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4 The Origins of Banking Panics: Models, Facts, and Bank Regulation

Charles W. Calomiris and Gary Gorton

4.1 Introduction

The history of U.S. banking regulation can be written largely as a history of government and private responses to banking panics. Implicitly or explicitly, each regulatory response to a crisis presumed a "model" of the origins of banking panics. The development of private bank clearing houses, the founding of the Federal Reserve System, the creation of the Federal Deposit Insurance Corporation, the separation of commercial and investment banking by the Glass-Steagall Act, and laws governing branch banking all reflect beliefs about the factors that contribute to the instability of the banking system.

Deposit insurance and bank regulation were ultimately successful in preventing banking panics, but it has recently become apparent that this success was not without costs. The demise of the Federal Savings and Loan Insurance Corporation and state-sponsored thrift insurance funds and the declining competitiveness of U.S. commercial banks have had a profound effect on the debate over proper bank regulatory policy. Increasingly, regulators appear to be seeking to balance the benefits of banking stability against the apparent costs of bank regulation.

This changing focus has provided some of the impetus for the reevaluation

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of the history of banking crises to determine how banking stability can be achieved at a minimum cost. The important question is: What is the cause of banking panics? This question has been difficult to answer. Theoretical models of banking panics are intertwined with explanations for the existence of banks and, particularly, of bank debt contracts which finance "illiquid" assets while containing American put options giving debt holders the right to redeem debt on demand at par. Explaining the optimality of this debt contract, and of the put option, while simultaneously explaining the possibility of the apparently suboptimal event of a banking panic has been very hard.

In part, the reason it is difficult is that posing the problem this way identifies banks and banking panics too closely. In the last decade attempts to provide general simultaneous explanations of the existence of banks and banking panics have foundered on the historical fact that not all countries have experienced banking panics, even though their banking systems offered the same debt contract. Empirical research during this time has made this insight more precise by focusing on how the banking market structure and institutional differences affect the likelihood of panic. Observed variation in historical experience which can be attributed to differences in the structure of banking systems provides convincing evidence that neither the nature of debt contracts nor the presence of exogenous shocks which reduce the value of bank asset portfolios provide "sufficient conditions" for banking panics.

Empirical research has demonstrated the importance of such institutional structures as branch bank laws, bank cooperation arrangements, and formal clearing houses, for the probability of panic and for the resolution of crisis. The conclusion of this work and cross-country comparisons is that banking panics are not inherent in banking contracts—institutional structure matters. This observation has now been incorporated into new generations of theoretical models. But, while theoretical models sharpen our understanding of how banking panics might have occurred, few of these models have stressed testable implications. In addition, empirical work seeking to isolate precisely which factors caused panics historically has been hampered by the lack of historical data and the fact that there were only a relatively small number of panics. Thus, it is not surprising that research on the origins of banking panics and the appropriate regulatory response to their threat has yet to produce a consensus view.

While the original question of the cause of banking panics has not been answered, at least researchers appear to be looking for the answer in a different place. Our goal in this essay is to evaluate the persuasiveness of recent models of the origins of banking panics in light of available evidence. We begin, in section 4.2, with a definition of a banking panic, followed by a discussion of panics in U.S. history. A brief set of stylized facts which a theory must confront is developed. In section 4.3, recent empirical evidence on panics which strongly suggests the importance of the institutional structure is reviewed. Theories of panics must be consistent with this evidence.

Theoretical models of panics are discussed in section 4.4, where we trace the evolution of two competing views about the origins of banking panics. In the first view, which we label the "random withdrawal" theory, panics were caused historically by unexpected withdrawals by bank depositors associated primarily with real location-specific economic shocks, such as seasonal demands for currency due to agricultural payment procedures favoring cash. The mechanism which causes the panic in this theory suggests that the availability of reserves, say through central bank open market operations, would eliminate panics.

The second view, which we label the "asymmetric information" theory, sees panics as being caused by depositor revisions in the perceived risk of bank debt when they are uninformed about bank asset portfolio values and receive adverse news about the macro economy. In this view, depositors seek to withdraw large amounts from banks when they have reason to believe that banks are more likely to fail. Because the actual incidence of failure is unknown, they withdraw from all banks. The availability of reserves through central bank action would not, in this view, prevent panics.

The two competing theories offer different explanations about the origins and solutions to panics. A main goal of this essay is to discriminate between these two views, so we focus on testing the restrictions that each view implies. Section 4.5 describes the empirically testable differences between the competing hypotheses and provides a variety of new evidence to differentiate the two views. We employ data from the National Banking period (1863–1913), a single regulatory regime for which data are easily available for a variety of variables of interest. The two hypotheses have three testable implications that are explored in this paper. First, with respect to the shock initiating the panic, each theory suggests what is special about the periods immediately preceding panics. Second, the incidence of bank failures and losses is examined. Finally, we look at how crises were resolved.

Isolating the historical origins of banking panics is an important first step toward developing appropriate policy reforms for regulating and insuring financial intermediaries. In this regard, it is important to differentiate between the two views of the causes of panics because each has different policy implications. While we do not make any policy recommendations, in the final section, section 4.6, we discuss policy implications.

4.2 Definitions and Preliminaries

Essential to any study of panics is a definition of a banking panic. Perhaps surprisingly, a definition is not immediately obvious. Much of the empirical debate turns on which events are selected for the sample of panics. This section begins with a definition, which is then applied to select events from U.S. history which appear to fit the definition. In doing this we suggest a set of facts which theories of panics must address.

4.2.1 What Is A "Banking Panic"?

The term banking panic is often used somewhat ambiguously and, in many cases, synonymously with events in which banks fail, such as a recession, or in which there is financial market turmoil, such as stock market crashes. Many researchers provide no definition of a panic, relying instead on the same one or two secondary sources for an identification of panics.[1] But it is not clear whether these sources are correct nor whether the definitions implicit in these sources apply to other countries and periods of history.

One result of the reliance on secondary sources is that most empirical research has restricted attention to the U.S. experience, mostly the post–Civil War period, and usually with more weight placed on the events of the Great Depression. Moreover, even when using the same secondary sources, different researchers consider different sets of events to be panics. Miron (1986), for example, includes fifteen "minor" panics in his study. Sobel (1968) discusses twelve episodes, but mentions eleven others which were not covered. Donaldson (1989a) equates panics with unusual movements in interest rates.

Historically, bank debt has consisted largely of liabilities which circulate as a medium of exchange—bank notes and demand deposits. The contract defining this debt allowed the debt holder the right to redeem the debt (into hard currency) on demand at par. We define a banking panic as follows: A *banking panic* occurs when bank debt holders at all or many banks in the banking system suddenly demand that banks convert their debt claims into cash (at par) to such an extent that the banks suspend convertibility of their debt into cash or, in the case of the United States, act collectively to avoid suspension of convertibility by issuing clearing-house loan certificates.[2]

Several elements of this definition are worth discussing.[3] First, the definition requires that a significant number of banks be involved. If bank debt holders of a single bank demand redemption, this is not a banking panic, though such events are often called "bank runs." The term banking panic is so often used synonymously with "bank run" that there is no point attempting to distinguish between the two terms. Whether called a "bank run" or a "bank panic," the event of interest involves a large number of banks and is, therefore, to be distinguished from a "run" involving only a single bank. Thus, the events surrounding Continental of Illinois do not constitute a panic. On the other hand, a panic need not involve all the banks in the banking system. Rarely, if ever, have all banks in an economy simultaneously been faced with large demands for redemption of debt. Typically, all banks in a single geographical location are "run" at the same time, and "runs" subsequently occur in other locations.

The definition requires that depositors *suddenly* demand to redeem bank debt for cash. Thus, protracted withdrawals are ruled out, though sometimes the measured currency-deposit ratio rises for some period before the date taken to be the panic date. In the United States, panics diffused across the

country in interesting ways. Panics did not occur at different locations simultaneously; nevertheless, at each location the panic occurred suddenly.

A panic requires that the volume of desired redemptions of debt into cash be large enough that the banks suspend convertibility or act collectively to avoid suspension. There are, presumably, various events in which depositors might wish to make large withdrawals. Perhaps a single bank, or group of banks at a single location, could honor large withdrawals, even larger than those demanded during a panic, if at the same time other banks were not faced with such demands.[4] But, if the banking system cannot honor demands for redemption at the agreed-upon exchange rate of one dollar of debt for one dollar of cash, then suspension occurs. Suspension signals that the banking system cannot honor the redemption option.

It is important to note that a banking panic cannot be defined in terms of the currency-deposit ratio. Since banks suspend convertibility of deposits into currency, the measured currency-deposit ratio will not necessarily show a sharp increase at, or subsequent to, the panic date. The desired currency-deposit ratio may be higher than the measured number, but that is not observable. Also, clearing-house arrangements (discussed below) and suspension allowed banks to continue loans that might otherwise have been called.[5] In fact, in some episodes lending increased. Thus, there is no immediate or obvious way to identify a banking panic using interest rate movements related to credit reductions. Moreover, since panics in the United States have tended to be associated with business cycle downturns, and also with fall and spring, interest rate movements around panics may be quite complicated. Associations between interest rate movements and panics as part of a definition seem inadvisable.

4.2.2 Panics in the United States

Even if there was agreement on a definition of a banking panic, it is still difficult to determine practically which historical events constitute panics. Many historical events do not completely fit the definition. Thus, there is some delicacy in determining which historical events in American history should be labelled panics. Table 4.1 lists the U.S. events which arguably correspond to the definition of panics provided above.

Consider, first, the pre–Civil War period of American history. During this period, bank debt liabilities mostly consisted of circulating bank notes. We classify six events as panics during this period: the suspensions of 1814, 1819, 1837, 1839, 1857, and 1861. Data limitations prevent a detailed empirical analysis of the earliest panics. Moreover, some of these are associated with "special" historical circumstances, and this argues against their relevance to the general question of the sources of banking instability. The Panics of 1814 and 1861 both followed precipitous exogenous declines in the value of government securities during wartime (related to adverse news regarding the probability of government repayment). Mitchell (1903) shows that bad finan-

Table 4.1 **Banking Panics and Business Cycles**

Height of Panic	Nearest Previous Peak	Notation
August 1814–January 1817[a]	January 1812	War-related
April–May 1819	November 1818	
May 1837	April 1837	
October 1839–March 1842[b]	March 1839	
October 1857	May 1857	
December 1861	September 1860	War-related
September 1873	September 1873	
May 1884	May 1884	
November 1890	November 1890	
June–August 1893	April 1893	
October 1896	March 1896	
October 1907	September 1907	
August–October 1914	May 1914	War-related

Sources: Peaks are defined using Burns and Mitchell (1946, 510), and Frickey (1942, 1947), as amended by Miron and Romer (1989). For pre-1854 data we rely on the Cleveland Trust Company Index of Productive Activity, as reported in Standard Trade and Securities (1932, 166).
[a]Suspension of convertibility lasted through February 1817. Discount rates of Baltimore, Philadelphia, and New York banks in Philadelphia roughly averaged 18, 12, and 9 percent, respectively, for the period of suspension prior to 1817. See Gallatin (1831, 106).
[b]Bond defaults by states in 1840 and 1841 transformed a banking suspension into a banking collapse.

cial news in December 1861 came at a time when banks in the principal financial centers were holding large quantities of government bonds (also see Dewey 1903, 278–82).

During the National Banking Era, there were four widespread suspensions of convertibility (1873, 1893, 1907, 1914) and six episodes where clearinghouse loan certificates were issued (1873, 1884, 1890, 1893, 1907, 1914). In October 1896 the New York Clearing House Association authorized the issuance of loan certificates, but none were actually issued. Thus, one could rank panics in order of the severity of the coordination problem faced by banks into three sets: suspensions (1873, 1893, 1907, 1914); coordination to forestall suspensions (1884, 1890); and a perceived need for coordination (1896). We leave it as an open question whether to view 1896 as a panic, as our results do not depend on its inclusion or exclusion.

The panics during the Great Depression appear to be of a different character than earlier panics. Unlike the panics of the National Banking Era, these events did not occur near the peak of the business cycle and did result in widespread failures and large losses to depositors. The *worst* loss per deposit dollar during a panic (from the onset of the panic to the business cycle trough) in the National Banking Era was 2.1 cents per dollar of deposits. And the *worst* case in terms of numbers of banks failing during a panic was 1.28 percent, during the Panic of 1893. The panics during the Great Depression resulted in significantly high loss and failure rates. During the Great Depression

the percentage of national banks which failed was somewhere between 26 and 16 percent, depending on how it is measured. The losses on deposits were almost 5 percent (see Gorton 1988).

Many authors have argued that the panics during the 1930s were special events explicable mainly by the pernicious role of the Federal Reserve (Friedman and Schwartz 1963) or, at least, by the absence of superior preexisting institutional arrangements or standard policy responses which would have limited the persistence or severity of the banking collapse (Gorton 1988; Wheelock 1988). From the standpoint of this literature, the Great Depression tells one less about the inherent instability of the banking system than about the extent to which unwise government policies can destroy banks. For this reason we restrict attention to pre–Federal Reserve episodes.

As can be seen in table 4.1, the National Banking Era panics, together with the Panic of 1857, all happened near business cycle peaks. Panics tended to occur in the spring and fall. Finally, panics and their aftermaths did not result in enormously large numbers of bank failures or losses on deposits. These observations must be addressed by proposed explanations of panics.

A final interesting fact about panics in the United States during the National Banking Era is their peculiarity from an international perspective. Bordo (1985) concludes, in his study of financial and banking crises in six countries from 1870 to 1933, that "the United States experienced banking panics in a period when they were a historical curiosity in other countries" (73). Explanations of the origins of panics must explain why the U.S. experience was so different from that of other countries.

4.3 Market Structure and Bank Coalitions

Proposed explanations of panics must also be consistent with, if not encompass the abundant evidence suggesting that differences in branch-banking laws and interbank arrangements were important determinants of the likelihood and severity of panics. International comparisons frequently emphasize this point. Also, within the United States the key observation is that banking systems in which branch banking was allowed or in which private or state-sponsored cooperative arrangements were present, such as clearing houses or state insurance funds, displayed lower failure rates and losses. Since there now seems to be widespread agreement on the validity of these conclusions, theories of banking panics must be consistent with this evidence.

The institutional arrangements which mattered were of three types. First, there were more or less informal cooperative, sometimes spontaneous, arrangements among banks for dealing with panics. These were particularly prevalent in states that allowed branch banking. Secondly, some states sponsored formal insurance arrangements among banks. And finally, starting in the 1850s in New York City there were formal agreements originated privately by clearing houses. We briefly review the evidence concerning the importance

of these institutional arrangements in explaining cross-country and intra-U.S. differences in the propensity of panics and their severity.

4.3.1 International Comparisons

Economies in which banks issue circulating debt with an option to redeem in cash on demand (demandable debt) have historically had a wide range of experiences with respect to banking panics. While some of these countries did not experience panics at all, other countries experienced panics in the seventeenth and early eighteenth centuries but not thereafter. In the United States and England, panics were persistent problems. This heterogeneous experience is a challenge to explanations of panics.

In England, panics recurred fairly frequently from the seventeenth century until the mid nineteenth century. The most famous English panics in the nineteenth century are those associated with Overend, Gurney & Co. Ltd. in 1866, and those of 1825, 1847, and 1857. Canada experienced no panics after the 1830s. Bordo (1985) provides a useful survey of banking and securities-market "panics" in six countries from 1870 to 1933. Summarizing the literature, Bordo attributes the U.S. peculiarity in large part to the absence of branch banking.

Recent work has stressed, in particular, the comparison between the U.S. and Canadian performance during the National Banking Era and the Great Depression. Unlike the United States, Canada's banking system allowed nationwide branching from an early date and relied on coordination among a small number (roughly forty in the nineteenth century, falling to ten by 1929) of large branch banks to resolve threats to the system as a whole. Haubrich (1990) and Williamson (1989) echo Bordo's emphasis on the advantages of branch banking in their studies of the comparative performance of U.S. and Canadian banks. Notably, suspensions of convertibility did not occur in Canada. The Canadian Bankers' Association, formed in 1891, was the formalization of cooperative arrangements among Canadian banks which served to regulate banks and mitigate the effects of failures. As in Scotland and other countries, the largest banks acted as leaders during times of crisis. In Canada the Bank of Montreal acted as a lender of last resort, stepping in to assist troubled banks (see Breckenridge 1910 and Williamson 1989).

The incidence of bank failures and their costs were much lower in Canada. Failure rates in Canada were much lower, but they do not accurately portray the situation since the number of banks in Canada was so small. However, calculation of failure rates based on the number of branches yields an even smaller failure rate for Canada. The failure rate in the United States for national banks during the period 1870–1909 was 0.36, compared to a failure rate in Canada, based on branches, of less than 0.1 (see Schembri and Hawkins 1988). Comparing average losses to depositors over many years produces a similar picture. Williamson (1989) compares the average losses to deposi-

tors in the United States and Canada and finds that the annual average loss rate was 0.11 percent and 0.07 percent, respectively.

