Panics and the Disruption of Private Payments Networks: The United States in 1893 and 1907

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The periodic financial crises which hit the United States before the establishment of the Federal Reserve System were often severe enough to occasion collective action on the part of the banking system. In order to relieve pressures on reserves, three times in the postbellum period, 1873, 1893, and 1907, banks in many or most cities declared periods of suspension or restrictions of cash payments at par in which they temporarily restricted or denied altogether the redemption of their deposit liabilities in cash (specie or legal tender notes) (Calomiris and Gorton 1991, pp. 96-100). Friedman and Schwartz (1963, pp. 163-168) have famously contrasted this response to panics under the national banking system (pre-1914) with that in the Great Depression under the Federal Reserve System. In the earlier period restrictions were argued to have mitigated the effects of panics by stopping bank runs. Bank failures, as a consequence, were, if not completely arrested (e.g., see Wicker 2000, pp. 78-80), certainly greatly reduced, thereby damping the rate of monetary contraction.[1] To be sure, they conceded (1963, p. 698) that such restrictions may have caused "severe but brief difficulties," but with little or no elaboration. Here we consider the downside effects of cash payment restrictions– there was one significant aspect that was not stabilizing, disruptions of the payments system, and it is that element on which this paper focuses.

Modern-day studies of the effects of panics and financial crises have concentrated on the transmission channels of changes in interest rates and/or credit availability (e.g., Mishkin 1996). Recent research in macroeconomics though has raised the possibility that monetary changes might affect the real economy through changes in aggregate supply as well as changes in aggregate demand. Contemporary studies have generally emphasized the impact on investment in working capital (and consequently on the firm's short-run ability to produce), but at a more basic level the "hemorrhaging" of payments networks which delayed the transfer of good funds in settlement of transactions, purchases of labor or commodity inputs, would have had (much more) pronounced real effects through aggregate supply dislocations as well (Barth and Ramey 2002; Christiano, Eichenbaum, and Evans 1997; Christiano and Eichenbaum 1992).

[1] These "therapeutic" effects of cash restrictions have been questioned in turn by Dewald (1972) and Timberlake (1984), but on the other hand consider Dwyer and Hasan (2007). We follow Friedman and Schwartz's terminology of restrictions of cash payments instead of the more common contemporary term of suspension to distinguish it from the temporary closure of particular beleaguered banks.

Serious payments system disruptions are of course still possible in the modern economy. Gridlock, for example, was prevented after the September 11 attacks only through swift and decisive intervention by the Federal Reserve (McAndrews and Potter 2002). But the issue takes on particular relevance for the pre-Federal Reserve period, when both local and non-local transactions were cleared and settled through private payments networks. As we describe in the following section, New York correspondent banks were central in these networks. They constituted the "clearing house of the country" in O.M.W. Sprague's phrase (1910, p. 126), holding interior banks' (excess) clearing and secondary reserves. Consequently, payments restrictions especially in New York could significantly reduce access to "good funds" for local and non-local payments and thereby impede normal operations of production and exchange (i.e., reducing liquidity of banks' clearing and secondary reserves).

In this paper we examine the nature of payments system disruptions in the panics of 1893 and 1907 and their impacts. We focus on these two episodes because of their fundamental impacts on the payments system. After 1893 New York banks began to assume an even more integral role in mediating long-distance payments and in supplying banks with central-bank like services (Weiman and James 2006). In the aftermath of the 1907 panic the apparent vulnerability of the national payments system to panics and suspensions in New York spawned a reform movement to create the Federal Reserve, which then nationalized the clearing-settlement functions of New York banks.

During panics and cash payment restrictions ready access to New York funds was impeded (i.e., they became less liquid), so we concentrate on dislocations in interior markets for New York funds which in turn interfered with the transferal of balances to meet local or non-local payments needs. Studies of panics have often been limited to just New York banks and financial markets (e.g., Mishkin 1991; Donaldson 1992, 1993)[2] and/or on the causes and patterns of bank suspensions and failures. Here however we examine the anatomy of the entire network, or at least impacts on regional financial centers, and thus the channels of disruption and propagation. We specify how these shocks disrupt payments networks, in terms of fragmentation and decreased liquidity, and in turn the effects on real economic activity.

I. Private Payments Networks

After the demise of the Second Bank of the United States, making payments at a distance posed a difficult problem in a country characterized predominately by independent unit banks with no central monetary authority or integrated nationwide banking system (see Knodell 1998). It could have been

[2] Carlson (2005), who looks at the pattern and causes of suspensions of interior banks in the panic of 1893, and Wicker (2000) are notable exceptions. Tallman and Moen (1995) pay close attention to the course of the panic of 1907 in Chicago.

accomplished by shipping specie to the payee, but a system of intercity payments involving the physical transfer of cash to settle every transaction would have been a costly one indeed. Unlike the product side, interregional integration of the system of collecting and clearing financial obligations could not be internalized along Chandlerian lines through the formation of large-scale enterprises, due to the prohibition against branch banking. Monetary integration, then, depended on the formation of a "national" banking system to transfer deposits among banks without corresponding shipments of cash. Instead, independent banks developed two types of private networks to facilitate interbank transactions, local clearing houses and correspondent relationships.

In the1850s banks in New York, Boston, Philadelphia, and Baltimore formed clearing associations for the collection and clearing of local checks (Cannon 1910; Gorton and Mullineaux 1987). The spatial gap in the payments system between local clearing houses and between city and country banks was filled by the development of the correspondent banking system. Earlier on "country" banks had come to maintain reserve balances routinely in commercial centers, notably Boston and New York, for the redemption of note issues (see Myers 1931; Weber 2003), and by mid-century a system of bank correspondents with New York as a national center mediating interregional payments had begun to emerge (Bodenhorn 2000, pp. 192-198). The organizational form of these networks of independent banks which developed was a rather novel one, based on longer-term relationships between banks, something between the tighter clubs of urban clearing-houses, which restricted membership and actively monitored operations, and the competitive market.

