Monetary Intervention Mitigated Banking Panics during the Great Depression: Quasi-Experimental Evidence from a Federal Reserve District Border, 1929–1933

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The Federal Reserve Act divided Mississippi between the 6th (Atlanta) and 8th (St. Louis) Districts. During the Great Depression, these districts' policies differed. Atlanta championed monetary activism and the extension of aid to ailing banks. St. Louis eschewed expansionary initiatives. During a banking crisis in 1930, Atlanta expedited lending to banks in need. St. Louis did not. Outcomes differed across districts. In Atlanta, banks survived at higher rates, lending continued at higher levels, commerce contracted less, and recovery began earlier. These patterns indicate that central bank intervention influenced bank health, credit availability, and business activity.

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I. Introduction

Banks failed throughout the Great Depression. Their demise contributed to the disruption of financial intermediation that spawned the deepest downturn in American history (Friedman and Schwartz 1963; Bernanke 1983; Temin 1989; Romer 1993). The Federal Reserve failed to stem the falling tide for many reasons. Its leaders adhered to outdated doctrines and monitored misleading indicators of monetary conditions (Meltzer 2003, 282, 402–22). The Federal Reserve Board lacked leadership and could not coordinate policies among its disputatious districts (Wheelock 1991, 72–74, 113–17; Meltzer 2003, 266, 408). The gold standard fettered mechanisms of monetary policy and the minds of central bankers (Eichengreen 1992).

Even if the Federal Reserve had tried to alleviate the banking crisis, no clear evidence exists that it could have helped depository institutions. Two schools of thought exist on this issue. One school believes that the principal causes of the banking crises were withdrawals of deposits, illiquidity of assets, and the Federal Reserve's reluctance to act. The Fed could have alleviated the crisis by acting as a lender of last resort (Friedman and Schwartz 1963; Wicker 1996). The second school concludes that banks failed because the economy contracted. Asset prices fell. Loan default rates rose. Banks became insolvent. In such circumstances, the Fed could do little to aid banks by injecting liquidity into the financial system (Temin 1976; Calomiris and Mason 2003).

These opposing views coexist for several reasons. One is methodological. None of the studies directly measures the effects of monetary policy. All infer the Federal Reserve's abilities indirectly, by interpreting correlations between bank failures, bank characteristics, and the business cycle. A second is differences in data sources. Friedman and Schwartz (1963) analyze data on bank suspensions aggregated at the national level. Their successors scrutinize similar series at lower levels of aggregation, disaggregated data consisting of samples of national banks, or panels of banks from within individual cities, states, or Federal Reserve districts. The most recent and comprehensive work analyzes a panel of data for all Federal Reserve member banks (Calomiris and Mason 2003). Future research, Calomiris and Mason indicate (1639), should analyze data on all banks, multiple measures of financial distress (such as suspensions and liquidations), and multiple channels of contagion (such as bank runs and correspondent linkages).

Even with such data, analyzing the impact of Federal Reserve policies would be difficult. At the national level, Federal Reserve policies were endogenous reactions to ongoing economic events. Changes in Federal Reserve policy often coincided with changes in fiscal, tariff, and regulatory policies and with shocks to the economy for which data are in-

sufficient or nonexistent. At the district level, the boundaries of Federal Reserve districts coincided in most cases with state borders. States changed policies throughout the depression, often at the same time and occasionally in reaction to actions of the Federal Reserve. Economic shocks also differed across time and space. The endogeneity of policies, simultaneous changes in multiple policy dimensions, and the spectrum of unobserved shocks impede efforts to attribute differences in outcomes to differences in policies. When observed, correlations between outcomes and policies might have been caused by phenomena for which investigators cannot control.

In such circumstances, quasi-experimental econometric strategies have become increasingly popular. The task is to find a group of banks that operated in a single regulatory and economic environment but were exposed to different Federal Reserve policy regimes. Comparing outcomes across regimes yields insights free from problems of inference inherent in traditional analysis. The obvious place to seek such a group is along the Federal Reserve district borders. Borders occasionally divided states. Mississippi is an example. Its northern half lay within the 8th Federal Reserve District (St. Louis). Its southern half lay within the 6th Federal Reserve District (Atlanta). The two districts' policies differed dramatically early in the depression. St. Louis was a staunch advocate of nonintervention. Atlanta was a leading advocate of assisting banks in need. The St. Louis and Atlanta Feds applied their different policies to the portions of Mississippi lying within their jurisdictions. The adoption of these policies preceded the onset of the depression and had little to do with circumstances in Mississippi, which was a small and peripheral portion of each Federal Reserve district, and much to do with the philosophies and experiences of the leadership of the two banks. Thus, the application of Federal Reserve policies to Mississippi possessed the characteristics of an exogenous policy experiment.

This essay analyzes the impact of Federal Reserve policies in the Mississippi case. Section II describes the data that we analyze. Section III examines the historical and economic justification for employing quasi-experimental methods. Section IV examines the link between monetary policies and banking activity. The analysis progresses through several stages. The first is a nonparametric examination of the building blocks of duration analysis: survival and hazard functions. The second is a parametric analysis of our panel of data. Our results indicate that aggressive discount lending would have helped banks survive the initial banking panic of the Great Depression in the fall of 1930. Section V examines the robustness of this result. Section VI examines the link between bank failures, credit contraction, and commercial activity. A clear correlation exists between bank failures during the panic of 1930 and subsequent declines in wholesale trade. Bank distress at other times

TABLE 1
NUMBER OF BANKS IN MISSISSIPPI ON JULY 1 OF EACH YEAR

	State Charter			National Charter		
		Federal Reserve District			Federal Reserve District	
Year	All	6th Atlanta	8th St. Louis	All	6th Atlanta	8th St. Louis
1929	274	120	155	35	21	14
1930	259	105	154	35	22	13
1931	222	96	126	28	18	10
1932	206	89	108	27	18	9
1933	189	82	106	24	15	9

SOURCE.—*Rand McNally Bankers' Directory*, various July issues, 1929–35.

(e.g., during the fall of 1931) and for other reasons (e.g., loan defaults) shows little (or no) correlation with subsequent commercial contraction.

Our methods directly address key questions concerning the collapse of the banking system during the early 1930s. Did Federal Reserve policies influence bank failure rates? Did providing liquidity (or credibly committing to do so) reduce rates of bank suspension and liquidation? Did the demise of banks reduce the supply of commercial credit? Did the contraction of credit reduce commercial activity? To each of these questions, the answer is yes.

Section VII discusses the implications of our analysis. By injecting liquidity into the banking system, particularly during the banking panic in the fall of 1930, the Federal Reserve Bank of Atlanta prevented bank failures rates and facilitated business activity. If other Federal Reserve banks had pursued similar strategies, fewer banks would have failed, and the depression may have followed a different course.

II. Data Sources

A spectrum of sources provides the essential evidence. The *Rand McNally Bankers' Directory* describes bank balance sheets, correspondent relationships, and characteristics. Observations drawn from July issues provide a panel of annual observations on state and national banks in Mississippi at their spring calls. Tables 1 and 2 recapitulate this information. The U.S. censuses of agriculture, manufacturing, and population describe the characteristics of counties. Summary statistics appear in table 3.[1] *Bradstreet's Weekly*, *Dun's Review*, the *Commercial and Financial Chronicle*, the *Federal Reserve Bulletin*, and the annual reports of the Federal Reserve Board and the Federal Reserve banks provide information on building

[1] These data can be downloaded from the Interuniversity Consortium for Political and Social Research, Study 3, Historical, Demographic, Economic, and Social Data: The United States, 1790–1970 (http://www.icpsr.umich.edu/icpsrweb/ICPSR/.

TABLE 2
CHARACTERISTICS OF BANKS IN MISSISSIPPI ON JULY 1, 1929

	6TH FEDERAL RESERVE DISTRICT (Atlanta)						8TH FEDERAL RESERVE DISTRICT (St. Louis)					
	All 6th (N = 141)			Near Border (N = 76)			Near Border (N = 169)			All 8th N = 112)		
	Median	Mean	Standard Deviation	Median	Mean	Standard Deviation	Median	Mean	Standard Deviation	Median	Mean	Standard Deviation
Financial ratios:												
Net worth/total assets	.10	.11	.04	.10	.11	.04	.13	.14	.06	.11	.13	.05
Cash/total assets	.37	.38	.14	.36	.39	.14	.38	.37	.15	.38	.38	.15
Deposits/total liabilities	.87	.85	.07	.88	.85	.08	.85	.82	.11	.86	.83	.10
Financial characteristics:												
Total assets ($1,000)	559	1,166	141	514	1,211	225	451	790	106	448	748	76
Loans and discounts ($1,000)	334	676	1,070	278	713	1,288	270	464	755	256	437	668
Cash and exchanges ($1,000)	92	204	310	84	228	373	92	174	276	91	157	237
Deposits ($1,000)	506	1,003	1,445	465	1,040	1,699	379	662	993	369	629	869
Paid-up capital ($1,000)	30	59	75	30	63	86	30	52	65	30	49	57
State-chartered banks (%)		.85	.36		.88	.33		.90	.30		.92	.28
Federal Reserve member (%)		.15	.36		.12	.33		.12	.32		.10	.30
Years in operation	24	23.2	12.3	24.5	24.0	12.7	21	21.9	14.9	20.5	21.8	14.2
Correspondents (N)	3	3.10	.90	3	3.08	.95	3	3.04	.89	3	2.96	.96

SOURCE.—*Rand McNally Bankers' Directory*, various July issues, 1929–35.
NOTE.—Near border sample consists of banks in counties for which at least 50 percent of the area lies within 1 degree latitude of the Federal Reserve district border.

TABLE 3
CHARACTERISTICS OF COUNTIES IN MISSISSIPPI IN 1930

	6th Federal Reserve District (Atlanta)				8th Federal Reserve District (St. Louis)			
	All		Near Border		Near Border		All	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Population (1,000s)	22.4	14.4	28.2	17.7	30.4	17.2	26.8	14.2
Persons per square mile	37.4	19.7	41.5	20.3	51.4	21.5	49.3	18.6
Urban population share (%)	14.2	22.3	12.2	22.8	12.5	11.1	9.3	10.8
Black population share (%)	43.4	18.2	49.5	18.2	56.1	18.1	49.6	23.3
Number of manufacturing establishments	20.1	20.0	25.6	24.6	27.1	14.1	25.2	15.9
Average annual manufacturing wage ($)	754.8	150.6	779.2	129.3	753.7	182.9	711.2	178.7
Net sales, retail stores, annual per capita ($)	190.0	76.8	188.2	91.7	185.0	51.5	175.1	54.0
Fraction of population in labor force (%)	38.8	6.2	41.3	6.3	42.9	7.6	42.4	8.0
Unemployment rate (%)	1.8	2.0	1.0	1.1	.6	.4	.5	.4
Fraction of farm acres in cotton (%)	57.5	26.4	68.0	18.2	77.7	14.1	79.7	11.9
Fraction of farm acres with crop failures (%)	3.3	6.4	3.8	7.3	1.1	.5	1.1	.8
Farm mortgage debt as a percentage of farm value	33.2	5.3	35.3	4.2	41.2	7.2	41.6	6.1
Interest charges as a percentage of mortgage debt	7.0	.5	6.9	.4	6.9	.5	6.9	.4

SOURCE.—Historical, Demographic, Economic, and Social Data: The United States, 1790–1970 (http://www.icpsr.umich.edu/icpsrweb/ICPSR/. For comparisons of additional characteristics, see Richardson and Troost (2006).

