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ABSTRACT

We show that decentralized privately created money with unstable values can hinder the traded, more transaction-friction sensitive, sector of the economy. We do so in the context of the National Banking Act of 1864 in the United States that created a new federally-regulated, fully-backed currency as an alternative to the pre-existing money supply, which consisted of unsecured notes printed by thousands of local private banks. Using a discontinuous change across towns in the costs of accessing this new type of stable, federally-backed money as a natural experiment, we show that places gaining access to the new currency experienced a shift in the composition of agricultural production from non-traded to traded goods and increased employment in trade-related professions. In addition, counties gaining access to the new stable money increased their manufacturing output by sourcing more inputs, and they innovated more, all consistent with the stable currency improving their market access and allowing them to expand through trade.

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1 Introduction

> *A predominance of private monies may introduce consumer protection and financial stability risks because of their potential volatility and the risk of run-like behavior. Indeed, the period in the nineteenth century when there was active competition among issuers of private paper banknotes in the United States is now notorious for inefficiency, fraud, and instability in the payments system.*
> –Lael Brainerd, Member of the Federal Reserve Board of Governors (2021)

All forms of money are a liability of the issuer, and their usefulness as mediums of exchange, stores of value, and units of account depends on either the confidence users have in the value of the assets backing the liability or the willingness of others to accept the liability as payment. Privately created money, such as cryptocurrencies in the modern day, often vary in their stability and can be prone to large devaluations when users lose confidence in (or receive better information about) the value of the underlying assets.[1] While private money can provide useful liquidity in certain markets and generate significant seignorage profits for issuers and early adopters, there is little empirical evidence on the real economic consequences of widescale usage, especially when they continue to be risky. However, understanding how privately issued money affects the real economy is a pressing question as unregulated private cryptocurrencies are increasingly used in the payments system.[2]

In order to evaluate the real economic consequences of supplying privately issued money, certain criteria for the institutional context should be met. First, we need a change from a regime where the values of the multiple monies are unstable and uncertain because they are created by private agents whose own assets back the monetary liabilities, into a system where this insolvency risk is removed. Second, we need the monies used in both regimes to be widely adopted in order for them to plausibly have a meaningful impact on real economic activity. Third, we need to be able to examine a long time period over which these effects can take place as the real economy tends to adjust slowly. These three criteria are impossible to meet in recent modern settings because digital currencies are still not widely adopted despite their increasing popularity and scrutiny by regulators.

[1] Not all private money is backed by an underlying asset: Bitcoin is the most prominent example, and Yermack (2015) documents many ways in which Bitcoin's price instability has made it less useful as a form of money. Stablecoins with values designed to be pegged to a known currency are the closest analogy to historical private money in the US. However, they can only maintain the peg if the value of the underlying assets does not deteriorate relative to their nominal liability. Central bank digital currencies are not a form of private money since they are issued by the monetary authority, like other traditional forms of fiat government money.

[2] El Salvador's decision to make Bitcoin legal tender in July 2021 is one such example.

The historical context of the United States in the 19th century meets these three criteria and provides an opportunity to empirically assess the real impact of stabilizing the value of private money. Pre-Civil War, the money supply in the country primarily consisted of paper notes printed by local banks with little to no regulatory oversight. Private bank notes, in conjunction with deposits, had low liquidity coverage and therefore low recovery rates if the bank failed. They were not legal tender and were only convertible into specie at the issuing location. As a result, there was significant uncertainty over their value, and they primarily circulated locally and traded at discounts across town borders (Gorton, 1996, 1999). Their illiquidity made them particularly costly to use in long-distance trade transactions where information frictions about banks' insolvency risks were higher.

The National Banking Act of 1864 created a new class of federally regulated "national banks" that operated alongside previously existing "state banks."[3] The National Banking Act mandated that all national bank notes be backed 110% in federal government bonds, and that they be redeemable at any other national bank around the country. In addition, the Act established structured procedures for insolvency and receivership that were designed to prioritize note holders against any losses. These government regulations severed the link between a bank's credit risk and the real value of its notes, thereby eliminating transaction frictions arising from asymmetric information (Dang, Gorton, Holmström and Ordonez, 2017). National bank notes were stable, liquid, and information-insensitive liabilities like Federal Reserve notes today.

In order to provide causal evidence on the importance of introducing these more stable liabilities to a local economy, we use the regulatory capital requirements in the National Banking Act that were based on town population cut-offs. Banks established in towns with fewer than 6,000 people needed to raise $50,000 of equity capital while banks in towns with more than 6,000 (and fewer than 50,000) people were required to raise twice as much. The discontinuous jump in the implied equity capital per capita meant that towns just below the population cut-off faced significantly lower entry costs per capita for establishing a national bank. These town population requirements were binding since banks were not allowed to branch, and there were strict residency requirements for bank directors.[4] The non-branching rule meant banks could not be created in a low-capital environment while locating its business

[3]State banks were chartered by state governments. Some states did not have a chartering system and therefore operated under a "free banking" regime. For simplicity, all types of banks that existed alongside national banks are called state banks.

[4]The National Banking Act required that a national bank must have at least 5 directors, and at least 75% of them must have resided locally.

in more populous environments elsewhere. The residency requirement also made it difficult to evade the capital requirement by simply raising the required equity outside of a town's borders. These features of the regulatory environment create a plausibly exogenous entry cost for new national banks in towns near the population cut-off and hence for the supply of the stable, fully-backed currency available there.

Gaining access to a national bank and its uniform currency altered the monetary frictions facing a local economy and reduced transaction costs for three reasons.[5] First, it directly increased the supply of liquid monetary instruments (national bank notes) circulating locally, reducing the dependence on illiquid alternatives. Second, it indirectly increased the town's "market access" by eliminating monetary transactions costs with any other town in the country that also had a national bank.[6] Third, national banks were more efficient at providing other forms of payment services operating through deposit liabilities, such as check clearing.[7] In conjunction, these changes lowered long-distance transaction frictions in places that gained access to national banks.