With intercity or interregional transactions mostly at the wholesale level, between local merchants and suppliers, for example, New York became the national center for clearing and settling interregional payments. "Tradesmen everywhere have dealings with New York City. There is not a store in the country which does not receive either directly or indirectly certain of its supplies from that city" (Johnson 1905, p. 79). New York funds were readily acceptable means of payment everywhere because so many agents made payments there. Drafts or other credit instruments payable in New York City drawn on the local bank's correspondent account there consequently became the most common medium for settling debts not just between interior cities and New York, but even between agents in different communities.

Toward the end of the nineteenth century, with the diffusion of deposit banking, checks drawn on individual accounts began to displace New York drafts as the instrument of payment in intercity trade. This in turn posed a problem for a centralized system of clearing and collection because banks were legally obliged to redeem checks at par only if they were presented for collection at their counter. Although clearing and collection of intercity/interregional payments had become more time consuming and complicated, the correspondent banking system provided a framework to facilitate them. Banks

relied on their correspondents or correspondents of their correspondents to collect checks drawn on "foreign" banks. Settlement was still generally accomplished by the issue of a draft on a financial center, usually New York, in interregional transactions. The geographical concentration of reserves that developed with the draft system continued in spite of the change in the standard payments instrument from drafts to checks.

New York balances or exchange were traded among local banks in interior cities, thereby allowing them to adjust the level of their correspondent accounts. Business customers sold exchange to their banks by depositing drafts or checks drawn on a New York (or other money center) bank. Banks would remit these items to their correspondent for collection and receive payment usually in the form of ledger entries to their correspondent balances, rather than shipments of cash. Thus, in the course of providing routine payment services to business customers, banks would deplete and replenish their correspondent balances. In turn, at any point in time, they could find themselves with deficient or excess correspondent balances. To remedy these imbalances, banks could arrange to ship cash to or from their correspondents, but would then incur significant transactions costs.

As an often cheaper alternative, banks developed a local wholesale or interbank market in exchange where they bought and sold surplus correspondent balances. Such a transaction – e.g., the purchase of a New York balance with vault cash – simply converted one form of excess (or clearing) reserve into another and so enabled banks to manage their overall portfolio of excess (or clearing) reserves. The price of New York funds, the domestic exchange rate, therefore was a function of the forces of local demand and supply and a direct measure of the cost of making long-distance payments. These internal exchange rates, representing the premium or discount which $1000 in New York funds commanded in the local market, were commonly quoted in the business or financial press. A positive number indicated New York exchange sold at a premium, and a negative figure, a discount. Thus, if the rate in Minneapolis was 50¢, $1000 in New York sold for $1000.50 locally, or at a .05 percent premium.

This system of internal or inland exchange rates was a fixed rate regime in normal times since the value of a dollar (in terms of gold) in New York was the same as that of one in Chicago. The spot price of New York funds in Chicago could differ from the mint parity exchange rate (one) within the currency points, the cost of shipping cash from Chicago to New York or *vice versa*, without eliciting an interregional/intercity currency flow (analogous to the gold points in the foreign exchange market under the gold standard). However in periods of panic and restrictions of cash payments the usual bounds defined by shipping costs of course did not apply.

II. The Panics of 1893 and 1907

The New York stock market collapsed in early May, 1893 with the failure of the National

Cordage Trust. Nevertheless, most of early financial disruptions occurred in interior cities rather than in New York with panics and bank runs in several interior cities. These continued through July in such cities as Portland, Kansas City, Denver, and Louisville (Wicker 2000, pp. 65-77) In view of the resultant cash drains to the interior on June 15 the New York Clearing House authorized the issuance of Clearing House certificates as a precautionary measure. These loan certificates, granted by a special committee Clearing House to members upon application and presentation of appropriate bank asset collateral, could be used to settle adverse balances at the clearing house. They thus functioned in effect as a currency substitute in settling local interbank balances and prevented currency drains to other local clearing-house banks. But with continued external drains on reserves on August 3 New York banks restricted cash payments, strongly limiting but not completely prohibiting cash payments to liability holders. This decision was followed immediately by banks throughout the country. The restriction in New York was not however complete and banks continued to ship cash to some degree to interior banks drawing down their bankers' balances (Sprague 1910, pp. 177-178, 182). The period of restriction for New York banks lasted around one month with resumption there beginning on September 2.

In Figure 1 we present daily domestic exchange rates for the period of the panic from five major financial centers-- Boston, Chicago, St. Louis, San Francisco, and New Orleans– as reported to the *New York Times*. The cash restriction date is marked by a vertical line. Exchange rates move strongly negative in the weeks before New York suspension in Chicago and St. Louis. Since domestic exchange rates represent the price of New York funds in terms of local vault cash, when local reserves are relatively scarce New York exchange should sell at a discount (i.e., local funds at a relative premium), while when New York funds are relatively scarce they should command a premium. In contrast, in Eastern cities, such as Boston and Philadelphia (not shown here), New York exchange rather than going to a discount in the weeks before restriction rises to a significant premium. In Southern cities such as New Orleans there was little evidence of disturbance before the restriction date. During the panic period, exchange rates clearly became much more volatile, attaining values far outside the normal currency shipping point bounds.[3] Rates during the period of restriction rose as high as $8 in Boston and $10 in New Orleans. On the flip side, they fell at points as low as -$8 in St. Louis and -$30 in Chicago.