Haubrich (1990) analyzes the broader economic costs of bank failures and of a less-stable banking system more generally. He investigates the contribution of credit market disruption to the severity of Canada's Great Depression. In sharp contrast with Bernanke's (1983) and Hamilton's (1987) findings for the United States, international factors rather than indicators of financial stress in Canada (commercial failures, deflation, money supply) were important during Canada's Great Depression. One way to interpret these findings is that, in the presence of a stable branch-banking system, financial shocks were not magnified by their effects on bank risk and, therefore, had more limited effects on economic activity.

4.3.2 Bank Cooperation and Institutional Arrangements in the United States

Redlich (1947) reviews the history of early interbank cooperation in the northern United States, arguing that this cooperation was at a nadir in the 1830s. Govan (1936) studies the ante-bellum southern U.S. branch-banking systems, describing cooperative state- and regional-level responses to banking panics as early as the 1830s. The smaller number of banks, the geographical coincidence of different banks' branches, and the clear leadership role of the larger branching banks in some of the states allowed bankers to coordinate suspension and resumption decisions, and to establish rules (including limits on balance sheet expansion) for interbank clearings of transactions during suspension of convertibility. The most extreme example of bank cooperation during the ante-bellum period was in Indiana, from 1834 to 1851.[6] Golembe and Warburton (1958) describe the innovative "mutual-guarantee" system in that state, which was later copied by Ohio (1845) and Iowa (1858). In this system, banks made markets in each other's liabilities, had full regulatory powers over one another through the actions of the Board of Control, and were liable for the losses of any failed member banks.

As early as the Panic of 1839, these differences in banking structure and potential for coordination seem to have been an important determinant of the probability of failure during a banking panic. *Hunt's Merchants' Magazine* reports the suspension and failure propensities of various states from the origin of the panic on 9 October 1839 until 8 January 1840. Banks in the centralized, urban banking systems of Louisiana, Delaware, Rhode Island, and the District of Columbia all suspended convertibility during the panic, and none failed in 1839. Similarly, the laissez-faire, branch-banking states of the South (Virginia, North Carolina, South Carolina, Georgia, and Tennessee) saw nearly universal suspension of convertibility (with 92 out of 100 banking facilities suspending) and suffered only four bank failures in 1839, all small newly organized unit banks in western Georgia.[7] Indiana's mutual-guarantee

banks all suspended, but would never suffer a single failure from their origin in 1834 to their dissolution in 1865, and after suspending in 1839 would never again find it necessary to suspend convertibility (see Golembe and Warburton 1958, and Calomiris 1989a).

Other states typically had fewer suspensions, less uniformity among banks in the decision to suspend, and a higher incidence of bank failure. In New England, outside of Rhode Island, only four out of 277 banks suspended and remained solvent, while eighteen (6.5 percent) failed by the end of 1839. In the mid-Atlantic states, outside of Delaware and the District of Columbia, 112 out of 334 banks suspended and remained solvent, while 22 (6.6 percent) failed. In the southeastern states of Mississippi and Alabama, 23 of 37 banks suspended and two (5.4 percent) failed. In the northwestern states of Ohio, Illinois, and Michigan, 46 out of 67 banks suspended, while nine (13.4 percent) failed.

Calomiris and Schweikart (1991) and Calomiris (1989a) demonstrate that the importance of branch-banking laws and banking cooperation is just as apparent in the experiences of banks during the crisis of 1857. They document that the branch-banking South and the mutual-guarantee coinsurance systems of Indiana and Ohio enjoyed a lower ex ante risk evaluation on their bank notes and suffered far lower bank failure rates than the rest of the country during the Panic of 1857.[8]

None of Indiana's or Ohio's mutual-guarantee banks failed or suspended convertibility during the Panic of 1857. Both Ohio and Indiana chartered free banks, in addition to the coinsuring systems of banks. During the regional crisis of 1854–55, 55 of Indiana's 94 free banks failed, and during the Panic of 1857, 14 out of Indiana's 32 free banks failed. In Ohio, failure rates were lower, with only one bank failing in the Panic of 1857. The difference between Ohio's and Indiana's free banks cannot be attributed to observed differences in the size of the shocks affecting the two locations. For example, the magnitudes of the declines in bond prices were roughly comparable.[9] What set Indiana's newer free banks apart from those of Ohio was their failure to coordinate suspension or to obtain aid from the coinsuring banks.

Ohio banks received assistance from the coinsuring banks during the panic. In Indiana, the free banks and the coinsuring banks did not cooperate. Moreover, the free banks had not had the time to establish an independent coordination mechanism. Ironically, just prior to the Panic of 1857, Indiana free banks began to discuss forming a clearing association for their mutual benefit.[10]

Branch-banking systems tended to be less prone to the effects of panics. Evidence on the importance of branch banking in the United States is provided by Calomiris (1989b, 1990) in a detailed, state-by-state examination of the response of banks in agricultural states to the large adverse asset shocks of the 1920s. Controlling for differences in the severity of shocks, states that allowed branch banking weathered the crisis much better than unit-banking

states. Bank failure rates for (grandfathered) branching banks in unit-banking states, and for branching banks in free-entry branching states, were a fraction of those of unit banks. Furthermore, in states that allowed branching it was much easier for weak banks to be acquired or replaced by new entrants.

Private banking associations in the form of clearing houses provided mechanisms for coordinating bank responses to banking panics. During the nineteenth century, starting in New York City in 1853, clearing houses evolved into highly formal institutions. These institutions not only cleared interbank liabilities but, in response to banking panics, they acted as lenders of last resort, issuing private money and providing deposit insurance. As part of the process of performing these functions, clearing houses regulated member banks by auditing member risk-taking activities, setting capital requirements, and penalizing members for violating clearing-house rules.

During banking panics, clearing houses created a market for the illiquid assets of member banks by accepting such assets as collateral in exchange for clearing-house loan certificates which were liabilities of the association of banks. Member banks then exchanged the loan certificates for depositors' demand deposits. Clearing-house loan certificates were printed in small denominations and functioned as a hand-to-hand currency. Moreover, since these securities were the liability of the association of banks rather than of any individual bank, depositors were insured against the failure of their individual bank.[11] Initially, clearing-house loan certificates traded at a discount against gold. This discount presumably reflected the chance that the clearing house would not be able to honor the certificates at par. When this discount went to zero, suspension of convertibility was lifted. Cannon (1910) and Sprague (1910) trace these increasingly cooperative reactions of city bank clearing houses to panics during 1857–1907. Gorton (1985, 1989b) and Gorton and Mullineaux (1987) also analyze these clearing arrangements.

Bank clearing houses, and their cooperative benefits, were limited to city-wide coalitions in the United States because of branching restrictions. The sharing of risk inherent in these cooperative arrangements required effective monitoring and enforcement of self-imposed regulations. Banks could only monitor and enforce effectively if they were geographically coincident. Moreover, as the number of banks in a self-regulating coalition increases, the incentives for effective supervision decline because the cost of monitoring is borne individually, while the benefits are shared among all members of the group.

4.3.3 Summary

The variety of institutional arrangements discussed above resulted in different propensities for panics and different abilities to respond to panics when they occurred. Internationally, not all countries experienced panics, even when the banking contracts appeared similar to those present in the United States. In the case of the United States, as reviewed above, there is direct evidence that these institutional arrangements resulted in different loss and

failure experiences. Also, there is evidence from the Free Banking Era (1838–63), during which bank notes traded in markets, that these differences were priced by markets. As shown by Gorton (1989a, 1990), the note prices varied depending on the presence or absence of arrangements such as insurance, clearing house, and so on.

The evidence on the importance of market and institutional structure strongly suggests the importance of asymmetric information in banking. If full information for all agents characterized these markets, then institutional differences would not matter. We interpret this evidence as implying a set of stylized facts with which a theory of banking panics must be consistent. A theory must not only explain why such institutional structure matters, but also the origins of such structures as responses to panics.

4.4 Models of Banking Panics

A decade ago, theoretical work on banks and banking panics was aimed at addressing the following questions: How can bank debt contracts be optimal if such contracts lead to banking panics? Why would privately issued circulating bank debt be used to finance nonmarketable assets if this combination leads to socially costly panics? Posed in this way, explaining panics was extremely difficult. In the last decade, two distinct theories have developed to explain the origins of banking panics. While these two lines of argument do not exhaust the explanations of panics, they seem to be the explanations around which research has coalesced.[12] In this section we briefly review the evolution of this research, stressing the testable implications of each.

One line of argument, initiated by the influential work of Diamond and Dybvig (1983), began by arguing that bank contracts, while optimal, necessarily lead to costly panics. Banks and banking panics were seen as inherently intertwined. Over the last decade, confronted with the historical evidence that panics did not accompany demandable-debt contracts in all cases, this view has evolved to include institutional structure as a central part of the argument. Nevertheless, as we trace below, the essential core of the theory remains unchanged, namely, that panics are undesirable events caused by random deposit withdrawals. We, therefore, label this view the "random withdrawal" theory of panics.

The second line of argument on the origins of panics emphasizes the importance of market structure in banking when depositors lack information about bank-specific loan risk. While it is important to explain the existence of banks as institutions, the second view essentially starts with the unit-banking system as given. In this view, runs on banks may be an optimal response of depositors. A key to this argument is the hypothesis that bank depositors cannot costlessly value individual banks' assets. In other words, there is asymmetric information. In such a world, depositors may have a difficult time monitoring the performance of banks. A panic can be viewed as a form of monitoring. If

depositors believe that there are some under-performing banks but cannot detect which ones may become insolvent, they may force out the undesirable banks by a systemwide panic. This line of argument, then, emphasizes sudden, but rational, revisions in the perceived riskiness of bank deposits when nonbank-specific, aggregate information arrives. We label this view the "asymmetric information" theory of panics.

These two lines of thought have different visions of why banks exist, though there are also important overlaps in the arguments. These theoretical considerations are discussed in the final subsection.

4.4.1 Random Withdrawal Risk

The model of Diamond and Dybvig (1983) was the first coherent explanation of how bank debt contracts could be optimal and yet lead to banking panics. An essential feature of the Diamond and Dybvig model is the view of banks as mechanisms for insuring against risk. In their model, agents have uncertain needs for consumption and face an environment in which long-term investments are costly to liquidate. Agents would prefer the higher returns associated with long-term investments, but their realized preferences may turn out to be for consumption at an earlier date. Banks exist to insure that consumption occurs in concert with the realization of agents' consumption preferences. The bank contract, offering early redemption at a fixed rate, is interpreted as the provision of "liquidity." This idea, further developed by Haubrich and King (1984), will not suffice, by itself, to explain panics.

In order for panics to occur, two further, related ingredients were needed. First, as Cone (1983) and Jacklin (1987) made clear, markets had to be incomplete in an important way, namely, agents were not allowed to trade claims on physical assets after their preferences for consumption had been realized.[13] Thus, stock markets or markets in bank liabilities were assumed to be closed. Second, deposit withdrawals were assumed to be made according to a first-come-first-served rule, or sequential-service constraint. These two assumptions, particularly the latter, were able to account for panics which were caused by random withdrawal risk.

A panic could occur as follows. In the Diamond and Dybvig model, a bank cannot honor all its liabilities at par if all agents present them for redemption. The problem is that liquidation of the bank's long-term assets is assumed to be costly. But, the essential mechanism causing the possibility of panic is the sequential-service constraint. With this rule, a panic can occur as a self-fulfilling set of beliefs. If agents think that other agents think there will be many withdrawals, then agents at the end of the sequential-service line will suffer losses. Thus, all agents, seeking to avoid losses associated with being at the end of the line, may suddenly decide to redeem their claims, causing the very event they imagined. The first-come-first-served rule prevents allocation of the bank's resources on a pro rata basis, which would have prevented the panic.

A key question for the original Diamond and Dybvig model concerned the causes of panics. Why would agents sometimes develop beliefs leading to a panic, while at other times believe that there would be no panic? This question, the answer to which was essential for any empirical test of the theory, was not really addressed. Diamond and Dybvig suggested that such beliefs may develop because of "a random earnings report, a commonly observed run at some other bank, a negative government forecast, or even sunspots" (1983, 410).

In the Diamond and Dybvig model, panics are due to random withdrawals caused by self-fulfilling beliefs. The difficulties with this hypothesis were quickly recognized. As mentioned above, Cone (1983) argued that panics would be eliminated if banking was conducted without the sequential-service constraint. Wallace (1988) observed that the explanation for the existence of the crucial sequential-service constraint was "vague." Jacklin (1987) made the observation about the required market incompleteness. Postlewaite and Vives (1987) observed that the optimality of the Diamond and Dybvig bank could not be demonstrated if probabilities could not be attached to the possibilities of self-fulfilling beliefs occurring. Gorton (1988) pointed out that the model was untestable because it did not specify how beliefs were formed or changed as a function of observables.

These difficulties with the Diamond and Dybvig model motivated further research along two lines. First, some justification for the sequential-service constraint had to be found. In Diamond and Dybvig this constraint, clearly not optimal from the point of view of the agents in the model, was assumed to be part of the physical environment. Without the constraint, panics would not arise. Second, the model had to be refined to make clear what types of events would cause beliefs to change such that a panic would occur. The Diamond and Dybvig model theoretically equated the existence of banks as providers of liquidity with the possibility of banking panics. But, in reality, not all banking systems experienced panics. Consequently, as argued by Smith (1987), explaining what shocks would cause agents to withdraw would require more attention to market structure in banking.

Wallace (1988) addressed the issue of the existence of the sequential-service constraint by introducing spatial separation of agents. The assumed isolation of agents prevents them from coordinating their withdrawals. In particular, they cannot organize a credit market at the time when withdrawal choices must be made.[14] This interpretation formally rationalized the existence of the constraint, but it was difficult to recognize as an historical phenomenon. Bhattacharya and Gale (1987), Smith (1987), and Chari (1989) interpreted the spatial separation of agents as corresponding to the institutional features of the U.S. banking system during the nineteenth century. While differing in some important respects, the common thread among these papers is the recognition that the United States had a large number of geo-

graphically separated banks due to prohibitions on interstate banking. Banks were linked by the regulatory structure of the National Banking System which required small country banks to hold reserves in specified reserve-city banks. New York City, deemed the central reserve city, was at the top of the reserve pyramid.

This reinterpretation remedied the two defects of the Diamond and Dybvig model in one stroke. The sequential-service constraint appeared to be imposed on the system by the three-tiered reserve system.[15] Isolation corresponded to the spatial separation of the country banks. Reinterpreting the Diamond and Dybvig model in this historical context meant locating a causal panic shock in the countryside. The gist of the causal mechanism now was that country banks, facing a withdrawal shock, would demand that their reserves from city banks be shipped to the interior. If enough country banks in various locations faced problems at the same time, then they would demand their reserves from their reserve-city banks. The reserve-city banks, in turn, would demand their reserves from their central reserve-city banks in New York City. Thus, panics were not inherent to banking, but were linked to a particular institutional structure, namely, unit banking and reserve pyramiding.

Vulnerability to panics was identified with the spatial separation of banks. But, in order for a panic to occur, the spatially separated banks must be unable to form an effective interbank insurance arrangement. If a coalition of banks could form, then banks could self-insure, moving reserves about through interbank loan markets. Chari (1989) argues that difficulties in unit banks monitoring each other's holdings of reserves vitiated credible interbank arrangements. In the absence of effective monitoring, banks will have an incentive to hold too little in reserves (and place reserves in interest-bearing loans), thus making coinsurance of withdrawal risk infeasible. According to Chari (1989), geographically separate unit banks should be forced to hold reserves by government regulation. The government would then enforce this regulation, and thereby make interbank lending feasible.

In the refined version of Diamond and Dybvig an important question still remained: what was the shock which caused the panic? In order to confront the data, this question must be answered. Unfortunately, not much of an answer has been provided. Bhattacharya and Gale (1987) refer only to "local" shocks in a model of spatially separated banks. Smith (1987) is also vague. Only Chari (1989) explicitly provides an explanation:

> The idea that the demand for currency can vary within communities is not implausible. In the second half of the 19th century an important source of these variations was agriculture. The demand for farm loans rose during the planting season and fell in the harvest. Since cash was required for many farm transactions, the demand for currency in agricultural communities was high at both planting and harvesting times and low at other times of the year. (11)

Indeed, there is a long literature on the seasonality of the demand for currency in the United States.[16] And, the identification of unexpectedly large demands for currency in the countryside as the cause of panics also has a long history.[17] Thus, the modern theory of panics which associates panics with random withdrawal risk due to seasonal fluctuations theoretically rationalizes a traditional view of panics.

To summarize, the theoretical development of the random-withdrawal risk theory of panics has resulted in a view which assigns the origin of the panic-causing shock to the countryside. Only one kind of shock has been proposed, namely, seasonally related demand for money shocks. This has testable implications for the random withdrawal theory, which are developed below.

4.4.2 Asymmetric Information

The alternative theory of banking panics is based on identifying the conditions under which bank depositors would rationally change their beliefs about the riskiness of banks. Then the theoretical task is to identify banking system features under which such changes in beliefs are manifested in panics. The core of the theory is that banking panics serve a positive function in monitoring bank performance in an environment where there is asymmetric information about bank performance. Panics are triggered by rational revisions in beliefs about bank performance.

