From Drafts to Checks: The Evolution of Correspondent Banking Networks and the Formation of the Modern U.S. Payments System, 1850-1914*

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ABSTRACT

Despite their continued prevalence in the U.S., checks circulated locally until the 1890s. We explain their lagged spatial diffusion by the evolution of centralized payments institutions to coordinate transactions among myriad banks, not real technological changes to "annihilate" distance. The pivotal institutions were large correspondent banks especially in New York. By the early 1890s New York funds constituted a national settlement medium, and the concentration of bankers' balances in New York yielded liquidity and other externalities smoothing the flow of check payments. Despite the efficiencies of correspondent banks, they unlike the Fed could not readily adopt newer electronic technologies.

Despite the greater efficiencies of electronic payments instruments, paper checks remain the principal non-cash payment instrument in the U.S., whether measured in terms of the frequency (45.3 percent) or value (59.1 percent) of transactions.[1] While the use of checks has declined relatively and absolutely since the mid-1990s, "creative destruction" in the U.S. payments system has proceeded at a glacial pace especially in comparison to other OECD countries (Humphrey, Pulley, and Vesala 2000; Hancock and Humphrey 1998). These trends have reinforced the distinctiveness of the modern U.S. payments system compared to that in continental Europe (except France), initially expressed in their adoption of alternative paper instruments, debit check versus credit giro transfers.[2]

From a historic perspective, the delayed spatial diffusion of a new payments technology should come as no surprise. The emergence of checks as a *national* payments instrument in the U.S. is a case in point. By the mid-nineteenth century deposit banking had rapidly spread in the largest commercial centers, and check transactions had become the preferred payments instrument in local wholesale trade.[3] Checks did not generally circulate beyond city limits until the mid-1880s, and according to David Kinley — the contemporary authority on the U.S. payments system — only by the turn of the 20th century would checks become the "preponderatingly method of payment" in local and long-distance wholesale trade.[4]

The long lag of at least 40 years in the spread of checks from a strictly local to a national payments instrument in wholesale trade raises similar questions as does the parallel trend in the diffusion of electronic payments instruments. Contemporary observers of the American banking scene recognized the

[1]Gerdes, Walton, Liu, and Park (2005); Gerdes and Walton (2002). Credit card and Automated Clearing House (ACH) payments accounted for 23.4 and 37.3 percent of the total value, respectively. The latter figure probably overstates the importance of ACH payments, the vast majority of which (2/3) were used for internal corporate transfers.

[2]Hein (1959); BIS (1999); and BIS (2006). In debit transfers payees receive an IOU, redeemable at the payer's bank. In credit transfers the fund are directly transferred to the payee's account.

[3]In the 1850s large money center banks specialized in issuing deposits relative to notes and organized the first check clearinghouses (Cannon 1910; Gorton 1985). Like bills of exchange, checks were used in regional transactions only between familiar parties (Colwell 1860, p. 250).

[4]Kinley (1910, p. 123; and 1897); Preston (1920). Without firm quantitative evidence, we rely on qualitative sources to corroborate Kinley's claim. They document the use of checks in non-local transactions by the mid-1880s, but their routine national circulation only after the Panic of 1893 (James and Weiman 2006; Gilbert 2000, p. 125; and Baxter 1983, pp. 559-60). Citing Claudius Patten, the Federal Reserve Bank of Richmond (1926a, p. 380) dates the transition in the early 1890s.

advantages of substituting checks for currency especially in making large-value payments. For buyers, checks were a more convenient, secure, and verifiable payments instrument (Colwell 1860, p. 243; Gibbons 1858, pp. 111-13, 138; NYCHA 1873, p. 12) Additionally, they could and did exploit the float often by writing checks in anticipation of future deposits.

The last item — the implicit extension of credit to payers — highlights the significant risk and cost of check transactions. To minimize potential default losses and to satisfy legal standards, payees and their banks incurred significant transactions costs to expedite the return of checks to the paying bank for collection. In turn, payers' banks faced greater liquidity risks because of more frequent uncertain check redemptions and of their potential liability for uncovered certified checks (Kahn and Roberds 1999).

In late antebellum America, according to Colwell (1860, pp. 241-50), the benefits of a check payments system exceeded these costs and risks only in the local wholesale trade of large commercial centers. Geographical proximity certainly mattered, as it lowered transportation and communications costs. As important was the density of recurrent "mutual" trades among local agents. Under these conditions they gained the "knowledge and confidence" necessary to accept each others' check IOUs, and their banks received offsetting deposits that bolstered their liquidity, even if they had to cover their customers' occasional overdrafts (McAndrews 1999).

Still, Colwell (1860, p, 637) argued, an economically viable check payments system depended on the formation of a local clearinghouse. The problem, as he saw it, stemmed from the highly fragmented American banking system, which dispersed the vast flows of payments among a large number of independent banks and magnified the transaction costs and risks of their increasingly complex bilateral transactions. Through a centralized exchange banks could conduct frequent clearings lowering their float costs, but still reap the economies of bulk check shipments. And they could economize on liquidity costs by accumulating their offsetting credits and debits and then periodically (e.g., once or twice a day) settling their net positions.

Beyond the city limits Colwell (1860, pp. 628-40) proposed the formation of a national payments authority to knit the thousands of banks across the country into a centralized check clearing and settlement system. Conscious of the recent political controversy over the Second Bank of the United

States (BUS), he opted for a purely public institution that would avoid conflicts of interest in regulating potential rivals. As a second best solution, he (1860, pp. 271-72, 480-81) recognized the benefits from an alternative form of centralization, the concentration of correspondent relations and balances in commercial centers. He regarded New York banks as the apex of this more loosely configured interbank network, because most banks had already established a correspondent there and so could clear and settle their mutual claims on the books of these New York banks.

Colwell's analysis implies that the emergence of checks as a national payments instrument awaited complementary institutional innovation, not real technological changes. We elaborate Colwell's institutional hypothesis, but for the obvious reason of timing emphasize his second-best solution, a hierarchical network of correspondent banks centered on New York. Improvements in rail and telegraph services, by contrast, were a necessary but historically prior condition for the growth and consolidation of a national market and along with it the spread of deposit and correspondent banking.[5]

Our analysis is divided into three parts. Section one analyzes two central but less familiar features of the post-Civil War U.S. payments system, regional domestic exchange markets and bank drafts drawn on correspondent accounts. The very existence of regional domestic exchange markets reflects the more decentralized U.S. payments system, in which interregional claims were settled by buying and selling distant funds rather than administered interbank transfers. Trends in domestic exchange rates, in turn, provide a metric of payments system integration and efficiency. Contrary to expectations (notably of the architects of the National Banking System), bank drafts supplanted national bank notes as the payment instrument in long-distance wholesale trade after the Civil War (Redenius 2006; James and Weiman 2005). Paralleling the spread of deposit banking, the increasing use of drafts spurred the transformation and growth of the correspondent banking system.

[5]Prescott and Weinberg (2003, pp. 450-51) emphasize real innovation, but also mention the spread of credit-reporting agencies. According to Chandler (1977), a seamless telegraph-railroad network forged an integrated national market by the early 1880s (see also Fishlow 1966; and Porter and Livesay 1971). As corroborating evidence, Harley (1978, pp. 219-21) shows the dramatic convergence by 1880 of wheat prices nationally and internationally. And as early as 1869 the R.G. Dun and Company published standardized credit reports on companies throughout the U.S. (see its collections in the Harvard Business School Baker Library; and Norris 1978).

In section two we use Comptroller of the Currency data on interbank draft payments to delineate the correspondent relationships among country, reserve, and central reserve national banks in the early 1890s. By this date these interbank connections had gelled into a loosely knit hierarchical hub-and-spoke network centered on New York. Because of the pivotal position of New York correspondents, section three analyzes regional markets for New York funds, which "served increasingly as a universal settlement medium" (Lacker, Walker, and Weinberg 1999, p. 6). We track the sharp decline in the variability of domestic exchange rates, our measure of payments system integration, in the late 1890s and through regression and other evidence relate this trend to the surge in correspondent balances held by regional center banks. This robust negative correlation, we suggest, shows the impact of mounting externalities in a more centralized payments system, notably the greater liquidity of correspondent balances in New York that underwrote credit lines to smooth the flow of payments (Goodhart 1998, pp. 33-37; Green and Todd 2001, p. 26).

In the conclusion we consider Colwell's contention that only a public authority could remedy the defects of the fragmented U.S. payments system. Our context is the recent debate over the Fed's entry into the check payments system in 1915, that is over the virtues and limitations of "hierarchies versus networks" in regulating and coordinating this vital infrastructure (see Stevens 1996; Lacker, Walker, and Weinberg 1999; and Gilbert 2000). We concur with the Fed's critics that the correspondent banking system worked tolerably well. Still, as the evidence suggests, Fed intervention rationalized banks' reserve management and the interregional check collection system. Consistent with our (and Colwell's) hypothesis, the Fed served as coordinator of technological and operating standards in the payments system (James and Weiman 2005).

1. Making Long-Distance Payments, 1850 to 1900

The transformation of the U.S. long distance payments over the latter half of the nineteenth century ran the gamut of bank payment instruments (Roberds 1997; Kahn and Roberds 1999; Prescott and Weinberg 2003). The bookends of this historical process were bearer notes issued by state-chartered

banks and individual checks drawn on state and national banks. They are distinct bank liabilities and so constituted distinct modes of payment.

Bearer notes are direct, negotiable claims on a bank's assets. They were convertible on demand at the issuing bank's office into an equivalent (or par) value of legal tender money, but could also be transferred from hand-to-hand through the course of trade. In the latter market transactions their relative value varied according to the reputation of the issuing bank and the organization and technology of note redemption. Under ideal conditions specified below, state bank notes were as good as gold and so could circulate for longer time periods and over longer distances, before they were redeemed for specie or swapped for fresh issues.

Individual checks, by contrast, are payment orders to transfer funds from a customer's deposit account to the designated party and so only a contingent claim on the bank's assets. Before the Fed, banks were legally obliged to honor these claims in full, when they were directly presented for payment at their offices and after they verified the payer's signature and account balance for sufficient funds.[6] This last step pinpoints the additional, more idiosyncratic source of default risk in check transactions.[7] This greater uncertainty limited the circulation of checks, which were instead immediately returned to the issuing bank for clearing and settlement.

The diagrams in Figure 1 trace out the payments pathways of bank note and check transactions and, in turn, their distinct clearing and settlement networks. In both cases the buyer acquires a bank's note or deposit liabilities in exchange for an IOU, and then makes a purchase. The bank note transaction immediately transfers the bank's liability to the seller (see #1 in Figure 1a). If the notes are sufficiently liquid, they can circulate from seller/buyer to seller/buyer, until they are finally returned to the issuing

[6]Banks were legally required to redeem checks on demand at par, only when they were directly presented for collection at their office. Remitting checks to the paying bank by mail could have been considered negligence (Spahr 1926, p. 104).

[7]With an endorsement checks were transferred to third parties, although their circulation was limited in scope. Local stores, like check-cashing outlets today, typically provided this service to their regular customers (Kinley 1895, p. 206; Caskey 1994).

bank for redemption. These intervening steps constitute a decentralized "peer-to-peer" network, mediated by a series of market relationships (see #2). Each new buyer, in effect, sells notes to the counterparty at the prevailing market price.

Through these transactions, the notes of distant ("foreign" or "country") banks tended to gravitate to commercial centers where they were traded and priced in an open market (see #3 in Figure 1a). Specialized intermediaries such as note brokers, dealers, and private bankers plied the bank note market to exploit interregional and intertemporal arbitrage opportunities (Sylla 1976; Knodell 1998a; Bodenhorn 2000, ch. 5). Through bulk purchases, they realized lower cost and more frequent shipments of notes to issuing banks for redemption. They also held inventories of notes in their asset portfolios and resold them later at a premium for local currency or commercial paper such as bills of exchange.

