# Accelerating into the Abyss: Financial Dependence and the Great Depression*

Mrdjan M. Mladjan†

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**Abstract**

My paper provides empirical support for the importance of financial distress in the propagation of the Great Depression. Even those in agreement are not unanimous in the mechanisms they propose. Friedman and Schwartz (1963) argue that bank failures caused money supply reductions which in turn depressed economic activity, while Bernanke (1983) suggests that bank failures raised the cost of credit intermediation. The empirical support for both interpretations has nevertheless been scant. Cole and Ohanian (1999, 2000) in turn conclude that bank failures could not have aggravated the Depression. My paper examines the mechanism by which financial distress affected the "real economy". I compare at the state level how industries with different needs for outside financing performed in the face of bank failures. Two measures, the external dependence indicator of Rajan and Zingales (1998) and the inverse interest cover, confirm the sensitivity of financially dependent industries to bank failures. I instrument bank failures with predetermined vulnerabilities of the banking system in each state. The results demonstrate that financial distress played an important role in aggravating the Great Depression.

*JEL:* E32, G21, N22, N62

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†Mrdjan M. Mladjan: Universitat Pompeu Fabra - Faculty of Economic and Business Sciences, office 20.214, Ramon Trias Fargas 25-27, 08005 Barcelona, Spain. mrdjan.mladjan@upf.edu

Did bank failures turn a garden-variety downturn into the Great Depression? Friedman and Schwartz (1963) see the banking panics as the principal propagation mechanism of the Depression. They argue the failed banks reduced the money supply which in turn depressed economic activity. Bernanke (1983) instead gives importance to the loss of information capital as a result of bank failures. Romer's (1993) survey of the Great Depression follows Bernanke and Friedman-Schwartz; it credits the bank failures of late 1930 with transforming a recession into a severe depression. The limitation of all this work is in following a post hoc, ergo propter hoc approach which might not persuade the skeptic.

The importance of bank failures in the Great Depression has recently been challenged. Cole and Ohanian (1999, 2000) conclude that failures could not have contributed much to the severity of the Depression because deposits overall declined much less than output. They also find no correlation in the cross-section of US states between changes in personal income and the percentage of deposits in suspended banks. In a similar vein, Chari, Kehoe, and McGrattan (2003) argue that financial distress can only account for a modest fraction of output decline during the Great Depression. Instead, they emphasize the relevance of efficiency and labor wedges.

This paper argues that bank failures and financial distress were important in deepening the Great Depression. It focuses on the mechanism by which they affected the real economy. I test the joint prediction of both Friedman-Schwartz and Bernanke that bank failures mattered by reducing lending to producers. As a result of both mechanisms, financially dependent industries ought to be the most affected. Using a panel of state-industry observations from the interwar years, I establish a two-trait pattern that agrees with this prediction. I find that bank failures are associated to output declines and that output declines of the financially dependent industries are more severe. Two indicators of financial dependence confirm the relationship: the external dependence of Rajan and Zingales (1998) (which measures technology-driven investment needs) and the inverse interest cover (which measures short term financing needs at the onset of the Depression).

The paper further demonstrates that bank failures caused output declines. I use predetermined measures of vulnerability of the banking system in each state as instruments of bank failures. The percentage of bank offices that belong to branch banks in the year 1920 serves as one of the instruments. States with better risk sharing within the banking system were more resilient to failures. The change in farm value over the 1910s serves as the other predictor of bank failures. Farmers were more leveraged in those states that expanded food production to meet the temporary European demand during WWI. As a consequence, the local banking systems were less stable after the war. My results are economically significant. I find that one percent of suspended deposits can reduce output growth by several percent. The reduction in growth furthermore varies across industries - the financially dependent are affected more.

My work provides empirical support for the importance of bank failures in the whole interwar period. The findings are also consistent with attributing the bank failures of late 1930 and of 1931 a causal role in transforming and deepening the Depression. I do not distinguish between the monetary and the non-monetary effects of bank failures. Instead, I give evidence they jointly caused output declines by reducing credit to producers. My estimates are not based on a structural model that describes the interaction between financial and real sectors. This is a regression model estimate of the causal effect of financial distress as proxied by bank failures. The paper does allow for the possibility that non-financial factors were also important in the Great Depression. My sample is limited to 19 among the 31 largest manufacturing industries, as ranked by the number of wage earners in 1929. Nevertheless, the sampled industries produced 40 percent of the US manufacturing output in 1929 (U.S. Bureau of the Census, 1929).

The paper builds upon two classic ones: Bernanke (1983) and Rajan and Zingales (1998). I estimate a regression model related to Bernanke (1983) as the second stage. Like in that work, bank failures are used to predict industrial output growth over the whole interwar period. This helps disentangle the effect of failures from that of a multitude of synchronous shocks that abounded in the Great Depression. Bernanke uses a time-series of national industrial output as the dependent variable. My data introduce variation across two more dimensions: states and industries. This is good for two reasons. Firstly, variation across states multiplies the number of informative observations that correlate bank failures and output growth. Secondly, variation across industries allows the use of industry-specific financial dependence to establish the link between bank failures and growth. This is in line with Rajan and Zingales (1998). A pattern of higher output declines of the financially dependent industries in the face of bank failures is telling - the interaction of banks and firms must matter.

Banks could nonetheless be failing when bank-dependent industries struggle; the OLS analysis leaves the concern of reverse causality. The careful narrative description of individual states' experiences, given in Friedman and Schwartz (1963) and Wicker (1996), is helpful whenever it corroborates a causal effect of bank failures on output. It is however hard to generalize across states and over the whole period. For this reason, the paper further uses instrumental variables to ascertain causality. Through its first stage regression, my work belongs to the literature studying the causes of bank failures. The literature includes Calomiris (1989), Alston et al. (1994), Wheelock (1995), and the more recent papers of Carlson and Mitchener (2005), and Richardson (2007). The paper follows Temin (1989) in designing the instruments by giving importance to international disequilibria created by the First World War. It acknowledges that the temporary European wartime demand for food led to fragile banking conditions in a number of US states.

I proceed as follows. The next section places US interwar bank failures in historical context. Section 2 describes the data on industrial growth, bank failures, determinants of bank failures, and measures of financial dependence. In Section 3 I explain the method used, present the results, and discuss my findings. Section 4 is a robustness check. It examines the relationship between bank failures and output growth only in the Great Depression. The final section concludes.

# 1 Historical Background and Context

This section describes the US interwar bank failures - their prevalence and their likely determinants. There is variation both in the intensity and in the geographic distribution of failures between the twenties and the Great Depression. In the twenties, bank failures were widespread in rural areas. With the onset of the Depression, the failures became more widespread and more intense. Those of the fall of 1930 were frequently credited with turning a recession into the Great Depression, while the failures of 1931 were blamed for deepening it. The suspensions of 1933 were unique in character. They were followed by resolute action of the federal government and produced little uncertainty. The causes of failures also varied between the two periods. Some shocks to banks were local (e.g. falling rural income) yet others were nationwide (e.g. Britain leaving gold in 1931). But, some determinants of failures, such as state banking structure and the conditions in the market for farmland, were common to both periods.

## 1.1 The Prevalence of Bank Failures

The interwar years can be divided into three periods by the prevalence of bank failures. These are the twenties, the Great Depression, and the years that followed it. Figure 1 shows the percentage of suspended deposits of the US commercial banks per year; the three periods are evident. They are also evident numerically. Descriptive statistics of bank failures by period are presented in Panel B of Table 1. The twenties had a large number of failures in rural areas (Alston et al. 1994) - one to four percent of banks were suspended each year. Transition to Depression corresponded to a roughly five-fold increase in suspension rates. Friedman and Schwartz identify four banking crises in the Great Depression: the first that occurred in late 1930, two that marked 1931, and a three-week nationwide crisis that ended with the "bank holiday" of March 1933. The years following the Great Depression were a much calmer period; less than 1% of banks failed in any of the years. The guarantees of the newly established Federal Deposit Insurance Corporation, and a decade of widespread failures too (Walter, 2005), consolidated the banking system.

**[Figure 1]**
**[Table 1]**

Banking distress is frequently regarded as a key factor that deepened the Depression. Friedman and Schwartz attributed particular importance to the first acceleration of suspensions from November 1930 to January 1931. They argued it turned a bad recession into the Great Depression. The failures of two large banks characterized the first crisis. In November 1930 the Tennessee investment banking house Caldwell and Company failed. Through its network of business partners, the financial distress spread into the neighboring states. The December 1930 failure of the New York based Bank of United States created negative expectations nationwide, not the least because of its name. The failures soon subsided, but the measures of hoarding suggest depositor confidence was never restored to pre-crisis levels; the system remained vulnerable to shocks that quickly followed. The second crisis lasted from April to August 1931. It consisted of a series of regional crises and urban panics (Wicker, 1996), the most prominent among which were in Toledo, Ohio and in Chicago, Illinois. The Chicago banks were particularly vulnerable to declining real estate values. They held many mortgages in their portfolios and had sold real estate mortgage bonds with a repurchase provision. The third crisis of September and October 1931 followed the second one without interruption. It was more intense, nationwide, and triggered by Britain leaving gold (Wicker, 1996). What appears to have stopped it was the establishment of the National Credit Corporation in its midst. Overall, the failures of 1931 were surpassed by intensity only by those of 1933 (11 percent of commercial banks, with almost 4 percent of deposits, were suspended in 1931). The National Credit Corporation, soon renamed Reconstruction Finance Corporation, provided a boost to confidence and loans to troubled banks. It could have been decisive for 1932 to pass with less financial distress than 1931, but the rash of failures continued.

What followed in 1933 was an outlier among all the interwar banking crises. It was the worst crisis with the best aftermath. On the one hand, this was the only time state banking moratoria and withdrawal restrictions were widely used. On the other hand, federal government itself guaranteed the soundness of each of the banks reopened in mid March. During the buildup of the crisis, the Federal Reserve and the Reconstruction Finance Corporation failed to agree on who is to act as the lender of last resort for a group of Michigan banks in distress (Wicker, 1996). This led the Governor of Michigan to declare a statewide banking holiday on February 14. Depositors from Michigan then attempted to obtain funds from any other state; the concerned residents of the contiguous states followed. This led to a cascade of more than thirty statewide moratoria. Payment suspensions in most parts of the country were already an accomplished fact by the time the new president Roosevelt declared a national "bank holiday" on March 6. One half of the banks with 11 percent of deposits was not allowed to reopen on March 15. There is evidence that the immediate impact of the crisis on industrial production was serious (Wicker, 1996). Nonetheless, the government's guarantee for the reopened banks quickly restored confidence in the banking system. Massive amounts of hoarded currency were redeposited, and the industrial production quickly recovered.