In contrast to 1893 when financial disturbances originated in the interior and eventually led to a crisis in New York, the 1907 panic followed more closely the models of 1873 and 1884 in which the initial crisis occurred among New York banks and its effects then radiated out to the interior. On October 16 when a copper corner by Augustus Heinze collapsed so also did two brokerage houses which

[3] Widely cited figures from just after the turn of the century put express rates per $1000 on currency shipments between New York and four cities as follows: Chicago, 50¢; St. Louis, 60¢; New Orleans, 75¢; San Francisco, $1.50 (Johnson 1905, p. 82).

were involved, and runs developed on three banks associated with Heinze. Although assistance from the New York Clearing House preserved the Heinze banks, the financial disturbance began in earnest less than a week later with runs on New York trust companies. A money pool organized by J. P. Morgan fended off disaster for the trust companies in the near term, but interior bank withdrawals led the New York Clearing House to issue clearing-house loan certificates and suspend cash payments on October 26. From New York, virtually a nationwide restriction of payments resulted in which banks in every financial center except Washington, D.C. participated. Cash payments were not resumed in New York until after the first of the year, a period of suspension more than twice as long as in 1893.

Figure 2 presents daily domestic exchange rates in six financial centers (including St. Paul this time). Again, the restriction date in New York is marked by a vertical line. In contrast to 1893 when the panic moved from interior points to New York, we might expect to observe "normal" conditions in regional domestic exchange markets until the unexpected shock of New York banks' suspension in late October 1907. The patterns of exchange rates show a striking similarity across Eastern and several Midwestern (Chicago, St. Louis, St. Paul) cities here; rates increased sharply after cash restriction by New York banks.

Note that the movements in exchange rates were generally much more violent in 1893 than in 1907. One factor which might underlie this difference is that there were times in which the market completely disappears with no trades taking place (the space between the dots in the figures) and those occurrences seemed to be much more frequent in 1907 than in 1893. In Chicago in 1907, for example, there were no transactions in domestic exchange at all for more than a week after the cash restriction date. Perhaps a better (or at least different) measure of disruptions in the domestic exchange market then during such periods might the number of days in which no rates are quoted. In San Francisco in 1907 the market essentially disappeared with no quotes for two months after suspension.

III. Differences in Severity across Cities

The impact of panic and cash restrictions clearly differed dramatically across cities and across time. Two measures of panic disruption which we could use here are the average and/or range of domestic exchange rates or the number of days over the period in which rates are quoted in the newspaper but no quote for the city in question appears. What factors might influence the severity of the impact of a panic on the local domestic exchange market? Here we examine the extent to which domestic exchange dislocations or perturbations were associated with the balance sheet structure of local banks. Such data for national banks were available for five call dates per year at the reserve city level in

the U.S. Comptroller of the Currency annual reports.

The extent of involvement of reserve city national banks (and central reserve cities, Chicago and St. Louis) in the correspondent banking system is captured by the ratio of 'due to banks,' correspondent balances of country banks held in, say, Chicago, to individual deposits, predominately local claims, or by the ratio of net interbank claims (net due to banks defined as 'due to banks' minus 'due from banks,' bankers' balances held in other reserve city or central reserve city banks) to deposits. The balance sheet data are taken from the call date immediately preceding the onset of the panic– the second, May 4, for 1893 and the fourth, August 22, for 1907. Since there are two alternative measures of disruption,[4] it seems prudent to control for the one while using the other as a dependent variable. The estimation results from panel regressions with fixed effects on the daily data are reported in Table 1. The limited number of observations alas constrains us to just a couple of independent variables, although richer specifications would of course be quite interesting.

Even though the overall fits of the regressions are not that impressive, the results are nevertheless quite suggestive. First of all, perhaps unsurprisingly, the number of no quote days is statistically significantly inversely related to the average exchange rate during restrictions and *vice versa*. More interestingly, the higher the ratio of net due to banks to deposits, the higher the average level of domestic exchange rates or premium on New York exchange (alternatively, the more important deposits were relative to net due from banks, the lower the exchange rate, or the more valuable local reserves were relative to bankers' balances). Similarly, the number of no trade days was also positively associated with the relative level of obligations to interior or country banks. Furthermore, it was the level of due to banks, obligations to interior country banks, that was the statistically significantly more important factor in creating stringency in the local market for New York exchange.

After the panic of 1893 bankers' balance holdings became much more important relative to individual deposits for national banks in many regional financial centers. For example, between our 1893 and 1907 call dates the ratio of due to banks to deposits roughly doubled in Chicago and St. Louis.[5] In turn, these banks held higher levels of balances in New York, but generally somewhat less than proportionally since the ratio of net due to banks to deposits increased a bit in most cities. The premia on

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[4] Both here are calculated over the period of cash restriction, but similar results obtain over the period from the panic onset. By the same token, due to banks ratios relative to total assets rather than deposits produced similar results.

[5] Chicago-- .64 to 1.28; St. Louis-- .65 to 1.28; St. Paul-- .33 to .51; San Francisco-- .36 to .66. In Philadelphia the increase was even larger, .23 to .82.

New York exchange which we generally observe in 1907 reflect, among other things, the increased role of the correspondent banking system and the position of New York in that system (see James, McAndrews, and Weiman 2008). Chicago, for example, experienced local banking panics in 1893 which must have contributed to the large discounts on New York exchange observed there, but such local distress can not account for the large discounts in other cities such as St. Louis, where also the value of vault cash relative to New York funds rose dramatically. Local disruptions of the exchange market, as measured by exchange rate movements or no trade days, in interior financial centers were strongly related to the level of due to bank liabilities at reserve city national banks.

