Looking Back On the Age of Checking in America, 1800-1960

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UNA MIRADA RETROSPECTIVA A LA ERA DEL CHEQUE PERSONAL EN AMÉRICA, 1800-1960.

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Resumen

Estados Unidos no sólo es el país que utilizó los cheques bancarios más, sino que también se aferró a su uso mucho más tiempo que otras economías desarrolladas. Sin embargo ahora, en el crepúsculo del cheque, trazamos la evolución del sistema de cheques en los Estados Unidos a través de sus fases principales, desde el período fundacional de ese país hasta el período moderno, incluyendo el surgimiento de casas de compensaciones, el crecimiento de la red de compensación interbancaria , El establecimiento por parte de la Reserva Federal de un sistema de compensación central a nivel nacional y la adopción de tecnología magnética estandarizada para facilitar el procesamiento de los cheques. En este artículo presentamos un análisis empírico que examina los determinantes de la compensación de cheques tanto a nivel agregado como a nivel estatal a fin de arrojar luz sobre el uso dominante de cheques por parte de la nación.

Palabras clave: sistema de pagos, cheque, bancos, Estados Unidos

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Abstract

The United States not only used bank checks the most but also clung to their use far longer than other developed nations. However, now in the twilight of the check, we trace the evolution of the checking system in the United States through its major phases from the founding of the nation through the modern period, including the rise of clearinghouses, the growth of the interbank clearing network, the Federal Reserve's establishment of nation-wide central clearing, and the adoption of standardized magnetic imaging for easy processing of checks. Our empirical analysis examines the determinants of check clearing both at the aggregate and state-level in order to shed light on the nation's dominant use of checks.

Key words: payment system, personal checks, banks, United States

Claves JEL: G21, E42, N14

1.- Introduction

The sun is setting on the use of the bank check in the United States. Check use peaked in the mid-1990s at over 50 billion and steadily declined to 18 billion by 2012.[1] The decline has been particularly steep for small denomination checks (i.e., less than $50) as credit and debit card use has become more commonplace in day-to-day transactions. At the end of the era, it is worthwhile to look back at the pattern of check usage in the United States from the start of the nation through the modern period. The United States is a particularly interesting case study. The Committee on Payment and Settlement Systems at the Bank of International Settlements[2] found that the nation used checks far more and for far longer than Japan, the United Kingdom, Canada, and the countries of the European Monetary Union. As such, the study of the evolution and pattern of U.S. check usage is important for those interested in historical payment systems in developing countries as well as those interested in payment system differences between developed countries.

This study builds on the seminal work of Quinn and Roberds[3] who trace the evolution of checking in the U.S.[4] Their broader narrative, however, does not directly address the empirical determinants of check usage or differences across cities, states, or regions. Other studies typically focus on a single event or aspect of the U.S. payments system. Jaremski and Rousseau[5] study the path and determinants of total deposits through 1914, but do not separate checkable deposits from time deposits. James and Weiman[6] examine the development of domestic bills of exchange from 1850 through 1914. Lacker, Walker, and Weinberg[7] and Gilbert[8] examine whether the Fed's entry into check clearing led to greater efficiency.[9] White[10] examines the effect of branching on check usage between 1920 and 1936. He finds that bank branching was a substitute for check clearing, but does not study any other factors or time periods. No studies have empirically examined the use of checking accounts and number of bank clearings over time and across locations in the United States.

This paper undertakes a multi-step approach to the study of checks. First, it examines the historical narrative of checks at the aggregate-level. The narrative not only brings together various measures of check usage, but also discusses the determinants that have been suggested for its rise. We also bring out the variation in check use across locations. Second, it empirically examines total deposits, demand deposits, and clearings at both the aggregate and state-level. The approach allows a test of the factors behind the nation-wide trend in checking as well as idiosyncratic factors across locations.

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[1] Gerdes and Walton (2005) and Federal Reserve (2013).
[2] Bank of International Settlements (1995, 2000, 2009).
[3] Quinn and Roberds (2008)
[4] James (2016) describes the evolution of payment systems worldwide, but his discussion on the U.S. concentrates primarily on the correspondent banking network's clearing of checks and the arrival of the Fed.
[5] Jaremski and Rousseau (2016).
[6] James and Weiman (2010).
[7] Lacker, Walker, and Weinberg (1999).
[8] Gilbert (2000).
[9] Cannon (1900) also provides a glimpse into check clearing just before the creation of the Federal Reserve.
[10] White (1983, p. 108-114).

The data suggest that the use of checks was low until the late 1800s when it began to surpass alternative payment methods. Our narrative and empirical evidence indicates that the slow growth was likely the result of the nation's lack of branching. Small banks lacking cheap or quick communication and transportation options would have avoided using checks whenever possible. Financial institutions such as interbank networks and clearinghouses stepped in to bridge some of the gap, but it was not until the late nineteenth century that checking emerged in full force.

2.- U.S. payment systems options

While checks and checking accounts are commonplace in the U.S. today, they were not always so popular. Indeed, technical factors and regulatory restrictions prevented them from being the dominant source of transactions. We, therefore, start by reviewing how check clearing and alternatives payment mediums functioned in the United States historically. Only then can we understand the historical context and factors that allowed checking accounts to rise to the top of the payments system.

2.1.- Checking account details and improvements

The key to understanding the pattern of the U.S. payments systems is to understand the limitations of the nation's unit (single office) banking system. Strict adherence to unit banking meant that banks could not open any branches. Several states eventually allowed banks to branch in their own city, but few allowed banks to branch in other cities and none allowed banks to branch across state lines until the 1980s.[11] The lack of branching severely increased the costs of clearing costs, as checks had to be cleared externally rather than internally.[12]

In the absence of branches, a receiving bank (i.e., the bank that was presented a signed check for deposit) would have had to either (1) physically travel to the paying bank (i.e., the bank that held check writer's accounts) or (2) mail the check to the paying bank. The first option was easy enough if the receiving and paying banks were located in the same city but costs dramatically rose as the distance between banks increased. The second option reduced transportation costs, but came with additional complications. The receiving bank first had to worry that the paying bank would not have enough funds to cover the check. Even if the funds were sufficient, the paying bank was not required by law to repay the check at par and often charged an exchange fee for their trouble. In order to compete for depositors, receiving banks typically shouldered the fee thus reducing their margins. Some cities, like Albany, became known for charging low fees and were referred to as "free cities" while other areas were infamous for high charges.[13]

Branching would have simplified this process. First, a receiving bank, when presented with a check drawn on a branch (i.e. an "on-us" check), could have cleared the check internally without a currency transfer. This would have greatly decreased the costs of using checks. Second, if the check was drawn on a paying bank in another city, then the receiver bank could have mailed the check to its local branch that was nearest to the paying bank and have had their agents present the

[11] The benefits of branch banking were recognized early on by Watkins (1929) and Sprague (1903, 1910).
[12] White (1983) and Chapman and Westerfield (1942, p. 243-244).
[13] Kemmerer (1922, p. 19).

check for repayment. Therefore, while branching in a city (or even a state) might have helped a bank reach more customers, it would not have dramatically increased its check clearing efficiency.

As imperfect substitutes, institutions and processes arose to improve the efficiency of the system. The first of these was the interbank correspondent system. Because banks could not open branches in another city, they created relationships with other banks in key cities instead. The respondent bank opened a deposit account at the correspondent bank, and the correspondent bank agreed to clear checks drawn on local banks at par (depositing the proceeds into the respondent's account). The respondent bank earned interest on their reserves and gained a way to cheaply clear non-local checks (i.e., called an "irregular" check), while the correspondent benefited by having access to the respondent's funds.[14]

While correspondent banks often agreed to use their own correspondent networks to clear checks of respondent banks, this still presented a logistical problem. A receiving bank would need to send the check to the correspondent that was closest to the paying bank who would then have to send it to their correspondent that was closest, and so on, until the correspondent was close enough to the paying bank that it could cheaply present the check for repayment. This process often resulted in circuitous routing. Cannon[15] describes the path taken by one check, written by Woodward Brothers of Sag Harbor, New York paid to Berry, Lohmann & Rasch of Hoboken, New Jersey. These towns are roughly 100 miles apart, but the check, once deposited in the Second National Bank of Hoboken, made a Byzantine voyage through to Boston, Tonawanda (near Buffalo), Albany, Long Island, Queens, Manhattan, back to Long Island, Brooklyn, and finally to Sag Harbor. This story is likely an extreme example, but it illustrates the costs and time involved with clearing irregular checks.

Clearinghouses were also established to facilitate the clearing of checks and other items. Created by groups of private banks, they were intended to lower the costs of clearing, particularly within large cities. Before their creation, banks had to send a representative to every other bank in the area in order to redeem their debt. Costs were low when there were few banks, but rose with the number of banks as more individual visits were needed. Clearinghouses reduced these costs by providing a central location and time to clear debt every day. Each member bank would then only have had to send a representative to the clearinghouse.[16]

While membership was restricted to banks in the local city, the creation of clearinghouses also improved the ability of check clearing in other cities. Many banks outside a clearinghouse city established correspondent relationships with clearinghouse members to clear the checks through the other clearinghouse members' networks. While far from perfect, clearinghouses drastically reduced the amount of time, energy, and cost it took to get a check cleared.

The advent of the Federal Reserve's clearing revolutionized the checking industry. The Fed established clearing centers throughout each of the system's 12 Reserve districts, and also provided free check clearing for all banks that held reserves at the Fed. Because member banks had to maintain reserve balances at the Fed, they could quickly clear checks without the need for

[14] For more detail on other aspects of the interbank network see James (1978), James and Weiman (2010), Bordo and Wheelock (2013), and Carlson and Wheelock (2015).
[15] Cannon (1900, p. 74-78).
[16] For more discussion of clearinghouses see Cannon (1900, 1910), Timberlake (1984), Gorton (1985), and Gorton and Mullineaux (1987).

currency transfers. The system greatly cut down on the costs associated with clearing checks throughout the country.[17]

2.2. Checking account competitors

The demand for a particular financial instrument depends on the costs and benefits of alternative options. Due to the technical issues of clearing irregular checks, several other instruments saw heavy use in the payments system over time. Federal currency was perhaps the most obvious substitute for checks. However, just like today, most people did not carry large amounts of currency on their person during this historical period. This was driven both by security concerns as well as the fact that all Federal currency before 1861 was either gold or silver coins. These coins were heavy, difficult to carry in large quantities, and were often worth more on the commodity market than as currency.[18] The issues of national paper money after 1860 were also generally constrained by regulation.