## 1.2 The Reasons of Bank Failures

The onset of the Great Depression creates a clear discontinuity in the prevalence of bank failures over time. It is however disputed whether the causes of failures also changed. Friedman and Schwartz (1963) make a distinction: falling borrower income led to most failures in the twenties while bank runs led to most failures in the Depression. Temin (1976) instead claims that many Depression-era failures were caused by falling agricultural income, and so were most failures in the 1920s. In a similar vein, White (1984) demonstrates that banks failing in the year 1930 had common characteristics with their counterparts from the previous years. The literature thus suggests that the failures from the two periods were not entirely different phenomena. If so, the same instruments could be used to predict them.

A characteristic of the whole interwar period is high incidence of rural bank failures. Figure 2 demonstrates this. The three subplots correspond to periods before, during, and after the Great Depression. The observation points are specific to states and years. The dependent variable is the fraction of failed deposits, while the explanatory variable is the percentage of state population in towns with less than 2500 people (ICPSR, 197?). Two facts are apparent in each subperiod: the majority of failures took place in rural states, and so did the most intense ones.

**[Figure 2]**

One reason rural bank failures were numerous and intense could be rural unit banking; it limits risk sharing within the system. Another reason could be a change brought by the end of the Great War. The American farmers faced an increased demand for their products while the European peasants were fighting. They borrowed to improve and expand their farms; the value of American farmland rose. But when the Europeans returned to their ploughs, the Americans saw their income fall. Meeting mortgage payments suddenly became difficult. The states with the greatest agricultural expansion could consequently expect the gravest bank distress in the interwar years. Banks in these states were particularly vulnerable to any shocks to income. Bad weather leading to poor harvest, for instance, frequently resulted in defaults on loans and bank closings. In general, any national shock propagating across the country would cause more failures in states with vulnerable banking systems. Both poorer risk sharing within the system (in states with less branch banking) and more leveraged clients (in states where agricultural expansion had been the greatest) make a banking system vulnerable. We shall examine these two indicators of banking system fragility shortly.

# 2 Data

This section explains my dataset. The dependent variable of the model is the growth rate of manufacturing output. It varies across states, periods and industries. The explanatory variables are the industry-specific measures of financial dependence and bank suspensions specific to state and period. I also use two state-variant instruments of bank failures. These are the percentage of offices of branch banks in the year 1920 and the changes in farm value over the 1910s.

## 2.1 Manufacturing Growth Rates

The dependent variable is the biannual growth rate of output specific to state and industry. A unit of observation is, for example, growth of glass output in Arizona between 1923 and 1925. The biannual U.S. Censuses of Manufactures served as the original source. I use a modified version of the dataset used in Rosenbloom and Sundstrom (1999). Their data include twenty one out of thirty one largest employers among the manufacturing industries, as ranked in 1929. I exclude two of these to make the sample more compact: rayon (because it contains only a handful of observations), and cigars (because it is an outlier by external dependence). I also merge lumber industry and planning mills industry since I map them to a single score of external dependence. The changes result in a dataset of eighteen industries. Their growth rates are obtained for 7 biannual periods between 1921 and 1937. These are 1921-1923, 1923-1925, 1925-1927, 1927-1929, 1929-1931, 1933-1935 and 1935-1937. The 1931-1933 period (covering 1932 and 1933) is excluded because of the distinct character of the bank failures in 1933; the rationale for exclusion is explained in the subsection 2.3. The values of output behind the growth rates were first deflated using the Consumer Price Index for All Urban Consumers (All Items) (U.S. Bureau of Labor Statistics, 2010). Panel A of Table 1 summarizes the growth rates of output.

My sample covers a lion's share of US interwar production. Few but large, the sampled industries contributed with 40 percent to total manufacturing output in 1929 (U.S. Bureau of the Census, 1929). Manufacturing accounted for 45 percent of the gross income of American establishments filing tax returns in the same year (U.S. Internal Revenue Service, 1929). My data thus account for 15-20 percent of US corporate income at the onset of the Great Depression. The sample is further representative of the large manufacturing industries. Rosenbloom and Sundstrom chose those of the biggest industries whose definition in the successive censuses did not undergo major changes. The changes in classification are not expected to be related to differences in growth across industries.

## 2.2 Measures of Financial Dependence

My model emphasizes financial dependence as a predictor of industrial output growth; financially dependent should contract more in the presence of bank failures. I use two measures of financial dependence: external dependence and inverse interest cover. External dependence is based on modern data whereas inverse interest cover is based on data from the twenties. The two measures vary across industries for different reasons. Both should nevertheless predict the industry-level need for external financing. In recessions and financial crises, they also ought to proxy for the premium required on external financing.

External dependence was devised by Rajan and Zingales (1998). It is equal to the percentage of capital expenditure that cannot be financed by the cash flow from operations. Rajan and Zingales argue that external dependence is determined by the industry's technology. The initial project scale, gestation period, cash harvest period, and the requirement for continuing investment are all technology-driven; this results in differences in dependence across industries. Because it measures dependence for investment purposes, external dependence is well suited for periods of expansion. Such were the twenties and the years following the Depression. The indicator must also matter in the Great Depression to the extent investment is undertaken in recessions. But, significant productive capacities were idle and investment was not a priority at the time.

I argue that external dependence ought to nevertheless be relevant in the Great Depression, too. It would matter by determining how leveraged an industry is at the onset of the Depression because the externally dependent must have invested and borrowed more in the 1920s. The debt burden would result in two difficulties in the Depression: a higher need to borrow and a higher premium on external financing. Leveraged industries require a part of their earnings to service the existing debt. Less internal financing is then available for any other necessity. Investment is indeed not a pressing concern in recessions. But, an industry in debt would have to borrow to finance working capital and debt rollover. The short maturities of the interwar loans render rollover even harder to avoid. The interwar commercial banks specialized in short term loans by "law and tradition" (White, 2000); their maturity was usually six months. Debt created prior to the Great Depression would hence typically be due during the crisis. In addition, the leveraged would not only borrow more but also pay more for the new loans. Those in debt in a recession would be perceived as risky by the creditors. My reasoning is in line with Caggese (2007): prior investment that turns out to be irreversible burdens a company during crisis.

Standard and Poor's Compustat data are used to construct the external dependence indicator. The sample covers US publicly traded companies in the 1950-2007 period. I calculate the measure as the industry average of firm-level data, following the methodology of Rajan and Zingales (1998). The 1929 Census of Manufactures industries were first mapped into 1987 Standard Industry Classification industries. This matched my data on output growth to the Compustat sample. Panel A of Table 2 summarizes the resulting indicator.

**[Table 2]**

The Compustat sample allows us to capture the technology-driven demand for external financing. Rajan and Zingales reason that in modern times the supply of finance for large US companies is almost unconstrained; their use of external finance directly relates to their demand. The actual level of debt across industries depends however on both the demand for credit and the availability of credit. The indebtedness would thus be changing over the interwar years with the aggregate availability of loans. Size, age and other firm characteristics would also affect the supply constraint. But, the inherent need for external financing determined by technology would remain unaltered. By resulting from a sample of large companies in recent times, our indicator of external dependence ought to capture this need.

That I use data from the second half of the twentieth century does leave one concern: the pattern of external dependence across industries could have changed since the interwar years. But, most sampled industries were already established in the 1920s. The ranking by dependence of, for instance, meat packing, petroleum refining and printing should have remained stable. Note also that applying the US indicator of modern external dependence to the interwar period resembles Rajan and Zingales (1998). They apply it across countries, while the modern companies around the world resemble their counterparts from the US past (by the technology they use and the financing constraints they face).

The timing concern does not apply to our other dependence indicator. The interest cover ratio is constructed using data from the twenties. It equals the earnings before interest and taxes divided by interest expense in that year. Comparing earnings to interest payments, it is an indicator of pressing current needs. Interest cover is not necessarily driven by technology; it could differ across industries for a myriad of historical reasons. What matters is that it measures the actual indebtedness at the onset of the Great Depression. When less earnings remain after interest payments, a firm is more likely to borrow. It would borrow to finance investment in expansions or working capital and debt rollover in recessions. In addition, low interest cover could raise concerns of potential bankruptcy among the creditors; poorly covered firms would also pay a higher premium on external finance.

While my first indicator of external dependence should be as stable over time as the technology that drives it, the interest cover is not considered an inherent industry property. I thus construct the interest cover as the seven-year industry group average from the period 1922-1928 and use it in regressions that start with the year 1929. This captures the actual state of indebtedness at a key moment – the onset of the Great Depression. Averaging over seven years ought to add stability to the indicator and enable its use over the several years that followed. The shorter regression period, compared to regressions using external dependence, lessens the concern that interest cover could have changed greatly over the sample. The yearly Statistics of Income (U.S. Internal Revenue Service, 1922-1928) served as the source. Our eighteen industries were matched to the ten Statistics of Income industry groups, resulting in an indicator with ten distinct values. Interest cover (an inverse measure of financial dependence) was inverted to be comparable with the external dependence indicator. Panel B of Table 2 lists the values of the inverse interest cover and the corresponding industry groups.