Banks in commercial centers also participated in the open note market as buyers of "foreign" notes and sellers of their own. By the 1850s, however, many large banks had negotiated complementary correspondent relations with country banks.[8] They agreed to redeem (buy) their respondents' notes at par or a small fixed discount in exchange for a minimum reserve balance (see #4 in Figure 1a). Through the visible hand of these administered relationships rather than open market transactions, correspondents rendered country bank notes a more liquid payments instrument and so supported their circulation over longer periods of time and distances.

For check transactions the payments pathway was completely internalized within the banking system. In this case correspondents in large commercial centers were *the* pivotal intermediaries, coordinating the flows of information and funds. Upon receipt of deposited checks, the seller's bank immediately shipped them to its correspondent for collection (see #1). The correspondent arranged for direct presentment of the items either through its local clearinghouse or an agent located near the issuing bank (as shown in

[8]Organized in 1824, the Boston-based Suffolk system was perhaps the first, if not most (in)famous, example of this early correspondent system (Bodenhorn 2002; Calomiris and Kahn 1996; Rolnick, Smith, and Weber 1998). In the mid-1820s New York city banks attracted note redemption balances from banks in its trade area (Myers 1931, p. 105). For examples in other port cities, see Bodenhorn (2000, pp. 192-98) and Weber (2003).

Figure 1b, #2). The buyer's bank, in turn, relayed the information authorizing the check payment to its correspondent (see #3), which then settled the transaction by transferring reserve deposits to the correspondent account of the seller's bank (see #2). The seller's bank would then be notified of the deposit (see #1).

Bank drafts are a cashier's check, drawn on the bank itself or as we emphasize a correspondent account. They constitute an intermediate payments instrument theoretically, not just historically. Like bank notes, drafts are a direct claim on the bank's assets, but like checks they had to be cleared and settled through the banking system. This blend of properties significantly lowered the transactions and float costs and attendant risks of draft versus check payments. The key difference can be illustrated in Figure 1b. Unlike individual checks, clearing and settling bank drafts avoided the additional steps and time in transmitting information between paying banks and their correspondents (see step #3 and Gilbert 2000, pp. 123-28). Instead, the correspondent of the paying bank directly authorized the bank draft and transferred the funds to the correspondent of the seller's bank. The correspondents, then, notified their respondents of the transaction, a debit and credit to their respective accounts.

The market for New York drafts operated at the retail and interbank levels. Banks sold drafts to business customers making payments in New York or another domestic location. Business customers also deposited New York drafts in their banks, which remitted them to their correspondent for a credit to their reserve account. Thus, in the course of providing retail long-distance payment services, banks would deplete and replenish their New York balances.

At any point in time, banks could find themselves with deficient or excess deposits in their correspondent accounts. To remedy these imbalances, they could ship specie or currency, but would then incur significant transactions and liquidity costs and risks.[9] As an alternative, they formed domestic exchange markets for buying and selling surplus correspondent balances, that is drafts drawn on their correspondent accounts. Through these transactions, banks simply converted one form of excess reserve

[9]As early as the 1850s specie shipments were rare (Colwell 1860, pp. 135, 190, 262, 447).

(e.g., vault cash) into another (e.g., a New York deposit) and so more readily managed their clearing reserves for customers' local and long-distance payments. Thus, akin to the federal funds market today, the local domestic exchange market determined the marginal cost to banks of transferring funds across space, not time.

The system of domestic exchanges was a fixed exchange rate regime, in which one dollar in New York and (e.g.) Chicago were equal in value. Depending on supply and demand conditions, however, the price of New York drafts could command a premium or discount. In commercial centers with specialized agricultural hinterlands like Chicago (or New Orleans), the price of New York funds fluctuated over the course of the year with the strong seasonal shifts in trade flows and resulting balance of payments. During the spring planting season when farm households and so local merchants stocked their shelves with goods purchased from New York wholesalers, the demand for New York exchange and hence exchange rates surged. After the fall harvest and the sale of crops via New York brokers, balances held in New York banks were replenished and were sold at lower prices, even at discounts.

While buffeted by these systematic seasonal (as well as cyclical) forces, domestic exchange rates could only vary, at least in principle, within the limits set by the cost of shipping specie or its paper currency equivalent.[10] If the market rate on New York balances exceeded (or fell below) these levels, it would have been more profitable for banks to ship currency instead of buying (or selling) exchange. Analogous to the foreign exchange market under the classical gold standard, the diagram in Figure 2 depicts the currency shipping points, which bound the demand price from above and the supply price from below. The actual market rate, no doubt, depended on more idiosyncratic factors, influencing banks' reserve positions and so their participation in the market, whether on the demand or supply side.[11]

[10]See Bolles (1888, p. 134). Our simple model assumes an exogenous market supply, determined by systematic factors, and symmetric shipping points. By substituting paper currency for gold coins, banks could save around 20 to 25 percent on express freight rates (U.S. Bureau of the Census 1908, pp. 24-25).

[11]Without more direct information, we infer the organization ("microstructure") of domestic exchange markets from a variety of sources (Bolles 1888, pp. 36; see also the references in James and Weiman 2006). We believe that they operated like over-the-counter or curb markets, adjacent to more established exchanges such as the local board of trade or bank clearinghouse (Stoll 1985; Garbade and Silber 1979b;

This simple model yields two related implications for our empirical analysis below. Any innovations in express freight service such as more efficient rail transport would reduce the currency shipping points (represented by the dotted lines in Figure 2) and so the range of exchange rate fluctuations. In other words, the variability, not level, of exchange rates gauges the efficiency of transferring funds across space and so payments system integration. Greater exchange rate volatility, after all, directly increases the "risk and uncertainty" of making long-distance payments and so constitutes a potential barrier to trade and capital flows (Garbade and Silber 1979a, pp. 7-8). Viewed alternatively, the diminished variability of domestic exchange rates would enable local agents to predict with greater certainty the value of New York exchange (in terms of local definitive money) and so readily adjust their terms of trade.[12]

As a corollary, persistent deviations from par cannot be taken as evidence of a fragmented payments system. Because of chronic balance of payments deficits and segmented capital markets, the price of New York exchange especially in peripheral regions could hover above par but within the currency bands for extended periods of time. In turn, financial innovations that increased short-term interregional capital flows would reduce the variability of regional exchange rates. While admittedly stylized, the diagram in Figure 2 illustrates the relevant historical example. In this case the dotted lines represent the fixed terms for borrowing and lending New York balances, quoted by correspondent banks. Instead of buying New York exchange from local banks in the domestic exchange market, a deficit banks could simply draw on a credit line from its New York correspondent for which it paid a fixed, implicit price. These administered transactions, in turn, could limit the fluctuations in exchange rates within the bands set by the shipping points and ultimately displace regional domestic exchange markets.[13]

Grossman and Miller 1988). Such idiosyncratic factors as the timing of customers' sales or payments would affect whether banks experienced a temporary excess or shortfall of correspondent balances and so attended the daily auction to quote an ask or bid price on New York funds.

[12]Following Garber and Weisbrod (1992, p. 3), this property implies the liquidity of New York exchange, which would command a "well-known and stable value relative to the [local] unit of account."

[13]Banks also loaned excess reserves to correspondents for a nominal interest rate of 2 percent (James 1976b; Gendreau 1983). Officer (1985, pp. 561-62) makes an analogous distinction between external and internal integration of U.S. foreign exchange markets, where the latter depends on market developments that "keep the exchange rate within the spread."

2. The Evolution of a National Correspondent Banking System

The diffusion of deposit-based payments instruments after the Civil War transformed the nature of correspondent banking and spurred the formation of a tiered national correspondent banking system. The correspondent business predated these payments innovations. Antebellum correspondents were vital intermediaries, supporting the wider circulation of bank notes as well as other long-distance payments instruments, domestic bills of exchange and drafts.[14] Following the dictum that finance follows (wholesale) trade, New York had emerged as the preeminent correspondent banking center by the 1850s. Fueled by transport and commercial innovations, its increasingly pivotal position in domestic and international trade greatly enhanced the value of a New York correspondent's redemption and payments services.[15] Net correspondent balances in New York City banks surged from an average of $2.24 to $11.8 million between the late 1830s and late 1850s or by more than five-fold (Bodenhorn 2000, p. 196; see also Myers 1931, pp. 103-25). Over the same period the correspondent business of its nearest rivals in Philadelphia and Boston grew by only 38.9 percent and 140.4 percent, respectively.

The share of New York banks in the correspondent market increased significantly and in fact peaked immediately after the Civil War (Redenius 2004; James and Weiman 2005). The National Banking Acts were an important factor, as they placed New York at the apex of a hierarchy of note redemption and deposit reserve centers. New York's position as a deposit reserve center seems to have been the more important draw. In 1870, for example, 90 percent of all viable national banks maintained a New York correspondent, but only 71 percent lodged their note redemption reserves with a New York agent.[16]

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[14]Catterall (1902, pp. 141-42); Hammond (1957, p. 318); and Knodell (2003). Because bills were typically payable in large commercial centers, banks remitted maturing items to their correspondents for collection and often received payment via credits to their correspondent accounts. Instead of repatriating the funds, they could supply y business customers with drafts drawn on their balances.

[15]By the 1840s New York City was the national "jobber" center, where imports and regional manufactures were transhipped in smaller "job" lots "to far-off country storekeepers" (Burrows and Wallace 1999, p. 436; Porter and Livesay 1971, pp. 52-53). Burrow and Wallace explain its centrality by three transport-commercial innovations: the steamboat, Erie Canal, and regularly scheduled packet lines.

[16]*Homan's Bankers' Almanac and Register* (1870); Redenius (2004, p. 25). *Homan's* presumes that the default correspondent of a national bank is located in New York. Still, 3 percent of banks reported a correspondent in another city, and 7 percent, no correspondent at all.

Several banks, in fact, listed private banks or dealers as their New York correspondent, even though they were not official reserve agents.

The agglomeration of correspondent relations turned New York drafts into a national payments instrument. Viewed alternatively, New York correspondent balances became a generally accepted *national* means of payment, i.e., "domestic exchange." Because virtually all banks maintained a New York correspondent, buyers and sellers regardless of their location could use New York drafts to complete non-local transactions. Buyers could purchase New York drafts locally, while sellers could deposit New York drafts in local banks, which then forwarded the items to their New York correspondent for clearing and settlement.

When viewed schematically, New York correspondents in the early 1870s constituted the central hub of a simple hierarchical interbank network (see Figure 3a). Because of the interdependent demands for correspondent relations, the vast size and scope of this network significantly enhanced the systemic value of New York balances and drafts.[17] In addition to the greater convenience of a New York correspondent, banks realized significant economies of transactions and liquidity costs, akin to those of clearinghouse members, that offset the fixed opportunity cost of maintaining a minimum clearing balance.[18]

The spread of deposit banking after the Civil War spurred the increasing scale and geographic scope of draft transactions and in turn the demand for local correspondents, especially in centers near or in areas of recent settlement (Conzen 1977; see also Meyer 1980). Exploiting their geographic proximity, correspondents in interior transport hubs and regional commercial centers mediated the increasing

[17]See Economides (1996); Saloner and Shepard (1995); and Gowrisankaran and Stavins (1999). Viewed in terms of this literature, New York correspondents realized a critical mass of respondents, especially large banks in regional money centers.

[18]Contemporaries noted the significant economies from the bulk shipment and processing of drafts and checks (*Bankers' Magazine* December 1883, pp. 456-58; February 1898, pp. 222-23, 227; July 1898, pp. 69-70; October 1901, p. 627; as well as Hallock 1903; Cannon 1910, p. 37; and Thralls 1916, pp. 20-22). The correspondent business also enhanced the efficiencies of the New York Clearing House, for example its adoption of more frequent (twice daily) clearings.

shipments of drafts to and from banks in their trade area.[19] Additionally, in the larger commercial centers of more developed and diversified economic regions (such as Boston and Chicago), correspondents settled local draft payments and so attracted increasing reserve balances from hinterland banks.

