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ABSTRACT

Modern financial crises are difficult to explain because they do not always involve bank runs, or the bank runs occur late. For this reason, the first year of the Great Depression, 1930, has remained a puzzle. Industrial production dropped by 20.8 percent despite no nationwide bank run. Using cross-sectional variation in external finance dependence, we demonstrate that banks' decision to not use the discount window and instead cut back lending and invest in safe assets can account for the majority of this decline. In effect, the banks ran on themselves before the crisis became evident.

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1 Introduction

One reason it has been hard to understand modern financial crises is that they all appear different. If financial crises are always due to the vulnerability of short-term debt to runs, shouldn't we always see bank runs? Indeed, before the existence of central banks, crises were clearly triggered by bank runs. However, the presence of a central bank complicates matters rendering a modern crisis timeline different and varied. Bank runs, if they occur at all, may happen late in the crisis. Or there could be no runs at all if, for example, a credible guarantee is issued.[1]

Nowhere is this dynamic more evident than 1930, the first year of the Great Depression. At the start of the Great Depression there were no nationwide bank runs and banks did not avail themselves of the discount window. Yet, output dropped substantially: industrial production fell over 20%. As a consequence, 1930 is viewed as a puzzle. For example, Romer (1988) writes: "The primary mystery surrounding the Great Depression is why output fell so drastically in late 1929 and all of 1930" (p. 5).[2] And Bernanke (1983) does not include 1930 in his study of the effects of bank failures on output: "it should be stated at the outset that my theory does not offer a complete explanation of the Great Depression (for example, nothing is said about 1929-1930)" (p. 258).

In this paper show that a large part of the output drop in 1930 can be explained by bank actions: the reduction in loans and purchase of safe assets. We argue that banks realized the severity of economic conditions and, in effect, ran on themselves.

We further argue that this exemplifies a common feature of modern crises where a central bank is present. Banks reduce loans prior to the crisis while depositors stand pat to see what the central bank does, even if they already recognize crisis conditions. The true start of the crisis, then, can be before any obvious indications of stress, such as bank failures. Indeed, Boyd et al. (2009) examine the dating of crisis in four crisis databases and find that large reductions in loan growth *predict* crisis start dates. Absent means to observe these responses by the banking sector, modern crises may appear to be idiosyncratic events without a common core element.

Our empirical strategy to ascertain the role of banks in output declines in 1929-31 combines state-industry level data on output with state-level data on the banking sector. We use data from the Federal Reserve to construct state-level measures of banking sector behavior in 1929-31; we employ data from the Biennial Census of Manufacturers to construct measures of state-industry level performance.

In order to identify the effect stemming from the banking sector's decision to cut back—and not from demand side effects—we use an approach along the lines of Rajan and Zingales (1998). We hand-

[1] The Laevan and Valencia (2008) crisis database covers the period 1970-2007, during which there were 124 systemic banking crises globally. They find that 62 percent of the crises in their data experienced bank runs, defined as a sharp reduction in total deposits.

[2] Also, Romer (1990): ". . . 1930 is . . . the most puzzling year of the Great Depression" (p. 599).

collect firm balance sheet data reported in Moody's Manuals from the period of 1922 to 1928 and calculate a measure of external finance dependence. We include this measure of external dependence as a treatment intensity in a cross-sectional regression of industry output on contemporaneous changes in the state-level aggregate bank balance sheet.

We find that industries which were more dependent on external finance were affected more severely by reductions in loans, reductions in total assets, reductions in deposits, and increases in holdings of safe assets by their home state banks. Further, we demonstrate that this conclusion is robust to controlling for contemporaneous bank suspensions.

The behavior of banks during this early stage of the Great Depression is evident from the aggregate balance sheet of the banking sector, shown in Table 1. From 1929 to 1931 banks cut back on loans by over 15%, and increased the share of total assets invested in safe assets by 6 percentage points. At the same time, there was little action stemming from the household side: total deposits fell by just 1.9 %. This contrasts with a drop in deposits of 27.4% in the subsequent two years.

Our estimates suggest that the reduction in loans accounted for a substantial share of the output decline in 1929-31. Extrapolating from the cross-sectional estimates and nationwide totals in total bank loans, we estimate a roughly 30% drop in the three output measures.

Our empirical approach is close to Mladjan (2016) and Lee and Mezzanotti (2017). In both of these papers, the authors look at interactions of measures of firm dependence on external finance interacted with bank failures to show effects on measures of economic performance. Mladjan (2016) studies the effects of bank failures on output in a panel of state-industry observations over the years 1929-1933. Lee and Mezzanotti (2017) look at a sample of 29 cities over the period 1929-1933. They also find that where bank failures were high, the more financially dependent industries show reductions in the same three outcome variables we use: total output, employment, and value added. In other related work, Benmelech et al. (2017) show that credit frictions played a large role in the employment drop from 1928 to 1933.

In contrast to these studies, we focus solely on the seemingly anomalous year of 1930. We demonstrate that the early part of the Great Depression, where bank failures were not substantial, can also be explained by the impact of the banking sector on the real economy. There is a large causal impact of the contraction of bank lending on macroeconomic activity *before* the major bank runs of the Depression.

Finally, we place the crisis dynamics of the Great Depression in a broader context. We find that the unfolding of the Great Depression is typical of modern crises. At the start there is no widespread bank run, but output falls. In contrast, panics during the National Banking Era, 1863-1914, occurred near business cycle peaks. With the establishment of the Federal Reserve in 1914, banks had the opportunity to borrow from the discount window. During one of the first recessions to occur under the watch of the newly-established Fed, the recession of 1920-1921, banks made extensive

use of the Fed discount window, which was giving out loans at an attractive rate. The broad use of the Fed's discount window to avoid a panic was hailed at the time as having precluded a panic (see Gorton (1988)). As we describe in Section 4 of this paper, the discount window subsequently became stigmatized as the Fed tried to ensure that it was not used as a permanent source of funding. Indeed, as demonstrated in Anbil (2018), the discount window stigma was a major consideration of depositors during the Great Depression. We hypothesize that because the use of the discount window had become stigmatized banks mostly avoided borrowing from the Fed in 1930 and instead opted to cut back on lending, and tilted towards a safer portfolio.