NOTE.—The near border columns contain statistics for counties for which at least 50 percent of the area lies within 1 degree latitude of the Federal Reserve district border.

permits, business failures, commodity prices, interest rates, and price and production indices.

The archives of the Federal Reserve Board provide additional information. Forms St. 6386a and 6386c from the Division of Bank Operations report changes in bank status including mergers and reopenings of suspended banks. Form St. 6386b reports bank suspensions and their causes. The reports distinguish between temporary and permanent suspensions. A temporary *suspension* occurred when a bank closed its doors to depositors for at least one business day and later resumed operations. Permanent suspensions, which we refer to as *liquidations*, were the subset of suspensions in which insolvent banks ceased operations, surrendered charters, and repaid creditors under the auspices of a court-appointed receiver.[2]

The U.S. *Census of American Business* (U.S. Census Bureau 1935) provides information on commercial activity. The census reports the number of establishments engaged in wholesale distribution and net sales of those establishments in 1929 and 1933. The figures for 1929 indicate the amount of wholesale activity in each county in the peak year prior to the contraction. The figures for 1933 indicate the amount of wholesale activity in each county at the trough of the depression.

These sources provide a panel of data consisting of all banks that operated in Mississippi between July 1929 and July 1933. The panel contains information about bank characteristics and economic conditions, which other scholars have used, and information about multiple measures of financial distress (such as suspensions and liquidations), other changes in bank status (such as mergers, consolidations forced by financial difficulties, and voluntary liquidations), multiple paths of contagion (including correspondent linkages and runs on banks), factors fundamental to the performance of the national economy and particularly pertinent to Mississippi (such as levels of farm indebtedness and the condition of the cotton crop), and measures of Federal Reserve policy regimes, which scholars have not employed in the past.

A wide variety of historical sources reveal the policy regimes of the Atlanta and St. Louis Federal Reserve banks. The archives of the Board of Governors contain correspondence between the Board, the Atlanta Fed, and the St. Louis Fed that describes their actions and illuminates their intentions. So do articles in depression-era newspapers and Gamble's (1989) in-house history of the Atlanta Fed. The annual reports of the Reserve banks also describe their policies and the implementation of their plans.

[2] These records reside in Record Group 82, "Central Subject File of the Federal Reserve Board of Governors, 1913–1954," National Archives and Records Administration, College Park, MD. For detailed descriptions of these data, see Richardson (2006, 2007*a*, 2007*b*, 2008).

Four independent sources enable us to determine the dates and the nature of Mississippi's banking crises. The first is the Federal Reserve's St. 6386 database, which indicates the dates and causes of bank suspensions. The second is a narrative description of events contained within the biennial reports of Mississippi's state Banking Department. The third is articles in an array of newspapers including three with the largest circulation in Mississippi, the *Meridian Star*, *Vicksburg Herald*, and *Vicksburg Sunday Post-Herald*; the leading papers from the headquarters' cities of the 6th and 8th Federal Reserve Districts, the *Atlanta Journal*, *St. Louis Globe-Democrat*, and *St. Louis Post-Dispatch*; and the *New York Times*. The fourth is a Department of Agriculture study into the seasonal pattern of bank balances in Mississippi from 1923 through 1936 (Wall 1937).

III. Historical Background

Our quasi-experimental approach builds on three facts. First, when the depression began, the policy regimes of the Atlanta and St. Louis Federal Reserve banks differed, and those differences were exogenous to the state of Mississippi and events occurring at the time. Second, Mississippi was homogeneous in economic, demographic, and regulatory dimensions, particularly in counties adjacent to the Federal Reserve district boundary. Third, in the fall of 1930, Mississippi experienced a panic in which a sudden shift in depositors' perceptions about the safety of financial institutions triggered runs on banks, and depositors withdrew funds en masse

A. Policy Regimes

Friedman and Schwartz (1963) pioneered efforts to identify Federal Reserve policy regimes using the narrative historical approach. Romer and Romer (1989) emphasize the importance of establishing clear criteria for identifying policy regimes. Since our essay focuses on banking crises, we define regimes in terms of policies regarding whether and how to intervene during widespread and rapid failures of financial institutions that contemporaries classified as panics.

In the spring of 1913, the organizing committee of the Federal Reserve System split the state of Mississippi evenly between the 6th and 8th Districts. Figure 1 depicts the division (as well as information discussed later). In the 6th District from 1913 until the mid-1930s, the Atlanta Fed followed Bagehot's rule, a doctrine that during financial panics, central banks should act as lenders of last resort and extend credit to institutions afflicted by illiquidity. Such lending should be sufficient to enable solvent but illiquid institutions to survive deposit losses

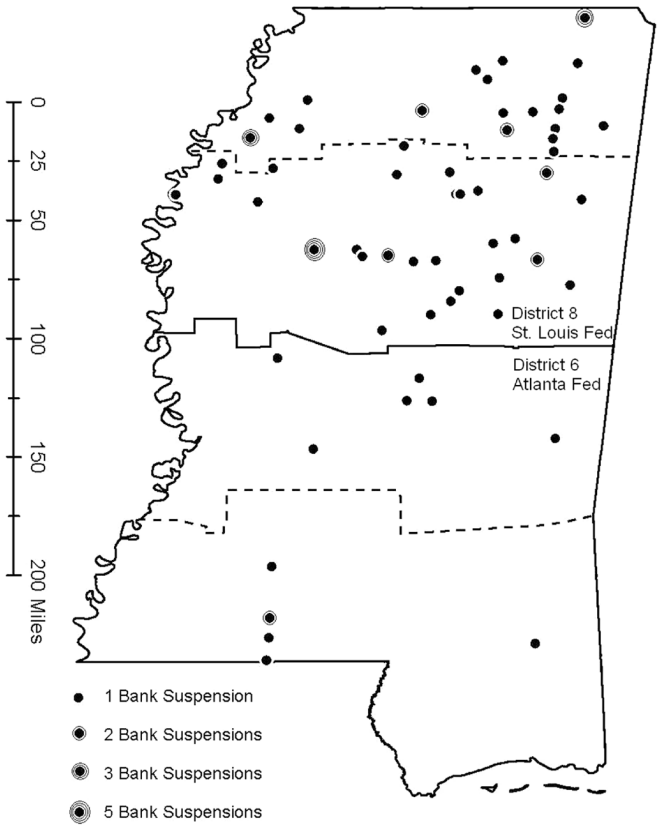

FIG. 1.—Mississippi's division into Federal Reserve districts and bank suspensions between October 1930 and March 1931. Source: See Section II. The solid line represents the Federal Reserve district border. The dotted lines enclose the counties for which at least half the area lies within 1 degree latitude of the district border.

and, thus, to prevent runs from driving healthy banks into insolvency. From 1913 to 1929, the Atlanta Fed faced four panics in which it could employ such policies. In each instance, the Atlanta Fed rushed large quantities of cash to the afflicted region, extended emergency loans to member banks, helped member banks extend credit to their country clients, and returned the situation to status quo ex ante (for details, see Richardson and Troost [2006]). During the depression of the 1930s, the Atlanta Fed consistently advocated monetary expansion. Atlanta's advocacy caught President Franklin Roosevelt's attention, and he appointed Atlanta's governor, Eugene Black, to be the chairman of the Federal Reserve Board.

The policies of the Federal Reserve Bank of St. Louis were far dif-

ferent. The St. Louis Fed was a principal proponent of the "Real Bills view that the supply of credit should contract during recessions" since a lower level of economic activity required less credit to sustain it (Wheelock 1991, 53, 111). According to this doctrine, excessive credit expansion generated fears of inflation and uncertainty about interest rates, which deterred investment and retarded recovery. For this reason, the directors "opposed reductions in discount rates and other actions [which would] retard the necessary process of liquidation" (Chandler 1971, 142). The 8th District held this view because the city of St. Louis served as an agricultural entrepot, and the Federal Reserve Bank of St. Louis focused on accommodating the strong seasonal business cycle by procyclically expanding and contracting credit.

Because the St. Louis Fed adhered to the doctrine of real bills, it ran a tight discount window. During periods of panic, it limited lending and at times refused requests to rediscount eligible paper. When it did extend loans, the St. Louis Fed required what was then known as *marginal* or *double* collateral. This collateral consisted of the eligible paper required by law plus an equal amount of U.S. government securities. This practice discouraged banks from using the discount window as a source of liquidity, since they had to turn over $2 of their most liquid assets to get $1 of cash (Westerfield 1932). The St. Louis Fed maintained this policy until the summer of 1931. In July of that year, the St. Louis Fed ceased opposing intervention, eased collateral requirements, and expanded lending through the discount window (Chandler 1971, 142).

B. Homogeneous Conditions

Mississippi was homogeneous economically and demographically. Table 3 demonstrates this by displaying county-level data drawn from the censuses of population, manufacturing, and agriculture for 1930. In both districts, the fraction of the population in the labor force was substantial. Unemployment rates were low. Farm debt hovered around one-third to one-fifth of farm value. Rural counties concentrated on cultivating cotton. Prevailing prices for labor (average annual manufacturing wage) and capital (ratio of interest charges to mortgage debt) differed little across counties. The largest differences arose in the extremities of the state. The counties adjoining the Federal Reserve district border had few discernible differences.

Mississippi's banking system was also homogeneous. The Banking Department applied standard procedures throughout the state. So did the Office of the Comptroller of Currency, Reconstruction Finance Corporation, Department of Agriculture, Works Progress Administration, and the intermediate credit banks, since Mississippi lay within a single district for all these federal bureaus.

Mississippi's unit banking system resembled that prevailing throughout the United States. The law prohibited branching. Banks operated out of a single building. They served areas near their headquarters, with most depositors and borrowers belonging to the local community. Few local banks belonged to the Federal Reserve System. Instead, they relied on correspondents in municipalities designated *reserve cities*, which belonged to the Federal Reserve System. Correspondent banks provided local banks with liquidity, often by discounting short-term commercial paper, which correspondents then rediscounted at a Federal Reserve facility. This financial structure enabled the Federal Reserve to influence the liquidity of nonmember institutions by encouraging correspondents to extend credit (or discouraging them from withholding credit).

C. The Banking Crisis

On November 7, 1930, Caldwell and Company collapsed in Nashville, Tennessee. Caldwell controlled the largest financial conglomerate in the South, and its principal affiliate, the Bank of Tennessee, served as the correspondent for hundreds of financial institutions. During the next few days, correspondent networks toppled like dominoes in Tennessee, Arkansas, Illinois, and North Carolina. Bank runs radiated geographically from the locus of the counterparty cascade. Caldwell's correspondent network did not extend into Mississippi, where the banking situation remained stable for 6 weeks (Richardson 2007*b*).

