

# Financial Crises and The Payments System: Lessons from the National Banking Era

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A . . . factor that has been present in most financial disruptions of the past fifteen years is the threat of dislocation in payment, settlement, or clearing systems. This has been reasonably well documented in the case of the stock market crash, but very difficult and potentially very serious problems with payment and settlement systems have also been encountered in other episodes. . . . [P]ayment and settlement systems are of special importance because such systems can be the vehicle through which a localized problem can very quickly be transmitted to others, thereby taking on systemic implications.

—E. Gerald Corrigan (1991)

**A** critical function of the Federal Reserve System is that of maintaining the integrity of the group of institutions known as the payments system. The Fed fulfills this role through two main channels. First, on a day-to-day basis, the Fed provides payment and settlement services through its check-clearing and electronic-funds transfer operations. Second, the Fed has historically intervened during financial crises in order to ensure that financial market participants were provided with the liquidity necessary to complete their desired transactions.<sup>1</sup>

In recent years, this second part of the Fed's role in the payments system has come under increased scrutiny. The most important causal factor behind this reexamination of the Fed's "safety net" for the payments system has been the changes in financial institutions brought on by improvements in technology. Specifically, advances in computer and communications technology have led to increases in the liquidity of many types of financial claims and have led to the creation of new financial markets and new forms of payment (see, for

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example, Fred R. Bleakley 1994, John H. Boyd and Mark Gertler 1994b, Jane W. D'Arista 1994, Frederic S. Mishkin 1994, and Martin H. Wolfson 1994). Recent years have also seen passage of legislation designed to more precisely delimit the scope and administration of the Fed's safety net.<sup>2</sup> This essay will examine the current debate over the Fed's payments safety net role in light of the historical experience of the National Banking Era (1864-1914). Though somewhat remote from modern experience, this period is highly relevant for the study of financial crises and payment system disruptions for the following reasons.

The first and most obvious reason is that a number of major financial crises occurred during the National Banking Era. Most historians of this era mark at least five, and some, as many as six or seven.

The second reason for considering this period is that there are certain noteworthy parallels between the financial history of the late nineteenth and early twentieth centuries and that of the late twentieth century. Specifically, the National Banking Era was also a time of tremendous growth and innovation in financial markets and institutions. Margaret G. Myers (1931) chronicled some of the important innovations during this period, which include the introduction of modern settlement systems for stock trades, the development of a call market or overnight funds market, and the development of the markets for trading commercial paper and foreign exchange. While these innovations were important in terms of improving the efficiency of financial markets, some of these were also potentially destabilizing in the sense that they facilitated highly leveraged bets on market outcomes. Important innovations in banking included the spread of checkable accounts as an alternative to circulating banknotes and the subsequent development of the clearinghouse system for clearing and settling checks.

As has been the case in the late twentieth century, the financial markets of the National Banking Era were also globalized in the sense that shocks were transmitted easily across national borders. Widespread adherence to the gold standard resulted in very tight international linkages among financial markets and particularly among short-term interest rates. Market crashes in London were quickly transmitted to New York (as occurred in 1890 and 1914) and vice versa (as occurred in 1907) (see Charles Goodhart 1995 and Oskar Morgenstern 1959).

The third reason for considering the history of this period is that during the National Banking Era there was no public-sector agency charged with management of the payments system in times of crisis, nor

were there (with the exception of one financial panic) legally sanctioned private-sector remedies for disruptions in the payments system. In the absence of legal remedies for payment system disruptions, banks were able to improvise emergency payments systems that were, though strictly speaking illegal, nonetheless accepted as necessary both by the public and by governmental authorities. The application of these makeshift payments systems was in some instances effective in preventing severe disruptions to financial markets and to the economy, but it was ineffective in other instances. The variety of experiences during the different crises thus offers useful evidence on the type and scope of measures necessary to maintain an effective emergency payments system during a crisis.

A fourth reason for considering the crises of the National Banking Era is that these have been very well studied. While there are some disagreements over matters of interpretation, the factual history of each crisis is well documented. A complete survey of the literature on these crises is beyond the scope of this essay; some of the most influential studies have been those of Alexander D. Noyes ([1909] 1980), O.M.W. Sprague (1910), Myers (1931), and Milton Friedman and Anna J. Schwartz (1963). More recently a number of studies, including Gary Gorton (1988), Gerald P. Dwyer, Jr., and R. Anton Gilbert (1989), Charles W. Calomiris and Gorton (1991), Mishkin (1991), and Jon R. Moen and Ellis W. Tallman (1992), have sought to reinterpret the National Banking Era experience in the context of contemporary banking theory.

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### **The Mechanics of the Payments System: Clearing and Settlement**

Why is the integrity of the payments system so critical to the functioning of the economy? The answer to this question lies in the mechanics of clearing and settlement. In developed economies, most goods and services are not directly purchased with cash (or technically, outside money).<sup>3</sup> Instead, most payments take the form of promises to deliver funds worth a certain amount. Ultimately these promises are converted to transferable claims on bank assets, such as checks. These claims are tallied and presented to the appropriate bank for payment, in a process known as clearing. Claims cleared among banks are, in most cases, only considered final payments once they have been settled, that is, offset by an opposite transfer of assets of equal value.

The set of rules governing clearing, settlement, and payment finality are thus of critical importance because they in effect determine an ordering of claims on the assets of any person or organization that purchases a good or service by transfer of the claims on bank assets. In the words of Corrigan (1990a, 131), once a payment becomes final, "the money in question is 'good money' even if at the next instant the sending institution goes bust." In other words, once a payment becomes final, the party receiving payment (payee) has no need to stand in line with other creditors should the bank used by the party sending payment (payor) later go bankrupt. Traditional rules concerning finality of payment in essence favor payees over other claimants on the payor's bank's assets.<sup>4</sup> Such rules, necessarily somewhat arbitrary, are a prerequisite for mutually beneficial exchange in a free market economy. People are unlikely to provide goods and services without knowing that they will be paid "good funds" in exchange.

In modern times, central banks form a crucial link in the process of clearing and settlement because in many instances settlement of claims among banks can be effected only via transfer of outside money in the form of reserves held in accounts at a central bank.<sup>5</sup> During the National Banking Era, the same function was served by the transfer of reserve assets, which consisted of either specie or its equivalent (typically notes issued by the U.S. government payable in gold on demand).

