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Interbank Markets and Banking Crises: New Evidence on the Establishment and Impact of the Federal Reserve

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Interbank Markets and Banking Crises: New Evidence on the Establishment and Impact of the Federal Reserve

BY Mark Carlson and David C. Wheelock*

This paper examines the impact of the Federal Reserve's founding on seasonal pressures and contagion risk in the interbank system. Deposit flows among classes of banks were highly seasonal before 1914; amplitude and timing varied regionally. Panics interrupted normal flows as banks throughout the country sought funds from the central money markets simultaneously. Seasonal pressures and contagion risk in the system were lower by the 1920s, when the Fed provided seasonal liquidity and reserves. Panics returned in the 1930s, due in part to shocks from nonmember banks and because the Fed's decentralized structure hampered a vigorous response to national crises.

Keywords: Federal Reserve; banking crises; banking panics; interbank market; correspondent banks; contagion; Great Depression

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An important role of a national banking system is to facilitate flows of money and capital from regions or sectors with surplus funds to those with deficits. In most countries, interregional transfers can occur between branch offices of individual banking organizations. In the United States, interbank markets and correspondent networks arose in the 19th Century to perform this function because most banks were legally prevented from operating extensive branch systems. In the correspondent system, large banks in major cities, especially New York City, served to route funds between regions (James 1978).

Reflecting the importance of agriculture at the time, interregional flows of funds were highly seasonal. Banks were called upon for loans to finance spring planting and the autumn harvest, and to facilitate payments across the country. Although the timing of seasonal demands varied somewhat between regions, the magnitude of seasonal activities

and the relatively inflexible supplies of money and reserves in the banking system caused regular strains (Kemmerer 1910). Still, the interbank system ordinarily managed to accommodate seasonal demands and to dissipate localized, idiosyncratic shocks across the larger banking system.

Crises occurred every few years, however, when large shocks drove up liquidity demand throughout the country, as in the panics of 1893 and 1907 (Calomiris and Gorton 1991). A distinguishing feature of major banking panics was that banks throughout the country withdrew funds from their New York City correspondents simultaneously, rather than at the staggered times that usually characterized seasonal flows. Faced with a surge in demand, New York City banks would suspend cash withdrawals and payments, which caused banks elsewhere in the country to suspend.¹

Contemporaries saw such disruptions as having large economic costs, and the Federal Reserve (Fed) was established to prevent

¹ These historical dynamics align well with some of the recent theoretical research on the stability of interbank networks. For example, Acemoglu, Ozdaglar, and Tahbaz-Salehi (2015) show that greater interconnectedness can make an interbank network less fragile in the presence of minor shocks, but can also facilitate contagion if shocks wipe out the excess liquidity of the banking system.

panics and the associated economic fallout. To accomplish this objective, the Fed's founders sought i) to alleviate money market pressures caused by seasonal and other fluctuations in the demands for money and credit, and ii) to reduce the importance of interbank linkages, especially the central role of the New York City banks:

“The very essence of the new plan is intended to meet the condition which in the past has caused chief trouble by eliminating this necessity of interdependence between districts. The Federal Reserve Act will presumably afford a means of making each district self-supporting in a credit way so that assuming the plan to work as it is expected to work the need for mutual seasonal aid and shipments of currency will be minimized (Preliminary Committee on Organization 1914, p.15).”

In this paper, we examine whether the Fed's establishment reduced seasonal pressures and contagion risk in the interbank system. We use principal components analysis to identify the common drivers of movements in interbank deposits at national banks before and after the founding of the Fed in 1914. Our results indicate that interbank deposit flows at both country and reserve city banks exhibited less seasonality during the 1920s than they had before 1914. Further, using a measure

suggested by Glasserman and Young (2015), we find that contagion risk among national banks also fell after the Fed's founding. Thus the proximate goals of the Fed's founders appear to have been accomplished.

Despite these changes, banking panics returned in the early 1930s. The decentralized structure of the Federal Reserve System both failed to prevent panics from spreading across regions and hampered the Fed's ability to muster a vigorous response to the crisis. It is hard to shield one part of the financial system from a crisis affecting other parts, and the historical experience discussed here highlights the value of a comprehensive response.

I. Seasonal Pressures, Panics, and the Interbank System

In this section, we examine the seasonal variation in interbank deposits of national banks during the National Banking Era and the extent to which they exhibited less seasonality after the Fed was established.

