Shadowy Banks and Financial Contagion during the Great Depression:
A Retrospective on Friedman and Schwartz

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Milton Friedman and Anna Schwartz's *Monetary History of the United States* revolutionized economists' understanding of the role of money in the aggregate economy. Until its publication, many scholars and practitioners believed that monetary forces played little independent role in economic affairs, and that monetary policy had little influence on the business cycle. The *Monetary History* also reshaped our views of the defining moments of the U.S. economy, none more so than the contraction of 1929 to 1933. One-sixth of their magnum opus focuses on what they call the Great Contraction – a period when output, prices, and money fell by more than a third, unemployment peaked at more than 25%, and the commercial banking system's collapse culminated in President Roosevelt's declaration of a nationwide banking holiday in March, 1933.

Friedman and Schwartz view the Great Contraction as a "tragic testimonial to the importance of monetary forces." They conclude that the Fed had "ample powers" to cut short the catastrophic process of monetary deflation and banking collapse, and argue that the bureaucratic structure and distribution of power within the Federal Reserve prevented officials from implementing national policies that might have had "palliative effects" and prevented "successive liquidity crises (Friedman and Schwartz, 1963, p.2.)."

Their account, which emphasizes how declining depositor confidence in banks depressed monetary aggregates, contrasts with many analyses of the financial crisis in 2008 and 2009, which focus on financial networks, contagion, and systemic risk.[1] Shadow banks (e.g. investment banks, insurance companies, hedge funds, and structured investment vehicles) have received considerable attention. In accepting short-term deposits and investing in long-term illiquid assets, these institutions acted like commercial banks, but operated outside the regulatory reach of the Federal Reserve and other banking authorities. It is suggested that their ability to leverage fueled the housing bubble, and through credit intermediation chains and correspondent relationships, threatened the commercial banking and payments systems.

The interconnected nature of financial institutions receives less attention from scholars studying the Great Depression. Prior to 1913, the "inverted pyramid structure" of reserves tiered at three levels (country banks, reserve city banks, and central reserve city banks) left the banking system vulnerable to interregional contagion, counterparty cascades, and network-based runs (James 1978, Sprague 1910). After 1913, however, it was believed that the Federal Reserve System had resolved these problems by introducing an elastic currency and acting as a lender of last resort (Friedman and Schwartz 1963, Miron 1986). Scholars have not explicitly assessed whether the reserve pyramid, which remained in place, and linkages between non-member and member banks propagated the financial crisis of the early 1930s or magnified its effects on the real economy.

In this paper, we examine whether interbank deposits of "shadowy" banks (i.e. state-chartered commercial banks neither regulated by the Federal Reserve nor direct recipients of Federal Reserve assistance) influenced the behavior of the critically important Fed member banks at the top of the pyramid – banks located in the central reserve cities of Chicago and New

[1] For example, see Allen, Babus, and Carletti (2010), Amini and.Minca (2010), Brunnermeier, Gang, and Darius (2012), Cohen-Cole, Patacchini, and Zenou (2011).

York. We use data aggregated regionally by Federal Reserve District, by type of bank (Fed member or non-member), and by level of the reserve pyramid (central reserve, reserve, and country) to explore how banking panics on the periphery induced responses at the center of the financial system and how their responses may have affected the real economy.

Our modeling is still at a preliminary stage, but our results suggest that during the 1920s, a period of economic expansion, bank distress in the hinterland was uncorrelated with interbank deposit flows. However, during the contraction of the 1930s, regional banking panics drained funds from central reserve city banks. As a result of bank runs, the volatility of interbank deposits increased. Money-center banks in Chicago and New York responded by reducing lending to businesses and individuals and increasing their holdings of government bonds and cash reserves. Our findings suggest that linkages between "shadowy banks" outside the Federal Reserve System and central reserve city Fed member banks magnified the effects of the crisis.

I. The Pyramid Structure of the United States Banking System

As the U.S. expanded during the 19th century, correspondent networks evolved to satisfy interior banks' demands for funds and desire to invest beyond their geographical proximity. In the 1860s, the National Banking acts cemented this structure, permitting country banks to meet their legal reserve requirements by keeping a large portion of their legally required reserves (originally up to 60%) as deposits in banks in reserve and central reserve cities. By the early twentieth century, central reserve city banks in New York held roughly two thirds of all required reserves, much of which was invested in the call loan market. Country and reserve-city banks also utilized interbank deposits for portfolio management; that is, they directly participated in the call loan market to manage the most liquid part of their assets. For example, when call loan rates rose above the standard interest rate paid on interbank deposits, country banks would directly invest in the call loan market, draining interbank deposits from New York City national banks (Bordo and Wheelock 2011).

