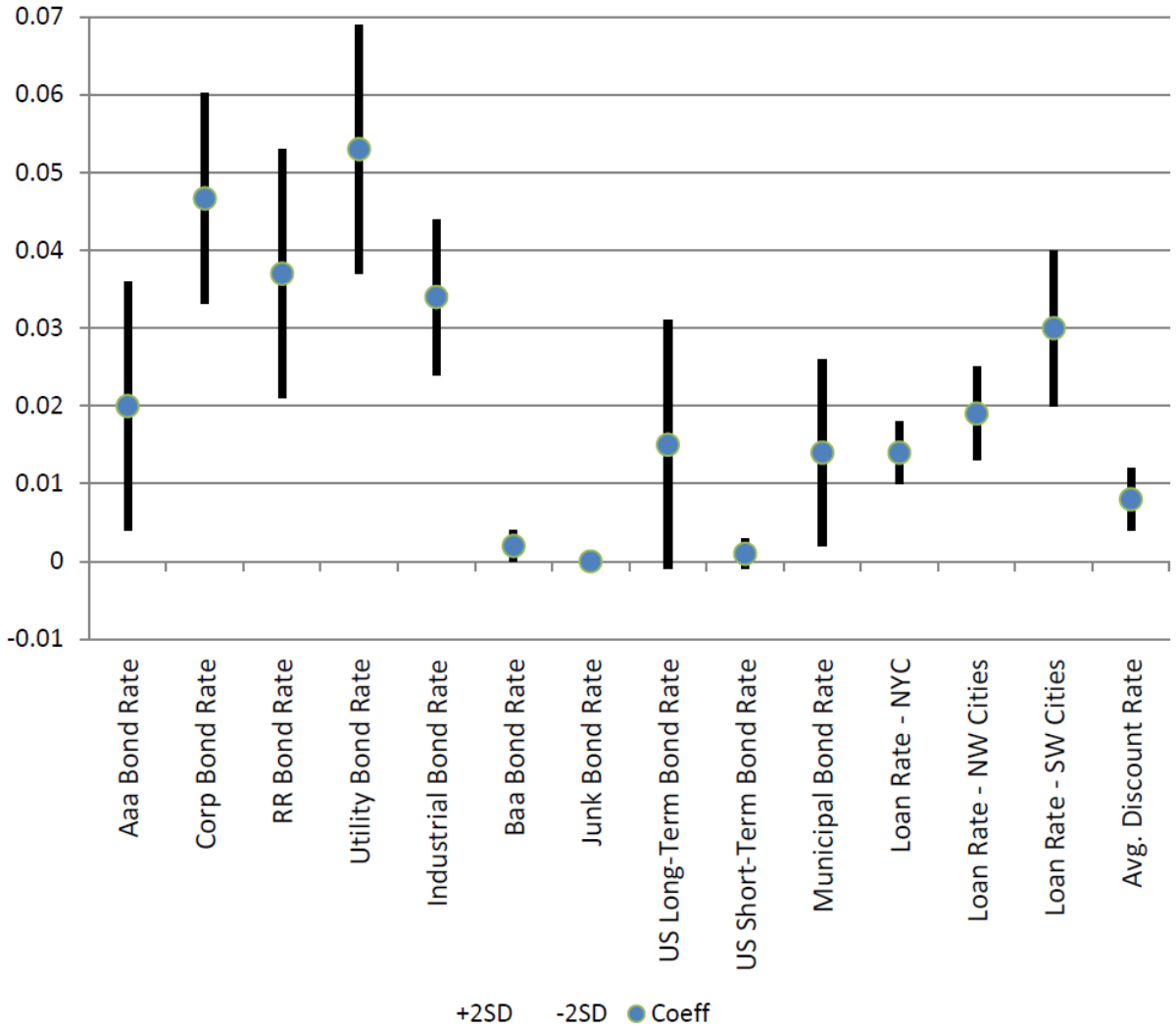
Notes: The six panels display the estimated response of the specified variable to a 100 basis point increase in the specific Federal Reserve District's discount rate of the observed unit (Fed District, state, or town). They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure 9: Predicting Quarterly Bank Closures - Coefficient on Securities/Assets by Quarter



Notes: Figure presents the coefficient (and two standard error bands) on each bank's security-to-asset ratio from equation (2) but estimated separately for each quarter.

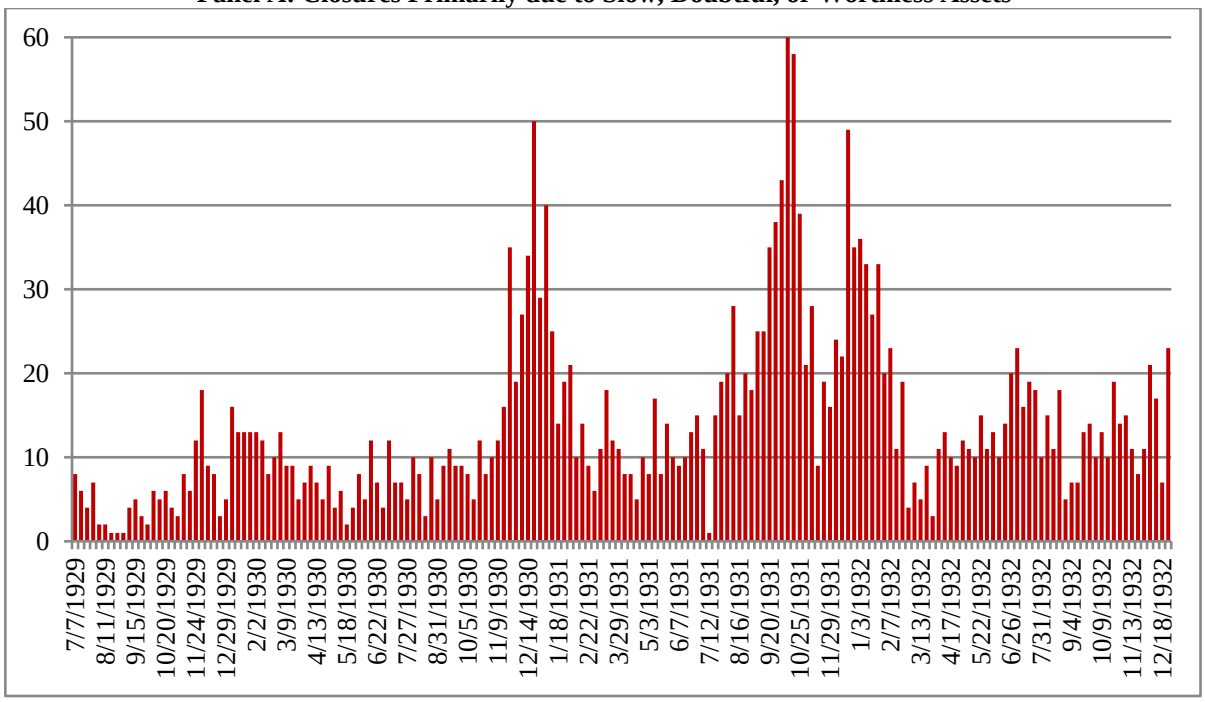
Figure 10: Predicting Quarterly Bank Closures - Other Interest Rate Measures