IV. Payments Disruptions

By limiting access to their money center accounts, withdrawal restrictions could seriously, if not fatally, compromise the liquidity of local banks, and in turn deprive their customers of the means to effect vital transactions such as meeting payrolls. Moreover, if agents are liquidity-constrained and so prefer to (or out of necessity must) finance their current payments on the basis of their current cash flows, these disruptions can set off a downward spiraling chain reaction through the payments system. The magnitude of such payments disruptions will depend on many factors, but most obviously and directly on the greater frequency of local cash payments and local banks' excess (clearing) reserves held as vault cash. These two factors are clearly related. If the non-bank public conducts a larger share of its transactions in cash – or equivalently if banks function more as "coat checks" storing customers' cash until needed – banks will tend to hold larger shares of their excess reserves as vault cash. Excess cash reserves will provide banks with an initial buffer that may tide them over a short, mild suspension shock. If it persists, however, customers' normal and "panicky" cash demands will deplete banks' excess reserves. Responding in kind, local banks will also restrict payments, which will have more severe effects because of customers' greater reliance on cash payments.

In the alternative scenario banks economize on their excess cash reserves, because their customers conduct a larger share of payments in drafts and checks – so called "credit instruments." Unlike cash payments, they can be settled through the transfer of correspondent deposits through the (local or distant) clearinghouse without any withdrawal of funds. In turn, they hold larger excess correspondent balances because of uncertain clearing demands, especially from customers' less predictable check payments. In this case the impact of a cash restriction is potentially greater, especially if customers run on the banks and increase their cash relative to deposit transactions. On the other hand, the impact of a restriction will be weaker, if customers continue to rely on some form of bank money,

which can be settled through the transfer of their "frozen" correspondent balances.[6]

As we have shown in earlier work (Weiman and James 2006), the Panic of 1893 and resulting depression was a significant watershed in the formation of the modern U.S. payments system, characterized by the greater use of check transactions relative not only to bank drafts but also to cash. With the diffusion of deposit banks and check transactions, more cities formed local clearing-houses to mediate local payments and interbank settlement depended more on banks' correspondent balances, not vault cash. Consequently, payments restrictions in 1907 would have had more devastating impacts, at least in theory, if panicky bank customers lost confidence in banks and increased their relative demands for cash and cash payments instruments. Given the differences in velocity between cash and checks (Fisher 1911), real effects could have been even greater in magnitude than would have been predicted by simple money multiplier effect.

We qualify this last prediction, because it abstracts from the complementary institutional innovation of the clearing-house organization which enabled banks to mount a collective, not individual, response to the withdrawal restrictions. Clearing-houses had assumed a critical lender of last resort function, supplying member banks with loan certificates as substitutes for cash reserves in clearing-house settlements (Timberlake 1984; Roberds 1995). During the 1907 panic, they greatly broadened the scope of their quasi-central-bank authority by issuing low-denomination loan certificates which circulated as cash substitutes. Of dubious legal authority, this innovation could effectively tide local banks over the potential restrictions storm, if it restored customers' confidence in the banking system, not individual banks.

Andrew (1908b, p. 502) chronicles the nature of local cash payment restrictions during the Panic of 1907. Inquires sent to banks in all cities with populations greater than 25,000 revealed that in two thirds of them banks restricted cash payments to some degree, with Washington, D.C being the only financial center not to restrict. In some cities bank customers were limited to a total cash withdrawal (of, say, $25 or $100); in others, daily withdrawals were restricted to $25, or $50, or $100 per day; in many or most cities including New York the restrictions were "discretionary."[7] Such limitations on the ability of

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[6] Again, the willingness of banks and the public to hold these 'coat checks' rather than convert them into cash is crucial. Otherwise, situations might become as in Louisville in 1893, where business was "almost at a standstill, banks declining to receive country checks even for collection and preferring not to handle New York exchange" (*Bradstreet's*, August 12, 1893, p. 511).

[7] Refusals by New York banks to pay out cash for their interior correspondents in 1907 are described in Senate Document No. 435 (U.S. Senate 1908). In 1893 restrictions were discretionary as well. "The majority of New York institutions continued to pay cash on demand to all depositors, and

bank customers to convert their deposits into cash most probably had serious and immediate effects. To the extent that checks were not readily acceptable everywhere and that recipients were not content simply to deposit them into their accounts, bank liabilities did not fully fulfill their role as a medium of exchange. Rockoff (1993) argues that this fact alone represented a decrease in the quality-adjusted money supply and could have disrupted planned spending. Moreover, business firms, unable to procure cash to meet payrolls, were forced to layoff workers and shut down plants. Sprague (1910, pp. 202-203) noted that while in July, 1893 newspapers published many accounts of factories closing due to failures, inability to make collections, or to obtain credits from banks, by August, after restriction, the most frequently cited cause had become the inability to procure cash to make payrolls. Toward the end of the month however some factories began to reopen and cash payments were restored in September.

Difficulties in meeting cash payrolls appeared to have been less pronounced in 1907 than in 1893 (Sprague 1910, p. 290)[8] even though Andrew judged the 1907 panic as the more disruptive to local payments. "Probably the most extensive and prolonged breakdown of the country's credit mechanism which has occurred since the establishment of the national banking system... Even during the critical periods of 1873 and 1893 it is unlikely that as many banks limited the payment of their obligations in cash" (1908b, p. 497). The 1907 panic was characterized by the extensive issue of local emergency currency or currency substitutes.[9] Banks in many localities issued small denomination clearing house certificates, obligations of the clearing house which could circulate from hand to hand (as opposed to the traditional large denomination ones used in interbank settlement); clearing house checks, again typically in small denominations and payable through the clearing house (i.e., not convertible into cash), but drawn on particular banks; cashier's checks in convenient denominations which were "practically circulating notes"; New York drafts in denominations of $1 up (in Birmingham); negotiable certificates of deposit to be used in local payments; or, finally, pay checks drawn by bank customers upon their banks in small denominations and used for payments of wages (widely used in Pittsburgh) (1908b, pp. 506-512).

In a cross-section the total volume of cash substitutes issued by city in 1907 is regressed on

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those which did refuse cash payments not only offered to such depositors checks on other banks, but cashed small checks without inquiry," but "the banks which did shut down on cash payments to depositors included several of the soundest institutions in the city" (Noyes 1894, pp. 26-27).

