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Liquidity and solvency problems during the banking crises of the National Banking Era

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Summary

Liquidity and solvency are conditional for banks' existence. They are endangered during banking crises. Since the banking crises of the National Banking Era in the USA are no exceptions, the question remains whether the foundation of the Federal Reserve System offered an adequate solution to the relevant problems of the era. The study concludes that the introduction of the Federal Reserve System offered a good chance to solve the structural problems. On the other side, the Federal Reserve System would not have been in a position to come to the aid of troubled banks in the crises of 1890, 1873 and 1884 – either due to solvency problems or runs by depositors.

JEL-classification: G 21, G 33, G 15
Keywords: Banking Crises, National Banking Era, Liquidity, Solvency, Federal Reserve System

Zusammenfassung

Zahlungs- und Schuldendeckungsfähigkeit stellen finanzwirtschaftliche Existenzbedingungen dar, deren Einhaltung in Bankenkrisen gefährdet ist. Das war nicht anders in den Bankenkrisen der National Banking-Ära der USA. Fraglich ist, ob mit der Einführung des Federal Reserve Systems eine angemessene Antwort auf die Probleme in den Bankenkrisen der National Banking-Ära gegeben wurde. Der Aufsatz kommt einerseits zum Schluß, daß das Federal Reserve System in der Lage war, die strukturellen Probleme zu lösen. Auf der anderen Seite wäre das Federal Reserve System mit den Schuldendeckungsproblemen in der Bankenkrise 1890 und mit dem panikartigen Verhalten der Einleger 1873 und 1884 überfordert gewesen.

JEL-Klassifikation: G 21, G 33, G 15
Schlagworte: Bankenkrisen, National Banking-Ära, Zahlungsfähigkeit, Schuldendeckungsfähigkeit, Federal Reserve System

Contents

1 Introduction

One of the reasons why banking crises regularly attract interest is because a large number of banks fail and there is the danger of a complete breakdown of the financial system. These failures are often perceived as just as unbearable as wild-water floods. So attempts are made to regulate them. The more regulatory action is geared to the causes of banking crises, the more effective it is. The existence of banks is basically jeopardised in crises at a first cause level because their liquidity or solvency may be impaired. The impairment of either of these two vital financial conditions usually results in the failure of a bank. To take effective regulatory action in the wake of a banking crisis, it would therefore be useful to know whether this banking crisis was caused by liquidity and/or solvency problems. At the same time, it is anything but easy to separate liquidity and solvency problems. Diamond/Rajan[1] recently noted that "*Unfortunately, liquidity and solvency problems interact and can cause each other, making it hard to determine the cause of a crisis*."

Despite this, the relevant literature focuses on liquidity problems and ignores solvency problems of banks in crises.[2] This is surprising, as banks' liquidity is ultimately tied to their solvency and banking regulators have been devoting their attention for some time now particularly to price risk and counterparty risk, which endanger solvency. Where liquidity problems are identified in a banking crisis, this immediately raises the question of whether these liquidity problems were caused by depositors. Answering this question is important, firstly, with the shape of concrete regulatory action, e.g. a deposit insurance scheme, in mind. Secondly, the theories on contagion in the banking system – take, for example, the run theory by Diamond/Dybvig, the domino effect theory by Paroush or the maximum strain theory by Stützel – concentrate to varying degrees on depositors besieging bank counters.[3] Focussing theories on the behaviour of depositors would, however, be neither right nor reasonable if depositors do not cause any liquidity problems in banking crises.

This essay deals with the banking crises of the National Banking Era in the United States (1863-1913). The introduction of the Federal Reserve System (FRS) in the US in

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[1] *Diamond/Rajan* (2005), p. 615.

[2] See, for example, *Tallmann/Moen* (1998); *Roberds* (1995); *Donaldson* (1992); *Smith* (1991); *Diamond/Dybvig* (1983).

[3] *Stützel* (1964); *Diamond/Dybvig* (1983); *Paroush* (1988); *Smith* (1991); *Donaldson* (1992); *Allan/Gale* (1998, 2000); *Diamond/Rajan* (2001, 2005).

1913 was conceived as a response to the problems encountered during the banking crises of the National Banking Era. This response involved, among other things, the FRS providing assistance to banks, which frequently suffered from liquidity squeezes in the banking crises, as a lender of last resort.[4] This was deemed necessary by the US Congress and the National Monetary Commission set up by it, as in many banking crises the financial sector in the US nearly came to a standstill for weeks or months due to partial suspensions of payments. It is questionable whether the introduction of the FRS, which was prompted by the experience made during the National Banking Era, was likely to alleviate major problems that arose during the National Banking Era and, as a result, to prevent similar banking crises later. In other words, was the experience made during the National Banking Era such that the introduction of the FRS created an instrument with which the fundamental problems could be successfully tackled? If this were the case, then the five banking crises of the National Banking Era ought to have been caused solely by system-related liquidity squeezes that could have been prevented by a lender of last resort. Specifically, the crises ought not to have been triggered by pure solvency problems or to have been due to liquidity problems outside the scope of centrally influencable coordination mechanisms.