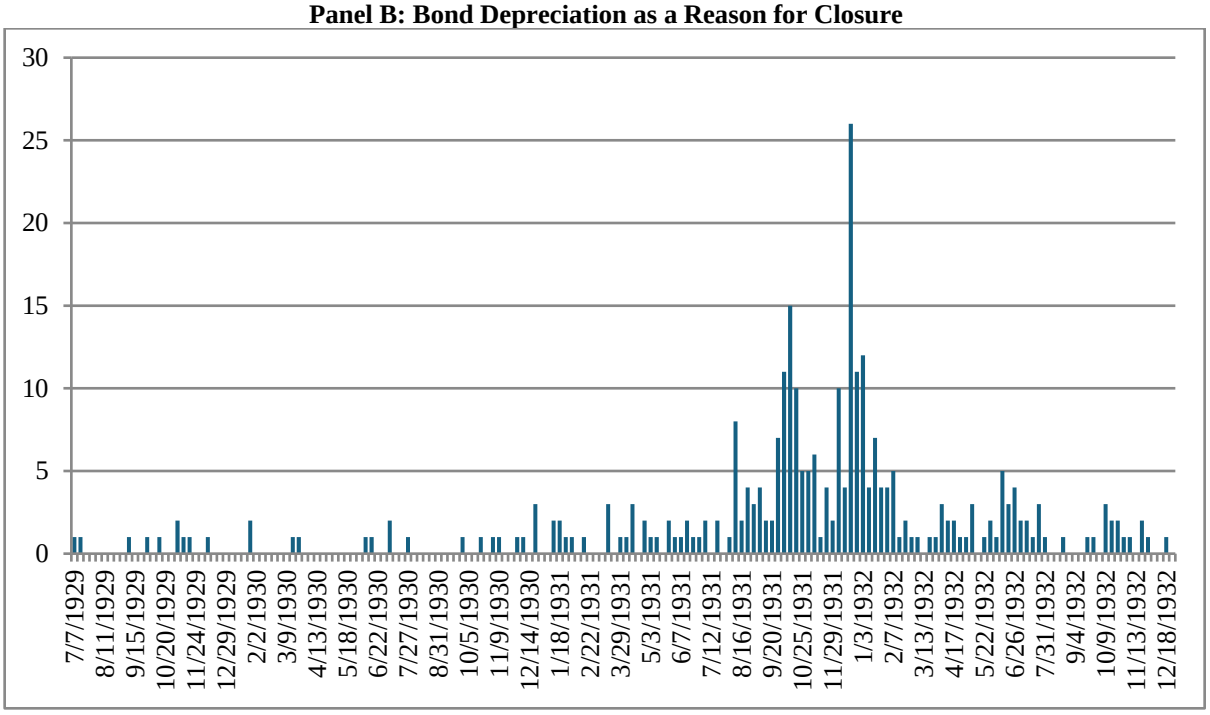
Notes: Figure presents the coefficient (and two standard error bands) on the interaction between bank's security-to-asset ratio and the specified interest rate from equation (2). See Appendix Table A2 for the sources.

Figure 11: Causes of Bank Closures (1929-1932)

Panel A: Closures Primarily due to Slow, Doubtful, or Worthless Assets



Panel B: Bond Depreciation as a Reason for Closure



Notes: Figures provide the number of exiting banks where the examiner reported whether the closure was due primarily due to assets that were slow, doubtful, or worthless (Panel A) or in their written notes mentioned depreciating bond prices explicitly (Panel B).

Notes: Figures present aggregate ratios for all national banks. The top panel contains the ratios of loans and securities relative to assets. The bottom panel contains the ratio of US Treasury bonds and other securities to total assets. Data were obtained from the Office of the Comptroller of the Currency's *Annual Report*.

Table 1: Predicting Quarterly Bank Closures - July 1929-Dec 1932

	Closed During Quarter		
	(1)	(2)	(3)
Assets (log)	-0.001	-0.001	-0.001
	[0.000]	[0.000]	[0.000]
Securities/Assets	-0.009***	-0.102***	-0.042***
	[0.003]	[0.036]	[0.010]
Securities/Assets * Aaa Yield in Quarter		0.020**	
		[0.008]	
Securities/Assets * Avg. Fed Discount Rate in Quarter			0.009***
			[0.002]
Loans/Assets	0.025***	0.025***	0.025***
	[0.003]	[0.003]	[0.003]
Capital+Surplus/Assets	-0.030***	-0.029***	-0.030***
	[0.005]	[0.005]	[0.005]
Surplus/(Capital+Surplus)	-0.045***	-0.045***	-0.045***
	[0.002]	[0.002]	[0.002]
HHI of County Deposits	-0.001	-0.001	-0.001
	[0.004]	[0.004]	[0.004]
Fraction of County's Total Deposits	-0.003	-0.003	-0.004
	[0.003]	[0.003]	[0.003]
Lagged Change in (log) Deposits	-0.003***	-0.003***	-0.003***
	[0.000]	[0.000]	[0.000]
County Controls in 1930?	Yes	Yes	Yes
State Fixed Effects?	Yes	Yes	Yes
Quarter Fixed Effects?	Yes	Yes	Yes
Observations	267997	267997	267997