Today, the Fed generally provides the banking and payments systems with the amount of liquidity that is consistent with monetary policy goals. Under current Fed operating procedure, doing so means accommodating short-term fluctuations in the demand for reserves in a manner consistent with a given target for the fed funds rate. Demands for liquidity are accommodated along three main channels: the provision of reserves via the fed funds market (see Marvin S. Goodfriend and William Whempley 1993 and Stephen A. Lumpkin 1993), the issuance of loans via the discount window (see David L. Mengle 1993a), and, on an intraday basis, the provision of "daylight" credit over Fedwire, the Fed's large-value electronic funds transfer system (see Mengle 1993b).

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### **Clearing and Settlement during Crises: The Policy Dilemma**

As a provider of funds to the banking and payments systems, the Fed faces certain informational problems

common to all providers of credit. Like all lenders, the Fed must provide credit to borrowers—banks, in the case of the Fed—without perfect knowledge of the borrowers' ability or desire to repay. In the absence of complete information on borrowers' creditworthiness, the recent literature on financial intermediation has shown that lending arrangements are subject to the problems of adverse selection (inability of the creditor to distinguish high-risk from low-risk borrowers) and moral hazard (incentives for borrowers to undertake actions that increase the likelihood of default).<sup>6</sup>

Such problems are not insurmountable. The Fed, like all prudent creditors, uses a variety of time-honored techniques for minimizing its exposure to risks resulting from informational asymmetries. These include collateral requirements, close monitoring of borrowers' financial conditions (that is, supervision and regulation), and minimum net worth (capital) requirements on the part of the borrowers.<sup>7</sup> There is a key difference, however, between the informational problems faced by central banks and all other creditors. This difference is most apparent during times of financial crisis when informational asymmetries between borrowers and lenders are likely to be exacerbated.<sup>8</sup> During such times, private-sector lenders can limit their risk exposure by charging markedly higher rates or by simply refusing to extend credit. Under contemporary institutional arrangements, however, it would be disastrous for a central bank to pursue such a strategy. Because outside money plays a critical and unique role in the modern-day payments system—that of settling transactions and providing payment finality—current institutional arrangements offer no alternative to the provision of central bank money during crises. In such circumstances, central banks must be willing to provide adequate supplies of liquidity for transactions to be completed at a reasonable cost. This observation was the major theme of Walter Bagehot's ([1873] 1991) treatise on central banking and is now regarded as standard central banking doctrine.

Unfortunately, the obligation of central banks to provide liquidity during times of uncertainty does not diminish the potential adverse selection and moral hazard problems they face as lenders. To the contrary, this obligation can lead to the impression on the part of the private sector that, official policy statements to the contrary, liquidity will always be forthcoming at least to some banks during a crisis or even a situation with the potential to become a crisis.<sup>9</sup>

The problem of how best to maintain the integrity of the payments system during times of crisis is thus seen to be a particularly delicate one. Policymakers

will always be confronted with the following dilemma: an overly restrictive approach to liquidity provision could easily hamstring the payments system and lead to a systemic crisis, while an overly generous policy can expose the central bank and ultimately the taxpayers to an excessive amount of credit risk.

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## Approaches to the Policy Dilemma

Along one dimension of the policy dilemma, Fed policy in concert with that of the Federal Deposit Insurance Corporation (FDIC) and the Federal Savings and Loan Insurance Corporation must be seen as successful: no major disruption to the banking and payments systems has occurred in the United States since the 1930s. There seems to be virtually unanimous scholarly agreement that the lack of disruptions is due in large part to prompt and aggressive interventions on the part of the Fed.<sup>10</sup>

There is considerably less agreement, however, over the issue of whether the Fed has been too generous with providing liquidity during potential "crisis" situations. The provision of credit through the discount window, in particular, has been the focus of criticism from the economics profession.<sup>11</sup> Critics of the Fed's discount window policy have seen a number of problems with discount window policy but have emphasized the problems resulting from extending discount window credit to banks with poor creditworthiness during crisis episodes. It should be noted that critics of Fed discount window policy have not suggested that the discount window has operated at a loss. Instead, the critics maintain that discount window loans have allowed troubled banks to remain open while uninsured depositors and other creditors remove their funds. If the bank then fails, the FDIC is exposed to greater losses as a result.

Recent legislation (FDICIA) seeks to limit this adverse selection problem by placing limits on the Fed's ability to make discount window loans to banks that do not meet minimum capital standards or are given the lowest supervisory rating.<sup>12</sup> Some academic critics, however, maintain that FDICIA does not go far enough. Their claim is that any benefits deriving from the provision of discount window credit are more than outweighed by costs associated with the potential adverse-selection problem.<sup>13</sup> In the view of these critics, liquidity demands of the private sector could be entirely accommodated by the Fed's open market operations.<sup>14</sup>

In light of this debate, the National Banking Era experience is of interest because the contemporary ar-

rangements for the provision of emergency liquidity were apparently very successful in dealing with the credit risk arising from informational asymmetries. During the National Banking Era there was no central bank and hence no provision of liquidity through open market operations or through a discount window.<sup>15</sup> During times of crisis, many banks faced with extraordinary demands on liquidity did have access to an emergency source of liquidity—clearinghouse loan certificates.

In the National Banking Era, banks in most of the larger cities were organized into associations called "clearinghouses." In normal times, clearinghouses did exactly what the name implies: they cleared checks drawn on their member banks and facilitated settlement by either transfer of reserve assets or transfer of claims to reserve assets held at a central settlement account.<sup>16</sup> In times of crisis, however, it was common for banks to completely suspend or at least curtail cash payments. To maintain the value of claims on their assets as means of payment, the clearinghouses would on occasion suspend the requirement that interbank settlement be effected in cash and would allow their members to settle in loan certificates. Loan certificates were simply debt issued against "good collateral"—that is, they were collateralized loans taken out by clearinghouse member banks that were in turn held by other clearinghouse members.<sup>17</sup> As noted by Richard H. Timberlake, Jr. (1993, 204-7), most contemporary analysts recognized that the issue of loan certificates amounted to a private and most likely illegal issue of reserve money. However, at the time there was nothing approaching a consensus as to what arrangements might replace the issue of loan certificates.