To provide evidence to this point we compare the early stage of the Depression with the prior recession in 1920-21. Repeating our analysis, we show that in contrast to the early part of the Depression, bank balance sheet changes cannot account for the drop in output during the 1920-21 recession.

Our findings regarding the unfolding of the Great Depression suggest a reason for the common thread underlying all modern financial crises. As shown in Boyd et al. (2009), modern crises are typically preceded by banks reducing loans. These authors examine the dating of crisis starts in the four main modern crisis databases: (1) Demirguc-Kunt and Detragiache (2002) and Demirguc-Kunt and Detragiache (2005); (2) Caprio et al. (2005); (3) Reinhart and Rogoff (2008); (4) Laevan and Valencia (2008). These databases pin down the starting dates using an event methodology, usually noting some form of government intervention. Boyd et al. (2009) find that large reductions in loan growth *predict* the crisis start dates in the four databases, roughly a year before the traditional start date. In contrast, similar magnitude deposit changes do not predict the start dates. Depositors appear to wait, perhaps due to explicit or implicit deposit insurance. Loans are reduced significantly but deposit reductions—meaning runs—only come later, if at all. In other words, banks realize the crisis conditions before any public signs of stress.

The paper proceeds as follows. In the remainder of this section we provide a brief literature review. In Section 2 we describe the data sources and the data construction process. Section 3 contains our main empirical results on impact of bank decisions on manufacturing output. In Section 4 we compare crises during the National Banking Era and under the Federal Reserve. We also provide a history of the development of the discount window stigma. We conclude in Section 5.

1.1 Related Literature

There is an enormous literature on various aspects of the Great Depression. Calomiris (1993) and Romer (1993) provide reviews of the literature. Perhaps closest to our work is Calomiris and Wilson (2004). They do not focus on the year 1930, but like us they find evidence of banks shedding risk. Their focus is on New York City banks where they show that in the early 1930's banks shed risk, reducing dividends and increasing their holdings of safe assets. They argue that they provide "an

explanation for the decline in bank capital and the increase in bank cash" (p. 422).

Also related are papers by Romer (1990) and Olney (1999). These authors focus on consumer demand behavior. Romer (1990) argues that the Great Depression was a singular event. The 1929 stock market crash created "uncertainty" which caused a reduction in household purchases of durable and semi-durable goods. Olney (1999) also focuses on consumers, pointing out that consumers were highly indebted and there were large costs to defaulting. Olney (1999) argues that for consumers to avoid default they cut consumption. These authors focus on the demand side, while we focus on the supply side. These authors argue that consumers' purchases of durables declined. Our explanation is not mutually exclusive with the demand-side explanation, especially as banks did not make significant amounts of loans to consumers until later. Consumer credit at the time came mainly from installment buying, see, for instance, Clark (1931).

Finally, closely related are papers on the effects of bank failures and suspensions on output during the Great Depression, e.g., Bernanke (1983), Calomiris and Mason (2003), and as already discussed, Lee and Mezzanotti (2017), Mladjan (2016), and Benmelech et al. (2017). These authors do not examine 1930 separately.

2 Results

Our empirical results establish the importance of banking sector in capturing the heretofore understudied first year of the Great Depression.

2.1 Identification

We use the cross-section of state-industry level data to establish the effects of bank behavior on macroeconomic outcomes. We measure variation in the aggregate banking sector balance sheet by state in the period from 1929 to 1931 and link this to output declines in different industries in the corresponding state. To separate out the shock caused by a contraction in lending from a demand side story (e.g., the particular state faced low productivity shocks which drove down macroeconomic quantities as well as the demand for bank financing) we employ industry external finance dependence as a measure of treatment intensity, following Rajan and Zingales (1998).

2.2 Data

We use data from three main sources: the Biennial Census of Manufacturers, Moody's Manuals, and statistics published by the Board of Governors of the Federal Reserve.

The Biennial Census of Manufacturers provides biannual data disaggregated by manufacturing sector (industry) and state. This data is described in detail in Rosenbloom and Sundstrom (1999) and available online on the author's website.[3] We use three measures of output: total wages (value added), value of production (gross output), and employment. The data covers 15 industries for a total of 387 industry-state observations. Because this data is collected only every two years, our regression evidence uses the change in the output measure in 1929 to 1931.

We hand collect firm-level data from the Moody's Manuals over the period 1922-1928 to construct the measure of dependence on external finance. Firms are assigned to industries based on Ken French's industry classifications.[4] The firms that are in the industries that are captured by the Census of Manufacturers form the basis of an industry-level measure of external finance dependence, constructed after Rajan and Zingales (1998). The industry level measure is based on 1224 firm-years.

Bank data is from *All-Bank Statistics: United States, 1896-1955* published by the Federal Reserve Board of Governors. With this data we measure changes in state-level total assets, and total loans, and total deposits. We also construct a measure of share of safe assets, defined as the sum of Treasuries, Munis, currency and coin, and banker's balances, normalized by total assets.

Finally, data on deposits in suspended banks is from the *Federal Reserve Bulletin*, September 1937, available online at the St. Louis Federal Reserve Bank FRASER database.[5]

2.3 Measuring Firm External Finance Dependence

For each firm-year we calculate dependence on external funding as capital expenditures (Capex) minus lagged cash flow from operations (CFO), divided by Capex:

$$\mathrm{CX}_t = \frac{\mathrm{Capex}_t - \mathrm{CFO}_{t-1}}{\mathrm{Capex}_t}$$

We lag CFO because the time t variable is not known when capital expenditure decisions are made. We then sort the firm-year measures into ten buckets, and assign integer values to each bucket. We do this to allow for potential nonlinearities in the relationship between CX and the bank measures.