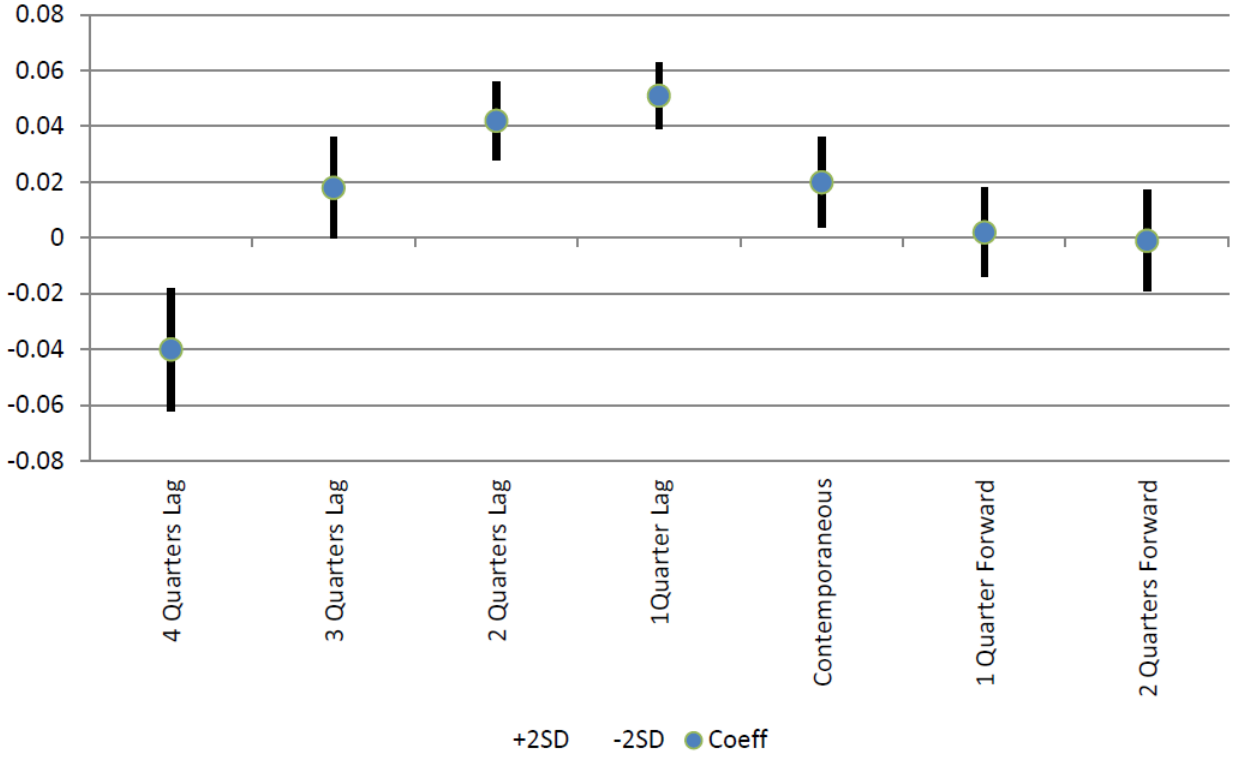
Notes: Table presents the estimated coefficients from the linear probability model of equation (2). Each observation is a bank quarter, and the outcome is whether the observed bank closed in the quarter. County controls include the logarithm of population in 1929; the fraction of the county living in an urban location of 2,500 or more people in 1929; the fraction of the adult population that is illiterate in 1929; the fraction of the population that is non-white in 1929; the number of farms per capita; the number of manufacturing establishments per capita; and the logarithm of retail sales in 1929. The regression also includes the logarithm of the bank's age, indicators for whether it was a national bank or a state Fed member, and indicators for whether it was in a Central Reserve City, a Reserve City, or a city with a clearinghouse. Standard errors clustered by county are provided in parentheses below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% levels.

Table 2: Predicting Quarterly Bank Closures Panel - Using Fed District Specific Discount Rate

	Closed During Quarter		
	(1)	(2)	(3)
Assets (log)	-0.001	-0.001	-0.001
	[0.001]	[0.001]	[0.001]
Securities/Assets	-0.009***	-0.022**	-0.027***
	[0.003]	[0.009]	[0.009]
Fed Discount Rate in Quarter	0.001	-0.001	
	[0.001]	[0.002]	
Securities/Assets *		0.003*	0.005**
Fed Discount Rate in Quarter		[0.002]	[0.002]
Loans/Assets	0.025***	0.025***	0.025***
	[0.003]	[0.003]	[0.003]
Capital+Surplus/Assets	-0.030***	-0.030***	-0.028***
	[0.005]	[0.005]	[0.005]
Surplus/(Capital+Surplus)	-0.045***	-0.045***	-0.046***
	[0.002]	[0.002]	[0.002]
HHI of County Deposits	-0.001	-0.001	-0.001
	[0.004]	[0.004]	[0.004]
Fraction of County's Total Deposits	-0.003	-0.004	-0.002
	[0.003]	[0.003]	[0.003]
Lagged Change in (log) Deposits	-0.003***	-0.003***	-0.003***
	[0.001]	[0.001]	[0.001]
County Controls in 1930?	Yes	Yes	Yes
State Fixed Effects?	Yes	Yes	Yes
Quarter Fixed Effects?	Yes	Yes	Yes
State X Quarter Fixed Effects?	No	No	Yes
Observations	267997	267997	267997