Despite the gradual erosion in their market share, New York correspondents remained the linchpin of this geographically expanding interbank network. Following Smith's fundamental principle on market expansion and the spatial division of labor, New York correspondents increasingly specialized in the settlement of interbank draft payments, especially between banks in regional commercial centers such as reserve cities. In other words, they integrated regional correspondents into a national settlement system akin to the Gold Settlement Fund of the early Federal Reserve System, and their balances constituted a de facto reserve base for bank deposits and deposit transactions (Goldenweiser 1925; Spahr 1926, ch. 8; Jones 1931, ch. 5). The diagram in Figure 3b depicts the centrality of New York correspondents in this more elaborate, tiered spatial-economic network. While New York correspondents cleared draft payments for banks in their hinterland and also regions without an established money center, they also cleared and settled draft payments between regional center banks. Even when reserve banks directly swapped and cleared their reciprocal draft payments, they tended to settle their accounts in terms of a national means of payment, that is by issuing drafts drawn on their New York correspondent.[20]

Evidence on the evolving structure and functioning of the postbellum correspondent banking system is rather limited. Published federal and state bank balance sheet data show the changing concentration of bankers' balances among the largest correspondent banks and banking centers (Watkins 1929; James 1978). The *Rand McNally Bankers' Directory* lists the names and locations of banks' correspondents, which when mapped delineate the shifting trade areas of existing correspondent centers and the

[19]Hallock (1903, pp. 43-46); Spahr (1926, pp. 84-130); Gilbert (2000, pp. 123-28); Chang, Evans, and Swartz (2005). The process did not always work this smoothly, particularly when correspondents' networks contained no local banks that could serve as a collecting agent. In these cases checks might pass from bank to bank, sometimes in famously circuitous routes, until a local agent was found (Bolles 1884, p. 274; Cannon 1910, pp. 70-73; Spahr 1926, pp. 105-07).

[20]Banks in smaller cities also used New York drafts to settle their clearinghouse accounts (*Bankers' Magazine* April 1884, p. 801; March 1888, pp. 660-9; April 1888, pp. 752-99).

emergence of new ones (Conzen 1977; Odell and Weiman 1998). Lacking data on both dimensions of the correspondent business, however, we can only infer the spatial-economic position of each center in what is presumed to be a division of labor in the interbank market.

An alternative source fills this empirical gap albeit only for the years 1890 to 1892. Recognizing the dramatic expansion of draft payments over the post-Civil War period and their integral role in the emerging national economy, the Comptroller of the Currency asked national banks to estimate the volume of their interbank draft transactions (for the fiscal year ending in the middle of each date). Following the hierarchy of the National Banking System, the published data record the volume of drafts drawn by national banks in lower order centers on their correspondent accounts in banks in higher order ones (U.S. Comptroller of the Currency 1890, pp. 14-22; 1891, pp. 16-24, 220-33; 1892, pp. 24-31). It also documents the flows of drafts between reserve city banks.

These data, it should be noted, do not capture the gross flows of drafts, which would also include those purchased by bank customers in the retail market. As the Comptroller Report (1892, p. 24) explains, "these exchanges represent the settlement of balances between the different banks and correspond exactly with the cash balances paid or received by the different banks, in settlement of their exchanges in our clearing-house cities." In other words, they represent interbank settlement transactions and so delineate the hierarchy of settlement and reserve centers in the draft payments system.

Our analysis is based on the 1891 report, which gives the information in the greatest geographic detail. The value of interbank draft transactions totaled $12.8 billion during that year. As banks' balance sheet data have shown, this market was highly concentrated economically and spatially. While less than 10 percent of all national banks, reserve city banks originated over 40 percent of all interbank draft transactions. Among country or non-reserve banks, the largest volumes were recorded in the more urbanized regions of the Northeast.

The evidence in Table 1 clearly shows the dominant position of New York correspondents in the national settlement market. Virtually all national banks (over 90 percent of those filing reports) drew

drafts on a New York correspondent during the year, and New York banks settled 61.3 percent of all draft transactions. These data do hint at increasing competition between correspondents in New York and other reserve centers, old and new. Even over this brief period from 1890 to 1892, the market share of New York banks fell from 63.1 to 60.8 percent. Other important centers (in descending order of their market shares) were Boston, Chicago, Philadelphia, and St. Louis, which together accounted for an additional 28 percent of all interbank draft transactions.

To delineate the extent of competition and complementarity between these money center correspondents, we show separately the spatial patterns of drafts drawn by reserve and country national banks (in columns two and three respectively). These data express quantitatively the more complex hierarchy of correspondent centers shown in Figure 3b. As the evidence suggests, official reserve status yielded modest benefits. Reserve city banks accounted for relatively large shares of the correspondent market of central reserve banks in New York (47.4 percent), Chicago (45.9 percent), and St. Louis (40.6 percent). Still, New York correspondents cleared and settled the vast majority of these interbank draft payments (74.3 percent), and their market was almost entirely devoted to mediating payments by non-local banks. For Boston and Chicago correspondents, by contrast, local banks accounted for over one-third of their business.

The competition was more intense at the regional level, that is for the business of country banks. New York's share of this market was only 53 percent, substantial but still significantly less than in the reserve city market. As shown in Table 2, banks in regional centers, even those without official reserve status, benefitted from their geographic proximity. In the New England and Pacific coast markets, for example, the share of New York correspondents was only 41.7 and 33.5, respectively. Purely geographic advantages were, however, limited. In regions that lacked established money centers (such as the Lower South), a New York correspondent was often the default option. And with the exception of Chicago, most correspondents were limited to the regional market, that is mediating intraregional transactions.

We depict this spatial division of labor through maps showing the market area of New York, Chicago, and St. Louis correspondent banks (see Figures 4 through 6).[21] According to this criterion, New York was the only truly national money center (see Figure 4). Its banks commanded significant shares of the settlement market in virtually all states. Their influence was greatest in the immediate tri-state area of New York, Connecticut, and New Jersey — which would become the New York Federal Reserve district — and weakest on the Pacific Coast. Yet, the uneven pattern clearly defies any simple model of distance decay. Rather, it is consistent with an alternative, but equally simple generalization. New York banks tended to dominate the interbank draft market, except where they confronted competition from regional money center banks.[22]

The other maps in Figures 5 and 6 clearly demonstrate the point, as they show the more limited spatial reach of correspondent banks in Chicago and St. Louis. Chicago was a transregional center, whose market embraced banks throughout the Midwest and not just in its immediate hinterland (see Figure 5). St. Louis correspondents, by contrast, operated in a strictly regional market comprised of country banks in Missouri and Arkansas but also southern Illinois, eastern Kansas, and northwestern Texas (see Figure 6).[23]

The tiered structure of interstate cash flows to and from banks in select reserve cities from 1905 to 1908 provides further evidence in support this generalization. The data (in Table 3), reported by local clearinghouses to the National Monetary Commission, show the cash flows between banks in each city and those in other regions; for the Eastern region, the cash flows to and from New York are shown

[21]A center's state-level market share is measured by $D_{ij}/\sum_j D_{ij}$ where D_{ij} equals the value of draft settlement payments of country banks in state i drawn on banks in reserve city j, and denominator equals the total value of draft settlement payments of country banks in state i.

[22]This generalization, of course, begs the question of why certain regions notably in the South lacked developed money centers (Odell and Weiman 1998; and Redenius and Weiman 2004).

[23]The market areas of other reserve cities were also regional in scope (e.g., New England for Boston correspondents) and trace out the geography of the Federal Reserve system. This spatial correlation suggests that the Fed architects institutionalized the correspondent banking relationships (Odell and Weiman 1998; McAvoy 2006).

separately.[24] For centers such as Boston, Philadelphia, Cincinnati, and San Francisco, these flows were largely confined to banks in their hinterland and New York. Their cash flows to and from other regions were negligible or zero. These interregional payments therefore must have been channeled through New York banks rather than through correspondents in other regional centers. The latter did mediate the financial flows of smaller cities in their hinterlands (Providence for Boston, Wilmington for Philadelphia, Little Rock for St. Louis), which had limited direct ties to New York.

3. Liquidity Externalities in the Domestic Exchange Market

From the demise of the Second BUS to the formation of the Fed, the average level and variability of domestic exchange rates dropped dramatically.[25] Contemporary and more recent analyses have explained these trends by exogenous factors, primarily falling railroad rates that reduced the cost of shipping commodities as well as currency. Our institutional hypothesis, by contrast, emphasizes the formation of a more centralized national correspondent banking system, which spawned vital liquidity and other (e.g., information) externalities in regional and national centers. The growth of correspondent banking in regional centers like St. Louis or San Francisco created thicker, more liquid domestic exchange markets, which tended to iron out idiosyncratic fluctuations in exchange rates (Garbade and Silber 1979b; Ho and Stoll 1983; Economides and Siow 1988; Chorida et al. 2001; and Fleming 2003).

The centralization of settlement transactions and reserve holdings in New York and to a lesser extent Chicago also yielded significant liquidity externalities.[26] By channeling reserve transactions through their New York correspondent, banks could expect their "due from" items to offset maximally their "due to"

[24]These data come from Kemmerer (1910, pp. 276-357) and yield a more comprehensive measure of intercity/interstate flows than any based on national banks alone.

[25]U.S. Comptroller of the Currency (1892, pp. 31-32); Garbade and Silber (1979a, pp. 11-15); Gilbert (1988); and James (1988). The Comptroller and Garbade and Silber explain these trends by declining real freight rates. Phillips and Swamy (1997) emphasize the introduction of a uniform national currency in the1860s which effectively lowered the cost of shipping specie.

[26]For a more recent example, see McAndrews and Rajan (2000). Goodhart (1988, pp. 33-35, 73), Goodfriend (1990, pp. 59-60), and McAndrews and Roberds (1999) also emphasize the information externalities arising from the centralization of settlement-reserve transactions.

obligations and so to minimize the fluctuations in their correspondent balances. Because their customers' payments and deposits were not perfectly synchronized, banks were still subject to potentially large transitory and seasonal liquidity shocks — either net withdrawals from or deposits to their correspondent accounts. By pooling the reserve transactions of large numbers of banks throughout the country, New York correspondents could effectively smooth these individual fluctuations and so minimize the turnover in their aggregate correspondent balances (Gilbert 1983).

Banks' liquidity, as Garber and Weisbrod (1990, p. 8) observe, ultimately depends on an efficient funds market, where they can borrow and lend excess reserves. In the absence of a formal clearinghouse "mechanism," the call loan market served as the "the functional equivalent of the federal funds market for [banks'] reserve adjustment purposes" (Goodfriend and Whelpley 1998, p. 17). Balance sheet data presented to the Pujo Committee show the "intimate relation" between these "due to" liabilities and call loan assets of New York's largest correspondent banks (Watkins 1929, pp. 219-23; Laughlin 1912, pp. 43-44). Their short-maturities, relatively secure collateral, and high yields certainly made call loans an ideal instrument for placing excess reserves. Their real rather than notional liquidity, however, derived from the "continuous inflow and outflow" of funds, reflecting the offsetting transactions of correspondent banks facing transitory net withdrawals and deposits.[27]

With reserve-city balance sheet data for five call dates each year, we can only measure the average seasonal variability of bankers' balances at the aggregate (either city or state for country banks), not individual bank, level. So, while we cannot directly analyze the liquidity economies of scale and scope for individual correspondents, we can gauge the external liquidity externalities in reserve city funds markets, like the New York call loan market.[28] As predicted, total bankers' balances in the largest

[27]Even during normal periods seasonal withdrawals by country banks and hence large net outflows of funds resulted in financial stringency and sharply higher rates in the New York call loan market (Miron 1986; Champ, Smith, and Williamson 1996).