This essay aims to investigate the US financial markets during the National Banking Era to determine whether the five banking crises of this 50-year period were due to liquidity and/or solvency problems. In addition, it examines the question of whether any liquidity problems that existed were caused by depositors. This essay does not present any primary data but is based on detailed work done by other authors.[5] After outlining the institutional environment and the five banking crises of the National Banking Era (Part 2), it deals with the selection of suitable financial market indicators to identify liquidity and solvency problems as well as depositor behaviour (Part 3). It then takes a closer look at movements in interest rates (Part 4), deposits and reserve ratios (Part 5) and the performance of the stock market (Part 6). Finally, it provides an overview of the findings (Part 7) and summarises the conclusions (Part 8).

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[4] *Bagehot* (1873); *Schwartz* (1986); *Allen/Gale* (1998); *Goodhart* (1988); *Miron* (1986); *Capie et al.* (1994), p. 68 and 175-179. "*The Fed was to execute monetary policy, act as a lender of last resort, and regulate and supervise banking*." However, the FRS had to share regulation and supervision with other institutions that had existed for many years, so that the lender of last resort function took centre stage. *Sylla* (1992), p. 16.

[5] See *Sprague* (1910); *Macaulay* (1938); *Wilson/Sylla/Jones* (1990); *Calomiris/Gorton* (1991); *Sechrest* (1993). For background research and case studies that complete the picture, see *Friedman* (1990); *Cannon* (1884); *Körnert* (2003); *Noyes* (1894); *Rich* (1989).

2 Institutional environment and an overview of the five banking crises

The US National Banking Era was ushered in by the passage of so-called National Currency Acts (National Banking Acts) between 1863 and 1865. The beginning of this era coincided with the American Civil War (1861-1865) and followed the Free Banking Era (1837-1863). The National Banking Era came to an end with the adoption of the Federal Reserve Act, i.e. the introduction of a central bank system in the US, in 1913.[6] The national banks were licensed by the Comptroller of the Currency and operated at three levels, namely as country banks, reserve city banks and central reserve city banks. These banks were required to hold part of their deposits as reserves, leading to the creation of a reserves pyramid whose apex was New York. Bordo/Rappoport/Schwartz write: "*Although Chicago and St. Louis were important regional centers, New York held the lion's share of bankers' balances. National banks in central reserve cities also held substantial correspondent balances of state banks, private banks, and trust companies.*"[7] For this reason, it is sufficient in the following to confine the investigation to the financial markets in New York, as the situation there reflects events in the country as a whole.

It must also be borne in mind that the great majority of all national bank reserves were invested on the New York call money market.[8] Call money funds were the most liquid interest-bearing form of investment; they were usually lent to brokers who, in turn, acquired securities, shares and bonds on the New York Stock Exchange as collateral. Although the country banks and reserve city banks also invested to a large extent directly on the call money market, it was ultimately the central reserve city banks in New York which dominated this market. It should therefore be noted that, thanks to both the direct and the pyramid-like investment of reserves and their collateralisation, the markets for call money, for commercial paper, for bonds and for shares in New York can be taken as an indicator for assessing the liquidity of the National Banking System.[9]

During the National Banking Era, five main banking crises occurred. The above classification is by O.M.W. Sprague (1873-1953), who, as Professor of Banking and Finance at Harvard University, compiled a report on these banking crises at the request of the

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[6] *Sechrest* (1993), p. 2-4 and 95; *Puth* (1993), p. 395 f. and 407 f.; *Dowd* (1992); *Horwitz* (1992), p. 150 f.; *Chari* (1989), p. 3 f.; *Friedman/Schwartz* (1963), p. 18 f.

[7] *Bordo/Rappoport/Schwartz* (1992), p. 212 ; see also *Salsman* (1993), p. 88 f.; *Sprague* (1910), p. 124-127; *Calomiris/Gorton* (1991), p. 130; *McCulley* (1992), p. 17 f.

[8] *Wilson/Sylla/Jones* (1990), p. 276; *Sprague* (1910), p. 13.

[9] *Bordo/Rappoport/Schwartz* (1992), p. 212.