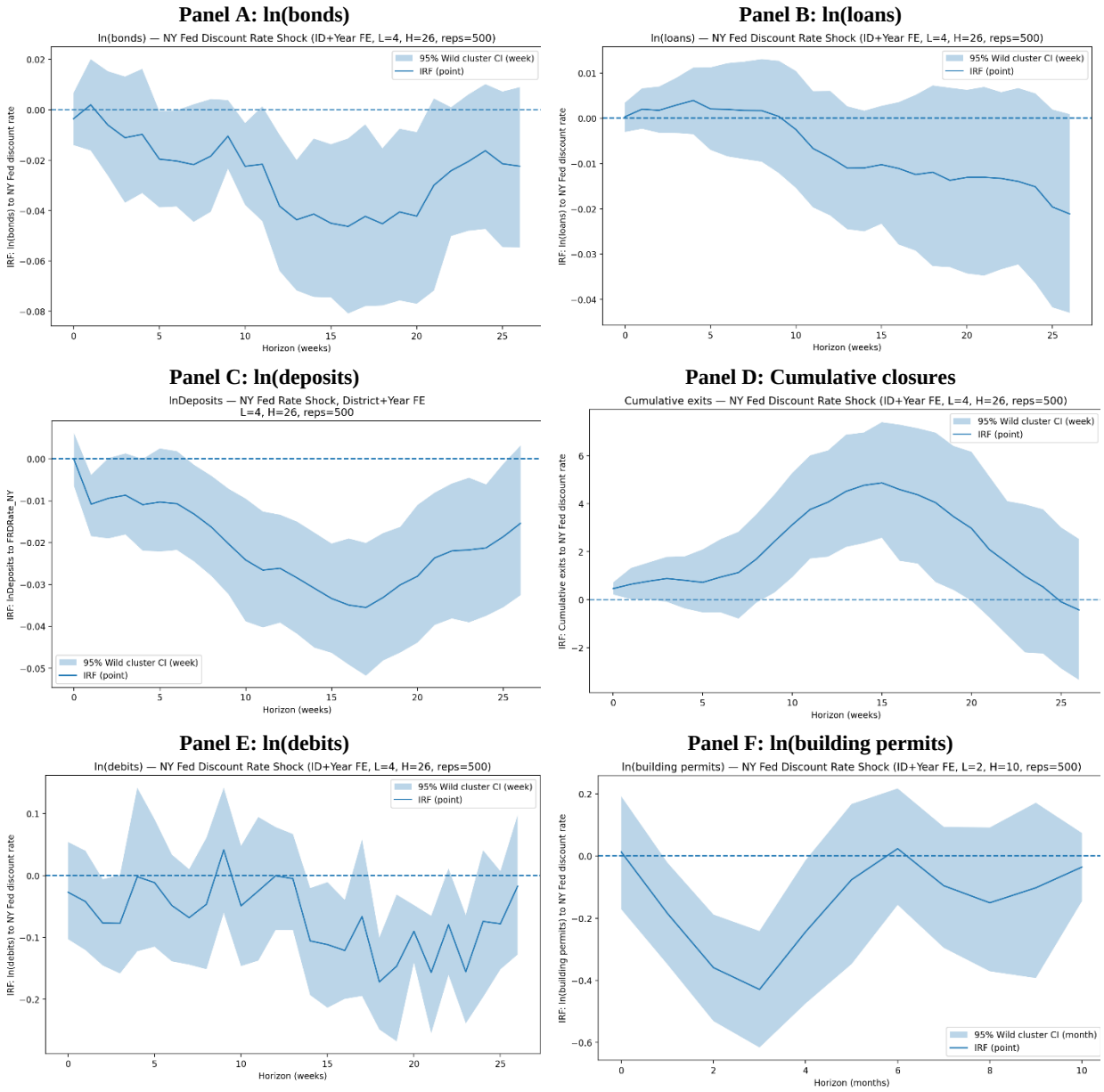
Notes: Table presents the estimated coefficients from the linear probability model of equation (2). Each observation is a bank quarter, and the outcome is whether the observed bank closed in the quarter. County controls include the logarithm of population in 1929; the fraction of the county living in an urban location of 2,500 or more people in 1929; the fraction of the adult population that is illiterate in 1929; the fraction of the population that is non-white in 1929; the number of farms per capita; the number of manufacturing establishments per capita; and the logarithm of retail sales in 1929. The regression also include the logarithm of the bank's age, indicators for whether it was a national bank or a state Fed member, and indicators for whether it was located in a Central Reserve City, a Reserve City, or a city with a clearinghouse. Standard errors clustered by county are provided in parentheses below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% levels.

Figure A1: Predicting Quarterly Bank Closures - Using Different Timing of the Quarterly Aaa Bond Yield



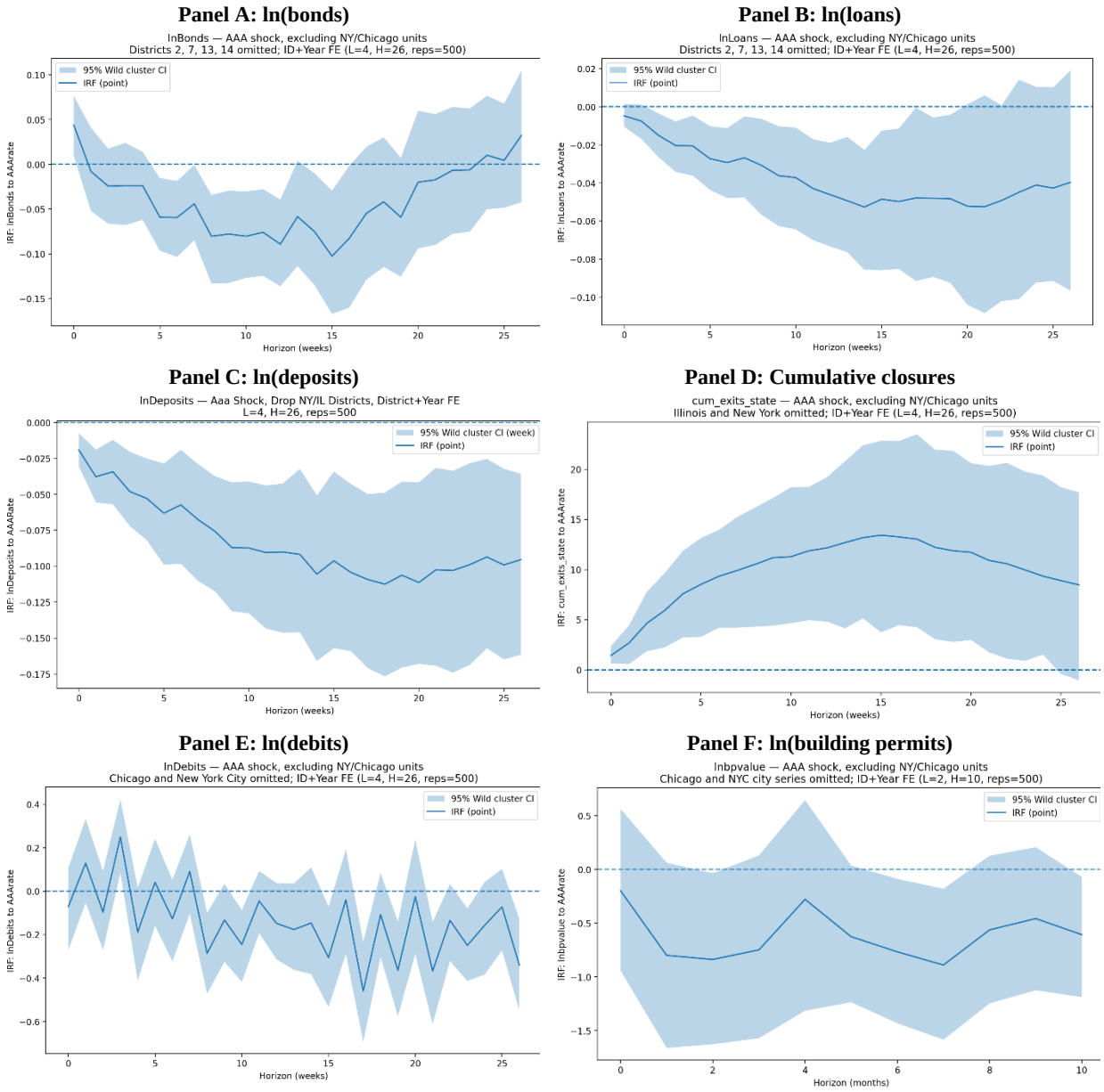
Notes: Figure presents the coefficient (and two standard error bands) on the interaction between bank's security-to-asset ratio and the Aaa bond yield for various leads in lags from equation (2).