[28]According to Cannon (1910, pp. 247-52, 284-85), members of the Boston and Chicago clearinghouses set up adjacent funds markets for trading excess reserve balances. In the Boston case he observed a strong positive correlation between rates in the "curb" funds and call loan markets.

markets of New York and Chicago tended to be more stable across the five call dates each year (see Table 4). This ordering with New York banks at the top holds regardless of whether variability is measured by the standard deviation of the distribution of percentage changes in "due to banks" between call dates or by the interquartile ranges.

These agglomeration effects enabled New York banks to economize on their reserve positions and thus on the costs of managing their correspondent accounts (Morrison 1966; Baltensperger 1974, 1980). In turn, they could furnish customer banks with credit lines and even a seasonal lending facility to finance their clearing deficits — the modern day equivalent of the Fed's daylight overdraft and seasonal discount lending services.[29] Contemporaries date the growth of this interbank lending market from the period immediately following the Panic of 1893, which coincides with a surge in country bank's accumulation of correspondent balances (Morrison 1966, p. 81-82; Gendreau 1983). The precise causal connection between these mutually reinforcing trends is difficult to ascertain. Country banks were attracted by the greater liquidity of New York balances and complementary financial services supplied by New York correspondents. The price of access, however, was a compensating correspondent balance, which bolstered the dominant position of New York correspondents.

This financial innovation, regardless of the precipitating factors, profoundly altered the interbank domestic exchange market. Instead of buying New York exchange locally, banks in regional centers could instead borrow funds from their New York correspondent. Moreover, because of the greater liquidity of correspondent balances in New York, correspondents there could in principle supply (and demand) these funds more elastically and on better terms than in the regional domestic exchange markets.

[29] *Bankers' Magazine* (April 1894, p. 764; February 1898, p. 221; January 1899, p. 47). Instead of a formal credit line or overdraft facility, New York banks extended credit implicitly by offering their customers liberal terms, upwards to a month, to settle their clearing accounts. Consistent with the timing of these articles, Lockhart (1921, pp. 223-25, 235-36) dates the growth of seasonal interbank lending after the Panic of 1893. This financial innovation illustrates the synergies realized by banks, in this case correspondents, from their dual functions as payments and financial intermediaries (Goodfriend 1990; McAndrews and Roberds 1999; Kayshap, Rajan, and Stein 2002). As Kashyap, Rajan, and Stein (pp. 45-47) show, these economies of scope vary inversely with the correlation between bank customers' deposit withdrawals and "takedowns" on credit lines (see also Strahan, Gatev, and Schuermann 2004).

This administered funds market, we predict, would confine domestic exchange rates to a narrower range of fluctuations than implied by shipping costs alone.[30] Thus, like Garbade and Silber (1979a, p. 15), we too attribute the decline in volatility to the evolution of "market-makers" in the market for domestic exchange. However, our analysis assigns the pivotal role to New York correspondents in a more integrated, national correspondent banking system.

To show the impact of these liquidity externalities on exchange rates fluctuations, we collected monthly data on sight domestic exchange rates in fourteen cities from 1887 to 1914 published in *Bradstreet's* magazine.[31] Significantly, these data span a time period, when declines in transportation rates were less dramatic and the interregional use of checks facilitated by the correspondent banking system was increasing. The quotations measure the premium or discount which $1000 in New York funds commanded in the local market. Positive numbers indicate that New York exchange sold at a premium and negative figures, a discount. Thus, if the rate in Chicago was 50¢, $1000 in New York sold for $1000.50 locally, or at a 0.05 percent premium. These figures were collected by local agents, submitted by telegraph, and printed weekly.[32]

The box and whisker plots in Figure 7 show the ranges of domestic exchange rates in each city for three-year periods; the figures exclude extreme observations due to the panics of 1893 and 1907.[33] The

[30]Declining interest rates on local bank lending reduced the opportunity cost of holding New York balances and hence the price of a credit line (Watkins 1929, pp. 106-07).

[31]Our data represent transactions during the first week of each month. The data set is limited to cities for which exchange rates were continuously reported and showed some variation over the period: Boston, Cincinnati, Cleveland, Louisville, Chicago, Minneapolis, Omaha, Milwaukee, St. Paul, St. Louis, Kansas City, New Orleans, Savannah, and San Francisco. Several smaller cities (e.g., St. Joseph, Galveston) were omitted, because they appeared for only part of the period or intermittently. Larger centers near New York, like Philadelphia and Baltimore, were also excluded, because their exchange rates were absolutely flat at par over the entire period except during panic conditions.

[32]Some sources also published 60 day exchange rates, but *Bradstreet's* did not and they are not considered here. Goodhart (1969, pp.196-205) and James (1978, pp. 252-62), respectively, assess the accuracy of city financial data (interest rates more precisely) reported by local agents in the *Commercial and Financial Chronicle* and *Bradstreet's.*

[33]The periods are 1887-89, 1890-92, 1893-96, 1898-1900, 1901-03, 1904-06, 1907-09, and 1910-13. During the 1893 panic, for example, the New York exchange premium rose to $10 in New Orleans and $20 in Charleston, while it fell to -$12.50 in St. Paul and -$5 in Chicago. Since the focus here is on long-term trends, inclusion of panic observations would dominate any volatility measure.

box extends from the 25th to the 75th percentile, the interquartile range. The line in the middle of the box represents the median. The lines emerging from the box are the whiskers, which extend to three halves of the interquartile range rolled back to where there are data. More extreme observations outside of these bands are plotted individually as circles.

The variability and level of exchange rates generally fell during this later period as well, albeit at slower rates. In most cities — except for Duluth, Milwaukee, and Omaha — the compression in exchange rates is quite pronounced. Even in Boston, where the initial spread was modest, there was a notable reduction in variability over time. Note that there does not seem to have been a general tendency for exchange rates to converge to par (or zero) prior to the formation of the Federal Reserve System.

As a first step in the analysis, we consider the impact of real factors, the declining seasonality of production and trade and transport innovations, on exchange rate fluctuations. A decline in the seasonality of interregional transactions would mute seasonal fluctuations in exchange rates and so their variation within three-year periods (Bolles 1888, pp. 134-36). We test this hypothesis by an analysis of variance decomposition using monthly dummy variables on the five year period preceding the panic of 1893 and the five years preceding the panic of 1907. For the ten cities with sufficient data, the variability of domestic exchange rates by city declines by an average of 74 percent over the interim. The monthly dummy variables account for on average 35 percent of the decline; the remaining 65 percent was due to changes in residual variance. The bulk of the volatility decrease then must have been due to technological or institutional changes rather than purely seasonal factors.[34]

Like in the pre-1880 period, a narrowing of the currency shipping point bands would also reduce exchange rate volatility. Currency was usually shipped by express companies, and for four major cities we have found some evidence on express charges including insurance for shipping currency to and from

[34]This calculation in fact overstates the relative importance of exogenous decreases in seasonality, because local banks were able to borrow from New York correspondents and thereby smooth out seasonal fluctuations in the domestic exchange market.

New York in 1905.[35] In lieu of data on specific railroad rates, the most important component of express charges, we adjust the 1905 benchmark figures by the average annual rate of change in freight revenues per mile (-1.1 percent) between 1888 and 1910 for other dates (Thomas 1911, p. 85). The other cost in shipping currency was the float cost of funds in transit. To measure the opportunity cost of funds shipped to New York, we use James's estimates of semiannual average loan and discount rates for national banks between 1888 and 1910 (James 1978, pp. 245-51); for the cost of funds shipped from New York, we use the standard 2 percent paid on New York bankers' balances. Travel times were taken from the 1902 *Rand McNally Official Railway Guide and Hand Book.*

Figure 8 shows quarterly exchange rates (circles) and the estimated currency shipping points (squares for export points and triangles for import points) for the four major cities for which we have currency shipping data.[36] (The figure excludes the extreme values during panics which otherwise would dominate the graph.) The story is quite similar in all four cities: a modest narrowing of the band width (except for New Orleans), but a pronounced narrowing of exchange rate variability over time. Before 1900 violations were infrequent in all four cities (except perhaps New Orleans). After 1900 rates rarely pressed against the bands, and violations were virtually unknown and indeed occurred only during the Panic of 1907. This evidence implies that transport innovations reducing the cost of shipping currency could not have been a major factor in explaining the observed reduction in exchange rate variability.[37]

Without data on the volume of domestic exchange transactions in local markets, we cannot estimate a fully identified model of demand and supply to assess the relative importance of institutional and real

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[35]Johnson (1905, p. 82) quotes express rates per $1000 on currency shipments between New York and four cities: 50¢ for Chicago, 60¢ for St. Louis, 75¢ for New Orleans, and $1.50 for San Francisco.

[36]Travel times may have decreased somewhat over the period, and James's semiannual estimates of local interest rates miss month-to-month variability. These data limitations point in the same direction. The estimated violations of the currency points, particularly in earlier years, could be exaggerated and hence should be regarded as upper bounds to the true value.

[37]In other words, the steep decline in exchange rate variability in the 1890s (see Figures 7 and 8) is inconsistent with the more gradual trends in real freight rates over the same period (Fishlow 1966, p. 584; Johnson 1910, p. 301). Officer (1985, pp. 580-82), by contrast, finds that narrowing shipping points, external integration, was more important in U.S. foreign exchange markets.

factors on the volatility of regional domestic exchange rates. Using the balance sheet data for fourteen reserve city and central reserve city national banks, we can however estimate an unidentified panel regression that yields more circumstantial evidence. The liquidity of domestic exchange markets in regional centers and of bankers' balances in New York, we assume, vary directly with the level of country banks' excess or clearing interbank balances. Therefore, for each city we relate the annual standard deviation of the domestic exchange rate (sdxrate) to the annual average level of discretionary (or excess) bankers' balances held by local national banks (excessbb).[38] In line with a distance decay gravity model, we also control for distance from New York, which all other things being equal should vary inversely with the volume of intercity payments and hence the density of domestic exchange transactions. Finally, to capture seasonal effects, we include the annual variability of deposits (measured by the standard deviation of log deposits over the five call dates per year).[39] For a random effects specification, our empirical model is:

$$sdxrate_{it} = \alpha_1 excessbb_{it} + \alpha_2 sddpsts_{it} + \alpha_3 disttony_i + \gamma + u_i + \varepsilon_{it}$$

where subscript i indexes the reserve or central reserve city and t stands for the year; u_i represents a random error component associated with city i.

Table 5 presents regression estimates for several econometric specifications over the period 1887 to 1910. The results in column 1 are for the random effects specification (although a Hausman specification

[38]Although our data are limited to only national banks, this shortcoming is less serious than it might seem. National banks were generally larger and more important than state banks, and hence more likely to have domestic exchange dealings. Excess or discretionary bankers' balances are defined as actual less required levels. To compute required bankers' balances, we follow the procedure in Pratt (1901, pp. 257-70). Virtually without exception, banks chose to hold the legal maximum of required reserves (equal to 50 percent) in the form of banker's balances, because they paid interest while vault cash did not. In principle, these interbank deposits could be held anywhere, although required reserves had to be lodged in a central reserve city (New York, Chicago or St. Louis) bank. We assume that the "due from banks" entry on balance sheets of reserve city banks represent holdings of New York balances. The evidence from section 2 on the configuration of interbank draft markets and on intra- and interregional cash flows strongly suggests that reserve city banks held the great bulk of their balances in New York.

[39]Without monthly data on transportation costs between each city and New York, we cannot control directly for the impact of changing transportation costs on currency shipping points. We experimented with an indirect approach by including a time trend as a proxy for the slow, steady decline in transport costs. The estimated coefficient, however, also picked up the positive trend in excess bankers' balances.

test rejects the null hypothesis that u_i is uncorrelated with the X_{it}'s at the 1 percent level). Those in column 2 assume a fixed effects model, while the equations in Columns 3 and 4 allow for a heteroskedastic error structure and for cross-sectional correlation of errors, respectively. (The last equation requires balanced panels and so limits the sample to only five cities).