Banks are not viewed as providing insurance in the asymmetric information theory. Rather, banks are seen as providing valuable services through the creation of nonmarketable bank loans together with the provision of a circulating medium.[18] Since banks are involved in the creation of nonmarketable assets, they may be difficult to value, and bank managements difficult to monitor. There is, thus, asymmetric information between banks and depositors concerning the performance of bank managements and portfolios. In an environment where there are many small, undiversified banks, these problems may be particularly severe.[19] Arguments for the existence of banks' value-creating activities in making loans depend on depositors' abilities to monitor the unobservable performance of bank managements.[20] The view of the asymmetric information theory of panics is that the sequential-service constraint and, indeed, panics themselves, are mechanisms for depositors to monitor the performance of banks.

In an environment with asymmetric information, a panic can occur as follows. Bank depositors may receive information leading them to revise their assessment of the risk of banks, but they do not know which individual banks are most likely to be affected. Since depositors are unable to distinguish individual bank risks, they may withdraw a large volume of deposits from all banks in response to a signal. Banks then suspend convertibility, and a period of time follows during which the banks themselves sort out which banks among them are insolvent. Indeed, it is possible to view panics as a means for depositors to force banks to resolve asymmetries of information through col-

lective action (i.e., monitoring and closure). The efficiency of this mechanism derives from a supposed comparative advantage (low costs) that banks possess.

No single model has given rise to the view that banking panics are essentially due to revisions of the perceived risk of bank debt in an environment where there is asymmetric information about bank asset portfolios. A number of researchers, including Calomiris (1989a), Calomiris and Schweikart (1991), Chari and Jagannathan (1988), Gorton (1987, 1989b), Gorton and Mullineaux (1987), Jacklin and Bhattacharya (1988), Williamson (1989), and others, have argued for this asymmetric information–based view of banking panics. These models are broadly consistent with the arguments of Sprague (1910) and Friedman and Schwartz (1963) which stress real disturbances, causing erosion of trust in the banking system, as precursors to panics. Although these viewpoints differ in important respects, they seem to have a similar idea at core.

The evolution of the asymmetric information view is not as straightforward as the random withdrawal theory, but there is some logic to its development. To see how the asymmetric information view differs from the random withdrawal theory and to trace some of its development, we will focus on the sequential-service constraint. The asymmetric information theory of banking panics views the sequential-service constraint in a fundamentally different way than the random withdrawal theory.

A convenient beginning point is Chari and Jagannathan (1988). They assumed a setting in which depositors are uninformed about the true values of banks. In their model, depositors randomly fall into one of three groups: those who become informed about the state of bank portfolios; those who withdraw because they wish to consume, independently of the state of banks; and those who are uninformed and do not wish to consume. Their basic idea was that some bank depositors might withdraw money for consumption purposes while other depositors might withdraw money because they knew that the bank was about to fail.[21] In this environment, the group of depositors which cannot distinguish whether there are long lines to withdraw at banks because of consumption needs or because informed depositors are getting out early may also withdraw. The uninformed group learns about the state of the bank only by observing the line at the bank. If there happens to be a long line at the bank, they infer (rightly or wrongly) that the bank is about to fail and seek to withdraw also.[22]

This view of panics assumes the sequential-service constraint and asymmetric information, but introduces the idea of heterogeneously informed depositors (also see Jacklin and Bhattacharya 1988). Heterogeneously informed depositors became the basis for Calomiris and Kahn's (1991) and Calomiris, Kahn, and Krasa's (1990) argument that a debt contract, together with the sequential-service constraint, is an optimal arrangement in banking when depositors are uninformed about the bank's assets and managers' actions. To see

the basic idea, suppose that information about the bank is costly to obtain. In order to monitor bank performance, some depositors must be induced to undertake costly information production. A sequential-service constraint rewards those who arrive first to withdraw their money because their deposit contracts are honored in full. Since informed agents would know when to withdraw, they would arrive first, receiving a larger return; those at the end of the line, the uninformed, would get less since the bank would have run out of cash. Thus, the sequential-service constraint induces efficient monitoring of banks by depositors.

In this context, however, the sequential-service constraint does not inevitably lead to banking panics. Instead, the above scenario would occur at specific banks which faced problems, but would not necessarily occur at many banks simultaneously. Banking panics do not occur unless there are a large number of undiversified banks. Some details about the reasons for this were provided by Gorton (1989b). He argued that a bank debt contract and sequential-service constraint, as implied by Calomiris and Kahn (1989), can be a costly way to monitor banks if it requires a large equity-to-debt ratio. (Equity is owned by the managers, so the managers' stake in the bank can be threatened by withdrawal.) For Gorton, bank debt has a role independent of the banks' value-adding activities in creating loans. Bank debt circulates as a medium of exchange. In that setting there must be some mechanism to clear bank liabilities. Gorton compares two institutional arrangements for clearing in the banking industry. The first was similar to American free banking in that bank debt liabilities were like bank notes. That is, bank debt traded in secondary markets. The market prices of these notes revealed information about bank-specific risks. Hence, there is no asymmetric information in this setting. As a result, bank managers are induced to perform their tasks of monitoring or information production because of the threat of redemption. But, optimal performance is only achieved if enough equity is at stake.

Now consider a second way of organizing the banking industry in which there is no market in which bank debt is traded. Instead of clearing bank debt through trade in a market, suppose that bank liabilities clear through a clearing house. This arrangement would create an information asymmetry since there are no publicly observed market prices of different banks' debts. The market incompleteness, assumed in some other models, arises endogenously if this clearing arrangement is chosen. Gorton shows that panics can occur under this second system, but that the costs of monitoring banks can be reduced. The reason is that, with the information asymmetry, banks are forced to internalize the monitoring. The threat of a panic induces banks to form clearing houses which monitor member banks and act as the lender of last resort. The equity-debt ratio can be reduced, economizing on resources. In this view, panics are part of an optimal arrangement for monitoring banks.

While the assumption of information-revealing note prices, revealing bank-specific risk, may be a bit extreme, the essential point is that the need for bank

debt holders to place a collective burden on banks to resolve information asymmetries is much greater under deposit banking than under note banking.[23] The clearing-house coalition is the natural group to resolve asymmetric information problems. Banks as a group have a collective interest in the smooth functioning of the payments system and comparative advantage in monitoring and enforcement.

Notice that there is a subtle difference between the arguments of Calomiris and Kahn (1991) and Gorton (1989b). Calomiris and Kahn argue that the sequential-service constraint provides an efficient way for depositors to monitor individual banks, though it may have the disadvantage of allowing systemic panics to occur. Gorton, however, sees the operation of the sequential-service constraint during panics as adding to the advantages of demandable debt.

The asymmetric information theory argues that insufficient diversification of asset risk among banks occurs under unit banking. Bank depositors do not know the value of bank asset portfolios. A panic may occur when depositors observe a public signal correlated with the value of banking-system assets. In Gorton (1988) the signal is an increase in a leading indicator of recession. In Calomiris and Schweikart (1991) the signal is a decline in the net worth of a particular class of bank borrowers. The signal may imply very slight aggregate losses to banks as a whole, but depositors are unable to observe the incidence of the shock across the many banks in the banking system. Conditional on the signal, deposits are riskier.[24] At some point, as the risk associated with asymmetric information rises, depositors prefer to withdraw their funds or force a suspension of convertibility which will resolve the information asymmetry.

4.4.3 Theoretical Considerations

The competing theoretical constructs discussed above propose different visions of the nature of banks and banking, though there is some common ground. The varying perspectives on the nature of banking are not unrelated to the resulting different theories of panics. From a purely theoretical point of view, there are desirable and undesirable features of the two theories. In this section we indicate these differences and commonalities.

Banks are unique institutions because of services that are provided on each side of the balance sheet. Examining the asset side of the balance sheet first, the two theories appear to agree on the nature of banks' value-adding activities with respect to the creation of bank loans. Monitoring borrowers and information production about credit risks are activities that banks undertake which cannot be replicated by capital markets. The arguments for this are articulated by Diamond (1984) and Boyd and Prescott (1986), among others. The essential idea is that bank production of these activities requires that the bank loan which is created be nonmarketable or, synonymously, illiquid, that is, that it not be traded once created. If the loan could subsequently be sold, then the

originating bank would not face an incentive to monitor or produce information. This argument depends on the banks' activities being unobservable, so that the only way of insuring that banks undertake the activities they promise is by forcing them to maintain ownership of the loans they create. This need for incentive compatibility makes bank loans nonmarketable.

The nonmarketability or illiquidity of bank loans plays an essential role in each theory of banking panics. The random-withdrawal risk theory requires that the liquidation of long-term bank assets be costly. Though never clearly stated, presumably the reason for this cost assumption is that bank loans are not marketable. The asymmetric information theory also assumes that bank loans are nonmarketable. If banks' monitoring and information production activities were observable, then there would be no information asymmetry. Bank loans are not traded because bank activity is hard to observe and monitor.

The two theories significantly differ concerning the nature of bank liabilities. The key question concerns the meaning of "liquidity." The random withdrawal theory sees banks as institutions for providing insurance against random consumption needs. The high-return, long-term investment can only be ended, and transformed into cash or consumption goods, at a cost (for the reasons discussed above). While agents prefer the high-return, long-term investment project, they may want to consume at an earlier date. The bank, by pooling the long- and short-term investments in the right proportions, can issue a security which insures against the risk of early consumption. The idea, articulated by Diamond and Dybvig (1983, 403), is that "banks are able to transform illiquid assets by offering liabilities with a different, smoother pattern of returns over time than the illiquid assets offer." Thus, the insurance feature of the bank contract is interpreted as the provision of "liquidity."

In the random withdrawal theory the illiquidity or nonmarketability of bank assets provides the rationale for the special feature of bank liabilities. In fact, precisely *because* the long-term investments are illiquid, the bank is needed. The banks' liabilities do not circulate as a medium of exchange in this model, so there is no sense in which demand deposits function like money. This appears to be a weakness of the model. But, the model provides a rationale for banks appearing to be financing illiquid assets with liabilities which have a redemption option. In the random withdrawal theory, liquidity means intertemporal consumption flexibility.

The asymmetric information theory also offers a definition of the "liquidity" of bank liabilities. This notion of liquidity refers to the ease with which a security can be valued and, hence, traded. (This definition of liquidity is based on Akerlof 1970.) Importantly, this notion of liquidity is related to explaining the combination of nonmarketable or illiquid bank loans with liabilities offering the redemption option. As mentioned above, Calomiris and Kahn (1991) argue that the illiquidity of bank loans makes bank debt, together with the sequential-service constraint, optimal. Here, uninformed depositors learn

about the state of the bank by observing whether informed depositors have run the bank. Thus, information about the value of bank debt is created. An implication would be that bank debt can be used as a medium of exchange. Gorton (1989b) and Gorton and Pennacchi (1990) also argue that bank liabilities are special because they circulate as a medium of exchange. In Gorton and Pennacchi (1990) the same notion of liquidity is articulated. The basic point is that bank debt is designed to be valued very easily because it is essentially riskless. This makes it ideal as a medium of exchange.

Gorton and Pennacchi consider a set-up similar to Diamond and Dybvig (1983) in that consumption needs are stochastic for some agents. But, other agents do not have random consumption and are informed about the state of the world. The informed agents can take advantage of the uninformed agents who have urgent needs to consume. This is accomplished by successful insider trading. Insiders can profit at the expense of the uninformed agents because these agents need to trade to finance consumption and do not know the true value of the securities they are exchanging for consumption goods. Gorton and Pennacchi show that market prices do not reveal this information. This problem creates the need for a privately produced trading security with the feature that its value is always known by the uninformed. A bank can prevent such trading losses by issuing a security which is riskless.

Banks can design a riskless security by creating liabilities which are, first of all, debt, and secondly, backed by a diversified portfolio. Debt contracts reduce the variance of the security's price. In addition, banks are in a relatively unusual position to back these liabilities with diversified portfolios, because banks make loans to many firms and, thus, hold large portfolios against which debt claims can be issued. For this reason, it is banks which issue trading securities, such as demand deposits.

The asymmetric information theory articulates a notion of liquidity that corresponds closely to the idea that bank liabilities have unique properties making them suitable as a circulating medium. Banks create securities with the property that they can be easily valued because they are riskless. The property of risklessness makes these securities desirable as a medium of exchange. The random withdrawal theory has a notion of liquidity corresponding to a type of insurance which banks are viewed as being in a unique position to offer. Bank debt does not circulate, but functions to insure against the liquidation of bank assets which would be costly. We leave it to the reader to judge whether any weight should be attached to these theoretical distinctions.

4.5 Confronting the Data: The United States During the National Banking Era

Having established the importance of banking institutions and market structure in generating banking panics, we proceed, in this section, to an examination of the comparative empirical performance of the two competing theo-

ries of the origins of banking panics. At the outset it is worth noting the substantial overlap in the predictions of the two views.

First, both views predict widespread banking contraction coinciding with suspension of convertibility. Second, the order in which suspension occurs in different regions (that is, typically moving from East to West) is consistent with either view, as well. According to both views, because of interbank reserve pyramiding, a nationwide move to withdraw funds for whatever reasons will concentrate pressure on eastern financial centers first. Because peripheral banks had substantial deposits in New York, and because depositors often moved to withdraw funds from banks in one location to compensate for suspension elsewhere, suspension in New York City or Philadelphia would precipitate widespread suspension by banks elsewhere. Suspension of convertibility typically spread from eastern cities to other locations within a day or two of suspension in the financial centers (see Calomiris and Schweikart 1991, and Sprague 1910).

Third, as noted above, both views predict that branch banking or deposit insurance would be associated with an increase in banking stability, that is, a reduction in the incidence and severity of banking panics. Branch banking diversifies, and deposit insurance protects against, both asset and withdrawal risks, and either removes the incentive for preemptory runs by depositors which both the withdrawal risk and asymmetric information views predict.[25]

Fourth, the two approaches are consistent with the fact that bank panics occurred in certain months of the year. The withdrawal risk approach views the seasonality of banking panics as evidence of the role of seasonal money-demand shocks in precipitating panics. According to the asymmetric information view, seasonal patterns in the incidence of banking panics, noted by Andrew (1907), Kemmerer (1910), and Miron (1986), indicate that the banking system was more *vulnerable* to asset-side shocks during periods of low reserve-to-deposit and capital-to-deposit ratios, but exogenous withdrawals by themselves were not the cause of panics. This is the argument for the seasonality of panics found in Sprague (1910) and Miron (1986). We provide further evidence for this argument below.

Despite the substantial agreement in the predictions of the two views, there are some important differences in their empirical implications. We have identified three verifiable areas of disagreement. First, because the two views differ over the sources of shocks, they differ in their predictions about what aspects of panic years were unusual, particularly the weeks or months immediately preceding the panic. The withdrawal risk approach implies an unusual increase in withdrawals from banks typically combined with an unusually large interregional flow of funds at the onset of a panic. In particular, Chari (1989) argues that unusually large demands for money in the periphery for planting and harvesting crops were an important source of disturbance. Eichengreen (1984) provides some supporting evidence for this point by showing that the propensity to hold currency relative to deposits was higher in

agricultural areas. During the planting and harvesting seasons, when the composition of money holdings shifted to the West, the money multiplier fell.

In contrast, the asymmetric information approach predicts unusually adverse economic news prior to panics, including increases in asset risk, declines in the relative prices of risky assets, increases in commercial failures, and the demise of investment banking houses. The importance of this news for banking panics depends on the links between the news and the value of bank assets.

A second difference between the two approaches concerns predictions about the incidence of bank liquidations during panics. According to the asymmetric information view of panics, the incidence of bank failures will reflect, in large part, the interaction between different bank loan portfolios and a systemic disturbance. Bank-failure propensities should vary according to the links between bank assets and the shock. For example, a shock which affects western land values or railroads' values clearly should tend to bankrupt banks holding western mortgages or railroad bonds more than other banks. According to models of random withdrawal risk, banks should fail disproportionately in locations with pronounced idiosyncratic money-demand shocks. Or banks fail because they have connections to those regions through correspondent relationships (which transmit the money-demand shocks).[26] Furthermore, the asymmetric information view predicts that the aggregate ratio of bank failures to suspensions should depend on the severity of the shock that initiates suspension, while the withdrawal risk approach would link the severity and suddenness of the withdrawal from banks to the ratio of suspensions to subsequent bank liquidations over different panics.

The third area of disagreement refers to sufficient conditions to resolve a panic. That is, the causes of banking panics can be inferred by the types of measures that are capable of resolving crises. (This has regulatory implications, discussed in the final section.) While both views of panics agree that bank coordination ex ante will probably mitigate the likelihood of panics and the effects of panics when they do occur, the two views have different implications for what efforts are sufficient to resolve panics. The withdrawal risk model predicts that panics take time to resolve because of the difficulty banks face in transforming assets into cash quickly. Historically, however, a large proportion of bank assets took the form of internationally marketable securities, including bills of exchange and high-grade commercial paper which were convertible into gold in international markets (see Myers 1931). In some instances there were more immediate sources of funds available. We investigate whether the time it would have taken to perform this conversion corresponds to the duration of suspension.