Figure A2: Impulse Responses due to a Positive NY Fed discount rate shock



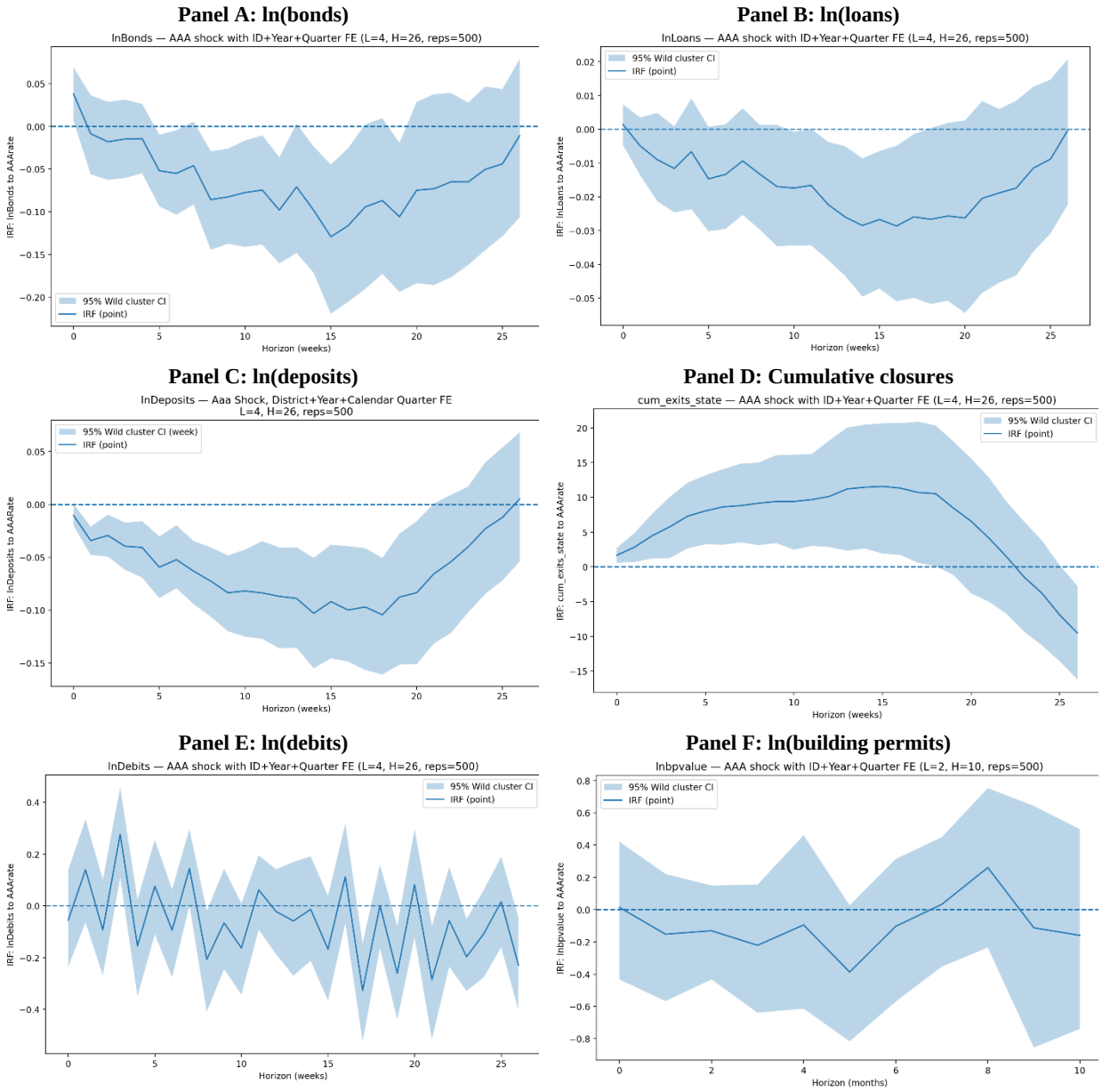
Notes: The six panels display the estimated response of the specified variable to shock to the NY Fed discount rate. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure A3: Impulse Responses due to a Positive Aaa-yield Shock (removing NYC and Chicago)



Notes: The six panels display the estimated response of the specified variable to a 100 basis point increase in the Aaa corporate bond yield. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions. New York and Chicago observations have been removed from the panels.