The industry-level measure is the firm asset weighted sum of CX bucket values in industry i:

$$\mathrm{Dep}_i \equiv \sum_{k \in I} \mathrm{CX}_k^{\mathrm{bucket}} \left(\frac{\mathrm{TA}_k}{\sum_{k \in I} \mathrm{TA}_k} \right)$$

where i indexes industries; k indexes firms; and I represents the set of all firms in industry i. The

[3] http://joshua-rosenbloom.squarespace.com/data-sets/

[4] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[5] https://fraser.stlouisfed.org/files/docs/publications/FRB/1930s/frb_091937.pdf

industries and the corresponding dependence measures are reported in Table 1 of the Appendix.

The CX measure constructed in this section is not specific to bank finance, but instead captures dependence on all sources of external finance. However, we find that bank lending constituted a substantial share of external finance at the time. As shown in Table 1, total bank loans in 1929 were nearly 42 billion USD. For reference, the total market cap of the 856 companies listed on the NYSE was 89.7 billion USD in August 1929, as reported in McGrattan and Prescott (2004).

3 Results

3.1 Aggregate Balance Sheet

The dynamics we describe are evident in the aggregate balance sheet of the banking sector. Table 1 shows the levels, the change in the levels, and percentage changes in the aggregate balance sheet items of all U.S. banks during the Great Depression (based on *All-Bank Statistics: United States, 1896-1955*). Corresponding to our output measures, the data is shown are for the years 1929, 1931, and 1933.

Most interesting in the table are the categories that show large increases and large declines from 1929-1931. Total loans, loans for securities, and all other loans show large declines. Safe assets including Treasuries, Munis, cash, and banker's balances show substantial increases. These changes are consistent with the findings of Calomiris and Wilson (2004) who focus on New York City, the most important banking center in the U.S. They show that during the year 1930 total loans divided by cash plus Treasuries declined 81 percent. This was primarily due to loans declining and safe assets increasing. Note that total deposits only declined by 1.9 percent in 1929-1931—the big declines in deposits occurred starting in 1932. The time-series behavior of these aggregates is shown in Figure 1.

3.2 Regression Evidence

The goal of our empirical analysis is to measure the impact of changes in the various bank balance sheet items on contemporaneous output measures. Specifically, our regressions take the form

$$\Delta \text{Outcome}_{i,s} = \alpha_i + \beta_s + \gamma \text{CX}_i \text{ x } \Delta \text{Bank}_s + \epsilon_{i,s},$$

where the outcome variable is defined as

$$\Delta \text{Outcome}_{i,s} = \log(\text{Measure}_{i,s,1931}) - \log(\text{Measure}_{i,s,1929})$$

for value added, gross output, and total employment of industry i in state s.

Similarly, the right-hand-side banking measures Bank_s are defined as

$$\Delta\text{Bank}_s = \log(\text{Bank}_{s,1931}) - \log(\text{Bank}_{s,1929}),$$

with the exception of Safeshare which is measured as a percentage point change. We show the aggregate time-series behavior of the output measures in Figure 1.

The variable CX_i is an industry level measure of external finance dependence, constructed in Section 2.3. The terms α_i are industry level fixed effects, and the terms β_s are state level fixed effects. The specification does not include time fixed effects because the regression is a pure cross-section.

By studying the interaction term of the state-level bank measure with industry-level external finance dependence index, we are able alleviate concerns about reverse causality. The underlying assumption is that in a given state, the output in industries with different exposures to external finance would have shrinked at the same rate—relative to the corresponding industry-wide averages—without the shock from the banking sector. Because the states differ in the magnitude of the banking sector shocks, we are able to identify the effect on output stemming from the shock to external finance availability—and not the effect from the demand side. Note we cannot include the CX_i and Bank_s terms separately because of the full slate of state- and industry-level fixed effects.

The regression results are shown in Table 2. Panel A examines value added as measured by wages during from 1929 to 1931. Table 2 Panel B repeats the analysis with gross output as the dependent variable. Panel C repeats the same analysis with employment. In all three panels, reduction in total loans, total assets, are associated with decreases in the output measures, and this relationship is in all cases statistically significant. In the specifications with value added and employment as the dependent variable, an increase in average Safeshare in the state is a statistically significant covariate of output changes.

In order to put the estimated magnitudes in context, we calculate the output drop implied by the estimated coefficients of an industry with median exposure to external finance (meaning CX=5) facing a banking sector whose balance sheet mirrors the national aggregate change. This calculation is provided in Table 4. In the table, "Implied Aggregate" refers to the aggregate change in the right-hand side variable from 1 under these assumptions. While all four measures of bank balance sheet are estimated to have a strong impact on output, the cutback in loans was the deepest, and as such imply the largest output loss with estimates ranging from 27% to 44%.

These results are robust to including a measure of bank suspensions. In Table 2 of the Online Appendix, we re-estimate the regressions reported in Table 2, controlling for the total amount of deposits in suspended banks by each state. Existing work in Mladjan (2016) has shown that suspended deposits are a strong determinant of output contraction over the entire Depression era.

We find that it is the decision of banks to cut back on lending and switch to safe assets that accounts for the drop in output in the early part of the Depression, even when accounting for suspended deposits.

Now, because of the availability of the Census of Manufacturing data we are only able to carry out the analysis for the 1929 to 1931 period. In Table 3 of the Appendix we show that our results hold when measuring the right-hand-side bank balance sheet measures from 1929-1930. With the exception of Safeshare, we find that the drop in bank total assets, bank loans, and bank deposits in 1929-1930 are significant determinants of the drop in 1929-1931 output measures.

In Appendix Table 4 we re-estimate the regressions in an OLS setting. We find a smaller implied response to the bank balance sheet variables, suggesting that the effect stems mostly from large states. In Appendix Table 5 we re-estimate the regressions using two instruments constructed by Mladjan (2016). The results are consistent with the WLS estimates presented in Table 2, with the exception of specifications with Safeshare that are no longer statistically significant.

3.3 Importance Discount Window Stigma: 1920-21 Recession

Like we show in Figure 1, banks made little use of the discount window in 1929-1931. Instead, they opted to cut back on lending. The regression evidence suggests that the decision to cut back on lending had a strong impact on economic output.