In many ways, the rules for issue of clearinghouse certificates resembled those that were imposed later for discount window loans under the Federal Reserve System. The most important rule was that the rate of discount on loan certificates was not indexed to a market rate but instead was set in advance at a rate typically below market rates (James G. Cannon 1910, 78). Like modern central banks, clearinghouses saw themselves as being able to "perfect a collateral interest"—that is, they could establish a senior claim on collateral posted by the banks issuing loan certificates.<sup>18</sup> In some crises, clearinghouses also took pains to keep the public from discovering which banks had taken out loan certificates.<sup>19</sup>

It would be a mistake, however, to characterize the National Banking Era practice of loan certificate issue as equivalent to the operation of a private discount window. Settling payments in loan certificates, while



an accepted practice among clearinghouse banks, was still settlement in private debt, and debt of dubious legality at that. When issue of loan certificates was combined with a restriction of cash payments, the result was the emergence of a "currency premium," such that checks were accepted in payment but not valued on par with currency (see Friedman and Schwartz 1963, 110, 161-62). Access by banks to credit in the form of loan certificates was much more restricted than that of present-day banks to the discount window. To be able to issue loan certificates, banks first had to belong to a clearinghouse. Clearinghouse membership requirements were typically quite stringent so that membership was far from universal. Membership was also localized in the sense that only banks in a given city were eligible for membership in that city's clearinghouse; contemporary branching restrictions made it impossible for most banks to operate in more than one locality. Finally, credit via the issue of loan certificates was simply unavailable during normal times. Loan certificates could only be issued once the governing body of the association (typically a representative committee) had met and agreed that a crisis situation existed that would require issue of the certificates. Once the decision to issue certificates had been made, all member banks were allowed to issue loan certificates upon posting eligible collateral (Cannon 1910, 77-78). The failure of a single institution was generally seen as insufficient cause for the issue of loan certificates.

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### **Then versus Now: A Comparison of the Two Approaches**

The National Banking Era approach to providing emergency liquidity provides a sharp contrast with the present-day safety net. (The salient features of the two systems are summarized in Table 1.<sup>20</sup>) As is well known, the National Banking Era approach was unsuccessful in the sense that major financial disruptions were common during that period, several of which were followed by severe recessions. Yet the loan certificate system was successful in preventing some disruptions from developing into full-fledged panics. The loan certificates were also remarkably free from credit risk. Timberlake (1993, 210) notes that the maximum loss rate recorded on any single loan certificate issue was 1.8 percent, and for most issues there were no losses.

One reason the loan system was so effective in curbing credit risk is that it was a system based on clearing in private debt. That is, once a clearinghouse

had decided to allow for the issue of loan certificates, member banks had little choice but to accept other members' debt (certificates) in settlement. This eventuality gave clearinghouse banks a strong incentive to monitor each others' creditworthiness and to expel insufficiently liquid or undercapitalized members.

While settlement in private debt provided an almost perfect solution to problems of credit risk, this practice had its own problems. The first was the fact that settlement in private debt lessened the value of checks drawn on bank deposits as a medium of exchange. The loss of confidence in checks as money was explicitly manifested in some instances by the emergence of a currency premium. A second and more critical shortcoming of the loan certificate system was the flip side of the system's ability to contain credit risk. That is, the potential exposure of clearinghouse banks to each other's credit risk gave clearinghouses strong incentives to limit the breadth of access to loan certificate credit. In several instances, the provision of liquidity via loan certificates was either delayed too long or was insufficiently broad to stem the development of a major panic. Goodhart (1988, 57-75) characterizes this problem as one of a potential conflict of interest between clearinghouse banks' desire on the one hand to maximize their own profits by avoiding the effects of panics and their desire on the other hand to avoid unnecessary aid to their commercial rivals.<sup>21</sup> In the case of the National Banking Era clearinghouses, the tendency of banks to withhold emergency access to liquidity was no doubt reinforced by the (strict) illegality of the loan certificates.

In contrast to the National Banking Era system, in which private clearinghouses issued their own debt as emergency liquidity, our present-day system of emergency liquidity provision depends on the ready availability of outside money—that is, central-bank-issued debt—for purposes of settlement. This debt is generally provided through fully collateralized discount window credit. Such a system clearly affords complete protection from credit risk on central bank money received in settlement. However, such a system also necessarily transfers some portion of the credit risk associated with emergency liquidity to the FDIC and ultimately to the taxpayers. This system also necessarily removes at least a portion of the incentives for private participants in the payments system to monitor other participants' creditworthiness aggressively. Critics of the discount window (see note 10) have argued in effect that attempts to substitute the Fed's evaluation of creditworthiness for those of the private sector have not been entirely successful.

**Table 1**  
**A Summary of the National Banking Era and Present**  
**Systems for the Emergency Provision of Liquidity**

Feature	National Banking Era System	Present System
Type of liquidity provided	Privately issued debt (clearing-house loan certificates)	Outside money (central bank liabilities)
Value as a medium of exchange	Often circulated (via check) at a discount; only acceptable locally	Universally accepted at par
Bearer of credit risk	Clearinghouse banks	Fed and Federal Deposit Insurance Corporation (in the case of discount window loans)
Incentive to limit credit risk	Strong due to self-interest of clearinghouse members	Less so, though strengthened by provisions of FDICIA
Breadth of coverage	Narrow	Wide, though traditionally limited to depository institutions
Availability of coverage	Only during mutually agreed-upon "crises"	Always
Incentive to provide timely coverage	Mixed	Strong
Public confidence in system	Mixed	Strong
Efficacy in limiting systemic crises	Mixed	No systemic crises since the 1930s

Another possible advantage of the current system over the National Banking Era system is in breadth of coverage. Specifically, a central bank will have an incentive to intervene and provide liquidity in situations in which a clearinghouse or similar coalition of private banks would have incentives not to provide liquidity. Again, critics of the discount window would argue that this option has been exercised too often and in cases where no real systemic crisis threatened.

Finally, an important advantage of the current system is the ability to credibly promise intervention even in cases for which little or no intervention actually takes place. A credible promise to intervene can lessen or even obviate the need to intervene, as was demonstrated during the October 1987 stock market crash. Various accounts of this episode (see note 10) agree that its successful resolution can be credited in large part to the Fed's public and credible commitment to

provide liquidity to banks as needed. Commercial banks, freed from concerns about their own liquidity, were able to provide market participants with the extraordinary amounts of liquidity needed to settle financial market transactions during this episode. An inevitable difficulty associated with such credibility is the familiar "too-big-to-fail" problem. To be effective, the Fed's ability to intervene in such situations cannot be taken as an implicit commitment to intervene in any situation that could result in the failure of a single institution.