Bank notes provided a much more convenient currency for transactions. Bank notes were dollar-denominated liabilities of individual banks that promised to pay in specie upon demand by the noteholder, and functioned as a medium of exchange in the marketplace. To protect noteholders, each note had to be backed by an equal or greater value of assets. Bank notes were plentiful, but they shared a common problem with checks: They were only required to be redeemed at face value (at par) when presented in person at the bank of issue. To allow the many thousands of bank notes to flow around the country, private note brokers identified and purchased notes at a discount from their face value. Local bank notes almost always traded at par because holders could easily demand payment from a local bank, whereas out of town notes often circulated at a discount to par depending on the issuing bank's risk and distance. Even after the National Banking Acts standardized notes and reduced discounts to zero, the notes were not widely used for interregional transactions, but filled the need for a portable local currency.[19]

For inter-regional transactions, bills of exchange were the most common check-alternative. A bill of exchange was a payment agreement written in one city but paid out in another. The bills were generally drawn on merchants or other financial intermediaries that were connected to the writer. Of particular importance in the U.S. economy was a variation called a bank draft. Bank drafts were essentially cashier's checks written by a bank in one location and drawn on its reserve balances at a correspondent bank in another location. The drafts, therefore, did not have to return to the issuing bank. Individuals that needed to make a payment in another location could purchase funds from a bank in their city but drawn on a bank in the other location. For example, a Chicago bank might sell $100 of its New York City reserves to a Chicago importer who needed to pay for his goods in New York City for $100 plus a minor service fee.[20] The buyer could then use the draft as payment and the receiver could deposit it in their bank.

3.- Historical development of U.S. checking

[17] Kemmerer (1922).
[18] Until the Gold Standard Act of 1900, the Treasury maintained a fixed exchange rate of gold to silver that, despite adjustments, usually left one of the two metals undervalued.
[19] For more details on bank notes and the discounts see Gorton (1996, 1999) and Jaremski (2011).
[20] James and Weiman (2010) show that the fees varied over time with the demand for funds in the specified cities.

We now turn to the historical development of checks. The narrative not only provides information on the growth of checking accounts and clearing but also motivates our eventual examination into the empirical determinants of that growth.

Unfortunately, there are no aggregate statistics on check clearing until the Fed was created in 1914. We thus use a variety of measures that proxy for check usage in the earlier time period. First, we examine the total value of deposits across the country.[21] The variable captures the access to and potential for the use of checks. Second, we examine the total value of clearings in clearinghouses. Clearinghouses handled the vast majority of checks in the United States. The only check clearings not covered by this measure are internally cleared checks or clearings between banks in the absence of a clearinghouse. Because branching was fairly uncommon even through 1914, internal clearings should be relatively small. Checks cleared in the absence of a clearinghouse are relatively larger; however, because clearinghouses were in most major cities and many small town banks still cleared through the correspondent network, the total value of missed checks should still be small relative to the observed amounts.

3.1.- Antebellum period (1790-1860)

Seen in Figure 1, deposits were not a large portion of the banking system until the late 1830s. The ratio of deposits to GDP only increased a small amount before 1820. The lack of growth is not surprising given the dominance of bank notes. Banks preferred notes because they circulated as currency and were not redeemed as quickly as checks were cleared. As such, banks could issue large amounts of notes yet only keep a fraction of their value in the vault as cash. The public may also have preferred notes because deposits were not subject to reserve requirements while bank notes were.[22] Bank note circulation declined over the period, but banks in 1860 still had as much value outstanding in the form of notes as they attracted in deposits.

The money supply was also highly dependent on the bank notes. Bank notes in circulation made up more than 50 percent of M1 before 1840. The rise in deposits and federal currency eventually reduced the fraction of bank notes to about 33 percent by 1860, but due to the physical drawbacks of paying with specie, the money *in use* consisted even more heavily of bank notes than gold and silver coins.

The correspondent system, while up and running, had not yet taken off. Figure 2 shows that the value of deposits of one bank placed in another bank (i.e., interbank deposits) relative to GDP.[23] The data show a rise in interbank deposits during the 1820s and 1830s and then a crash down during the Panics of 1837 and 1839. Overall, however they remained a relatively small portion of the banking system through the early-1860s.

The proxy measures suggest that check use in the antebellum was relatively small compared to the use of bank notes. Even bank drafts had not reached a critical mass due to the fledgling development of the correspondent network.

3.2.- Postbellum period (1861-1913)

[21] For a discussion of deposit growth rather checking growth, see Jaremski and Rousseau (2015).
[22] Only three states had implemented reserve requirements on deposits by 1860 (Mitchener and Jaremski 2015).
[23] Interbank deposits are often listed as "Due from banks" or "Bankers balances" on balance sheets.

The first substantive expansion of deposits began in 1863. The ratio of deposits to GDP more than doubled between 1864 and 1869. This was the largest five-year increase in deposits achieved at any time before 1860, but unlike previous episodes, the expansion had only just begun. Indeed, it was not until the Panic of 1907 that the ratio ever declined for more than a single year. By the time the Federal Reserve Act was passed in 1913, the ratio of individual deposits to GDP stood at 58 percent. Of these deposits, 54 percent were considered demand deposits that could have been drawn on by checks.[24]

Figure 3 shows that the value of clearings at the New York City clearinghouse (established in 1853) rose over the course of the Civil War, but slowly declined relative to GDP between 1870 and 1894. In 1894, the number of clearings in New York City was about 200 percent of GDP. That value then jumped to around 300 percent by 1900, where it remained until the Great Depression.

When disaggregating clearings by location, several patterns emerge. First, we see that New York City made up the bulk of all clearings in the nation. At no point in that period did clearings in New York City fall below half of all clearings, and for most years it was above 60 percent. Chicago, Philadelphia, and Boston had a large number of clearings relative to other cities, but still remained small compared to New York City. For instance, New York City averaged about 10 times the clearings in Boston or Philadelphia and about 8 times the clearings in Chicago. Second, each city's clearings display different behavior over time. Clearings in Boston seems to jump up during the 1890s and then return to their previous values, clearings in Chicago dip in the early 1900s yet grow much larger thereafter, whereas clearings in Philadelphia remained steady until they start to rise after 1915.

The substantial rise in aggregate deposits and clearings was likely driven by several factors. First, the National Banking Acts of 1863 and 1864 required that new national banks formed under the law only back their notes with U.S. Treasury securities and at 90 percent of their face value.[25] This greatly reduced the profitability of notes and pushed national banks towards deposits. In a further effort to force existing state banks to convert to national charters, Congress also passed a 10 percent tax on outstanding notes of state banks in 1865.[26] As a result of these factors, bank liabilities shifted from notes to deposits. By the end of 1900, bank notes made up less than 5 percent of all liabilities and an even smaller share of the money supply due to the rise in federal currency.

Second, the National Banking Acts encouraged the development of the interbank correspondent network. The Acts allowed national banks to apply their deposits with correspondents in large cities toward their legal reserve requirements and required that national banks redeem their notes and checks in at least one major city. Only national banks in designated central reserve cities (i.e., New York City, Chicago, and St. Louis) were required to fully satisfy their requirement by holding reserves in the form of vault cash. Banks thus had to have big city correspondents which effectively codified and expanded the existing correspondent banking network for national banks. The increased importance of interbank deposits is visible over time.

[24] For the years when data are available, demand deposits remain a relatively consistent proportion of deposits. The only deviations come just before and just after the Great Depression.

[25] The Gold Standard Act of 1900 changed the requirement to 100 percent of face value, but by that time, checks had reached critical mass.

[26] Jaremski (2013).

Unlike the slow growth in the antebellum period, Figure 3 shows that several time periods experienced extraordinary growth: Civil War, the late 1890s, and the Great Depression.

Third, clearinghouses were becoming more widespread. New York City established the first U.S. clearinghouse association in 1853, and a handful of large financial centers quickly followed. Growth slowed, however, and it was not until the 1890s that growth began to quicken again. As seen in Figure 4, the late growth was quite extensive and over 200 clearinghouses were in operation by 1914.[27] While additional clearinghouses were formed, they did not take away from the importance of New York City. In fact, their creation likely expanded the power of the New York City Clearinghouse. Members of smaller clearinghouse tended to serve the banks in their local region, but maintained large accounts in New York City so that they could clear irregular checks.[28] This placed New York City squarely in the center of the nation's clearing network, and explains its continued dominance.

Finally, the advent of the railroad age brought banks "closer" together. The massive amount of railroad building during the late 1850s continued through the second half of the century. The number of miles of track stood over 39,000 in 1867 and grew to 200,000 by the end of the century.[29] Not only did the rails allow for faster travel of people and mail, but they also were often paired with telegraph lines which allowed for faster communication and thus would have reduced the costs and difficulties of clearing checks.

The economy eventually reached a tipping point. Starting in the 1890s, there was a shift out of bank drafts and towards checks.[30] The shift seems to be driven by the development of the interbank system as nearly all banks had multiple correspondents to help clear their checks. For instance, Jaremski and Wheelock[31] found that 84 percent of national banks in 1913 had at least one correspondent in New York City.[32] Thus they could issue checks drawn on their own bank without paying a fee, knowing that the checks could be quickly cleared through the nearest clearinghouse or else through New York City's clearinghouse. The decline in the use of bank drafts is reflected in the data. In the mid-1890s, the downward trend in clearings reversed and deposits saw a massive increase. A smaller but still significant jump occurs in the interbank deposits data.

It is worth noting that branching was not common until the very end of the period (Figure 5). In 1900, branches made up less than 1 percent of all banks. Branching gained some traction in the early 1900s, but the overall expansion of the banking system kept pace. It was not until the 1920s that they became a non-trivial portion of the system.[33] The rural banking collapse that followed the dire post-World War I agricultural slump is at least partially responsible for the change. Failures were concentrated in small agricultural banks while large branch banks thrived during the period. Moreover, several states passed branching laws enabling branching either within

[27] The early expansion seems to have been limited to large financial centers, particularly central reserve clearinghouses between 1853 and 1873. The first five clearinghouses (New York, Boston, Baltimore, Cleveland, and Philadelphia) were among the largest cities both in terms of population and banks. The growth was particular strong after the period's panics. 5 clearinghouses were established within three years after 1884, 25 were established within three years after 1893, and 34 were established within three years after 1907.

[28] James and Weiman (2010) and Jaremski and Wheelock (2016).

[29] Andrew (1910, p. 12).

[30] James and Weiman (2010).

[31] Jaremski and Wheelock (2016).

[32] State bank correspondents display a similar pattern.

[33] White (1985) and Economides, Hubbard and Palia (1996).

their city or within their state. That said, the growth of branching nation-wide was fairly steady across time and displayed no distinct jumps. The large movements in the figure are generally driven by the decline in the number of unit banks.

Figure 6 shows the number of branches per thousand persons and the total number of branches in 1925 by state. As shown by the figure, the distinction between no law and a law making branching illegal was relatively small. Few branches were created in either type of state.[34] The Figure shows that California with legalized branching and New York with branching legal but restricted geographically had the largest number of branches. In per capita terms however, New York ranks somewhere in the middle, while California remains the largest. Most states had relatively few branches, especially compared to the number of people; however, a couple important branches could still make all the difference.