During this period, newspapers in Mississippi reported the financial scandal underlying Caldwell's demise (e.g., *Vicksburg Herald*, November 8, 1930, 1). Newspapers also reported on the financial scandals contributing to the closure of the Bank of the United States in New York City (*Atlanta Journal*, December 11, 1930, 33; December 12, 1930, 36; December 16, 1930, 29) and the closure of the Guaranty Building and Loan Association in Hollywood, California (*Atlanta Journal*, December 12, 1930, 1, 10). Newspapers emphasized a court decision that invalidated a law that exempted Mississippi banks from taxation (*Meridian Star*, December 1, 1930, 1). The decision threatened to increase banks' operating expenses and weaken their financial positions. The decision also cast doubt on Mississippi's recently revised banking codes and threatened to saddle banks with large liabilities from the deposit insurance program, which the state discontinued in the spring.

The incessant discussion of financial corruption, banking panics, industrial recession, and court cases appears to have taken a toll on depositors' confidence. The *Vicksburg Herald*'s weekly tabulation of Vicksburg bank balance sheets shows deposits falling at an increasing rate during November and December. The process remained orderly until Friday, December 19, 1930, when panic struck. On that day, the state

Banking Department closed three banks: one because of embezzlement and two because of frozen assets and poor collections. The next day, one of the larger banks in the state placed itself in the hands of the Banking Department after the suspicious death, rumored to be a suicide, of its president.

Rumors triggered runs on nearby banks, which soon spread to neighboring towns, and within a week, throughout the state. Forty-nine institutions quickly closed their doors to depositors. The law allowed banks to suspend operations for up to 5 days at directors' discretion and for a longer period if they could demonstrate both compelling necessity and the ability to reopen after the crisis passed. Banks that remained in operation slowed withdrawals from savings accounts by requiring 30 days' notice for withdrawals (a provision in most deposit contracts) and refusing to terminate time deposits before maturity.

During this whirlwind of withdrawals, aggregate deposits at Mississippi's banks fell by nearly 30 percent, even though four out of 10 banks closed their doors to depositors and the remainder slowed withdrawals however possible. Lending by banks fell by a similar percentage (*Biennial Report of the Banking Department of the State of Mississippi*, 1931, 4). In prior Decembers and Januaries, balances had increased in Mississippi's banks, as farmers deposited proceeds from the harvest. The typical end-of-year inflow increased deposits from 20 percent to 30 percent. Thus, at a time when Mississippi's banks expected large inflows of funds, they experienced large outflows. When withdrawals abated in February 1931, the level of deposits was 55 percent lower than a year earlier and 65 percent lower than the average of the preceding five Februaries. Deposits and lending remained near this nadir until 1934 (Wall 1937, 20).

D. The Historical Experiment

Responses to this banking panic create the historical experiment. The 6th District reacted as it had in the past. It rushed cash in large quantities to banks undergoing runs. It extended credit to member banks as quickly and substantially as possible and encouraged them to extend loans to their counterparties. During the three weeks following Caldwell's collapse, discounts to member banks increased by $2,800,000, and total Federal Reserve credit to member banks increased by more than $8,100,000 (Wicker 1996, 54).

The 8th District also acted as it had in the past. The St. Louis Fed made no effort to expedite discount lending and may have slowed disbursement by more stringently monitoring the quality of paper submitted for rediscounting. During the first three weeks of the crisis, discounts to member banks in the 8th District declined by $2,100,000, and

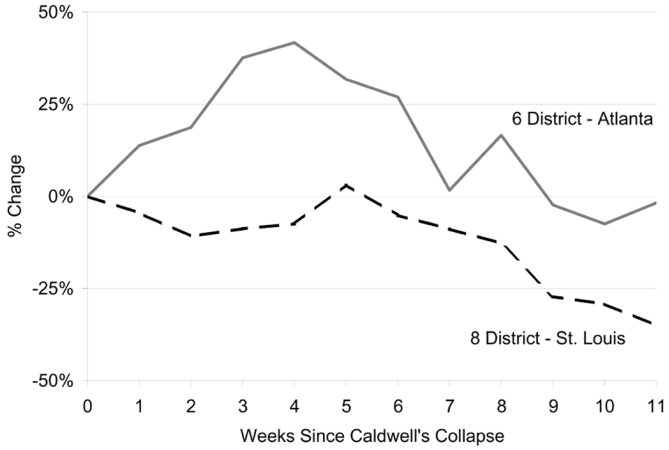

FIG. 2.—Discount response after the collapse of Caldwell, aggregate discounts each week as a percentage of initial level. Source: See Section II.

total Federal Reserve credit to member banks in the 8th District declined by more than $11,800,000 (Wicker 1996, 54).

Figure 2 illuminates changes in discount lending following Caldwell's collapse. Discounts of the 6th District rose rapidly to a peak 40 percent higher than before the crisis. Discounts of the 8th District fell gradually, as the extension of new loans slowed and existing loans expired.

In this situation, models of the Diamond-Dybvig type provide clear predictions (Diamond and Dybvig 1983). Bank failure rates in the 6th District should have been lower than bank failure rates in the 8th District, since a lender of last resort can mitigate financial panics by extending credit to illiquid institutions (and perhaps forestall a panic by credibly committing to do so).[3] Since the Atlanta Fed implemented such a policy in a prompt, ample, and public manner, difference in outcomes between the 6th and 8th Districts (if any) should reveal the effectiveness (or ineffectiveness) of Atlanta's policies.

Nonpanic periods serve as a control case that helps to test the homogeneity assumption underlying our analysis. Bagehot's rule is a policy implemented during panics, when withdrawals, contagion, and illiquidity bedevil banks. The policy does not operate and therefore should have no direct effect on bank failure rates outside of panic periods. The period following the summer of 1931, when the St. Louis Fed adopted

[3] Recent theoretical work indicates that monetary expansion can prevent the failure of depository institutions, curtail contagion among banks, and alleviate the contraction of liquidity even when real shocks (such as loan defaults or delays in bond repayment) are the root of the problem and trigger the illiquidity crisis. See Diamond and Rajan (2005, 2006).

TABLE 4
BANK SUSPENSIONS AND LIQUIDATIONS

Begin July 1		End June 30	Percentage of Banks Suspending			Percentage of Banks Liquidating		
				Federal Reserve District			Federal Reserve District	
			All (1)	6th Atlanta (2)	8th St. Louis (3)	All (4)	6th Atlanta (5)	8th St. Louis (6)
1929	to	1930	4.8	7.1	3.0	4.5	7.1	2.4
1930	to	1931	28.9	14.2	39.5	13.6	7.1	18.6
1931	to	1932	13.2	14.9	11.8	8.0	7.9	8.1
1932	to	1933	7.7	7.5	7.9	7.3	6.5	7.9
1933	to	1934	.9	.0	1.7	.9	.0	1.7
1929	to	1934[a]	49.8	38.7	59.2	30.9	26.8	34.4

SOURCE.—*Rand McNally Bankers Directory* and National Archives and Records Administration Record Group 82. See Section II and Richardson (2006, 2007*a*, 2007*b*, 2008) for details.

[a] The last row indicates the percentage of banks operating on July 1, 1929, that either suspended or liquidated by June 30, 1933.

policies resembling those in Atlanta, also serves as a control case. If policies mattered, differences in outcomes should exist when policies differed but should not occur when policies were the same.

E. Patterns Apparent in Basic Data

Table 4, figure 1, and figure 3 illuminate the outcomes of interest. Table 4 reports suspension and liquidation rates for each year from July 1929 to July 1934. The rates peaked in the second year of the depression and remained above predepression levels until the national banking holiday in March 1933. Table 4 shows that when the Atlanta and St. Louis Feds pursued opposite policies during the fall and winter of 1930, fewer banks failed in the 6th District, which made every effort to inject liquidity into the banking system. More banks failed in the 8th District, which preached nonintervention and where Federal Reserve credit outstanding fell substantially. Afterward, as the policies of the districts converged and the nature of the banking difficulties changed, rates of suspension and liquidations also converged.

Figure 3 illustrates these patterns by plotting the percentage of "banks in operation" and "banks in business" each day over the entire span of our data panel from July 1, 1929, to June 30, 1933.[4] Banks in operation

[4] The numerator of the series banks in operation is the number of banks in operation on July 1, 1929, minus the number of banks that since that date suspended operations (either temporarily or permanently), consolidated because of financial distress, liquidated voluntarily, or surrendered their charter after merging with another institution and plus the number of banks that since July 1, 1929, newly opened for business or reopened after temporarily suspending operations. The numerator of the series banks in business equals banks in operation plus the number of temporarily suspended banks. The denominator of both series is the number of banks in operation (which equals the number of banks in business) on July 1, 1929.

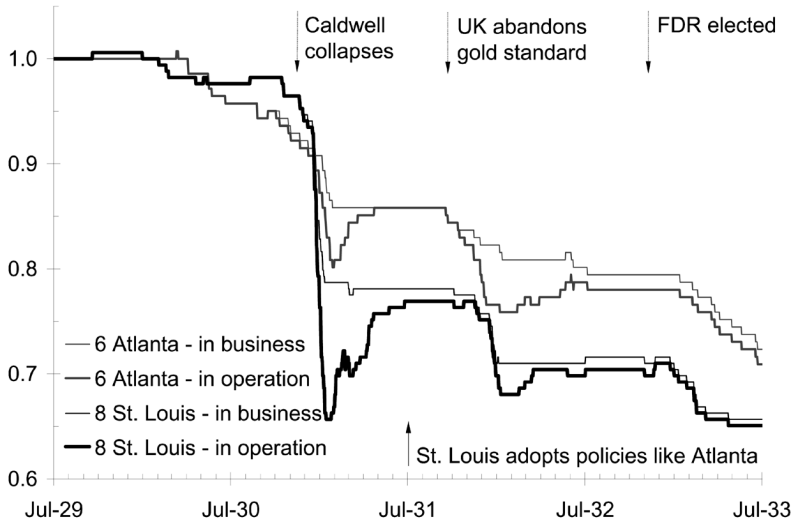

FIG. 3.—Percentage of banks in business and in operations in the 6th and 8th Federal Reserve Districts in Mississippi, July 1929 to June 1933. Source: See Section II.

are banks whose doors are open to the public. Banks in business are banks that are not bankrupt. The difference is the number of temporarily suspended banks. Figure 3 also indicates the date when the St. Louis Fed's policies began to converge toward those of the Atlanta Fed and the dates of the events that the historical literature identifies as triggers of the surges in suspensions apparent in the evidence. Figure 3 shows that during the post-Caldwell panic, when policy regimes differed across districts, banks suspended operations (temporarily and permanently) at much higher rates in the 8th District. During later surges in bank suspensions, when policies differed little and the rise in failures stemmed largely from fundamental factors, banks in the 6th and 8th Districts failed at similar rates.

Figure 1 plots on a map of Mississippi each bank that suspends from October 1930 through March 1931. The map indicates the division of the state into the 6th (below solid line) and 8th (above solid line) Districts. The area between the dotted lines indicates counties for which at least half of the area lies within 1 degree latitude of the Federal Reserve district border. The events precipitating the panic began in the town that had five bank suspensions. The suspensions appear to be distributed widely throughout both districts without prominent geographic patterns.

IV. Methods and Results

Statistical analysis substantiates these observations by controlling for characteristics of individual banks, the economic environment, and other phenomena that might have generated the observed differences across districts. We first control for potentially confounding factors nonparametrically. Then we present parametric estimates.