The relationship between the call loan market and the inverted pyramid structure of reserves was fragile, however. Widespread withdrawals from banks outside the central reserve cities could and often did raise call loan rates and reduce stock prices, occasionally triggering financial panics. All of the major panics of the National Banking era were marked by withdrawals of funds by the country and reserve-city banks from New York City (Bordo and Wheelock 2011). Even though the national banking system’s reserve requirements created a large potential pool of reserves that could be used in a banking crisis, no central coordinating mechanism existed to deploy them. Rather, individual banks, wary of being run, hoarded reserves and feared paying penalties if they fell below the legal requirement. As a consequence, the national banking systems’ reserves, though large in aggregate, were effectively unavailable for meeting the demands of panicked depositors in crisis periods (Beckart, 1922).

The Federal Reserve System was, in part, established to prevent bank runs by providing an elastic currency and a lender of last resort that might counteract the stress that seasonal cycles placed on central reserve cities. The Federal Reserve Act required member banks to meet their reserve requirements by carrying deposits at a Federal Reserve Bank. This requirement was supposed to reduce the concentration of correspondent balances in reserve cities and limit fluctuations in the call loan money market (believed to be a major propagator of banking panics).

These requirements, however, did not pertain to two-thirds of all commercial banks that remained outside the Federal Reserve System in 1929 and held roughly one-half of all deposits. These non-member banks continued to meet state-mandated reserve requirements by holding interbank deposits in commercial banks (usually Federal Reserve members) in reserve and central reserve cities. These state-chartered banks were neither regulated nor assisted by the Federal Reserve (Mitchener 2005, 2007). They operated in the “shadows” of the system’s rules, similar to today’s shadow banks. In June of 1929, over 96% of all interbank deposits came from non-member country banks, i.e. those banks located outside a reserve city. And like all banks, they used interbank deposits as a way to manage their liquid portfolios and offer a broader variety of services to their customers. A shock, such as a bank run, could potentially induce non-member, country banks to withdraw their interbank deposits from reserve and central reserve city banks, inducing changes in the balance sheets of these banks that may not have fully been understood by Fed officials in the 1930s.

II. Interbank Deposits Flows in the 1920s and 1930s

Our analysis begins by assessing whether non-member banks operating in small towns throughout America’s agricultural and industrial heartland transmitted banking distress to the financial centers, particularly the central reserve city banks located in New York and Chicago. It then explores whether these network linkages changed between the Roaring 1920s and depressed 1930s. The channel of transmission that is studied is interbank deposits, which linked the balance sheets of banks to each other, but represent only one of several network ties that could have potentially transmitted panics from the periphery to the center of the system. Interbank deposits are largely an afterthought in the *Monetary History* because, as Friedman and Schwartz point out, precisely where deposits were held within the system is not important for establishing that aggregate changes in the money supply influenced the real economy.[2] However, the location of deposits within the system may be important for understanding financial contagion and systemic stability.

We created a new, panel database containing interbank deposits and other balance sheet characteristics for different tiers of the banking system (country, reserve, and reserve city), in each of the 12 Federal Reserve districts, and supplemented it with information on banking distress and economic activity.[3] Summary statistics indicate that interbank deposits exceeded 20% of all demand deposits and 60% of aggregate reserves in reserve and central reserve cities. Since laws required banks to retain minimum legal reserves, the quantities above these minima, which banks could access without triggering regulatory intervention, were termed "excess reserves." On the eve of the Great Contraction, excess reserves were low and interbank balances exceeded excess reserves by a substantial multiple. Thus, member banks could satisfy unexpected declines in interbank balances only by liquidating investments or borrowing reserves from the Fed.

Figure 1 illustrates changes in interbank deposits during the 1920s and 1930s. In the earlier decade, interbank deposits fluctuated seasonally around a rising trend. After the stock market crash of October 1929, interbank deposits rose rapidly, but once banking panics began in the fall of 1930, declined sharply and became increasingly volatile, flowing in and out of central reserve and reserve cities in large quantities.