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## **A Synopsis of Crises during the National Banking Era**

From the end of the Civil War until the outbreak of World War I, six crises required the issue of loan certificates by the New York Clearing House Association and other major clearinghouses. While details of the various episodes vary, each crisis followed the same basic pattern. The crisis would typically begin in New York with an event that investors would find unsettling, often the failure of one or more financial intermediaries. The failures would lead to asset price declines and liquidity pressures on the New York banks, pressures partially accommodated by the issue of clearinghouse loan certificates. In some cases (for example, 1884 and 1890) the issue of loan certificates was enough to forestall the development of a full-fledged money panic.

Often the issue of loan certificates was either too late or of insufficient quantity to reassure bank depositors, however. Throughout the country, depositors would attempt to withdraw their deposits in cash, causing banks outside of New York and the other major cities to attempt to liquidate their deposits with the city banks. The end result was often a nationwide suspension of cash payments by banks, as occurred in 1873, 1893, and 1907, followed by a severe macroeconomic contraction.

Little definite is known concerning the ultimate causes of the crises. However, certain factors associated with some or most of the incidents are often thought to have contributed to the likelihood of a crisis. Among the factors that have been cited are seasonal (spring and fall) demands for liquidity resulting from agricultural activity and cyclical developments such as gold outflows, declining stock prices, rises in interest rates, and rises in the spreads on interest rates for low-quality versus high-quality investments. There is also some de-

bate concerning whether the behavior of depositors during the panics stemmed more from changing perceptions about the quality of their banks' assets or from a sort of herd instinct (see Calomiris and Gorton 1991, Mishkin 1991, and Moen and Tallman 1993).

The summary below does not attempt to attribute the occurrence of the panics to any particular cause. Instead it presents a brief description of the evolution of each crisis, the response by the New York Clearinghouse Association and other clearinghouses in terms of liquidity provision, the effectiveness of the liquidity provision in stemming the panic, and the macroeconomic consequences of the crisis. Information about the panics is further summarized in Table 2.

**The Panic of 1873.** The panic began with the September 8 failure of an insignificant warehousing firm because of bad loans to western railroad interests. By the following week, several large banks and investment houses had failed for essentially the same reason. In the face of a collapse in stock prices, the New York Stock Exchange closed on September 20 and did not reopen until ten days later. The closing of the stock market did much to spread the general perception of a panic.

The key factor behind the closing of the New York Stock Exchange was the primitive nature of contemporary systems for clearing and settling stock trades. At the time literally every stock trade had to be offset by a transfer of bank funds via certified check, a practice that resulted in liquidity demands far in excess of the funds that most trading firms had on deposit. The difference between the liquidity needs of the brokers and the funds they had on deposit was financed directly by the banks. Consequently, it was not unusual for banks to extend uncollateralized daylight credit to brokers in excess of ten times what they might have on deposit.<sup>22</sup> The demands for such "clearance" funds only grew with the onset of the panic, just as the banks became more reluctant to expose themselves to the risks associated with fluctuations in stock prices. Without access to sufficient funds to clear trades, the New York Stock Exchange had little choice but to cease operations. On September 24 the stock exchange proposed to the New York Clearinghouse Association that a special pool of liquidity be created by the clearinghouse for the sole purpose of settling stock trades; this proposal was summarily rejected (Sprague 1910, 39-40).

Following the closing of the stock market, the New York Clearinghouse Association members continued to experience a liquidity drain. On September 20, 1873, they voted to issue up to \$10 million in loan certificates. The issue of loan certificates was followed by a partial suspension of cash payments on September 24.

**Table 2**  
**Summary of National Banking Era Panics<sup>a</sup>**

	1873	1884	1890	1893	1907	1914
Proximate Cause	Stock Market Crash and Closure	Stock Market Crash	Stock Market Crash	Stock Markets and Commercial Failures	Run on NYC Trusts	Outbreak of World War I
Loan Certificate Issue, NYC (\$ millions)	26.6	24.9	16.6	41.5	101.0	NA
Loan Certificate Issue, Nationwide (\$ millions)	NA	NA	NA	60-100	330	212 <sup>b</sup>
Bank Reserves, NYC (\$ millions)	46.9	70.7	92.5	99.0	181.0	NA
Bank Reserves/Monetary Base, Nationwide (\$ millions)	230/783	347/1,189	478/1,366	529/1,514	1,205/2,889	1,630/3,353 <sup>b</sup>
Suspension of Payments?	Yes	No	No	Yes	Yes	No
Followed by Recession?	Yes	No	No	Yes, severe	Yes, severe	No

<sup>a</sup> All figures are approximate. The figures for loan certificate issues represent the total issue during the crisis. The amount of loan certificates outstanding at any given time was likely somewhat less than these numbers. The figures for reserves and the monetary base are for the dates that are closest to the crisis for which data are available. Estimates of reserves and money do not include loan certificates.

<sup>b</sup> In addition to the issue of loan certificates, the 1914 panic saw the issue of about \$400 million in Aldrich-Vreeland emergency currency. Some portion of this emergency currency is incorporated into the 1914 estimates of reserves and money.

Sources: Friedman and Schwartz (1963), Sprague (1910, 1915), Timberlake (1993).



Cannon (1910, 85) estimated the amount of the loan certificates issued by the New York Clearinghouse Association members during the crisis at more than \$26 million. Some idea of the impact of this issue can be obtained by noting that aggregate reserves of New York banks before the onset of the crisis were on the order of \$50 million (Timberlake 1993), and the entire stock of base money in the United States was about \$800 million (Friedman and Schwartz 1963, 799).

The 1873 issue of loan certificates was a success in the sense that bank failures during the crisis were limited to the failure of a few relatively unimportant institutions and in the sense that for most depositors checks drawn on bank deposits continued to serve as a medium of exchange. However, the provision of liquidity by means of loan certificates was, as explained above, insufficient to allow for operation of the stock market. Following the suspension of cash payments, the value of bank deposits was diminished by the emergence of a currency premium that peaked at roughly 5 percent by the end of September. The suspension of payments by the New York banks also wreaked havoc with banking and commerce across the country. Suspension in New York was followed by widespread suspension of payments by banks throughout the country. In some cases the shortage of cash led to layoffs because manufacturers were unable to meet their payroll obligations (Sprague 1910, 61-75). In some of the larger cities, clearinghouse associations followed the lead of the New York Clearinghouse Association and issued their own loan certificates (Cannon 1910, 86-90).