3.3.- Federal Reserve period (1914-1960)

In addition to creating a lender of last resort, the Federal Reserve was created to operate a nationwide and more efficient payments system.[35] The Federal Reserve established clearinghouses in major cities across the system's districts.[36] The Fed also set up a Gold Settlement Fund to facilitate clearing. By May of 1915, each Federal Reserve Bank was required to send to the Treasury one million dollars in gold or gold instruments as well as a sum at least equal to what they owed to the other Reserve Banks. These funds were used for check clearing at the Fed, and each Reserve Bank was required to keep at least a million dollars in reserve at all times. This system often used the telegraph but there were occasional delays. In 1918, the Federal Reserve Banks solved this issue by putting in place a leased wire system for the exclusive use of the Reserve Banks. This system has come to be known as FedWire.[37]

The designers of the Fed hoped to create a universal system, but bowed to political realities. National banks were the only bank type required to join the Federal Reserve System. State-chartered banks and trust companies were permitted, but not required, to join the Fed.[38] Given a choice, few state banks choose to join: only 34 out of 18,645 were members in 1916.[39] Less than half of the banking system remained outside the Federal Reserve by the Great Depression (Figure 6).[40]

In April 1916, the Fed starting requiring member banks to remit at par any check the Reserve Banks presented. To encourage adoption, the Fed increased the number of locations from

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[34] Each state is classified according to the legal status of branching in 1931 (Federal Reserve 1937). The few branches in states where branching was illegal were likely branches created before the law were passed.

[35] Lacker, Walker, and Weinberg (1999).

[36] The Federal Reserve's founders envisioned a universal par check-clearing system. The Federal Reserve absorbed clearinghouses in the cities where it operated and cleared checks for all banks in the nation that held reserves at the Fed at face value.

[37] Spahr (1926).

[38] The requirement of membership for national banks was hotly contested. The *Annual Report* of the Federal Reserve Board (1915, p. 12) describes two lawsuits challenging the constitutionality of section 11 (k).

[39] Gilbert (2000).

[40] Even when adding in the national banks that were forced to join, less than 40 percent of all United States banks and 60 percent of all commercial bank assets were contained in the system. See Calomiris, Jaremski, Park and Richardson (2015) for a summary of the determinants of Fed membership.

which it offered check clearing services from 12 initially to 22 cities in 1920.[41] The Fed also exerted pressure on uncooperative banks by holding all checks drawn on nonpar institutions for several months and threatening to send an agent to present those checks at the banks' counters, where they had to be cleared immediately in cash at face value. However, after the Supreme Court ruled against the practice in 1923, the Fed could only encourage participation but not force it.[42] The practice accounts for the decline in non-par banks in the late 1910s and the increase in the mid-1920s (Figure 6). The fraction of non-par banks continued to grow through 1941 and then began to slowly decline[43].

Despite continued resistance to non-par clearing, the Fed's importance in check clearing grew during the 1920s (Figure 7). Banks were mostly prohibited from opening branches and thus the Fed was useful to clear checks outside of one's bank. The Fed also would implicitly subsidize banks by crediting a bank for a submitted check before it had received the funds from the sending bank. In 1915, the Fed cleared 8.8 million checks, worth $4.7 billion dollars, which made up only 2.9 percent of checks cleared through clearinghouses. These amounts grew through 1929 to 852.1 million checks with a gross value of 351.7 billion which was 49.1 percent of the amount total clearinghouse clearings. While the Depression shrank the absolute value of clearings, the Fed share of clearings grew to 65.1 percent.[44] The growth was not just due to bank failures of non-members during the Depression, but also the large number of bank failures shook up banks' correspondent networks and made banks hesitant to use non-Fed clearing arrangements. Thus the Fed was well-positioned to continue to play a large role in checking during the postwar era.[45]

The development and growth of computers at midcentury promised great efficiency gains in processing checks. Early computer systems were developed by the Bank of America in conjunction with the Stanford Research Institute, and First National City Bank of New York, working with International Telephone and Telegraph. While these banks developed their own systems, the American Banking Association soon after developed a common system in 1954. Magnetic-ink character recognition (MICR) technology was used to allow for easy computer reading of checks, and system was fully developed by 1960. This system has continued to be used to the current day, and has greatly facilitated check-clearing and continued the check's dominance through the present.[46]

4.- Empirical facts of checking accounts and clearings

The narrative evidence presents several important hypotheses for the rise of checking in the United States. However, many of these aggregate factors are correlated with each other and thus a univariate view will not clearly separate the independent importance of each factor. We, therefore, implement a multivariate regression approach. First, we examine the aggregate pattern of our check usage variables. Stopping short of causality, the regressions show how correlated the various factors are with our measures of check usage and are suggestive of the relative strength of our explanations. Second, we examine the check usage measures at the state-level. Not only does

[41] Gilbert (2000).
[42] Lacker, Walker, and Weinberg (1999, p. 11)
[43] White (1983).
[44] Gilbert (2000, p. 131).
[45] Quinn and Roberds (2008).
[46] Yavitz (1967).

this help us separate local economic factors from aggregate trends, but the idiosyncratic behavior also helps better identify each factor.

Matching the previous section, we examine several proxies for checking behavior. We start with total and demand deposits to capture the potential for checking, and then we examine the value of clearings at clearinghouses in each year to capture the size of transactions that were carried out through the banking system.[47]

4.1.- Empirical determinants of checking at the aggregate level

Based on the narrative evidence, we focus on a variety of microeconomic, macroeconomic, and financial factors that could be correlated with the use of checking. First and foremost, we control for factors related to the financial system. The number of banks in operation controls for the size of banking. Banking for the vast majority of the period was constrained to cities and thus a location without a bank would not have any deposits or clearings. The amount of interbank deposits controls for the size of the interbank clearing system and the ability to quickly clear irregular checks. The ratio of branches to total banks is included to account for the development of branching. Next measures of the money supply control for the amount of check substitutes available using the amount of paper money and the amount of specie (i.e., hard currency). We control for the nation's developing transportation and telegraph system with the logarithm of the number of railroad miles.[48] Finally, the Nominal GDP and Consumer Price Index pick up broader trends in output as well as the demand for money.

The linear regression model[49] takes the form:

$$C_t = a + \beta_1 Financial_t + \beta_2 Money_t + \beta_3 Macro_t + e_t \quad (1)$$

where C_t is one of the proxies for the use of checks, $Financial_t$ is the vector of financial variables, $Money_t$ is the vector of money supply variables, $Macro_t$ is the vector of macroeconomic variables, and e_t is the robust error term.

Table 1 displays the results for the logarithm of total deposits from 1833 through 1940. The coefficients indicate that the size of the financial system is heavily correlated with deposits as is the size of the interbank deposits. The amount of paper money in circulation also is positively correlated with the number of deposits, suggesting that the two might not always act as substitutes for each other over the broader time period. The ratio of branches to total banks is also positively correlated with total deposits.

The period is the longest series that can be analyzed and illustrates the broader trends that exist in the data. However, the long-run analysis has some data limitations. First, the total amount of deposits is a rough view of checking behavior as checks could not be drawn on time deposits. The estimates of demand deposits and clearings only start in the late nineteenth century and thus cannot be examined for such a long period. Second, the changing use and composition of money

[47] Indeed, the clearings data match the trends in aggregate bank debits *(Banking and Monetary Statistics* 1947).
[48] Because telegraph lines were generally run along railroads, there is no clear way to separate the effects.
[49] To exploit the time-dimension of the data and to complement the linear model, we perform vector autoregressions on the same data as in Table 2. The results are generally similar and are found in the Appendix.

might also lead to biased results. We move to study a shorter period of time with more targeted data in Table 2.

The results for total deposits change slightly when we restrict the sample to the more recent data. Specifically, the coefficient on paper money becomes insignificant and negative and the coefficients on CPI, Nominal GDP, and railroads become positive and significant. As prices were relatively constant outside of the Civil War before 1879, the inclusion of the early period might be adding noise. The change in paper money is likely driven by the introduction of stable paper currency by both the Federal government and the National Banking Acts. The effect of money thus would experience a secular change over time.

The coefficients for demand deposits display a similar pattern as total deposits. Demand deposits are positively correlated with the number of banks, branching, CPI, and the value of interbank deposits. The only major departure is that railroads are no longer significant. Fewer variables are correlated with clearings. Only Nominal GDP and the branching ratio is positive and significantly correlated with clearings. The value of interbank deposits even is negatively but insignificantly correlated with clearings, likely a result of efficiency of clearing through New York City. Before the interbank network became more centralized, a check often had to be passed to multiple banks in order to clear a check. After banks gained a connection to New York City, they only had to send a check to a single location rather than many places.

The results in Table 2 show that the historical narrative synchs up with the empirical trends in the data even when controlling for a variety of factors. The next step is to determine what local factors mattered for the differences in check usage across space.

4.2.- Empirical determinants of checking at the state-level

As highlighted in the narrative, there was a lot of variation in the amount of check usage across cities. Seen in Table 3, there is also considerable variation across states and across time. The data also show that many states did not have a clearinghouse even by 1900. While much of the variation is explained by the size of each market, the remaining variation allows us to better study what other microeconomic or financial factors may have led to check usage. We conduct a similar analysis as the previous section, but instead of having one observation per year, we have an observation for each state per year.[50] States enter the sample when there is at least one active clearinghouse in the state.

To match the more detailed data, we add in some new explanatory variables. First, we include the state's total population, urbanization rate, crop and manufacturing output to capture the state's industry mix which would affect their checking needs.[51] Second, we break up the branching ratio by the types of laws in each state in order to better capture the effect of branching. We create separate dummies for states that had unrestricted branching and states that restricted branching to a city or county in 1930. Third, we obtain the number of railroad miles in each state in 1910. Fourth, we add the number of telephones in a state in 1907. Finally, we explicitly control for nation-wide changes across time using year fixed effects rather than including aggregate measures

[50] To obtain a measure of clearings for the state, we sum all the clearings by year in the state's cities as reported by the Comptroller of the Currency.

[51] We obtain these variables from Haines (2004) and extrapolate between Census years to obtain annual values.

of money supply, CPI, or GDP. The coefficients of the model are therefore identified on differences of states relative to the nation-wide average.

Table 4 displays the state-level results. Many of the same factors affect total and demand deposits. Urbanization, interbank deposits, and both branching variables are positively correlated with both deposit measures whereas crop output is negatively correlated. At the same time, there are also several differences. The number of banks and telephones positively affect total deposits but have no significant effect on demand deposits. Alternatively, railroad miles and population have a positive effect on demand deposits but have no significant effect on total deposits. Moreover, manufacturing has a differential effect on the two types of deposits, it adds to total deposits and detracts from demand deposits.

Clearings are positively correlated with population, urbanization, farm output, and interbank deposits, but are negatively correlated with the number of banks, railroad miles, and telephones. Relative to states without any branching laws or that prohibited branching, states with unrestricted branching laws tended to have more clearings and states with restricted branching laws had no significant difference.