Finally, both measures of financial dependence were transformed to make the results convenient for interpretation. Each indicator's median was set to zero and the maximum to one. Equations (1) and (2) give the linear transformations of both measures. Note that the interest cover was both rescaled and inverted.

$$T(ED) = \frac{ED - ED_{MEDIAN}}{ED_{MAX} - ED_{MEDIAN}} \quad (1)$$

$$T(IC) = \frac{IC_{MEDIAN} - IC}{IC_{MEDIAN} - IC_{MIN}} \quad (2)$$

## 2.3 Bank Failures

Financially dependent industries are expected to grow less when banks fail. I follow much of the literature in using deposits suspended as an indicator of bank failures, and in using suspensions and failures as interchangeable terms. What becomes a failure and what remains a suspension is only known ex post. Depositors of each suspended bank have no immediate access to their funds even if they later recover a part of their deposits. Deposits of all commercial banks[1] are obtained from the Banking and Monetary Statistics 1914-1941 (U.S. Board of Governors of the Federal Reserve System, 1943), while the total deposits of failed banks are sourced from All Bank Statistics 1896-1955 (U.S. Board of Governors of the Federal Reserve System, 1959). The two measures combined give the percentage of deposits in commercial banks suspended. A unit of observation is, for instance, the percentage of deposits in the banks suspended in California in 1928 and 1929.

The suspensions of the March 1933 banking holiday present a challenge for the analysis. On the one hand, this was by far the largest episode of interwar suspensions. On the other hand, they were accompanied by federal government action. This accounts for the absence of panic associated to the preceding failures. I expect the certainty to have made all the difference. Even though the suspended banks were inaccessible, the surviving ones had no reason to constrain lending in an atmosphere of renewed trust. Bernanke (1983) decided to treat the failures of March 1933 differently for their distinct character. He recoded them to 15% of their value, the size of the second worst episode of failures in October 1931.

Because suspensions of 1933 were arguably a unique phenomenon I instead decided to exclude them from the analysis. I expect my test of the role of failures in the Great Depression to still be valid for two reasons. First, Wicker (1996) examines monthly output at the national level and observes that 1933 failures did have real effects. This is in line with my findings for the other failures. They were however short lived - revived trust in the system started the recovery soon after March 1933. Second, three out of four Depression-period banking crises of Friedman and Schwartz occurred in 1930 and 1931; they are included in my sample. It was the banking crisis of the fall of 1930 that was attributed a causal role in turning a run-of-the-mill recession into the Great Depression, and the crisis of 1931 was given a role in worsening the downturn. If the 1930 and 1931 failures had real consequences then bank failures must have deepened the Great Depression.

[1] Commercial banks include all banks other than the mutual savings banks (U.S. Board of Governors of the Federal Reserve System, 1943). In the whole period 1921-1937 there were only 13 failures of mutual savings banks in the whole country, and I exclude them from the analysis. Commercial banks thus include the national banks and two categories of state commercial banks: those that are members of the Federal Reserve System, and those that are not.

## 2.4 Determinants of Bank Failures

Any OLS regression that includes bank failures as predictors of output growth could give coefficients biased by reverse causality - banks could be failing because the output of their clients is declining. To measure the true impact of bank failures on output, the paper uses two state-variant predictors of bank failures as instruments: percentage of branch offices in the year 1920 and the increase in the value of farmland over the 1910s. They are summarized in Panel C of Table 1.

The associated literature documents a number of predictors of financial distress. Alston et al. (1994), Calomiris (1989), Wheelock (1995), Carlson and Mitchener (2005), and Richardson (2007) all examine the consequences of banking structure, regulation, and policy on financial stability. Among the previously used predictors of failures, I found three to have the greatest power: branching indicators, population per bank, and deposits per capita. For simplicity, I chose to use only a branching indicator - the percentage of branch offices in a state[2]. Note that the changes over time in the prevalence of branch banks at the state level could be simultaneously determined with the growth rates of manufacturing industries. To minimize the concern, I use only the value of branching indicator from the year 1920, at the very beginning of the studied period. The data on branch banking are sourced from the Banking and Monetary Statistics 1914-1941 (U.S. Board of Governors of the Federal Reserve System, 1943). They include the number of banks in a state that operate branches and the total number of branches for selected years. Combining branch banking data with the total number of banks, I constructed the state-specific ratio of branch bank offices to the total number of offices in the year 1920. The indicator is shown in equation (3):

$$branching_s = \frac{Nbranchbanks_s + Nbranches_s}{Nallbanks_s + Nbranches_s} \epsilon \; [0,1] \qquad (3)$$

The paper uses another measure of sensitivity of each state's banking system to financial distress - the changes in farm value over the decade of the Great War. I follow Temin (1989) by giving importance to international disequilibria created by WWI in generating the Great Depression. The greater had been the expansion in agricultural land and its value in the 1910s, the more leveraged were the local clients in the years that followed (as outlined in section 2.2). In states with highly leveraged residents, banks were more likely to fail as a result of any state or national economic shock. The source for the data on values of farmland is Pressley and Scofield (2001).

[2]State legislation allowing branching was found to exhibit a high degree of collinearity with the actual branching outcomes I use here.

# 3 Method and Main Results

In this section I first explain the rationale behind the main regression model and its several modifications. The model examines how industrial output growth correlates with bank suspensions conditional on financial dependence. It is used to verify two conjectures: whether bank failures resulted in output declines, and whether the pattern of output decline across industries is consistent with a reduction in credit to producers. After the model, I present the results. The OLS analysis gives the conditional correlations while the instrumental variable analysis attempts to measure the effect of bank failures on output. I interpret the economic significance of all the estimates obtained. I finally compare the OLS and the IV results, evaluating the reasons for their difference.

## 3.1 Method

Two principal mechanisms defend the role of bank failures in propagating the Great Depression. These are Friedman and Schwartz's fall in the money supply and Bernanke's rise in the cost of credit intermediation. I argue that the monetary and the non-monetary theory for the effect of bank failures have one prediction in common – the induced reduction in lending. In the interpretation of Friedman and Schwartz, the monetary contraction and lending reduction are inseparable. Bank failures undermine the trust of depositors in the banking system. This raises the expectation of deposit withdrawals, inducing the surviving banks to constrain lending and build buffer-stock capital. The money supply falls through the deposit multiplication mechanism: bank failures reduce deposits and lending while precautionary declines in lending of the surviving banks reduce the multiplier. In Bernanke's interpretation too, the bank failures reduce lending. When loan officers stay without jobs their former clients use less credit because they can obtain it only at a higher cost; the surviving banks know little of them.

This paper tests the joint prediction of Friedman-Schwartz and Bernanke that bank failures reduced lending to producers; it does not distinguish between the two theories. If declines in lending mattered, they affected financially dependent industries the most. Industries in greater need for external financing, and those that pay a higher premium on external financing, should be the hardest hit by the failures. This would create a two trait pattern in states and periods with more bank failures. Industrial output would fall, and the fall in output of the financially dependent industries would be more severe. The main regression model that tests for the two-trait pattern is given by equation (S1):

$$g_{sit} = \beta_0 + \beta_1 \cdot findep_i \cdot fail_{st} + \beta_2 \cdot fail_{st} + \beta_3 \cdot findep_i + a_s + u_{sit} \quad \text{(S1)}$$

The dependent variable is the growth rate of manufacturing output of industry i in state s over the biannual period t, $g_{sit}$. Biannual frequency, unlike monthly for instance, allows for time for any lagged effect of failures to become evident. The sample interval is 1921-1937 for regressions that use external dependence and 1929-1937 for regressions that involve inverse interest cover. There are three principal explanatory variables: percentage of deposits in failed banks in state s during period t ($fail_{st}$), financial dependence of industry i ($findep_i$), and their interaction. The three are complemented by state fixed effects ($a_s$). The coefficients $\beta_1$ and $\beta_2$ are used for our test. The $\beta_2$ will be negative if bank failures cause output of the industry with the zero score of dependence to fall, while $\beta_1$ will be negative if the financially dependent experience larger output declines. The measures of financial dependence were transformed to have the median of zero and the maximum of one. When measures are rescaled, $\beta_2$ represents the predicted reduction in growth of the median-dependent industry in states and periods with one percent of suspended deposits. The $\beta_1$ represents the difference in growth rates, in localities with one percent of failures, between the industry of median and the industry of maximum financial dependence. The sum of $\beta_1$ and $\beta_2$ then represents the predicted reduction in growth for the industry with the maximum level of financial dependence.

In addition to the main regression model, I estimate three other specifications. They differ by the included fixed effects. The fixed effects control for unobserved factors that influence both financial and real sectors, but lead to conservative coefficient estimates. The main model in specification (S1) includes only the state fixed effects ($a_s$). They capture the unobserved state characteristics which influence output growth. Specification (S2) also includes time fixed effects ($a_t$), intended to control for any omitted factors that simultaneously operate across all states. I nevertheless expect time fixed effects to capture in part the effect of the bank failures themselves. Two factors are responsible. First, in some years failures were widespread across states. Second, the effect of failures could also be felt in the neighboring states through a spatial spillover effect. Bank failures would in part be indistinguishable from a nationwide shock in either case; such a shock would be absorbed by the time fixed effects included in specifications (S2) and (S3), or state-time fixed effects included in specification (S4). With this in mind, I interpret the estimates in specifications (S2) - (S4) as the lower bound of the relationship between bank failures and growth.

$$g_{sit} = \beta_0 + \beta_1 \cdot findep_i \cdot fail_{st} + \beta_2 \cdot fail_{st} + \beta_3 \cdot findep_i + a_s + a_t + u_{sit} \quad \text{(S2)}$$

Specifications (S1) and (S2) allow us to measure $\beta_3$, the relationship between financial dependence and growth in the absence of bank failures; they do not include the industry fixed effects. An economically insignificant $\beta_3$ would suggest that financial dependence does not matter for growth in the absence of failures. A significant $\beta_3$ would instead cause concern. It would mean that the growth pattern across industries in the absence of failures could be biasing $\beta_1$, the interaction coefficient between financial dependence and failures.