Our empirical analysis focuses on the effect of towns gaining a national bank for the first time in order to capture the impact of the more stable monetary base. We begin by constructing a sample of towns that we follow for several decades. The first filter we impose is that towns have fewer than 6,000 people in 1870 (the first decadal census after the passage of the Act) so that they that all face the same low capital requirement initially. Second, we require that they did not have a national bank as of 1875 and therefore no prior direct access to stable bank notes.[8] Third, we require that their population was between 4,000 and 8,000 in 1880. Choosing a small population bandwidth of 4,000 to 8,000 in the subsequent decade allows us to limit our sample to towns that are likely to be similar in both observable and unobservable characteristics. Within this set of towns, some crossed the 6,000 population cutoff in the 1880 census, which doubled the entry cost for a national bank. We use the crossing of this threshold as an exogenous shifter for national bank entry into the town. The

[5] Alternatives to bank notes like specie, coins, and checks were scarce and difficult to use. Section 2 discusses the frictions facing each of these.

[6] The term market access is a reduced form expression for the costs of trading with all other places. It arises from general equilibrium trade theory, and the market access for a given location is a function of the sizes and trading costs of transacting with all other locations.

[7] The National Banking Act included other regulatory changes such as a pyramidal structure in reserve deposits and a formalized clearing system, which strengthened their interbank connections and benefited check clearing among national banks relative to state banks.

[8] The analysis is not sensitive to choosing 1875 as the first year we calculate whether a town has a national bank, but we choose it because there was an additional revision to the National Banking Act in 1874 that impacted the required liquidity coverage ratio. We show robustness to other years in the appendix.

identifying assumption is that there was no concurrent shocks to places just below the cut-off that would have caused their outcomes to be systematically different after 1880.

To strengthen the empirical strategy, we control for the growth trajectory with the population change from 1870 to 1880, for a town's financial development in the pre-period with the number of state banks, and for the area's physical trade costs with the number of railroads in the county. We also show that pre-period observable characteristics were not significantly different between the towns with a population above 6,000 versus those below 6,000 population in 1880, both conditionally and unconditionally.

We find a strong first stage: having fewer than 6,000 people in 1880 is associated with a 30% higher probability of gaining a national bank by the middle of the decade. This relationship does not simply reflect smaller places being systematically different. As a robustness exercise, we show that alternative placebo cut-offs around the true cut-off are not correlated with entry.

Having established that lower regulatory capital requirements increased bank entry, we examine the first real economic outcome: the propensity to engage in trade. We estimate difference-in-differences regressions instrumenting for the likelihood of having a national bank. We first show that national bank entry significantly shifted the composition of goods produced toward traded goods while not affecting total agricultural production. Output of traded crops (those listed on the Chicago Board of Trade) crowded out non-traded crops while overall output did not change. The pure compositional change avoids confounding effects from other bank activities that would also affect the total levels of production. It is also consistent with the evidence that the regulatory restriction for national banks against lending to the agricultural sector was binding (Knox, 1900). We also find that national bank entry did not impact agricultural capital, which was typically externally financed, so our effects are unlikely to arise from a standard bank credit channel (e.g., Paravisini, Rappoport, Schnabl and Wolfenzon, 2015).

We further demonstrate the positive impact of national banks on the traded sector by estimating the impact on employment in that sector. We use contemporary business directories with town-level coverage and the full count Censuses of Population to show that there was a relative increase in the professions engaged in transactions but not production, such as commission merchants, buyers, and shippers. Those occupations grew in places that gained national banks while placebo professions that capture general growth, such as architects, experience similar growth in treated and control towns.

We provide a complementary result with price data where we show that cities that

gained national banks also experienced a larger reduction in the prices of tradable goods relative to non-tradable goods. These results are again consistent with the interpretation that the shock led to reductions in transactions costs that are specific to the traded sector after the introduction of more stable money, rather than a traditional credit supply shock that does not target trade.

Next, we study the impacts of national banks on the manufacturing sector. We use the decennial Census of Manufactures to show that places that gained a national bank experienced significantly greater growth in total production between 1880 and 1890. The growth in manufacturing output appears to be driven by growth in inputs and employment, whereas manufacturing capital was not significantly affected. Decomposing these total effects, we find that while manufacturing capital did not change, the use of inputs grew. Reducing frictions for sourcing inputs increases the quantity of inputs and also allows firms to source them more broadly and therefore likely improved the match quality of the inputs they used. This "input sourcing" channel can raise output without requiring credit expansion as importing better inputs makes firms more productive (Goldberg, Khandelwal, Pavcnik and Topalova, 2010).

The reduction in transaction-specific trade costs induced by access to the stable money increased a location's market access (or "real market potential" (Head and Mayer, 2004)). A prediction from the economic geography literature is that increases in market access also raise the return to innovation as firms can spread the cost of innovating over a larger number of units of production. This increases expected future profits, which also raises the incentive to innovate (e.g., Redding, 2013). We investigate this channel using the number of patents across counties as a measure of innovation activity and find that places that gained national banks also had more innovation by local inventors.

Lastly, we complement our results on the immediate effects with long-run dynamic difference-in-differences estimations from 1860 to 1900. These estimations provide graphical evidence of no differential pre-trends and show that the elevated levels of manufacturing production persisted until at least 1900.[9] The initial growth in output in conjunction with the growth in trade and innovation likely contributed to the persistence. In particular, the short-term changes in trade and innovation activity potentially gave places with national banks a comparative advantage in the manufacturing sector over a longer period.

Our paper primarily relates to the recent empirical and theoretical work on the opti-

[9]The county-level data on manufacturing do not exist for 1910, and the levels are no longer significantly different by 1920. Given the large amount of changes that likely occurred in WWI and after the establishment of the Federal Reserve system, we stop our analysis on the long-term effect at 1900.

mal design and regulation of digital private monies, much of which has drawn comparisons between stablecoin design and traditional banking (Eichengreen, 2019; Catalini and de Gortari, 2021; Catalini and Shah, 2021; Gorton and Zhang, 2021; Gorton, Ross and Ross, 2022). These papers highlight various mechanisms by which pegged private digital currencies (stablecoins) can achieve their eponymous stability, most of which involve maintaining sufficient liquid reserves, like US Treasuries, as the backing asset. To the best of our knowledge, this paper is the first to provide empirical evidence that improving the stability of privately issued money, in this case by regulating the quantity and quality of the assets backing the monetary liability, positively affects real economic activity.

Private bank notes are only one form of short-term bank debt, and while the large literature on bank debt illiquidity has mostly focused on their fire-sale externalities and their role in increasing financial fragility (Diamond and Dybvig, 1983; Stein, 2012; Admati and Hellwig, 2014), this paper studies a context in which the regulatory environment ensures that they are truly safe with full liquidity coverage, which creates a Gorton and Pennacchi (1990)-type transactions medium. The national bank notes that are fully backed by government debt in our context take the form of the optimal contract that removes any discount from the debt's face value, thereby making transactions efficient (Dang, Gorton, Holmström and Ordonez, 2017). In that sense, we provide evidence for a sub-national monetary channel in the tradition of Friedman and Schwartz (1965); Romer and Romer (1989).