By not including state-fixed effects in the previous state-level specifications, the regressions look at the cross-sectional variation across states as well as the time series variation within a state. We started with this approach because of the late starting date of the data. By the 1890s, many states had already reached a steady-state growth path and began to specialize. Most of the important variation would thus already be present in the states, and a time-series analysis would not be able to identify it. Moreover, many of the variables we have are only measured at a single point in time which means we would not be able to include them in the model. That said, the approach is not able to a prove causality of any particular variable because it is possible some underlying constant factor (i.e., climate, crop suitability, access to waterways) associated with the state is the reason for the growth of both the left and right hand side variables. Therefore, with the caveats above, we re-estimate the models with state-fixed effects in Table 5 to focus on the effect of the explanatory variable's growth on the deposits and clearings.

The results with state fixed effects are fairly similar to those without them. Urbanization and interbank deposits are still significantly correlated with deposits and clearings. Crop output remains negatively correlated with deposits and positively correlated with clearings, but in this case we see the same pattern for manufacturing output. The sign switch for total deposits from Table 4 to Table 5 on manufacturing is likely driven by the fact that most manufacturing areas were set by the late 1800s, and thus the positive sign in Table 4 was a comparison of agricultural areas with a little manufacturing to locations with large amounts of manufacturing. Similarly, the number of banks and population are now positively and significantly correlated with all the dependent variables. Again the change is likely driven by population and financial growth leading to an expansion of the payment systems, but in the cross-section the most developed states might not always have the most deposits and clearings.

5.- Conclusion

As the sun sets on the age of checking, this paper takes a look back at what led to its growth and dominance in the United States for so long. Looking at data from 1800 through the 1950, we find that the United States' pattern of deposits is likely a product of its historical unit banking

structure. Lacking the ability to clear most checks internally, banks had to set up other institutions to clear checks across locations. These introduced large costs that dampened the growth of checking and encouraged the use of alternatives. It was not until the late 1800s that checking seemed to break out of this trend and become the leading payments technology. That said, the banking system's lack of branching continued to prevent non-checking payments systems from emerging even though they might have been more efficient. Technological improvements only accelerated the use of checking during the postwar period, though the decline in checking is likely inevitable now.

The results should not be surprising to scholars of the European banking systems. Most European counties survived on a check substitute similar to the bills of exchange, and shifted from these as a result of similar factors: the rise of a better integrated financial system and increased information and transportation technology. Nishimura[52] found that the decline of inland bills of exchange in London primarily hinged on improvements in transportation and communication, but there is also a role for the later bank amalgamation movement. Nishimura[53] also found that the Banque de France used its growing branch network to flood the nation's market with discounted bills of accommodation created by provincial banks. In Spain, Maixe-Altes and Iglesias[54] found that the decline of the bills of exchange markets were the result of the expansion of the branch network of the Bank of Spain.

To examine the importance of check clearing internationally, we compare real clearings, deflated using the CPI for each country, converted to US Dollars and normalized by each country's real GDP for total clearings in London, Paris, the Reichsbank of Germany, and New York City. The average ratio of London to New York clearings is 11.8% for the period 1888-1938, while the average ratios of Paris and Germany to New York are well below 1% during this period.[55] The United States' clearing totals thus stand far apart from other industrial countries.

The checking determinants beg the question of why the U.S. used checks far more than other countries. Much of this has to do with its unique situation. For starters, the U.S. was not quick to develop nation-wide branching even after the period studied in this paper. It was not until the 1980s and 1990s that deregulation allowed bank amalgamation to shrink the number of banks under a couple thousand. Even today, the high number of banks makes it an outlier amongst developed countries. Essentially the U.S. could be considered a large number of similar but unintegrated banking markets that regularly had to interact with each other. This required a clear way for each bank to interact with each other that did not involve internal or bank-specific technology. Second, the U.S. was much larger in geographic areas than most other counties. Banks, therefore, had to have a local focus and structure themselves to meet the needs of the local economy rather than the national one, creating a separation between urban and rural banks. Geography also meant a few large financial centers or banks could not serve the entire market (or even a large portion of it). Finally, the U.S. never developed a European style central bank. The Fed was created explicitly different from the more active central banks of Europe. The German giro system allowed the payer to deposit funds directly into the account of the payee without the need for checks. The more involved central bank of the British and French banking system helps explain their lower

[52] Nishimura (1971).
[53] Nishimura (1995).
[54] Maixe-Altes and Iglesias (2009).
[55] All data from the NBER Macrohistory dataset available from the Federal Reserve Economic Database.

clearings. British financial development helps explain the much larger clearing total there relative to the U.S. The result was a large number of banks and no central authority that could force bank to adopt a more efficient payments system.

The diversity in banking and lack of integration continued to complicate payment systems going forward. The large number of small and rural banks was slow to adopt newer technology during the rise of the computer and electronic age. Electronic funds transfer systems and point of sale systems represented a relatively large investment and offered little benefit for banks without branches or that did little business outside the local area. This not only slowed the integration of the electronic banking network, but also allowed other institutions (i.e., credit card companies) to develop and fill the gap.

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Appendix A: Vector Autoregression Results

To see how robust our OLS results are, we compare with an autoregressive analysis which allows variables to interact with each other over time. Specifically, we perform vector autoregressions (VARs) on the same variables included from Table 2 and compare the direction and statistical significance of the OLS model to the VAR model's impulse response functions.[56] The VAR is run three times, once for each dependent variable. The Cholesky ordering is: Specie, Paper Money, Interbank Deposits, Number of Banks, Branches/Banks, CPI, Nominal GDP per Capita, Railroads, and then the dependent variable.[57]

We display the impulse response results in Figures A1-A3 with a two standard deviation conference interval. The impulses show the effect of a onetime shock to an explanatory variable on the dependent variables (Total Deposits, Demand Deposits, and Clearings) in order to match the OLS results. While one could look at bi-directionality of the variables in the models, it is not the focus of this paper and is left to other studies.

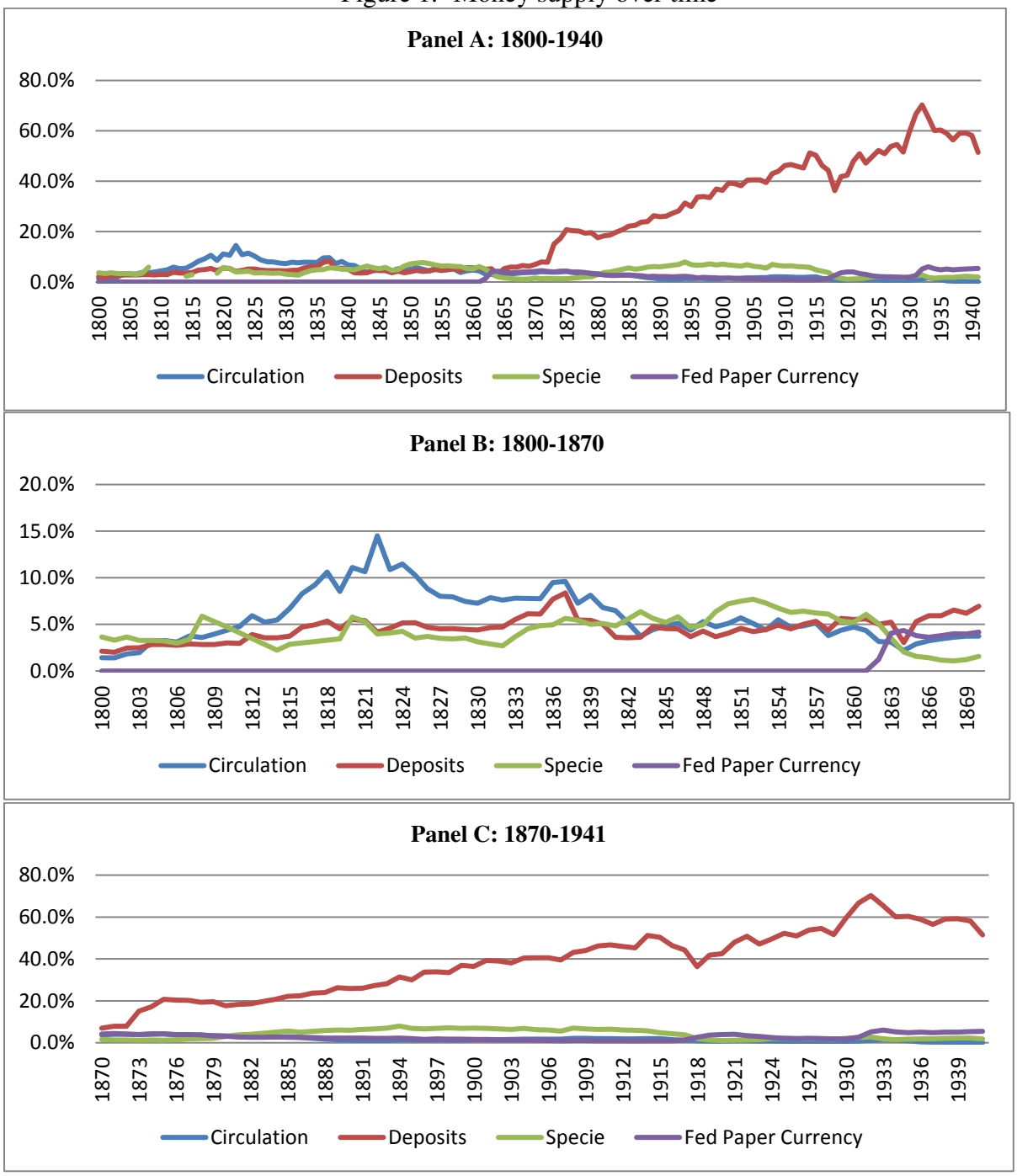
Figure A1 shows the OLS and VAR results match except that Bank Branches and Railroad mileage are significant in the OLS results but not in the VAR, whereas paper money matters in the VAR but not the OLS.[58] Figure A2 shows that the OLS and VAR results match with the sole exception of Number of Banks which matters in the OLS but not in the VAR. Figure A3 shows that the VAR and OLS results match except that Interbank Deposits matter in the VAR but not in the OLS.

[56] The models are estimated with two lags based on the AIC statistic.

[57] The justification for this Cholesky ordering is: specie is first as most specie flows were determined international by the specie standard of the time. Paper money is next as it is interchangeable domestically with specie. Money developments then affect the banking system which then affects Nominal GDP per capita. Nominal GDP is strongly related to railroad mileage as railroad investment responds with a delay. The dependent variables come last.