Figures 2 and 3 illustrate the relationship between banking distress and interbank deposit flows between a central reserve city and its hinterland. For 1923-28, scatter plots show little or

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[2] "Since one bank's asset is another bank's liability, interbank deposits cancel when the accounts of banks are consolidated into the accounts of the banking system as a whole," Friedman and Schwartz (1963, p.20).

[3] Details regarding sources and methodology are described in the appendix.

no correlation between changes in the numbers of banks in outlying regions and interbank deposit flows to central reserve cities. For 1929-32, however, a positive correlation exists between banking distress and interbank deposit flows of reserve city banks. The relationship was especially pronounced in the central reserve cities of Chicago and New York, where large outflows of interbank deposits coincided with large numbers of bank liquidations (see Figure 4)., Using a variety of regression specifications, we consistently reject correlation between bank distress and interbank flows during the 1920s, but confirm a strong correlation between bank distress and interbank flows during the 1930s.

These patterns are likely related to the nature of banking distress in the two periods. During the 1920s, over 5,400 banks suspended operations. With the exception of a few famous panics such as the Florida panic of 1929, most of these failures appear to have been due to solvency shocks. Many of small, country banks failed as a result of lending to farmers who had expanded production and capacity when prices were rising during World War I, but then defaulted on loans when agricultural prices declined in the 1920s. Insolvencies of small banks spread across space and over time seldom triggered large flows of liquid funds from financial centers. On the other hand, regional bank runs (often taking place outside the reserve cities) were a feature of the early 1930s (Wicker, 1996). Depositor withdrawals likely triggered country banks to withdraw their interbank deposits in order to meet deposit-driven runs.

To further explore these relationships, Table 1 presents seemingly unrelated regression (SUR) estimates. Pairs of regressions in the table compare interbank deposit flows with various indicators of banking distress: (1) liquidations of *non-member* banks throughout the entire United States; (2) liquidations of all banks; and (3) a broader measure that includes all liquidations (terminal suspensions), temporary suspensions, voluntary liquidations, and mergers under duress.

Because of the correlation of error terms in our equations, we estimate each pair using Zellner's (1962, 1963) method of seemingly unrelated regressions. The correlation arises for a clear reason: an increase in flows in or out of one central reserve city often resulted in the opposite flow arising in the other city, as depositors relocated funds from one location to the other.

The first pair of equations compares interbank flows to liquidations of non-member banks throughout the entire United States. Coefficients are economically large and statistically significant at standard confidence intervals. For example, the point estimate for the first pair suggests that a liquidation of a non-member banks coincided with an outflow of $870,000 in interbank deposits from New York and $130,000 from Chicago. A variety of robustness checks (panel estimates, city-specific time trends, disaggregating data by region) yield similar results to those shown in Table 1 and suggest that, during the Great Contraction, bank distress was closely correlated with interbank deposit flows. When distress increased in the 1930s, interbank deposits flowed out from financial centers. When distress eased, interbank deposits flow back into financial centers. A plausible explanation for the correlation shown in Figure 3 and Table 1 is illiquidity prompted by bank runs. As depositors withdrew funds from country banks, those banks responded by drawing down interbank balances, a large portion of which (often over 50%) were the reserves of member banks in reserve and central reserve cities.

III. Implications for Bank Lending during the 1930s

During the banking panics of the 1930s, interbank deposit flows appear to have transmitted financial shocks from the periphery to the core of the U.S. financial system. What were the consequences for banks at the center and for the real economy? Table 2 examines how interbank deposit flows may have changed the composition of assets held by reserve city banks.

We aggregate assets into three categories: (1) private sector lending (the sum of the loans, acceptances, and corporate securities (predominantly bonds); (2) government lending; and (3) reserves (the sum of the cash in banks' vaults and the deposits at the Fed). Lending to businesses contracted for all banks, with reserve city banks contracting slightly more than country banks and central reserve city banks contracting substantially more than the rest. Lending to the government rose for all banks, with reserve cities expanding lending to government at nearly four times the rate of country banks and central reserve city banks expanding holdings of government securities at six times the rate of country banks. From the onset of banking panics to the end of 1932, cash reserves rose substantially in central reserve cities – increasing by more than 18% in New York and roughly 37% in Chicago. In the same period, reserves fell by 19% in reserve cities and 25% in country banks.