While the literature on the bank credit channel has demonstrated the importance of credit supply for the traded sector (e.g., Amiti and Weinstein, 2011; Paravisini, Rappoport, Schnabl and Wolfenzon, 2015; Paravisini, Rappoport and Schnabl, 2015; Xu, 2022), this paper highlights an indirect channel in which stabilizing the value of bank liabilities by fully backing them with safe government debt (a form of narrow banking) improves their function as a transactions medium. This form of narrow banking has also been proposed as a way for stablecoins to maintain their peg and achieve use cases closer to that of traditional fiat currency (Catalini and Shah, 2021; Liao and Caramichael, 2022).

Finally, this paper adds to the literature on the historical determinants of economic growth in the United States, and in particular contributes to the better understanding of how the banking sector has shaped the geography of economic activities in the late 19th century (Friedman and Schwartz, 1965; Rousseau and Wachtel, 1998; Rousseau and Sylla, 2005; Landon-Lane and Rockoff, 2007). Our results are consistent with Sylla (1969, 1982), which argue that the National Banking Act's high regulatory capital requirements held back economic development by failing to expand the bank note supply sufficiently, and Cagan

(1963) that attributes economic growth in the late 19th century to currency stability.

The rest of the paper is organized as follows. Section 2 discusses the historical context around the time period studied, and provides motivating facts for the assets and liabilities channels. Section 3 explains the data collection, sample construction, and the empirical strategy. Section 4 presents the empirical results on the effect of national bank entry on real economic outcomes, and Section 5 concludes.

2 Historical Context & Data

2.1 The Free Banking Era

Between the expiration of the charter of the Second National Bank in 1836 and the establishment of the Federal Reserve system in 1913, there was no unified banking system in the United States.[10] The National Banking Act of 1864 marked an intermediate step when federally-regulated banks operated alongside state-regulated banks. The period before the National Banking Act was known as the Free Banking Era. During the Free Banking Era, there was free entry into banking in most states, and charters were not difficult to obtain in the remainder. Regulatory oversight was generally weak, and banks were prevented from branching so they had concentrated geographic exposure. Under this unit banking structure, local price shocks could easily lead to bank failures (Bordo, 1998). There was neither a formal system of interbank lending nor a lender of last resort, so bank runs and failures were frequent (Grada and White, 2003). In summary, the antebellum banking system was fragmented, loosely regulated, and exposed local economies to the conditions of their local banks.[11]

A well-known feature of the Free Banking Era was that banks issued their own bank notes that were only redeemable at face value in specie at the originating bank's office. In 1860 on the eve of the Civil War, there were almost 1,600 state banks, each issuing its own notes. In large cities, the notes from hundreds of banks circulated together.

The lack of regulation over these notes created several frictions that reduced their liquidity. As a result, bank notes did not generally trade at part with each other, creating numerous exchange rates among currencies. First, the fact that there were so many bank notes of different designs meant that they were hard to verify and subject to counterfeit. Uncertainty about a note's legitimacy could cause the note to trade at a discount or to be

[10] See Appendix C for more historical background on the First and Second National Bank before the Free Banking Era.

[11] See Rockoff (1991) for a comprehensive review of the key characteristics of the Free Banking Era.

refused. Publications such as "Bank Note Reporters and Counterfeit Detectors" were crucial for determining the legitimacy of a note. Figure A.1a displays an example of a private bank note from Massachusetts with face value $20 where the name and location of the issuing bank is prominently displayed. Figure A.1b shows the written description for the same bank's notes in a printed "counterfeit detector," where the $20 bill is described in the bottom left corner. These publications helped merchants and note brokers to ascertain the authenticity of unfamiliar notes, which was a costly and information-intensive task. The note brokers specializing in this activity operated on commission, and non-local notes generally had to be converted into local notes before they could be used for in local transactions (Appleton, 1831; Gorton, 1999).

Second, the physical redemption costs of returning a note to its originating bank also contributed to a note's discount (Gorton, 1999; Ales, Carapella, Maziero and Weber, 2008). The discounts were on average larger for banks located farther away as physical trade costs increased and it became more costly to verify the operational status of those banks. Figure 1 plots average discounts of state bank notes in several states relative to banks in Philadelphia. While the states in the northeast closer to Philadelphia (panel a) had discounts up to 10%, the ones farther away from Philadelphia (panel b) had discounts as high as 80%.

Third, lack of regulatory oversight from state legislation meant that banks often issued notes beyond their redemption capabilities, which generated uncertainty in their value.[12] The volatility in the discounts plotted in Figure 1 in part reflects significant underlying time-varying idiosyncratic bank risks.

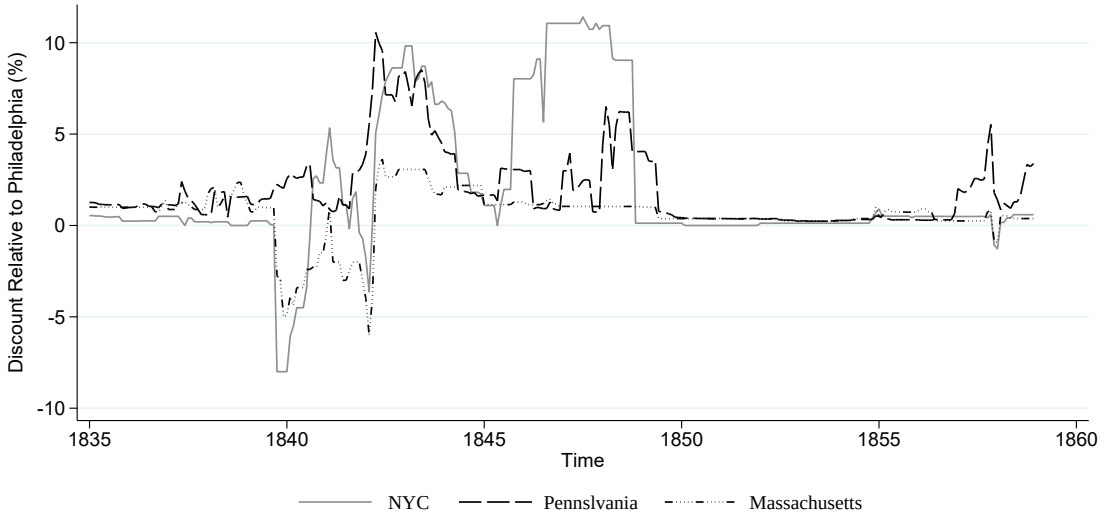
Depending on the state's regulations, notes in this era were either backed by state bonds or by the bank's portfolio of loans. A significant drop in the value of the collateral could lead to bank note redemption runs during which notes were heavily discounted (Rolnick and Weber, 1982). For example, Illinois banks committed over 5 million dollars between 1836 and 1842 to building a canal that would connect the Illinois River and Lake Michigan, hoping to reduce transportation cost to a larger market. However, this investment completely drained state funds and caused a wave of state bank failures in Illinois. As a result, the relative discount of Illinois state bank notes averaged at around 70% in 1842, compared to about 15% in the previous year. Rockoff (1975) estimates that losses on notes due to bank failures in other contexts ranged from 7% in Indiana to 63% in Minnesota.