Before the Fed's founding, commercial banks held deposits with correspondents for a variety of reasons, such as to facilitate clearing payments and as a way of investing surplus funds when seasonal needs were low. Deposits with correspondents also counted toward meeting legal reserve requirements. National banks in designated reserve cities

could satisfy part of their reserve requirements by holding deposits with banks in central reserve cities (New York City, Chicago and St. Louis), and national banks in all other locations, i.e., “country banks,” could satisfy a portion of their requirements by holding deposits with banks in reserve cities or central reserve cities.

To examine the behavior of correspondent deposits for country banks, we examine changes between call report dates in deposits “due from” national banks, scaled by total bank assets. These flows indicate the demands that country banks placed on the system.

Reserve city banks provided seasonal funds and other services for country banks, while in turn receiving funds and services from central reserve city banks. For reserve city banks, we focus on a measure of net deposits due from banks consisting of deposits due from state and national banks minus deposits due to state and national banks, again scaled by total assets.

Our data come from the Reports of Income and Condition (i.e., call reports), aggregated at the state level for country national banks, and at the city level for reserve city banks. For the pre-Fed period, we focus on the years 1894-1906, a sample period bracketed by two major panics (1893 and 1907). There were five call reports per year during this period, resulting in

65 observations. To examine the impact of the Fed, we use data from the start of 1922 (to avoid the impact of World War I financing) through mid-1928 (due to changes in reporting thereafter). There were only three or four calls per year during the 1920s, leaving us with 26 observations. We use data for country banks from all 48 of the contiguous US states, and for 18 cities that were classified as reserve cities in both the pre-Fed years (at least since 1890) and throughout the 1920s.

We use principal components analysis to identify the factors driving the behavior of interbank deposits. Prior to the Fed, interbank flows were highly seasonal. For country banks, the first two principal components of deposits due from banks exhibit marked seasonal patterns and account for nearly half the variation in the series (see Figure 1). Southern states load most strongly on the first principal component, reflecting a highly seasonal demand for funds associated with the planting, harvesting and marketing of cotton. The second principal component is also highly seasonal but somewhat offset in time from the first. States that load most strongly on the second principal component include those in the Great Plains, where corn and wheat were dominant. Differences in the timing of seasonal needs between regions created an

environment where banks could move funds advantageously.

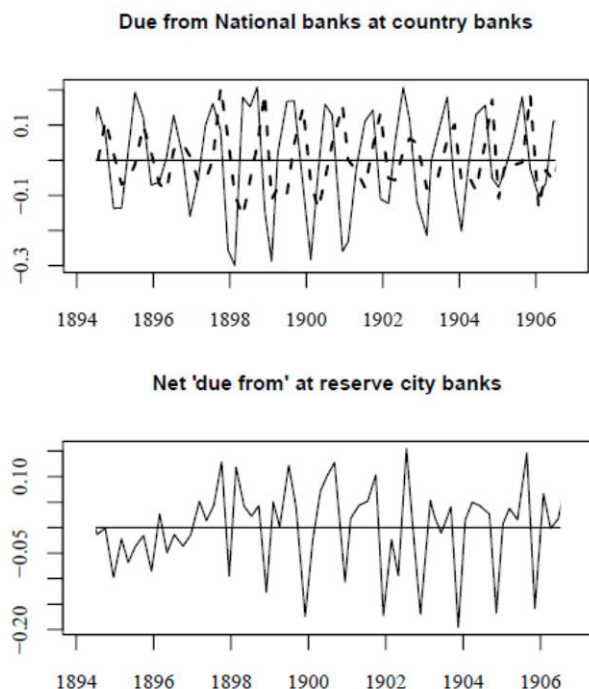


FIGURE 1. SEASONAL PATTERNS BEFORE THE ESTABLISHMENT OF THE FEDERAL RESERVE

NOTE: THE TOP PANEL PLOTS THE FIRST TWO PRINCIPAL COMPONENTS OF DUE FROM NATIONAL BANKS FOR COUNTRY BANKS. THE BOTTOM PANEL PLOTS THE FIRST PRINCIPAL COMPONENT OF NET DUE FROM BANKS FOR RESERVE CITY BANKS. DATA ARE FROM THE CALL REPORTS AND FOLLOW CALL REPORT FREQUENCY.

Strong seasonal patterns are also apparent for reserve city banks, though only the first principal component of changes in net due from banks displays strong seasonality. However, this factor explains over a third of the variation across the reserve cities. Taken together, the patterns for country and reserve city banks illustrate the regular stresses on the banking system as funds moved in, out, and through the system.