A. *Nonparametric Estimates*

The analysis of time to failure rests on survivor and hazard functions. This subsection presents nonparametric estimates of survivor functions constructed via the Kaplan-Meier method and of hazard functions constructed by smoothing raw hazard rates (i.e., the number of bank failures divided by the number of banks at risk on each date). Kernels are discrete Epanechnikov. Bandwidths of 28 days on graphs spanning 4 years and 7 days on graphs spanning 4 months are wide enough to smooth daily volatility without obscuring weekly shifts in the probability of failure.[5]

Figure 4 presents survival and hazard functions for all banks in Mississippi during the banking crisis in the fall of 1930. The time under analysis is restricted to the four months following the collapse of Caldwell and Company. The population at risk is all banks in operation. A bank that surrendered its charter voluntarily or merged with another institution departs from the population at risk (but is not counted as a failure) on the date that it ceased operations. A bank that suspended operations is counted as a failure on the date that it closed its doors to the public.

[5] Our estimates of the survival function, $S(t)$, the raw hazard function, $h(t)$, and the smoothed hazard function, $g(t)$, are

$$\hat{S}(t) = \prod_{t_i<t} \frac{n_i - d_i}{n_i},$$

where n_i is the number of banks in business at the beginning of time period t_i, d_i is the number of banks experiencing an event (such as entering receivership) at time t_i, and t_i indicates the ith time period. The raw hazard for period t_i is

$$\hat{h}(t_i) = \frac{d_i}{n_i}.$$

The hazard function is estimated by smoothing raw hazards, so that the hazard in the ith time period is

$$\hat{g}(t_i) = \sum_{z=-u}^{u} K_z \hat{h}(t_{i+z}),$$

where u is the bandwidth and

$$K_z = \frac{(u+1)^2 - z^2}{\sum_{z=-u}^{u} [(u+1)^2 - z^2]}.$$

In figure 4, the gray lines depict the 6th District. The dotted lines depict the 8th District. Figures 4*A* and *B* show that following Caldwell's collapse, patterns of hazard and survival differed dramatically between the 6th and 8th Districts. Failure rates in the 8th District rose rapidly and exceeded those in the 6th District for most of the crisis. The array of nonparametric tests for the equality of survival functions—including the log rank, Breslow, Peto-Peto, and Tarone-Ware tests—reject at the 1 percent significance level the null hypothesis that the survival function for the 6th District equaled that for the 8th District. All the tests produce χ^2 statistics (with one degree of freedom) of over 20.

The remainder of figure 4 demonstrates that differences in suspension rates across districts during the post-Caldwell panic cannot be attributed to fundamentals or selection. Figures 4*C* and *D* limit the analysis to banks that operated within 1 degree latitude of the Federal Reserve district border.[6] These figures demonstrate that even in a narrow band along the border, banks failed at a higher rate in the 8th District and a lower rate in the 6th District. Economic fundamentals varied little over such short distances, particularly in economically and politically homogeneous central Mississippi. Thus, differences in fundamentals were not the reason that failure rates differed between districts.

Figures 4*E* and *F* limit the analysis to banks in operation before the founding of the Federal Reserve in 1913. Figures 4*G* and *H* limit the analysis to banks founded after the Federal Reserve System. These figures demonstrate that banks in both groups failed at a higher rate in the 8th District. Therefore, selective pressures, which would have altered the pattern for these groups, were not the reason that failure rates differed between districts.

Figure 5 illustrates patterns of suspensions over the entire sample period. The event under analysis is suspension of operations. The definition of the population at risk remains as above except for temporarily suspended banks, which depart the population at risk when suspended and reenter the population at risk after resuming operations. All the graphs depict a similar pattern. In the 8th District, more banks failed, and failures were clustered during periods of panic. In the 6th District, fewer banks failed, particularly during the banking panic of 1930, and failures were spaced more evenly through time.

Figures 5*A* and *B* illuminate important issues. During nonpanic periods, the suspension rate in the 6th District exceeded that of the 8th

[6] Throughout this essay, whenever we state "within 1 degree latitude of the border," we are referring to this county-based distance definition. The set includes all banks operating in a county for which at least 50 percent of the surface area lay within 1 degree latitude of the border. This definition generates a band running through the center of the state straddling the Federal Reserve district border. The outer edges of the band vary from 70 to 95 miles distance from the boundary.

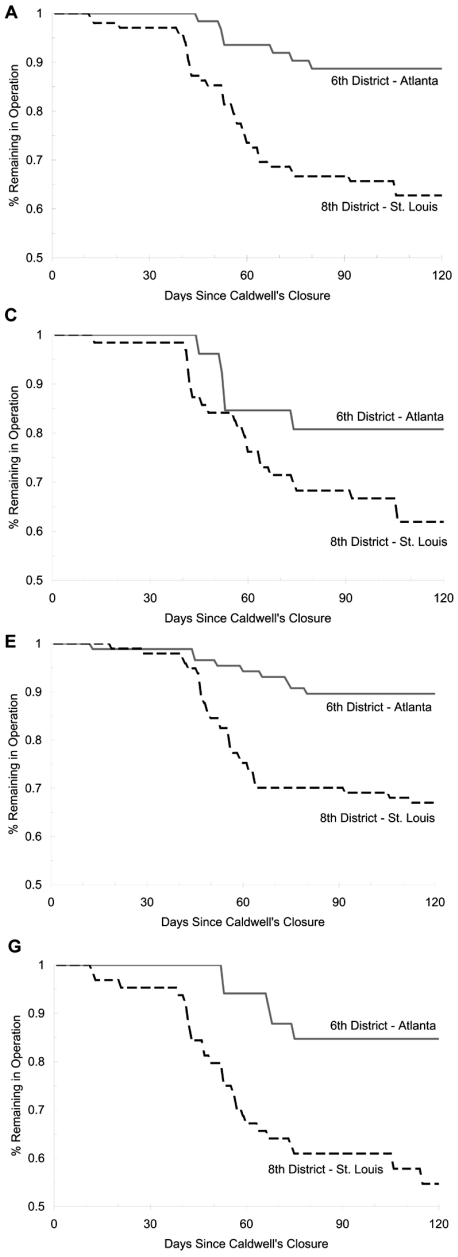

FIG. 4.—Survival and hazard during the post-Caldwell panic, principle nonparametric controls. *A*, Survival within 1 degree latitude of border. *C*, Survival within 50 miles of border. *E*, Survival for banks founded before Fed. *G*, Survival for banks founded after Fed.

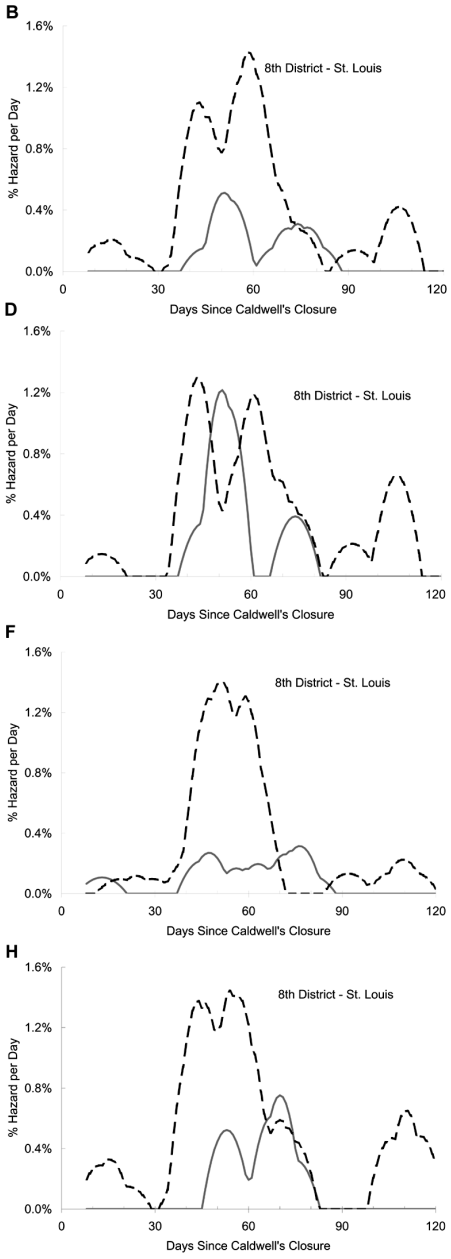

FIG. 4.—Survival and hazard during the post-Caldwell panic, principle nonparametric controls (*continued*). *B*, Hazard within 1 degree latitude of border. *D*, Hazard within 50 miles of border. *F*, Hazard for banks founded before Fed. *H*, Hazard for banks founded after Fed.

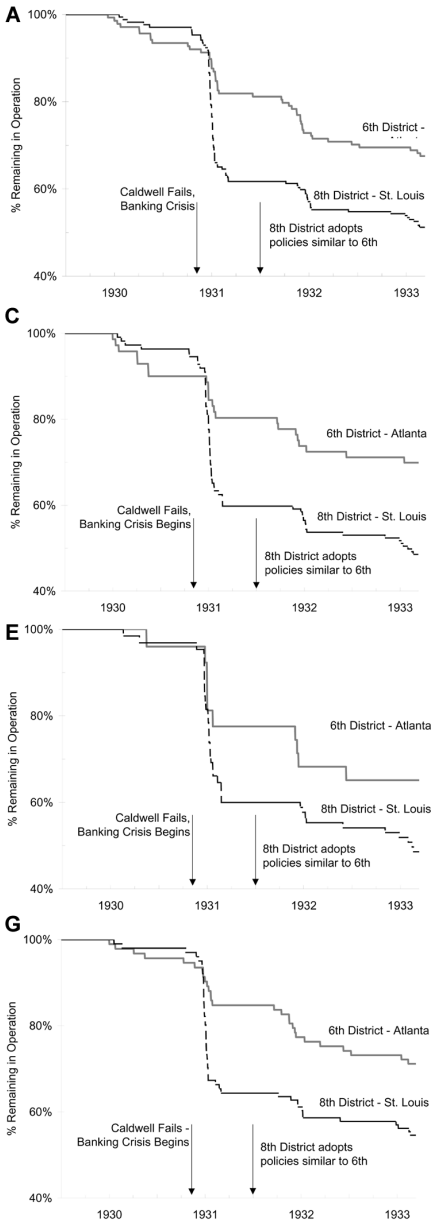

FIG. 5.—Bank suspension in the 6th and 8th Federal Reserve Districts, July 1929 through February 1933. *A*, Survival for all banks. *C*, Survival within 1 degree latitude of border. *E*, Survival within 50 miles of border. *G*, Survival for banks founded before Fed.