Despite all of these frictions, bank notes survived and were used because specie and

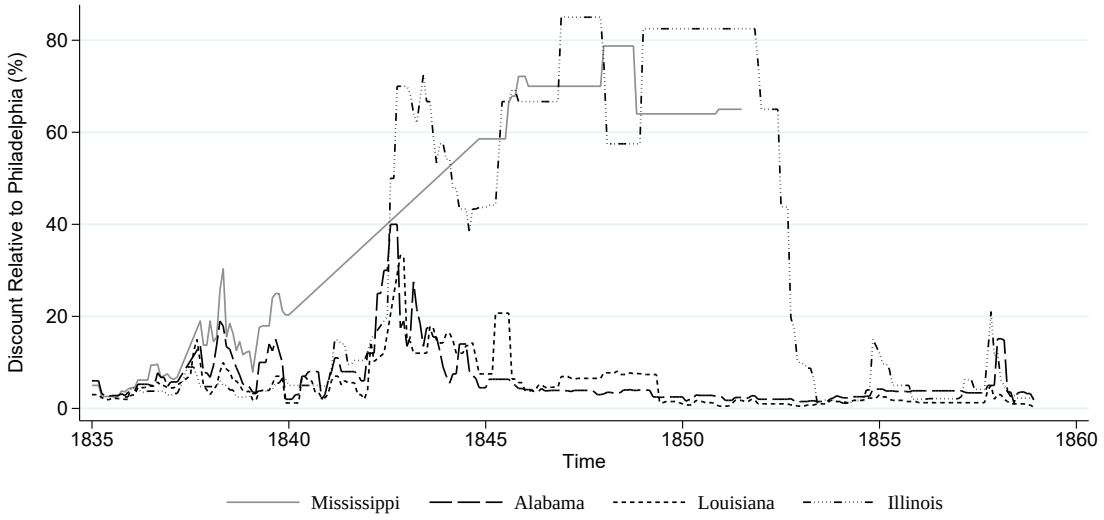
[12] Milton Friedman referred to the phenomenon of banks over-inflating their currency to the point of not being able to meet redemption as "wildcat banking," a term that is now frequently applied to the Antebellum period in American banking.

Figure 1: Discounts on state bank notes relative to Philadelphia

(a) Regions close to Philadelphia



(b) Regions far from Philadelphia



Notes: Figure 1 plots the monthly average discounts on state bank notes from each listed state relative to banks in Philadelphia (Ales, Carapella, Maziero and Weber, 2008). States are split by region with then Northeast categorized as "Close" (Figure 1a) and the remainder in the South and Midwest as "Far" (Figure 1b). The original source is *Van Court's Bank Note Reporter and Counterfeit Detector* published monthly in Philadelphia between February 1839 and December 1858.

coins were not a viable alternative. Payment in specie was costly because of physical transportation costs, which included protecting shipments from theft. Coins were scarce and in an array of unwieldy denominations (Ware, 1990; Gorton, Ross and Ross, 2022). The primary coins circulating in the antebellum era were Spanish and US silver dollars, both of which were subject to debasement and deterioration (Greenfield and Rockoff, 1995). While the U.S. Mint produced coins, these were primarily used in international trade rather than domestically (Carothers, 1930).

The real costs of uncertainty and volatility from circulating multiple currencies created large frictions in exchange and trade, and these costs drew the attention of policymakers.[13] In 1863, Senator John Sherman from Ohio cited the uncertain values in bank notes as costly for every citizen. In Congress, he argued for the passage of the National Banking Act explicitly in terms of securing a stable medium of exchange:

> This currency will be uniform. It will be printed by the United States. It will be of uniform size, shape, and form; so that a bank bill issued in the State of Maine will be current in California; a bank bill issued in Ohio will be current wherever our Government currency goes at all; and a bank bill issued in the State of Connecticut will be freely taken in Iowa or anywhere else. There is *no limit to its convertibility*. It will be of uniform value throughout the United States. I have no doubt these United States notes will, in the end, be taken as the Bank of England note now is all over the world, as a medium, and a standard medium of exchange [...] They will be safe; they will be uniform; they will be convertible. Those are all the requisites that are necessary for any system of currency or exchange.[14]

The cost of illiquidity of state bank notes, together with the need to raise money for the North during the Civil War, eventually led to the passage of the National Banking Act.

2.2 The National Banking Era

The National Banking Act that initially passed in 1863 aimed to stabilize the banking system and to create a network of national banks that were subject to federal regulations. The newly introduced national banks differed from state banks in many important ways in this dual-banking system.

First, national bank notes were required by law to have uniform value and be redeemable at all national banks in addition to the issuing bank. The bank notes were backed

[13] See Appendix C for contemporary examples of how the uncertain value of state bank notes led to legal disputes and inconvenience in exchange.

[14] Senate floor, February 10, 1863; http://www.yamaguchy.com/library/spaulding/sherman63.html

110% by U.S. Treasury bonds, and losses in the collateral's face value had to be supplemented with additional bonds.[15] In the case of a national bank failure, the Office of the Comptroller of the Currency (newly created to regulate national banks) oversaw the liquidation process and prioritized note holders from losses. Unlike state bank notes that bore discounts coming from the banks' credit and liquidity risk in addition to physical redemption costs, the full backing and convertibility of national bank notes made these liabilities risk-free and therefore completely stable.