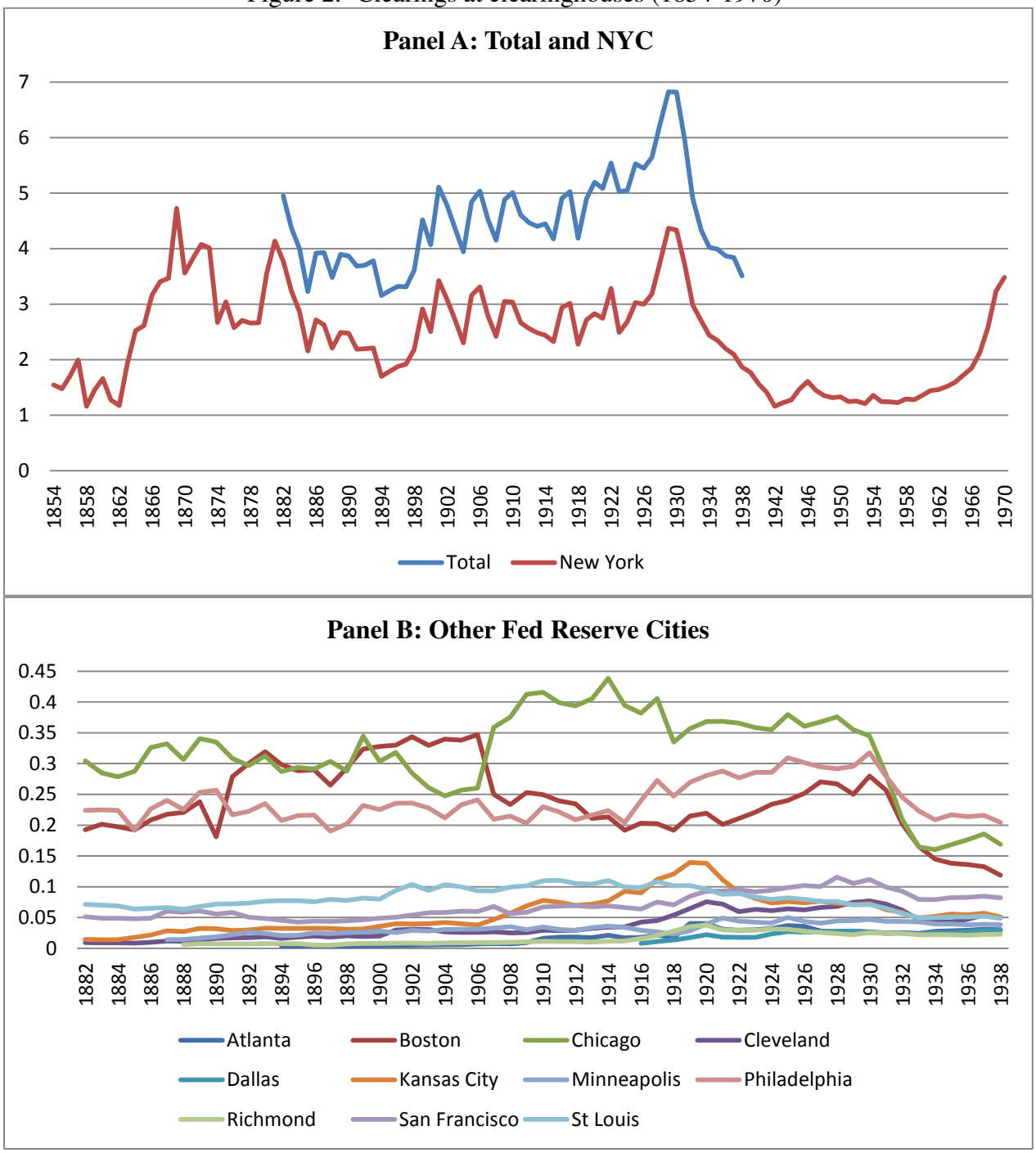
[58] For this as well as the other figures, we describe statistical significance at the 10 percent level.

Figure 1.- Money supply over time



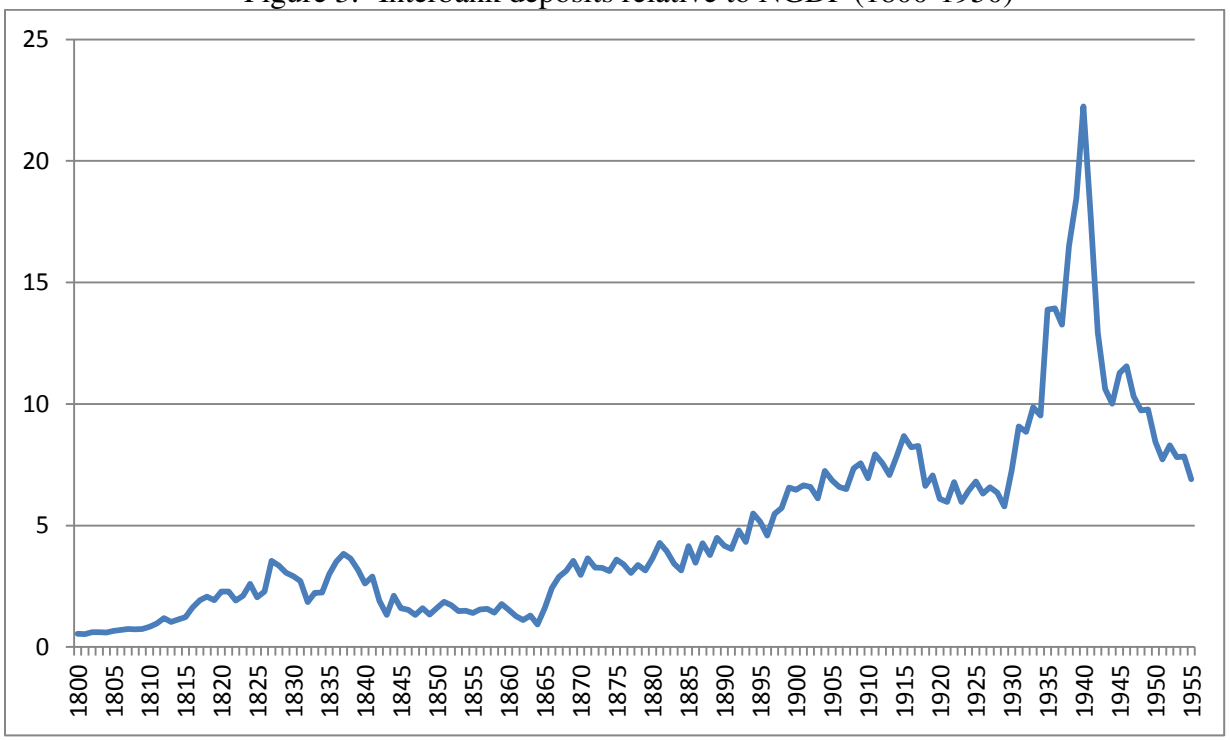
Notes: Deposits from Weber (2008) from 1800-1832, Comptroller (1931) for 1833-1896, and Flood (1998) thereafter. Circulation from Weber (2008) from 1800-1832, *Banking and Monetary Statistics* (1943) thereafter. Specie from Carter *et al*. (2006) from 1800-1860 and *Banking and Monetary Statistics* (1943) thereafter. Fed Paper Currency from *Banking and Monetary Statistics* (1943), and Nominal GDP from Johnston and Officer (2016).

Figure 2.- Clearings at clearinghouses (1854-1970)



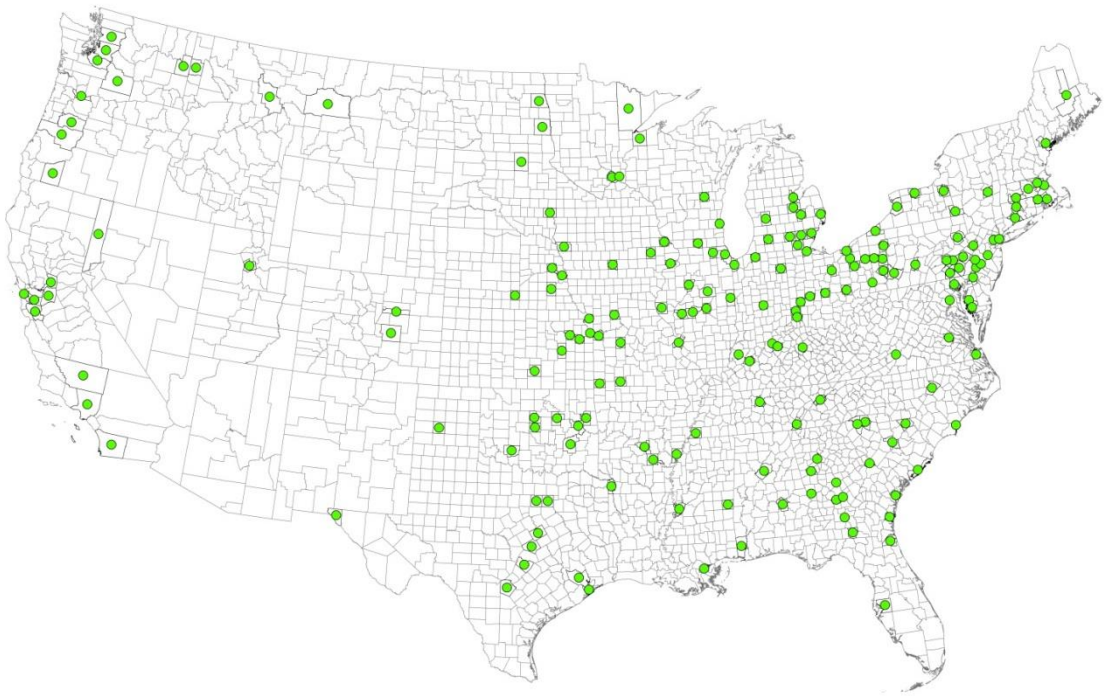
Notes: New York City and Total Clearings from *Banking and Monetary Statistics* (1947). Clearinghouses in other cities taken from Comptroller's *Annual Report* in each year. Totals and NYC clearings from BMS match the Comptrollers numbers in years when reported. Nominal GDP taken from Johnston and Officer (2016). The lack of total clearings before 1882 and after 1938 is a result of data availability.