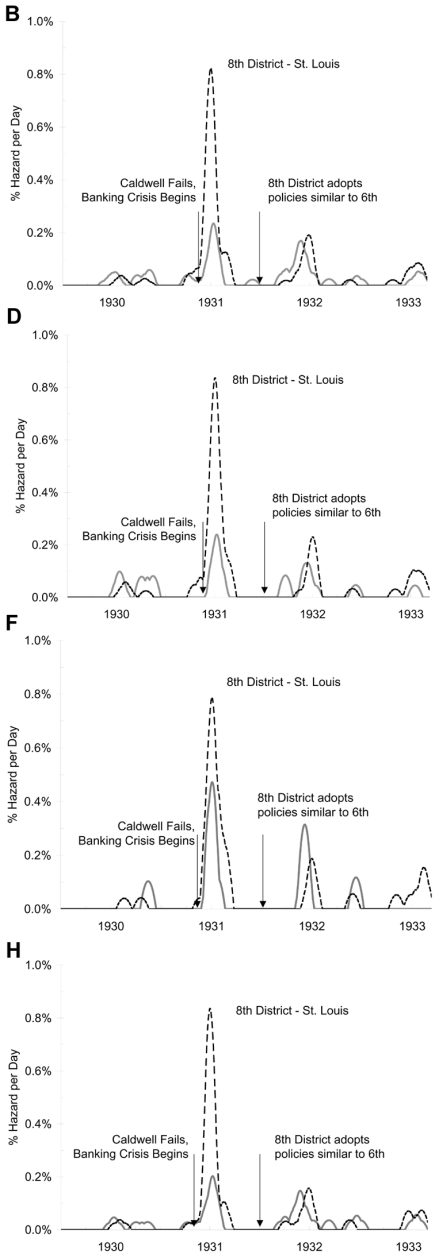

FIG. 5.—Bank suspension in the 6th and 8th Federal Reserve Districts, July 1929 through February 1933 (*continued*). *B*, Hazard for all banks. *D*, Hazard within 1 degree latitude of border. *F*, Hazard within 50 miles of border. *H*, Hazard for banks founded before Fed.

District, particularly in the period preceding the collapse of Caldwell, when principal employers in two towns in the southern half of the state closed, forcing nearby banks out of business. This pattern suggests that economic fundamentals favored banks in the 8th District over those in the 6th District. During periods of panic, however, banks in the 8th District failed at higher rates. This pattern is consistent with the effective application of Bagehot's rule, which should reduce failure rates during panics, when the lender of last resort loans freely, but not during normal times, when the lender of last resort husbands its reserves and allows insolvent banks to liquidate.

The remaining figures demonstrate the robustness of the result. Figures 5*C* and *D* limit the analysis to all banks that operated within 1 degree latitude of the border. Figures 5*E* and *F* limit the analysis to all banks that operated within 50 miles of the border. Figures 5*G* and *H* limit the analysis to banks established before 1913. In each case, the pattern remains the same.

The pattern also remains the same when we limit analysis to groups of banks with similar characteristics, such as longevity or stable management, or groups of banks operating in similar environments, such as cities or cotton-growing regions. Subpopulations that we have examined include state-chartered banks, nationally chartered banks, Federal Reserve member banks, Fed nonmember banks, banks in the western and eastern halves of the state, banks in operation for more or fewer years than the median age of all banks, banks with and without management changes between 1925 and 1929, banks in counties with more and less than the median percentage of agricultural acreage dedicated to cotton cultivation, and banks in counties with above and below the median number of manufacturing establishments. When the measure of distress is changed to liquidation, the interdistrict differences in bank failure rates retain the same sign but increase in magnitude. The invariance of the pattern across measures of distress and across subpopulations defined by likely correlates with economic fundamentals and selected characteristics suggests that neither fundamentals nor selection drives our results.

We confirm the differences apparent in the pictures with the appropriate nonparametric tests for the equality of survivor functions. In all cases, the null hypothesis of the equality of the survival functions in the 6th and 8th Districts can be rejected for the post-Caldwell panic. Similar hypothesis tests for the equality of survival functions following Britain's departure from the gold standard in the fall of 1931 and Roosevelt's election in the fall of 1932, when gold outflows forced the Federal Reserve to raise interest rates and bank failures increased throughout the nation, cannot reject the null hypothesis. This result corroborates the homogeneity assumption underlying our analysis, that banks in

northern and southern Mississippi operated in similar economic environments, faced similar challenges, and experienced similar outcomes, except during the panic in the fall of 1930, when discount-lending policies differed between districts.

The tripartite pattern apparent in figure 5—(1) hazard rates for the 6th and 8th Districts similar at all times except during the panic following Caldwell's collapse, when the hazard for the 8th District exceeded that in the 6th by a wide margin; (2) cumulative hazard for the entire period higher in the 8th District; and (3) failures clustered during periods of heightened risk—appears robust to alterations in our nonparametric framework. A nonparametric test for this pattern, however, does not exist. Generating such tests requires additional assumptions. For this task, we turn to parametric methods.

B. Parametric Estimates

A plethora of potential parameterizations exist for our analysis. We present results for the current gold standard in this literature, the log-logistic survival model of Calomiris and Mason (2003). In this model, the unit of observation is the individual bank. The dependent variable is log days until distress. Time under observation begins on July 1, 1929, and ends at the national banking holiday in March 1933. The explanatory variables include the characteristics of banks, the characteristics of counties in which banks operate, a measure of business conditions at the national level, indicators of periods of panic, and in our version of this model, indicators of Federal Reserve policy regimes. Bank characteristics update annually each July 1. County characteristics (from the Census of 1930) remain constant over time. Economic conditions update monthly. This framework allows us to determine the relative importance of fundamentals and contagion as sources of bank distress and to test whether Federal Reserve intervention mitigated (or accentuated) banking panics.

Table 5 presents the results of this exercise. Column 1 reports the basic model. It contains indicator variables for the three surges in bank suspension in the fall of 1930, fall of 1931, and winter of 1933; for whether a bank operated within the 6th District; and for whether during each of three surges in bank suspensions a bank operated within the 6th District. The crisis indicators reveal to what extent failure rates rose above the baseline during each surge. The crisis/district interaction terms reveal for each crisis whether failure rates differed between the 6th and 8th Districts. The coefficients for the banking crises in 1930 and 1931 are statistically significant, indicating that during the crises, the rate of bank distress rose above the baseline. The coefficient for the fall 1930 crisis/Atlanta Fed interaction term is also statistically sig-

TABLE 5
LOG-LOGISTIC SURVIVAL REGRESSIONS FOR INDIVIDUAL BANKS
Dependent Variable: Log Days until Bank Distress

	(1)	(2)	(3)	(4)	(5)	(6)
Fed Atlanta during crisis 1930	11.20*	2.65*	2.45*	2.64*	2.82*	1.96*
	(1.18)	(.78)	(.67)	(.76)	(1.35)	(.53)
Fed Atlanta during crisis 1931	1.25	.42	.47	.31	.13	.28
	(.84)	(.65)	(.59)	(.64)	(1.23)	(.50)
Fed Atlanta during crisis 1933	.61	1.07	.97	.86	.73	.77
	(.92)	(.94)	(.90)	(.98)	(1.35)	(.72)
Federal Reserve Atlanta	−1.01*	−.90*	−.98*	−1.05*	−.93**	−.77*
	(.38)	(.36)	(.47)	(.43)	(.52)	(.33)
Banking crisis—fall 1930	−12.38*	−3.76*	−3.50*	−3.70*	−4.19*	−2.67*
	(1.19)	(.92)	(.77)	(.92)	(1.60)	(.58)
Banking crisis—fall 1931	−2.85*	−2.41*	−2.23*	−2.34*	−2.66*	−1.88*
	(.74)	(.59)	(.54)	(.56)	(.78)	(.45)
Banking crisis—winter 1933	−1.00	−1.51**	−1.40**	−1.50**	−1.46	−.47
	(.70)	(.87)	(.81)	(.87)	(1.33)	(.56)
Assets % cash		6.37*	5.66*	6.31*	7.06*	4.55*
		(1.51)	(1.41)	(1.53)	(2.35)	(1.142

Net worth/total assets		7.53*	6.08*	6.60*	6.57*	6.96*
		(2.21)	(1.94)	(2.19)	(2.54)	(2.29)
Constant	9.09*	5.59*	4.97*	6.99*	11.31*	68.41
	(.35)	(1.97)	(2.09)	(2.14)	(3.65)	(78.73)
$\ln(\gamma)$	−.37*	−.65*	−.70*	−.67*	−.61*	−.82*
	(.09)	(.11)	(.11)	(.12)	(.13)	(.12)
Bank characteristics vector		MS	MS	MS	MS	CM
County characteristics vector			MS	PC	PC	CM
Number of explanatory variables	9	17	21	22	22	28
Sample limited to					Border counties	
Number of subjects	318	318	318	318	181	318
Number of failures	129	129	129	129	72	129
Days at risk	314,954	314,954	314,954	314,954	176,581	314,954
Log likelihood	−186.3	−144.2	−140.3	−141.8	−78.8	−133.8
Wald χ^2	115.6	34.3	44.6	40.6	35.4	98.35
Wald χ^2 degrees of freedom	7	15	19	20	20	26

NOTE.—The dependent variable is log days until distress (liquidation, suspension, or consolidation under duress) after July 1, 1929. Standard errors (in parentheses) estimated with Huber-White sandwich method clustered on individual banks. CM indicates that the vector of control variables conforms to the specifications of Calomiris and Mason (2003). MS indicates that the vector is fitted to Mississippi fundamentals. PC indicates that the vector consists of principal components of county variables. The border county sample consists of all banks located in counties for which at least 50 percent of the area lay within 1 degree latitude of the Federal Reserve district border. The number of explanatory variables includes the constant and the curvature parameter.

* Significant at the 5 percent level.

** Significant at the 10 percent level.

TABLE 6
MAGNITUDES OF EFFECTS OF POLICY REGIMES AND PANICS: CHANGE IN CUMULATIVE HAZARD RATES IN LOG-LOGISTIC REGRESSIONS

	(1)	(2)	(3)	(4)	(5)	(6)
Fed Atlanta during panic 1930	−30.5	−32.6	−33.2	−33.2	−27.8	−37.4
Fed Atlanta during panic 1931	−6.2	−2.6	−3.2	−2.0	−.6	−2.5
Fed Atlanta during panic 1933	−1.7	−3.1	−3.0	−2.5	−1.4	−2.2
Banking panic—fall 1930	36.1	40.2	40.7	40.4	36.0	43.1
Banking panic—fall 1931	12.4	11.0	10.9	10.7	8.9	11.3
Banking panic—winter 1933	2.5	3.9	3.8	3.8	2.4	1.5

nificant, indicating that during the crisis, banks in the 6th District failed at lower rates than banks in the 8th District. We cannot reject the null hypothesis that the other coefficients equal zero.

Table 6 reveals the magnitudes of the coefficients. Column 1 indicates that the crisis in the fall of 1930 raised bank failure rates substantially. The marginal effects can be stated as changes in cumulative hazard rates (a metric readily comparable to that of the graphs in the previous section). The regression coefficients, the parametric assumptions concerning the survival function, and the data can be combined to estimate the probability of distress for each bank for each day of a crisis period. For the crisis during the fall of 1930, the mean estimate is 1.74 failures per day per thousand banks. A counterfactual—what would the hazard rate have been during the panic in the absence of the Atlanta Fed's intervention—can be estimated by setting the indicator variables for the panic/Federal Reserve District 6 interaction equal to zero and redoing the calculation. The mean estimate for the no-intervention counterfactual is 2.43 per thousand. Another counterfactual—what would the hazard rate have been in the absence of the panic—can be estimated by setting the indicator variables for panic and panic/Federal Reserve District 6 interaction equal to zero. The mean estimate for the no-panic counterfactual is 0.11 per thousand. The difference between the counterfactuals indicates the impact of the panic. The difference is 2.32 per thousand. Compounding that figure over the 155 days of the crisis reveals that the panic increased the cumulative hazard for the average bank by 36.0 percent. Similar calculations indicate the effect of the Atlanta Fed's expansionary policy.