Specification (S3) adds industry fixed effects to specification (S2). They prevent bias in the estimates of $\beta_1$ from factors that vary at the industry level. The final specification (S4) also includes industry and introduces state-time fixed effects. Bank failures vary across states and periods. State-time fixed effects are to eliminate any bias in $\beta_1$ from factors that could be confounded with bank failures. Specification (S4) however cannot estimate the effect of bank failures on the median-dependent industry, measured by $\beta_2$. It is only informative about the difference between the effect of bank failures on median and maximum-dependent industries, measured by $\beta_1$.

$$g_{sit} = \beta_0 + \beta_1 \cdot findep_i \cdot fail_{st} + \beta_2 \cdot fail_{st} + a_s + a_i + a_t + u_{sit} \quad \text{(S3)}$$

$$g_{sit} = \beta_0 + \beta_1 \cdot findep_i \cdot fail_{st} + a_{st} + a_i + u_{sit} \quad \text{(S4)}$$

Fixed effects do help control for unobservables, but they are expected to remove in part the effect of the failures itself. The time fixed effects should capture it the most, leading to conservative coefficient estimates for the effect of failures on growth. On the other hand, any OLS estimates could be biased by reverse causality. Banks failing as a result of output declines would lead to a negative $\beta_2$. Even more banks failing because of difficulties of their financially-dependent clients would lead to a negative $\beta_1$. The section 3.3 addresses the concern that results could be driven by reverse causality by instrumenting bank failures. Notice, nonetheless, that even an OLS estimate of a negative $\beta_1$ renders unlikely that both banks and firms are suffering independently of each other. Their interaction must instead matter.

## 3.2 OLS Results

The results of OLS regressions that use external dependence as the indicator of financial dependence are given in Panel A of Table 3. The estimates are economically and statistically significant. Bank failures are associated with lower output growth and they are associated with even lower growth of the externally dependent industries. These results are consistent with the conjecture that bank failures had real effects through a reduction in lending.

Regression estimates of all four specifications suggest that the externally dependent contract the most in the presence of failures. The $\beta_1$ coefficient of interaction between external dependence and deposits suspended is furthermore stable across the regressions. The most dependent industry contracts on average 1.5 percent more then the median dependent industry in the presence of one percent of deposit suspensions. The median dependent industries contract too, but the estimates of $\beta_2$ vary across the specifications. They change from - 4.5 in specification (S1) to -1.0 after time fixed effects are included in specifications (S2) and (S3), or state-time fixed effects are included in specification (S4). This was expected for two reasons: the years when bank suspensions were widespread across states, and a spatial spillover in the effect of failures. Both factors make failures resemble a nationwide shock captured by the time fixed effects. On the one hand, time fixed effects do control for omitted determinants of output in effect across states; it would be improperly bold to associate the whole effect estimated in specification (S1) to bank failures. On the other hand, it could be equally misleading to claim that time fixed effects capture none of the effect of failures. But, with $\beta_1$ stable at -1.5 and $\beta_2$ changing from - 4.5 to -1.0 we can at best obtain a range of predicted decline in output growth. At least 1.0 percent of lower growth for the industry of median external dependence and 2.5 percent of lower growth for the industry of maximum external dependence is related to one percent of failures. The corresponding figures are at most 4.5 percent for the median-dependent and 6.0 percent for the maximum-dependent industry. The estimated range of output decline associated to bank failures is thus broad. But, its distribution over industries is consistent with a fall in bank lending.

Although externally dependent industries contract more when banks fail, the estimates of $\beta_3$ suggest they perform like others in the absence of failures. Specifications (S1) and (S2) estimate the coefficient on external dependence, $\beta_3$; these specifications do not include industry fixed effects. The $\beta_3$ of 0.04 means that industries with the maximum score of external dependence (of one) grew four basis points more than those with the median score of external dependence (of zero). The difference is not economically significant - it results in one percent of additional growth in fifty years. If so, the pattern of output decline across industries in the presence of failures (measured by $\beta_1$) should not be biased by the distribution of growth over industries in the absence of failures.

**[Table 3]**

Panel B of Table 3 presents the results of OLS regressions that use inverse interest cover as the indicator of financial dependence. The industry group average in the 1922-1928 period serves as the indicator, while the four specifications are estimated over the 1929-1937 sample period. The results agree with those for external dependence. Bank failures are associated to lower output growth, and even lower growth of the worse covered industries (those that have a high inverse interest cover). Again, the results are consistent with real effects of bank failures through a reduction in lending.

All four specifications confirm that worse covered industries contract more than others during failures. The estimates of $\beta_1$ are statistically and economically significant. The worst covered industries grow on average 0.8 percent less than the median covered industries in states and periods with one percent of suspended deposits. That this is less than the 1.5 percent difference estimated using external dependence is no surprise; inverse interest cover measure varies over 10 industry groups while external dependence measure varies over the full set of 18 sampled industries. While $\beta_1$ is stable across the regressions, the extent to which median covered industries are expected to contract varies across specifications. The estimates of $\beta_2$ change from -5.0 in specification (S1) to -0.8 in specifications (S2) and (S3) that include time fixed effects and specification (S4) that includes state-time fixed effects. I consider that a fraction of this difference ought to be attributed to the effect of bank failures themselves. But, it is not clear how large a fraction. With $\beta_1$ stable at -0.8 and $\beta_2$ changing from -5.0 to -0.8 we do however obtain the predicted range of reduction in output growth in the presence of one percent of suspended deposits. The median covered industries then experience 0.8 to 5.0 percent of lower growth, while the least covered (most dependent) industries experience 1.6 to 5.8 percent of lower growth. While the range is broad, the pattern of decline (measured by $\beta_1$) is again consistent with a fall in bank lending.

There is once more evidence that the pattern of growth decline is not biased by the distribution of growth across industries in the absence of bank failures. Specifications (S1) and (S2) that do not include industry fixed effects estimate the coefficient on inverse interest cover, $\beta_3$. The worst covered industries grew 3 basis points less than median covered industries. The difference leads to a mere percent of less growth over more than sixty years. Neither external dependence nor inverse interest cover thus matter for growth in the absence of failures.

The OLS results do not contradict a causal effect of bank failures on output growth. The results also strongly suggest that bank and firm difficulties did not directly result from any third factor. Their interaction must have instead mattered - bank failures are associated to worse performance of the financially dependent industries. The findings are furthermore supported by both measures of financial dependence. Consistent with a causal effect, the OLS estimates however cannot rule out reverse causality. Banks could be failing in response to output declines, and even more so when their financially dependent clients suffer. To establish that bank failures indeed caused output contractions, I proceed to use instrumental variables.

## 3.3 IV Results

I use two state-specific indicators to predict the ability of the local banking system to absorb any given shock. These are the percentage of branch offices in the year 1920 ($bstructure_s$) and the increase in the value of farmland over the 1910s ($\Delta farmvalue_s$). The two are summarized in Panel C of Table 1. I assume that neither state-variant indicator is systematically related to industrial output growth other than through bank failures. My first indicator, the percentage of branch offices, is telling of risk sharing within the system; unit banks were likely to fail during the 1920s. It also indicates how much risk taking occurs in expansions; branched banks that greatly expanded in the twenties were likely to fail during the Great Depression. The risk-sharing effect turns out to dominate in both of our samples (1921-1937 for external dependence, and 1929-1937 for inverse interest cover). My other indicator, market conditions for farmland inherited from the previous period, predicts the quality of the loans banks made. The European agricultural demand during the Great War fueled a rise in the price of farmland. The most affected states were left with fragile banking systems. The farmers would fail to pay the mortgages they took out in expansion when challenged by the subsequent decline in agricultural prices.

The two indicators, in their original form, are however for two reasons not appropriate to be used as instruments of bank failures. First, they are not able to explain by themselves the variation in failures over time. Second, because they only vary across states, they are not fit for use in any specification that includes state fixed effects (all of my specifications do). To overcome these difficulties, I interact them with the period-specific national level of deposit suspensions ($USfail_t$). The compound instruments I obtain both vary over time and survive the inclusion of state fixed effects. The rationale is the following: any national shock that propagates across states would result in more failures in states with poorer risk sharing within the banking system and more leveraged clients. Table 4.1 demonstrates how the compound instruments predict the state-specific deposit suspensions.

**[Table 4.1]**

My instruments are significant predictors of bank failures. The smallest F-statistic of the determinants reported in Table 4.1 is above 17. This holds for regressions over both samples (1921-1937 and 1929-1937) and for specifications both with and without state and year fixed effects. While these estimates enable us to evaluate how well the instruments predict the bank failures, note that they do not represent the first stage regressions.

There can actually be one or two first stage regressions, depending on the number of endogenous variables. This in turn varies with the fixed effects each specification includes.

There are two endogenous variables in specifications (S1), (S2), and (S3). These are deposit suspensions and financial dependence interacted with deposit suspensions. I need two first stage regressions to match them. The following diagram lists the endogenous regressors and the instruments used in the first three specifications. To explain financial dependence interacted with deposit suspensions I interact the compound instruments with financial dependence. Notice however that all four instruments need to be used in the first stage regression for each of the endogenous variables.

| Endogenous Variables in Specifications (S1)-(S3) | Instruments |
|---|---|
| $fail_{st}$<br>$findep_i \cdot fail_{st}$ | $bstructure_s \cdot USfail_t$<br>$\Delta farmvalue_s \cdot USfail_t$<br>$findep_i \cdot bstructure_s \cdot USfail_t$<br>$findep_i \cdot \Delta farmvalue_s \cdot USfail_t$ |

Specifications (S1) - (S3) require several alterations to the usual IV inference. The tests of instrument strength need to be changed and the standard errors need to be appropriately clustered. I use a compound statistic to judge the strength of instruments. It takes into account the F-statistics of excluded instruments in each of the two first stage regressions. This is Cragg-Donald statistic and, in case of heteroskedasticity robust or clustered standard errors, the Kleibergen-Paap statistic. Both are reported with each of the specifications in Table 4.2. Notice further that some of the variables do not span all dimensions of my dataset. Deposit suspensions and two of the instruments (those not interacted with financial dependence) vary over states and periods only. Both the first and the second stage regressions are however run over states, periods and industries. Such a structure of one first stage can give unwarranted strength to our instruments. To obtain realistic test statistics, I cluster the standard errors at the state-time level.