The increase in reserves in central reserve cities and the decline in lending to businesses coincided with the period of banking panics, the most likely factor triggering flows of deposits in and out of central reserve cities. We estimate how deposit flows influenced portfolio choices in the central reserve cities using econometric methods similar to those employed in Table 1. We regress changes in banks' portfolio choices on changes in levels of deposits to determine how portfolio allocations changed as deposits flowed in and out of banks. We group these regressions into systems of three equations, with each equation examining the correlation between deposit flows and one of the three categories of assets defined above. We estimate the system of equations simultaneously using SUR regressions in order to account for correlations in error terms across equations.[4]

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[4] The first equation examines the correlation between deposit flows and lending to business. The second equation examines the correlation between deposit flows and lending to government. The third equation examines the correlation between deposit flows and allocations to reserves.

Table 3 shows asset allocations for: (1) New York from 1920 to 1929, (2) New York from 1930 to 1932, (3) Chicago from 1920 to 1929, and (4) Chicago from 1930 to 1932. The coefficients indicate how, on average, asset allocations change in response to deposit flows. For example, the coefficient of 0.74 on business lending shown for the first system of equations (1) can be interpreted as that business lending increased by an average of $74 for each $100 inflow of deposits and decreased by $74 when $100 of deposits flowed out.

The estimated regression coefficients deepen our understanding of the patterns that appear in the figures. During the 1920s, when deposits generally flowed into central reserve cities, bankers allocated about 70% of those inflows to business loans, 10% to government securities, and 5% to reserves. However in the 1930s, when deposits generally flowed out of reserves cities and when deposit flows became increasingly volatile (particularly interbank deposits), bankers reduced lending by more than the amount that flowed out, increased reserves of cash, accumulated deposits at the Federal Reserve, and purchased government bonds.[5] This asset reallocation proved to be prudent preparation for future outflows. Chow-tests across cities show that New York and Chicago differed little during the Roaring Twenties, but the behavior of banks in both cities changed during the contraction, as banks reduced business lending in order to pay off depositors and to build reserves against future withdrawals.

We also split deposit flows into demand, time, government (including postal savings), and interbank, to see whether banks reacted differently to different types of deposit flows. For

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[5] These regressions appear robust to reasonable changes in the specification, with the caveat that the key period – the contraction of the early 1930s – contains few observations; this limits the types of estimation one can do.[5] Since seasonality may be of concern, we re-ran all regressions with quarterly indicator variables and interacted those indicators with the independent variable. This specification yields coefficients that are similar in size, but have larger standard errors (since this system has 11 observations and 7 independent variables). We also estimate the systems with all variables expressed as changes per day since the number of days between calls differ substantially in some years. This exercise yields similar results.

the 1920s, it seems as if banks treated one dollar of deposits much like another, regardless of the source. For the 1930s, it seems as if banks treated deposits differently depending on the source. Demand, time, and government deposits show more correlation with changes in business lending. Interbank deposits appear more correlated with changes in government securities and cash reserves.[6]

Overall, our preliminary evidence suggests that during the Great Contraction, the reserve pyramid and interbank linkages transmitted financial shocks from financial system's periphery to its core. In New York and Chicago, business lending contracted precipitously, as banks liquidated loans, cancelled lines of credit, accumulated primary reserves (cash and deposits at the Fed), and built secondary reserves (government bonds). These changes seem to be, at least in part, a logical response to the increasing volatility of interbank deposits and the increasing cost of managing liquidity by borrowing in a deflationary environment in which monetary authorities raised discount rates to defend the international gold standard.

Though we focus on a different channel through which banking panics affected real economic activity, it is nevertheless possible that the counterfactual monetary policy advocated by Friedman and Schwartz (1963) would have reduced the contraction in lending resulting from the network effects we describe. Liquidity support to distressed banks at the time of the panics may have arrested deposit outflows (as described in Carlson, Mitchener, and Richardson 2011 and Richardson and Troost 2009), and reduced pressure at the top of the pyramid. However, because non-member banks were not able to borrow directly from the Fed's discount window, the shadowy banks of the 1920s and 1930s may have still faced runs.

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[6] Due to the small sample sizes and the high correlation betweem demand, time, and interbank deposit flows, it worth exercising some caution in interpretation.