The four regression models yield roughly consistent coefficient estimates with the only exception being the distance variable. The estimated coefficients of the other variables, excess bankers' balances and the seasonal variation in deposits, have the predicted signs and are statistically significant. The former implies that domestic exchange rate variability diminishes with banks' holdings of additional excess correspondent balances and, in our view, the greater liquidity of regional domestic exchange markets and of bankers' balances in New York. Likewise, greater seasonality in deposit flows and hence balance of payments is associated with more volatile exchange rates.

The regression estimates are also consistent with the results of the variance decomposition analysis. They imply that excess bankers' balances are the more economically important variable, accounting for about 80 percent of the change in fitted values. In terms of timing the significant shifts occurred after the Panic of 1893. Between 1894/96 and 1900/02 excess bankers' balances more than doubled in thirteen of the regional centers. Exchange rate volatility, measured by the mean standard deviation, fell by 36.6 percent over the period and by another 75 percent over the next decade. Viewed in terms of our simple model of regional domestic exchange markets, this evidence suggests that the growth and centralization of correspondent relationships forged a more integrated payments system, overcoming the coordination problems that had confined check transactions to the local level.

4. Conclusions

Checks in late antebellum America were the payments instrument of choice in local commercial transactions, but were rarely used in interregional trade because of their greater risks and transactions costs compared to bank notes. The wider diffusion of checks required fundamental innovations to

accelerate but especially to coordinate the more complex flows of information and funds between banks. Prior to the Fed, a centralized correspondent banking system furnished this vital payments system infrastructure. Moreover, despite the dramatic expansion of the banking and payments over this period, New York remained "the clearing house of the country" in O.M.W. Sprague's words (1910, p. 126).

The enduring centrality of New York banks derived from the successive, cumulative impacts of network externalities in the emerging national payments system based on bank deposits, not notes. Because of their pivotal position as bank note redemption and deposit reserve centers, New York banks supplied a more convenient generally acceptable national payments instrument, drafts drawn on correspondent accounts. The rapid diffusion of drafts in the post-Civil War period increasingly internalized the flows of payments within the banking system, organized through a loosely knit hierarchy of long-term correspondent relations.

The declining levels and variability of domestic exchange rates attest to the increasing effectiveness of these interbank relationships in mediating long-distance draft payments. We explain these trends by mounting liquidity externalities, especially those realized by New York correspondents. The rapid growth and concentration of bankers' balances in New York — what the Pujo Committee (U.S. House of Representatives 1912) referred to as the "money trust" — yielded internal economies from respondents' mutually offsetting flows of withdrawals and deposits and an external economy in the form of a highly liquid call loan funds market. These liquidity effects underwrote financial innovation, an interbank lending market where banks could borrow funds from their New York correspondent to cover their transitory (and seasonal) deficits instead of buying funds in the local domestic exchange market. This kind of payments finality reduced the cost and risks to payees' banks in accepting deposits of non-local checks and to payers' banks in meeting their customers more uncertain withdrawal demands (Goodhart 1988, p. 37; Green and Todd 2001, p. 26).

The growth of the interbank loan market in the late 1890s, thus, extended the reach of the visible hand in the payments system by substituting routine overdrafts for domestic exchange purchases. In New

Orleans and Louisville, our evidence suggests, it may have displaced the domestic exchange market altogether after 1907. This financial innovation did not erase the cost of transferring funds across space, but only changed its form. To secure a credit line, banks paid the opportunity cost of a compensating correspondent balance. And to cover their expenses for paying checks through the mail and to make up for lost revenues from the sale of drafts, many banks charged exchange fees, a slight discount off of the face value of the check.

Private competition continued unabated in at least one domain, however, the market for correspondent relations. To capture the business of country banks, New York correspondents offered a variety of inducements, including the payment of interest on deposits (NYCHA 1873; James 1976b; Gendreau 1988). Contemporary critics including a majority of New York Clearing House banks decried this "old custom," which correspondents financed by placing excess correspondent balances in the call loan market. In addition to fueling speculative stock purchases, they argued, this practice lulled banks into a false sense of liquidity security, clearly evident when country banks withdrew funds from New York en masse during the fall harvest season.

In addition to the payment of interest on deposits, banking reformers specified two other serious defects of the corresponding banking system. Its decentralized structure dispersed banks' reserves, which idled a larger share of their assets and increased their vulnerability to panicky withdrawals (see for example Laughlin 1912, pp. 8-22; and Warburg 1914). And exchange charges or "non-par clearing" of checks, they insisted, unfairly burdened large payees or their banks in commercial centers, and resulted in the circuitous routing of checks to agents that could directly present them for collection and so avoid these fees (Hallock 1903; Cannon 1910; Spahr 1927, pp. 101-29).

Whether the original intent of its founders or not, the Fed immediately established a check payments system that would remedy these defects (Talbert 1913-14; Willis 1923; Federal Reserve Bank of Richmond 1926b; and more recently Stevens 1996). The recent debate over the Fed's intervention questions whether it acted like a truly neutral payments authority along the lines envisioned by Colwell.

Few question the formation of the Gold Settlement Fund, which centralized member banks' clearing reserves and thereby nationalized a pivotal role of New York correspondents. The Fed's decision complemented its core mission of insuring the liquidity of the banking and payments systems. It enabled banks to economize on their reserve holdings (Gilbert 2000) and established a more secure public funds market to recycle their excess reserves. Moreover, it adopted organizational and technological innovations — a centralized book-entry system of accounts and telegraphic communications network — that virtually eliminated the cost of transferring funds interregionally and so domestic exchange markets.

More controversial, then and now, is the Fed's entry into clearinghouse-correspondent business.[40] The charge of circuitous routing, the Fed's critics correctly observe, was based on only a handful of examples, cited repeatedly by reformers. With more systematic evidence from the New York Clearing House and the Fed, we can compare the "efficiency" of their check collection operations.[41] Referring to Figure 1b, these data measure the time required for the last legs of the process (#3 and #2), the shipment of checks to paying banks, their reverse flow of authorizations, and the final transfer of funds.

By way of illustration, we compare the collection period for checks sent from New York to Minneapolis-St. Paul (see Table 6). In 1912 via the correspondent system the time required for these transactions averaged 5 days. Within the decade, the Fed's system more than halved the collection period to only 2 days. We estimate comparable time savings (of roughly 3 days or 55 percent) for 21 other major cities across the U.S. Our results are consistent with Spahr's observation (1926, p. 180) that the Fed's schedule was based on only "one-way mail time" required to ship checks "between the ... reserve

[40]The historical debate largely revolves around the "par clearing" controversy over the Fed's decision to abolish exchange charges on check collections (Stevens 1998; Lacker, Walker, and Weinberg 1998). In the late 1990s the "Rivlin Committee" conducted an internal review to determine whether the Fed should continue to operate in the retail payments system (FRS 1998).

[41]The New York Clearing House Association Committee on Inland Exchange (1912) compiled the pre-Fed data based on members' check collections for May 1912. The Fed data are taken from the published schedules of its Inter-District Collection System for 1918 and 1920, showing the time lags for final credit on checks deposited by member banks (Board of Governors of the Federal Reserve System 1918; Spahr 1926). According to Spahr (p. 180), Reserve banks devised their schedules based on the "average time" of their check collections operations (see also Federal Reserve Bank of Richmond 1926b, pp. 399-400).

banks and their branches." The return trip authorizing the final payment, by contrast, was instantaneously transmitted via the Fed Wire to the Gold Settlement Fund. Without this technology, the Fed's collection times would presumably double, and its advantage would have virtually evaporated (see columns 4 and 5).

From these findings we draw two related implications that affirm our central themes. First, the correspondent banking system was reasonably effective in coordinating the flows of checks and related information among banks throughout the country. Based on our admittedly simple estimate of the "one-way mail time" for check shipments from New York correspondents to banks in other commercial centers (equal to one-half of the actual collection time), we infer that the highly publicized cases of circuitous routing of checks must have been the exception, not the rule (see also Chang, Evans, and Swartz 2005).

Second, in forging a truly national payments system, the Fed surmounted a fundamental organizational not technological barrier. The telegraph, after all, was not a novel technology in 1918, and in fact was commonly used for time-sensitive, high-value business communications as early as the 1850s (DuBoff 1980, 1984; Field 1988). What limited its systematic application in this context, as Colwell insightfully diagnosed, was the vast number of independent banks and their dispersed complex interactions. Through its hierarchy of clearinghouses, the Fed concentrated and coordinated this vital payments information and so could justify the fixed costs of a leased private network to furnish prompt secure electronic transmissions. From the outset, then, the Fed assumed the critical function of "standards coordinator" in the U.S. banking and payments system (James and Weiman 2005).

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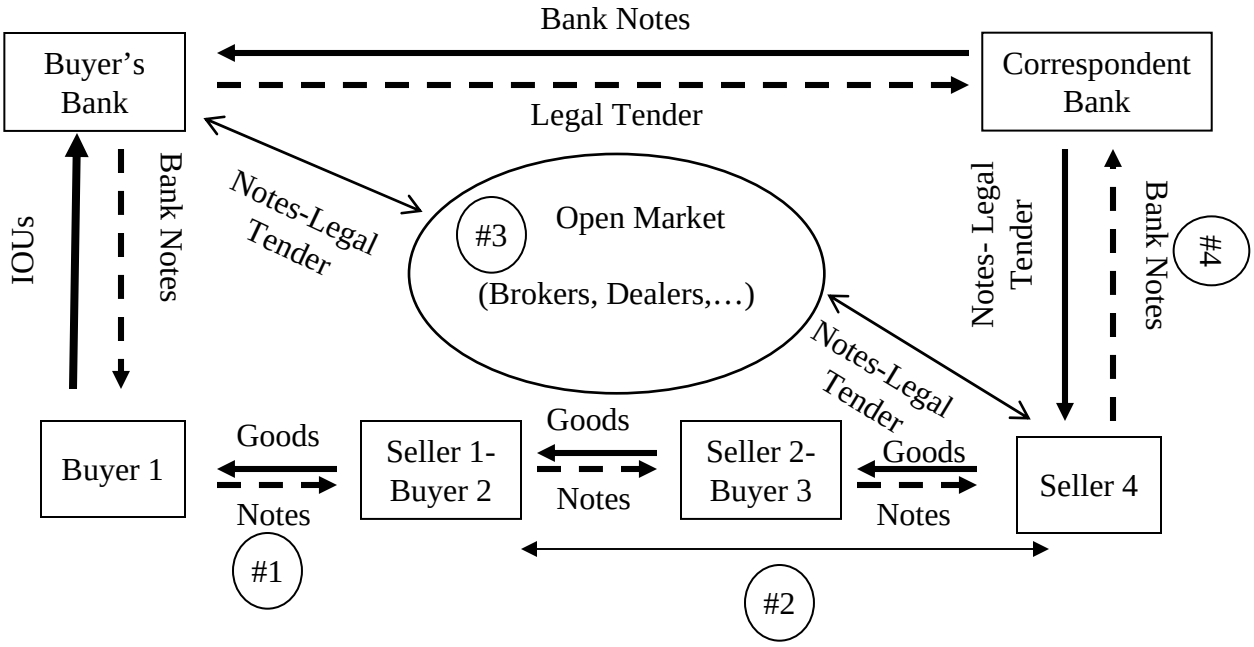
Figure 1
Bank Note and Check Transactions and Payments Network