Unlike specifications (S1) - (S3), specification (S4) includes a single endogenous regressor - financial dependence interacted with deposit suspensions. The effect of deposits suspended themselves cannot be estimated; they vary by state and period while specification (S4) includes state-time fixed effects. A single first stage regression with two instruments (listed in the following diagram) is thus required. Because there is only one endogenous regressor, the compound F-statistics become equal to the single F-statistic of the excluded instruments. Note that, when state-time fixed effects are introduced in (S4), the number of state-time clusters becomes insufficient to match the number of variables. The heteroskedasticity robust standard errors estimator is hence invoked in place of the clustered one.

| Endogenous Variable in Specification (4) | Instruments |
|---|---|
| $findep_i \cdot fail_{st}$ | $findep_i \cdot bstructure_s \cdot USfail_t$<br>$findep_i \cdot \Delta farmvalue_s \cdot USfail_t$ |

Table 4.2 reports the IV estimates of the causal effect of bank failures on industrial output growth. The effect of failures is conditioned by external dependence in regressions reported in Panel A, and by inverse interest cover in regressions reported in Panel B. The IV results agree with the OLS findings: bank failures appear to have reduced output through a decline in lending. The IV estimates predict an even stronger effect of bank failures on the financially dependent then the OLS analysis; this is confirmed by both measures of financial dependence. The $\beta_1$ parameter of the interaction between financial dependence and bank failures is on average two times larger in IV then in OLS specifications. It is statistically significant across all regressions. The most externally dependent industries contract between 2.8 and 3.4 percent more than median dependent industries as a result of one percent of deposit suspensions. The corresponding range in specifications using the inverse interest cover is 1.6 to 2.2 percent; the inverse interest cover indicator does not vary over the full sample of industries. Furthermore, the two estimations of specification (S1) (one for each measure of financial dependence) predict a formidable seven percent decline in growth of the median dependent industry in response to one percent of failed deposits. This too is larger than a $\beta_2$ of around five percent in the OLS regressions. The IV estimate of the effect on the median dependent industry proves however to be more sensitive to the inclusion of time fixed effects than its OLS counterpart. It loses its size and becomes statistically insignificant in specifications (S2) and (S3). But, the time fixed effects are expected to capture in part the effect of failures themselves. The IV results also confirm the OLS finding that industries with different levels of dependence do not exhibit significant differences in growth in the absence of failures (differences measured by $\beta_3$). If anything, the externally dependent grow somewhat more when there are no suspensions.

The tests of instrument strength raise no doubts about the reliability of the IV estimates. In specifications (S1) and (S4) I reject any concern over weak instrument inference; in regressions using both measures of financial dependence all test statistics remain above 17. In specifications (S2) and (S3) some concern remains when using the stricter, Kleibergen-Paap, clustered standard errors statistic. The estimated size of the coefficient on the interaction between financial dependence and bank failures, $\beta_1$, is however reassuringly stable across all four specifications.

**[Table 4.2]**

## 3.4 Comparing the OLS and the IV Results

It is striking that the IV estimates not only confirm but also reinforce the OLS ones. The IV estimates of $\beta_1$ are larger than the OLS estimates, and so are the IV estimates of $\beta_2$ in the specification without time fixed effects. In the presence of reverse causality (whereby difficulties in manufacturing lead to bank failures) the use of instruments is expected to instead reduce the obtained coefficients. Nevertheless, two factors would make the IV parameter estimates larger. First, our instruments could have more predictive power in areas with fewer alternatives to financing by banks. The change in farm value in the 1910s must be a better predictor of bank failures in rural than in urban areas. Rural manufacturing establishments likely had less access to non-bank financing than their urban counterparts. Second, deposit suspensions can be interpreted as measuring financial distress with an error. Suppose that bank failures have a direct and an indirect effect. The direct effect is limited to the same state where the failures happen. It can be explained by the local reductions in the money supply and the loss of intermediation capital. The indirect effect operates both in the state experiencing failures and in the neighboring states. It can be explained by lending declines that result from a loss of depositor confidence. The concern that more banks could fail would raise the expected deposit withdrawals both in the same state and in the contiguous states. The surviving banks would constrain lending to build buffer-stock capital.

Figure 3 illustrates how my explanatory variable measures the actual financial distress with an error; it shows two stylized maps representing states experiencing bank failures. I denote the direct effect with $\delta$ and the indirect effect with $\gamma$; both give the reduction in growth resulting from a unit of failures. The map on the left shows the direct effect. The total effect (that includes both the direct and the indirect effect) is depicted by the map on the right. Note that the state-specific deposit suspensions correspond to the direct effect only. This means that suspensions measure the total effect of failures, both in the states experiencing failures and the neighboring states, with an error (of $-\gamma$). As a consequence, the OLS estimates are biased towards zero.

But, my instruments should be able to correct for the bias by predicting the indirect effect, both in the state experiencing failures and the contiguous states. The changes in farm value over the 1910s and percentage of branch offices in the year 1920 measure the fragility of a banking system. The indirect effect ought to be stronger in states with fragile banking systems; vulnerable banks worry the most for their liquidity following failures in their neighborhood. By correcting for the measurement error, the IV inference ought to give the true and a greater effect of bank failures than the one implied by the OLS correlations.

[Figure 3]

# 4 Robustness Check - Great Depression Only

The results from the interwar sample thus assign a prominent role to bank failures in reducing output growth. The use of the full interwar sample is to make the estimates more reliable; there were many shocks in the Great Depression and their effects could be confounded with those of the bank failures. I want to however verify that the results are not driven only by the part of the sample that excludes the Depression. This section provides evidence that bank failures led to output declines during the Great Depression itself. Three tests confirm the finding using data from that period only. I first analyze how gross corporation income correlates with deposit suspensions across states. Then I plot distributions of output growth, conditional on financial dependence and the intensity of local bank failures. I conclude with OLS and IV regression analysis using only the Great Depression sample.

The growth of gross corporation income in the Great Depression correlates negatively, across states, with deposit suspensions. Cole and Ohanian (2000) found no correlation between personal income growth and bank suspensions in a similar exercise. But, gross corporation income should be more affected by the shocks to local banks than personal income; it is a measure of output produced within a state. Personal income must also include a number of inter-state transfers (such as the salaries of federal employees) that blur cross-sectional identification. The gross income of corporations is obtained from the Statistics of Income (U.S. Internal Revenue Service, 1929-1933). Figure 4 plots growth in gross corporate income over the Great Depression against the state fraction of deposits suspended. The correlation is negative, although marginally statistically insignificant.

Any inter-state spillover in the effect of bank failures would however make the correlation with any measure of output hard to observe. I study the consequences of spatial spillovers for cross-sectional identification in a Monte Carlo exercise that accompanies this paper. The results show that documenting correlation becomes particularly difficult under conditions that were satisfied during the Great Depression. These include failures which are intense and widespread, large spillover effects of failures (that could be caused by contagion), and failures that originate in the economic and financial centers of the country. The correlation between corporate income growth and bank suspensions observed in this paper should be given a high value in light of my simulation results. Figure 4 thus suggests that higher declines in production occurred in states experiencing intense failures.

[Figure 4]

If bank failures led to output declines through a fall in lending, we would also expect output declines in states with failures to be larger for the financially dependent industries. Figures 5.1 and 5.2 plot the distribution of manufacturing growth over the Great Depression conditional on financial dependence. Figure 5.1 conditions growth on external dependence while Figure 5.2 conditions it on inverse interest cover. The observation points are specific to state and industry. Two relationships are evident for both measures of dependence. First, the Great Depression (a period with many bank failures) is associated with worse performance of the financially dependent industries. The subplots at the top of each figure demonstrate this by using observations from all states; growth distributions of the financially dependent appear shifted towards lower values. High and low financial dependence in the plots designate the top and the bottom third of industries. Second, financially dependent industries suffered substantially more in high failure states. The bottom-left subplots condition industry growth on financial dependence in states with few failures. The bottom-right subplots do the same in states with many failures. High and low failures designate the top and the bottom third of states. The majority of the worst performers in high failure states are evidently the financially dependent. The low growth tail of the distribution is particularly thick for the financially dependent in states with many bank failures. The effect is more evident for the high inverse interest cover industries, but it is also apparent for high external dependence industries. Figures 5.1 and 5.2 thus demonstrate that financially dependent did badly during the Great Depression in all states, and that they did even worse in high failure states. This suggests that no third factor was likely to be directly driving the plight of both the firms and the banks. Either troubled banks caused their clients to suffer, or they suffered themselves because of difficulties of their clients.

**[Figure 5.1]**
**[Figure 5.2]**

I proceed to establish that bank failures indeed caused output declines in the Great Depression; I apply IV regression analysis only to that period. The state-specific change in farm value over the 1910s serves as the instrument of bank failures. There is no need to interact it with time-variant national failures – the sample is now the cross section of states in the Depression. The growth period of 1932 and 1933 is excluded because it corresponds to the distinct failures of 1933. This still leaves the most relevant period in the sample. The failures of 1930 and 1931 include three out of four Friedman-Schwartz banking crises; they allegedly transformed a recession into the Great Depression. Figure 6.1 demonstrates how the instrument correlates with deposit suspensions during 1930 and 1931. The greater was the increase in the value of farmland in the 1910s, the more banks failed in the Great

Depression.

The first column of Table 5 reports estimates of the effect of bank failures on the growth of total output of all sampled industries. Panel A presents the OLS results while Panel B gives the IV results. The effect of bank failures is negative and not statistically significant. It becomes larger when instrumented. The first plot in Figure 6.2 illustrates this - the dotted line representing the IV regression is steeper. The second column of Table 5 gives the estimates of the effect of bank failures on the growth of total output of the most externally dependent third of industries. The effect of bank failures is negative, statistically significant, and larger than in the full industry sample; it becomes even larger when instrumented. The second plot in Figure 6.2 corresponds to the externally dependent sample. Its dotted IV regression line is steeper both from its OLS counterpart and from the IV line for the complete industry sample. My findings from the full interwar period are thus confirmed in the Great Depression: bank failures resulted in output declines, and they resulted in even bigger output declines of the financially dependent industries.

**[Figure 6.1]**

**[Table 5]**

**[Figure 6.2]**

# 5 Conclusion

In the view of Ben Bernanke, a complete understanding of the Great Depression is a key to all the secrets of macroeconomics. This paper attempts to bring us closer to this understanding. It does so by evaluating the importance of bank failures. I use an interwar panel of US states and exploit the differences in financial dependence between manufacturing industries. Bank failures are found to cause manufacturing output declines, the greater the more an industry is financially dependent. My findings are supported by two distinct measures of financial dependence: external dependence and inverse interest cover. External dependence captures technologically driven investment needs, while inverse interest cover reflects the actual short term financing needs from the 1920s. I further instrument failures to establish causality. Indicators of pre-determined fragility of the state banking systems serve as the instruments. My IV results confirm the OLS estimates. I find that one percent of suspended deposits can reduce output growth by several percent. The paper nonetheless does not estimate the fraction of the Great Depression that can be explained by bank failures. The uncertainty stems from the time fixed effects, expected to partly capture the effect of failures themselves. As a consequence, the work does leave the possibility that non-financial factors also mattered.