Given the paucity of data on this period, it is difficult to gauge the macroeconomic costs of the 1873 panic. Friedman and Schwartz (1963, 40-41) suggest that aggregate output may not have contracted following the crisis. This conjecture is confirmed by Christina Romer (1989), who estimates that GNP grew by about 1 percent from 1873 to 1874. Nathan S. Balke and Robert J. Gordon (1989), on the other hand, estimate that GNP fell by about 0.5 percent that year. In any case it is almost certain that for the year following the panic, output grew well below its intermediate-term trend value of about 4.5 to 6.5 percent, implying that the output cost of the panic was most likely substantial.

**The Panic of 1884.** The 1873 panic had provided an almost perfect example of how not to manage a crisis. The provision of emergency liquidity had been made too late and in insufficient quantity to compensate for structural weaknesses in the banking system and in financial market settlement systems.

These lessons were not lost on the New York Clearinghouse Association members. In early May 1884 the

financial markets were rocked by the failure of a number of prominent firms due to fraud. On May 13 it was revealed that the president of the Second National Bank had absconded with more than \$3 million of the bank's securities, and the following day a similar revelation of fraud started a run on the Metropolitan National Bank.

On the afternoon of May 14 the New York Clearinghouse Association approved the issue of loan certificates to all members, including Metropolitan National. Ultimately about \$25 million of loan certificates were issued, as compared with the clearinghouse's reserves of \$70 million (Timberlake 1993, 204). Metropolitan National was able to reopen its doors immediately, and the general feeling of panic subsided within a week, according to contemporary accounts. In contrast to the situation in 1873, there was no general suspension of cash payments, no currency premium, no closing of the stock exchange, and no nationwide disruption of banking and commerce; the macroeconomic effects of the panic also appear to have been minimal.<sup>23</sup>

**The Panic of 1890.** Sprague (1910, 143-44) traces the proximate cause of the 1890 crisis (in the United States) to the November 7 decision by the Bank of England to raise its discount rate from 5 to 6 percent. Sharp declines in the London and New York stock markets led to the failure of Decker, Howell, and Company on November 11, which also involved the Bank of North America. The New York Clearinghouse Association met on the afternoon of that day and decided on a prompt issue of loan certificates. Ultimately \$17 million in certificates was issued, as compared with \$92 million in reserve holdings (Timberlake 1993, 204).

As was the case in 1884, the prompt issue of loan certificates seems to have contained the effects of the 1890 panic. On November 15 the New York financial markets were again shocked by the news of the near-failure of Baring Brothers and Company, and almost thirty brokerage houses failed as a result of subsequent declines in the stock market (Mishkin 1991, 86). Despite these developments, no general suspension of payments was declared and the effects of the panic were largely confined to New York.<sup>24</sup>

**The Panic of 1893.** The 1893 crisis was noteworthy as an event that defied the conventional wisdom of the times. The success of the loan certificate issues of 1884 and 1889 had strengthened the markets' confidence in this system of providing emergency liquidity. The liquidity demands of the stock market had also been reduced by the introduction in 1892 of a modern system for settling stock trades (Myers 1931, 303-5).

However, early 1893 saw the beginning of a sequence of events that would expose a serious flaw in the loan certificate system. A recession began in February that was accompanied by an unprecedented number of commercial failures. The stock market crashed on May 4 following the failure of a market favorite. Nineteen national banks failed (or at least suspended payments) during May and June, leading to liquidity pressures on other banks throughout the country and causing them to withdraw their deposits from New York banks.<sup>25</sup>

Recognizing the danger of a panic, the New York Clearinghouse Association authorized the issue of loan certificates on June 15, 1893. As had been the case in

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*There are certain noteworthy parallels between the financial history of the late nineteenth and early twentieth centuries and that of the late twentieth century.*

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1884 and 1890, payments were not initially suspended. However, in the face of a continued, nationwide crisis of confidence, the loan certificates were ineffective in slowing the panic. The loan certificates had validity only within New York City and could not be used as a substitute for cash outside the city. Gold continued to flood out of New York during July, and by the beginning of August virtually all banks had suspended cash payments (Sprague 1910, 170-78). Suspension led to a currency premium that peaked at around 4 percent and persisted until September (Sprague 1910, 182).

The suspension of cash payments only increased the demand for loan certificates. The size of the 1893 New York Clearinghouse Association issue was unprecedented at \$41.5 million as compared with prepanic reserves of \$99 million (Timberlake 1993, 204). Sprague (1910, 182) estimates that during the month of August 95 percent of interbank settlements in New York were effected by transfer of loan certificates.

The 1893 panic also resulted in unprecedented issue of loan certificates outside of New York. Most is-

ssues were in amounts under \$1 million, although the Boston and Philadelphia clearinghouses issued \$11 million each. Perhaps more importantly, many clearinghouse issues were made in small denominations and were widely used as hand-to-hand currency. Quite a few of these small-denomination clearinghouse loan certificates were issued by banks or by commercial firms in small communities that had no clearinghouse (Cannon 1910, 95-116). Sprague (1910, 197) places the maximum amount of loan certificates outstanding at any time during the panic at about \$60 million. With the aggregate stock of narrow money about \$1.5 billion at the time, even by this conservative estimate the issue of loan certificates still amounted to a significant addition to this aggregate.

Despite these ingenious efforts at liquidity provision, the economy continued to contract during and after the panic of 1893. Roughly 5 percent of all U.S. banks failed during the crisis, along with 15,000 commercial firms. The total money stock fell by 6 percent, and output continued to contract until June 1894 (Friedman and Schwartz 1963, 109; Mishkin 1991, 87). The Miron-Romer (1990) index of industrial production shows a 14 percent drop from 1892 to 1893, followed by a weak rebound of only 2.7 percent from 1893 to 1894. Balke and Gordon (1989) have estimated that real (inflation-adjusted) GNP was flat from 1892 to 1893 and contracted by about 3 percent in 1894. Romer (1989) has estimated that the economy contracted by about 1 percent in both 1893 and 1894. Not all of these effects can be attributed to the panic, as a recession was apparently well under way when the panic began. However, the disruptions caused by the panic doubtless contributed to the length and severity of the downturn.