Second, both capital and loans faced stricter regulations at the federal level, which were designed to prevent runs and improve financial stability. Capital requirements were much higher than the ones for state banks, which were often zero. In addition, 75% of the directors raising the capital had to reside locally. To limit risk-taking behaviors, national banks faced limits on the long-term loans they could make, were not allowed to take land as collateral, and were subject to detailed supervision. These restrictions limited capital accumulation that required long-term credit, and it restricted credit to the agricultural sector where collateral most often took the form of farmland. In contrast, state banks were often encouraged to extend credit to the agricultural sector, and in fact, some states even required a minimum fraction of loans to farmers (Knox, 1900).

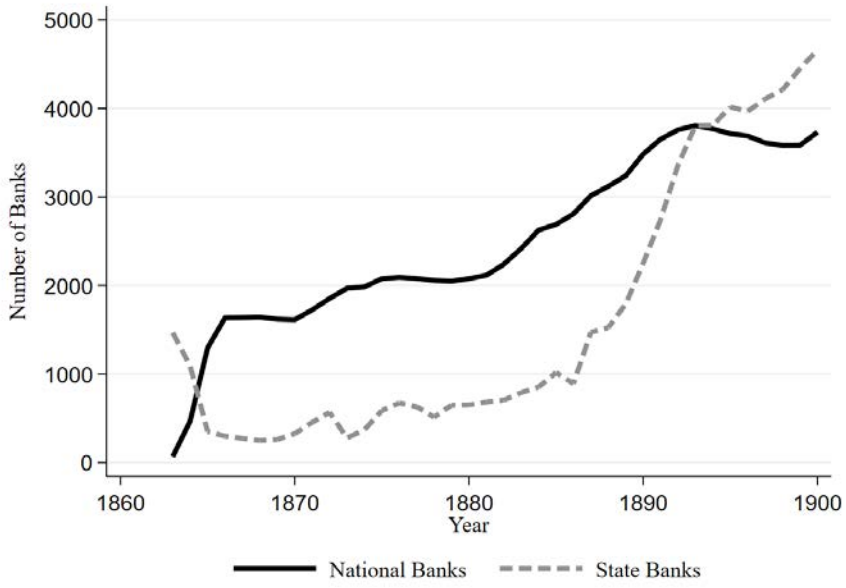
The restrictions in banking business and more rigorous oversight resulted in greater stability in national banks. Between 1875 and 1890, the average national bank failure rate was about 0.25%, compared to 2.5% of state banks. The significantly higher state bank failure rate further contributed to the riskiness of state bank notes during this time period. Table A.1 provides a summary of the key distinctions between national and state banks.

To induce state banks' conversion to national banks, the Treasury collected a 2% tax on state bank notes (increased it to 10% in 1865). The tax greatly diminished state banks' ability to issue and circulate their own bank notes, but it did not eliminate state banks completely. Figure 2 shows the evolution of the number and total assets of national banks and state banks from 1863 to 1900. The initial period of national bank growth was mostly due to conversions from state banks, and the subsequent decades from 1870 to 1890 featured a relatively steady proportion of state and national banks, while the period after the 1890s saw a resurgence of state banking (Jaremski, 2014). Given the large changes in the banking sector at the beginning and end of this period, we focus on national bank entry over the steady-state of bank composition in the period from the 1870s to 1880s.

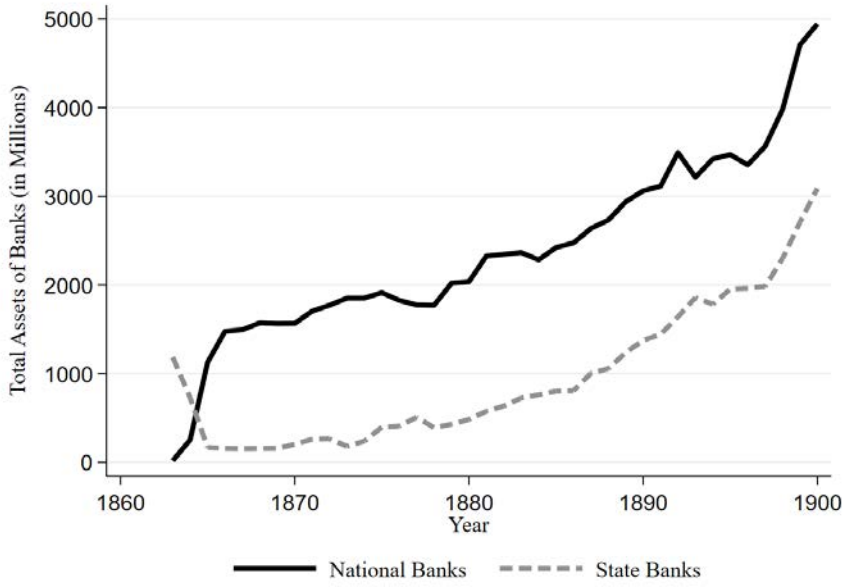
[15] This form of narrow banking was designed in part to create a demand for U.S. Treasury debt that also helped to finance the federal government (Gorton, Laarits and Muir, 2022).

Figure 2: National and state banks: (1863-1900)

(a) Number of banks



(b) Total assets by bank type



Notes: Figure 2 plots the total numbers and assets of national and state banks in the United States between 1863 and 1900. Data from EH.net.

2.3 Monetary relevance of national bank entry

The national bank notes introduced during this period resolved the frictions that had caused state bank notes to trade at a discount. They maintained their nominal value and were particularly useful as a medium exchange at long distances where state bank notes had larger discounts. However, simply introducing this type of frictionless currency did not eliminate monetary frictions for all local economies, especially those without direct access to a national bank. These notes remained scarce, and their constrained supply has been recognized by both contemporaries and more recent scholars (e.g., Bell, 1912; Friedman and Schwartz, 1965; Gorton, Laarits and Muir, 2022).[16]

One indication of the constrained supply of national bank notes is that state bank notes still circulated for decades despite being taxed. Even in the early 1880s, many national banks report state bank notes on their balance sheets. State banks gradually adopted checking accounts, an alternative form of bank liability, as a means of payment that was not taxed. However, checks were sensitive to individual depositors' idiosyncratic risks. They could only be cleared when both the status of the bank and of the personal account could be verified, and banks were only obligated to redeem checks at par when they were presented at the originating bank's office. In addition, banks lost reserves as soon as a check cleared, whereas notes could be used to settle transactions without immediate demand for reserve (Briones and Rockoff, 2005). As such, they were at least as illiquid at long distances as state bank notes and were not a superior alternative. Empirically, they only became common in long-distance wholesale trade at the turn of the twentieth century (Kinley, 1910; Preston, 1920; James and Weiman, 2010).