The Great Depression was a turbulent time, with a multitude of domestic and international shocks. Their effects could potentially be confounded with that of the bank failures. The principal findings are obtained from the whole interwar sample to account for this. But, the results are also confirmed in the cross section of US states during the Great Depression. Gross income of corporations is negatively correlated with failed deposits at the state level. This is unlike the elsewhere used state personal income, a measure that should include a number of inter-state transfers. In addition, distribution plots show that dependent industries perform worse in states with intense Depression-era bank failures. They also reveal that the most dependent industries are dominant among the worst performers in states with many failures. Furthermore, both OLS and IV regressions over the Depression sample are supportive of a causal role of bank failures. The result emerges in spite of spillover effects that blur identification in the cross-section of states. My results overall suggest that bank failures were causing output declines both in the whole interwar period and the Great Depression itself.

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# 6 Figures

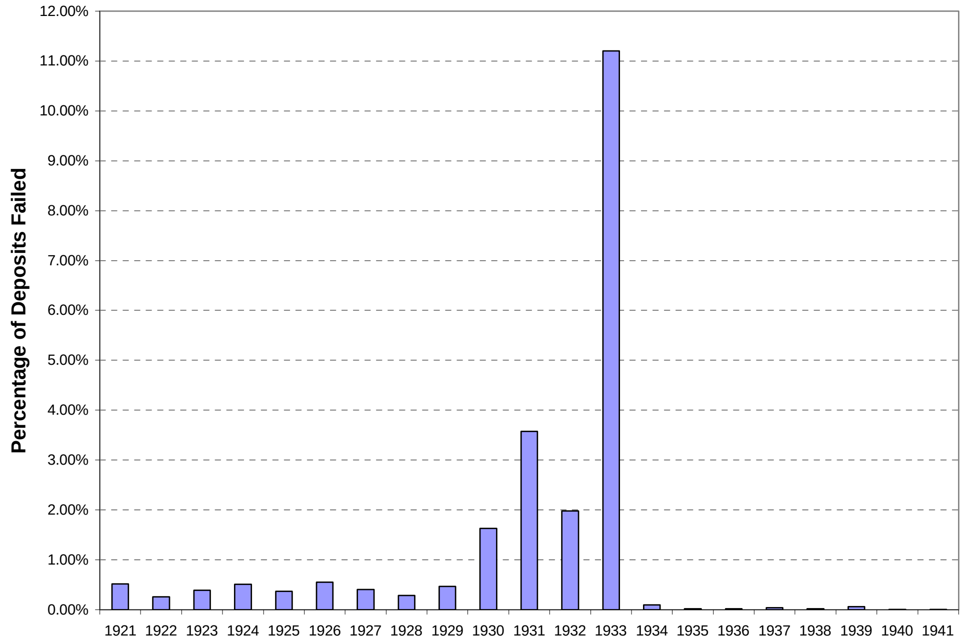


**Figure 1**

US Interwar Bank Failures

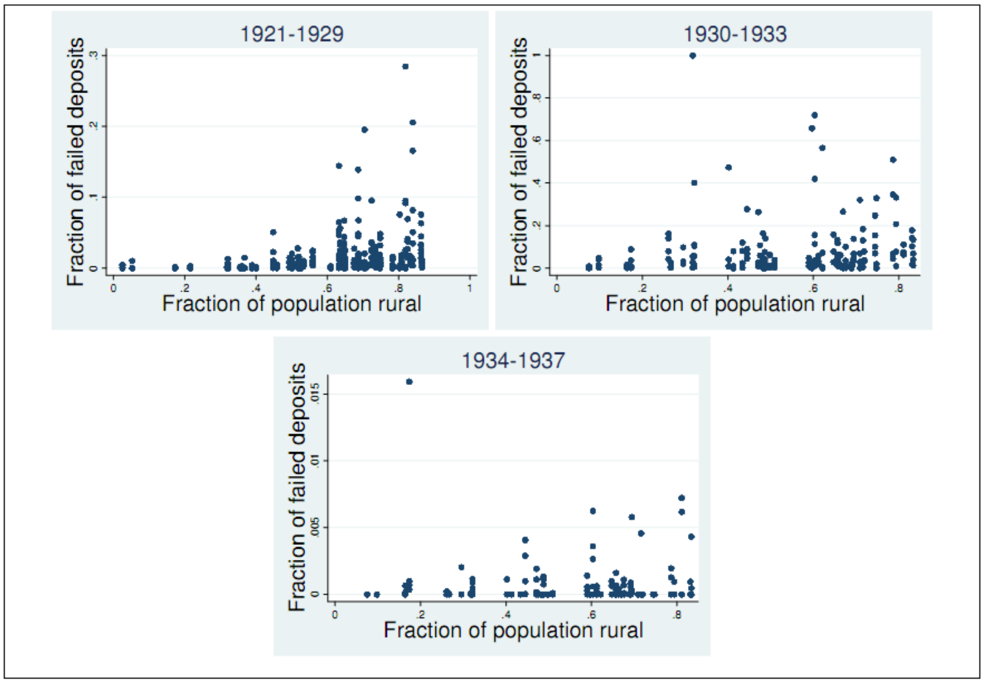


**Figure 2**

Bank Failures in Rural and Urban States

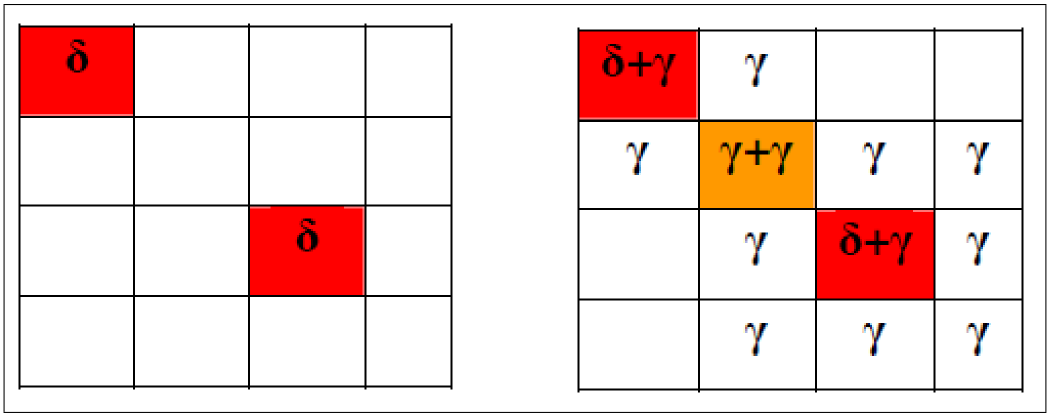


**Figure 3**

Direct and Indirect Effect of Bank Failures in a Cross-Section of States

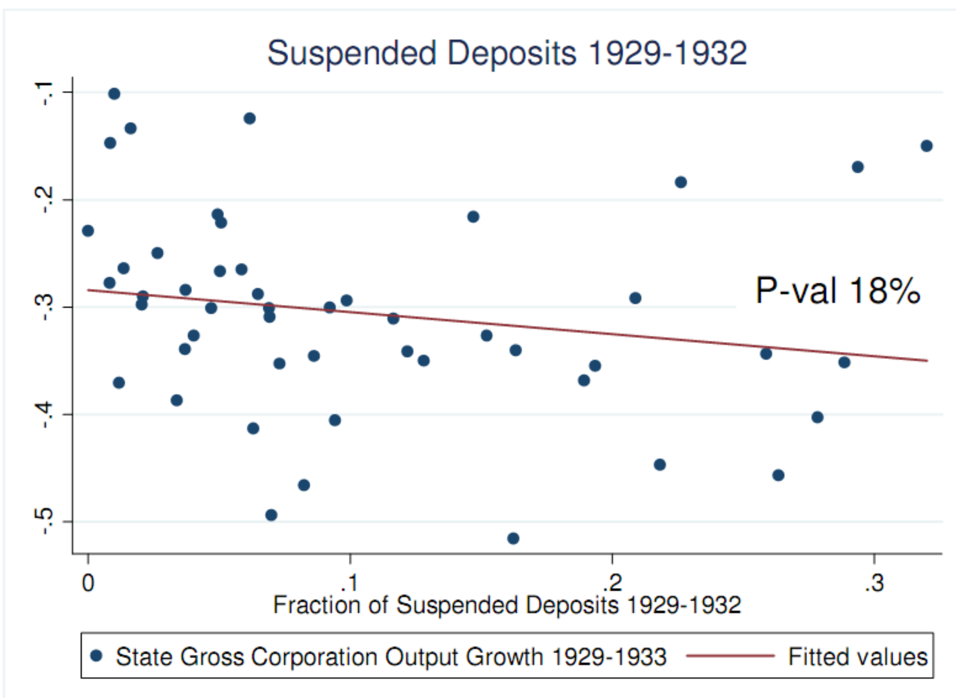


**Figure 4**

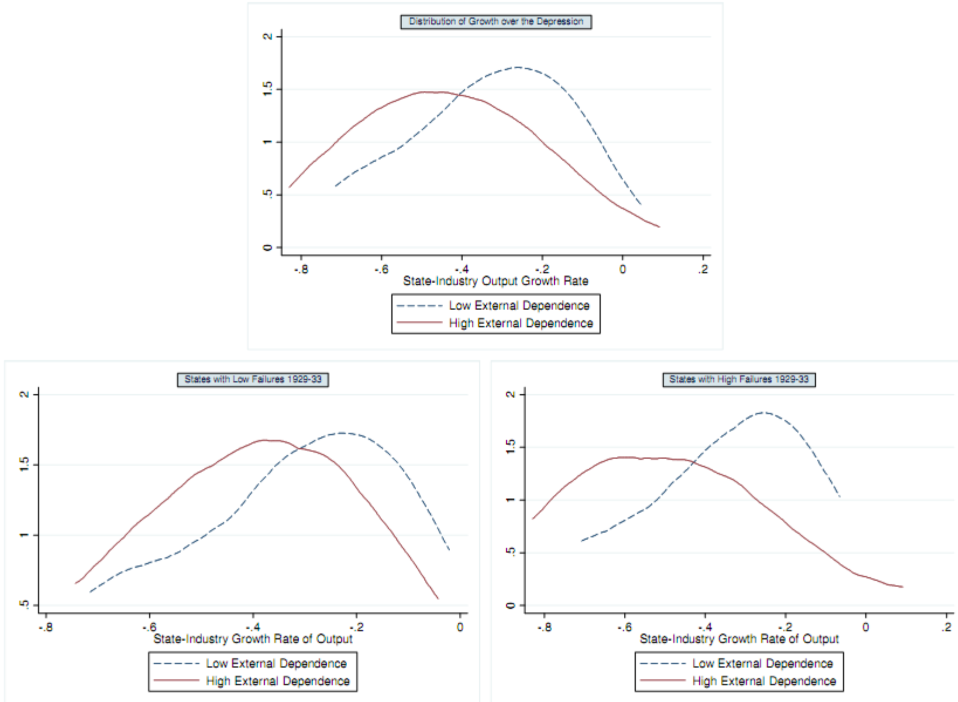


**Figure 5.1**

Growth During the Great Depression, Conditional on External Dependence