National Monetary Commission in 1910. Sprague's report is an indispensable record by a contemporary witness.[10] In the following, the five banking crises are investigated. Table 1 shows when they began, how long the partial suspension of payments lasted, and how many national banks failed. The appearance of a premium upon currency was selected for measuring the length of the partial suspensions of payments. Sprague writes: "*The first and immediate consequence of partial suspension by New York banks was the appearance of a premium upon currency*."[11] Three crises (1873, 1893 and 1907) led to partial suspensions of payment, which lasted around one month in 1873 and 1893 and approximately two months in 1907. The failures were recorded by the Comptroller of the Currency as occurring between months 6-12 of 1873, 3-8 (1884), 8 (1890)-2 (1891), 4-10 (1893) and 8 (1907)-2 (1908). As the Comptroller only records failures of national banks, the total number of bank failures is much higher.

Table 1: Main banking crises during the National Banking Era according to Sprague (1910)

Start of the banking crisis			Partial suspension of payments	Failures of national banks	
Year	Week	Month			
1873	37	Mid-September	24.09. - 22.10.1873	9	
1884	19	Beginning of May	Prepared	8	
1890	45	Beginning of November	Prepared	10	Σ 82
1893	22	End of May/beginning of June	03.08. - 02.09.1893	49	
1907	42	Mid-October	31.10. - 28.12.1907	6	

In particular, the number of bank failures in 1893 and the length of the partial suspension of payments in 1907 were seen as so socially unbearable that they paved the way for far-reaching changes.[12] Firstly, the Aldrich-Vreeland Act (Emergency Currency Act) in 1908 allowed a select group of banks to issue emergency currency in liquidity squeezes. Secondly, the US Congress instigated a wide-ranging investigation of the bank crises and explored possible restructuring measures; to this end, it set up the above-mentioned National Monetary Commission, for which Sprague compiled his report in 1910. The main consequence of the banking crises during the National Banking Era was the establishment of the Federal Reserve System in 1913.[13]

[10] *Sprague* (1910); *Chari* (1989), p. 4; *Friedman/Schwartz* (1963), p. 160 and 171; *Miron* (1986), p. 261-264; *Bordo* (1992), p. XV.

[11] *Sprague* (1910), p. 56, 187 and 280-282; *Chari* (1989), p. 6; *Calomiris/Gorton* (1991), p. 114 and 133.

[12] For an overview of the average annual losses suffered by bank depositors as an indicator of social unbearableness, see *Williamson* (1989), p. 24 f.; *Gorton* (1988), p. 753. A comparison with the depositor losses between 1921 and 1960 is possible in *Friedman/Schwartz* (1963), p. 438.

[13] *Salsman* (1993), p. 94 f.; *Friedman/Schwartz* (1963), p. 168-173; *Donaldson* (1992); *McCulley* (1992); *Smith* (1988). For details of the FRS's first test in the 1914 crisis, see *Sprague* (1915).

3 Financial market performance as an indicator of liquidity and solvency problems at banks

To identify and separate liquidity and solvency problems at banks in the US, the performance of the financial markets during the National Banking Era is investigated. It is assumed that banks suffering from liquidity problems try to eliminate their shortage of liquidity by obtaining fresh funds. There are basically two ways of obtaining fresh funds: Banks can, on the one hand, borrow from other market participants. They can do so by, for instance, raising loans or issuing securities. On the other hand, banks can generate funds by selling assets they own. The forced sale of securities held as liquidity reserves is an example. Securities such as bonds and shares, which are tradable on regulated markets, are particularly suitable as liquidity reserves.

A typical feature of a liquidity squeeze would be that raising loans or issuing securities to generate funds is only possible in an environment of rising interest rates. Selling bonds also leads to falling prices while interest rates rise. Interest rate movements during the National Banking Era are therefore examined more closely in the following. To measure the length of liquidity problems, the interest rates for call money, as indicators of a short-time liquidity squeeze, and for 60/90-day commercial paper, as indicators of a medium-term liquidity squeeze, are also analysed. Finally, the interest rates for bonds, which can be sold to alleviate both short-term and medium-term liquidity problems, are examined.

In addition, movements in deposits and reserve ratios (reserves/deposits) are studied and the question of whether liquidity problems were created by a particularly sharp drop in deposit balances and a low reserve ratio at the same time is addressed. Answering this question allows conclusions with regard to the behaviour of depositors and the argument that the onset of the crises, which coincided conspicuously with the planting and harvesting times (Table 1), was triggered by flows of funds needed for agricultural purposes.