Figure 3.- Interbank deposits relative to NGDP (1800-1950)



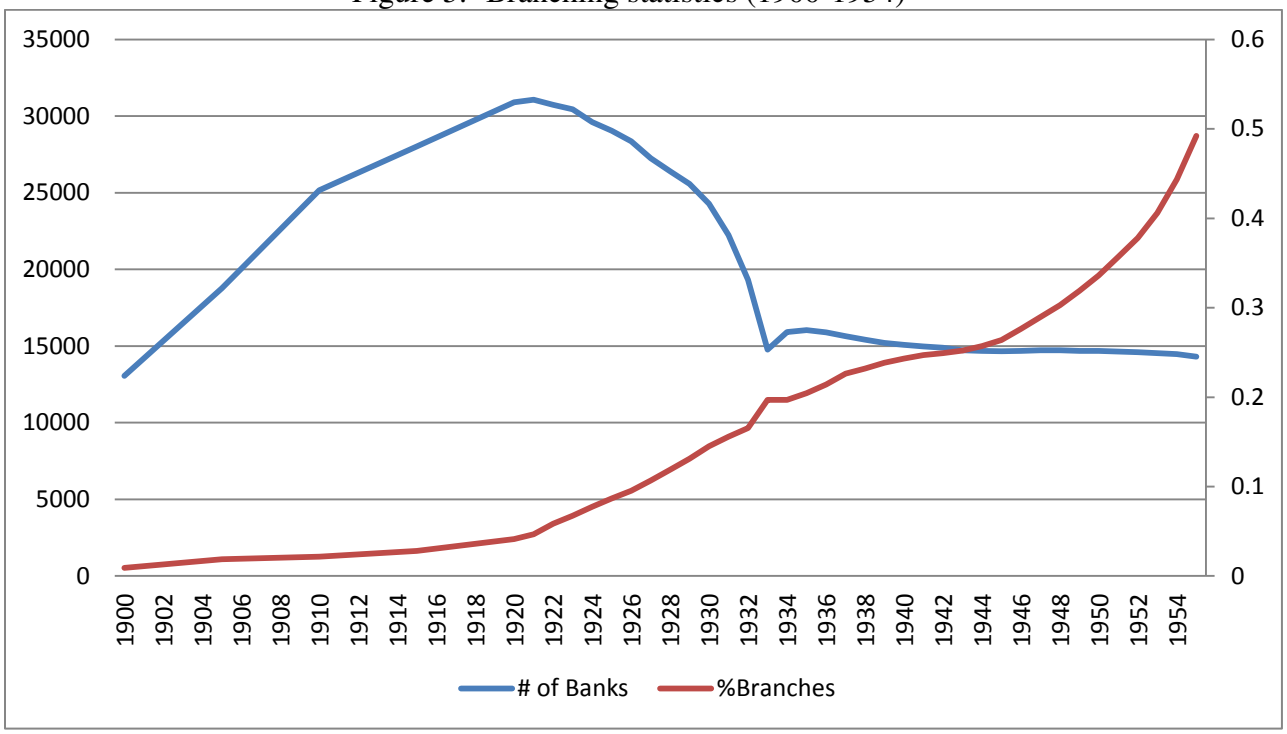
Notes: Interbank deposits (commonly known as "Due From Banks" or "Bankers Balances") come from Weber (2008) from 1800-1832, Comptroller (1931) for 1833-1896, and Flood (1998) thereafter. Nominal GDP from Johnston and Officer (2016).

Figure 4.- Location of clearinghouses in 1914



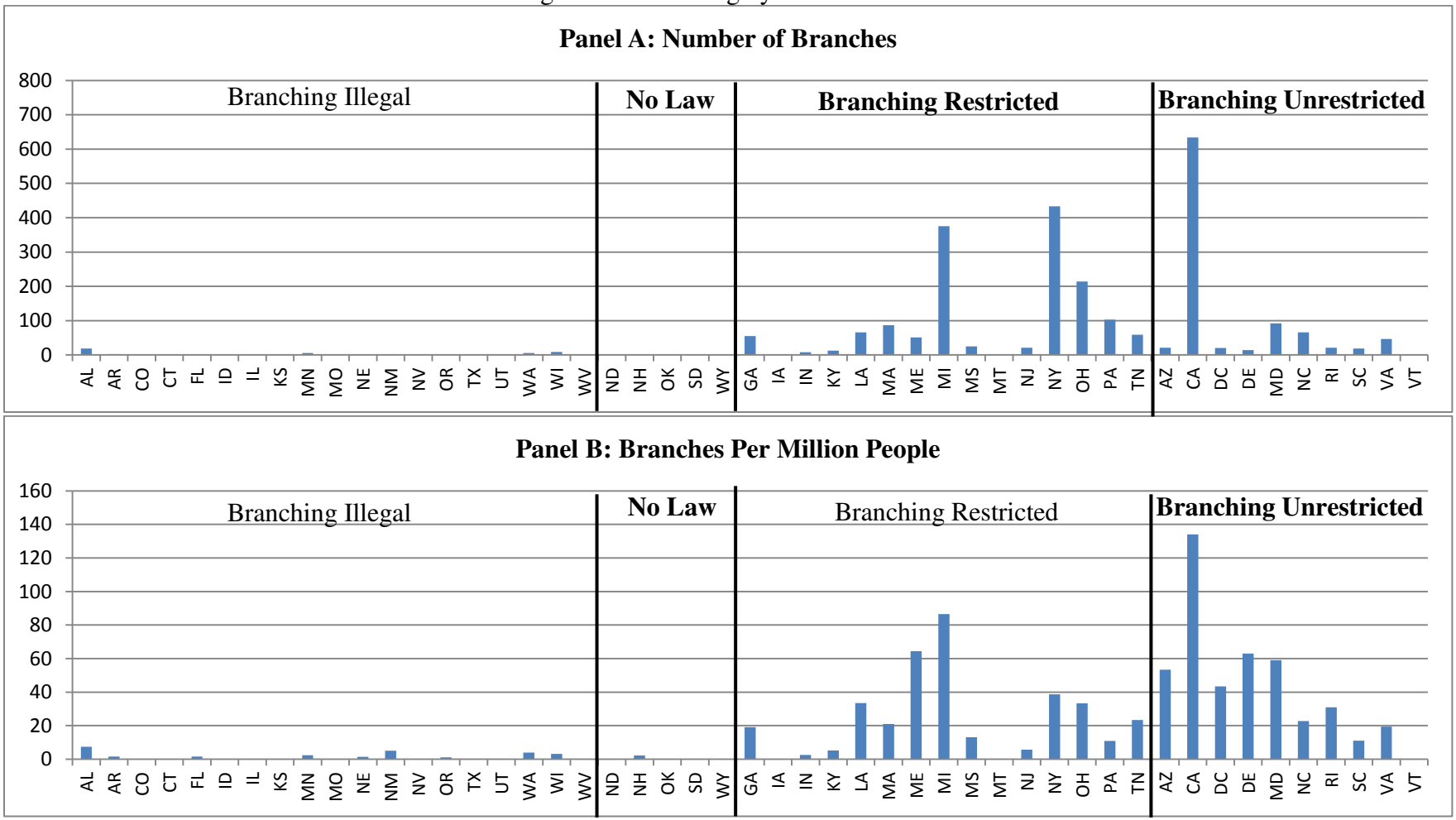
Notes: Map provides the locations of all clearinghouses in operation in 1914. Taken from Jaremski (2015). Locations are based on county-center.

Figure 5.- Branching statistics (1900-1954)



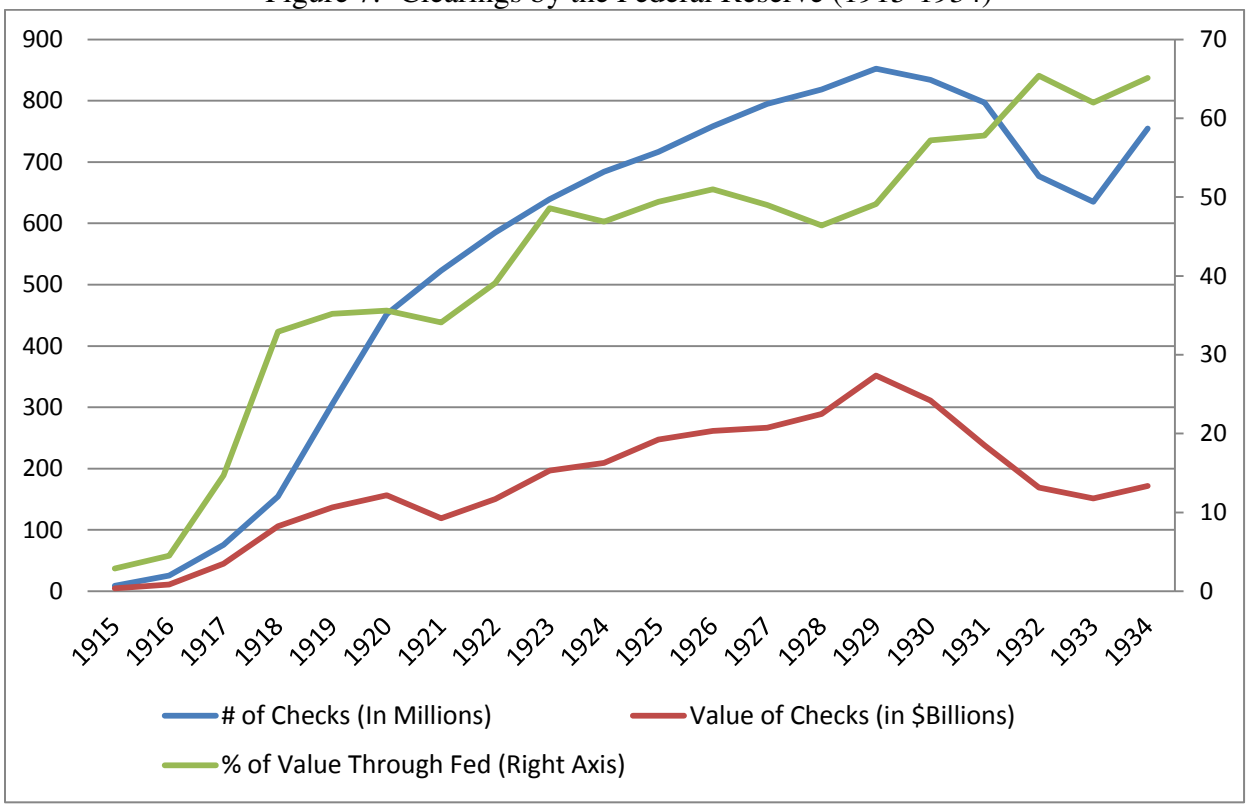
Notes: Data on branches from Federal Reserve (1937). Number of banks from Flood (1998).