**The Panic of 1907.** Surprisingly, the 1893 panic did not result in any major initiatives toward increasing the resiliency of the banking and payments system. The years between 1893 and 1907 also saw the rapid ascent of a new and particularly illiquid type of financial intermediary known as trusts. Trusts were essentially banks that offered deposit contracts that appealed to individuals and corporations who were more interested in higher returns over the long run and less interested in drawing on these deposits as a means of payment.<sup>26</sup> Exploiting loopholes in contemporary banking law, trusts were able to increase the yield on their assets relative to banks by holding less-liquid, higher-yielding portfolios that included virtually no reserves. By 1907, the total assets of trusts in New York State had grown to roughly three-quarters the size of national bank assets in the state (\$1.364 billion versus

\$1.8 billion) and were more than twice as large as the assets of state banks (\$541 million) (Moen and Tallman 1992, 612-16).

In spite of their evident importance in the banking industry, in 1907 most New York City trusts were not members of the New York Clearinghouse Association. Instead, payments drawn on the trusts were settled indirectly through accounts held by the trusts at the various clearinghouse banks. The proximate cause of the 1907 panic was the October 21 announcement by one of the New York Clearinghouse Association banks that it would no longer clear checks for Knickerbocker Trust Company. A run on Knickerbocker began the next day, followed by runs on other trust companies (Sprague 1910, 251-56). Because the trust companies were not in the New York Clearinghouse Association, they were not eligible for assistance via loan certificates. By the end of that week J.P. Morgan had formed a syndicate of large banks to extend credit to the beleaguered trusts, but by this time the general feeling of uncertainty had spread. Loan certificates were issued in New York beginning on October 26. New York banks suspended cash payments in early November, which led to a currency premium and widespread suspension of payments by banks in other parts of the country (Sprague 1910, 257-77).

The subsequent issue of loan certificates was unprecedented in amount and scope. The New York City issue alone totaled \$101 million versus \$181 million in deposits at the start of the panic (Timberlake 1993, 204). Outside of New York, loan certificates were widely used both as a means of interbank settlement and as hand-to-hand currency. A. Piatt Andrew (1908) estimated that the aggregate issue of loan certificates in cities with population greater than 25,000 totaled \$330 million. As the total stock of narrow money was approximately \$2.9 billion, these issues amounted to a significant expansion of the money supply (Friedman and Schwartz 1963, 706).

Like the 1893 panic, the panic of 1907 began shortly after the onset of a recession (June 1907), during which the U.S. industrial output again fell by roughly 14 percent as measured by the Miron-Romer (1990) index. Real GNP contracted by about 5.5 percent as estimated by Balke-Gordon (1989) and 4 percent according to the Romer's (1989) estimates. The traditional interpretation of this episode has placed almost all of the blame for the severity of the macroeconomic downturn on the financial panic. Although this interpretation has been challenged by some writers (Mishkin 1991, 89-91, for example), the output costs of the panic must be reckoned as large by any accounting.

**The Panic of 1914.** The immediate legislative response to the 1907 panic was the passage in 1908 of the Aldrich-Vreeland Act. This act essentially legitimized the issue of clearinghouse loan certificates as emergency currency. There were, however, some important differences between the emergency currency issued under Aldrich-Vreeland and the earlier clearinghouse issues.

Under Aldrich-Vreeland, national banks in the larger cities were allowed to group into associations for the purpose of issuing currency during emergencies. State banks and trusts were not eligible to issue emergency currency even if they were members of the local clearinghouse. The emergency currency was to be issued against a relatively narrow class of marketable assets held as collateral (U.S. securities and commercial paper) and was to be taxed at an annualized rate of 5 percent for the first month of its issue, increasing each month thereafter by one percent to a maximum of 10 percent. This schedule was later reduced to an initial rate of 3 percent, increasing by half-percentage points to 6 percent (Timberlake 1993, 209; Sprague 1915, 518-19). A distinctive advantage of the Aldrich-Vreeland currency over the clearinghouse loan certificates was that the former was legally considered currency and hence valid for settlements among banks that were not members of the same clearinghouse. For the same reason the legal status of the Aldrich-Vreeland currency all but eliminated the possibility of a currency premium.

The Aldrich-Vreeland Act was superseded by the 1913 Federal Reserve Act. Before the Federal Reserve System could begin operations, however, world financial markets were shaken by the start of the first World War. Although the United States was not directly involved in the war at that time, the outbreak of hostilities had devastating effects on U.S. financial markets. The markets' supply of short-term credit from London was entirely cut off, just as the stock market crashed when European interests sought to liquidate their U.S. holdings. The resulting liquidity strains led to the closure of the New York Stock Exchange on July 31, 1914. The stock exchange remained essentially closed for the next two months, and unrestricted trading did not resume until April 1 of the following year (Friedman and Schwartz 1963, 172). Other domestic financial markets and the markets for foreign exchange were also severely disrupted (Sprague 1915, 521-31).

Following the closure of the stock market, runs began on banks as they had in earlier panics. The resulting liquidity demands were met by issues of both loan certificates (in aggregate about \$212 million nationwide)

and Aldrich-Vreeland emergency currency (in aggregate about \$400 million). These issues expanded the narrow money supply by about one-eighth over its prepanic levels, a factor of increase somewhat larger than that experienced in 1907.<sup>27</sup>

Despite the parallels with earlier panics, the panic of 1914 did not precede any major economic contractions, nor was there any general loss of confidence in the banking system. Part of the reason for this lay in the peculiar wartime nature of the crisis. In the months immediately following the crisis, the U.S. banking system was bolstered by gold inflows resulting from the demands for U.S. exports (Schwartz [1986] 1992a, 20). Aided by these same export demands, U.S. industrial output rose by 20 percent from 1914 to 1915 (Miron and Romer 1990, 336), while real GNP grew by about 5 percent (see Romer 1989 and Balke and Gordon 1989). Yet various accounts agree that the successful resolution of the crisis resulted in large part from the prompt issue of the Aldrich-Vreeland currency.

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### **The Lessons of the National Banking Era Crises**

The variety of crises experienced during the National Banking Era offer a number of lessons for the effective provision of liquidity during crises. The system of providing liquidity via loan certificates was in many ways an imperfect solution to this problem, "a poor tenth best," in the words of Charles P. Kindleberger (1989). Yet this makeshift system was clearly on the margin of success and failure. It was as effective in certain instances (1884, 1890, and, in its legitimized form, 1914) as it was a failure in others (1873, 1893, 1907). In addition, the loan certificate system was highly successful in limiting the amount of credit risk borne by providers of emergency liquidity, that is, clearinghouse members.