Analysing the performance of the stock market plays an ambiguous role in explaining the liquidity and solvency problem: It can, for example, be assumed that banks experiencing liquidity problems resort, among other things, to forced sales of bonds *and* shares to keep the liquidation discounts resulting from such sales as low as possible. The usual result would be price losses on bonds *and* shares. Where liquidity problems are concerned, it would be unusual if interest rates were seen not to react but the stock

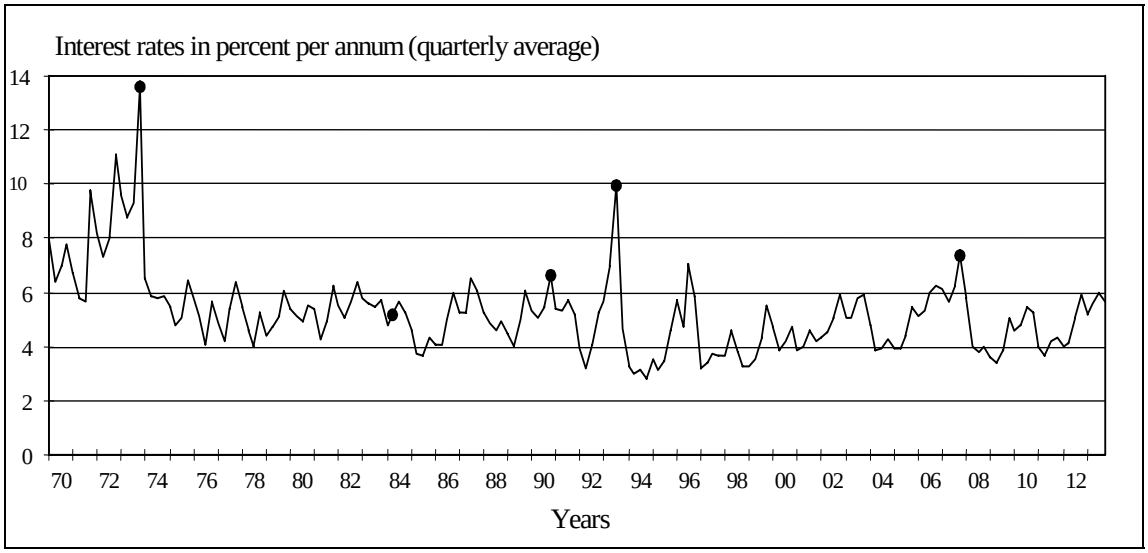
market reacted strongly. Conversely, a sharp drop in prices on the stock market that is not accompanied by rising interest rates is therefore a sign of pure solvency problems. These solvency problems arose during the National Banking Era because the pyramiding of reserves meant that the losses on the stock market had an immediate impact on the solvency of the national banks and other banks.

4 Interest rate movements

4.1 Movements in commercial paper rates

The interest rates for 60/90-day commercial paper are used to find signs of medium-term liquidity squeezes, assuming in the process that banks tried to bridge these squeezes by issuing or selling commercial paper. In both cases the price of the scarce commodity (liquidity), i.e. interest rates, would rise. The examination of interest rate movements commences with 60/90-day commercial paper, since Table 1 already suggests that the crises of 1873, 1893 and 1907 involved medium-term liquidity problems, as partial suspensions of payment ensued. Figure 1 shows the interest rates for commercial paper as a quarterly average, with the quarters in which crises occurred marked with a dot. It is noticeable that high interest rates for commercial paper were a feature particularly of the banking crises in 1873, 1893 and 1907. This was much less the case in the crises of 1884 and 1890, where there was no partial suspension of payments.

Figure 1: Quarterly average of interest rates in per cent per annum for commercial paper in New York between 1870 and 1913[14]



[14] Figures based on *Sechrest* (1993), p. 129 f. See also *Macaulay* (1938), A 144-156.

Table 2: The 20 lowest monthly yields on commercial paper in the US between 1866 and 1913[15]

Ranking	Year with a banking crisis[a]		Year without a banking crisis		Yield
	Year	Month[b]	Year	Month[b]	in per cent[c]
1	*1893*	*7*			*-2.67*
2	*1907*	*11*			*-2.10*
3	***1873***	***9***			***-1.90***
4			1871	10	-0.59
5			1868	11	-0.24
6	**1893**	**5**			**-0.24**
7			1879	8	-0.24
8			1872	9	-0.19
9			1877	8	-0.16
10			1896	1	-0.14
11			1898	3	-0.14
12			1896	8	-0.12
13			1879	3	-0.10
14			1886	8	-0.09
15			1876	9	-0.09
16			1909	10	-0.02
17			1898	4	0.02
18			1881	8	0.02
19			1895	12	0.03
20			1869	6	0.04

[a] Month with crisis week in bold print; month with partial suspension of payments in italics; month with crisis week and partial suspension of payments in bold print and italics.
[b] Reference month and previous month taken as basis for comparison.
[c] According to the formula C = 100 - (100r/12), where "r" is the average monthly interest rate for 60/90-day commercial paper.