In order to illustrate the importance of the decision not to go to the discount window, we repeat the analysis presented in Table 4 for the 1920-1921 recession. This recession started in January 1920; the trough, according to the NBER, was July 1921. Unlike during the Great Depression, the discount rate offered by the Fed was below market rates. As a result, and in direct contrast to the Great Depression, banks made extensive use of the Fed's discount window during the Recession of 1920-1921. Correspondingly, as we report in Table 3, the four measures of bank balance sheets have little explanatory power over industry level outcomes. We interpret this as evidence of the importance of discount window stigma during the Great Recession. We take up the the development of Federal reserve discount window stigma in the next section.

4 Bank Panics in the National Banking Era and in the Great Depression

As discussed, the lack of discount window borrowing in the early part of the Great Depression stands in contrast to the recession of 1920-1921. In this section we summarize the history of earlier banking panics in the U.S. Then we provide a brief history of the Federal Reserve's discount window

policy and the development of stigma.

4.1 The National Banking Era

The National Banking Era began with legislation in 1863 that introduced a system of "national banks" that could issue their own currency, but that required backing by U.S. Treasuries. The legislation was aimed at developing a demand for U.S. Treasuries so as to finance the North in the Civil War. But, in addition, it was thought that with Treasury backing, creating a uniform currency (i.e., one without discounts from face value as had occurred with private bank money prior to the Civil War), there would no longer be banking panics—which did not turn out to be the case. In the National Banking Era panics depositors sought to withdraw their cash in National Bank notes.

Gorton (1988) analyzes seven panics that occurred during this period: 1873, 1884, 1890, 1893, 1896, 1907, and 1914. These panics occurred at or just after business cycle peaks; see Gorton (1988) and Calomiris and Gorton (1991).[6] Gorton (1988) showed that banking panics during the National Banking Era, 1863-1914, were information events. The panics occurred when depositors observed an innovation in a leading indicator of recessions, namely the liabilities of failed businesses.[7] If this measure exceeded a threshold it indicated that a large recession was coming and, upon observing this information, there would be a panic. There was never a panic without this threshold being exceeded and there was no case where the threshold was exceeded without a panic. Subsequent to the Federal Reserve System coming into being this threshold can be used to determine the counterfactual of when panics could have occurred.

4.2 Federal Reserve System and the Discount Window

The purpose of the Federal Reserve System was to prevent banking panics by having a permanent discount window which banks could always access.[8]

According to the measure of innovation in the liabilities of failed businesses, estimated over the period 1873-1934, there were two shocks exceed the threshold: June 1920 and December 1929.[9]

[6]This timing is generally true. For example, Dimsdale and Hotson (2004) summarize the U.K. experience since 1825: "The general pattern is one in which financial crises occur close to business cycle peaks, and are followed by a downturn in the wider economy" (p. 26). And in the modern era it also tends to be true. See, for example, Demirguc-Kunt and Detragiache (1998) who study a large sample of developed and developing countries over the period 1980-1994 and find that "crises tend to erupt when the macroeconomic environment is weak" (p. 81).

[7]Burns and Mitchell (1946) identified this variable as a leading indicator of recession.

[8]Prior to the Federal Reserve, private bank clearinghouses opened discount windows only during crises. See Gorton and Mullineaux (1987).

[9]Gorton (1988) lined up the data with the Office of the Comptroller of the Currency Call Report dates. October 1929 was not a bank Call Report date, so the shock is essentially coincident with the stock market crash in October 1929.

These two dates just follow business cycle peaks, just as in the pre-Fed period. However, there was no panic at the start of the recession of January 1920-July 1921. Banks heavily used the discount window during the 1920-21 recession. Figure 1 shows the dramatic use of the window during the 1920 recession. The successful avoidance of a panic in 1920 was was widely remarked upon at the time. For example, Herbert Hoover, then the Commerce Secretary, said that "we know now that we have cured [bank panics] through the Federal Reserve System."[10] And Wesley Mitchell wrote in 1922 that: "We have learned how to prevent crises from degenerating into panics" (see Mitchell (1922)).

At that time of the 1920-21 recession, the discount rate was below market rates because the Federal Reserve wanted to support the sale of U.S. Treasuries to pay off the debt from World War I. Background on the Fed-Treasury relations during this period can be found in Beckhart (1924), Parker and Steiner (1926), Whittlesey (1959), Wicker (1966), Wicker (2015), and Meltzer (2003), among others. In any case, banks did avail themselves of the discount window to a significant extent, as seen in Figure 1. But, the Fed became concerned that banks were using the discount window as a permanent source of funding and also that banks were using the discount window borrowings to lend to speculative stock market investors. To solve these perceived problems, the Fed introduced the discount window stigma. To control discount window borrowing without raising the discount rate (to accommodate the Treasury), the Fed introduced non-pecuniary penalties. The methods used to control credit are listed by Parker and Steiner (1926): the issuance of warnings; the use of moral suasion; advising banks to reduce their outstanding lines of credit and to discriminate against speculative and non-essential loans; the rationing of credit; the attempt to drive war paper from the portfolios of reserve member banks; controlling the issue of Federal Reserve notes; closer scrutiny of paper offered for discount.

Parker and Steiner (1926) write that: "moral pressure was exercised by means of conferences with groups of banks and with individual banks to ascertain the reason for heavy borrowing and if necessary to request them to reduce their aggregate borrowings" (p. 530). In the beginning of the 1920s there was less stigma. E.g., Carlson and Burcu (2016): "There was notably less stigma associated with borrowing from the discount window in the 1920s and borrowing was fairly widespread with about one-third of all member banks borrowing in any given month (roughly 3,000 borrowers out of 9,000 member banks)" (no page). But, this changed. Armantier et al. (2015) "From the late 1920s, the DW [discount window] gradually fell into disuse as the Fed began to take a dim view of DW borrowing and adopted a stance against this practice" (no page). Whittlesey (1959): ". . . administration of the discount window, in the admonitory, moral suasion sense, has a tendency to strengthen the attitude of mind among bankers, the instinct against borrowing, which is the basis of the tradition [against borrowing]. To be admonished is likely to seem embarrassing and even humiliating" (p. 213-214.).