Figure 6.- Branching by State in 1925



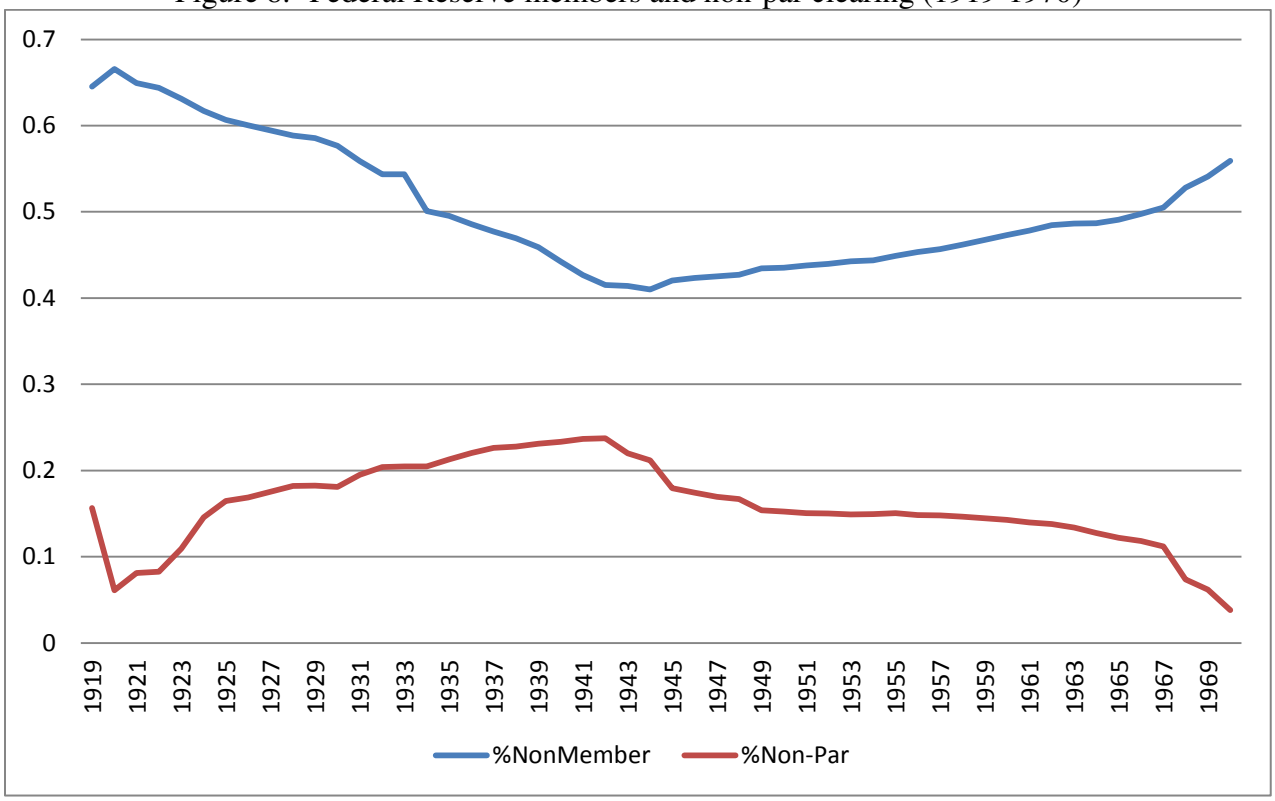
Notes: Figures provide the number of branches by state in 1925. The states are subdivided into the types of branching laws in place as of 1931. Branch data from Federal Reserve (1937).

Figure 7.- Clearings by the Federal Reserve (1915-1934)



Notes: Data from Gilbert (2000).

Figure 8.- Federal Reserve members and non-par clearing (1919-1970)



Notes: Data from *Banking and Monetary Statistics* (1947, 1976). Because Non-Member banks could choose to clear at par, the numbers will not sum to 100%.

Table 1.- linear regression for total deposits at the national-level

	(1) Ln(Total Deposits) 1833-1940
Ln(Number of Banks)	0.894***
	(0.0951)
Ln(Paper Money in Circulation)	0.459***
	(0.117)
Ln(Specie)	0.0243
	(0.0777)
Branches/Total Banks	2.352***
	(0.732)
Ln(Nominal GDP per capita)	-0.115
	(0.221)
Ln(CPI)	-0.346
	(0.307)
Ln(Interbank Deposits)	0.320***
	(0.0827)
Ln(Railroad Miles)	0.0280
	(0.0483)
Observations	107
R-squared	0.994

Notes: Table presents the results of an OLS regression. The dependent variable is listed at the top of the column. Each observation is the national aggregate for a specific year. Data from Comptroller of the Currency's *Annual Report* (1931), Flood (1998), Johnston and Officer (2016), and Carter *et al*. (2006). Robust standard errors are presented in parenthesis below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 2.- Linear regression for deposits and clearings at the national-level

	(1) Ln(Total Deposits) 1896-1940	(2) Ln(Demand Deposits) 1896-1940	(3) Ln(Clearings) 1882-1938
Ln(Number of Banks)	0.329*	0.544**	0.467
	(0.188)	(0.212)	(0.319)
Ln(Paper Money in Circulation)	-0.0751	-0.0755	0.0434
	(0.0633)	(0.0698)	(0.164)
Ln(Specie)	0.0614	-0.0249	0.145
	(0.0504)	(0.0502)	(0.111)
Branches/Total Banks	3.633***	2.920***	3.158*
	(0.885)	(0.967)	(1.635)
Ln(Nominal GDP per capita)	0.288**	0.401**	1.535***
	(0.137)	(0.151)	(0.314)
Ln(CPI)	0.590***	0.326**	0.0411
	(0.147)	(0.154)	(0.354)
Ln(Interbank Deposits)	0.105**	0.308***	-0.268
	(0.0491)	(0.0528)	(0.171)
Ln(Railroad Miles)	0.877***	-0.0321	-0.216
	(0.307)	(0.342)	(0.476)
Observations	45	45	57
R-squared	0.997	0.996	0.982

Notes: Table presents the results of an OLS regression. The dependent variable is listed at the top of the column. Each observation is the national aggregate for a specific year. Data from Comptroller of the Currency (1931), Flood (1998), Johnston and Officer (2016), and Carter *et al.* (2006). Robust standard errors are presented in parenthesis below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 3.- Aggregate clearings (in $Millions) by state

	1900	1920	1938		1900	1920	1938
AL	43	1,231	1,061	MT	32	295	238
AR	24	674	407	NC		244	1,220
AZ			490	ND	18	268	132
CA	1,117	14,255	15,985	NE	339	3,587	1,638
CO	210	2,010	1,615	NH			28
CT	207	991	1,202	NJ		590	2,918
DC	130	890	1,100	NM		17	
DE	48	190	190	NV		46	
FL	13	789	1,199	NY	52,549	253,573	163,461
GA	403	5,054	2,935	OH	1,716	13,606	8,650
IA	177	2,075	712	OK		1,906	771
ID		100	65	OR	100	1,918	1,512
IL	6,438	33,861	15,566	PA	5,958	35,085	24,844
IN	199	1,540	1,349	RI	330	720	530
KS	62	1,264	683	SC		456	204
KY	433	1,446	1,679	SD	8	284	119
LA	500	3,860	2,070	TN	251	3,180	2,050
MA	7,029	20,877	10,407	TX	463	6,343	6,545
MD	1,100	4,871	3,340	UT	120	1,040	764
ME	57	206	151	VA	227	4,105	2,604
MI	537	6,046	4,860	WA	243	3,259	2,188
MN	940	5,581	4,888	WI	300	1,738	1,412
MO	2,600	21,726	9,061	WV		353	259
MS		90	228	WY			56

Notes: State total are sum of all city clearings in state for that year from the Comptroller of the Currency. Blanks represent periods of time when no clearinghouses were in operation in that state.

Table 4.- Linear regression for deposits and clearings at the state-level

	(1) Ln(Total Deposits) 1900-1940	(2) Ln(Demand Deposits) 1900-1940	(3) Ln(Clearings) 1900-1938
Ln(Number of Banks)	0.100***	0.0236	-0.131**
	(0.0198)	(0.0151)	(0.0560)
Ln(Population)	0.0202	0.0875***	0.787***
	(0.0188)	(0.0149)	(0.0661)
Urbanization Rate	0.442***	0.444***	2.738***
	(0.00871)	(0.0671)	(0.302)
Unrestricted Statewide Branching Dummy	0.153***	0.0925***	0.221***
	(0.0258)	(0.0184)	(0.0690)
Restricted Statewide Branching Dummy	0.118***	0.0798***	0.00372
	(0.0161)	(0.0130)	(0.0445)
Ln(Crop Output)	-0.122***	-0.0929***	0.351***
	(0.0152)	(0.0110)	(0.0518)
Ln(Manufacturing Output)	0.175***	-0.0320***	-0.00636
	(0.0168)	(0.0110)	(0.0485)
Ln(Interbank Deposits)	0.729***	0.878***	0.936***
	(0.0140)	(0.0108)	(0.0591)
Ln(Railroad Miles in 1914)	-0.0200	0.0515***	-0.109**
	(0.0190)	(0.0131)	(0.0502)
Ln(Telephones in1907)	0.116***	-0.0192	-0.0942*
	(0.0197)	(0.0143)	(0.0486)
Observations	2,837	2,837	1,843
R-squared	0.957	0.971	0.843
Year FE	YES	YES	YES

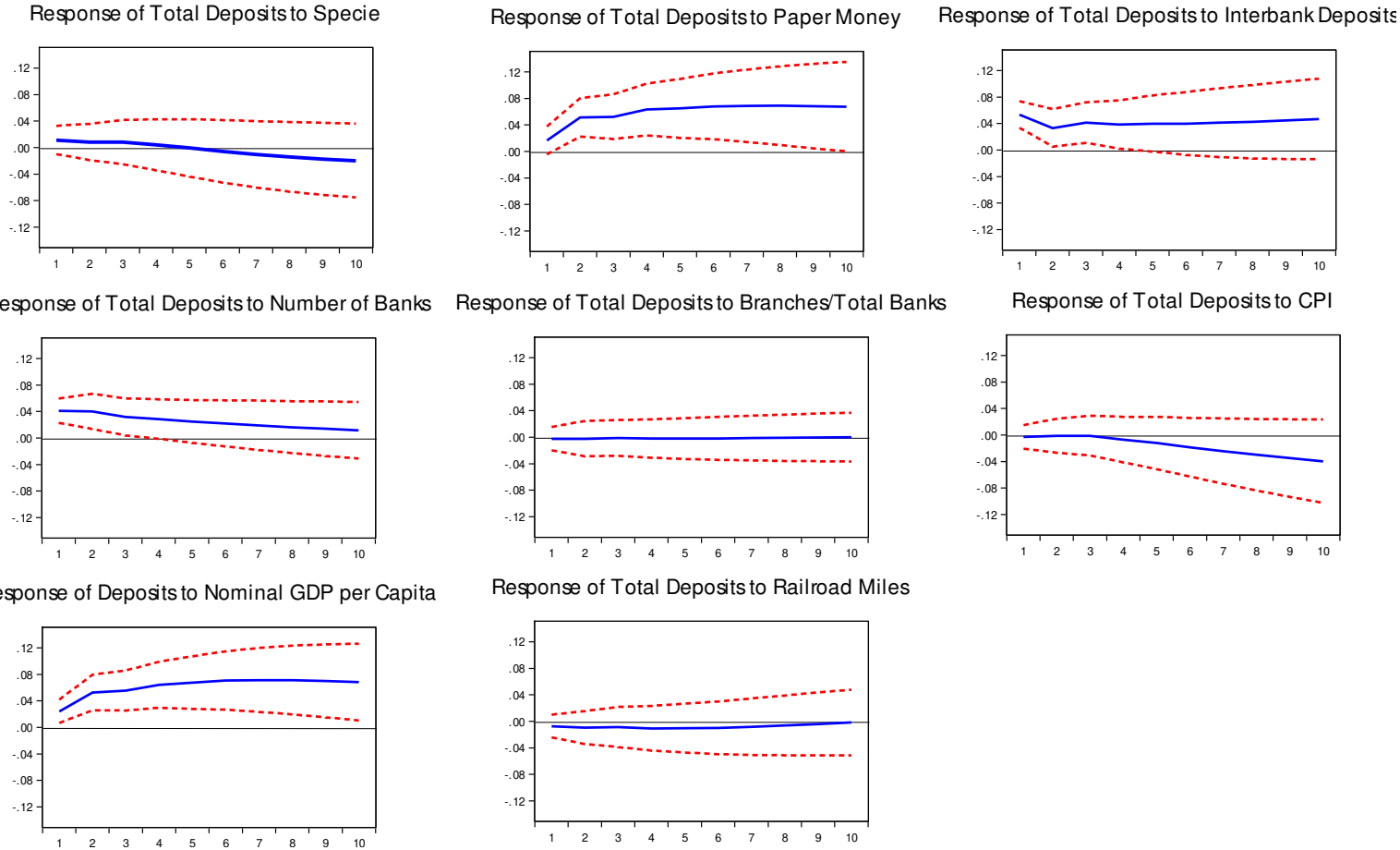
Notes: Notes: Table presents the results of an OLS regression. The dependent variable is listed at the top of the column. Each observation is a state-year. Data from Comptroller of the Currency (1931), Flood (1998), Johnston and Officer (2016), Carter *et al.* (2006), Bureau of the Census (1910), and Interstate Commerce Commission (1914). Robust standard errors are presented in parenthesis below the coefficients. * denotes significance at 10%; ** at 5% level and *** at 1% level.