Alternatively, the asymmetric information view sees the duration of suspension as an indicator of how long it takes to resolve confusion about the incidence of asset shocks. The availability of specie per se may be insufficient to resolve panics, especially if many banks' assets are not "marked to market"

and are viewed as suspect. Furthermore. the asymmetric information view predicts that interbank transfers of wealth can resolve asset-risk concerns without necessarily taking the form of specie movements and. thus. can put an end to crises. We consider examples of private and public bailouts that took this form.

4.5.1 How Were Pre-Panic Periods Unusual?

We begin by examining whether pre-panic periods were characterized by unusually large withdrawals and interregional flows of funds. Consistent with our definition of panics. we date the beginning of trouble by reference to the timing of a cooperative emergency response by banks. such as providing for the issue of clearing-house loan certificates. This will produce an upwardly biased measure of the withdrawals during panic years. since by the time banks had recognized and acted upon a problem. some endogenous preemptive withdrawals may already have occurred. Thus. our inter-year comparisons of shocks are biased in favor of finding large withdrawals in advance of panics. In other words. a negative finding would provide an a fortiori argument against the importance of random withdrawals.

All comparisons are made across years for the same week of the year. This allows one to abstract from predictable seasonal components of withdrawals.

Our first measures refer to the condition of New York City banks at the beginnings of panics so defined. using data compiled up to 1909 by the National Monetary Commission (see Andrew 1910). We focus on the percentage of deposits withdrawn and the ratio of reserves to deposits as indicators of the New York banks' vulnerability or illiquidity. The two measures are complementary. Because weekly disturbances in money demand are likely to be serially correlated within the year (the sine qua non of the seasonal withdrawal-risk approach). it is useful to focus not only on the reserve ratio but also on the amount actually withdrawn from banks. as an indication of how much is likely to be withdrawn for similar purposes in the following weeks. At the same time. a large withdrawal during times when banks are holding large reserves will be of little consequence. so one must also pay attention to the reserve ratio when comparing years of similar seasonal withdrawal shocks.

Introducing two complementary measures of seasonal "illiquidity risk" complicates matters slightly for determining the extent to which pre-panic episodes were unusual. How does one compare years where the two measures provide opposite results for the degree of "tightness"? We adopt the following conventions: A year is said to be *unambiguously tighter* than another year (during a particular week) if its reserve ratio is lower and the percentage of deposits withdrawn in the immediate past is higher during a given week. A year is defined as *possibly tighter* if the percentage of withdrawals is higher and the reserve ratio differs by less than 1 percent.

We also had to choose a definition of the *immediate past*. Seasonal with-

drawals associated with planting and harvesting tend to be spread over periods of one to two months (more on this below). Clearly, protracted steady withdrawals of funds over a two-month period would not have posed nearly the threat to banks that a sudden withdrawal of the same amount would have posed. The transatlantic cable was in operation beginning in 1866, and it took roughly ten days for a steamship to cross the Atlantic to exchange European specie for marketable bills of exchange and commercial paper. Calomiris and Hubbard (1989b) show that specie flows across the Atlantic and within the country responded extremely rapidly to specie demands, with most long-run adjustments to a shock occurring in the first month. We decided on four weeks as a reasonable time horizon for withdrawal risk since it would take at least two weeks after recognizing a threat to liquidity to retrieve the gold from abroad and distribute it.[27]

Table 4.2 is divided into five pairs of columns, which provide data from 1871 to 1909 on reserve ratios and the percentage change in deposits immediately prior to benchmark weeks that witnessed the onset of banking panics. Panics originated in week 19 (mid May 1884), week 22 (early June 1893), week 37 (late September 1873), week 42 (late October 1907), and week 45 (mid November 1890).

The "quasi panic" of 1896 is excluded from our list. Its inclusion would strengthen the conclusions reported below, since its onset did not correspond to unusually large seasonal withdrawals. Our conclusions would also be strengthened by extending comparisons to include weeks other than 19, 22, 37, 42, and 45. That is, one could seasonally adjust the complete data set on withdrawals and reserve ratios and perform comparisons across weeks, as well.[28] By restricting our attention to the five clear panic cases and to interyear comparisons for panic weeks, we biased our results in favor of concluding that panic episodes were times of unusually large withdrawals. This will strengthen the interpretation of our findings below. We also chose not to detrend the reserve ratios in table 4.2 for the same reason. Detrending the reserve ratio increases the number of episodes in which we find "unambiguously tighter" conditions than those preceding panics.

The measures reported in table 4.3 do not support the notion that panics were preceded by unusually large seasonal shocks or that panics resulted from tripping a threshold of bank liquidity, as measured either by reserve ratios or rates of deposit withdrawal. As shown in table 4.3, even using our extremely conservative methods, we find eighteen episodes in which panics did *not* occur, even though seasonal "liquidity risk" at New York City banks was unambiguously more acute than in periods preceding panics. Three additional episodes involved comparable or larger withdrawals than panic years, with only slightly higher reserve ratios (1900, 45; 1905, 42; 1909, 42). Measures of stringency just prior to the Panics of 1907 and 1893 were roughly at their median levels for the same weeks in other years.

Table 4.2 **Four-Week Percentage Change in Deposits and Reseve Ratios of New York City Banks Prior to Weeks when Panics Occurred**

	Panic of 1884, Week 19		Panic of 1893, Week 22		Panic of 1873, Week 37		Panic of 1907, Week 42		Panic of 1890, Week 45	
	%Δ	Reserve Ratio	%Δ	Reserve Ratio	%Δ	Reserve Ratio	%Δ	Reserve Ratio	%Δ	Reserve Ratio
1871	7.4	34.67	5.7	35.06	−0.2	29.98	−16.4	29.50	−0.4	32.39
1872	11.0	30.98	6.4	33.14	−12.5	29.01	−0.0	32.38	6.7	30.28
1873	7.9	30.67	5.6	30.65	**−13.3**	**27.54**	—	—	—	—
1874	−1.0	35.56	−0.9	37.39	−0.0	35.78	−2.9	32.84	−3.0	31.71
1875	4.1	29.89	5.1	32.13	−2.2	32.38	−4.9	27.49	−3.7	29.09
1876	1.2	29.60	2.6	32.79	3.5	34.85	−4.7	29.99	−4.3	29.09
1877	3.2	32.70	−1.6	33.88	−2.4	30.64	−5.7	28.84	−1.9	29.56
1878	−0.4	32.86	0.4	32.14	0.2	30.90	−4.4	27.30	−0.3	31.09
1879	13.2	32.14	5.1	26.83	−10.2	26.31	2.0	25.54	−0.3	24.71
1880	0.8	27.35	3.9	31.13	−0.1	26.91	1.2	26.57	2.2	25.56
1881	3.6	29.67	10.2	27.79	−5.7	25.14	−9.7	25.66	0.2	26.02
1882	3.0	27.72	−1.3	26.32	−6.6	24.66	−4.3	25.97	−1.2	23.98
1883	6.4	26.64	1.3	27.91	−1.8	26.17	−1.7	24.99	−2.2	26.56
1884	**−4.4**	**26.35**	—	—	—	—	—	—	—	—
1885	2.1	40.28	0.9	41.81	1.0	38.28	−0.6	35.36	−0.2	32.39
1886	−0.2	27.37	−2.1	28.77	−6.8	27.20	−1.5	26.31	0.2	26.60
1887	−0.2	26.10	−1.4	26.16	−1.3	26.11	4.2	27.62	0.3	27.69
1888	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1889	1.6	27.10	0.5	28.29	−1.4	26.21	−3.8	25.22	−1.4	24.56
1890	−0.9	25.36	−0.2	26.21	−4.3	24.13	−3.4	24.91	−3.7	25.35
1891	−3.1	26.18	−5.2	26.94	−0.7	27.15	1.6	27.19	2.9	26.19
1892	0.7	27.78	0.1	29.59	−5.0	25.95	−5.1	25.11	−3.6	25.57
1893	−1.1	29.09	**−0.3**	**29.84**	—	—	—	—	—	—
1894	2.7	38.92	−1.1	38.62	0.3	35.21	1.1	35.51	0.2	35.41
1895	6.3	30.77	6.9	32.28	−1.0	29.66	−5.0	27.88	−1.0	28.64
1896	2.4	29.08	0.8	29.45	−4.9	26.96	1.7	27.62	−4.6	27.10
1897	0.8	32.73	−0.2	33.09	1.8	29.15	−3.2	27.37	2.5	28.34
1898	0.5	32.04	7.0	32.35	−7.4	25.61	6.0	28.13	6.4	26.92
1899	1.4	28.00	−1.1	29.78	−3.9	25.03	−3.9	25.17	−4.0	24.62
1900	3.8	26.76	2.1	27.26	1.4	27.29	−6.0	25.34	−3.7	25.55
1901	0.8	25.83	−2.2	27.22	−3.6	25.76	1.6	26.63	0.8	25.89
1902	0.3	25.35	−2.1	26.25	−5.7	25.07	−2.1	25.64	1.5	27.00
1903	3.5	26.08	0.8	26.06	1.6	26.66	−2.0	26.95	−3.4	25.61
1904	4.1	27.00	−1.4	27.69	1.2	28.14	−2.6	26.33	−0.8	25.84
1905	0.9	26.44	−0.7	25.53	−8.4	25.42	−5.8	26.22	0.2	24.75
1906	3.2	26.26	0.9	25.65	−4.8	25.34	3.7	25.57	−5.2	24.84
1907	2.1	25.75	0.7	26.13	−1.4	25.65	**−2.1**	**26.08**	—	—
1908	3.6	30.03	2.2	28.72	2.4	28.84	0.3	27.39	−0.4	27.33
1909	1.6	26.08	0.8	26.37	−3.8	25.58	−8.3	26.37	−2.6	25.59
Median	1.6	27.78	0.7	29.45	−1.8	26.96	−2.6	26.95	−0.8	26.92

Source: Andrew (1910, 79–117).

Table 4.3 **Times of Greater "Seasonal Withdrawal Stress" than During Panic Years (within-week comparison)**

Unambiguously Greater		Possibly Greater	
Year	Week	Year	Week
1881	42		
1882	22		
1882	42		
1886	22		
1887	22		
1889	42		
1891	22		
1892	42		
1899	22		
1899	42		
1899	45		
1900	42		
		1900	45
1901	22		
1902	22		
1902	42		
1904	22		
1905	22		
		1905	42
1906	45		
		1909	42

Source: Table 4.2

Clearly, seasonal withdrawals from, and reserve ratios of, New York City banks were not "sufficient statistics" for predicting panics. Tables 4.4 and 4.5 provide additional evidence that pre-panic periods were not episodes of unusually large seasonal flows of funds to the interior. Andrew (1910) reports weekly data on shipments of gold between New York City banks and the interior beginning in 1899. These data were used to construct measures of net cash flows from New York to the interior for the four- and eight-week periods prior to the Panic of 1907, and prior to comparable weeks in earlier years. According to these measures, 1900, 1901, and 1906 witnessed greater or comparable withdrawals for *both* time horizons relative to 1907. For the eight-week period, six out of eight years witnessed larger seasonal net outflows.

Andrew (1910) compiled monthly data on cash shipments to and from New York City by region of origin and destination beginning in 1905. Data for September (the month in which harvesting payments are most concentrated, as discussed below) are used to construct table 4.5. Again, 1906 shows a much larger outflow in September. Furthermore, since the Chari (1989) model emphasizes regional variation, it is interesting to note that both 1905 and 1906 show larger region-specific outflows than any in 1907. In September 1906,

Table 4.4 Net Flows of Cash from New York City Banks to Interior, 1899–1907

	For 4 Weeks Prior to October 21, or Comparable Dates[a]	For 8 Weeks Prior to October 21, or Comparable Dates[a]
1899	9,682	26,273
1900	25,190	34,836
1901	15,585	27,266
1902	6,973	16,050
1903	10,636	16,127
1904	9,968	22,962
1905	6,764	23,832
1906	21,649	37,076
1907	17,700	18,248

[a]Comparable dates are as follows: 20 October 1899; 19 October 1900; 18 October 1901; 24 October 1902; 23 October 1903; 21 October 1904; 20 October 1905; 19 October 1906; 18 October 1907.
Source: Andrew (1910, 172–77).

Table 4.5 Net Shipments of Cash for Month of September 1905–1907, from New York City Clearing House Banks to Interior

Region	1905	1906	1907
New England	2,640	3,453	3,846
Eastern states	3,130	6,616	809
Southern states	8,035	3,921	4,834
Middle West	1,965	7.886	6,611
Western states	−5	−2	89
Pacific states	−496	−107	−95
Aggregate			
Sum of balances	15,269	21,767	16,094
Mean of balances	2,545	3,628	2,682

Source: Andrew (1910, 232–39).

two regions received net transfers of cash in excess of the largest amount received by any region in September 1907, while in September 1905 one region did.

Advocates of random withdrawal risk might object to these findings on the grounds that it was *anticipated* future seasonal withdrawals, not past withdrawals, that caused banking panics. To this objection we have four responses. First, anticipations of cash needs in the West and South for planting and harvesting should be closely related to previous weeks' withdrawals, since not all farmers plant or harvest crops in the same week. Thus, years of unusual expected withdrawals (e.g., large harvest years) typically will be years of unusual withdrawals in the immediate past.

Second, information on the volume of crops harvested, which provides independent information on the expected payments required for harvesting, indicates that years in which panics occurred in the fall (1873, 1890, 1907) were

not years of unusually large harvests for corn, wheat, and cotton. Table 4.6 reports data on the percentage differences between the annual volume of these three crops compared to five-year moving averages centered in that year, from 1871 to 1907. As can be seen, in 1873, 1890, and 1907, the harvests were not unusually large. In fact, in many cases they were unusually small.

Table 4.6 **Percentage Difference Between Annual Harvest of Corn, Wheat, and Cotton and Respective Five-Year Moving Averages Centered in that Year[a]**

	Corn (thousand bushels)	Wheat (thousand bushels)	Cotton (thousand bales)
1871	−0.5	−8.0	−19.3
1872	10.1	−4.2	2.0
1873	−9.7	3.3	6.7
1874	−22.4	8.5	−9.8
1875	15.3	−4.9	5.9
1876	3.7	−13.6	−1.8
1877	−2.5	0.3	−3.4
1878	−4.7	4.0	−4.9
1879	7.6	6.1	4.0
1880	15.0	−9.6	10.7
1881	−1.8	−15.1	−10.5
1882	2.7	8.6	14.2
1883	−4.2	−3.4	−6.0
1884	4.8	14.0	−7.7
1885	15.2	−19.0	4.2
1886	−5.8	3.9	−0.7
1887	−20.3	4.8	2.0
1888	14.1	−6.3	−5.3
1889	16.0	3.4	10.5
1890	−19.7	−18.1	11.5
1891	15.6	26.7	14.6
1892	1.6	8.2	−19.9
1893	−6.6	−19.2	−6.4
1894	−31.8	1.5	1.1
1895	17.3	2.4	−19.7
1896	17.0	−16.4	−9.3
1897	−8.0	0.0	16.9
1898	−6.6	25.0	10.6
1899	9.0	−9.4	−8.1
1900	3.6	−17.4	−0.1
1901	−27.3	19.7	−5.3
1902	16.2	7.0	0.6
1903	1.3	−3.2	−8.4
1904	−4.2	−16.1	1.6
1905	4.7	6.6	−0.8
1906	9.5	12.0	6.5
1907	−5.2	−8.5	−4.3

Source: Andrew (1910, 14).
[a]Calculated as a percentage of the value of the moving average.

Third, the timing of panics (with the possible exception of the Panic of 1873) places them *after* weeks of seasonal shocks associated with planting and harvesting, so that any money flows for these purposes would have occurred prior to the dates when panics began. Kemmerer's (1910) and Swift's (1911) analyses of seasonal patterns for interregional currency transfers and agricultural trade make clear that planting was associated with large retentions of funds in the interior in February through April, with large seasonal flows to New York beginning in May. Similarly, late August through early October marked the height of the fall currency transfer. Average seasonal deviations reported by Swift and Kemmerer are given in table 4.7. Data on seasonal variation in currency premia across cities within the United States point to the same seasonal pattern of currency scarcity as in New York, as shown in table 4.8.

Swift (1911) and Allen (1913a) emphasize the difference between the early autumn movement of currency to finance harvesting and the late autumn increase in loans (associated with *increased* deposits in the banking system) to finance the movement of the crops. Allen cites the description of this difference given by the New York Chamber of Commerce Currency Committee:

> These harvests and the marketing of the crops bring to bear upon the banks a two-fold strain, one for capital, the other for currency. The demand for

Table 4.7 **Average Seasonal Currency Flows, 1899–1906**[a]

	Average Net Inflow of Funds from Interior to New York City Banks (million $)	Deviation from Average Monthly Flow Over the Year (million $)
January	23.8	18.8
February	10.0	5.0
March	4.1	−0.9
April	7.7	2.7
May	9.5	4.5
June	12.3	7.3
July	13.4	8.4
August	3.8	−1.2
September	−15.6	−20.6
October	−13.1	−18.1
November	−0.3	−5.3
December	3.9	−1.1
Average over the year	5.0	0.0

Source: Kemmerer (1910, 358–59).