The most evident and least controversial lesson from the National Banking Era experience is that in crisis situations, timing is critical. Emergency liquidity, if it is to be provided, should be provided before bank depositors and market participants begin to perceive institutions as illiquid. In the panics of 1873 and 1907, much of the damage resulted from failure on the part of the clearinghouses and particularly the New York Clearinghouse Association to provide adequate liquidity early in the crisis. Relatively large issues of loan certificates after the fact could not correct the damage once a panic was under way. Even with the

transactions technologies of the times, the delay of a day or two was critical. The post-1930s record of crisis interventions by the Federal Reserve (see note 10) and by foreign central banks suggests that this lesson has been almost universally accepted.<sup>28</sup>

The panic of 1893 illustrates, however, that timing is not everything. In the 1893 crisis, timely provision of loan certificates could not make up for structural weaknesses present within the banking industry at the time. In particular, the inability of the banks to geographically diversify their deposit base meant that their clearinghouse loan certificates could serve only as local currency. City banks were therefore susceptible to shocks that drained reserves away from the large cities towards the interior; country banks did not have access to the liquidity provided by the issue of loan certificates in the cities. Banks were also constrained in their ability to diversify their assets. Some striking evidence on the fragility of the U.S. banking industry during the National Banking Era can be obtained by a comparison of the U.S. and Canadian experiences during the panics. For example, Michael D. Bordo, Angela Redish, and Hugh Rockoff (forthcoming) observe that Canadian banks, which generally enjoyed a geographically diverse deposit base as well as ready access to emergency liquidity, were not run during National Banking Era panics.

Today, the U.S. banking industry is obviously much more diversified over both sides of the balance sheet than was the case during the National Banking Era. Depositors are also insulated from the direct effects of shocks to the banking industry by the government "safety net." However, ongoing structural changes in the banking industry have led to increased risk-taking on the part of banks, as documented by Boyd and Gertler (1993, 1994a). Boyd and Gertler conclude that recent policy initiatives such as the 1991 passage of FDICIA and the Basle Accord of 1988, which seek to limit such risk-taking behavior, are justified because they improve economic efficiency and lessen the likelihood of taxpayer bailouts. The National Banking Era experience only reinforces this conclusion.

Another lesson from the National Banking Era derives from the experience of the 1873 panic, in which ample provision of interbank liquidity could not overcome structural weaknesses in securities market settlement systems and particularly an overreliance on bank credit. At the time the operation of the New York stock market depended entirely on the willingness of banks to extend indefinite amounts of uncollateralized credit to market participants. When this credit was not forthcoming, the immediate result was complete breakdown



of the market. The ultimate result of the 1873 and subsequent panics was the development of the clearing-house system for clearing stock market trades, in which major market participants pool resources in order to guarantee the liquidity of the market.

Today, methods for clearing and settlement in financial markets are vastly more sophisticated than was the case in 1873. Yet incidents such as the 1974 failures of Bankhaus Herstatt and Franklin National Bank, the 1980 silver crisis, the 1987 stock market crash, and the 1995 failure of Barings have all placed acute stresses on financial markets and their settlement systems.<sup>29</sup> Some financial markets, particularly the markets for foreign exchange, continue to require extraordinary amounts of bank credit for their daily operations (see New York Foreign Exchange Committee 1994). As indicated in the epigraph introducing this article, this problem is a continuing concern to policymakers. The Federal Reserve and other central banks have undertaken measures designed to encourage proper management of risks associated with the settlement of financial market transactions. Recent policy initiatives along these lines include the adoption of fees for daylight overdrafts on Fedwire and the adoption of minimum standards for private large-value payment systems (Board of Governors 1993, 98-99; 1994, 109).

The panic of 1907 sharply illustrates a problem with financial innovation, which is the tendency of the markets for financial intermediation to innovate around existing, costly arrangements for liquidity provision, through a process that Edward J. Kane (1977, 1981) has characterized as a "regulatory dialectic." In the case of the 1907 panic, the trusts arose as a new form of financial intermediary that was successful in circumventing the contemporary restrictions placed on bank portfolios, particularly reserve requirements. The trusts operated under the impression that they could "free ride" on the liquidity-providing services of the banks and the clearinghouses. However, many trusts did not have access to liquidity sufficient to cover depositor demands during the 1907 panic. Had the New York trusts had access to loan certificates in 1907, these institutions most likely would not have been run and a widespread panic would not have occurred. Only after the panic had revealed the illiquidity of the trusts was there any significant change in the institutional mechanisms for emergency liquidity provision.

As was the case in the early twentieth century, recent years have seen a tremendous amount of innovation in the banking and payment systems. It is debatable whether these innovations pose a direct

challenge to banks' traditional role as liquidity providers.<sup>30</sup> However, certain financial innovations have placed new and potentially large (in times of uncertainty) demands on the liquidity of the banking system. For example, Boyd and Gertler (1993) survey three types of off-balance-sheet activities that have become increasingly prevalent in the U.S. banking system: loan commitments and standby lines of credit, loan sales and securitization, and provision of derivative instruments (such as swaps). As was the case with the trusts, these activities have enhanced the efficiency of financial intermediation by allowing firms and

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*The most evident and least controversial lesson from the National Banking Era experience is that in crisis situations, timing is critical.*

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households access to cash flows that more closely suit their individual circumstances. During normal times these activities do not place large demands for liquidity on the banking system, as was also the case with the trusts. Because each of these activities involves some liquidity guarantees on the part of banks, however, the potential exists that each could result in sudden, large demands for liquidity. The 1907 experience suggests that the issue of policy response in such situations will be an important one as new forms of intermediation continue to evolve (Tallman and Moen 1995).

Finally, a comparison of the 1914 panic with earlier disruptions illustrates the payoff to a well-planned, credible, and legally sanctioned system for providing liquidity in crisis situations. The extraordinary liquidity demands associated with the 1914 panic were as large if not larger than that of any previous panic, yet there was no general loss of confidence in the banking or payments system. The knowledge that liquidity would be forthcoming in the form of the legally sanctioned Aldrich-Vreeland emergency currency did much to alleviate the possibility of a sustained economic contraction. Nor are there any instances of losses recorded for either the legally sanctioned emergency currency or the

traditional clearinghouse loan certificates that were issued in response to the panic.

In summary, the experience of the National Banking Era offers more than an colorful chapter in U.S.

economic history. Rather, the evolution of National Banking Era liquidity crises and proposed solutions to these crises offers a valuable set of policy experiments whose relevance seems to appreciate with time.