Quarterly averages are, however, only a relatively rough guide. Table 2 therefore goes a step further by filtering out the 20 lowest yields on commercial paper – the more interest rates have risen compared with the previous month, the lower these yields are. The crisis of 1873 began in mid-September and the partial suspension of payments on 24th September; commercial paper rates rose strongly from August to September (Ranking: 3rd). In the crisis of 1893, the crisis week was at the end of May/beginning of June and the partial suspension of payments began on 3rd August. Both the crisis week and the suspension of payments were preceded by months in which interest rates rose (May 1893, 6th; July 1893, 1st). The same can be said of the crisis of 1907: From October to November commercial paper rates rose sharply (2nd). The picture is different for the two crises where there was no suspension of payments: The crises of 1890 and 1884 are not included in Table 2. As was to be expected due to the partial suspensions of payments across the banking system, only the banking crises of 1873, 1893 and 1907 are therefore left as crises involving medium-term liquidity squeezes. This now raises the question of

[15] Based on *Wilson/Sylla/Jones* (1990), p. 283 and 304 f. See also *MacCauley* (1938), A 144-156.

whether the absence of medium-term liquidity squeezes in the banking crises of 1884 and 1890 means that there were no short-term liquidity squeezes either. An analysis of call money rates helps to answer this question.

4.2 Movements in call money rates

It is conceivable that, while no medium-term liquidity squeezes culminating in partial suspensions of payment may occur in banking crises, short-term liquidity squeezes nevertheless cause disruption threatening the existence of banks. These short-term liquidity problems are identified with the help of the movements in call money rates. Table 3 sets out the 20 highest monthly call money rates. It shows that in the crisis of 1873 medium-term liquidity squeezes were short-term as well: Months 3, 4, 9 and 10 are among the 20 months with the highest call money rates. There is a similar picture in 1907, where month 11 ranks 18th. The crisis of 1893 does not feature among the crises involving partial suspensions of payments and medium-term liquidity squeezes. There is no sign of short-term liquidity problems in the banking crisis of 1890.

Table 3: The 20 highest average monthly call money rates in the US between 1866 and 1913[16]

Ranking	Year with a banking crisis[a]		Year without a banking crisis		Interest rate
	Year	Month	Year	Month	in per cent[b]
1	**1884**	**5**			**163.40**
2	1873	4			87.50
3	***1873***	***9***			***72.05***
4			1872	12	58.68
5			1881	2	50.12
6			1879	11	45.80
7			1879	10	40.10
8			1872	4	36.25
9			1872	9	35.20
10			1868	11	35.00
11			1887	6	33.26
12	*1873*	*10*			*31.20*
13			1869	6	30.10
14			1886	12	28.69
15			1880	11	22.00
16	1873	3			21.35
17			1868	12	20.55
18	*1907*	*11*			*19.80*
19			1869	1	18.40
20			1870	12	18.40

[a] Month with a crisis week in bold print; month with a partial suspension of payments in italics; month with a crisis week and partial suspension of payments in bold print and italics.
[b] Average monthly call money rates.

[16] Based on *Wilson/Sylla/Jones* (1990), p. 284 and 303 f.

Much more significant is, however, the finding that in the crisis of 1884, for which no medium-term liquidity squeezes were diagnosed in the previous section, serious short-term liquidity problems evidently occurred. An average monthly call money rate of 163.40% was recorded for the whole of the crisis month of May. This is about twice as high as the already high call money rate in the crisis of 1873. It must therefore be concluded that the crises of 1873, 1884 and 1907 featured short-term liquidity squeezes.

4.3 Movements in bond rates

Banks' liquidity position can be enhanced in crises by forced sales of assets. If bonds are sold in the process, this can lead to falling prices while interest rates rise at the same time. Issuing new bonds to obtain liquidity would also have the same effects. Table 4 shows the 20 lowest monthly yields on Aaa bonds, and the correlation between low yields and high interest rates should be noted. The months specified in Table 4 are compared in each case with the previous month.

Table 4: The 20 lowest monthly Aaa bond yields in the US between 1866 and 1913[17]

Ranking	Year with a banking crisis[a]		Year without a banking crisis		Yield
	Year	Month[b]	Year	Month[b]	in per cent[c]
1	*1873*	*10*			*-4.12*
2			1896	8	-2.43
3	*1907*	*11*			*-1.95*
4	*1893*	*7*			*-1.68*
5	1884	6			-1.19
6	*1893*	*8*			*-1.15*
7	***1873***	***9***			***-1.07***
8			1871	10	-1.03
9			1898	4	-0.98
10			1896	7	-0.96
11			1898	3	-0.95
12			1879	9	-0.84
13	**1884**	**5**			**-0.82**
14			1887	9	-0.81
15			1881	9	-0.80
16			1866	12	-0.78
17			1879	3	-0.76
18	***1907***	***10***			***-0.71***
19			1876	9	-0.65
20	**1893**	**6**			**-0.64**

[a] Month with crisis week in bold print; month with partial suspension of payments in italics; month with crisis week and partial suspension of payments in bold print and italics.
[b] Reference month and previous month taken as basis for comparison.
[c] $C = (2/0{,}5r)\,[1-(1+0.5r)^{-m}] + 100\,(1+0.5r)^{-m}$, where "m" equals 40 periods (purchase) and 39 5/6 (sale) plus $ 2 semi-annual interest payments on Aaa bonds.