The primary remaining alternatives were specie and greenbacks. Specie redemption for bank notes was suspended in 1861, and greenbacks were issued by the Union government in 1862 as a fiat paper currency. In a demonstration of Gresham's Law, greenbacks immediately pushed specie out of circulation, and gold did not return to circulation in the United States outside of California (Mitchell, 1903; Greenfield and Rockoff, 1995).[17] Greenbacks were

[16] Gorton, Laarits and Muir (2022) provide an explanation for the "underissuance puzzle," arguing that the scarcity in national bank notes ultimately arose from a scarcity in the U.S. Treasury bonds needed to back the notes. Since Treasury bonds can be used in other ways (as shown by their convenience yield), purchasing them to back bank notes was an expensive endeavor, and raising bank capital for this purpose was costly. Banks issued more deposit liabilities to compensate for the lack of note liabilities, which shifted the source of financial fragility from runs on notes to runs on deposits.

[17] Corroborating evidence on the lack of gold in circulation comes from the national "gold" banks that could issue notes redeemable in gold. All of these, except for a few in California, failed because they could not obtain the gold to back their notes (Greenfield and Rockoff, 1990). The lack of gold in the US during this period was also the subject of William Jenning Bryan's "Cross of Gold" speech in 1896.

subsequently retired in 1878, before the period of real outcomes we study.

The entry of a national bank into a local area therefore reduced monetary transactions frictions in three ways. First, it directly increased the supply of stable bank notes circulating locally, which reduced the reliance on less liquid alternatives for long distance payments. Second, a local national bank could directly redeem the notes of any other national bank in the country, which allowed the town to join the network of frictionless payments (see Figure A.4 for a map of county-level national bank access in 1885). Third, national banks had a more integrated interbank system of reserves that gave them an advantage in clearing checks as well. While the introduction of national bank notes in 1864 raised the overall liquidity of money around the country, there are still significant cross-sectional differences in access depending on whether a national bank operated locally. Therefore this historical context provides a unique opportunity to study the real impact of stabilizing privately created money.

2.4 Data sources

We combine several newly collected and digitized historical datasets, described below.

Town populations: We manually collect town and city populations from the original reports of the 10th and 11th Decennial Censuses of Population that report information covering the decades 1860 to 1880 (Figure A.2a). It was necessary to manually collect these because the publicly available digitized census records report total county-level populations and population in areas above 2,500 people, but smaller units are only available in the original census reports.

Bank characteristics: We collect the balance sheets for all national banks in 1875 and 1885 from the Annual Report of the Comptroller of the Currency (Figure A.2b). These report locations as well as the main balance sheet components such as their bank note circulation and loans. We collect the locations of non-national banks (state and private bankers) from *The Banker's Almanac and Register* of 1876 and 1885 (Figure A.2c).

County characteristics: We measure counties' physical trade costs with railroad access in 1875 and 1880 (Atack, 2016) and market access in 1870 and 1880 (Donaldson and Hornbeck, 2016). County-level populations and occupations in 1870 and 1880 are from the digitized decennial Census of Populations.

Outcomes: We consider three sets of outcomes. The first set is from the decennial Census of

Manufactures and the Census of Agriculture from 1860 to 1900. We retrieve inputs, capital, and production for both sectors in each county. For agriculture, we also record farmland values and types of expenditure.

Second, we digitize city- and town-level business activities from the *Zell's Classified United States Business Directory* in 1875 and 1887. This directory lists names of all businesses and professionals in a town (Figure A.2d).[18] We counted the number of businesses in the directory associated with trade-intensive versus not trade-intensive professions.

Third, we examine the effect on local innovation at the county level using historical patent data from Petralia, Balland and Rigby (2016). The data provides counts of all patents granted within counties, which proxy for county-level innovation intensity.

Table 1 reports summary statistics in 1870, before national bank entry.

Table 1: Summary Statistics

	Mean	Med.	St. Dev.	N
Population 1870	3,968.62	4,096.00	1,098.78	147
Population 1880	5,059.28	4,866.00	927.76	147
Railroads	4.35	4.00	2.69	147
Market access (log)	15.83	16.00	0.49	147
State banks	0.65	0.00	0.96	147
Manu. production	662.73	492.02	500.87	147
Manu. capital	347.38	278.88	273.70	147
Manu. estab	0.03	0.03	0.01	147
Manu. inputs	399.47	289.39	325.56	147
Manu. employment	0.33	0.26	0.23	147
Ag. production	230.45	224.36	133.67	147
Ag. capital	37.32	36.35	24.88	147
Ag. estab	0.22	0.21	0.13	147
Ag. farm value	1,057.36	977.17	663.04	147

Notes: Table 1 reports the mean, median, and standard deviation of each location characteristics in the pre-entry period. The measure of railroads is from Atack (2016) and measured in 1876. State and other non-national bank financial institutions are obtained from the *Banker's Almanac and Register* of 1876, and market access cost for 1870 is calculated by Donaldson and Hornbeck (2016). Manufacturing and agricultural production are from the census of 1870.

[18] To the best of our knowledge, this source has not been used in prior studies. The 1875 *Zell's Classified United States Business Directory* was obtained from the Boston Public Library. The 1887 directory was obtained from the Baker Business Archives at Harvard Business School.

3 Empirical Strategy

3.1 Instrument for national bank entry

Bank entry is unlikely to be random, and in particular, banks are more likely to be founded in areas that are growing and expected to be more profitable, biasing any estimated effects of observed entry upward. We therefore instrument for bank entry using the differences in regulatory capital requirements imposed on national banks based on the size of the town in which the bank was chartered to operate, shown in Figure 3. Our instrument for national bank entry in 1885 is an indicator variable of a town being below the 6,000 population cut-off in 1880. The validity of the instrument relies on the premise that national bank entry is impacted by the threshold, but that the threshold was not chosen based on the size of towns that demanded national banks in the 1880s. Given that the legislation was written almost two decades prior to the entry period we study, and that we focus on a small bandwidth around the threshold, we consider it unlikely that policymakers could have so accurately predicted and targeted this demand.