Data Appendix

Our principal source for constructing information on the reserve pyramid is *Banking and Monetary Statistics of the United States, 1914 to 1941* (Federal Reserve Board of Governors 1943). It presents information from the call reports of Federal Reserve member banks aggregated by Federal Reserve District, including counts of banks in each district as well as detailed summaries of assets (15 categories) and liabilities (17 categories) for member banks located in reserve cities, and for banks located outside of reserve cities (called country banks). It also contains detailed classifications of the loans, investments, and deposits of banks from 1928 through 1941. For the second and seventh Federal Reserve Districts, we calculate the balance sheets of banks in the central reserve cities of New York and Chicago by subtracting reserve and country banks from all banks.

For our analysis, we then aggregate bank asset information into three categories: (1) lending to businesses (the sum of loans, acceptances, and corporate bonds); (2) lending to the U.S. government (the sum of government securities of varying maturity); and (3) reserves (the sum of cash in the vault and deposits at Federal Reserve banks). We calculate reserves in this manner to conform to the approach used by Friedman and Schwartz, who excluded from their calculations balances at domestic banks (which counted as part of a bank's legally required reserves if deposited in a bank in a reserve or central reserve city) and balances at foreign banks. We also excluded cash items in the process of collection from banks' reserves, because the slow pace of intercity check clearing left these items simultaneously on the balance sheets of multiple banks, leading to a double counting of reserves presumed reserves. During periods of distress, banks found items in the process of collection generally illiquid and uncollectible (see Richardson 2007 for details).

Data are for each call date. The nature of the calls raises statistical issues. Many modern time series tests assume observations arise from stable data generating processes with consistent spacing, which is not characteristic of these data. The spacing of the calls was long and variable. Calls occurred on average every 96 days, but the standard deviation of that average, 35, was high. Restricting the analysis to regularly spaced calls, December and June, eliminates more than half the observations from the data set, leaving six during the Great Contraction – far too few to employ statistical tests based upon asymptotic arguments. Moreover, the December and June calls almost always occurred on the last day of the month. Banks' balance sheets on these dates differ systematically and substantially from balance sheets on other dates, when the calls were intentionally unpredictable. Note that the last call of 1932 occurred on December 31, a point in time when the slump appeared to have stabilized and a month before events triggered the financial panic preceding the banking holiday. The initial call for 1933 occurred on June 30, after the collapse of the commercial banking system, the banking holiday, and the Emergency Banking Act. Call-report data reveals little about these dramatic events.

Data on bank suspensions come from several sources. From *Banking and Monetary Statistics*, we can calculate annual changes in the number of Federal Reserve member banks in each Federal Reserve District for the period 1914 to 1941. While this information is consistent over the entire time period, it is a net figure – bank closings minus bank openings – and does not allow us to discern whether changes occurred due to mergers, voluntary liquidations, nationally-chartered banks adopting state charters, or state-chartered banks voluntary departing from the Federal Reserve System. The most accurate source for information about bank failures during this period is the micro-level data from the Board of Governors' bank suspension study. These are described in Richardson (2007, 2008). For the years 1929 through 1932, we tabulate the micro data by call date and Federal Reserve district, creating an accurate analog for our panel of bank balance sheets by call date. The series overlap extensively, and permit us to cross-check the data. The comparisons are reassuring; all series spanning the same place, time, and type of bank appear highly correlated (correlation coefficients typically range from 0.85 to 0.95). This suggests that all of the series reflect underlying patterns of bank distress.

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Figure 1: Interbank Deposits, 1920 - 1932