[17] Based on *Wilson/Sylla/Jones* (1990), p. 282 and 305 f.

It is noticeable that in the crisis of 1873 both the month containing the crisis week (September) and the months marked by a partial suspension of payments (September and October) featured low bond yields, i.e. high bond rates (Ranking: 7th and 1st). In the crisis of 1884, the crisis month of May (13th) and the following month of June (5th) are included in the list of the 20 lowest yields. In the crisis of 1893 (Month 6/20th, 7/4th and 8/6th) the negative-yield months and the crisis-week months/suspension months coincided. By the same token, it can be argued as follows for the crisis of 1907: In months 10 (18th) and 11 (3rd) there is a correlation between the crisis-week month/suspension month and the low-yield months.

It should be pointed out in particular that the crisis of 1890 is not to be found on the list of the 20 lowest Aaa bond yields, which is why forced sales of bonds due to liquidity problems are unlikely. For the further course of the investigation, it must be noted that liquidity squeezes can only be identified in the banking crises of 1873, 1884, 1893 and 1907, although the 1884 squeeze was short-term. The medium-term liquidity squeezes of 1873, 1893 and 1907 on the other hand led to partial suspensions of payments. On the strength of the evidence considered so far, the banking crisis of 1890 cannot be said to have involved either a short-term or a medium-term liquidity squeeze.

5 Movements in deposits and reserve ratios

It has been repeatedly argued that the liquidity problems during the National Banking Era, which led to partial suspensions of payments, were due to sudden and unexpectedly large withdrawals of deposits caused largely by the seasonal fluctuation in the demand for funds in farming areas. This seasonal fluctuation was reportedly linked closely to the planting and harvesting months. Chari[18] notes: "*A more accurate interpretation … is that the demand for currency in agricultural areas fluctuated seasonally, being particularly high in the spring and fall. This view is supported by the fact that deposits of country banks in New York were generally low in the spring, rose in the summer, and fell to their lowest level in October*."

Bearing in mind that the onset of the banking crises was in the spring and fall (Table 1), this argument does not appear unreasonable, and the liquidity problems would then have their origins in the unpredictable fluctuation in funds. The question is whether this was really such an influential reason or whether it was just one factor that came to the fore to

[18] *Chari* (1989), p. 6; *Calomiris/Gorton* (1991), p. 124; *Andrew* (1906); *Miron* (1986), p. 261.

a varying extent in different crises. To assess this, it is examined with the help of Table 5 whether, compared with the crisis years, there are times before the crisis week when large withdrawals of deposits coincided with a lower reserve ratio.[19] A look merely at the change in deposits is, on its own, not enough, as large withdrawals of deposits and a high reserve ratio are less of a problem. If it could be demonstrated that there were in fact times when large withdrawals of deposits coincided with a lower reserve ratio but were not followed by a banking crisis, this would call into question the cause-effect relationship explained in purely agricultural terms. It can at the same time be examined whether the liquidity problems identified may not be due in their entirety to rather sudden and unexpectedly large withdrawals of deposits.

Divided into five large columns listing the individual banking crises, Table 5 takes a closer look at the change in deposits and reserve ratios (reserves/deposits) at the New York national banks in the four weeks – arranged in ascending order – before the crisis week. This means, for example, that the banking crisis of 1884 commenced in week 19 (see also Table 1), deposits fell by 4.4 per cent before week 19, and the average reserve ratio for this period was 26.35 per cent. No other year can be found between 1871 and 1909 in which deposits fell more sharply, and the reserve ratio was lower, four weeks before week 19.

The picture is quite different in some cases for the other crises: Four weeks before week 22 (crisis of 1893) nine cases occurred between 1871 and 1909 (1882, 1886, 1887, 1891, 1899, 1901, 1902, 1904, 1905 – printed in italics in Table 5) in which the reduction in deposits in conjunction with a lower reserve ratio was heavier than in 1893. These nine cases are not connected with a banking crisis. The same can be argued for the crisis of 1890 (heavier reduction in deposits in conjunction with lower reserve ratio in 1899 and 1906) and the crisis of 1907 (1881, 1882, 1889, 1892, 1899, 1900).