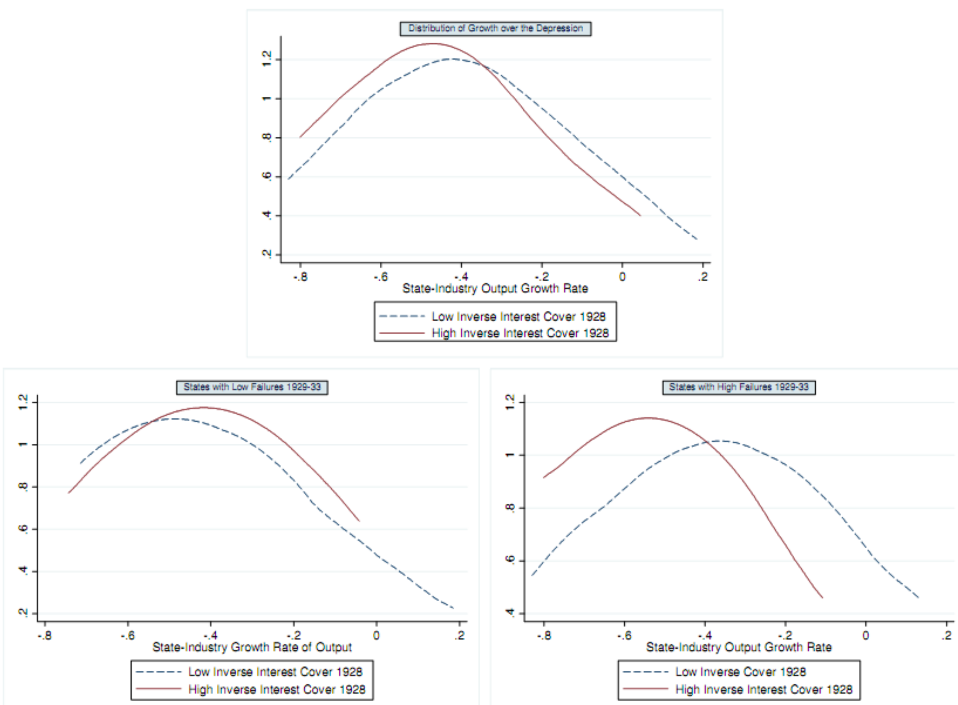


**Figure 5.2**

Growth During the Great Depression, Conditional on Inverse Interest Cover

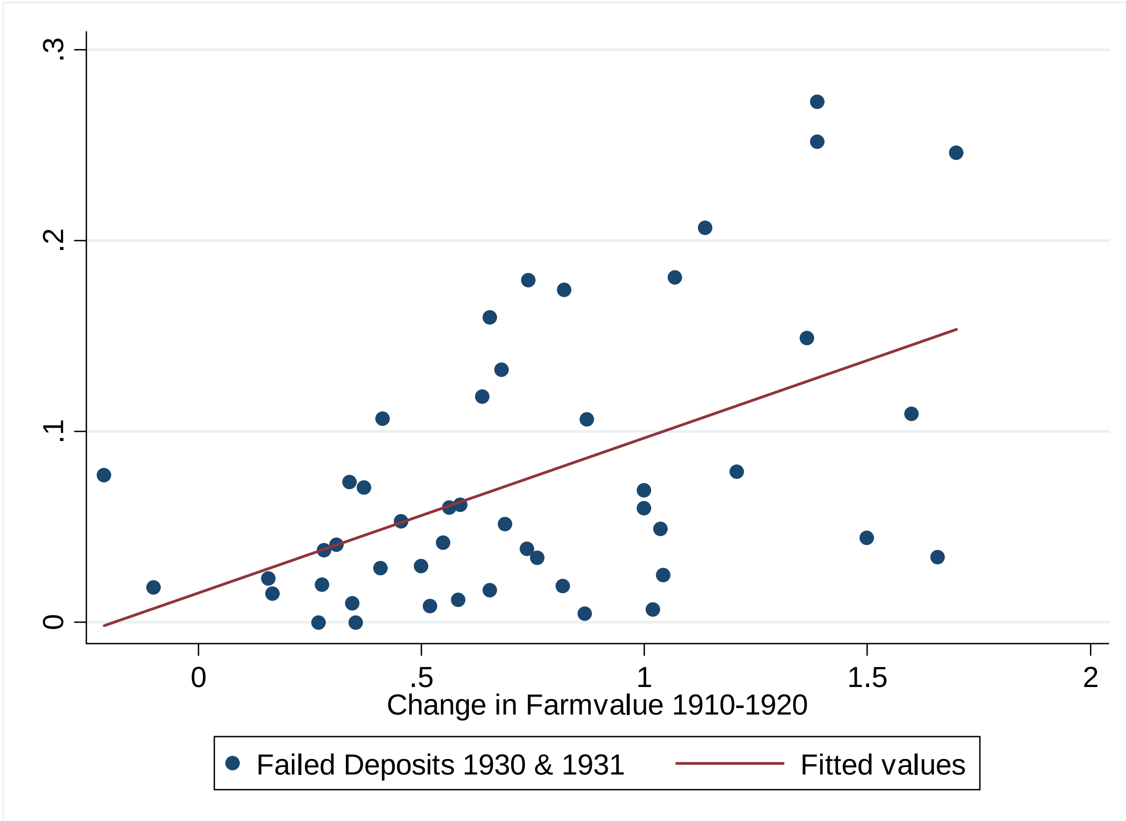


**Figure 6.1**

Farm Value Instrument During the Great Depression

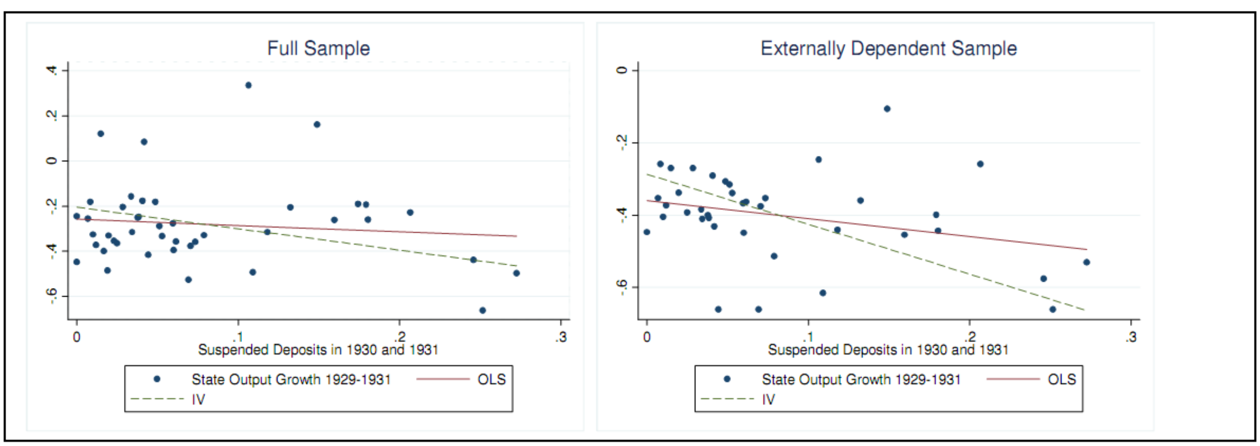


**Figure 6.2**

Output Growth in the Great Depression

# 7 Tables

TABLE 1 - DESCRIPTIVE STATISTICS

| | Panel A<br>Biannual Manufacturing Growth Rates | | | |
|---|---|---|---|---|
| | 1922-1937 | 1922-1929 | 1930-1931 | 1934-1937 |
| Output growth | 11.26<br>(37.36) | 10.36<br>(35.16) | -26.09<br>(35.56) | 32.36<br>(26.50) |
| Obs | 1928 | 1097 | 279 | 552 |
| Variation across | States, periods and industries | | | |
| | **Panel B**<br>Percentage of Deposits in Suspended Banks | | | |
| | 1922-1937 | 1922-1929 | 1930-1931 | 1934-1937 |
| Deposits suspended<br>(biannual %) | 2.48<br>(4.99) | 2.37<br>(4.66) | 7.50<br>(7.16) | 0.17<br>(0.71) |
| Obs | 336 | 192 | 48 | 96 |
| Variation across | States and periods | | | |
| | **Panel C**<br>Banking Structure and Farmland Value Change | | | |
| Branch offices<br>in 1920 (%) | 8.27<br>(12.08) | | | |
| Farm value<br>change over 1910s (%) | 73.31<br>(44.95) | | | |
| Obs | 48 | | | |
| Variation across | States | | | |

*Notes*: This table shows variable averages with standard deviations in parentheses. Observations with few establishments per state are excluded so as to leave at least 95% of an industry's product value in a given year. Output values used for calculation of output growth were deflated using "CPI for all Urban Consumers, All Items". Output growth observations below the 1st percentile and above the 99th percentile were recoded to the values of the 1st and 99th percentile. The biannual period 1932-1933 was excluded from the sample.