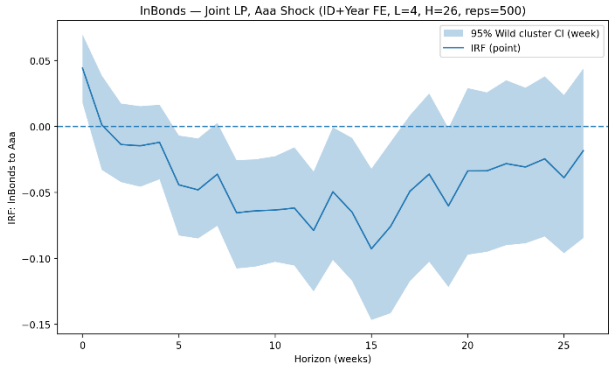
Figure A4: Impulse Responses due to a Positive Aaa-yield Shock (adding quarter fixed effects)



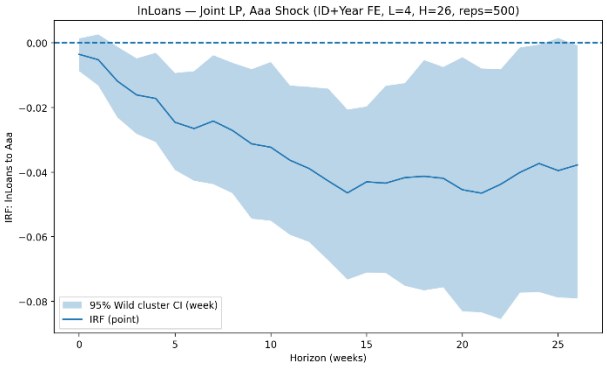
Notes: The six panels display the estimated response of the specified variable to a 100 basis point increase in the Aaa corporate bond yield. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure A5: Impulse Responses due to a Positive Aaa-yield Shock (Jointly)

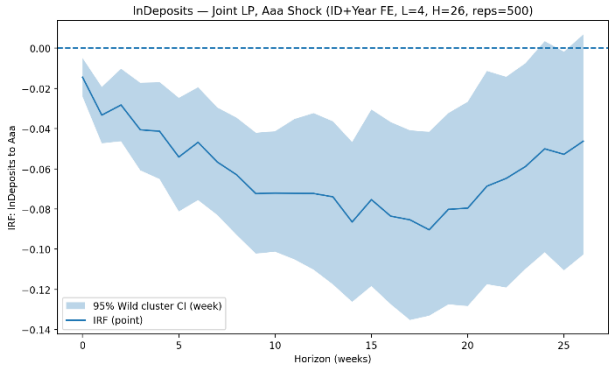
Panel A: ln(bonds)



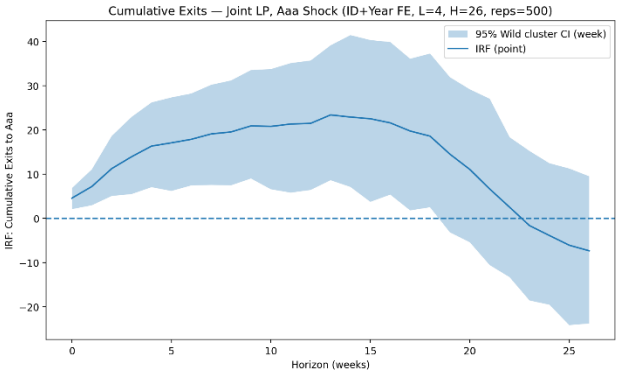
Panel B: ln(loans)



Panel C: ln(deposits)



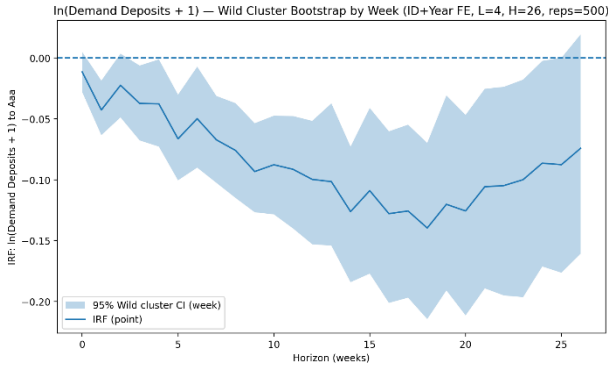
Panel D: Cumulative closures



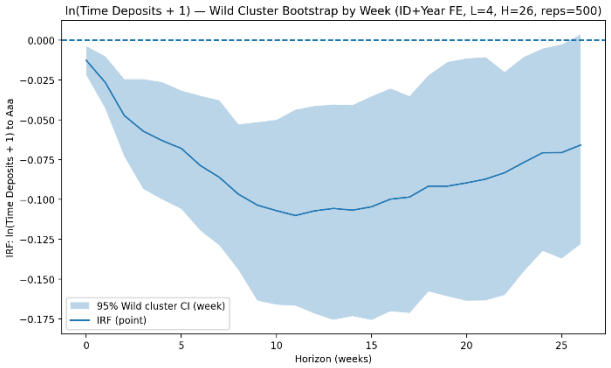
Notes: The four panels display the estimated response of the specified variable to a 100 basis point increase in the Aaa corporate bond yield. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Figure A6: Impulse Responses due to a Positive Aaa-yield Shock (disaggregated deposits and loans)

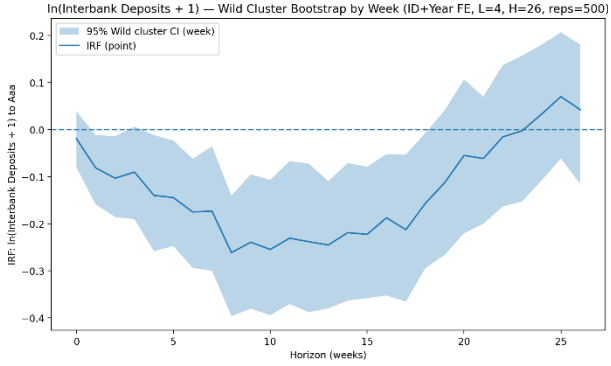
Panel A: ln(demand deposits)