In the crises of 1890, 1893 and 1907, there were therefore a total of 17 cases in the period examined where larger withdrawals of deposits coincided with lower reserve ratios at the time in question but no banking crises occurred. This strongly challenges the argument that seasonal withdrawals of deposits for agricultural purposes were always the reason for the banking crises. Furthermore, it could be concluded that only in the crises of 1873 and 1884, where no changes of comparable significance occurred between 1871 and 1909, did depositors cause liquidity problems by withdrawing deposits on a large

[19] *Calomiris/Gorton* (1991), p. 132-141.

scale in the weeks prior to the crisis. Liquidity problems have already been ruled out as a feature of the banking crisis of 1890, and this is underlined by the movements in deposits and reserve ratios.

Table 5: Change in deposits (Δ) and reserve ratios in per cent at the New York national banks in the four weeks before the crisis week (1871-1909)[20]

Year	Week 19 (1884 crisis)		Week 22 (1893 crisis)		Week 37 (1873 crisis)		Week 42 (1907 crisis)		Week 45 (1890 crisis)	
	% 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	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
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

[20] Closely based on *Calomiris/Gorton* (1991), p. 134 and 132.

6 Stock market performance

The performance of the stock market may support or challenge the results obtained so far. On the assumption that forced sales of securities affect market prices, a parallel development on the bond market and the stock market would be expected. Table 6 contains a monthly comparison of the drop in the New York Stock Exchange (NYSE) stock index between the reference month and the previous month. As far as the crisis of 1873 is concerned, the 20 sharpest drops include month 9 (Ranking: 8th), with the crisis week and partial suspension of payments, and month 10 (5th), with the suspension of payments. In the crisis of 1884, month 5, with the crisis week, ranks 6th and the following month 6 ranks 17th. Month 5 of 1893, with the crisis week, ranks 4th and month 7 ranks 3rd. In the crisis year 1907, a total of four months feature among the 20 sharpest drops: month 3 (2nd), 8 (9th), 10 (1st) and 11 (20th). Month 11 of 1890 ranks 10th.

Table 6: The 20 sharpest monthly drops in the NYSE stock index in per cent between 1866 and 1913[21]

Ranking	Year with a banking crisis[a]		Year without a banking crisis		Δ Stock index in per cent
	Year	Month[b]	Year	Month[b]	
1	***1907***	***10***			***-10.9***
2	1907	3			-9.8
3	1893	7			-9.4
4	**1893**	**5**			**-8.9**
5	*1873*	*10*			*-8.7*
6	**1884**	**5**			**-8.6**
7			1880	5	-7.9
8	***1873***	***9***			***-7.8***
9	1907	8			-7.5
10	**1890**	**11**			**-7.3**
11			1877	6	-7.2
12			1877	4	-7.1
13			1899	12	-6.7
14			1901	7	-6.7
15			1896	7	-6.6
16			1869	9	-6.5
17	1884	6			-6.4
18			1876	9	-6.0
19			1877	2	-5.9
20	*1907*	*11*			*-5.8*

[a] Month with crisis week in bold print; month with partial suspension of payments in italics; month with crisis week and partial suspension of payments in bold print and italics.
[b] Reference month and previous months as basis for comparison.

[21] Based on *Wilson/Sylla/Jones* (1990), p. 281 and 306 f. Similar data is furnished by *Calomiris/Gorton* (1991), p. 142.

Table 6 shows that the five crises years account for nine of the ten sharpest monthly drops in the stock index. If the crisis of 1890 is left out, the stock market data supports the findings of the last sections. Surprisingly, the crisis of 1890 is at odds with the findings so far, as in its case the sharp drop in the stock index has no recognisable parallels on the bond market or in the movement in other interest rates.

7 Overview of the results of financial market analysis

The results obtained by analysing financial markets are presented in Table 7 (see also Table 1). In the *banking crisis of 1873*, banks experienced short- and medium-term liquidity problems that were caused not least by depositors and culminated in an approximately one-month partial suspension of payments. Nine national banks failed. To alleviate the liquidity problems, bonds and shares were sold. Sales-related losses in value (liquidation discount) created solvency problems at banks. The *banking crisis of 1884* was marked by short-term liquidity problems, which were due also to massive withdrawals of deposits. Eight national banks failed. Forced sales of bonds and shares helped to avert medium-term liquidity problems. Solvency problems at banks were the result of liquidation discounts.