1a. Bank Note Transaction



1b. Check Transaction

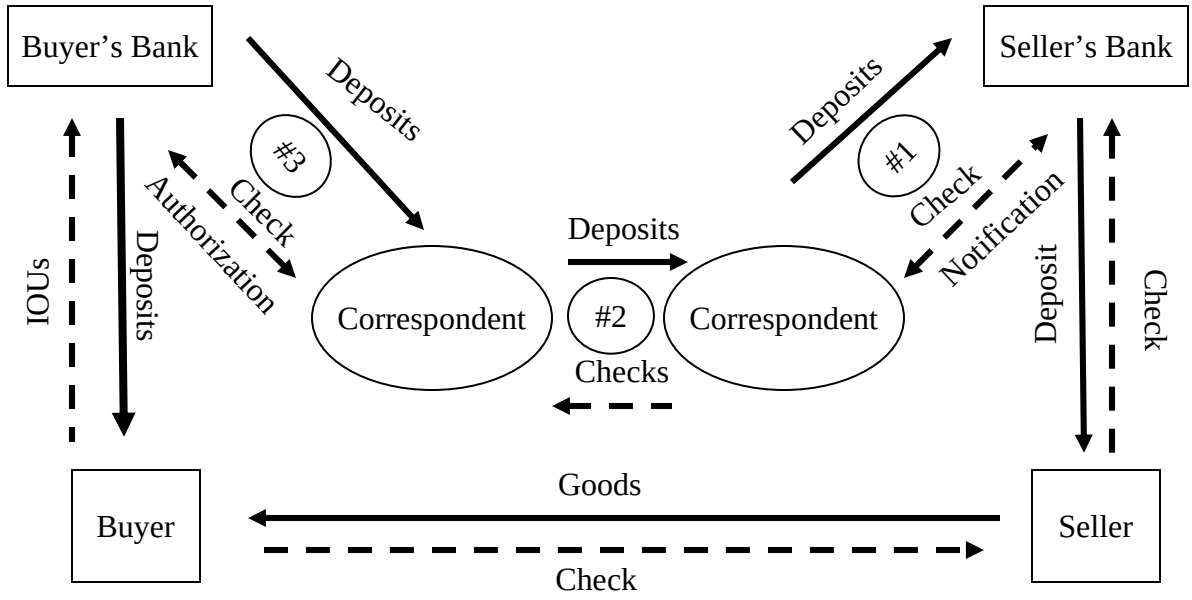


Figure 2
Domestic Exchange Market in a Regional Commercial Center

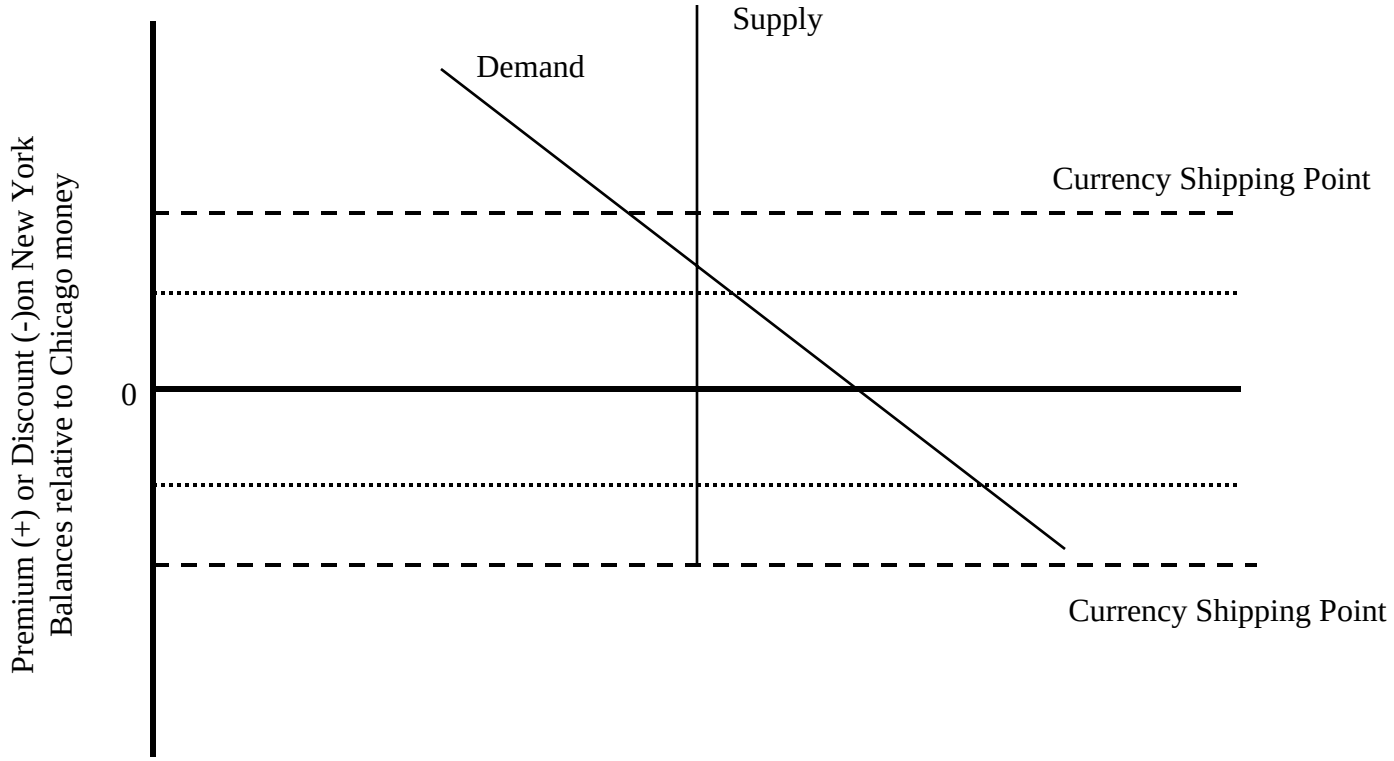
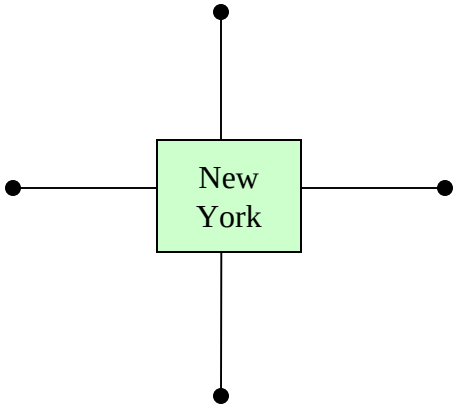
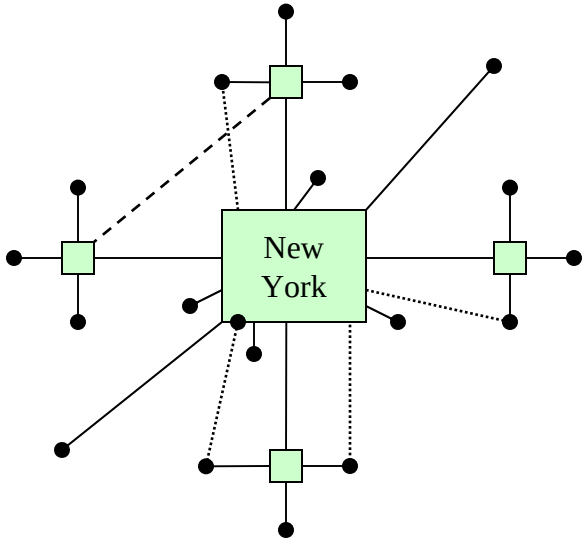


Figure 3
Transformation of the Correspondent Banking Network over the late 19th Century