A. Banking Panics

The fragility of the interbank system became quite clear during the banking panics, when, amid concerns about liquidity and solvency, banks that ordinarily increased their balances with correspondents attempted to withdraw funds instead. Normally, country banks increased their deposits with city banks correspondents by 25 percent between the months of May and December. However, in 1907, country bank deposits with city correspondents fell by 38 percent in those months. Those declines are consistent with reports that the Panic of 1907 and other panics of the era were as much panics by bankers as by individual depositors (Vanderlip 1908). They also point to the importance that interbank markets played in financial instability during the National Banking era. In 1907, pressures on reserve city and central reserve city banks resulted in the suspension of convertibility of deposits into currency and curtailment of interregional payments and other services, which contemporaries viewed as having severe economic consequences (Sprague 1908).

B. After the Establishment of the Fed

The seasonality of interbank balances declined after the Fed was founded. While the

first principal component of “due from banks” for the country banks in the 48 states remains somewhat seasonal, the second principal component does not (Figure 2). Rather than relying on the interbank system to meet their seasonal needs, country banks turned to the Fed; discount window loans in all districts show a decided seasonal pattern (Carlson and Wheelock 2015). The reduction in seasonal pressures was also apparent at reserve city banks where the first principal component of net deposits due from banks exhibits little seasonality. Thus, the Fed appears to have successfully mitigated seasonal pressures and reduced them as a source of stress.

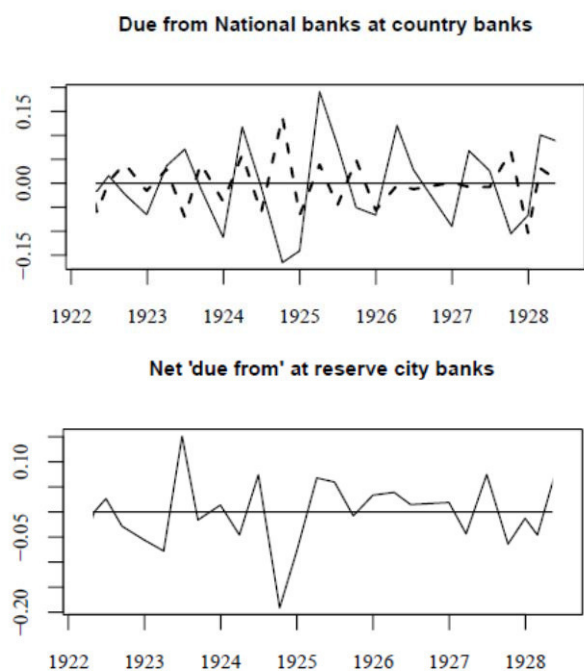


FIGURE 2. SEASONAL PATTERNS AFTER THE ESTABLISHMENT OF THE FEDERAL RESERVE

NOTE: THE TOP PANEL PLOTS THE FIRST TWO PRINCIPAL COMPONENTS OF DUE FROM NATIONAL BANKS FOR COUNTRY BANKS. THE BOTTOM PANEL PLOTS THE FIRST PRINCIPAL COMPONENT OF NET DUE FROM BANKS FOR RESERVE CITY BANKS. DATA ARE FROM THE CALL REPORTS AND FOLLOW CALL REPORT FREQUENCY.

II. Contagion in the Interbank Market

In addition to alleviating seasonal strains, the Fed may have directly reduced the potential for shocks at the core of the banking system to impact other parts. Under the Federal Reserve Act, correspondent balances could no longer be used by national banks to satisfy a portion of their reserve requirement and such deposits declined. Reduced exposures lowered contagion risk for national banks, which we illustrate using a measure of vulnerability to contagion from Glasserman and Young (2015). The measure compares an index of “contagion risk” from central reserve city banks to an index of the average vulnerability of country banks. Contagion risk from central reserve city banks is a function of their size, leverage, and interconnectedness to other banks in the system, while the vulnerability of country banks is a function of their average size and leverage.²

We plot the ratio of the contagion risk index to the index of average vulnerability over time. A decrease in the ratio implies that country banks have become less vulnerable to shocks coming from the central reserve cities. As shown in Figure 3, the vulnerability of country banks to shocks emanating from

² Size is measured by net worth. Leverage is measured as the ratio of claims on non-bank entities to net worth. Interconnectedness is measured as the proportion of an entity’s liabilities owed to other banks. See Glasserman and Young (2015) for details.

central reserve cities fell sharply after the Fed was established. (Similar measures for reserve city banks also fall in the 1920s.) The declines owe to a drop in the interconnection of central reserve cities to the rest of the system.