[8] Although the *Chicago Tribune* (November 23, 1907) notes that "some plants are idle because of the difficulty experienced in obtaining cash with which to pay employees..."

[9] These instruments were employed in 1893 as well, although not to the extent as in 1907. See Warner (1896).

totals of balance sheet entries for national banks (as of September 1906) and dummy variables for reserve city status. The estimation results are reported below (t statistics in parentheses).

$$\begin{aligned} \text{Totalissue}_i = {} & .1254\ \underset{(3.17)}{\text{Duetobanks}_i} - .1283\ \underset{(-3.65)}{\text{Duefrombanks}_i} + .0458\ \underset{(1.91)}{\text{Individualdeposits}_i} \\ & + 7591.479\ \underset{(2.99)}{\text{Centralreservecity}_i} + 528.285\ \underset{(0.58)}{\text{Reservecity}_i} - 1.760\ \underset{(0.59)}{\text{Population}_i} - \underset{(-0.16)}{132.673} \end{aligned}$$

Adjusted R^2 = .9877; NOBS= 33

Note first of all the symmetry in the effect on the volume of cash substitutes issued between duetobanks and duefrombanks-- one dollar more in obligations to other banks increasing the amount of cash substitutes created, while a one dollar increase in interbank balance holdings decreasing it by a similar amount. More importantly here however, the level of interbank balances held by national banks in the city had a much stronger influence on the volume of issue than did the level of individual deposits (both have significantly positive estimated coefficients however). This result holds even allowing for differences in reserve city status across cities. In particular, central reserve cities seem to have faced much stronger withdrawal demands from their correspondents (given the level of duetobanks), resulting in the issue of more cash substitutes. Such a result supports the observations of contemporaries (Sprague 1910; Andrew 1908a) who primarily blamed country correspondent banks rather than local individual depositors for the large withdrawals creating pressure on reserves thereby leading to cash restrictions and the issue of substitutes. Finally, population is included in the regression as a scaling factor.

Andrew estimated the volume of cash substitutes outstanding during the 1907 restrictions at over $500 million, as compared with a currency stock of $1,810 million in 1907 IV (Friedman and Schwartz 1970, p. 65). "For two months or more these devices furnished the principal means of payment for the greater part of the country, passing almost as freely as greenbacks or bank-notes from hand to hand" (1908b, p. 515).[10] To be sure as Rockoff argued, these instruments must have been imperfect substitutes for true currency, and this deterioration of the quality of the money stock may have had some adverse effects, but at the same time they must have relieved some of the pressure on local banks' vault cash. After all as we have seen, during the 1907 restriction New York exchange was typically at a substantial

[10] The largest component of this total however remained the traditional large-value clearing house loan certificates ($238 million as compared with an issue of $69.1 million in 1893).

premium (until late in the period in any case), indicating that however scarce local reserves may have been, New York exchange was even scarcer. Andrew (1908b, p. 516) concluded that the substitutes "worked effectively and doubtless prevented multitudes of bankruptcies which otherwise would have occurred."

The issue of currency substitutes must have mitigated the problems in making local payments to some degree, even though converting New York balances into vault cash during restrictions remained quite costly. There was no such substitute available however to offset the dislocations of the non-local, interregional payments system.[11] The timeliness and predictability of intercity payments was disrupted, with the only alternative being shipping currency (if available), a process which clearly delayed final settlement of transactions. Such interferences with making payments at a distance and hence with the smooth functioning of the payments system should have had an adverse effect on internal trade. *Bradstreet's* in 1893 noted "the clog to trade shown by prohibitive rates for New York exchange at centers east, west, and northwest" (August 5, 1893, p. 495). Similarly, the *Wall Street Journal* observed in 1907 the "disorganization of domestic exchanges which prevents the free movement of commodities for export" (December 2, 1907, p. 8).[12]

It is, of course, impossible here to isolate precisely the impact of payments disruptions alone from the concurrent effects of credit contraction during panics and cash restrictions.[13] In 1893 panic and also payments disruptions preceded general cash restrictions in several interior cities; in 1907 panic and

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[11] A resolution of the Merchants' Association of New York passed November 21, 1907 read in part: "Checks payable 'through clearing-house only' are useful for local settlements, but do not pay non-local debts. The business of all large manufacturing and mercantile concerns is chiefly non-local, and cannot go on if local funds are everywhere tied up. Interstate exchange is essential to the conduct of interstate business, and this constitutes the greater part of our domestic exchanges. Provision for the settlement of local indebtedness is helpful, but provision for the settlement of non-local indebtedness is essential, and, therefore, still more helpful" (*Bankers' Magazine*, December, 1907, p. 970).

[12] The grain trade seemed to have been particularly affected. "Naturally, there has been some dislocation of the nation's business, notably in domestic exchanges, which has reacted on the collecting and forwarding forces by a time stopping the buying of wheat in the Northwest and of cotton at the South" (*Bradstreet's*, November 2, 1907, p. 698). By mid-month, "One especially hopeful sign has been renewal of grain purchases in the Northwest, exchange checks on larger interior markets being the medium of exchange, thus allowing of the resumption of grain forwarding..." (November 16, 1907, p. 730). In the flour trade, "shipments [were] falling off by reason of difficulty in financing drafts, and the wheat price is now secondary to the question of finance" (*Bradstreet's*, November 23, 1907, p. 747).