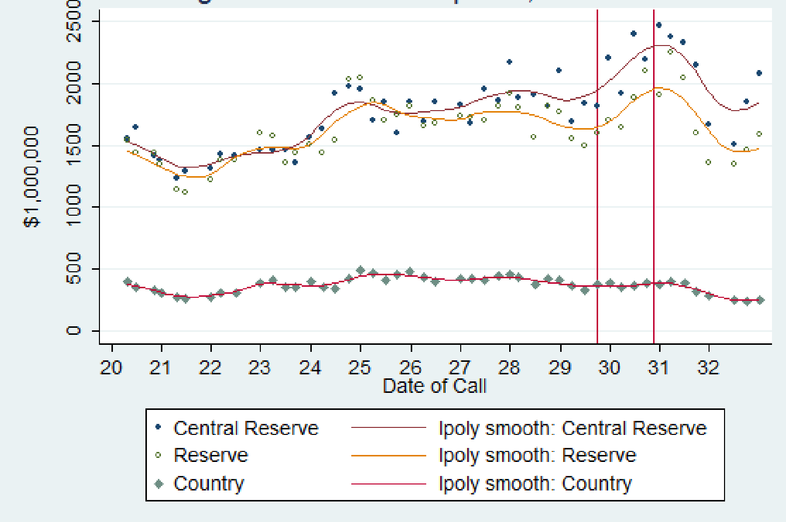

Figure 2: Distress and Deposits, Chicago and Hinterland, 1923 to 1928

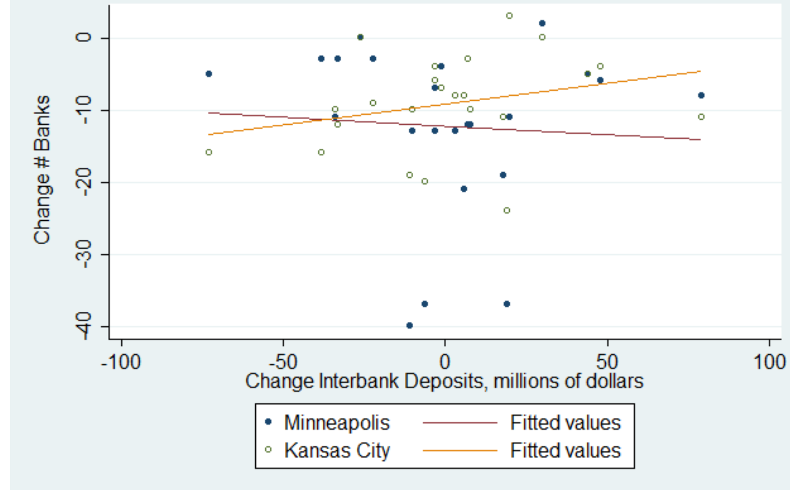

Figure 3: Distress and Deposits, Chicago and Hinterland, 1929 to 1932

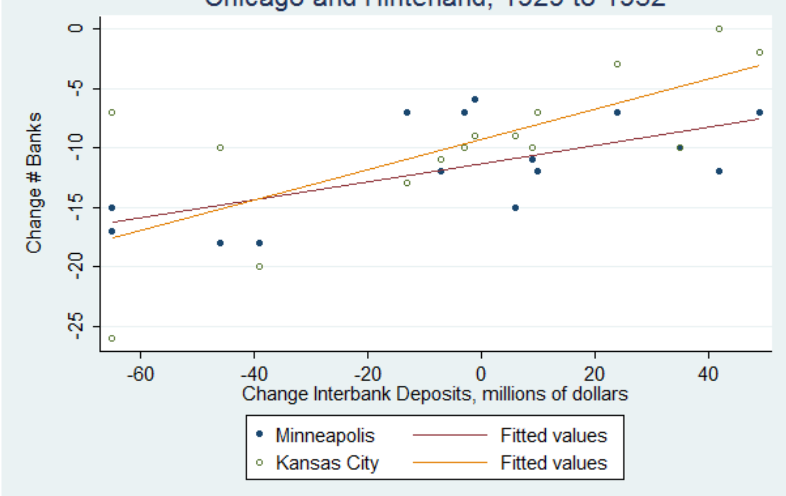

Figure 4: Bank Liquidation and Interbank Deposits, Nov. 1930 - Dec. 1932

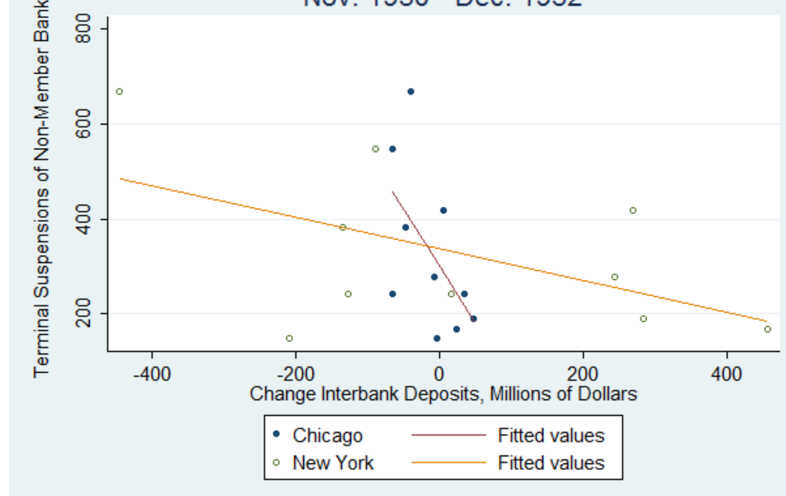

Table 1: Bank Distress and Interbank Deposit Flows, November 1930 to December 1932