[10] Quoted in Ginzberg (2004), p. 33.

4.3 The Great Depression

The introduction of non-pecuniary penalties worked. Discount window borrowing declined, but with unintended consequences. Banks did not borrow from the discount window in 1929 and 1930, as they had in 1920-21.

Wicker (1996), speaking of the localized panic in late 1930, wrote: "We can look in vain in the pages of the financial press for an event clearly designated as a panic; it was certainly not the name given to the accelerated bank suspensions in the final two months of 1930. The public had no difficulty in identifying the banking crises in 1873, 1884, 1893, and 1907. The passage of time should not have dulled the recognition of a banking crisis in 1930, especially if the events in those months bore a close resemblance to what had happened earlier" (p. 24). Our interpretation is that banks realized they were in crisis conditions but did not go to the discount window because of the stigma.

By the end of 1930 there were bank failures as there had been in the 1920s, but the consensus view is that these were not significant in turning a recession into a depression. The significant runs came later. White (1984): ". . . the [1930] banking crisis did not mark the change from a recession to a depression. These results corroborate other recent studies that . . . find that the crisis [in 1930] was primarily regional in nature and had little impact on the national economy" (p. 120); and "The importance of the banking crisis in 1930 in the history of the Great Depression appears to be somewhat inflated. The increased number of bank failures did not represent a radical departure from the 1920s. The characteristics of the banks that failed in 1930 were very similar to those failed in earlier years" (p. 138). Also, Calomiris (1993): " . . .the first banking crisis of 1930, may have been primarily of local importance and seems to have had little effect on national economic activity" (p. 65).

While the bank failures in late 1930 were limited, banks did start to fail later during all out panics in 1931 and 1933, as described by Friedman and Schwartz (1971), for example.

5 Conclusion

The first year of the Great Depression appears to be an anomaly. Industrial output dropped by over 20% but there were no immediate signs of banking troubles evident during prior crises. In this paper we show that the banks' decision to significantly cut back on lending and invest instead in safe assets contributed to the drop in output. Consistent with the results of Boyd et al. (2009), we find large declines in loan growth preceding the start of the crisis. As these authors show, loan growth predicts the start dates of modern financial crises that are based on the date when the government or central bank responds.

This observation establishes a common thread through seemingly idiosyncratic modern financial crises. At the start of the Great Depression, depositors did not run to banks, perhaps having faith in the discount window which was used to great effect in the recession of 1920-21. In modern crises more generally, depositors wait, perhaps due to explicit or implicit deposit insurance. Therefore, the economy can be in crisis conditions without any apparent signals of distress.

Our results are complementary to Romer (1990) and Olney (1999). Romer (1990) argue that the stock market crash of 1929 created "uncertainty" which caused a reduction in household purchases. Similarly, the explanation in Olney (1999) centers on households cutting expenditures. These cuts were primarily not due to banks reducing consumer loans as banks did not make significant amounts of consumer loans until later (see Clark (1931).) With respect to Romer (1990), we offer a possible interpretation of this "uncertainty." Households observed the leading indicator shock and knew that they would have panicked prior to the Fed—but there was still uncertainty about whether the discount window would work. Banks, however, responded to the leading indicator by cutting lending and investing in safe assets.

6 Tables

Table 1: Aggregate Balance Sheet 1929-1933.

	Level			Level Change			Percentage Change		
Description	1929	1931	1933	1931-29	1933-31	1933-29	1931-29	1933-31	1933-29
Total Loans	41,934	35,415	22,537	-6,518	-12,878	-19,397	-15.5	-36.4	-46.3
Loans For Securities	13,844	10,998	5,655	-2,846	-5,343	-8,189	-20.6	-48.6	-59.2
Loans For Real Estate	11,796	11,626	9,954	-170	-1,672	-1,842	-1.4	-14.4	-15.6
All Other Loans	16,294	12,791	6,928	-3,503	-5,863	-9,366	-21.5	-45.8	-57.5
Total Investments	17,305	19,973	18,125	2,669	-1,849	820	15.4	-9.3	4.7
Treasuries	5,477	6,602	8,229	1,125	1,627	2,752	20.5	24.7	50.3
Munis	2,860	3,472	3,178	612	-294	318	21.4	-8.5	11.1
Other Investment Securities	8,968	9,900	6,717	932	-3,182	-2,251	10.4	-32.1	-25.1
Total Cash	9,223	10,405	7,793	1,182	-2,612	-1,429	12.8	-25.1	-15.5
Cash In Collection	2,397	2,531	1,510	134	-1,021	-886	5.6	-40.3	-37.0
Currency Coin	770	851	641	81	-210	-129	10.5	-24.6	-16.7
Bankers Balances	6,056	7,023	5,642	967	-1,381	-414	16.0	-19.7	-6.8
Safe	15,162	17,947	17,690	2,785	-257	2,528	18.4	-1.4	16.7
Other Assets	3,844	4,270	3,104	426	-1,166	-740	11.1	-27.3	-19.2
Total Assets	72,315	70,070	51,359	-2,245	-18,711	-20,956	-3.1	-26.7	-29.0
Total Deposits	58,269	57,187	41,684	-1,082	-15,503	-16,585	-1.9	-27.1	-28.5
Capital	3,883	3,748	2,943	-135	-806	-941	-3.5	-21.5	-24.2
Surplus And Other Capital Acc.	5,867	6,123	4,445	256	-1,678	-1,422	4.4	-27.4	-24.2
Safeshare Times 100	21	26	34	5	9	13	22.2	34.5	64.3
Suspended Deposits	231	1,665	2,471	1,434	806	2,240	621.9	48.4	971.4

Table 2: WLS Regressions. 1929-1931. Sample consists of 387 state-industry observations. Left hand side variable measured as a log change from 1929 to 1931.