Table 5.- Linear regression for deposits and clearings at the state-level with state fixed effects

	(1) Ln(Total Deposits) 1900-1940	(2) Ln(Demand Deposits) 1900-1940	(3) Ln(Clearings) 1900-1938
Ln(Number of Banks)	0.295***	0.150***	0.647***
	(0.0168)	(0.0182)	(0.0452)
Ln(Population)	0.392***	0.175***	0.712***
	(0.0355)	(0.0382)	(0.0920)
Urbanization Rate	0.978***	1.065***	1.650***
	(0.151)	(0.162)	(0.337)
Ln(Crop Output)	-0.136***	-0.152***	0.208***
	(0.0144)	(0.0183)	(0.0438)
Ln(Manufacturing Output)	-0.0900***	-0.155***	0.103*
	(0.0185)	(0.0207)	(0.0544)
Ln(Interbank Deposits)	0.692***	0.798***	0.240***
	(0.0120)	(0.0134)	(0.0373)
Observations	2,837	2,837	1,843
R-squared	0.983	0.978	0.968
Year FE	YES	YES	YES
State FE	YES	YES	YES

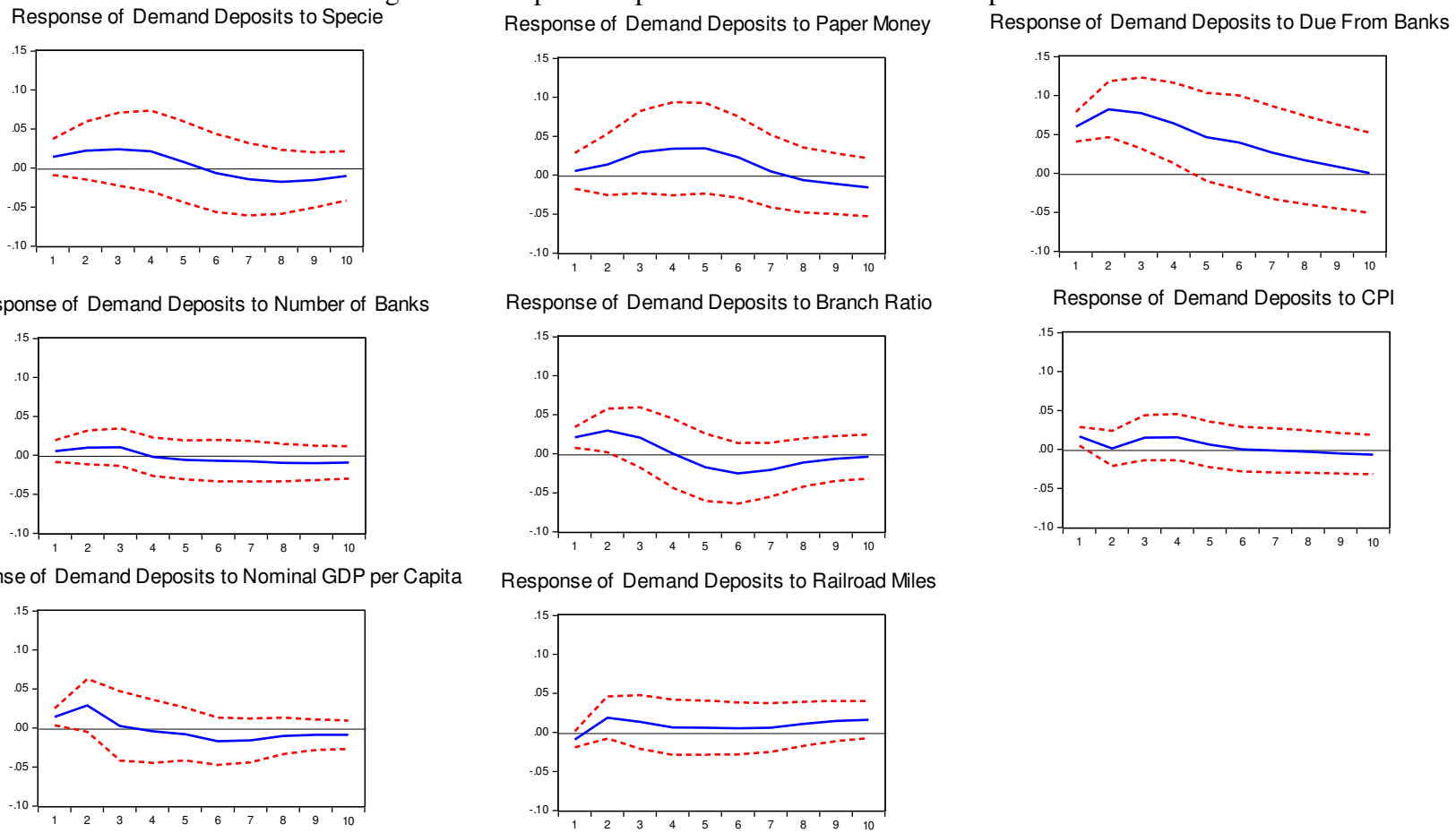
Notes: Notes: Table presents the results of an OLS regression. The dependent variable is listed at the top of the column. Each observation is a state-year. Data from Comptroller of the Currency (1931), Federal Reserve (1937), Flood (1998), Johnston and Officer (2016), and Carter *et al.* (2006). Robust standard errors are presented in parenthesis below the coefficients. * denotes significance at 10%;** at 5% level and *** at 1% level.

Figure A1.- Impulse response functions for total deposits



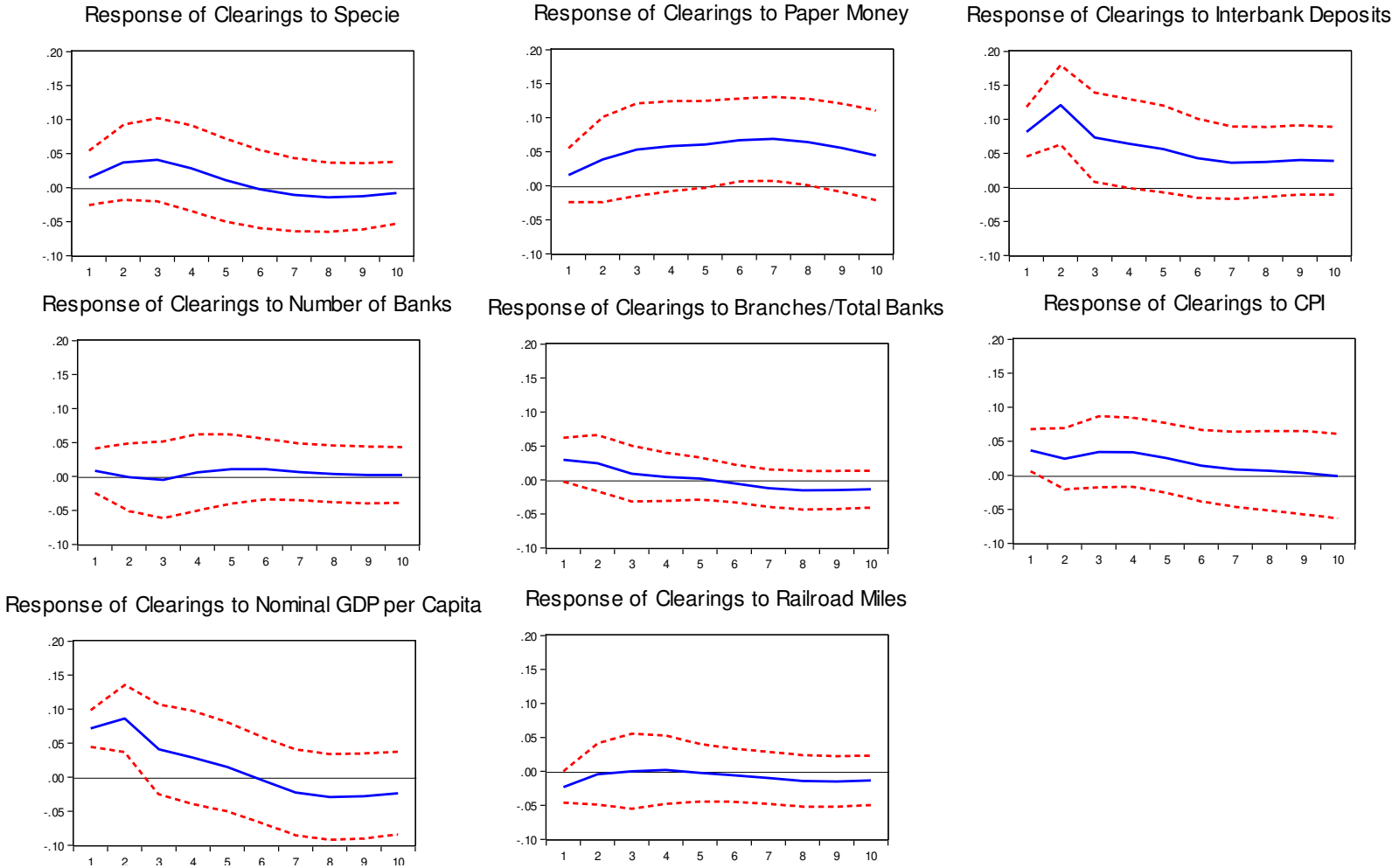
Notes: Impulse response simulation results for all variables from Table 2 on total deposits. Blue line is point estimate and dotted red lines correspond to a 95% confidence band.

Figure A2.- Impulse response functions for demand deposits



Notes: Impulse response simulation results for all variables from Table 2 on demand deposits Blue line is point estimate and dotted red lines correspond to a 95% confidence band.

Figure A3.- Impulse response functions for check clearings



Notes: Impulse response simulation results for all variables from Table 2 on total clearings Blue line is point estimate and dotted red lines in correspond to a 95% confidence band