[a]Figures for weekly flows were compiled by the *Commercial and Financial Chronicle* and reported in Kemmerer (1910). Goodhart (1969) argues that these are the most reliable of available data. The data reported here do not include 1907 and 1908 (because of the panic, the last three months of 1907 witnessed unusual interbank outflows from New York, with correspondingly unusual inflows in early 1908). According to Kemmerer's (1910) definition of "months," some months contain five weeks, while others contain four. April, July, September, and December each contain five weeks.

Table 4.8 **Seasonal Variations in the Relative Demand for Money in Chicago, St. Louis, and New Orleans, as Evidenced by Exchange Rates in New York City (average figures, 1899–1908, per $100)**

Month and Week	Chicago Average Rate	St. Louis Average Rate	New Orleans Average Rate
January			
1	2.5¢p	7¢p	35.5¢d
2	5¢p	3¢d	15.5¢d
3	5¢p	7.8¢p	0.5¢d
4	10¢p	1.5¢p	8¢d
February			
5	2¢p	8¢d	19¢d
6	6¢d	13¢d	26.5¢d
7	9¢d	7¢d	24¢d
8	20¢d	4.5¢p	26¢d
March			
9	29.5¢d	5.5¢d	13¢d
10	23¢d	.05¢d	18.5¢d
11	13¢d	2¢p	15.5¢d
12	14.5¢d	3.5¢p	17¢d
April			
13	5¢d	2¢p	22.5¢d
14	14¢d	5¢d	18.5¢d
15	7.5¢d	8¢d	18¢d
16	4¢p	4¢p	20¢d
17	9¢d	1.5¢d	21.5¢d
May			
18	3.5¢d	4.5¢d	45¢d
19	2.5¢p	7.5¢p	46¢d
20	16¢p	20.5¢p	45¢d
21	16¢p	35¢p	37.5¢d
June			
22	10¢p	24¢p	20¢d
23	5¢p	7¢p	8.5¢d
24	4¢p	8¢p	12.5¢d
25	10.5¢p	12¢p	33¢d
July			
26	11.5¢p	2.5¢d	33¢d
27	16.5¢p	18¢d	56.5¢d
28	7.5¢d	21.5¢d	50.5¢d
29	8¢d	11¢d	42¢d
30	10.5¢d	9.8¢d	26¢d
August			
31	11¢d	24.5¢d	35¢d
32	17.5¢d	23.5¢d	28.5¢d
33	19¢d	31.5¢d	42¢d
34	34.5¢d	27¢d	42¢d

(continued)

Table 4.8 (continued)

Month and Week	Chicago Average Rate	St. Louis Average Rate	New Orleans Average Rate
September			
35	37.5¢d	32¢d	59.5¢d
36	36.5¢d	48¢d	65.5¢d
37	25¢d	40.5¢d	79.5¢d
38	26¢d	39¢d	82¢d
39	33¢d	55.5¢d	81¢d
October			
40	32¢d	54¢d	95.5¢d
41	29.5¢d	46.5¢d	85.5¢d
42	27.5¢d	45¢d	85.5¢d
43	31¢d	72.5¢d	82¢d
November			
44	29¢d	60.5¢d	$1.005d
45	20¢d	26.5¢d	$1.09d
46	4.5¢d	11.3¢p	$1.03d
47	13¢p	53.3¢p	91.5¢d
December			
48	2.5¢d	7.3¢p	81.5¢d
49	11.5¢d	2¢d	82.5¢d
50	5¢p	32¢p	74¢d
51	3.5¢p	11.8¢p	86.5¢d
52	3.5¢p	2¢d	66¢d

Source: Kemmerer (1910, 94–95).
Note: "p" = premium; "d" = discount.

> capital comes from the buyers and shippers of agricultural products and is in the main satisfied by an expansion of bank loans and deposits, most of the payments being made by checks and drafts. The demand for currency comes principally from the farmers and planters who must pay their help in cash. In the satisfaction of this demand the banks are unable to make use of their credit, but are obliged to take lawful money from their reserves and send it into the harvest fields. (Quoted in Allen 1913a, 128.)

The upshot of this analysis is that, whatever seasonal currency outflows were associated with planting and harvesting, these flows *preceded* the Panics of May 1884, June 1893, (late) October 1907, and November 1890. Thus, it would be difficult to argue that at these dates people were expecting large seasonal withdrawals of cash to agricultural areas.

Fourth, the observation that a reversal of seasonal flows of cash from New York typically would have been expected beginning in May and late October implies that "illiquidity risk" thresholds consistent with the withdrawal risk approach should have been lower in early spring and autumn. That is, given the expected reversal of fund flows in the summer and winter, a liquidity shock in late spring or fall should have prompted less of a concern than in early

spring or fall. Table 4.2 provided evidence that contradicts that implication. The withdrawal shock associated with the onset of the Panic of 1893 (week 22) indicates a *lower* threshold to initiate a panic than for the shock associated with the Panic of 1884 (week 19). Similarly, the panics in 1907 (week 42) and 1890 (week 45) were associated with lower previous percentage withdrawals than the Panic of 1873 (week 37). This evidence leads one to wonder why there were not many more panics in weeks 19 and 37. That is, using a cross-week comparison criterion to predict panics, we predict fifteen additional panics that never occurred, which are listed in table 4.9. Thus, under the assumption that seasonal liquidity-shock thresholds should be smaller during weeks of higher risk of seasonal withdrawals from New York, the number of unrealized, predicted panics rises from 18 (or 21) to 33 (or 36). Furthermore, one could add to this list by considering unusual seasonal withdrawals prior to weeks other than (and before) weeks 19 and 37. One such case would be March 1881 (week 10), with withdrawals equal to 13.4 percent of deposits over the previous four weeks and a reserve ratio of 25.15. In summary, an emphasis on expected future withdrawal risk, rather than actual past withdrawals, strengthens the case against the random-withdrawal risk approach.

We turn now to investigate whether pre-panic periods were unusual in a manner consistent with the predictions of the asymmetric information theory of panics. The accounts of Sprague (1910), Calomiris and Schweikart (1991), and Gorton (1988) emphasize various specific real disturbances prior to panics, some originating in particular markets (e.g., the western land market in 1893), or high-risk railroad securities in several cases, as well as general business contractions. The single time-series most likely to be systematically associated with all of these shocks is the stock price index. Thus, it seems reasonable to require that pre-panic periods be characterized by unusually adverse movements in stock prices. The extent to which such disturbances threaten the banking system, however, will depend on (1) their severity; (2) the extent to which they signal adverse circumstances in other markets; and (3) the extent to which banks are exposed to risk.

As a starting point it is interesting to compare real economic news prior to the 18 (21) "unrealized panics" (using the within-week criterion) to news pre-

Table 4.9 **Times of Greater "Seasonal Withdrawal Stress" than During Panic Years (cross-week comparison)**

Year	Week	Year	Week	Year	Week
1881	37	1892	37	1901	37
1882	37	1893	19	1902	37
1890	19	1896	37	1905	37
1890	37	1898	37	1906	37
1891	19	1899	37	1909	37

Source: Table 4.2.

ceding the five actual panics. Table 4.10 reports the three-month percentage change in nominal and real (WPI-deflated) stock prices prior to all 26 episodes. This time horizon is long enough to allow continuing bad news to become fully reflected in stock prices, but not too long as to include gradual price declines. Whether one focuses on real or nominal stock price changes depends on the extent to which the wholesale price index follows a random walk (i.e., whether short-run changes in commodity prices are a good indicator of long-run expectations). Barsky (1987) shows that, roughly speaking,

Table 4.10 **Stock Price Declines Over Three Months Prior to Periods of "Seasonal Withdrawl Stress" (within-week criterion)**

Actual Panics	Predicted Unrealized Panics[a]	Nominal %Δ[b]	Real %Δ (WPI deflated)[c]	
1873 (37)		**−7.9**	**−7.9**	
	1881 (42)	−3.2	−10.1	
	1882 (22)	−1.6	−3.5	
	1882 (42)	0.8	−1.1	
1884 (19)		**−12.6**	**−8.5**	
	1886 (22)	−5.0	−0.2	
	1887 (22)	6.3	6.3	
	1889 (42)	2.3	1.0	
1890 (45)		**−8.4**	**−13.3**	
	1891 (22)	1.2	−0.4	
	1892 (42)	0.6	−0.7	
1893 (22)		**−12.2**	**−7.4**	
	1899 (22)	−1.9	−3.9	
	1899 (42 and 45)	0.8	−5.9	
	1900 (42 and [45])	2.7	3.6	
	1901 (22)	6.6	7.7	
	1902 (22)	3.2	0.4	
	1902 (42)	−1.0	−7.9	(−3.7)[c]
	1904 (22)	0.0	3.6	
	1905 (22)	−3.3	−0.5	
	[1905 (42)]	5.4	4.6	
	1906 (45)	10.0	4.8	
1907 (42)		**−18.6**	**−19.8**	
	[1909 (42)]	2.8	−0.6	

Source: U.S. Department of Commerce (1949), 344–45), and table 4.2.

[a]Episodes of "possibly greater" seasonal stress than preceding panics appear in brackets.

[b]Stock price changes are measured using monthly data as follows: for week 19 and week 22 we use February and May prices to calculate the percentage change; for week 37 we use June and September prices; and for week 42 and week 45 we use July and October prices. Evidence on daily stock price changes from the *Commercial and Financial Chronicle* indicates that most of the stock price declines measured in May 1884, September 1873, and October 1907 preceded the onset of panic. In the two remaining panics the monthly stock price changes reported here entirely predate the panics.

[c]The wholesale price index shows an unusually large upward movement in October 1902, which is reversed immediately thereafter. Real percentage change computed using November's price level is given in parentheses.

price movements can be characterized this way, although Calomiris (1988) shows that 1869–79 (and especially 1876–79) was an exceptional period of deflationary expectations in anticipation of the resumption of greenback convertibility. Thus, with the exception of the 1870s, deflated stock price movements are probably the best indicator of real change. At the same time, the existence of measurement error in the wholesale price index argues against identifying a large real stock price movement that does not coincide with nominal movements in stock prices.

The evidence presented in table 4.10 supports the view that large withdrawals only threatened the banking system when they were accompanied by (perhaps precipitated by) real disturbances. The five pre-panic episodes experienced the largest nominal declines in stock prices by far and were all associated with similarly large real declines in stock prices.

Thus far we have shown that adverse stock price movements preceded panics and that unusually large seasonal movements of cash or withdrawals from New York banks were neither necessary nor sufficient conditions for panics. We now ask whether adverse stock price movements by themselves provide sufficient conditions for predicting panics. Specifically, did all sufficiently large percentage declines in stock prices predict panics? Table 4.11 describes all periods of unusual three-month downturns in stock prices, that is, all nonoverlapping three-month intervals in which stock prices fell by more than 5 percent.[29]

Of the 23 intervals of greater than 5 percent nominal decline in stock prices, nine preceded or coincided with panics. Another of these intervals preceded the "quasi panic" of 1896. As table 4.11 shows, these ten pre- and post-panic intervals showed much larger nominal and real declines in stock prices than the remaining thirteen non-panic intervals. The average nominal and real percentage declines for the five pre-panic intervals were −11.9 and −11.4, respectively, while the averages for the thirteen non-panic intervals were 1.7 and 0.07 percent. There were only five non-panic intervals that showed real stock price declines as large as the *minimum* of ten pre- and post-panic intervals. In other words, assuming a threshold of 7.9 percent real decline in stock prices is sufficient to produce a banking panic, one can predict all actual panics (including 1896) and falsely identify only five non-panics as panics.

Of course, the asymmetric information view need not see stock price declines as a sufficient condition for producing panics. As already noted, it is the threat to banks that matters. Stock price declines will have more severe consequences for banks the more they are associated with widespread commercial defaults, and the more banks' portfolio positions expose themselves to loan-default risk.

In table 4.11, we also present data on seasonal differences in the liabilities of business failures for the periods of stock market price declines beginning in 1875. These are the percentage change in the liabilities of business failures for the given interval relative to the previous year's interval. This allows us to

Table 4.11 Three-Month Periods of Unusual Stock Price Decline, 1871–1909

	Nominal %Δ	Real %Δ	Seasonal Difference (%Δ) in Liabilities of Commercial Failures[a]
1873 (June–September)	−7.9	−7.9	NA
1874 (February–May)	−6.3	−4.0	NA
1876 (February–May)	−7.9	−3.3	30.0
1877 (January–April)	−17.2	−12.9	−8.1[b]
1880 (February–May)	−8.3	−2.6	−11.5
1882 (August–November)	−5.6	−1.1	26.6[c]
1883 (May–August)	−5.4	−0.5	115.8[d]
1884 (February–May)	−12.6	−8.5	202.9
1884 (August–November)	−8.8	−4.5	−6.3[c]
1886 (February–May)	−5.0	−0.2	−27.3
1887 (May–August)	−7.7	−6.5	168.4[d]
1890 (July–October)	−8.4	−13.3	50.3[c]
1893 (February–May)	−12.2	−7.4	428.3
1893 (May–August)	−15.4	−6.6	389.2[d]
1895 (September–December)	−10.2	−8.8	25.2
1896 (May–August)	−13.1	−11.1	71.2
1900 (April–July)	−7.4	−5.0	148.0
1902 (September–December)	−8.8	−13.6	−3.8
1903 (February–May)	−9.5	−4.7	23.3
1903 (May–August)	−12.9	−12.6	22.7
1907 (January–April)	−12.3	−13.1	−7.7
1907 (May–August)	−7.1	−7.9	110.0
1907 (August–November)	−17.0	−14.7	143.5

Source: U.S. Department of Commerce (1949, 344–45, 349).

[a]Data on seasonal differences in liabilities of business failures are for four-month period ending the month after the corresponding stock decline, unless otherwise noted.Quarterly data exist for 1875–94; monthly data exist after 1894.

[b]Uses average of first- and second-quarter data.

[c]Uses average of third- and fourth-quarter data.

[d]Uses average of second- and third-quarter data.

abstract from the pronounced seasonality in the series owing to the seasonality in the settlement of debts (see Kemmerer 1910, 219; and Swift 1911).[30] Not surprisingly, the intervals of the sharpest stock price declines also tend to be the intervals of greatest increase in the seasonal difference of the liabilities of commercial failures.

If one asks which periods (for which data are available, i.e., 1875 and after) of the most extreme adverse economic news (real stock price declines in excess of 7.4 percent) are also periods of unusually large business failure (seasonal differences of greater than 50 percent), one is left with only the actual panic episodes and the quasi panic of 1896. In other words, if one posits that the simultaneous violations of thresholds for percentages of real stock price decline and commercial failure increase are sufficient conditions for panic, one can predict panics perfectly. Indeed, one would even be able to predict

that the stock price decline of 1896 would not be as severe a threat to banks as the other episodes, since business failures increased by a somewhat smaller percentage.

An analysis of national bank portfolio risk exposure is also consistent with the predictions of the asymmetric information approach and helps explain why panics tended to occur when they did (near business-cycle peaks, in the fall and spring). According to the asymmetric information view, panics are most likely when bad news immediately follows a period of high loan demand and sanguine expectations. These will be periods when the leverage of banks and their borrowers is highest. This explains why in panic periods, adverse news was translated into unusually large declines in securities' prices and high borrower-default rates.

Because the dates of call reports for national banks vary greatly across years, the potential for meaningful specific inter-year comparisons of bank balance sheet positions is limited. Nevertheless, two broad pattems are unmistakable. First, the risk exposure of banks is highest in spring and fall, and lowest in winter and summer. Second, years of cyclical peaks are associated with unusually high risk exposure. These pattems are demonstrated in table 4.12.

Bank leverage was highest at cyclical peaks (including panic years). Reading down any column in panel A of table 4.12, one compares average loan-to-reserve ratios at different cyclical points, holding the time of year constant. In every case, the ratio is higher at peaks than at troughs and, in most cases, peaks show the highest loan-to-reserve ratios. Clearly, the longer an economic downtum is maintained (as one approaches troughs), the lower is the ratio of loans to reserves. Table 4.12 also provides data on loan-to-reserve ratios at different times of the year and at different points in the business cycle.