A. Value Added—measured by wages.

CX VW X Δ Bank Ta	0.615***			
	(5.95)			
CX VW X Δ Bank Loans		0.568***		
		(5.57)		
CX VW X Δ Bank Safeshare			-1.565**	
			(-3.02)	
CX VW X Δ Bank Deposits				0.618***
				(6.21)
Constant	0.376	0.649*	0.00553	0.249
	(1.74)	(2.50)	(0.02)	(1.25)
Observations	387	387	387	387
R^2	0.712	0.708	0.689	0.714

B. Gross Output—measured by value of production.

CX VW X Δ Bank Ta	0.508***			
	(4.07)			
CX VW X Δ Bank Loans		0.349**		
		(2.82)		
CX VW X Δ Bank Safeshare			-0.302	
			(-0.49)	
CX VW X Δ Bank Deposits				0.507***
				(4.22)
Constant	0.184	0.170	-0.431	0.0743
	(0.70)	(0.54)	(-1.56)	(0.31)
Observations	387	387	387	387
R^2	0.509	0.496	0.484	0.511

C. Employment.

CX VW X Δ Bank Ta	0.502***			
	(5.37)			
CX VW X Δ Bank Loans		0.438***		
		(4.74)		
CX VW X Δ Bank Safeshare			-1.128*	
			(-2.42)	
CX VW X Δ Bank Deposits				0.502***
				(5.58)
Constant	0.501*	0.673**	0.153	0.395*
	(2.56)	(2.86)	(0.73)	(2.19)
Observations	387	387	387	387
R^2	0.665	0.659	0.641	0.667

Table 3: WLS Regressions. 1919-1921. Sample consists of 387 state-industry observations. Left hand side variable measured as a log change from 1929 to 1931.

A. Value Added—measured by wages.				
CX VW X Δ Bank Ta	0.143			
	(0.94)			
CX VW X Δ Bank Loans		0.0338		
		(0.31)		
CX VW X Δ Bank Safeshare			0.292	
			(0.95)	
CX VW X Δ Bank Deposits				0.138
				(1.05)
Constant	-0.222	-0.220	-0.0274	-0.151
	(-1.27)	(-1.03)	(-0.12)	(-0.88)
Observations	395	395	395	395
R^2	0.588	0.587	0.588	0.589
B. Gross Output—measured by value of production.				
CX VW X Δ Bank Ta	-0.0751			
	(-0.52)			
CX VW X Δ Bank Loans		-0.157		
		(-1.55)		
CX VW X Δ Bank Safeshare			0.597*	
			(2.05)	
CX VW X Δ Bank Deposits				-0.0135
				(-0.11)
Constant	-0.430*	-0.263	-0.142	-0.456**
	(-2.59)	(-1.31)	(-0.65)	(-2.80)
Observations	394	394	394	394
R^2	0.597	0.599	0.601	0.596
C. Employment.				
CX VW X Δ Bank Ta	0.0174			
	(0.13)			
CX VW X Δ Bank Loans		0.0253		
		(0.27)		
CX VW X Δ Bank Safeshare			-0.126	
			(-0.47)	
CX VW X Δ Bank Deposits				-0.0750
				(-0.66)
Constant	-0.273	-0.298	-0.333	-0.284
	(-1.80)	(-1.62)	(-1.65)	(-1.91)
Observations	395	395	395	395
R^2	0.458	0.458	0.458	0.459

Table 4: Interpretation of Coefficients. SD is the sample standard deviation of output measure, or the bank balance sheet measure. Aggregate Drop refers to the change in the total balance sheet item, as reported in Table 1. Implied Aggregate measures the implied drop in output assuming an industry with median dependence on bank finance (CX=5) facing a banking sector that mirrors the change on the national level.

	Coefficient	SD	Aggregate Drop	Implied Aggregate
Wages		0.30		
Total Assets	0.615	0.11	-3.10%	-9.5%
Loans	0.568	0.15	-15.50%	-44.0%
Safeshare	-1.565	0.03	4.65%	-36.4%
Deposits	0.618	0.11	-1.90%	-5.9%
Output		0.34		
Total Assets	0.508	0.11	-3.10%	-7.9%
Loans	0.349	0.15	-15.50%	-27.0%
Safeshare	-0.302	0.03	4.65%	-7.0%
Deposits	0.507	0.11	-1.90%	-4.8%
Employment		0.30		
Total Assets	0.502	0.11	-3.10%	-7.8%
Loans	0.438	0.15	-15.50%	-33.9%
Safeshare	-1.128	0.03	4.65%	-26.2%
Deposits	0.502	0.11	-1.90%	-4.8%