[13] For example, between the May 4 and October 4 call dates in 1893 loans of national banks fell by almost 15 percent (Sprague 1910, p. 208).

cash restrictions were only days apart (October 21 and 26). That said, the economy did seem to go into a tailspin during periods of restrictions of cash payments. Monthly figures for four quantity measures of trade and economic activity– freight ton-miles, pig iron production, the Babson (physical quantity) index of business activity, followed by the Miron-Romer monthly index of industrial production (U.S. Bureau of the Census 1949, pp. 332-334; Moore 1961, p 130; Miron and Romer 1990)– for 1893 and 1907 are presented in Figure 3. The NBER-dated business cycle peaks were in January, 1893 and May, 1907 (Burns and Mitchell 1946, p. 78). Clearly the graphs show little indication of a serious downturn in either case until the onset of the financial panics in May, or particularly in June, 1893 and October, 1907, after which time the indicators fall sharply. The months bracketing the restriction periods– July and September in 1893, October and January (1908) for 1907– are marked by vertical lines. The pronounced declines in the series during the cash restrictions period in 1907 are evident. In 1893 the sharp decline begins in June but accelerates after July, with cash restrictions, although this is less evident to the untrained eyeball.[14] Moreover, rather dramatically in virtually every case the decline stops and/or the series turn up with the resumption of cash payments in September, 1893 and January, 1908.[15]

The declines over the periods of cash restrictions in 1893 and 1907 in most cases were quite comparable. The Miron-Romer industrial production index, for example, declined by 16.7 percent between July and September in 1893 and by 21.7 percent between October 1907 and January 1908.[16] The period of cash restriction was twice as long in 1907 as in 1893, so if one thinks of the effects of restriction as being a continuing process– the difficulty of obtaining cash to meet local payrolls or of making payments at a distance– then the per month real effects of restriction in 1907 were less severe than in 1893, even though the cash restrictions in 1907 have been characterized as both more widespread and more severe than in 1893 (1908b, p. 497). There are a couple of reasons why this may have been so. First, the issue and use of local cash substitutes was much more extensive in 1907. Second, by

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[14] Log-linear regressions on time from June to September, 1893 show statistically significant sharper rates of decline after July.

[15] Sprague (1910, pp. 201-02) notes for 1893, "Much of the decline in August, with the subsequent partial recovery, can only be ascribed to the trade paralysis produced by the financial situation at that time." Of course, the economy only stabilized rather than bounced back after resumption, but "after the beginning of September the course of the crisis of 1893 was no longer a banking affair" (p. 209).

[16] Freight ton-miles fell by 10.8 percent between July and September, 1893 and by 10.4 percent between October, 1907 and January, 1908. The declines in pig iron production were 42.2 and 52.8 percent, respectively, while in the Babson index they were 12 and 18 percent.

around the turn of the century checks had become standard payments instruments in interregional transactions (Kinley 1910). To the extent that recipients were willing simply to deposit checks received in their accounts, rather than attempting to cash them, and in turn use the proceeds to issue checks of their own, there would not have been a total collapse of the payments system, although collections may have been rather slower.

V. Conclusion

The private payments networks based on the correspondent banking system which had developed to clear and settle interregional or intercity transactions in the pre-Federal Reserve period were normally quite efficient arrangements. However when the convertibility of New York balances was threatened or limited, these networks were also important channels for transmitting financial pressures. Such restrictions in turn had serious consequences for payments settlement at both the local and interregional level and consequently for the level of economic activity. The degree of disruption to domestic exchange markets in regional financial centers over this period was increasingly a function of their place in these intercity networks rather than local conditions. Banks in reserve cities with larger holdings of bankers' balances from country banks relative to individual deposits experienced greater strains in 1907. On the other hand, the increasing acceptance of checks relative to cash mitigated some of the real shock.

Most contemporary writers (e.g., Noyes 1894; Sprague 1910) thought restrictions of cash payments were disasters, and monthly evidence from 1893 and 1907 suggest that the downturns intensified during these periods. In the more recent literature, the effects of these restrictions have been usually minimized or neglected. Even though widespread bank failures were avoided, the medicine may nevertheless have had serious debilitating effects. Richard Grossman (1993) demonstrates that cyclical downturns were more severe in the national banking period when associated with a financial crisis than when they were not. His simulations show that a relatively small bank failure shock could have led to a 2 percent decline in real GNP, while a large shock would have been catastrophic. Based on the timing of the bank failures and the immediacy of the effects on output, it seems reasonable however to suppose that some of the short-run adverse effects, perhaps most, of what Grossman attributes to bank failures may well have been the impact of payments system disruptions.

Prevention of such widespread and severe disruptions of the payments system in the wake of financial crises was the fundamental financial reform issue to many or most contemporaries and led directly to the establishment of the Federal Reserve system. A principal feature of the new central bank was the nationalization of the interbank settlement network. Fed institutions such as the gold settlement

fund and Fedwire (for telegraphic transfers of reserves) replaced their private analogues, New York balances held to settle payments and the domestic exchange markets.

The Fed's takeover of the interbank settlement system was not peculiar to the U.S. payments system. According to the most recent survey of payments systems by the Bank for International Settlements (2005), central banks own and operate the main large-value (interbank) payments network in virtually all developed economies, either outright or in a partnership arrangement. What distinguishes the U.S. payments system from that of other countries and remains controversial to this day was the Fed's entry into the check clearing system and the relative efficiency of public and private clearing systems (Stevens 1996; Lacker, Walker, and Weinberg 1999; Gilbert 2000). However even today in the face of the increased privatization of the payments system spurred in large part by the Monetary Control Act of 1980, the Federal Reserve still plays an potentially crucial role as the clearing house of last resort in financial crises (Summers and Gilbert 1996; James and Weiman 2005).