Columns 2–6 in tables 5 and 6 strengthen this supposition. Column 2 adds to the explanatory variables a vector of bank characteristics. The characteristics include the percentage of total assets composed of cash,

exchanges with banks, and marketable securities (assets % cash); net worth as a share of total assets (net worth/total assets); the natural log of total assets; the percentage of liquid assets held as cash or deposits in banks; the percentage of noncash assets invested in real estate; the number of years that the bank had been in operation; whether the bank possessed a state charter; and the share of deposits at all banks in the county held at the bank under observation. We report coefficients for the first two variables. The remainder can be found in the online version. In all our specifications, we correct standard errors for heterogeneity using the Huber-White sandwich method with error terms clustered on individual banks.

Column 3 adds to the regression the characteristics of the counties within which each bank operated. Column 3 adds the ratio of aggregate farm debt to farm value, a measure of recent changes in farm values, the percentage of farm acres in pasture or fallow, and the percentage of farms under 100 acres. Rather than accounting for county characteristics by choosing a subset of the numerous available variables, columns 4 and 5 add to the regression the five principal components (as identified by the Kaiser criterion) of 22 county-level variables that appear particularly pertinent to Mississippi. Employing the principal components changes neither the signs nor the significance levels of variables concerning the banking crises and Federal Reserve policy regimes and changes their magnitudes only slightly.

Column 5 performs a robustness check. It limits the sample to banks located in counties within 1 degree latitude of the Federal Reserve district border. This group of banks operated in a narrow geographic range and experienced similar economic shocks. Limiting the sample to this group has little influence on the magnitudes, signs, and significance levels of the coefficients.

Column 6 estimates the canonical Calomiris and Mason version of the model. We format our data as in their 2003 essay, employing nearly identical bank, county, state, and national data, and replicate their result. The regression does an excellent job of predicting the longevity of individual institutions. Fundamentals are highly correlated with bank distress. However, our version of the model includes indicators for Federal Reserve policy regimes. The coefficients on these indicators demonstrate that the Federal Reserve could lower bank failure rates by acting as a lender of last resort during banking panics.

V. Robustness

Our conclusion remains robust to a wide variety of alterations in our econometric framework. Parametric models employing different parametric assumptions, explanatory variables, and corrections for hetero-

geneity and serial correlation yield identical qualitative and similar quantitative results. Nonparametric analysis demonstrates that our results do not depend on particular mathematical and statistical assumptions. Both types of analysis demonstrate that differences in the observed characteristics of banks and the environments in which they operated do not drive our results. Our results arise from patterns in the raw data apparent from whatever perspective one views the evidence. Moreover, since all our parametric models include corrections for unobserved heterogeneity and selection on unobserved characteristics and since our nonparametric models examine subpopulations defined by factors likely correlated with unobserved and/or selected characteristics, unobserved differences among banks are unlikely explanations for the patterns that appear in the data.

Several crucial issues, however, cannot be addressed statistically. Could some unmeasured fundamental shock explain differences between the 6th and 8th Districts during the post-Caldwell crisis? To be consistent with the evidence, the shock would have to be one that raised failure rates in the 8th District relative to the 6th District during the period beginning December 19, 1930, and ending March 2, 1931, but neither before nor after, and the shock would have to be one that affected the districts uniformly and retained its punch right up to the border but did not spill over into the adjoining district. The shock could not be one that we have controlled for both parametrically and nonparametrically. Such shocks include anything correlated with the characteristics of banks—such as size, age, services, financial characteristics, or Federal Reserve membership—or the economic or demographic characteristics of the towns or counties in which banks operated—such as population density, number of manufacturing establishments, and cotton cultivation. These facts seem to rule out all possible climatic, cultural, agricultural, and industrial shocks, all of which would seem to be correlated with our controls or to operate on time horizons longer than 10 weeks.

Could the confounding factor be financial links to the Caldwell conglomerate or geographic proximity to the locus of the post-Caldwell panic? The evidence indicates otherwise. Consider the case of financial linkages. One of our sources, Rand McNally, lists the correspondents for all banks in Mississippi. Another source, the St. 6386 reports in archives of the Board of Governors, indicates whether a correspondent's closure caused the suspension of a client. These sources show that no links existed between banks in Mississippi and the Caldwell conglomerate or its subsidiaries. This evidence of absence confirms statements made by Mississippi's superintendent of banks, J. S. Love, during a press conference on November 22, 1930: "Our [Mississippi's] banks are free from outside allied connections. There does not exist in this state any group or chain banking system. . . . [We] see no cause for alarm"

(*Vicksburg Sunday Post-Herald*, November 23, 1930, 11; *Meridian Star*, November 23, 1930, 1–2). Finally, including the matrix of correspondent linkages on the right-hand side of our regressions alters neither the signs nor the significance levels of our coefficients.

Now, consider the case of geographic proximity. In Mississippi, bank runs began 6 weeks after Caldwell's demise and $3\frac{1}{2}$ weeks after the last bank in another state failed as a result of correspondent links to the Caldwell conglomerate. Runs began in the center of Mississippi, not in close proximity to borders of states engulfed by Caldwell's collapse. In addition, although the eastern half of Mississippi lay closer to Nashville, which contained Caldwell's headquarters, the bulk of Caldwell's financial operations, and its largest banking affiliate, the pattern of failures did not differ in the eastern and western halves of Mississippi or on the basis of distance from Nashville.

Could the confounding factor be some difference in policy between the districts other than discount lending? One potential candidate is open-market purchases. But for both districts, discount lending far exceeded open-market purchases. Between September 7 and December 28, 1931, for example, the quantity of U.S. government securities possessed by the 8th District did not change at all and the quantity possessed by the 6th District increased by only $4,000. At the same time, the quantity of discounts on the balance sheet of the two districts fell by roughly $4,000,000 and $7,000,000, respectively. Moreover, when the districts purchased eligible paper and government securities, they did so as an adjunct to discount lending, in order to provide favorable terms, expedite the process of converting assets to cash, and quickly provide liquidity to specific banks. The quantities of assets that the districts purchased were never large enough to influence macroeconomic aggregates such as the deflation or risk-free interest rate. Such macroeconomic aggregates neither differed between districts nor varied substantially during the event. So, they cannot explain interdistrict differences in bank survival rates.

Another potential candidate is bank standards and supervision. But nine out of 10 banks in Mississippi were state-chartered institutions. Mississippi applied identical standards and examination procedures in the northern and southern sections of the state. The *Biennial Report* of Mississippi's Banking Department, which lists the names of the examiners and the institutions that they examined, indicates that examiners rotated among institutions throughout the state. Mississippi's state banking codes required that banks be examined "at least twice each year at irregular intervals without prior notice, and with no bank to be examined by the same examiner twice in succession" (Warburton 1955, 15). So, interdistrict differences in regulations and examination procedures did not exist.

Another potential candidate is bailouts and subsidies. But, neither the state government nor the Federal Reserve district banks provided such assistance, and no banks in Mississippi received assistance from the Reconstruction Finance Corporation until 1932. Affirmative evidence of the absence of subsidies and bailouts exists. The Federal Reserve Board's form St. 6386c contains a section that describes changes in financial structure and assistance received toward reopening. These forms indicate that no banks that reopened following the post-Caldwell panic received subsidies or changed their financial structures in any way. The Federal Reserve Board's form St. 6386b, which records bank suspensions, contains a section describing borrowings from the Federal Reserve, the RFC, and similar institutions. These forms indicate that none of the state banks that closed their doors (temporarily or permanently) during the post-Caldwell panic held such loans.

Could the confounding factor be some other unmeasured shock or policy? To answer that question, we (i) scrutinized seven newspapers (named in Sec. II) for the months of September 1930 through March 1931, (ii) read the annual reports of Mississippi's banking commissioner for the years 1928–37, (iii) read the annual reports and monthly bulletins of the Federal Reserve 6th and 8th Districts, and (iv) scrutinized records of bank failures collected by the Federal Reserve Board. All these sources described the epidemic of bank runs that occurred in Mississippi at that time. None described a shock to the economy or differences in policies (other than discount lending) that might have caused more banks to fail in the northern than in the southern half of the state. It seems unlikely that such a large number of observers, with the knowledge needed to detect such an unusual and sizable shock and with the ability and incentive to report it, would have failed to report such an event, if it had occurred.

What about selection? Selection could have operated through several channels including the opening of new banks, closing of old banks, and migration of banks between districts. In each of these cases, banks likely to benefit from a supportive discount window because they possessed less liquid portfolios would grow as a proportion of the banks in the 6th District, whereas banks that did not perceive the need for assistance during panics because they possessed more liquid portfolios would grow as a percentage of the banks in the 8th District. This process of selection would concentrate banks susceptible to panics in the 6th District. The concentration could cause the efficacy of monetary intervention to be understated, since the treatment group consisted disproportionately of vulnerable institutions.

The extant evidence, however, allays such concerns. First, when given the option of reporting to the Federal Reserve district bank supervising the other portion of the state at the founding of the Fed in 1913, none

of Mississippi's banks chose to do so. Second, statistical tests cannot reject null hypotheses that bank survival, failure, and establishment rates in the 6th District equaled those in the 8th District between 1916 and 1928, the predepression years for which we have data. Third, statistical tests cannot reject the null hypotheses that in 1929, banks possessed similar asset portfolios and similar numbers of correspondents in the 6th and 8th Districts.

Selection might have operated through other channels. Managers and depositors are also mobile. Careful managers who worried about panics, foresaw the need for liquidity, and believed that the 6th District would provide more liquidity than the 8th might have migrated to the 6th District. They may also have been better judges of credit, been more efficient, and kept more cash on hand. Depositors might also have anticipated benefits from the 6th District's policies and have shifted funds toward the district that promised to provide liquidity. Either reaction might have made banks in the 6th District stronger than those in the 8th District. In this case, the efficacy of monetary intervention would be overstated.

The extant evidence, once again, allays such concerns. First, a sample of bank presidents, vice presidents, managers, and cashiers drawn randomly from 50 banks (approximately one-sixth of those in Mississippi) for the years 1915, 1925, 1929, and 1930 shows no shifts of management between the 6th and 8th Districts. Second, Warburton's study of banking in Mississippi found no significant shifts in distribution of deposits from 1915 through 1929. Throughout this period, roughly the same percentage of deposits was held by state banks, by failed banks, and by the five largest banks. The five largest institutions, for example, held 25.4 percent of the deposits in 1915 and 24.3 percent in 1929 (Warburton 1955, 31–36). Third, data from banks near the Federal Reserve district boundary show no change in the quantity of deposits at banks in the 6th District relative to the 8th District between July 1929, just prior to the suspension of deposit insurance, and July 1930, just after Mississippi discontinued its deposit insurance system, a point in time when the danger of bank runs, and thus liquidity assistance, increased suddenly and substantially. Fourth, deposits did not flow from the St. Louis to the Atlanta District in the wake of the post-Caldwell panic. In fact, banks in the 8th District near the border lost fewer deposits than banks farther from the border, all else held equal, and for banks operating near the border, average deposits at banks that remained in business in the 8th District rose relative to average deposits at banks that remained in business in the 6th District. These patterns are the opposite of what one would expect, if proximity to the border induced the flight of deposits.