Independent Variable	Dependent Variables: Change in Millions of Dollars in Interbank Deposits in the Indicated Central Reserve City (1)		(2)		(3)		(4)	
	NY	Chicago	NY	Chicago	NY	Chicago	NY	Chicago
Liquidations, Non Member	-0.87	-0.13						
	(-2.01)	(-2.20)						
Liquidations, All Banks			-0.68	-0.11				
			(-2.12)	(-2.35)				
Distress, Non Member					-0.57	-0.08		
					(-1.81)	(-1.81)		
Distress, All Banks							-0.45	-0.07
							(-2.00)	(-1.98)
Constant	310.7	33.3	308.8	33.2	278.0	25.8	284.3	26.4
	(1.97)	(1.48)	(2.06)	(1.56)	(1.78)	(1.12)	(1.94)	(1.22)
F-Stat	4.04	4.84	4.50	5.51	3.28	3.28	4.01	3.92
R-Squared	0.29	0.33	0.31	0.35	0.25	0.25	0.29	0.28
N	10	10	10	10	10	10	10	10

Notes: t-statistic in parenthesis. Estimations run using SUREG command in STATA with small option. Each seemingly unrelated system contains two equations, one estimating interbank deposit flows in New York, the other estimating interbank deposit flows in Chicago.

Table 2: Percentage Changes in Lending and Reserves During the Great Contraction

	NY	Chicago	Reserve	Country
Peak to Trough				
Lending to Business	-40.6	-51.5	-33.3	-32.9
Lending to Government	134.2	96.6	63.3	16.2
Reserves	31.6	66.5	-14.8	-28.2
Onset of Panics to End 1932				
Lending to Business	-37.3	-54.9	-31.3	-30.6
Lending to Government	138.7	44.3	37.1	20.8
Reserves	18.5	37.1	-19.0	-25.4

Note: The peak of assets in commercial banks occurred in the call report immediately following the stock market crash in the fall of 1929; thus we measure peak to trough from call 10/4/1929 to call 12/31/1932. Banking panics began in November 1930, following the call in September of that year; thus we measure onset of panics to end of 1931 from call 9/24/1930 to call 12/31/1932.

Table 3: Deposit Flows and Portfolio Allocations, Banks in Central Reserve Cities, 1920 through 1932.

	Dependent Variables Intra-Call Change in Portfolio Category for Indicated City and Time Span											
	(1)			(2)			(3)			(4)		
	New York 1920 - 1929			New York 1930 - 1932			Chicago 1920 - 1929			Chicago 1930 - 1932		
	Bus.	Gov.	Res.	Bus.	Gov.	Res.	Bus.	Gov.	Res.	Bus.	Gov.	Res.
Change in Deposits												
Coefficient	0.74	0.10	0.05	1.17	-0.40	-0.01	0.62	0.17	0.04	1.26	-0.4	-0.6
Standard Error	[0.06]	[0.02]	[0.01]	[0.20]	[0.11]	[0.04]	[0.07]	[0.02]	[0.01]	[0.15]	[0.08]	[0.04]
t-statistic	(12.2)	(6.1)	(11.4)	(5.97)	(-3.83)	(-0.28)	(9.39)	(9.40)	(8.37)	(8.23)	(-0.45)	(-1.43)
Constant												
Coefficient	321.4	139.6	361.9	-3007	5106	1003	392	-160	99	-829	311	308
Standard Error	[443.2]	[112.2]	[33.5]	[1680]	[900]	[311]	[111]	[31]	[8]	[274]	[149]	[75]
t-statistic	(0.73)	(1.14)	(10.80)	(-1.83)	(5.67)	(3.23)	(3.54)	(-5.1)	(11.75)	(-3.02)	(2.08)	(4.12)
F-Stat	147.6	36.6	130.1	35.6	14.7	0.1	88.2	88.4	70.0	67.8	0.2	2.0
R-Squared	0.80	0.50	0.78	0.76	0.57	0.0	0.70	0.70	0.65	0.86	0.02	0.16
N	37	37	37	11	11	11	37	37	37	11	11	11

Notes: Results are estimated using SUR. Each seemingly unrelated system contains three equation respectively regressing changes in business lending, government bonds, and cash reserves on changes in deposits.