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Table 1
Balance Sheet Panel Regressions
(t statistics in parentheses)

Independent variable	Dependent variables						
	xrateaverage	notradedays	netduetobanks/deposits	duetobanks/deposits	constant	R^2	Prob>F
notradedays	-3.8015 (2.92)		113.186 (3.30)		-26.500 (-2.12)	.0143	.0987
notradedays	-2.5265 (-3.33)			60.3037 (4.52)	-25.056 (-2.83)	.0592	.0452
xrateaverage		-0.1947 (-2.92)	27.6489 (5.62)		-7.1764 (-4.28)	.0007	.0251
xrateaverage		-0.3114 (-3.33)		21.2247 (4.61)	-9.4111 (-3.87)	.0011	.0429

Note: Boston, Chicago, St. Louis, New Orleans, San Francisco

Figure 1: Daily Domestic Exchange Rates in the Panic of 1893

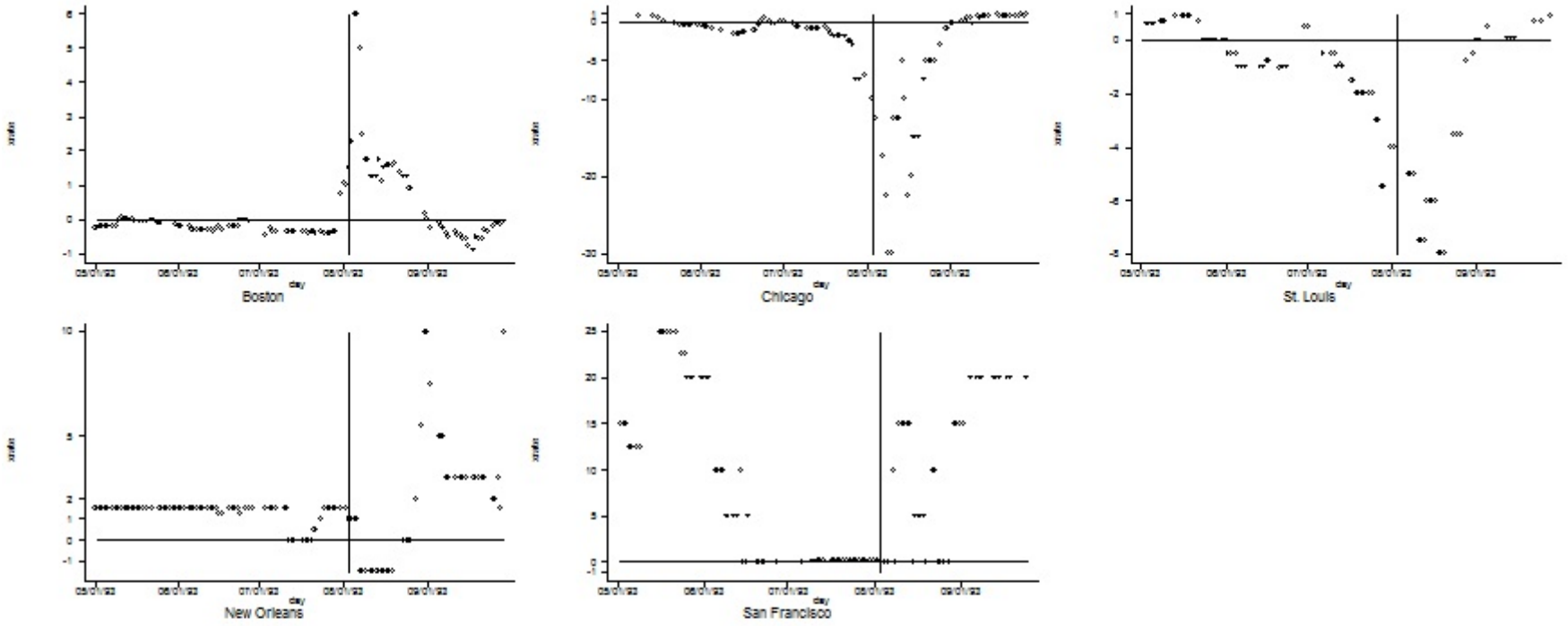


Figure 2: Daily Domestic Exchange Rates in the Panic of 1907

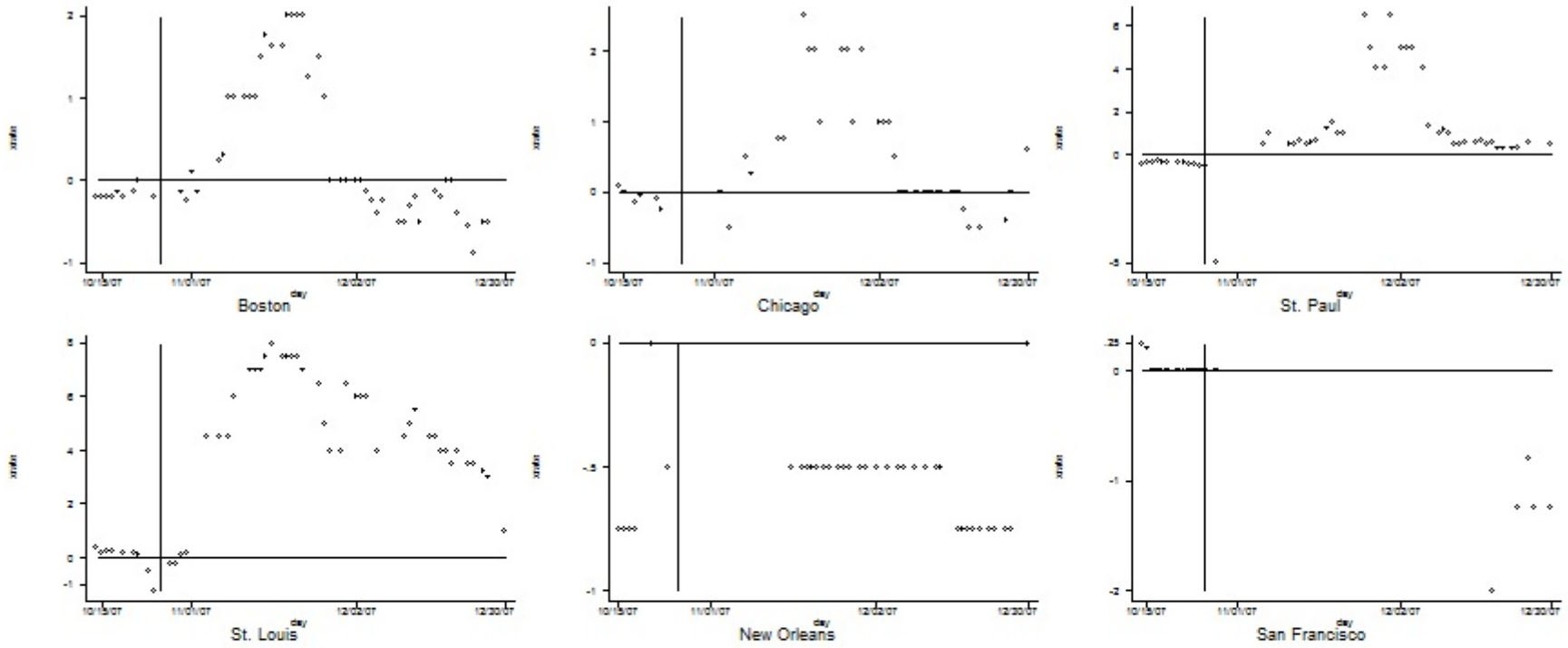
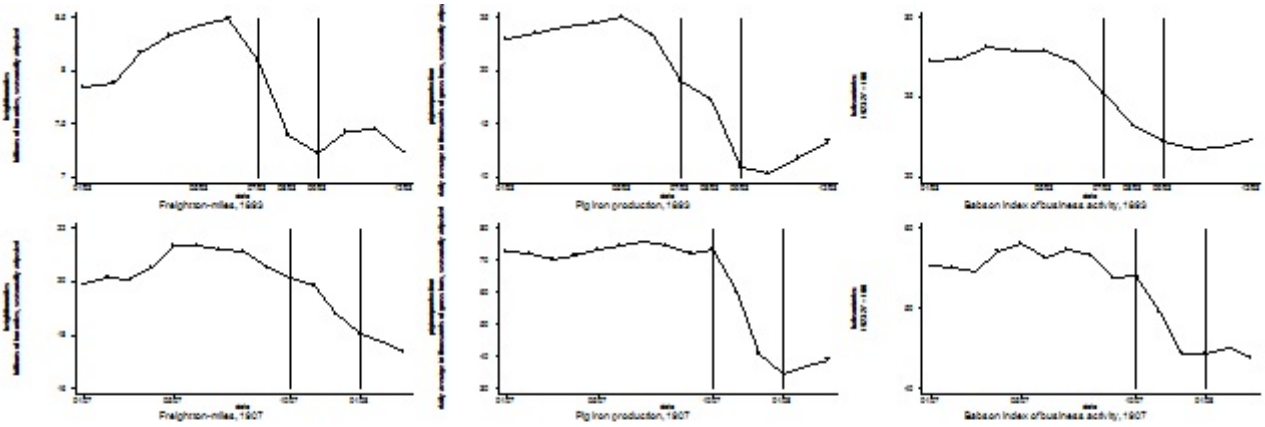
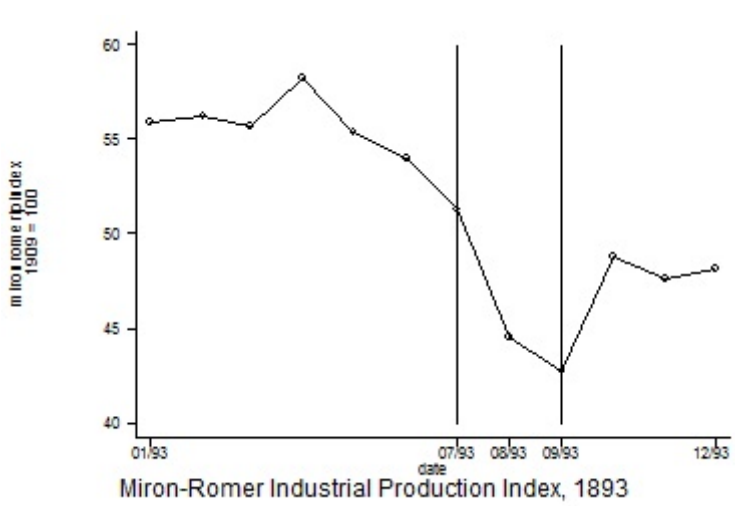
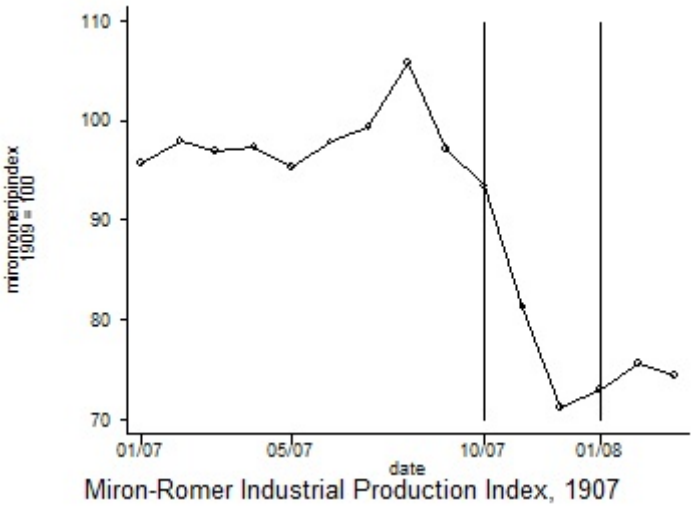


Figure 3: Monthly Indicators of Economic Activity in 1893 and 1907





Miron-Romer Industrial Production Index, 1893



Miron-Romer Industrial Production Index, 1907