Several factors explain the absence of selection. First, the public may not have been aware of policy differences between the 6th and 8th

Districts. The St. Louis Fed did not advertise its opposition to intervention or the way in which it operated the discount window. Moreover, since no panics occurred in the 8th District between the founding of the Fed and the Great Depression, the St. Louis Fed never demonstrated the actions that it would take in such an event.

Second, depositors and bankers may have underestimated the likelihood and severity of a potential banking panic, because severe banking panics had not occurred in Mississippi or on a national scale for a generation, and because during the Roaring Twenties, few people expected the onset of a catastrophic contraction. Thus, depositors and bankers may not have anticipated the need for a lender of last resort.

Third, the public may not have anticipated beneficial effects from monetary intervention. Debates over the effectiveness of the policy have raged for at least two centuries, dating back to Hume's writings on the topic and continuing vigorously today. The benefits of the approach were disputed during the 1920s. Leading academics, bankers, businessmen, and policy makers, including much of the leadership of the Federal Reserve System, believed that discount lending would exacerbate, rather than alleviate, the situation. It is unclear what depositors believed about the topic or if they had any beliefs at all.

Fourth, from 1914 until 1930, Mississippi operated a statewide deposit insurance system. Its existence may have rendered the Atlanta Fed's assistance superfluous and may also have reduced depositors' attention to the issue. Mississippi's superintendent of banking believed this to be the case. He repeatedly wrote that deposit insurance discouraged depositor monitoring and therefore encouraged mismanagement. For this reason, Mississippi discontinued its deposit insurance system on March 13, 1930 (Mississippi Banking Department *Biennial Report* 1929, 4–9; 1931, 4–5).

Fifth, even if the public had possessed perfect foresight, shifting from one district to another may not have been in their best interest. Bank managers' ability to attract deposits depended on their standing within their community and their reputation for honesty, reliability, and financial acumen. Their ability to earn profits depended on personal knowledge of individuals and businesses and their success at using that knowledge to assess the risks and returns of extending credit. Moving to a new location meant abandoning the informational and reputational advantages that enabled individuals to operate banks profitably. Shifting deposits to distant towns also entailed disadvantages. Holding deposits at a distance made it more difficult to monitor the health of one's bank and made it more difficult to withdraw funds during a panic, when individuals at the head of the line received the full value of their deposits, and those at the end of the line lost a large portion of their life savings.

TABLE 7
ASSET QUALITY AT SUSPENDED BANKS IN MISSISSIPPI, JANUARY 1929 THROUGH MARCH 1933

	GOOD		PROBLEMATIC	
	Number	%	Number	%
6th Atlanta:				
1. Panic	3	25.0	9	75.0
2. Nonpanic	2	8.0	23	92.0
8th St. Louis:				
3. Panic	37	55.2	30	44.8
4. Nonpanic	12	38.7	19	61.3

SOURCE.—National Archives and Records Administration, Record Group 82. See Richardson (2006) for details.

NOTE.—Rows 1 and 3 present figures for all banks suspending during October, November, and December 1930 and January, February, and March 1931. Rows 2 and 4 present figures for banks suspending operations in all other months from January 1929 through March 1933. The rows sum to 100 percent. Columns indicate the percentage of suspended banks in each district in each period whose assets were judged by examiners to be *good* and, thus, to have been neither a primary nor a contributing cause of the suspension, and *problematic* (i.e., either slow, doubtful, or worthless) and to have been either a primary or a contributing cause of the suspension.

A final type of evidence completes the case. Three sources report the quality of assets at failed banks. First, the Federal Reserve Board St. 6386 forms indicate examiners' ex ante (i.e., before the suspension) assessment of the quality of assets at suspended banks. Examiners reported the quality of assets at banks to be *good* and neither to have been a primary nor a contributing cause of the suspension, or *problematic* (i.e., either slow, doubtful, or worthless) and to have been either a primary or contributing cause of the suspension. Table 7 presents this information. It shows that the quality of assets at institutions that suspended operations in the 8th District was better than the quality in the 6th District. During the post-Caldwell panic, the majority of the banks that suspended operations in the 8th District had portfolios consisting predominantly of good assets.

Second, Warburton's study, "Deposit Guaranty in Mississippi," provides evidence on recoveries from the assets of failed banks (Warburton 1955, 41–51, tables 11–13). From 1916 to March 1930, when Mississippi guaranteed bank deposits, recoveries averaged just over 51.5 percent (i.e., on average, assets with a book value of $100 yielded $51.50). Recoveries from the assets of banks that failed during the post-Caldwell panic averaged 70.4 percent. Third, the 1929, 1930, and 1931 *Biennial Report*s of Mississippi's Banking Department (tables F and G) record information on recoveries from banks in liquidation. For 39 banks that failed during the post-Caldwell panic, data exist on (*a*) recoveries from the initial sale of assets shortly following suspension (these sales were supposed to be of assets that yielded nearly book value or better), (*b*) the initial estimate of the value of the remaining assets, and (*c*) eventual recoveries from sales of the remaining assets during the years 1931–33.

After the initial liquidation, examiners estimated the total value of the assets remaining from banks in the 6th District to be $1,022,025. By the end of 1933, recoveries from the sale of those assets equaled $1,014,735 (i.e., 99.3 percent of their estimated value). After the initial liquidation, examiners estimated the total value of the assets remaining from banks in the 8th District to be $2,738,760. By the end of 1933, recoveries from the sale of those assets equaled $2,179,231 (i.e., 79.6 percent of their estimated value).

Together, the sources illuminate important patterns over time and across districts. Over time, banks that failed during the panic of 1930, when liquidity forced banks with cash flow problems to shut their doors, were healthier than banks that failed at other times, when healthy institutions had access to liquidity. Across districts, banks that failed in the 8th District, where the Federal Reserved did not act as a lender of last resort, were healthier than banks that failed in the 6th District, where the Federal Reserve strove to expand the supply of credit. Afterward, in the 8th District (where more and healthier banks failed), receivers sold substantial quantities of bank assets (primarily loans to local businesses, consumers, and farmers), and the values of those assets declined precipitously. In the 6th District (where prompt intervention by the Federal Reserve enabled many banks to weather the storm), receivers put fewer assets on the market, and the values of those assets declined to a lesser degree.

VI. Impact on Commercial Activity

Did bank failures harm the broader economy? Did the destruction of financial institutions impair industry and commerce? Would saving banks have had beneficial economic effects?

Patterns of credit and commerce over time and across districts suggest that bank failures did, in fact, restrict wholesale trade. These patterns are illustrated by figure 6 and table 8, which show that after the banking panics, credit and commerce contracted more in the 8th District's portion of Mississippi than in the 6th District's portion. Figure 6*A* plots total deposits at banks in the 6th and 8th Districts' portions of Mississippi from 1930 through 1933. Deposits declined less in the 6th and more in the 8th District. Controlling for prepanic trends in deposits magnifies the difference. Figure 6*B* plots total loans and discounts, which is a reasonable proxy for total lending to local businesses. Lending declined less in the 6th and more in the 8th District. Controlling for prepanic trends magnifies this difference. Table 8 reports patterns of wholesale trade, an economic sector that depended on banks to finance ongoing operations and short-term working capital. Between 1929 and 1933, the number of firms in the 8th District's portion of Mississippi fell by 34.7

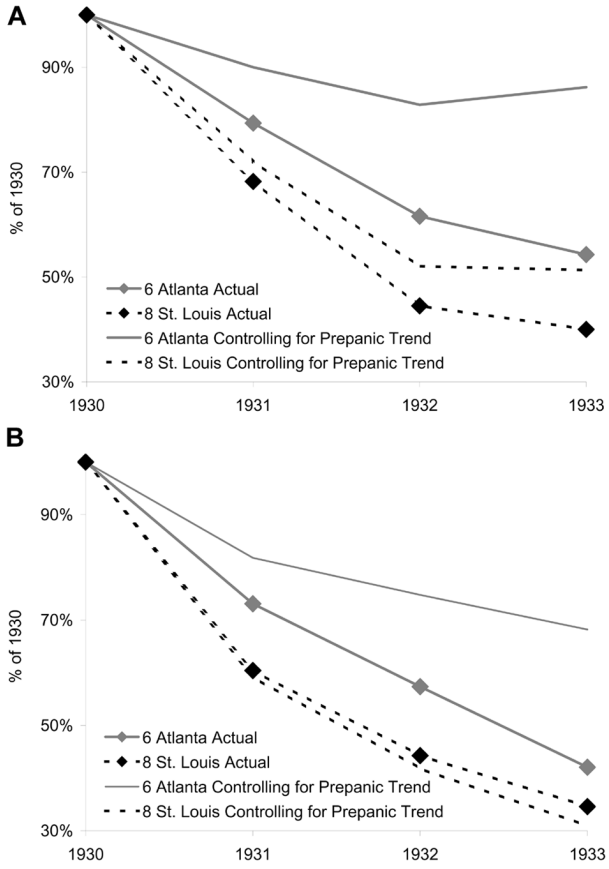

FIG. 6.—Comparing consequences of the banking panics in the 6th and 8th Districts. *A*, Total deposits as a percentage of total deposits in June 1930. *B*, Total loans and discounts as a percentage of the total in June 1930.

percent, a failure rate nearly twice that of firms in the 6th District. Wholesale transactions also fell farther in the 8th than in the 6th District.

Variation in the reason for and location of bank failures enables us to draw clear conclusions concerning the contraction of credit and decline in commercial activity. The regressions reported in table 9 exploit this variation. The dependent variable is the decline in wholesale transactions (measured as 1929 real dollars) in each county from 1929 to 1933 (measured by summing net sales for all wholesalers in each county during the year 1929 and subtracting the same sum for the year 1933). Baseline specifications appear in columns 1 and 2. Column 1's sole explanatory variable is the decline in total loans outstanding from 1929 to 1933 (measured by summing loans and discounts on the balance

TABLE 8
DECLINE IN WHOLESALE TRADE

	Federal Reserve District	
	6th Atlanta	8th St. Louis
Wholesale firms:		
Number in 1929	783	930
Number in 1933	641	607
Δ%	−18.1	−34.7
Net sales:		
$1,000s in 1929	140,776	245,486
$1,000s in 1933	59,513	83,727
Δ%	−57.7	−65.9

SOURCE.—*Census of American Business*, 1929 and 1933.

sheets of all banks in each county in operation on July 1 of each year). Note that the dependent variable measures the change in a flow, wholesale transactions summed up over the entire year minus wholesale transactions summed over a later year. The explanatory variable measures the change in a stock, total lending on the balance sheets of banks on the first business day in July minus the same figure at a later date. The link between the stock and flow is the average maturity of short-term

TABLE 9
COUNTY-LEVEL REGRESSIONS OF COMMERCIAL ACTIVITY ON CREDIT CONTRACTION
Dependent Variable: Decline in Net Wholesale Transactions from 1929 to 1933