A. Simple Linear Network ca. 1870s



B. Tiered, Hierarchical Network ca. 1890s

——— Clearing and Settlement

– – – – – Clearing only

..... Settlement only

FIGURE 4: INTERBANK DRAFT MARKET OF NEW YORK CORRESPONDENT BANKS, 1890-1891

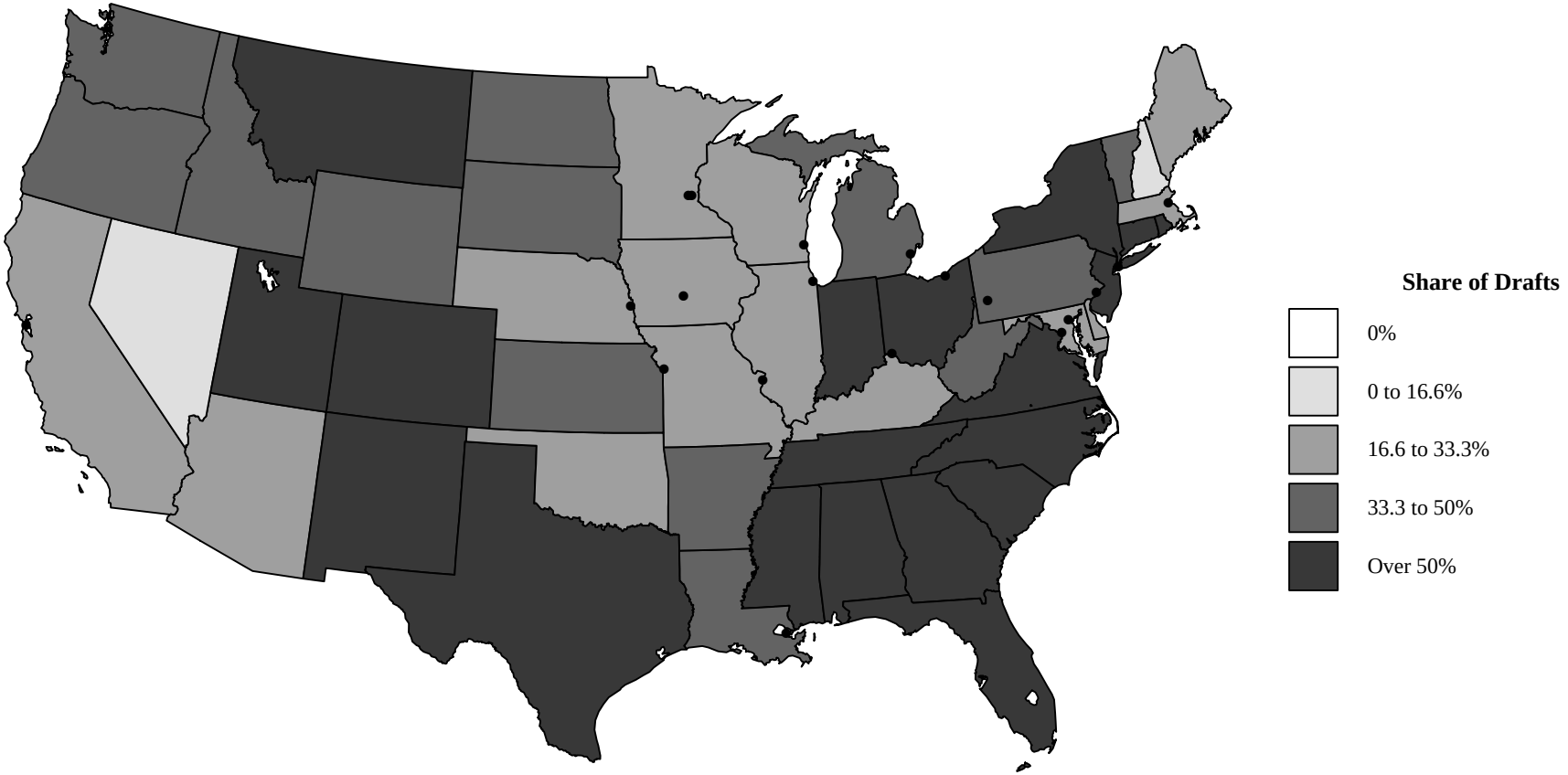


FIGURE 5: INTERBANK DRAFT MARKET OF CHICAGO CORRESPONDENT BANKS, 1890-1891

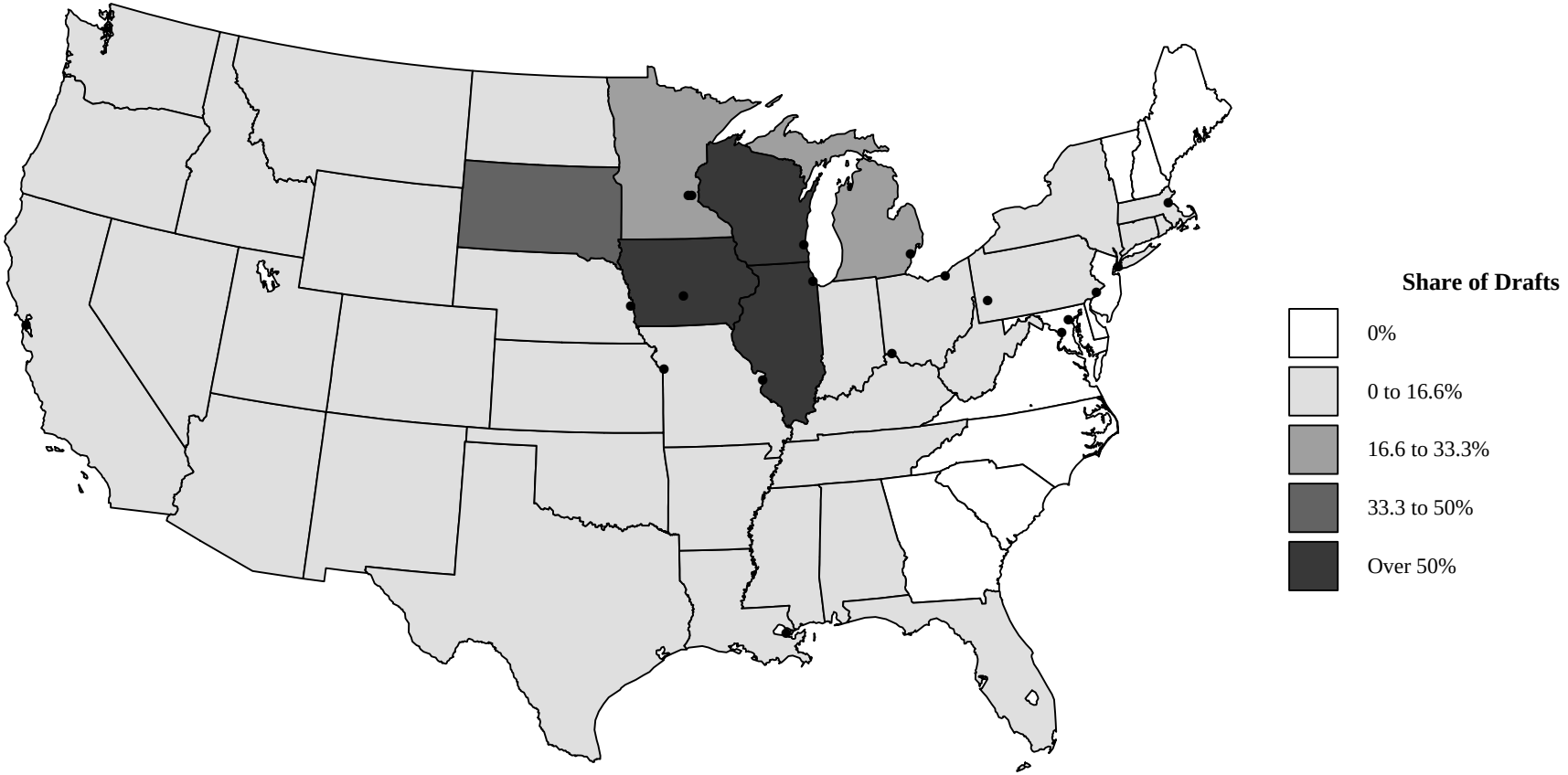


FIGURE 6: INTERBANK DRAFT MARKET OF ST. LOUIS CORRESPONDENT BANKS, 1890-1891

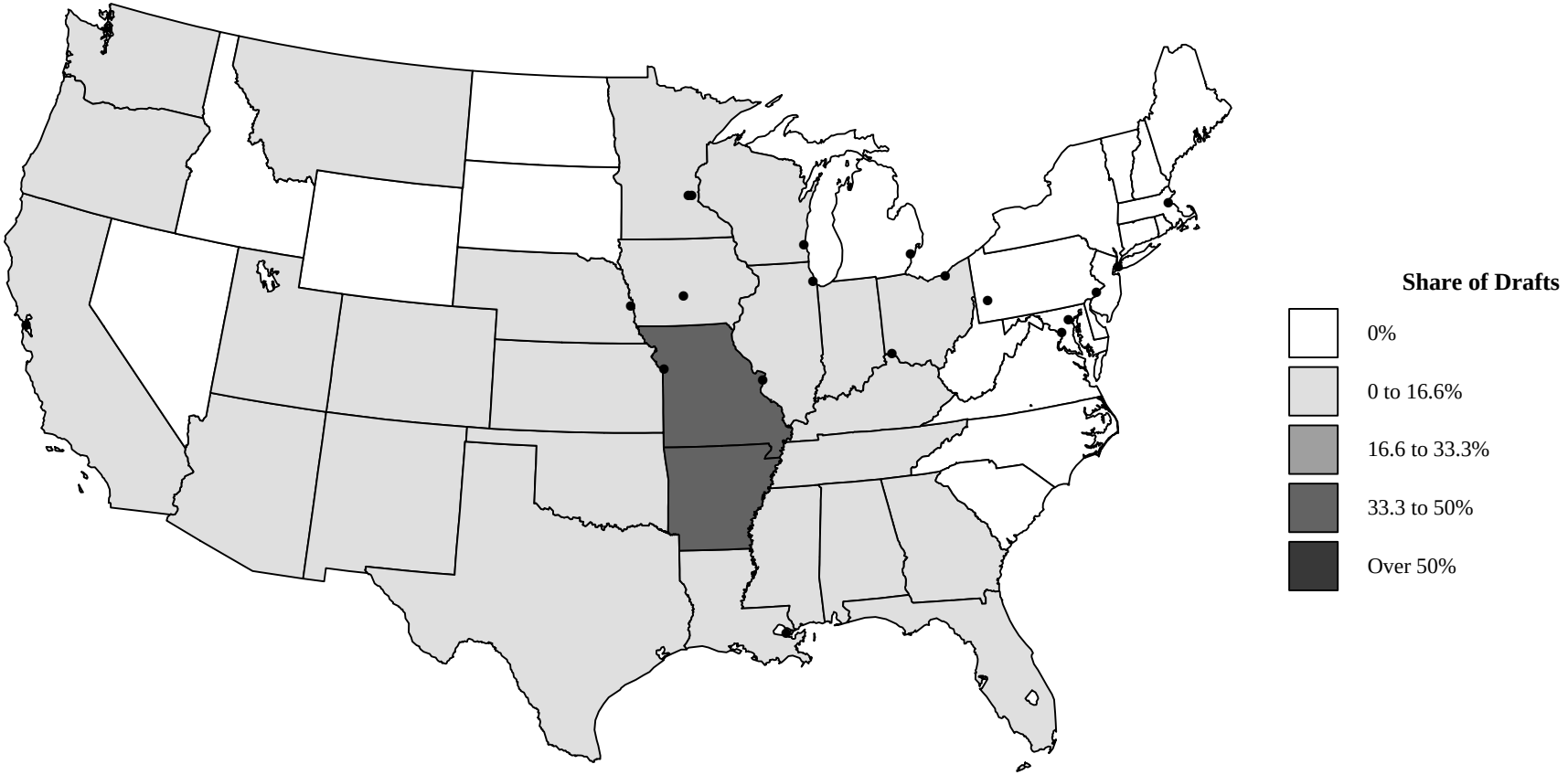


Figure 7
Means and Spreads of Domestic Exchange Rates by Reserve City, 1887-1914

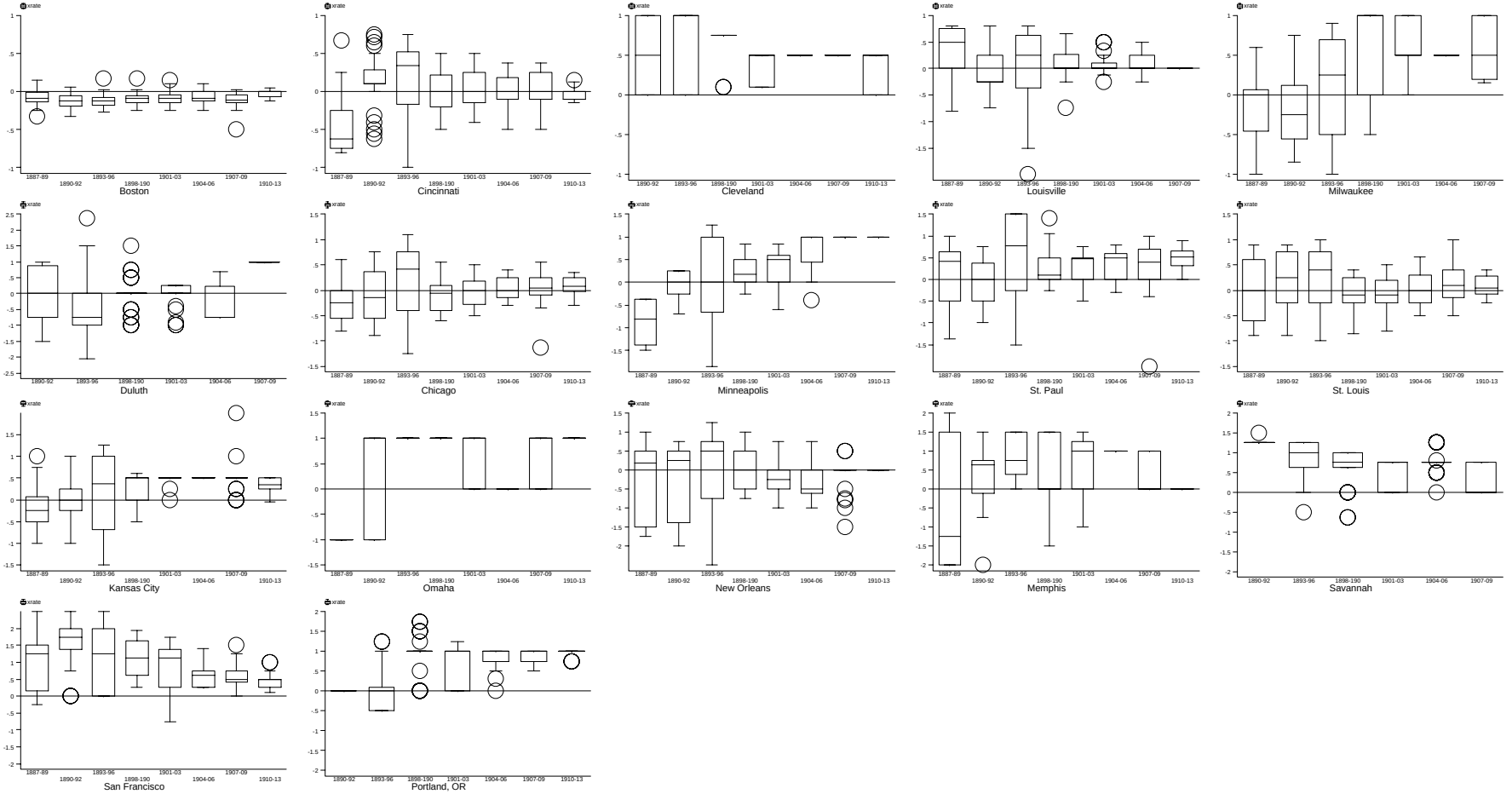
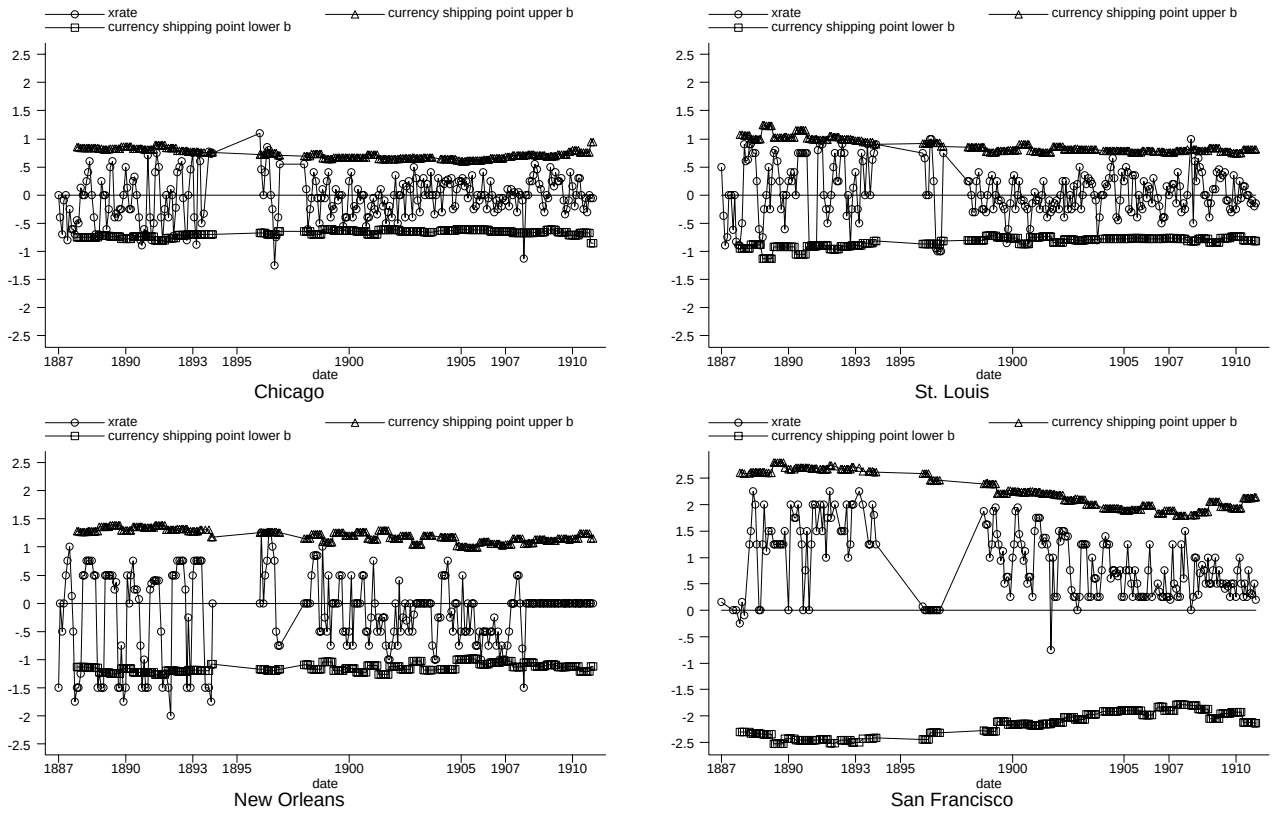