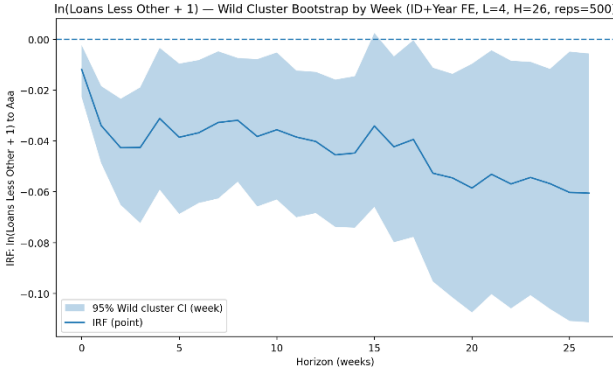
Panel B: ln(time deposits)



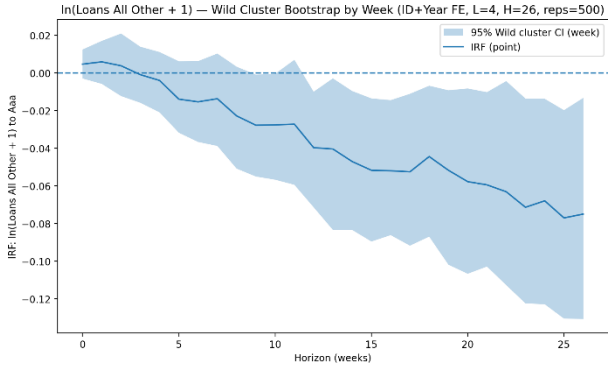
Panel C: ln(interbank deposits)



Panel D: ln(secured loans)



Panel E: ln(other loans)



Notes: The five panels display the estimated response of the specified variable to a 100 basis point increase in the Aaa corporate bond yield. They show local projection estimates of equation (1) in the text. The shading represents 95%-confidence intervals from a wild time-clustered bootstrap over 500 repetitions.

Table A1: Correlations Between Monthly Bond and Interest Rate Series

	Aaa bond yield	Corp Bond Yield	RR Bond Yield	Utility Bond Yield	Industrial Bond Yield	Baa Bond Yield	Junk Bond Yield	US Long-Term Bond Yield	US Short-Term Bond Yield	Municipal Bond Yield	Loan Rate - NYC	Loan Rate - NW Cities	Loan Rate - SW Cities	Avg. Discount Rate
Aaa Bond yield	1.000													
Corp Bond Yield	0.845	1.000												
RR Bond Yield	0.956	0.941	1.000											
Utility Bond Yield	0.696	0.897	0.828	1.000										
Industrial Bond Yield	0.710	0.931	0.803	0.715	1.000									
Baa Bond Yield	0.734	0.544	0.620	0.185	0.632	1.000								
Junk Bond Yield	0.395	0.317	0.306	-0.072	0.529	0.890	1.000							
US Long-Term Bond Yield	0.888	0.762	0.878	0.668	0.603	0.563	0.254	1.000						
US Short-Term Bond Yield	0.101	0.084	0.180	0.416	-0.227	-0.535	-0.759	0.296	1.000					
Municipal Bond Yield	0.891	0.901	0.915	0.718	0.851	0.719	0.526	0.869	-0.002	1.000				
Loan Rate - NYC	0.278	0.379	0.414	0.632	0.113	-0.327	-0.557	0.363	0.886	0.221	1.000			
Loan Rate - NW Cities	0.316	0.499	0.485	0.705	0.279	-0.244	-0.435	0.369	0.781	0.326	0.975	1.000		
Loan Rate - SW Cities	0.228	0.432	0.406	0.677	0.208	-0.359	-0.536	0.272	0.803	0.236	0.969	0.986	1.000	
Avg. Discount Rate	0.206	0.357	0.369	0.622	0.103	-0.409	-0.595	0.278	0.873	0.187	0.976	0.966	0.986	1.000

Notes: Table provides the correlation coefficients for the various bond and loan rates from July 1929 through December 1932.

Table A2: Source and Description of Monthly Interest Rate Series

Series	Source	Description
Aaa Bond yield	NBER Macrohistory	U.S. Yields On Corporate Bonds, Highest Rating
Baa Bond Yield	NBER Macrohistory	U.S. Yields On Corporate Bonds, Lowest Rating
Loan Rate - NYC	NBER Macrohistory	U.S. Rates On Customer Loans, New York City
Loan Rate - NW Cities	NBER Macrohistory	U.S. Rates On Customers' Loans, Northern and Western Cities
Loan Rate - SW Cities	NBER Macrohistory	U.S. Bank Rates On Customers' Loans, Southern and Western Cities
RR Bond Yield	NBER Macrohistory	U.S. American Railroad Bond Yields, High Grade
Corp Bond Yield	NBER Macrohistory	Unweighted average of Utility, Industrial, and RR bond yields
US Long-Term Bond Yield	NBER Macrohistory	U.S. Yield On Long-Term United States Bonds
US Short-Term Bond Yield	NBER Macrohistory	U.S. Yields On Short-Term United States Securities, Three-Six Month Treasury Notes and Certificates, Three Month Treasury
Municipal Bond Yield	NBER Macrohistory	U.S. Index of Yields Of High Grade Municipal Bonds
Utility Bond Yield	NBER Macrohistory	U.S. Index of Yields Of High Grade Public Utility Bonds
Industrial Bond Yield	NBER Macrohistory	U.S. Yield On High Grade Industrial Bonds, Aaa Rating
Avg. Discount Rate	Federal Reserve Bank	Unweighted average of monthly discount rates in each district
Junk Bond Yield	Basile et al. (2025)	Yields of Junk Bonds

Notes: Table provides the source of each of the monthly interest rate series used in the paper.