	(1)	(2)	(3)	(4)	(5)	(6)
Decline in loans, 1929–33	1.55*	1.21*				
	(.54)	(.60)				
Decline in loans due to all bank liquidations, 1929–33			2.54*			
			(.77)			
Decline in loans due to bank liquidations during panic of 1930–31				4.00*	3.98*	5.37*
				(1.00)	(.96)	(.68)
Decline in loans due to bank liquidations outside of panic period				.87	.90	−.88
				(.63)	(.67)	(1.05)
Decline in loans at surviving banks			−.52	−.28	−.30	−.45
			(.59)	(.41)	(.42)	(.40)
Loans at banks suspending temporarily during panic of 1930–31					.155	−.96**
					(.51)	(.53)
Constant (1,000s)	−681**	−1,009*	−952*	−949*	−907*	−1,498*
	(376)	(561)	(451)	(400)	(453)	(536)
Vector of county characteristics		Yes	Yes	Yes	Yes	Yes
Sample limited to counties near border						Yes
Observations	82	82	82	82	82	39
R^2	.36	.64	.77	.80	.81	.93

NOTE.—Standard errors are in parentheses.
* Significant at the 5 percent level.
** Significant at the 10 percent level.

financial instruments used to finance wholesale transactions, such as commercial paper and bankers' acceptances. That average was just over 90 days during the period under consideration. This maturity meant that each dollar a bank invested in short-term commercial paper turned over four times each year and financed $4 of wholesale trade. The coefficient of 1.55 on the variable decline in loans, 1929–33, therefore, has a sensible magnitude. It suggests that when banks lost $1 in lending capacity, they reduced lending to wholesalers by 39 cents (i.e., 1.55 divided by 4) and reduced lending to others by 61 cents. Column 2 adds a vector of county characteristics (identical to the vector of principal components used in table 5) to the set of explanatory variables. The correlation between wholesale activity and bank lending remains statistically significant and retains a reasonable magnitude. Column 3 separates the decline in lending into two components: the decline in lending due to bank failures (measured as the dollar value of lending trapped in banks sent to receivership) and the decline in lending at banks remaining in operation. The first component remains significant in the statistical and practical sense. The second component's coefficient is not statistically significant and has a magnitude much closer to zero. The decline of lending capacity at banks remaining in operation, in other words, appears uncorrelated with the decline in wholesale activity. Column 4 subdivides the decline in lending into three components: the decline in lending due to bank liquidations during the panic of 1930–31, the decline due to bank liquidations in all other periods, and the decline at banks remaining in operation. The null hypothesis that the coefficient equals zero can be rejected only for the first component. In other words, the loss of lending capacity following the panic of 1930–31 was significantly and substantively correlated with declines in wholesale activity. The loss of lending capacity for other reasons was not. Column 5 checks the robustness of that result by adding an explanatory variable measuring lending at banks that suspended operations temporarily during the banking panic of 1930–31. This variable, which controls for the severity of panics orthogonal to bank liquidations, is insignificant.

The correlation between bank failures and business activity appears to be robust. Column 6 shows that the pattern holds even after restricting the sample to counties lying within 1 degree of the Federal Reserve district border. Additional regressions using the number of wholesale firms, the number of retail firms, the volume of retail trade, and tax revenues yield similar signs and significance levels.

The magnitudes of the coefficients in table 9 have substantive interpretations. During the 1930s, bank portfolios contained large quantities of short-term commercial paper with maturities averaging approximately 3 months. Thus, $1 of bank lending power financed approximately $4

in wholesale transactions during a year. Extending short-term commercial credit was a principal function of commercial banks. Facilitating the operation of this market was a principal mission of the Federal Reserve. Until 1932, short-term commercial paper was the only asset deemed eligible for rediscount at the Federal Reserve discount window. If the disruption of the banking system influenced real economic activity, it should certainly have affected short-term financing for wholesale firms. This appears to be the case. Specifications 4 and 5 indicate that by locking $1 of lending power in banks thrown into receivership, the banking panic of 1930 took $1 of credit from the market of commercial paper, reducing wholesale transactions by $4 annually.

The two stages of our analysis enable us to draw causal conclusions linking monetary policy to bank behavior to economic outcomes. The first stage showed that discount lending helped banks survive financial panics. The second stage showed that bank failures during the panic reduced lending available for wholesale activity. Bank distress at other times (e.g., during the fall of 1931) and for other reasons (e.g., loan defaults) shows little (or no) correlation with the commercial contraction.

VII. Discussion

The multiple sources and methods employed in the previous sections tell a consistent tale. During the banking panic that began in December 1930, banks failed at lower rates in the 6th Federal Reserve District, where the Atlanta Fed injected liquidity into the banking system, than in the 8th Federal Reserve District, where the St. Louis Fed followed the doctrine of real bills. The St. Louis Fed could have followed the same policy as the Atlanta Fed, and if it had, bank failure rates would have been lower, commercial lending would have remained higher, and the contraction would not have been as severe.

The quasi-experimental structure of our study, which frees our estimates from difficulties of inference that typically trouble studies of firms in complex, changing, and endogenous economic environments, strengthens our conclusion. The limitations of our analysis are the same as those for any study of this type. While our methods generate a precise and powerful result, they do so for a particular point in time and space: an agricultural state during the initial banking panic of the 1930s. The generalizability of our result depends on the representativeness of the place and period under study. On this dimension, our study stands on strong ground.

Mississippi's banks were representative of the segments of the financial system that bore the brunt of the contraction. Mississippi was an agricultural state suffering from droughts, falling commodity prices, and

the broad economic downturn that followed the stock market crash. Unit banks predominated. Most banks possessed state charters. Similar conditions existed in the regions of the nation and segments of financial industry that suffered the bulk of all bank failures.

Mississippi's banks were also representative of the segments of the financial system crucial for understanding links between banking panics, monetary policies, and the real economy. Most banks in Mississippi were medium- to small-sized state-chartered institutions. Their customers tended to be individuals, farmers, and businesses lacking access to equity markets and other nonbank sources of credit. Their managers possessed information about local borrowers that was lost when they ceased operations. Bernanke (1983) identifies the destruction of this information and the resulting disintermediation as one of the channels by which financial crises exacerbated the Great Depression. In addition, the medium- to small-sized banks in Mississippi were typical of the institutions that bore the brunt of the deposit losses during the early years of the depression, as depositors shifted funds toward larger member banks that were less likely to fail or removed funds entirely from the depository system. Medium- to small-sized state banks were also the institutions that accumulated the largest excess reserves. Monetarists identify declines of the deposit-currency and deposit-reserve ratios as principal factors behind the collapse of the money supply and aggregate economy between 1931 and 1933 (Friedman and Schwartz 1963). Moreover, the collapse of state banking systems that began in the fall of 1930 received prominent media coverage. The widespread reporting of the bank failures—including incessant coverage of defalcations, indictments, and suicides of bankers—must have generated fear and uncertainty among consumers and businessmen. Romer (1993) among others identifies uncertainty and expectations as mechanisms by which financial crises deepened the depression. Thus, the banking situation in Mississippi during the 1930s reflects the three primary channels—money, intermediation, and expectations—by which bank failures influenced real economic activity.

Was concerted action by the Federal Reserve feasible? The weight of the evidence suggests that the Federal Reserve System could have done more to combat the initial wave of banking panics in the fall of 1930. At that time, the Federal Reserve knew the theoretical justification for intervening to halt banking panics. The Federal Reserve also had the ability to act as a lender of last resort. Gold stocks were large. Gold was flowing into the country. Credit could have been extended to banks without endangering the exchange rate regime.

The policies followed by the Atlanta Fed required the commitment of few resources. The extra manpower required to extend emergency loans, the forms that had to be filled out, and the fuel required to move cash from the Fed to commercial banks were trivial. The financial costs

were also limited. The Federal Reserve Bank of Atlanta was not saddled with large liabilities like those the government incurred during the savings and loan crisis of the 1980s. In contrast, the Atlanta Fed profited by extending emergency credit, because the loans were repaid. Atlanta's credibility may have been one reason for the low cost of its policies. In expectational panics of the Diamond-Dybvig type, a lender of last resort that credibly commits to fulfilling its mission may expend fewer resources than a central bank that makes a belated and halfhearted attempt to halt a panic. Atlanta's experience demonstrates, in other words, that the costs of action are sometimes less than the costs of inaction.

Evidence that the Atlanta Fed's policies influenced broader business conditions comes from several sources in addition to the regressions presented in the previous section. Economic historians have shown that the depression followed a unique course in the 6th Federal Reserve District. The 6th District experienced a contraction during 1929 and 1930 as sharp and severe as the hardest-hit Federal Reserve districts, but the 6th District's recovery began earlier and progressed swifter than anywhere else in the United States. The 6th District's recovery began during the first quarter of 1931, which was the quarter that the Atlanta Fed embarked on its efforts to extend discount loans to banks and expand the supply of credit. During that quarter, the contraction accelerated in all other districts, and by 1933, the 6th District's economy was the healthiest in the nation. This pattern appears in data on employment and unemployment (Wallis 1989) and indices of industrial production (Rosenbloom and Sundstrom 1999). The pattern also appears in data on banks. In the 6th District, depositors kept more of their savings in the financial system, bankers held lower excess reserves and made more loans, and businesses borrowed more money. Scholars refer to the pattern as the Southern Paradox, since they have failed to find any features of the southern economy that can explain the South's sudden, singular recovery (Margo 1993).

Several strands of literature suggest that stopping the banking panics would have moderated the contraction for the nation as a whole. First, much of the scholarship on the Great Depression, including Friedman and Schwartz (1963) and Bernanke (1983), sees banking panics as a principle propagator of the contraction and a key to understanding the downturn's depth and length. Second, many macroeconomic models highlight a connection between the onset of banking panics in the fall of 1930 and the depression's acceleration at that time. For example, Cecchetti and Karras (1994) find that "there is an aggregate supply collapse that coincides with the onset of severe bank panics . . . suggesting an association between [the supply shocks] and the credit channels emphasized by Bernanke" (80–81, 99–100). Christiano, Motto, and Rostagno (2003) find that the flight from deposits to currency during

the year following Caldwell's collapse (and the consequent accelerator effects, debt deflation, and credit crunch) explains the severity of the contraction during the years 1931–33. Third, monetarists such as Friedman and Schwartz (1963) argue that the onset of banking panics in the fall of 1930 led to the collapse of the monetary system. The initial panic marks the point at which the money multiplier, the deposit-currency ratio, the deposit-reserve ratio, and all measures of the money supply plummeted. Their decline from November 1930 to March 1933 was the most rapid and prolonged in American economic history. Their decline lowered the price level, raised real wages and interest rates, and, through those and other channels, reduced both aggregate supply and demand.

If those scholars are correct, then the evidence presented in this essay indicates that the Federal Reserve System missed an opportunity to take inexpensive actions that would have stemmed the initial wave of banking panics and altered the course of the contraction. The broader implications of this finding remain to be determined. Would mitigating the initial wave of panics have prevented the panics that came later? Would mitigating panics have prevented the debilitating deflation and collapse of intermediation that dragged the U.S. economy ever deeper into depression? What were the relative strengths of the money and credit channels for the transmission of monetary policy? All these inquiries remain open questions. The evidence presented in the preceding paragraphs is only suggestive. However, we believe the approach that we pioneer—applying quasi-experimental methods to panels of data on banks and businesses exposed to different monetary regimes along Federal Reserve district borders—can be extended to answer these and other questions concerning monetary policy, financial intermediation, and the causes, consequences, and possibilities of preventing Great Depressions.

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