## Notes

1. For a summary of the Fed's interventions during financial crises and an introduction to the relevant literature see Mishkin (1991).
2. The Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 has been particularly important. See Wall (1993) for an introduction.
3. For the purposes of this article, outside money may be defined as either cash or reserves held by banks at a central bank.
4. The legal treatment of depositors' claims on bank deposits in this regard is somewhat different from that of similar claims on most other types of firms. For example, chapter 7 of the U.S. bankruptcy code (which does not apply to banks and certain other financial intermediaries) allows for reversal or "avoidance" of transfers by liquidating firms. Transfers to creditors that are made up to ninety days before a bankruptcy filing, or up to one year before bankruptcy in the case of "insiders," may be avoided. See Woelfel (1994, 125).
5. Blommestein and Summers (1994) discuss some of the potential advantages of interbank settlement in reserves. A more formal rationale for this practice is offered in Kahn and Roberds (1995).
6. See Gertler (1988) for a survey of this literature.
7. Limitations on the availability of one of the most direct forms of Fed credit—discount window loans—are discussed by Garcia and Plautz (1988) and more recently by Mengle (1993a) and Wall (1993). Historically, discount window credit generally has been provided only to depository institutions, although some limited discount window lending to nondepository institutions took place in the 1930s under the Federal Reserve's emergency lending authority.
8. Mankiw (1986), Corrigan (1991), Mishkin (1991), and Summers (1991) all discuss the tendency of informational asymmetries to become magnified in such situations. One manifestation of this heightened uncertainty is discussed in Clair, Kolson, and Robinson (1995), who provide evidence that during such times banks have a strong tendency to shift interbank payment processing out of private systems and into Fed payments systems.
9. Mengle (1990) discusses this problem in some detail. In the recent literature this is usually described as the problem of "too-big-to-fail."
10. See, for example, Schwartz ([1986] 1992a), Garcia and Plautz (1988), Brimmer (1989), Bernanke (1990), Mishkin (1991), Davis (1992), Calomiris (1994) and Wolfson (1994). Among the more recent events requiring Fed intervention have been the 1970 Penn Central bankruptcy (see Schwartz, Brimmer, Mishkin, Davis, Calomiris), the 1974 failure of Franklin National Bank (Schwartz, Garcia and Plautz, Wolfson), the 1980 silver crisis (Garcia and Plautz, Brimmer, Wolfson), the 1984 Continental Illinois episode (Davis, Wolfson), the 1987 stock market crash (all except Schwartz and Calomiris), and the 1991 failure of the Bank of New England (Wolfson; see also Schwartz 1992b).
11. Examples include Friedman (1960), Garcia and Plautz (1988), Goodfriend (1988), Kaufman (1991), and Schwartz (1992b).
12. FDICIA-imposed limits on discount window lending are summarized in Roberds (1993) and discussed at some length in Smith and Wall (1992) and Wall (1993). FDICIA also contains a clause that would allow these limits to be exceeded during systemic crises. In addition to the FDICIA reforms, the Omnibus Budget Reconciliation Act of 1993 contains "depositor preference" provisions designed to reduce FDIC exposure to credit risk. The efficacy of these provisions has been viewed by some observers as questionable; see for example Kaufman (1993) and Thomson (1994).
13. See Kaufman (1991) and Schwartz (1992b). For contrasting views see Summers (1991) or Calomiris (1994).
14. The Fed provides liquidity via the market for overnight funds (the repo or RP market). However, only a narrow, homogeneous class of bank assets (U.S. Treasury securities) are available for RP.
15. On occasion the Treasury would attempt to increase the supply of liquidity via open market purchases. These attempts at a "monetary" policy are seen by most historians as ineffective during times of crisis; see, for example, Timberlake (1993). Myers (1931, 286-87) also records several instances in which syndicates of large commercial banks formed pools of liquidity that were made directly available to the financial markets via the call loan market.
16. See Cannon (1910, 36-57) for a description of contemporary settlement practices.
17. See Cannon (1910, 75-76), Myers (1931, 98-99), and Timberlake (1993, 199-200). Loan certificates taken out by any member bank were required to be accepted by other members in settlement upon penalty of expulsion from the clearinghouse.
18. Discussions of discount window lending—see Goodfriend (1990, 263-65), for example—emphasize the legal advantage enjoyed by government agencies in being able to establish senior claims against bank assets, although Goodfriend notes that this advantage may not exist in the case of repur-



- chase agreements. It is unclear why National Banking Era clearinghouses felt that they could enforce seniority of their claims. Part of the answer probably lies in the fact that, in the case of the loan certificates, posted collateral was rarely liquidated. Cannon (1910, 237-39) does describe one Supreme Court case in which the seniority of clearinghouse claims was successfully defended.
19. See Gorton and Mullineaux (1987, 465). The experience of some New York banks during the 1893 panic suggests that this information did not always remain secret. See Sprague (1910, 181).
  20. This comparison is not meant to suggest that the two systems summarized in Table I are the only possible means of providing emergency liquidity to the banking and payment systems.
  21. Goodhart cites the ability to overcome this conflict of interest as a natural advantage of central banks, a view that is disputed by Dowd (1994).
  22. See Sprague (1910, 38-39) and Myers (1931, 282-85). Myers notes that this practice, known as overcertification, flourished in spite of its illegality.
  23. On the events of 1884 see Sprague (1910, 108-23), Cannon (1910, 90-91), Noyes ([1909] 1980, 99-100), Myers (1931, 412-13), and Mishkin (1991, 83-84).
  24. There were issues of loan certificates by the clearinghouses in Boston and Philadelphia. See Cannon (1910, 92-94).
  25. See Sprague (1910, 168-171). The drain on bank reserves may have been exacerbated by political uncertainty over whether the United States would maintain the gold standard. See Friedman and Schwartz (1963, 108-9).
  26. Deposits at trusts were still essentially bank-like in the sense that they were payable on demand at par.
  27. See Friedman and Schwartz (1963, 172). Sprague (1915, 518) noted that almost all of the Aldrich-Vreeland currency issued during the panic was issued against government bonds; in this sense the 1914 emergency currency issues more closely resembled modern open market operations than discount window loans.
  28. On the actions of foreign central banks during crises see Corrigan (1990b) or Davis (1992).
  29. On the Herstatt failure see Davis (1992, 154-56) and Corrigan (1990b), on Barings see Falloon (1995); on the other incidents see note 10.
  30. For two contrasting points of view on this subject see D'Arista and Schlesinger (1993) and Boyd and Gertler (1994b).

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