Table 7: Summary of financial market analysis

	1873	1884	1890	1893	1907
Call money rates (short-term liquidity problems)	X	X			X
60/90-day commercial paper rates (medium-term liquidity problems)	X			X	X
Partial suspensions of payments	X			X	X
Aaa bond rates	X	X		X	X
Deposits and reserve ratios	X	X			
NYSE stock index	X	X	X	X	X

In the *banking crisis of 1893*, there were no short-term liquidity problems but instead medium-term problems, which led to an approximately one-month partial suspension of payments. 49 national banks failed. No significant changes in deposits are recognisable. While banks managed to obtain funds by selling securities (shares and bonds), the resulting discounts created solvency problems. Leaving aside the behaviour of depositors and the approximately two-month partial suspension of payments, the *banking crisis of 1907*, in which six national banks failed, can be explained in the same way as the crisis of 1873.

In the four crises of 1873, 1884, 1893 and 1907 liquidity problems can be identified. Medium-term liquidity problems (1873, 1893, 1907) always triggered partial suspensions of payments; purely short-term liquidity problems were dealt with in 1884 without a suspension of payments. As in all four crises shares and bonds were sold to alleviate liquidity problems and their sale caused liquidation discounts, a clear separation between liquidity problems and solvency problems is not possible in these crises. Only two of the four crises entailing liquidity problems suffered from high deposit withdrawals and a low reserve ratio. These were the crisis of 1873, involving short- and medium-term liquidity problems and a partial suspension of payments, and the crisis of 1884, involving short-term liquidity problems without a suspension of payments. The argument that seasonal flows of funds mainly to agricultural areas led to liquidity problems was not backed up by the data available.

The *banking crisis of 1890* plays a special role: Although no liquidity problems were diagnosed in its case, ten national banks – the second-highest number – failed. The reason for this must be sought in solvency problems experienced by the banks. These solvency problems were caused by dramatic losses in the value of shares due to falling prices on the NYSE. A more in-depth analysis of the crisis of 1890 shows that the US was affected by problems not of its own making which ultimately spilled over into the US as part of a global domino effect.[22] In Britain, Barings Bank experienced serious financial difficulties after project funding in Argentina went badly wrong. To support Barings and to cover themselves against the consequences of its possible failure, the market participants in London began to accumulate liquidity reserves to an increasing extent. As the tense situation on the London financial markets made a large-scale sale of securities without sizeable liquidation discounts impossible, continuously offloading stocks on supposedly stabler stock exchanges such as the NYSE was the preferred option. Ultimately, however, the NYSE was not robust enough and the crisis ran its course, with disastrous consequences for some market participants in the US.[23]

8 Conclusions

The Federal Reserve System introduced in the US in 1913 was designed as a response to the problems experienced in the banking crises of the National Banking Era. Accord-

[22] *Sprague* (1910), p. 124-152; *Pressnell* (1968); *Orbell* (1985); *Batchelor* (1986); *Ziegler* (1988); *Kindleberger* (1989), p. 169 f.; *Ferns* (1992); *Körnert* (2003), p. 189-193.
[23] *Sprague* (1910), p. 127 f., 131 f. and 140-142; *Schwartz* (1986), p. 14 f.; *Miles* (2002).

ing to the Bagehot rule, the FRS, as a lender of last resort, would only have been allowed to remove liquidity problems, but not solvency problems, at banks. Consequently, a US central bank system like the FRS would have been unable to do anything in the banking crisis of 1890, as only in the other four banking crises did liquidity problems arise.

But the four banking crises involving liquidity problems in 1873, 1884, 1893 and 1907 also call for differentiated assessment when it comes to determining an effective regulatory response. After all, the data available shows that depositors caused considerable disruption only in the two banking crises of 1873 and 1884. Even a functioning central bank system can play only a very a limited role in calming depositors and preventing a run on deposits at banks. A deposit insurance scheme usually proves more effective in this case. Such a scheme was not set up, however, until the passage of the Banking Act in 1933 and the establishment of the Federal Deposit Insurance Corporation.

The banking crises of 1873, 1893 and 1907 involved persistent liquidity problems in the US banking system which led to partial suspensions of payments lasting weeks or months. The pyramiding of reserves in particular proved inappropriate as a means of averting liquidity problems. The introduction of the Federal Reserve System was suited to rectifying this situation on a permanent basis. In addition, it should be pointed out in connection with theories on banking crises that the behaviour of depositors is an important, but by no means the dominant, phenomenon that needs to be analysed and explained.

All in all, the liquidity and solvency problems experienced during the banking crises of the National Banking Era were much more multi-facetted than the introduction of only one regulatory measure initially suggests. Theories that take little account of the many different aspects of the cause-effect relationships in banking crises and offer monocausal explanations should therefore be met with scepticism. All the same, the FRS had a positive effect after its introduction. Although on the long road of banking regulation, leading from deposit insurance to concentration on capital rules, much of the experience made in earlier years was subsequently put to good use, regulatory action too often remained merely a response to urgent problems or was rendered less effective by a complicated scenario of conflicting interests.

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