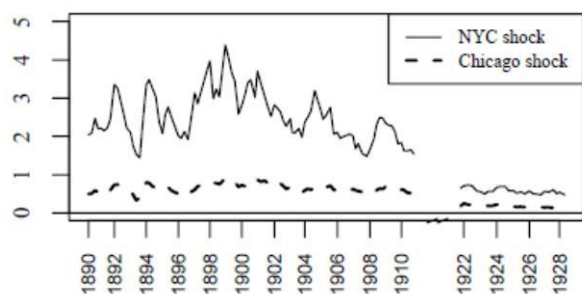


FIGURE 3. VULNERABILITY OF COUNTRY BANKS TO SHOCKS ORIGINATING IN TWO CENTRAL RESERVE CITIES

Note: Data are from the call reports and follow call report frequency.

III. The Great Depression

Consistent with the intent of its founders, the Fed's establishment substantially reduced seasonal pressures and diminished the importance of interbank connections among national banks. Thus, the Fed appears to have lowered contagion risk in the banking system. However, banking panics returned with a vengeance in the early 1930s. The geographically-decentralized structure put in place to deal with the perceived problems of the National Banking Era may have contributed to some of the challenges that the Fed faced in responding to the banking sector collapse of the Great Depression.

While the Fed reduced the role of the interbank market, it certainly did not eliminate

it. Few state-chartered banks joined the Federal Reserve System; most continued to rely on correspondents—often Fed member banks—for reserve accounts, loans and other services. Fed member banks also remained engaged in the interbank market and still held deposits at correspondents, albeit at a reduced level. These connections appear to have played a role in transmitting banking sector stress during the Great Depression. Mitchener and Richardson (2014) find that during the Depression, withdrawals by non-Fed-member country banks from their city correspondents caused significant declines in lending by city banks, and thereby amplified local banking distress, much as had occurred through the interbank system during the National Banking era. The Fed was slow to react to banking distress in the Depression in part because it originated with nonmember bank failures and runs (Friedman and Schwartz 1963).

The Fed's decentralized structure may have also hampered a vigorous response to the Depression. Individual Reserve Banks focused primarily on local problems and conditions, and could not agree on a comprehensive policy to end the crisis.

Thus, despite largely eliminating seasonal pressures and substantially reducing reliance on the interbank market to move funds, the banking system remained vulnerable to a

massive liquidity shock. The decentralized organization the Fed's founders created had great difficulty mounting a vigorous response to a national banking crisis; the system was subsequently reorganized and centralized in 1935. This historical experience points to the importance of central bank cooperation in the modern era as national financial systems become increasingly interconnected.

REFERENCES

- Acemoglu, Daron, Asuman Ozdaglar and Alireza Tahbaz-Salehi. 2015. "Systemic Risk and Stability in Financial Networks." *American Economic Review* 105 (2): 564-608.
- Calomiris, Charles and Gary Gorton. 1991. "The Origins of Banking Panics: Models, Facts, and Bank Regulation." In *Financial Markets and Financial Crises*, edited by R. Glenn Hubbard, 109-75. Chicago: University of Chicago Press
- Carlson, Mark and David C. Wheelock. 2015. "The Impact of the Establishment of the Federal Reserve on the Fragility and Vulnerability of the Interbank System." Unpublished.
- Friedman, Milton and Anna J. Schwartz. 1963. *A Monetary History of the United States 1867-1960*, Princeton: Princeton University Press.
- Glasserman, Paul and H. Peyton Young. 2015. "How Likely is Contagion in Financial Networks?" *Journal of Banking and Finance* 50: 383-399.
- James, John. 1978. *Money and Capital Markets in Postbellum America*, Princeton University Press: Princeton.
- Kemmerer, Edwin. 1910. *Seasonal Variations in the Relative Demand for Money and Capital in the United States*, National Monetary Commission, U.S. Government Printing Office: Washington DC.
- Mitchener, Kris and Gary Richardson. 2014. "Shadowy Banks and the Interbank Amplifier during the Great Depression." Unpublished.
- Preliminary Committee on Organization (1914). *Report to the Reserve Bank Organization Committee*, June 1, 1914.
- Sprague, O.M.W. 1908. "The American Crisis of 1907." *Economic Journal* 18 (71): 353-72.
- Vanderlip, Frank. 1908. "The Panic as a World Phenomenon," in *Lessons of the Financial Crisis*, *Annals of the American Academy of Political and Social Science* 31 (2): 2-7.