TABLE 2 - INDUSTRY CHARACTERISTICS

| Industry | Score | Industry | Score | Industry | Score |
|---|---|---|---|---|---|
| | | Panel A<br>External Dependence (ED) | | | |
| canning | 1.00 | chemicals | 0.24 | bread | -0.20 |
| motor vehicles | 0.80 | cotton goods | 0.04 | nonferrous metal | -0.36 |
| iron | 0.72 | glass | 0.00 | furniture | -0.40 |
| meat packing | 0.68 | petroleum refining | 0.00 | confectionery | -1.00 |
| lumber and planing mill | 0.48 | rubber | -0.04 | boots | -2.52 |
| paper | 0.44 | motor vehicle parts | -0.08 | printing | -3.00 |
| | | Panel B<br>Inverse Interest Cover (IIC) | | | |
| rubber | 1.00 | cotton goods | 0.09 | motor vehicles | -1.18 |
| boots | 0.33 | furniture | 0.06 | nonferrous metal | -1.18 |
| bread | 0.27 | lumber and planing mill | 0.06 | chemicals | -1.55 |
| canning | 0.27 | paper | -0.06 | petroleum refining | -1.55 |
| confectionery | 0.27 | iron | -1.18 | printing | -1.58 |
| meat packing | 0.27 | motor vehicle parts | -1.18 | glass | -2.03 |

*Notes*: Industries are listed by decreasing financial dependence. Inverse interest cover is based on ten industry groups: Rubber and rubber products; Leather and leather products; Food products, beverages and tobacco; Textiles and textile products; Lumber and wood products; Paper, pulp and products; Metal and metal products; Chemicals and allied substances; Printing and publishing; and Stone, clay, and glass products. The complete names of the industries from the 1929 Census of Manufactures are: 1. Canning and preserving: Fruits and vegetables; pickles, jellies, preserves and sauces; 2. Motor vehicles, not including motor cycles; 3. Iron and steel: Steel works and rolling mills - including all departments, such as bolt and nut, wire, tinplate, etc.; 4. Meat packing, wholesale; 5. Lumber and timber products, not elsewhere classified; and Planing-mill products - including general mill-work - not made in planing mills connected with sawmills; 6. Paper; 7. Chemicals, not elsewhere classified; 8. Cotton goods; 9. Glass; 10. Petroleum Refining; 11. Rubber tires and inner tubes; 12. Motor-vehicle bodies and motor-vehicle parts; 13. Bread and other bakery products; 14. Nonferrous-metal alloys and products, not including aluminum products; 15. Furniture, including store and office fixtures; 16. Confectionery; 17. Boots and shoes other than rubber; 18. Printing and Publishing - Newspaper and Periodical.

TABLE 3 - OLS

| Dependent variable is Output growth$_{sit}$ | Panel A (1921-1937) External Dependence (ED) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $ED_i$ X Deposits suspended$_{st}$ | -1.44 | -1.34 | -1.32 | -1.73 |
| | (0.33)** | (0.37)** | (0.37)** | (0.35)** |
| Deposits suspended$_{st}$ | -4.53 | -0.99 | -0.99 | |
| | (0.25)** | (0.30)** | (0.31)** | |
| $ED_i$ | 0.04 | 0.04 | | |
| | (0.01)** | (0.01)** | | |
| Fixed effects | | | | |
| State | Yes | Yes | Yes | No |
| Time | No | Yes | Yes | No |
| State X Time | No | No | No | Yes |
| Industry | No | No | Yes | Yes |
| Obs | 1928 | 1928 | 1928 | 1928 |
| $R^2$ | 0.20 | 0.44 | 0.48 | 0.57 |

| Dependent variable is Output growth$_{sit}$ | Panel B (1929-1937) Inverse Interest Cover (IIC) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $IIC_i$ X Deposits suspended$_{st}$ | -0.77 | -0.72 | -0.74 | -0.90 |
| | (0.40)* | (0.39)* | (0.41)* | (0.41)** |
| Deposits suspended$_{st}$ | -4.94 | -0.81 | -0.83 | |
| | (0.26)** | (0.30)** | (0.30)** | |
| $IIC_i$ | -0.03 | -0.03 | | |
| | (0.01)** | (0.01)** | | |
| Fixed effects | | | | |
| State | Yes | Yes | Yes | No |
| Time | No | Yes | Yes | No |
| State X Time | No | No | No | Yes |
| Industry | No | No | Yes | Yes |
| Obs | 1092 | 1092 | 1092 | 1092 |
| $R^2$ | 0.29 | 0.48 | 0.50 | 0.56 |

*Notes*: The dependent variable is biannual output growth. Panel A regressions are run over the 1921-1937 sample, while those in Panel B are run over the 1929-1937 sample. The 1933 % deposits suspended is coded as missing. Constants were calculated but were not reported. Heteroskedasticity-robust standard errors are in parentheses: * p < 10%,** p < 5%.

TABLE 4.1 - DETERMINANTS OF BANK FAILURES

| Dependent variable is Deposits suspended$_{st}$ | Panel A (1921-1937) | |
|---|---|---|
| | (1) | (2) |
| Branch offices in 1920$_s$ (%) X US Deposits suspended$_t$ (%) | -1.88<br>(0.85)** | -1.36<br>(1.09) |
| Farm value change over 1910s$_s$ (%) X US Deposits suspended$_t$ (%) | 1.77<br>(0.16)** | 1.59<br>(0.29)** |
| Fixed effects | None | State and Year |
| Obs | 336 | 336 |
| $R^2$ | 0.28 | 0.48 |
| F-test of determinants | 62.74 | 17.22 |

| Dependent variable is Deposits suspended$_{st}$ | Panel B (1929-1937) | |
|---|---|---|
| | (1) | (2) |
| Branch offices in 1920$_s$ (%) X US Deposits suspended$_t$ (%) | -1.35<br>(0.71)* | -1.82<br>(0.94)* |
| Farm value change over 1910s$_s$ (%) X US Deposits suspended$_t$ (%) | 1.86<br>(0.13)** | 1.39<br>(0.25)** |
| Fixed effects | None | State and Year |
| Obs | 192 | 192 |
| $R^2$ | 0.52 | 0.67 |
| F-test of of determinants | 103.42 | 19.48 |

*Notes*: The dependent variable is the biannual percentage of deposits suspended. Constants were calculated but were not reported. Standard errors are in parentheses: * p < 10%,** p < 5%.

TABLE 4.2 - IV

| Dependent variable is Output growth$_{sit}$ | Panel A (1921-1937) External Dependence (ED) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ED$_i$ X Deposits suspended$_{st}$ | -2.83 | -3.43 | -3.46 | -3.26 |
| | (0.50)** | (0.57)** | (0.59)** | (0.45)** |
| Deposits suspended$_{st}$ | -6.96 | 0.58 | 0.61 | |
| | (0.98)** | (0.81) | (0.81) | |
| ED$_i$ | 0.07 | 0.08 | | |
| | (0.01)** | (0.01)** | | |
| Fixed effects | | | | |
| State | Yes | Yes | Yes | No |
| Time | No | Yes | Yes | No |
| State X Time | No | No | No | Yes |
| Industry | No | No | Yes | Yes |
| Obs | 1928 | 1928 | 1928 | 1928 |
| Clusters | 299 | 299 | 299 | |
| Centered $R^2$ | 0.13 | 0.37 | 0.41 | 0.55 |
| F-statistics | | | | |
| Cragg-Donald | 296.03 | 77.30 | 77.04 | 778.91 |
| Kleibergen-Paap | 17.22 | 4.83 | 5.20 | 42.92 |

| Dependent variable is Output growth$_{sit}$ | Panel B (1929-1937) Inverse Interest Cover (IIC) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| IIC$_i$ X Deposits suspended$_{st}$ | -2.24 | -1.62 | -1.67 | -2.09 |
| | (0.57)** | (0.54)** | (0.54)** | (0.59)** |
| Deposits suspended$_{st}$ | -7.25 | 0.37 | 0.38 | |
| | (0.86)** | (0.80) | (0.82) | |
| IIC$_i$ | 0.01 | -0.01 | | |
| | (0.02) | (0.01) | | |
| Fixed effects | | | | |
| State | Yes | Yes | Yes | No |
| Time | No | Yes | Yes | No |
| State X Time | No | No | No | Yes |
| Industry | No | No | Yes | Yes |
| Obs | 1092 | 1092 | 1092 | 1092 |
| Clusters | 169 | 169 | 169 | |
| Centered $R^2$ | 0.24 | 0.46 | 0.48 | 0.55 |
| F-statistics | | | | |
| Cragg-Donald | 330.63 | 68.55 | 67.42 | 667.18 |
| Kleibergen-Paap | 18.58 | 6.58 | 6.53 | 78.14 |

*Notes*: The dependent variable is biannual output growth. Panel A regressions are run over the 1921-1937 sample, while those in Panel B are run over the 1929-1937 sample. The 1933 % deposits suspended is coded as missing. Constants were calculated but were not reported. State-Year clustered standard errors are in parentheses in the first three specifications; Heteroskedasticity robust standard errors are in parentheses in the fourth specification: * p < 10%,** p < 5%.

TABLE 5 - BANK FAILURES IN THE GREAT DEPRESSION

| Dependent variable is Output growth$_s$ | Panel A - OLS (1929-1931) | |
|---|---|---|
| | (1) All output growth | (2) ED high output growth |
| Deposits suspended$_s$ | -0.28 | -0.50 |
| | (0.39) | (0.26)* |
| States | 43 | 38 |
| **Dependent variable is Output growth$_s$** | **Panel B - IV (1929-1931)** | |
| | (1) All output growth | (2) ED high output growth |
| Deposits suspended$_s$ | -0.96 | -1.39 |
| | (0.73) | (0.56)** |
| States | 43 | 38 |

*Notes*: The dependent variable is state output growth (aggregated over all industries in column 1 and over the top third of externally dependent industries in column 2) over 1929-1931. Explanatory variable is deposits suspended over 1930 and 1931. Constants were calculated but were not reported. Standard errors are in parentheses: * p < 10%,** p < 5%.