Reading across panel A, one can see how seasonality influenced bank loan risk exposure. Typically, March, October, and November calls saw seasonal peaks in the ratio, with declines from March to June, and from November to December. Panics occurred at times of the year when banks were unusually vulnerable to loan-default risk.[31] While *withdrawal* risk was low during pre-panic periods, loans (and hence, loan-default risk) were high in late autumn, when most panics occurred (see Allen 1913a; Swift 1911; and Kemmerer 1910). It is interesting to note in table 4.11, however, that periods of severe bad news in risky-asset pricing are typically confined to these same seasons. Notice how few of the precipitous declines in stock prices occur from November to February, or from April to July. Intervals ending in April or May account for nine incidents of severe decline, and declines for intervals ending in August through November account for eleven more. This leaves three episodes which occurred in other times of the year, namely, two intervals ending in December (1895 and 1902), and one in July (1900). No intervals of decline ended in January, February, March, and June. More formally, using a chi-squared test we were able to reject the null hypothesis that the probability of a

Table 4.12 **Cyclical and Seasonal Influences on the Ratio of National Bank Loans to Reserves, 1870–1909**

	A. Mean Loan-to-Reserve Ratios					
	March 10[c]	May 17[d]	June 11[e]	October 3[f]	November 12[g]	December 13[h]
Trough and early recovery[a]	4.62	5.19	4.77	5.74	5.96	5.30
Recovery and expansion	NA	5.87	5.93	6.40	6.65	6.24
Peaks and early decline[b]	6.72	6.45	6.06	6.84	6.68	6.05
Decline	6.89	NA	NA	6.64	NA	6.54

	B. Data for Specific Calls	
Date	Business-Cycle Reference	Loan-to-Reserve Ratios
March 10 Calls[c]		
Comparable March calls		
10 March 1876	Decline	6.96
11 March 1881	Peak	6.57
11 March 1882	Early decline	6.72
13 March 1883	Decline	7.47
7 March 1884	Decline	6.23
10 March 1885	Trough	4.72
6 March 1893	Peak	6.88
9 March 1897	Trough	4.52
May 17 Calls[d]		
Comparable May calls		
19 May 1882	Early decline	6.30
13 May 1887	Peak	6.12
13 May 1889	Recovery	5.87
17 May 1890	Peak	6.94
17 May 1892	Early recovery	5.65
14 May 1897	Trough	4.72
June 11 Calls[e]		
Comparable June calls		
9 June 1870	Trough	4.25
10 June 1871	Early recovery	4.57
10 June 1872	Expansion	5.47
13 June 1873	Peak	5.89
14 June 1879	Recovery	6.21
11 June 1880	Expansion	5.64
9 June 1903	Peak	6.23
9 June 1904	Trough	5.50
October 3 Calls[f]		
Comparable October calls		
2 October 1871	Recovery	5.63
3 October 1872	Expansion	6.79
2 October 1874	Decline	5.81
1 October 1875	Decline	7.39
2 October 1876	Decline	6.91
1 October 1877	Decline	7.25
1 October 1878	Trough	6.53

Table 4.12 (continued)

Date	B. Data for Specific Calls	
	Business-Cycle Reference	Loan-to-Reserve Ratios
2 October 1879	Early recovery	6.36
1 October 1880	Recovery	6.00
1 October 1881	Peak	6.74
3 October 1882	Early decline	7.11
2 October 1883	Decline	6.95
1 October 1885	Trough	4.96
5 October 1887	Early decline	6.48
4 October 1888	Early recovery	6.28
30 September 1889	Expansion	6.88
2 October 1890	Early decline	7.03
30 September 1892	Recovery	6.63
2 October 1894	Early recovery	4.98
6 October 1896	Decline	5.52
5 October 1897	Early recovery	5.31
30 September 1901	Recovery	6.49
November 12 Calls[g]		
Comparable November calls		
17 November 1903	Early decline	6.68
10 November 1904	Early recovery	5.96
9 November 1905	Expansion	6.54
12 November 1906	Expansion	6.97
16 November 1909	Expansion	6.45
December 13 Calls[h]		
Comparable December calls		
16 December 1871	Recovery	5.65
17 December 1875	Decline	8.10
12 December 1879	Expansion	6.46
12 December 1888	Recovery	6.34
11 December 1889	Expansion	6.85
13 December 1895	Peak	6.05
17 December 1896	Decline	4.98
15 December 1897	Early recovery	5.12
13 December 1900	Early recovery	5.48
10 December 1901	Recovery	5.92
Other Dates of interest		
12 September 1873	Early decline	5.89
24 April 1884	Peak	6.52
4 May 1893	Peak	6.70
25 November 1902	Expansion	6.28

Sources: Andrew (1910, 63–66); and Burns and Mitchell (1946, 111–12), based on Frickey (1942, 328).
[a]Business cycles are defined relative to the Frickey (1942) index, reported in Burns and Mitchell (1946). "Early" recovery refers to a date no more than six months after the trough.
[b]"Early" decline refers to a date no more than six months after the peak.
[c]"March 10 calls" include all call reports from March 6 to March 13.
[d]"May 17 calls" include all call reports from May 13 to May 19.
[e]"June 11 calls" include all call reports from June 9 to June 14.
[f]"October 3 calls" include all call reports from September 30 to October 6, except for the unusual post-panic year 1893.
[g]"November 12 calls" include all call reports from November 9 to November 17.
[h]"December 13 calls" include all call reports from December 10 to December 17.

severe decline in the stock market was randomly distributed over the year at the 0.004 significance level. More contemporary pattems are also consistent with these findings. The stock market crashes of 1929, 1987, and 1989 all occurred in mid to late October.

Thus, it is not possible to argue that bank or borrower leverage transformed normal disturbances into panics. From a cyclical perspective, bad news and high leverage are both associated with cyclical peaks. Furthermore, fundamental seasonal pattems in the economy seem to concentrate adverse news in the spring and fall, at times when leverage is also high. What can explain these pattems? It is not difficult to explain why cyclical peaks are times of bad news (ex post), otherwise they would not have been cyclical peaks, and the high leverage of banks in these times is explicable by reference to previous rosy circumstances (given the evidence that economic activity during this period was strongly autoregressive; see Calomiris and Hubbard 1989a, 442–43). The simplest explanation for the seasonal pattem is that seasons of greatest economic activity will witness both higher borrowing and more news.[32]

Of course, very bad news and high leverage were not always coincident, and these episodes reinforce the notion that both bad news and risk exposure are necessary to produce a panic. The (nominal and real) stock price declines of December 1895 and December 1902 were larger than the average declines that preceded panics, but these did not produce panics, occurred "off season" at times when bank and borrower leverage was low (see table 4.12), and were associated with less-pronounced business failure increases.

Before moving on to the next section, it may be useful to make a methodological point regarding what we have *not* done in this section. We did not use linear regression analysis, with adjustments for seasonal factors, to test models. Given the oscillation between panic and non-panic episodes, it would be difficult to argue that bank balance sheet variables are a stationary process. Thus, direct comparison across plausibly comparable episodes seemed to us a better way to proceed. Moreover, as we have stressed, the implications of the two approaches are best stated in terms of responses to violations of thresholds and nonlinear combinations of such violations (news and leverage). More formal technical analysis of these nonlinearities would be possible, but given the conclusiveness of the simple approach, we found this was not necessary.

The results of this subsection suggest that seasonal money-demand shocks originating in the countryside cannot possibly be the cause of panics. Rather, the results are consistent with the view that "bad" macroeconomic news combined with the vulnerability of banks to shocks, a vulnerability which is associated with banking activities in a natural way, accounts for panics. These results confirm the time-series econometric work of Gorton (1988) which shows that panics are associated with a threshold level of news receipt concerning the growth in liabilities of failed businesses, which is a leading indicator of recession (see also Calomiris and Hubbard 1989a). Gorton (1988)

argued that panics in the United States occurred every time measures of the liabilities of failed businesses reached a critical threshold, and did not occur otherwise.

4.5.2 Bank Liquidations and Deposit Losses During Panics

We now analyze the data on bank failures during panics to compare the predictions of the asymmetric information and random-withdrawal risk views. Both predict that cooperation among banks (branching or coinsurance) reduces the incidence of bank failure during panics. As noted above, there is abundant evidence to support this view. But the two theories differ in many of their implications regarding which banks are mostly likely to fail, as well as the extent and regional distribution of bank failures in different panics.

The withdrawal risk approach sees the greatest threat to banks as coming from regionally concentrated shocks transmitted through the correspondent network. Regionally concentrated shocks should be especially problematic for banks in the region of the shock, especially those in regional reserve centers and their correspondents in other regions. Episodes of greatest money-demand shocks or vulnerability to money-demand shocks should correspond to those with the highest incidence of bank failure. Finally, bank failures during panics are mainly attributable to the exogenous money-demand disturbance, rather than to the investment decisions of bankers.

The asymmetric information approach has strong testable implications for bank failure, since it identifies asset shocks as the source of panics and sees panics as an attempt by the banking system as a whole to resolve asymmetric information by closing insolvent banks, that is, those which have suffered the greatest declines. Thus, there should be a direct link between ultimate bank failures and the asset shock that triggers the panic. Regions with relatively large asset shocks (such as region-specific agricultural commodity and land price declines) should show higher incidences of failure. Also, within regions, banks with the greatest exposure to the asset shocks that induce the panic should be more likely to fail (some shocks are more likely to affect city banks than country banks because of their different loan portfolios). Across panics, the aggregate failure rate should depend on the severity of the disturbance *as well as the concentration* (more regionally concentrated shocks induce higher average failure rates). Finally, individual banker behavior in undertaking risky investments could be an important determinant of within-region variation in failures.

Table 4.13 presents state and regional data on the number of national banks and national bank failures for intervals surrounding panics, including the quasi panic of 1896. Table 4.14 provides data on individual bank failures during panics and their causes, according to the brief summary of each case provided by the Comptroller of the Currency in his *Annual Report* of 1920.

With respect to the stated causes of bank failures, the data in table 4.14 are

Table 4.13 **The Number of National Banks and National Bank Failures During Panics, by State and Region, 1873–1907[a]**

	1873		1884		1890		1893		1896		1907	
Region and State	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures
New England												
ME	63	0	72	0	78	0	83	0	82	0	79	0
NH	42	0	49	0	51	0	53	2	50	0	57	0
VT	42	0	47	1	51	0	48	0	49	0	50	0
RI	62	0	63	0	59	0	59	0	57	0	23	0
MA	217	0	246	0	260	0	268	0	268	0	203	0
CT	80	0	88	0	84	0	84	0	82	0	80	0
	506	0	565	1	583	0	595	2	586	0	482	0
East												
NY	277	1*	314	2*	319	0	336	2*	330	3	401	0
NJ	62	0	69	0	94	0	99	0	102	0	168	0
PA	202	1	270	0	349	0	399	0	419	0	722	1
DE	11	0	15	0	18	0	18	0	18	0	24	0
MD	33	0	41	0	59	0	68	0	68	0	97	0
DC	5	1	6	0	12	0	13	0	14	0	12	0
	590	3	715	2	851	0	933	2	951	3	1,424	1

South												
VA	24	2	23	0	32	0	36	0	37	0	96	0
WV	17	0	19	0	21	0	30	0	33	0	88	0
NC	10	0	15	0	21	1	24	0	28	0	57	0
SC	12	0	13	0	16	0	14	0	15	0	25	0
GA	13	0	13	0	30	0	30	3	30	0	86	0
FL	0	0	2	0	15	0	18	1	17	0	35	0
AL	9	0	9	0	30	0	30	1	27	0	73	0
MS	0	0	3	0	12	0	13	1	10	0	26	0
LA	9	1*	8	0	19	0	20	0	21	1*	36	0
TX	8	0	44	0	189	0	226	4	209	3	510	1
AR	2	0	5	1	9	0	9	0	9	0	35	0
KY	36	0	64	0	76	0	81	1	77	2	139	0
TN	24	0	30	0	51	0	55	4	48	0	77	0
	164	3	248	1	521	1	586	15	561	6	1,283	1
Middle West												
OH	169	1	200	0	233	0	244	1	249	1	358	2
IN	93	1	97	2	100	0	120	2	113	0	219	1
IL	137	0	161	1	192	0	216	3**	220	2*	389	0
MI	77	0	87	0	110	0	102	2	92	4	91	0
WI	45	0	45	0	68	0	82	0	81	0	125	0
MN	32	0	43	0	60	0	77	0	76	2*	245	0
IA	75	0	108	0	139	0	170	1	168	2	301	1
MO	36	0	34	0	79	0	79	0	68	1*	113	0
	664	2	775	3	981	0	1,090	9	1,067	12	1,841	4

(continued)

Table 4.13 (continued)

	1873		1884		1890		1893		1896		1907	
Region and State	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures	Banks	Failures
West												
ND	1	0	30	0	29	0	35	3	29	4	121	0
SD		0		0	39	0	39	2	31	1	83	0
NE	10	0	41	0	135	1	137	2	114	1	193	0
KS	26	1	35	0	159	7	138	1	105	2	199	0
MT	5	0	10	1	25	0	28	3	26	1	37	0
WY	2	0	4	0	11	0	13	1	11	0	29	0
CO	7	0	22	0	46	0	53	1	42	0	97	0
NM	0	0	6	0	9	0	11	1	7	1	36	0
OK	0	0	0	0	5	0	6	0	13	0	294	0
	51	1	148	1	458	8	460	14	378	10	1,089	0

Pacific												
WA	0	0	12	0	51	1	66	5	41	2	41	0
OR	1	0	6	0	37	0	40	1	33	0	53	0
CA	5	0	13	0	37	0	37	1	31	1	126	0
ID	1	0	3	0	7	0	13	0	11	0	34	0
UT	3	0	4	0	10	0	14	0	11	0	18	0
NV	0	0	1	0	2	0	2	0	1	0	7	0
AZ	0	0	1	0	2	0	5	0	5	0	14	0
	10	0	40	0	146	1	177	7	133	3	293	0
Total	1,985	9	2,491	8	3,540	10	3,841	49	3,676	34	6,412	6
Reserve center banks		2		1		0		3		4		0

Sources: U.S. Comptroller of the Currency, *Annual Report* (1873, 1884, 1890, 1893, 1920).
Notes: "Banks" means the number of banks in existence prior to panics. "Failures" means bank failures at or near the time of panic (only liquidated banks are included). Specifically, we include bank failures that occurred within the following intervals: June–December 1873; March–August 1884; August 1890–February 1891; April–October 1893; July 1896–January 1897; August 1907–February 1908.
*Denotes a reserve-center bank failure.
**Denotes two reserve-center bank failures.

Table 4.14 The Causes of National Bank Failures During Panics[a]

	1873	1884	1890	1893	1896	1907
Total number of failures	9	6	10	49	34	6
Number attributed to asset depreciation alone	4	2	5	31	26	3
Number attributed to fraud alone	0	2	0	7	3	2
Number attributed to both asset depreciation and fraud	5	4	5	11	5	0
Asset depreciation attributed to monetary stringency	0	0	0	17	8	0
Asset depreciation only; attributed to real estate	0	1	2	0	4	0
Bank failure attributed to real estate depreciation and fraud	0	1	2	0	1	0
Bank failure attributed to run on bank	0	0	0	0	0	1

Source: U.S. Comptroller of the Currency, *Annual Report* (1920, 56–73).
[a]Relevant intervals for bank failures are defined in table 4.13.

strongly supportive of the asymmetric information view and provide virtually no evidence that money-demand shocks provided necessary or sufficient conditions for banks to fail. Of the 116 bank failures that occurred during intervals surrounding panics, 101 were attributed to asset depreciation, with eleven of these cases mainly involving real estate–related investments (all from 1884 to 1896). Thirty of these 101 failures involved fraudulent activities. An additional fourteen failures were attributed solely to fraud. The single remaining failure was attributed to a bank run (in 1907). These data clearly indicate that bank failures during panics often involved shady activities by bankers (44 out of 116 cases), which typically made banks' assets especially vulnerable to bad news (hence the association between asset depreciation and fraud in most of the fraud cases). The fact that bank failure is linked to asset depreciation does not itself contradict the withdrawal risk approach, since advocates of this view argue that panics themselves caused asset depreciation of banks. In 25 cases, asset depreciation was deemed the result of high market interest rates during the panics. Nevertheless, in the overwhelming majority of cases (91 of the 116), failure was not attributed to panic-induced stringency in the money market. Furthermore, the fact that the Comptroller only attributed one failure to a bank run per se shows that the *direct* link between bank runs and bank failures during panics was not important.

The withdrawal risk and asymmetric information views also differ in their implications regarding the relative severity of bank failure rates during the various panics. According to the withdrawal risk approach, inadequacy of reserves to meet withdrawal needs is the key factor in causing suspensions and failures alike. Thus, the degree to which panics were associated with illiquid-

ity in the banking system should be reflected in bank failure rates as well. In other words, the three widespread suspensions of convertibility (1873, 1893, and 1907) should be associated with the largest failure rates, followed by the Panics of 1884 and 1890 in which there was bank coordination without widespread suspension, with the quasi panic of 1896 showing the least-severe failure experience of all. Moreover, within the group of suspensions, 1893 should have been milder than 1873 or 1907, since it followed especially small spring seasonal money flows and occurred in the middle of the year (rather than in the fall), when anticipated interregional flows favored New York City and reserve ratios of the system as a whole rose (as shown in table 4.12). Thus, one should find that the failure rates are ranked in four groups roughly as follows: 1873 and 1907; 1893; 1884 and 1890; and 1896.

The predictions of the asymmetric information approach regarding the relative severity of bank failures during these panics could be quite different. The asymmetric information approach does not equate systemic illiquidity risk of banks with failure risk. It can envision cases in which the aggregate illiquidity of the banking system is severe but the ex post failures are relativity few. It can also envision cases where large *observable* shocks to a subset of banks could cause many failures without leading to a suspension of convertibility for the banking system as a whole. In particular, panics that are associated with large region-specific asset shocks may produce larger failure rates in one region, while posing a relatively small problem for systemic convertibility of deposits on demand. In the asymmetric information approach, nationwide commercial-failure rate and production data, as well as other *region-specific* proxies for real shocks preceding panics, would be useful guides for ranking the likely consequences for bank failures.