Table A3: Predicting Quarterly Bank Closures Panel - Other Balance Sheet Controls

	Closed During Quarter							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Assets (log)	-0.001	-0.001	-0.001	-0.001	-0.001***	-0.001***	-0.001**	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Securities/Assets	-0.102***	-0.042***	-0.121***	-0.064***	-0.132***	-0.067***	-0.130***	-0.067***
	[0.036]	[0.010]	[0.035]	[0.009]	[0.036]	[0.009]	[0.036]	[0.009]
Securities/Assets *	0.020**		0.019**		0.020***		0.020***	
Aaa Yield in Quarter	[0.008]		[0.008]		[0.008]		[0.008]	
Securities/Assets *		0.009***		0.009***		0.008***		0.008***
Avg Fed Discount Rate in Quarter		[0.002]		[0.002]		[0.002]		[0.002]
Loans/Assets	0.025***	0.025***						
	[0.003]	[0.003]						
Cash/Assets					-0.073***	-0.073***		
					[0.004]	[0.004]		
Cash/Deposits							-0.050***	-0.049***
							[0.003]	[0.003]
Capital+Surplus/Assets	-0.029***	-0.030***	-0.030***	-0.030***	-0.038***	-0.039***	-0.018***	-0.019***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]
Surplus/(Capital+Surplus)	-0.045***	-0.045***	-0.044***	-0.044***	-0.042***	-0.043***	-0.043***	-0.043***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
HHI of County Deposits	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Fraction of County's Total Deposits	-0.003	-0.004	-0.004	-0.004	-0.002	-0.002	-0.003	-0.003
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Lagged Change in(log) Deposits	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***	-0.003***	-0.003***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
County Controls in 1930?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	267997	267997	267997	267997	267997	267997	267844	267844

Notes: Table presents the estimated coefficients from the linear probability model of equation (2). Each observation is a bank quarter, and the outcome is whether the observed bank closed in the quarter. County controls include the logarithm of population in 1929; the fraction of the county living in an urban location of 2,500 or more people in 1929; the fraction of the adult population that is illiterate in 1929; the fraction of the population that is non-white in 1929; the number of farms per capita; the number of manufacturing establishments per capita; and the logarithm of retail sales in 1929. The regression also includes the logarithm of the bank's age, indicators for whether it was a national bank or a state Fed member, and indicators for whether it was in a Central Reserve City, a Reserve City, or a city with a clearinghouse. Standard errors clustered by county are provided in parentheses below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% levels.

Table A4: Predicting Quarterly Bank Closures - Robustness Checks

	Closed During Quarter							
	Dropping RC and CRC Cities		Using 1929 Securities Ratio		Dropping Voluntary or Temporary Closures		Dropping Involuntary Closures or Mergers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Assets (log)	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Securities/Assets	-0.093***	-0.048***	-0.093***	-0.040***	-0.079**	-0.035***	-0.025*	-0.009**
	[0.035]	[0.009]	[0.033]	[0.009]	[0.033]	[0.009]	[0.014]	[0.004]
Securities/Assets * Aaa Yield in Quarter	0.017**		0.018**		0.015**		0.005	
	[0.007]		[0.007]		[0.007]		[0.003]	
Securities/Assets * Avg Fed Discount Rate in Quarter		0.010***		0.009***		0.008***		0.002**
		[0.002]		[0.002]		[0.002]		[0.001]
Loans/Assets	0.026***	0.025***	0.027***	0.028***	0.024***	0.024***	0.002	0.002
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]
Capital+Surplus/Assets	-0.035***	-0.036***	-0.030***	-0.031***	-0.029***	-0.030***	-0.001	-0.001
	[0.005]	[0.005]	[0.005]	[0.005]	[0.004]	[0.004]	[0.002]	[0.002]
Surplus/(Capital+Surplus)	-0.045***	-0.045***	-0.045***	-0.046***	-0.040***	-0.041***	-0.006***	-0.006***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
HHI of County Deposits	0.001	0.001	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]	[0.002]
Fraction of County's Total Deposits	-0.007**	-0.007**	-0.003	-0.004	-0.003	-0.003	-0.001	-0.001
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.001]	[0.001]
Lagged Change in (log) Deposits	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
County Controls in 1930?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	253652	253652	263131	263131	266038	266038	257935	257935

Notes: Table presents the estimated coefficients from the linear probability model of equation (2). Each observation is a bank quarter, and the outcome is whether the observed bank closed in the quarter. The column headings describe what banks are dropped from the regressions or what other variables are used. County controls include the logarithm of population in 1929; the fraction of the county living in an urban location of 2,500 or more people in 1929; the fraction of the adult population that is illiterate in 1929; the fraction of the population that is non-white in 1929; the number of farms per capita; the number of manufacturing establishments per capita; and the logarithm of retail sales in 1929. The regression also includes the logarithm of the bank's age, indicators for whether it was a national bank or a state Fed member, and indicators for whether it was in a Central Reserve City, a Reserve City, or a city with a clearinghouse. Standard errors clustered by county are provided in parentheses below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% levels.

Table C1: Cumulative Abnormal Returns By Industry

	Cumulative Abnormal Stock Market Returns By Time Window (in percentage points)										
	Banks	**Cnsmr**	**Manuf**	**HiTec**	**Food**	**Clths**	**Chems**	**Textls**	**Machines**	**Autos**	**Retail**
t=[-30,-1]	-2.88	-3.99	0.20	2.35	-2.63	-1.60	-0.55	-10.08	-2.16	1.42	-6.60
t=[-20,-1]	-2.95	-4.22	-0.20	1.89	-1.95	-0.75	-2.76	-8.96	-1.03	-0.24	-6.49
t=[-10,-1]	0.78	-1.60	0.45	0.31	1.33	0.22	-4.65	-2.85	-0.73	-1.24	-3.37
t=[-2,-1]	0.23	0.88	0.12	-1.90	2.30	-0.87	-3.01	4.00	2.25	-0.95	1.37
t=(-1,1]	2.34	0.07	-1.23	-0.36	-0.18	-1.88	-0.47	2.32	2.79	-0.31	0.14
t=(-1,10]	7.87	0.41	0.10	-0.44	1.25	-1.94	-0.02	3.76	4.04	-1.56	0.71
t=(-1,20]	11.47	0.87	1.22	-2.27	2.85	-2.22	-0.18	-0.72	8.17	-2.98	2.35
t=(-1,30]	16.61	1.83	2.20	-4.82	4.82	-1.81	2.90	1.33	10.03	2.81	-0.27

Notes: Table presents the cumulative abnormal returns by industry. Daily industry-level return data from Kenneth French's online data library. These data assign all CRSP-listed NYSE, AMEX, and NASDAQ firms to industry portfolios and report the daily return of each portfolio. Each industries intercept and market slope are estimates for the 30-250 days before the Fed rate hike on October 9th.