We focus on the first cut-off at the 6,000 population mark rather than the 50,000 cutoff because state banks in cities near the 50,000 population mark converted into national banks immediately after the passage of the Act.[19] We study entry in the 1880s relative to the 1870s for two reasons. First, some towns changed names and incorporation status during the Civil War, causing a misalignment between 1860 and 1870 census, making it difficult to track them in subsequent decades. Second, the disruptions during the Civil War make it less likely that towns that looked comparable in 1860 remained so by 1870.

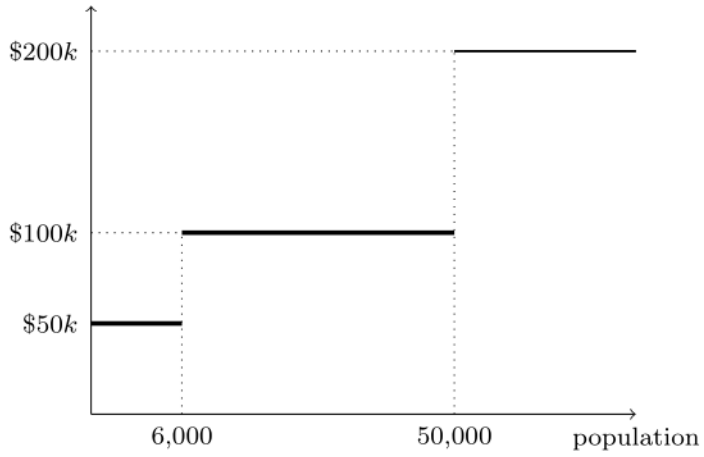
After instrumenting for national bank entry in the 1880s, we estimate the impact of entry on real outcomes using difference-in-differences that absorb time trends between periods and location-average differences.[20] The identifying assumption is that there is no concurrent differential shock to locations at this population cut-off in 1880 that could impact the outcomes of interest.

We construct our sample of comparable towns the following way: first, we select towns with fewer than 6,000 residents in 1870 that did not have a national bank by 1875. These towns all faced the same lower entry cost initially but lacked a large supply in liquid bank

[19] Banks in large cities had sufficient capital to immediately convert to a national charter, and so the capital requirements did not bind for them. Larger cities also had less than a quarter of the entry costs per capita compared to those around the 6,000 mark, so the barriers were also lower in real terms. The real magnitudes of the $50,000 difference in required capital at the 6,000 mark was approximately 140 times the average manufacturing wage in 1880.

[20] The former accounts for the overall growth in the liquid money supply over time.

Figure 3: National Banking Act regulatory capital requirement by population



Notes: Figure 3 plots plots the capital that national banks incorporated in towns within each population bracket had to raise in order to obtain a charter.

notes. Second, we require that towns did not grow or shrink beyond a population range of 4,000 to 8,000 in 1880 in order to keep towns comparable in size. Within this sample, some towns crossed the 6,000 threshold in 1880 and faced double the capital requirement. As an example, consider Towns A and B, each with 4,000 residents as of the 1870 census. In 1880, Town A grew to a population of 5,000, whereas Town B grew to 7,000 people. Without the capital requirement, the towns are close enough in size that they are similarly able to support a bank. However, the discontinuity in the requirement makes raises the entry costs significantly for Town B relative to A.

We use the instrumental approach as opposed to a regression discontinuity design because of the lack of density in the population distribution immediately around the cut-off. Our approach of including towns within a certain bandwidth maintains the spirit of the discontinuity design while allowing us to increase our sample.[21]

Our identification strategy follows a number of papers studying bank behavior in the postbellum United States, and in particular those that use the National Banking Act's regulatory capital requirements based on population as a source of exogenous variation (**?**Carlson,

[21]Figure A.3 shows the distribution of town size for all towns with between 2,000 and 10,000 population in 1880, represented by the uncolored bars. The colored bars represent all towns with fewer than 6,000 people in 1870 that did not have a national bank as of 1875. which is the relevant subsample of towns for our analysis. The black bars represent the towns that we include in our main sample.

Correia and Luck, 2022).[22] In contrast to Carlson, Correia and Luck (2022), we focus on towns that gained a national bank for the first time rather than incumbent entry.[23] This distinction is important for the main economic object of our paper: namely, the introduction of a new stable currency and improvements to the payments system, as opposed to bank competition in lending.

3.2 Pre-period balance

The identifying assumption for our empirical analysis of real effects is that towns above and below the threshold did not experience a simultaneous shock in 1880 that would impact their real outcomes afterward. We consider this unlikely for several reasons. First, there is no evidence of any other regulation at the 6,000 population threshold introduced around this period.[24] Second, focusing on a relatively narrow population bandwidth around the 6,000 cutoff increases the likelihood that towns were comparable in both observable and unobservable ways. Third, we provide evidence that towns in our sample are not observably different during the pre-period.

Figure 4 provides the coefficients and confidence intervals for both conditional and unconditional covariate balance tests where we regress each characteristic on an indicator variable for being below the 6,000 population threshold in 1880. Each regression is individually estimated, and we normalize all dependent variables so that the magnitudes can be interpreted as standard deviations from the mean. All variables are measured in the decade before national bank entry unless otherwise noted. The "Unconditional" regressions are estimated without controls, and the "Conditional" regressions include state fixed effects and the population change from 1870 to 1880. In terms of population, places that are below the threshold in 1880 are slightly smaller in 1870, unconditionally. After controlling for the population change, they are significantly smaller, as expected.

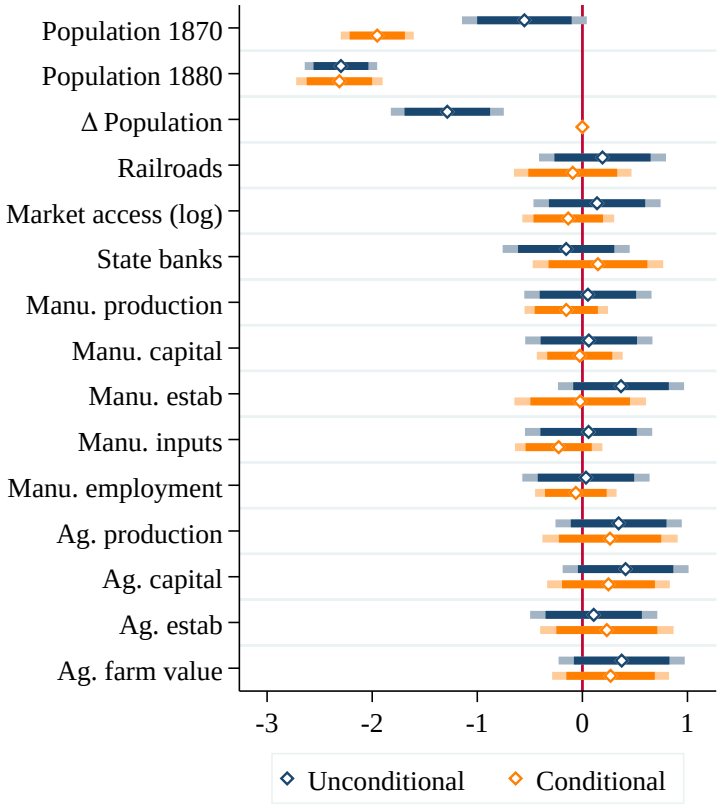
It is not surprising that towns that did not cross the population threshold in 1880 had lower growth rates from 1880 than those that did not. In addition to being the only char-