For aggregate data we consider the new Miron and Romer (1989) monthly production index (augmented by Frickey [1942, 1947] for the period prior to 1884) and liabilities of commercial failures. A consistent monthly series of commercial failures at the national level is not available for the entire period from 1873 to 1907. Limited comparisons that are possible using quarterly and monthly data for 1875 to 1907, however, provide a rough ranking of commercial failure severity, again using seasonal difference as our measure. Table 4.15 reports data for the liabilities of commercial failures and industrial production growth for the bank failure intervals used to construct table 4.13.

Interestingly, if one confines oneself to these two aggregate measures, the predicted ranking of bank failure severity for panics is very close to that of the withdrawal risk view above. The ranking would be: 1893, 1907, 1873, 1884, 1890, 1896. If the positions of 1893 and 1873 are switched, the ranking becomes the same as that implied by the random withdrawal approach.

The actual ranking of bank failure rate and depositor loss rate severity for national banks as a whole is different from the predicted ranking of the withdrawal risk view and the predicted ranking from economywide measures of real shocks. The ranking, with the percentage of national banks failing given

Table 4.15 **Liabilities of Commercial Failures and Industrial Production During Panic Intervals**

	Liabilities	Industrial Production (%Δ)
June–December 1873	NA	−6.9 (−12.9)[a]
April–September 1884[b]	140.8	−4.0
April–September 1883	77.9	
seasonal difference	80.7%	
October 1890–March 1891[b]	131.3	−2.9
October 1889–March 1890	80.6	
seasonal difference	62.9%	
April–September 1893[b]	204.0	−26.6
April–September 1892	41.7	
seasonal difference	389.2%	
July 1896–January 1897	146.7	2.0
July 1895–January 1896	106.2	
seasonal difference	38.1%	
August 1907–February 1908	169.6	−28.5
August 1906–February 1907	73.6	
seasonal difference	130.4%	

Sources: U.S. Department of Commerce (1949, 349), Miron and Romer (1989); Frickey (1947, 120; 1942, 328).

[a]Miron and Romer (1989) begin their index in 1884. Frickey's (1947) monthly index of production for transportation and communication is reported instead, as well as Frickey's (1942) quarterly index of economic activity (in parentheses).

[b]Intervals were dictated by the use of quarterly data for commercial failures prior to 1894 and differ slightly from bank-failure intervals reported in table 4.13.

in parentheses, is: 1893 (1.28 percent), 1896 (0.92 percent), 1873 (0.45 percent), 1884 (0.32 percent), 1890 (0.28 percent), and 1907 (0.09 percent). The relative positions of 1893 and 1873 in this ranking correspond to the predictions of the asymmetric information approach, but in other respects this ranking differs drastically from either of the two "predicted" rankings.

First, the Panic of 1907 is practically a non-event from the standpoint of national bank failures. Indeed, it was a time of unusually *low* bank failures during the National Banking Era. For the entire period of 1865 to 1909, there were 0.94 bank failures per month on average. There were only six failures during the seven-month interval we examined for the Panic of 1907, implying a rate of 0.86 failures per month. Considering the more than tripling of the number of banks over this period, this amounts to a substantially lower failure rate (per bank, per month) than the average rate for the entire period.

Second, the quasi panic of 1896 was a time of substantially above-average bank failure, even though it did not result in suspension. According to the asymmetric information approach, this would imply that the shocks of 1896 were not accompanied by a great deal of confusion regarding their incidence.

To summarize, the data on actual bank failures support the asymmetric information approach more than the random withdrawal approach, but they also pose a challenge, namely, to explain the lack of bank failures during the severe contraction of 1907 and the unusually large incidence of failure during the relatively mild business-cycle downswing of 1896.

With respect to the low national bank failure rate during the Panic of 1907, a recent paper on the panic by Moen and Tallman (1990) points out that national banks and state banks fared much better than trusts in New York City during the panic:

> Depositor runs on trust companies in 1907 occurred without similar runs on New York City national banks. . . . The balance sheets of trust companies in New York City suggest that their asset values were subject to greater volatility than the other intermediaries. . . . In addition, it is notable that the initial runs on intermediaries in 1907 occurred at the trust companies, institutions that were not eligible to hold legal reserve funds for interior banks. Thus, the onset of the Panic does not appear to be a result of the institutional structure of reserves held at national banks, often referred to as the "pyramid" of reserves.

Moen and Tallman show that trusts had much greater proportions of investments in securities and in call loans, which were collateralized by securities. This made them more vulnerable to the stock market decline that preceded the panic. They also find that practically all of the contraction in New York City loans during the panic is attributable to the trust companies. On the basis of this evidence, Moen and Tallman argue that the Panic of 1907 is best understood as a consequence of adverse news about the value of a subset of assets in the economy.

One does not need to search too hard to find reasons for the unusually high failure rates during 1896. Table 4.13 shows that failures were concentrated in a few states, while many other states avoided failures altogether during the panic. This was also true in 1890 and 1893. In 1890, eight out of ten failures occurred in Kansas and Nebraska, producing a combined failure rate in these states of 4.1 percent. In 1893 the outliers were the western states, with a 3.0 percent overall failure rate, and a combined failure rate for Montana and the Dakotas of 7.3 percent. Washington had a failure rate of 7.6 percent. The southern states (especially Texas, Tennessee, and Georgia) failed at a rate of 2.6 percent. In the Middle West during the Panic of 1893, the states of Illinois, Indiana, and Michigan experienced a combined failure rate of 1.6 percent.

In 1896 the pattern is quite similar. Western states' national banks failed at the rate of 2.6 percent, with a failure rate in the Dakotas of 13.8 percent. Texas and Kentucky, in the South, suffered a combined failure rate of 1.7 percent, while 4.9 percent of Washington's national banks failed. In Michigan, Iowa, and Illinois the combined failure rate was 1.7 percent. Explaining unusually high failure experiences of national banks during panics, therefore,

reduces to explaining why scattered states in the Middle West, West, Pacific, and South regions experienced high failure rates during the 1890s.

The regional pattern of failures seems incompatible with the withdrawal risk view of panics. States with high failure rates in any one panic were often quite distant, differed in planting and harvesting times, and were oriented toward different financial centers. Thus, it would be unlikely for them to experience simultaneous liquidity shocks. For example, Washington, Kentucky, Texas, Michigan, and the Dakotas (in 1896) are unrelated in terms of correspondent relations, harvest and planting timing, and geographical proximity. Georgia, Texas, Tennessee, the Dakotas, and Montana are similarly unrelated (in 1893).

What does explain the regional patterns of bank failure, and why is it that high regional bank failures in 1890 and 1896 were not associated with systemic illiquidity? The answer seems to be that the 1890s were a time of unusually adverse shocks concentrated in agricultural product and land markets. These shocks were known to be isolated to particular markets and had especially adverse consequences for borrowers and bankers whose portfolio values varied with the value of investments in newly cleared land.

Allan Bogue's (1955) classic study of the speculative land boom and bust of 1873–96 documents the changing fortunes of mortgage brokers who acted as intermediaries between western landowners and mortgage investors throughout the country. During the boom of the 1870s and early 1880s, agricultural prices and land prices rose, and many mortgages were bought by banks in other regions. A series of ever-worsening economic news for agriculture created waves of foreclosures, bankruptcy, and bank failure. Bogue writes:

> Between 1888 and 1894 most of the mortgage companies failed. The causes of failure were closely interrelated. The officers of the mortgage agencies had misunderstood the climatic vagaries of the plains country. They had competed vigorously to finance the settlement of areas beyond the ninety-eighth meridian (e.g., western Kansas and Nebraska). Beginning in 1887 the plains country was struck by a series of disastrously dry years. The effects of drought and short crops are sometimes alleviated by high prices, but in these years the prices of agricultural products were depressed. Many of the settlers along the middle border failed to meet their obligations. The real estate holdings of the companies grew to unmanageable size; operating capital was converted into land at a time when the bottom had dropped out of the land market. (267)

Panics in the 1890s were associated with large declines in productivity and the terms of trade for agriculture. In each of the years prior to the panics of 1890 and 1893, the terms of trade in agriculture, as measured by the ratio of the price of wheat to the wholesale price index, declined by approximately 30 percent.

The hypothesis that the unusual failure experience of certain states in the

1890s can be explained by the collapse of the high-risk mortgage market in certain agricultural areas has testable implications. First, the Comptroller of the Currency identifies cases of national bank failure that are primarily attributable to real estate depreciation. As table 4.14 shows, almost all real-estate-related failures of national banks that accompanied panics occurred during the Panics of 1890 and 1896.

Of course, national banks faced restrictions on mortgage lending which limited their direct exposure to land price declines. State banks, however, tended to permit greater involvement in mortgage lending. Hence, another testable implication of the land-value-shock explanation of bank failures during the 1890s is that state banks in Kansas and Nebraska should have had *unusually high* rates of bank failure compared to their counterparts in the national banking system in those same states. In other panics, rates of failure in those states should have been lower and more similar between national and state banks.

As a first step toward testing this proposition, we collected data on state bank failures during panic intervals for the Panics of 1893 and 1907 from state banking reports available at the Library of Congress. These data are provided in table 4.16. We find that state bank failure rates were high relative to national bank failure rates in Kansas and Nebraska in 1893. This same pattern is not visible in other states in 1893. Furthermore, in 1907, Kansas and Nebraska state banks had failure records similar to western national banks.

These data provide some support for the notion that region-specific asset shocks in western lands were important in explaining the peculiar regional patterns of bank failures in the 1890s. They also provide evidence supporting the general importance of asset risk in explaining the incidence of bank fail-

Table 4.16 **State and National Bank Failure Rates from Available States During Panic Intervals in 1893 and 1907[a]**

	State Bank Failure Rate[b] (%)		National Bank Failure Rate (%)	
	1893	1907	1893	1907
Massachusetts	0	0	0	0
New Jersey	0[c]	0	0	0
New York	0.7	0.9	0.6	0
Kansas	8.1	0.1	0.7	0
Nebraska	2.0	0.3	1.5	0
Michigan	0.7	0	2.0	0

Sources: U.S. Comptroller of the Currency, *Annual Report* (1920); the reports of banking authorities of various states; Board of Governors of the Federal Reserve System (1959, passim).

[a]Panic intervals are April–October 1893 and August 1907–February 1908.

[b]For 1893 the number of state banks is assumed to be roughly equal to the number in existence in 1896 for which data are available.

[c]One bank failed, but it was able to pay its depositors in full.

ure, which is essential to the asymmetric information approach. In future research we plan to extend our sample to include other states and episodes.

4.5.3 Sufficient Conditions for Ending Panics

The mechanisms for resolving banking panics, by bringing suspension of convertibility to an end, provide a way of discriminating between the two hypotheses concerning the origins of banking panics. In this section we first ask whether physical inflows of gold or the availability of cash per se were sufficient to bring an end to suspensions of convertibility. Cash availability includes the possibility of borrowing from the discount window during the Great Depression. Then we ask whether coinsurance in the absence of aggregate increases in gold is sufficient to end banking panics. Here we consider some cooperative arrangements of banks to mitigate the effects of panics. We also examine the experiences of branches of Canadian banks in the United States during panics.

If suspension of convertibility is made necessary by a scarcity of cash in the banking system, then shipments of gold should be able to resolve the problem. The asymmetric information view also predicts that shipments of gold will occur during panics, in part as a means for banks to signal their creditworthiness to depositors. But according to the asymmetric information view, gold shipments into the country are neither a necessary nor a sufficient condition for bringing panics to an end. Gold shipments are not a necessary condition for ending panics because a sufficient degree of asset insurance or coinsurance might itself resolve problems of asymmetric information, potentially even in the absence of gold inflows. Gold shipments are not a sufficient condition because it is the transfer of gold to *banks*, rather than the physical fact of gold availability per se, that brings an end to the panic.

As Myers (1931) shows, New York City banks held substantial amounts of internationally traded securities, including bills of exchange and commercial paper, in their portfolios in the nineteenth century. While the proportion of commercial paper to other investments declined over the period, even as late as 1909, banks in New York City held 30–40 percent of their interest-bearing assets in this form (Myers 1931, 336). From 1866 on, the transatlantic cable connected New York to the major financial centers of Europe and allowed financial transactions to take place at a moment's notice. Finally, it took approximately ten days for a steamship to travel from London to New York. Thus, upon suspending convertibility it should have been possible for New York City banks to wire to have a shipment of gold sent to alleviate any money-demand shocks. They could have paid for the gold with their substantial holdings of prime-grade paper. Allowing for railroad delivery lags within the United States, the process of shipping and distributing the currency should have taken no longer than two or three weeks. Calomiris and Hubbard (1989b) show that international gold flows moved rapidly across the Atlantic during

the Panic of 1907, and coincided with internal movements of gold flows which indicate extremely rapid adjustment to changes in the demand for gold, most of which was accomplished within a month of the initial shock.

Yet the duration of suspensions of convertibility could be substantially longer than the time horizon for the delivery of gold. The durations of the suspensions of 1873 and 1893 were roughly a month (see Sprague 1910, 53–58, 180–86), but the suspension during the Panic of 1907 lasted from 26 October 1907 until 4 January 1908 (277–82). While Sprague chides the New York banks for not resuming sooner, the currency premium on certified checks was still roughly 1 percent as late as December 20.

Another way to consider whether the availability of cash can end a panic, as suggested by the random withdrawal theory, is to examine the behavior of banks during the Great Depression. A basic purpose of the Federal Reserve Act was to establish a lender of last resort which would provide cash when necessary. The Fed's discount window would appear to provide a mechanism for obtaining ample amounts of cash to banks, even if the Fed did not engage in open market operations. Yet, during the 1930s, banking panics did occur and banks did not avail themselves of the discount window opportunity. This contradicts the random withdrawal theory. Even if the Fed made discount window borrowings relatively expensive, as suggested by Gendreau (1990), banks presumably would have preferred to pay a high price at the discount window rather than become insolvent. And yet, they did not.

The behavior of banks during the Great Depression is consistent with the asymmetric information theory, however. In this view, the basic problem is that depositors do not know which banks are most likely to fail. A bank which went to the discount window would be publicly identifying itself as a weak bank, would immediately face a run, and could go bankrupt. The information asymmetry would be resolved if the weak banks went to the discount window. It was for precisely this reason that, during the panics of the National Banking Era, clearing houses never revealed the identities of banks which had received the largest quantities of loan certificates. The need for secrecy was paramount if the interests of all banks were to be protected (see Gorton 1985, and Gorton and Mullineaux 1987).

In summary, monetary scarcity per se was not a sufficient condition for prolonging or avoiding suspensions of convertibility. On the other hand, the availability of cash, through gold flows or the discount window, was not a sufficient condition for ending a panic either. We now turn to the question of whether crises could be avoided or brought to an end by collective action that did not involve aggregate increases in specie. The clearest and most famous example is the resolution of the Baring crisis, as recounted by Kindleberger (1978).

The possible insolvency of Baring Brothers investment banking house in London in November 1890, to which Sprague (1910) attributed the Panic of

1890 in the United States, threatened a more general financial crisis in Britain, presumably because of asymmetric information about the precise causes and extent of its insolvency, and its possible links to commercial banks or their borrowers. Evidence on the importance of these information externalities comes mainly from the behavior of London bankers themselves. As it became clear that Baring was insolvent, London bankers cooperated to assume full mutual liability through an insurance fund to guarantee against any losses to Baring's creditors.

Three points deserve emphasis here. First, there was no money-demand shock and no bank run on Baring. Baring was not a commercial bank. Thus, there was no question of its failure resulting from money-demand shocks or low reserves. Second, the banks' commitment was sufficient to quell whatever incipient disturbance they had feared. Third, the banks voluntarily assumed liability without compensation for a firm that was clearly insolvent. If there were not substantial externalities associated with asymmetric information and if it did not pay the banks to dispel doubts about the incidence of the disturbance, then why would banks have volunteered to provide a bailout?

A final important experiment which helps to test the withdrawal risk view against the asymmetric information view concerns the role of Canadian banks in the United States during banking panics. Earlier we discussed the fact that Canadian banks were heavily branched and cooperated to regulate themselves through the Canadian Bankers' Association. The result was that Canada did not experience banking panics, and had significantly lower loss and failure rates compared to the U.S. experience. These Canadian banks also had American branches. If the withdrawal risk theory is correct, then during a panic, branches of Canadian banks should have experienced specie withdrawals similar to those of American banks in the same location. However, Schembri and Hawkins (1988) argue that, rather than suffering the same disintermediation as their American counterparts, Canadian branches were viewed as a "safe haven" during the crisis and received net inflows at that time.

4.6 Bank Regulation and Financial History

Banking panics have long been a motivating factor in the development of financial regulation and monetary policy. Ideally, public policy should reflect the "lessons of history," once relevant differences between historical and contemporary environments are considered. Designing public policy is complicated not only because it is difficult to distill the appropriate lessons from history but also because banking and capital markets continue to be transformed by technological change. That is to say, history does not end. Possibly, the lessons of history are not relevant in the new environment. In this section we briefly consider some of these issues in the context of our conclusion that the historical evidence is consistent with the asymmetric information hypoth-

esis. Since this conclusion contradicts a long history of received wisdom, we begin by asking why the alternative view—that seasonal money shocks cause panics—has had such a long history. It may be that the answer to this puzzle is very important for understanding public policy.