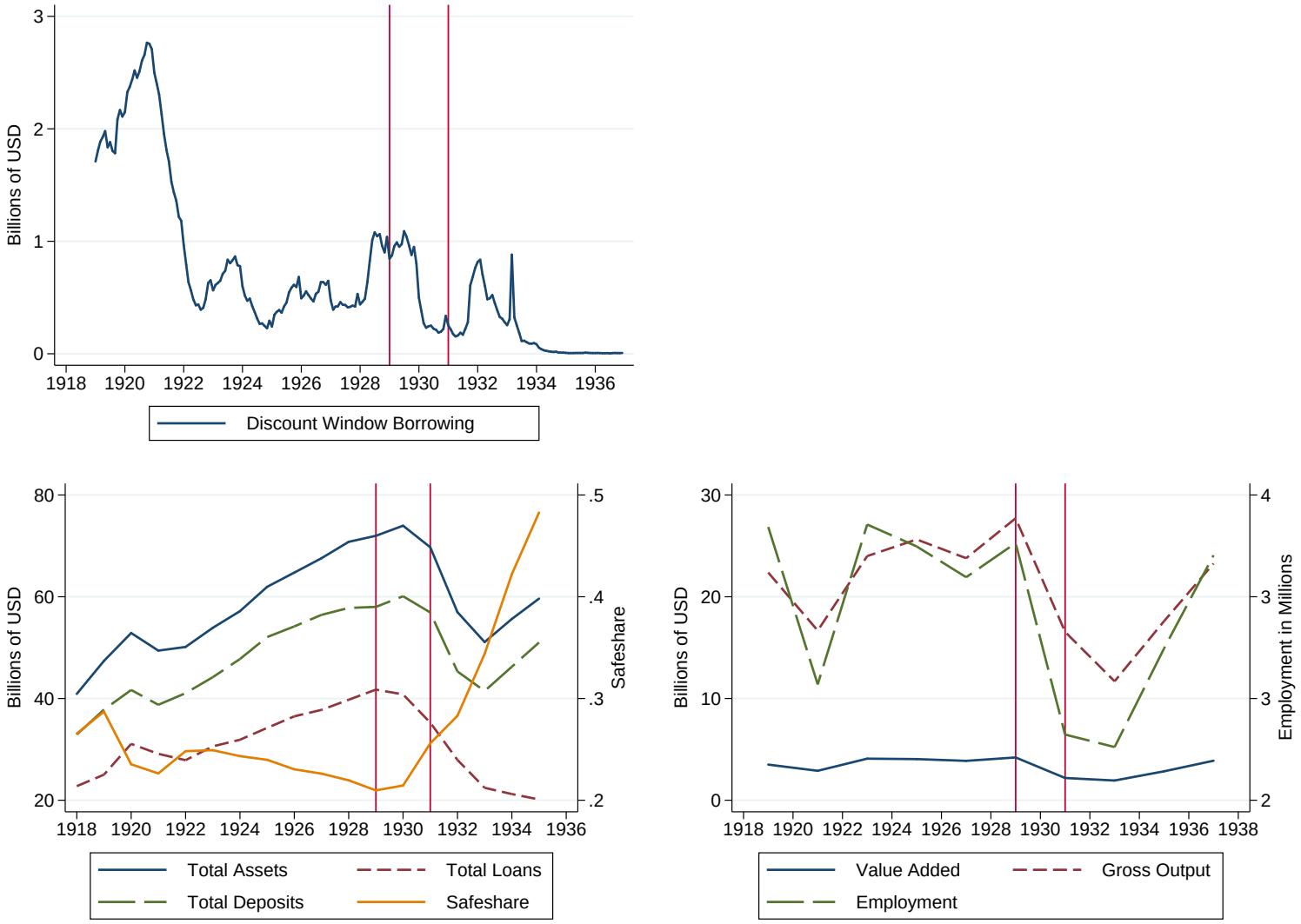

Figure 1: Total Borrowings of Depository Institutions from the Federal Reserve. Bank Balance Sheet Variables. State Output Measures.

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1930: First Modern Crisis. Online Appendix

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1 Introduction

In this Online Appendix we explain the mapping of Census industry categories to Ken French's industry categories, and show summary statistics of the industry finance dependence measures. We then provide a number of robustness checks to the regression evidence presented in the main text. We show regressions with controls for bank suspensions, regressions with right-hand-side variables calculated from 1929-1930 only, and OLS and IV versions of the main regressions.

2 Industry Mapping

The Census of Manufactures contains state-level data on the output and employment of 21 industries. In order to calculate industry finance dependence we map individual companies from Moody's manuals to the Census industries. We proceed as follows:

1. Start with Moody's individual firm-years where each firm has an associated permno. 2. Use company permno to match SIC codes provided by CRSP. 3. Match SIC codes to Ken French industries. 4. Match French industries to Census industries.

With the industry match to Census data, we can collapse firm-level finance dependence measures into an industry-level quantity, like described in Section 2 of the main text.

Table 1 shows the 15 Census industries for which we are able to construct a finance dependence measure, and corresponding distinct firms and firm-years in the sample. The Table also shows the number of states for which we have output data in that category. For comparison, CS VW constructs the same dependence measure but instead uses contemporary Compustat data.

Table 1: Firm-level Industry Finance Dependence Measure.

Industry Description	# States 1931	# Company-years	# Companies	CX VW	CS VW
Boots	20	38	8	4.69	4.21
Bread	48	47	12	5.84	4.64
Canning	34	29	8	4.75	4.49
Chemicals	20	76	16	5.66	5.38
Cigars, Cigarettes	21	52	13	5.84	3.55
Confectionary	38	50	10	6.36	4.47
Cotton Goods	22	57	16	6.35	5.62
Furniture	37	6	2	4.56	5.00
Glass	10	8	2	6.52	5.58
Lumber	41	5	1	7.01	5.66
Meat Packing	35	10	2	6.31	5.16
Motor vehicles	8	125	31	4.32	6.22
Petroleum refining	15	156	41	4.75	5.63
Printing, Newspapers	36	10	3	3.47	5.03
Rubber Tires, tubes	2	42	10	5.92	6.03
Total 15 industries	387	711	175		

3 Robustness Checks

Table 2: WLS Regressions 1929-1931. Controlling for amount of deposits in suspended banks.

A. Value Added—measured by wages.

CX VW X Δ Bank Ta	0.673***			
	(4.19)			
CX VW X Δ Bank Loans		0.497***		
		(3.73)		
CX VW X Δ Bank Safeshare			-1.524**	
			(-3.01)	
CX VW X Δ Bank Deposits				0.668***
				(4.54)
CX VW X Δ Bank Suspended	0.191	-0.282	-1.087***	0.177
	(0.47)	(-0.82)	(-4.12)	(0.46)
Constant	0.405	0.586*	0.291	0.259
	(1.80)	(2.16)	(1.23)	(1.29)
Observations	387	387	387	387
R^2	0.712	0.709	0.705	0.715

B. Gross Output—measured by value of production.

CX VW X Δ Bank Ta	0.621**			
	(3.21)			
CX VW X Δ Bank Loans		0.244		
		(1.51)		
CX VW X Δ Bank Safeshare			-0.271	
			(-0.44)	
CX VW X Δ Bank Deposits				0.599***
				(3.37)
CX VW X Δ Bank Suspended	0.373	-0.418	-0.818*	0.327
	(0.77)	(-1.01)	(-2.57)	(0.71)
Constant	0.240	0.0755	-0.216	0.0939
	(0.88)	(0.23)	(-0.75)	(0.39)
Observations	387	387	387	387
R^2	0.510	0.498	0.495	0.512

C. Employment.

CX VW X Δ Bank Ta	0.593***			
	(4.09)			
CX VW X Δ Bank Loans		0.388**		
		(3.21)		
CX VW X Δ Bank Safeshare			-1.097*	
			(-2.39)	
CX VW X Δ Bank Deposits				0.578***
				(4.35)
CX VW X Δ Bank Suspended	0.300	-0.199	-0.828***	0.268
	(0.82)	(-0.64)	(-3.47)	(0.77)
Constant	0.546**	0.629*	0.370	0.411*
	(2.69)	(2.56)	(1.72)	(2.27)
Observations	387	387	387	387
R^2	0.665	0.659	0.654	0.668

Table 3: WLS Regressions 1929-1931. Right hand side variables measured from 1929-1930.