Figure 8
Exchange Rate Fluctuations and Currency Shipping Points
for Select Cities, 1887-1914



Domestic Exchange Rates and Currency Shipping Points

Table 1
Interbank Draft Market of National Banks in the
Five Largest Reserve Centers, 1890-1891

Location of Correspondent	All National Banks				Reserve Banks		Country Banks	
	#[1]	%[2]	Value of Drafts[3]	Shares	Value of Drafts	Share	Value of Drafts	Share
New York	3326	91.4%	$7,836.2	61.3%	$3,716.6	74.3%	$4,119.6	53.0%
Boston	853	23.5%	$1,492.2	11.7%	$313.8	6.3%	$1,178.4	15.1%
Chicago	1146	31.5%	$1,254.7	9.8%	$576.0	11.5%	$678.7	8.7%
Philadelphia	664	18.3%	$541.3	4.2%	$129.0	2.6%	$412.3	5.3%
St. Louis	589	16.2%	$237.9	1.9%	$96.6	1.9%	$141.3	1.8%
Total			$11,362.3	88.9%	$4,832.0	96.6%	$6,530.3	83.9%

Source: U.S. Comptroller of the Currency (1891), pp. 17-25, 221-33.
Notes: 1) # equals the total number of national banks that drew drafts on at least one correspondent in the designated city. The total exceeds the number of national banks, because banks could draw drafts from banks in multiple cities.
2) % measures the percentage of banks that drew drafts on at least one correspondent in the designated city. Again, the columns do not sum to 100 percent because banks maintained and drew drafts on several correspondents.
3) The remaining columns show the total value of drafts drawn on banks in each city and the share of the total interbank draft market for national banks.

Table 2
Interbank Bank Draft Market of Country National Banks, 1890-1891

Region	New York	Chicago	Regional Center	
			Reserve	Other
New England	41.7%	0.1%	56.5%	1.6%
Mid-Atlantic	71.5%	0.1%	24.2%	0.2%
South Atlantic	74.6%	0.1%	9.3%	6.6%
East North Central	46.9%	29.3%	13.3%	2.2%
West North Central	34.0%	30.4%	30.2%	2.9%
East South Central	65.6%	0.7%	27.0%	5.9%
West South Central	52.1%	1.2%	16.9%	26.9%
Mountain	58.5%	8.6%	10.3%	12.4%
Pacific	33.5%	5.7%	35.9%	18.2%

Notes: Regional Centers, reserve cities.
1) New England: Boston.
2) Mid-Atlantic: Philadelphia, Pittsburgh.
3) South Atlantic: Baltimore.
4) East North Central: Cincinnati, Detroit, Milwaukee.
5) West North Central: St. Louis, Omaha, Kansas City, Minneapolis-St. Paul.
6) East South Central: St. Louis, New Orleans, Louisiana, Cincinnati
7) West South Central: St. Louis, New Orleans
8) Mountain: Kansas City, Omaha
9)Pacific: San Francisco.

Table 3
Interbank Cash Flows for Banks in Select Regional Centers
(Average for 1905-08 in $1,000s)

	Boston				Philadelphia				Atlanta			
Region	Inflow	Share	Outflow	Share	Inflow	Share	Outflow	Share	Inflow	Share	Outflow	Share
New England	$83,189	86.7%	$79,586	94.5%	$38	0.1%	$375	1.6%	$175	3.6%	$0	0.0%
East	$12,652	13.2%	$1,557	1.8%	$28,871	90.7%	$16,482	68.8%	$4,236	86.3%	$2,893	81.8%
New York	$12,652	13.2%	$1,557	1.8%	$11,347	35.7%	$7,304	30.5%	$3,500	71.3%	$1,755	49.6%
South	$0	0.0%	$130	0.2%	$2,666	8.4%	$4,393	18.3%	$166	3.4%	$43	1.2%
Midwest	$164	0.2%	$2,887	3.4%	$67	0.2%	$2,605	10.9%	$333	6.8%	$600	17.0%
West	$0	0.0%	$11	0.0%	$3	0.0%	$11	0.0%	$0	0.0%	$0	0.0%
Pacific	$0	0.0%	$5	0.0%	$175	0.5%	$104	0.4%	$0	0.0%	$0	0.0%
Total	$96,005		$84,176		$31,818		$23,974		$4,911		$3,536	

	Cincinnati				San Francisco			
Region	Inflow	Share	Outflow	Share	Inflow	Share	Outflow	Share
New England	$0	0.0%	$0	0.0%	$2	0.1%	$0	0.0%
East	$1,299	7.6%	$1,113	6.5%	$2,422	86.6%	$3,823	32.2%
New York	$933	5.5%	$1,104	6.5%	$2,389	85.4%	$3,823	32.2%
South	$11,961	70.1%	$9,661	56.6%	$0	0.0%	$0	0.0%
Midwest	$3,805	22.3%	$6,277	36.8%	$17	0.6%	$686	5.8%
West	$0	0.0%	$8	0.0%	$34	1.2%	$792	6.7%
Pacific	$0	0.0%	$0	0.0%	$143	5.1%	$6,486	54.6%
Total	$17,065		$17,058		$2,798		$11,871	

Notes:
For each city, the data show cash flows into (out of) its banks from (to) banks in another region.
The share measures the percentage of transactions with banks in another region.
Source: Kemmerer (1910, pp. 276-357).

Table 4
Variability in Percentage Changes in Due to Banks between Call Dates for National Banks, 1880-1910

City	Standard Deviation	Interquartile Range	Average Due to Banks (millions)
New York City	0.100	0.138	$ 307.58
Other Central Reserve Cities (Chicago, St. Louis	0.120	0.160	$ 61.47
Reserve Cities	0.168	0.184	$ 11.92
Non-Reserve Cities (country banks)	0.416	0.306	$ 2.03

Notes: Calculations by authors.

Source: Weber (2000a)

Table 5
Domestic Exchange Rate Panel Regression Results, 1887-1910
(z statistics in parentheses)

Dependent variable = standard deviation of exchange rates over a 3-year period (sdxrate)				
Independent Variable	(1) Random Effects	(2) Fixed Effects	(3) GLS, Heteroskedastic	(4) GLS, Correlated*
Excess Bankers' Balances (excessbb)	-1.02e-08 (-6.03)	-1.12e-08 (-6.23)	-4.83e-09 (-5.16)	-2.39e-09 (-4.11)
Stan. Dev. of Deposits (sddpsts)	0.7023 (2.31)	0.6255 (2.05)	1.5187 (4.76)	0.4257 (1.47)
Distance to NYC (disttony)	-.000080 (-1.28)		0.000049 (2.11)	0.00056 (10.75)
Constant	0.4445 (4.83)	0.4047 (12.92)	0.2141 (6.49)	0.0112 (0.41)
Wald test: χ^2 (3) Prob> 2	47.84 0.000	24.43 0.000	86.53 0.000	123.94 0.000
Observations Cities	340 14	340 14	340 14	120 5
Hausman test: χ^2 (2) Prob > 2	9.67 0.008			

* Boston, Cincinnati, Chicago, St. Louis, New Orleans only

Table 6
Collection Period for Checks Sent from New York via the Correspondent Banking System in 1912 and the Fed's Inter-District Collection System in 1918/20
(time in days)

	Actual			No Fed Wire[3]	
For checks sent to:	CBS[1]	FRBNY[1]	Difference	FRBNY	Difference
Atlanta	5.2	2	3.2	4	1.2
Baltimore	3.2	1	2.2	2	1.2
Boston	3.5	1	2.5	2	1.5
Buffalo	4.1	1	3.1	2	2.1
Chicago	4.7	2	2.7	4	0.7
Cincinnati	4.7	2	2.7	4	0.7
Cleveland	4.3	2	2.3	4	0.3
Denver	6.5	4	2.5	8	-1.5
Hartford	4.7	2	2.7	4	0.7
Kansas City	5.3	3	2.3	6	-0.7
Los Angeles	8.9	5	3.9	10	-1.1
Minneapolis	5.0	2	3.0	4	1.0
New Orleans	6.9	3	3.9	6	0.9
Omaha	5.8	3	2.8	6	-0.2
Philadelphia	3.5	1	2.5	2	1.5
Pittsburgh	4.0	1	3.0	2	2.0
Richmond	4.2	1	3.2	2	2.2
San Francisco	9.4	5	4.4	10	-0.6
Seattle	8.9	5	3.9	10	-1.1
St. Louis	4.8	2	2.8	4	0.8
St. Paul	4.9	2	2.9	4	0.9
Washington	3.0	2	1.0	4	-1.1
Average	5.3	2.4	2.9	4.7	0.5

Sources: NYCHA (1912); Board of Governors of the Federal Reserve System (1918); Spahr (1926, pp. 182-83).
Notes:
[1]CBS and FRBNY stand for the correspondent banking system and the Federal Reserve Bank of New York, respectively.
[2]To estimate estimate the collection period for the Fed without the Fed Wire, we simply double the "one-way mail times" reported in column 2.