4.6.1 The Politics of Panics

Why does the previous literature on the origins of banking panics, including, in particular, some of the studies of the National Monetary Commission, view monetary shocks as a source of banking instability? We think there are two answers. The first reason for the misinterpretation of the importance of money-demand shocks in causing panics is the political usefulness of this distortion of the facts during the debate over the establishment of the Federal Reserve System, which included the possible regulation of commercial bank lending to securities brokers and of securities markets transactions of banks through underwriting and trust affiliates. The "interior money-demand shock" story exonerated New York City banks and Wall Street speculators from any blame for causing stock market collapses and banking panics. Instead, this story identified decentralized disturbances in the periphery as the cause of both (rather than "excessive" bank credit backed by stocks in New York).

In a series of articles criticizing the money-demand view and its proponents, W. H. Allen (1911, 1913a, 1913b) offered contrary evidence and questioned the motives of Aldrich, Andrew, Kemmerer, Vreeland, and the National Monetary Commission as a whole. He argued against Kemmerer's (1910) use of call loan interest rates (the rate charged to stock brokers) as a guide to general conditions in the money market, and pointed out that seasonal money flows were not large in panic years. He emphasized the difference between money movements in the early fall and credit growth in the late fall. Finally, Allen (1913b) accused the Commission of catering to the interests of Wall Street bankers:

> Wall Street bankers originated the idea of making a financial bogie of crop demands; they also originated this theory of the cause and effect of the concentration of money at New York; and Congress, with all of its investigating, has never even tried to learn if there were not other possible causes of this concentration of money [in the stock market] and the resulting financial ills. . . . The currency committees of the present Congress are, it is believed, freer from outside control than any currency committees that we have had in many years. Nevertheless, they have lapsed into the old habit of looking to our big bankers as the sole depositaries of financial facts. (105)

Allen was not alone in this view. In a speech to the Wisconsin State Bankers' Association in 1903, Andrew J. Frame, president of a rural national bank in Wisconsin, disputed the claim that agriculture-related shocks in the periphery were the main cause of banking instability:

> I challenge any man to prove that since 1893 there have been more than two fall seasons when the money market has been above a normal or reasonable level, and then *speculation and not crop movements were the primary causes of trouble* [emphasis added]. (Frame 1903, 12)

Frame goes on to cite several prominent banking sources who agree with his view that the "excessive speculation" of New York City bankers is the greatest threat to banking stability. While the arguments of these various sources fall far short of proving their case, they do offer insight into the conflicting opinions and motivations of bankers, who tried to influence opinion on currency reform. Given the political benefits to New York City bankers of the National Monetary Commission's recommendations, one is led to wonder whether the Commission was "captured" by the most powerful group having a stake in its banking reform proposals.

A second reason for the persistence of the seasonal money-shock view is that authors frequently used the terms "money" and "money market" loosely, sometimes meaning cash, sometimes credit. This has led to confusion regarding the views of earlier scholars. As noted before, Sprague (1910) clearly focused on asset shocks, but saw seasonal money *market* strain as one of many factors influencing bank vulnerability. While Kemmerer (1910) did emphasize money-demand shocks in much of his discussion, he also discussed credit seasonality and was often unclear about whether he viewed seasonality as mainly influencing bank leverage (and hence vulnerability to asset shocks) or withdrawal risk per se. His direct references to panics occupy only three pages of his 500-page statistical tome. Even there, in his reference to Jevons' (1884) discussion of seasonality, Kemmerer seems to emphasize credit risk rather than money demand as the primary determinant of the seasonality of panics.

4.6.2 Bank Regulation and the Historical Record

What conclusions can be drawn from the evidence on the origins of panics for regulation of banks? We divide our discussion of the implications of the asymmetric information view of the causes of historical banking panics into two parts. First, we describe the broad implications of the above analysis. Then we explore the general relevance of the historical record for today's financial system.

As we have noted, both views of banking panics agree that a banking system composed of a small number of nationwide branching banks would have been much more stable. According to Chari (1989), stability would have come from diversification of withdrawal risk. According to the asymmetric information view, diversification ex ante and credible coinsurance ex post would have substantially reduced, if not eliminated entirely, the possibility and costliness of banking panics historically. Therefore, there is a consensus that a smaller number of larger, branched, more diversified banks, approximating the Canadian system, would likely prevent panics. Short of this con-

clusion, however, there is disagreement between the two views about appropriate public policies towards banks.

According to the random withdrawal risk view, under the historical conditions of the United States, with unit banking and before federal deposit insurance, the basic problem is that there are not enough reserves to go around in time of crisis. When there is a seasonal, unusually high desired currency-deposit ratio, the economy needs cash. Notably, the implication of this view is that an increase in cash through open market operations would be effective in forestalling panics. During the National Banking Era the government was unable to conduct open market operations to inject cash. The U.S. Treasury was unable to purchase securities in sufficient amounts to prevent panics or effectively aid in their resolution.

Moreover, in the random withdrawal risk view, banks themselves were unable to form effective coalitions to mitigate the effects of panics. Banks as a group were unable to diversify withdrawal risk because reserves were unobservable. Taken literally, this view suggests intervention in the form of open market operations or reserve requirements, which may make feasible private bank coalitions for diversifying withdrawal risk.

The asymmetric information view suggests different directions for future research. First, in this view, open market operations by themselves will not be effective in preventing or easing panics. The problem is not that depositors want cash for its own sake, as in the random withdrawal view, but are concerned that their bank will fail. In this case, discount loans can (in the absence of deposit insurance) be an effective way to transform illiquid bank assets into a security that depositors can easily value, namely cash. Private clearing houses historically provided the discount window through the issurance of clearing-house loan certificates. Both government lending to banks and deposit insurance share the same essential feature, namely, the government is willing to bear risks that are peculiar to the banking system, either by making loans to banks or by guaranteeing bank deposits.

It is difficult to determine the potential importance of asymmetric information problems for today's banks. The very fact that banks are regulated prevents a clear determination of how banks would have evolved in the absence of this regulation. To some extent, perhaps to an extreme degree, regulation prevents the evolution of the banking system in ways that may be very desirable. The fact that such evolution is not directly observable prevents us from finding persuasive evidence that it would not occur in a different regulatory environment. There are two final observations we wish to make about the current environment in this regard.

The first observation is that the historical efficacy of bank self-regulation seems (to us) not to have been well understood in the literature. Private bank coalitions were surprisingly effective in monitoring banks and mitigating the effects of panics, even if panics were not eliminated. While in today's thrift debacle we observe the costs of having eliminated panics through government

deposit insurance, this does not imply that all insurance is undesirable. Private self-regulation may be quite effective, especially when combined with some government policies. One does find examples in other less-regulated financial markets of coinsurance arrangements and problems of asymmetric information. For example, futures-market clearing house members coinsure against each other's default by standing between all market transactions, as a group.[33]

The second observation is that the business of banking has changed in some important respects over the last decade, partly in response to regulation. The regulatory costs for financial intermediaries of increasing the size of their balance sheets (reserve requirements, insurance premia, etc.), along with the advantages of diversification, have encouraged them to initiate and re-sell loans. While initially this was confined mainly to mortgages, commercial loan sales have become increasingly common in the last decade (see Gorton and Haubrich 1989). There still may be a substantial proportion of small- and medium-sized borrowers whose loans are not saleable. Nonetheless, to the extent that loans can be sold on the open market, asymmetric information is less of a concern. The fact that loans can be sold indicates that information-sharing technology has improved, and hence that asymmetries are likely to be less dramatic. The ability of banks to sell loans, even if only among themselves, provides an important means for asset diversification, as well. Investigating the extent to which loan sales by intermediaries reflect fundamental changes in information sharing and the regulatory implications of these changes is an important area for future research.

Notes

1. The two secondary sources which are widely used are Kemmerer (1910) and Sprague (1910). Neither author provides a definition of a banking panic. Both works are concerned with the U.S. National Banking Era. Sprague details what occurred during the events of 1873, 1884, 1890, 1893, and 1907. Kemmerer arbitrarily identifies panics, finding six major and fifteen minor panics during the period 1890–1908 (see pp. 222–23, 232).

2. Clearing-house loan certificates were the joint liabilities of all members of the clearing house. They were issued during banking panics. See Gorton (1985) and Gorton and Mullineaux (1987) for further discussion.

3. The definition is in terms of bank debt which circulates as a medium of exchange and which contractually allows redemption on demand at par. But, the definition does not otherwise distinguish between different types of bank liabilities. There may have been an important difference, however, between bank notes, which were noninterest-bearing bearer liabilities, and bank deposits, which bore interest and were not bearer liabilities, being checking accounts of the type familiar. Since banks often issued both types of liabilities, especially in the United States, effects of the distinction are difficult to detect empirically. But theoretically, different theories make important distinctions.

The main difference, discussed later, concerns the existence or nonexistence of secondary markets. In the United States, such markets existed for bank notes but not for demand deposits. On this point, however, the definition is left vague.

4. Nicholas (1907) provides evidence that idiosyncratic money-demand shocks to a particular bank were offset by interbank loans.

5. Suspension of convertibility did not mean that banks ceased to clear transactions or make loans. Indeed, suspension was usually the beginning of the end of the contraction, and marked a period of loan and deposit recovery, albeit at slow rates initially as banks strived to accumulate specie reserves to facilitate resumption. Sprague (1910, 56–58, 186–91, 280–82) documents the existence of a secondary market for bank deposits during suspensions under the National Banking System as early as 1873. Certified checks of suspended banks typically traded at slight discounts of no more than 4 percent and usually less than 1 percent. Thus, while suspension placed limits on the movement of specie out of the banking system, it allowed depositors and merchants to exchange one form of bank liability for another, both within a locality and, to a lesser extent, across localities.

6. In 1851 a free-banking statute created a second group of uncoordinated banks in the state.

7. As Schweikart (1987) argues, the performance of Mississippi, Florida, and Alabama banks during this period mainly reflected government use of banks as a fiscal tool. These states are excluded from the comparison.

8. Bank failure rates were low throughout the South and, unlike the North, confined almost entirely to small rural banks. Recovery of bank balance sheets was relatively rapid in the South, and many banks continued operations in an atmosphere of relative normalcy in comparison to the North. These differences can be traced to differences in bank coordination, particularly interbank lending during the crisis, rather than to a different incidence of fundamental shocks in the North and South.

9. Rolnick and Weber (1984) argue that free bank failures were caused by exogenous asset depreciation. During banking panics, however, coordination among banks, or a lack thereof, also seems important.

10. Interestingly, ex ante pricing of bank note risk prior to the Panic of 1857 mirrored these ex post differences in the relative performance of free banks in Indiana and Ohio. Ohio's mutual liability and free banks, and Indiana's mutual liability banks, all enjoyed a common discount rate in New York City of 1 percent, while the Indiana free banks were discounted at 1.5 percent. For data on bank note discount rates in the Philadelphia market and a model of bank note risk pricing, see Gorton (1990, 1989a).

11. Clearing houses created significant amounts of money. During the Panic of 1893, clearing houses issued $100 million of loan certificates, about 2.5 percent of the money stock. During the Panic of 1907, about $500 million was issued, about 4.5 percent of the money stock. This private money circulated as hand-to-hand currency, initially at a slight discount from par. See Gorton (1985) and Gorton and Mullineaux (1987).

12. Other panic theories are provided by Bryant (1980), Donaldson (1989b), and Waldo (1985). Also, see Minsky (1975) and Kindleberger (1978).

13. Jacklin (1987) shows that dividend-paying equity shares dominate demand deposits in the Diamond and Dybvig (1983) model, but that this depends on the specific nature of the preferences assumed by Diamond and Dybvig. It does not hold for fairly general preference structures. Nevertheless, trading restrictions are a necessary ingredient to the Diamond and Dybvig argument, as Jacklin shows.

14. A market would allow for agents' beliefs to be coordinated, eliminating panic-causing conjectures about other agents' beliefs. Pre–Civil War America, with active markets for bank liabilities, appears to contradict this view of spatial separation.

15. Typically, in these models the sequential-service constraint still applies to the depositors of each individual bank. But, while the initiating shock may thus be the same as in the original Diamond and Dybvig model, the main point is the reserve pyramiding which causes country banks to essentially behave as individual depositors with respect to the central-reserve city bank.

16. The importance of seasonality is discussed by Andrew (1907) and Kemmerer (1910). Goodhart (1969, 3) writes: "Financial crises were attributed, with a great deal of truth, not so much to cyclical factors as to the natural results of the recurring autumnal pressures upon the money-market; these seasonal pressures were so extreme that it took only a little extra strain—in the form of overheated boom conditions or the bursting bubbles of Wall Street speculation—to turn tightness into distress."

17. See Eichengreen (1984) for a review. Eichengreen finds substantial interregional variation in the propensity to hold cash relative to demand deposits. Thus, variations across regions in the demand for money would be associated with interregional flows of currency. Furthermore, seasonal demands for money in the West (where cash-to-deposit ratios were high) would cause an aggregate contraction in the money supply (shrinkage in the money multiplier).

18. The appropriate literature discussing bank activities on the asset side of the balance sheet consists of Diamond (1984), Boyd and Prescott (1986), Campbell and Kracaw (1980), among others. On bank liabilities as a circulating medium see Gorton (1989b), Gorton and Pennacchi (1990), and Calomiris and Kahn (1991). These ideas are discussed further in subsection 4.4.3.

19. In the United States, most banks have not had traded equity claims historically because the overwhelming number of banks were small institutions. Thus, there were no markets in any bank assets or liabilities.

20. Diamond's (1984) argument explains how it is possible for depositors to monitor the monitor, that is, how the depositors can rely on the bank to monitor the borrowers.

21. In Chari and Jagannathan (1988), as in Diamond and Dybvig (1983), bank liabilities have no discernible role as a circulating medium of exchange. Thus, in Chari and Jagannathan it is not clear why agents withdraw from the bank if they want to consume. Apparently, bank liabilities do not function to satisfy cash-in-advance constraints.

22. There is no explanation in Chari and Jagannathan (1988) for why this would be a systemic event affecting the entire banking system, rather than an event producing a run on a single bank.

23. The assumption of full revelation of bank-specific risk may be extreme for the following reasons. Note brokers sometimes refused to make markets in individual banks' notes, particularly during panics. Furthermore, earlier banking panics, for example, one in Indiana in 1854, took the form of runs by note holders rather than depositors. Gorton's (1990) evidence on the information content of bank notes pertains to state-specific, not bank-specific, risk. The extent to which bank-specific note risk was information revealed by the note market prices remains an area for future research.

24. Moreover, the expected losses on deposits may be expected to occur when consumption is highly valued, during a recession, for example. As shown in Gorton (1988), losses per se cannot explain panics. But, losses occurring during a recession would receive more weight in utility terms. The combination of these events can cause panics. See Gorton (1988) for a model.

25. Chari (1989) argues that the reduction in the "bank failure" rate in the United States upon introducing deposit insurance supports the withdrawal risk view over the asymmetric information view. We do not agree. In an undiversified system of many

unit banks, confusion over the incidence of an asset shock will lead despositors to withdraw, absent the ex post protection of deposit insurance. This will, in turn, cause suspensions of convertibility, disruptions in commerce, deflations, and increased bank insolvency rates.

26. One could argue, from an asymmetric information perspective, that correspondents' asset risks are related and, therefore, the asymmetric information approach could also explain increases in the probability of failure associated with correspondent relations. However, as demonstrated later in our discussion, the asymmetric information approach does not rely on these linkages to explain variations in failure rates within a given region.

27. It is worth noting that experimentation confirms that our results are robust to variations in the choice of time horizon over the interval from two to five weeks.

28. Three particularly large withdrawals (for their respective weeks) occurred before week 50 in 1880 (-15.5 percent, bringing the reserve ratio to 24.96 percent), week 10 in 1881 (-13.4 percent, bringing the reserve ratio to 25.15 percent), and week 33 in 1896 (-8.3 percent, bringing the reserve ratio to 27.01 percent).

29. Each interval of decline is defined as follows. Moving forward in time we compare the price index of each month in the sample to the index three months before. Intervals are defined not to overlap. For example, if stock prices fell from February to May, then fell again in June and rebounded in July, we would register only the February–May interval (not the March–June interval).

30. Seasonal patterns for 1901–10 show the highest commercial failure rates in the months of October through February (see Swift 1911, 40).

31. Banks, of course, would have understood the seasonal vulnerability induced by changes in leverage. One might expect that banks would have responded by importing and exporting reserves to offset seasonally related loan changes. Presumably, the costs of importing and exporting specie, to maintain constant leverage (i.e., the ratio of risky to riskless assets), were high.

32. There is an alternative explanation for these findings. High leverage during times when adverse news is relatively likely is consistent with the view of Minsky (1975) and Kindleberger (1978) that investors and banks were myopic. According to this view, the reason that large stock price declines, higher leverage, and panic are most likely coincident events is that they are all driven by myopic speculative frenzies. Such frenzies are most likely to occur in the months and cyclical phases of greatest economic activity.

33. Also, Calomiris (1989c) describes cooperative arrangements between commercial paper issuers and banks that insure against similar problems.

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