A. Value Added—measured by wages.

CX VW X Δ Bank Ta	0.646***			
	(4.90)			
CX VW X Δ Bank Loans		0.619***		
		(3.69)		
CX VW X Δ Bank Safeshare			-0.609	
			(-0.67)	
CX VW X Δ Bank Deposits				0.652***
				(5.10)
Constant	0.0117	0.116	-0.397*	-0.0663
	(0.07)	(0.54)	(-2.25)	(-0.40)
Observations	387	387	387	387
R^2	0.717	0.709	0.697	0.719

B. Gross Output—measured by value of production.

CX VW X Δ Bank Ta	0.469**			
	(3.04)			
CX VW X Δ Bank Loans		0.378		
		(1.94)		
CX VW X Δ Bank Safeshare			-0.654	
			(-0.63)	
CX VW X Δ Bank Deposits				0.473**
				(3.15)
Constant	-0.184	-0.175	-0.460*	-0.242
	(-0.90)	(-0.70)	(-2.28)	(-1.25)
Observations	387	387	387	387
R^2	0.529	0.521	0.516	0.530

C. Employment.

CX VW X Δ Bank Ta	0.459***			
	(4.19)			
CX VW X Δ Bank Loans		0.448**		
		(3.24)		
CX VW X Δ Bank Safeshare			-0.754	
			(-1.01)	
CX VW X Δ Bank Deposits				0.466***
				(4.39)
Constant	0.151	0.234	-0.107	0.0979
	(1.04)	(1.32)	(-0.74)	(0.72)
Observations	387	387	387	387
R^2	0.691	0.684	0.675	0.692

Table 4: OLS Regressions. 1929-1931.

A. Value Added—measured by wages.				
CX VW X Δ Bank Ta	0.224*			
	(2.09)			
CX VW X Δ Bank Loans		0.141		
		(1.83)		
CX VW X Δ Bank Safeshare			-0.560	
			(-1.47)	
CX VW X Δ Bank Deposits				0.259*
				(2.51)
Constant	-0.223	-0.245	-0.345*	-0.231
	(-1.27)	(-1.35)	(-2.19)	(-1.51)
Observations	387	387	387	387
R^2	0.629	0.628	0.627	0.632
B. Gross Output—measured by value of production.				
CX VW X Δ Bank Ta	0.152			
	(1.29)			
CX VW X Δ Bank Loans		0.0623		
		(0.73)		
CX VW X Δ Bank Safeshare			-0.0830	
			(-0.20)	
CX VW X Δ Bank Deposits				0.187
				(1.64)
Constant	-0.363	-0.444*	-0.541**	-0.355*
	(-1.88)	(-2.21)	(-3.12)	(-2.10)
Observations	387	387	387	387
R^2	0.510	0.508	0.507	0.511
C. Employment.				
CX VW X Δ Bank Ta	0.0967			
	(0.96)			
CX VW X Δ Bank Loans		0.0626		
		(0.86)		
CX VW X Δ Bank Safeshare			-0.501	
			(-1.41)	
CX VW X Δ Bank Deposits				0.132
				(1.36)
Constant	-0.143	-0.149	-0.112	-0.123
	(-0.87)	(-0.87)	(-0.76)	(-0.85)
Observations	387	387	387	387
R^2	0.547	0.546	0.548	0.548

3.1 IV Regressions

In the IV specifications DEP_i x Bank_s is instrumented by two variables:

1. Percentage of state's bank offices that belong to branch banks in 1920 x DEP_i.
2. Growth of farm land value in 1910s x DEP_i.

Note that interaction terms are instrumented with the corresponding interactions. More information on the construction of these instruments is available in Mladjan (2016).

Table 5: IV Regressions. 1929-1931.

A. Value Added—measured by wages.				
CX VW X Δ Bank Ta	0.543**			
	(2.88)			
CX VW X Δ Bank Loans		0.572**		
		(2.95)		
CX VW X Δ Bank Safeshare			-10.55	
			(-1.69)	
CX VW X Δ Bank Deposits				0.620**
				(3.21)
Constant	0.206	0.608	2.854	0.178
	(0.76)	(1.54)	(1.42)	(0.75)
Observations	387	387	387	387
R^2	0.619	0.592	-0.170	0.618
B. Gross Output—measured by value of production.				
CX VW X Δ Bank Ta	0.637**			
	(3.03)			
CX VW X Δ Bank Loans		0.687**		
		(3.11)		
CX VW X Δ Bank Safeshare			-12.53	
			(-1.67)	
CX VW X Δ Bank Deposits				0.763***
				(3.51)
Constant	0.289	0.793	3.444	0.296
	(0.96)	(1.76)	(1.43)	(1.11)
Observations	387	387	387	387
R^2	0.484	0.426	-0.838	0.473
C. Employment.				
CX VW X Δ Bank Ta	0.388*			
	(2.18)			
CX VW X Δ Bank Loans		0.421*		
		(2.32)		
CX VW X Δ Bank Safeshare			-7.654	
			(-1.55)	
CX VW X Δ Bank Deposits				0.470**
				(2.58)
Constant	0.248	0.560	2.177	0.259
	(0.98)	(1.52)	(1.37)	(1.16)
Observations	387	387	387	387
R^2	0.535	0.512	-0.014	0.531

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