[22] Gou (2016) uses the introduction of a new population cutoff in the early 20th century to study the effect of capital requirements on bank stability. Similarly to Fulford (2015) and Carlson, Correia and Luck (2022), we focus on the 6,000 cutoff in the 1880 census, and as in Carlson, Correia and Luck (2022) we also control for the change in town population following the previous census as a proxy for a town's overall growth trajectory.

[23] The concurrent work by Carlson, Correia and Luck (2022) focuses on the role of bank competition and thereby requires a different sample of towns where there was at least one national bank in the initial period. Their channel of bank competition is on the asset side of the balance sheet and shows implications for lending behavior, leverage, and survival during the 1893 Panic.

[24] The federal government was much more limited in this period and very few federal regulations existed. State-level regulation changes are absorbed by the fixed effects in the specifications.

Figure 4: Covariate balance



Notes: Figure 4 plots the coefficients and 95% (in dark bands) and 99% (in light bands) confidence intervals of individually estimated and normalized regressions of: $X_i = \beta \mathbb{I}(Pop1880 < 6k) + \varepsilon_i$ where X_i is a location-level characteristic. All variables are normalized to have mean zero and standard deviation of one. The conditional regressions include state fixed effects and the population change from 1870 to 1880 as well. Railroads are from Atack (2016) and measured in 1876. State and other non-national bank financial institutions are obtained from the *Banker's Almanac and Register* of 1876, and market access cost for 1870 is calculated by Donaldson and Hornbeck (2016). Manufacturing and agricultural measures are from the census of 1870.

acteristic that is unbalanced, these differences could potentially bias the results if they are correlated with a town's real outcomes through non-bank channels. For example, places that rapidly expanded in the previous decade could continue to grow faster due to agglomeration effects. We therefore control for population changes between 1870 and 1880 to account for a town's overall growth trajectory that could persist into subsequent decades. Although all other characteristics are balanced, we include differences in physical trade costs and overall financial development as part of our standard set of controls.

3.3 First stage

We estimate the following first stage regression:

$$\mathbb{I}(\text{National Bank})_{i,s} = \beta \mathbb{I}(\text{Pop1880} < 6000)_{i,s} + \Gamma' X_{i,s} + \eta_s + \varepsilon_i \tag{1}$$

for town i in state s. $\mathbb{I}(\text{National Bank})_{i,s}$ is an indicator variable for having at least one national banks in the town as of 1885, and $\mathbb{I}(\text{Pop1880} < 6000)_{i,s}$ is an indicator variable for having a town population below the 6,000 threshold in 1880 census. $X_{i,s}$ is a vector of control variables such as the population change between 1870 and 1880, the number of railroads in 1875, and the number of state banks in 1876. η_s denotes state fixed effects, which limits the estimation to using within-state variation and accounts for unobserved state-level differences such as regulatory changes.

Table 2 shows the first stage results as we add control variables. The point estimate in column 1 indicates that the lower regulatory capital requirement is associated with a 30% higher chance of gaining a national bank. This positive relationship is robust to controlling for railroad access, the number of state banks, and overall market access. The coefficient with the full battery of controls is 28%, which is only slightly smaller than the baseline effect.

We provide several robustness checks that the instrument is relevant, discussed in more detail in Appendix B. First, we provide falsification tests with placebo population cutoffs near the 6,000 threshold. These falsification tests help to address the concerns that national banks simply tended to be established in smaller areas due to expectations for higher future growth. Table A.5 shows that all other population cutoffs are not significantly correlated with a difference in the likelihood of gaining a national bank.

Second, we expand the population ranges that we allow in our sample to include bandwidths of 3,000 to 9,000 and 2,000 to 10,000 population in 1880. The larger bandwidths help to alleviate concerns that there is a spurious correlation right around the cutoff that does not hold more generally. Table A.6 shows that the cutoff remains statistically significant with

Table 2: Relationship between population threshold and national bank entry

	𝕀(National Bank)				
	(1)	(2)	(3)	(4)	(5)
𝕀(pop<6k)	0.307***	0.304***	0.287***	0.296***	0.281***
	(0.104)	(0.104)	(0.0997)	(0.104)	(0.100)
Δ Pop	Y	Y	Y	Y	Y
Railroads (1875)		Y			Y
State banks (1876)			Y		Y
Market access cost				Y	Y
State FE	Y	Y	Y	Y	Y
F-stat	7.988	5.499	9.917	5.990	6.074
N	147	147	147	147	147

Notes: Table 2 estimates the first stage relationship: $\mathbb{I}(\text{National Bank})_{i,s} = \beta \mathbb{I}(\text{Pop1880} < 6000)_{i,s} + \Gamma' X_{i,s} + \eta_s + \varepsilon_i$. State FEs and the population change from 1870 to 1880 are included in all specifications. The number of railroads and state banks are measured in 1875 and 1876, respectively, and the log of market access cost is calculated in 1870. * p<0.1, ** p<0.05, *** p<0.01.

similar magnitudes ranging from 24 to 33% in all specifications with the expanded samples. We choose the more conservative sample size for our main results since a greater population window raises concerns about comparability between the larger and smaller places.

Third, our results are not an artefact of the specific years that we use to observe national banks in each decade. In Table A.7, we estimate the first stage where we construct the sample of towns with the requirement that they have no national banks in 1873 and 1887, and we measure entry in 1883 and 1887 respectively. The results are very similar. Measuring entry in the 1880s for places that did not have a national bank as of 1875 may also raise the concern that places that anticipated higher future growth founded their national banks in the late 1870s when they faced a low entry cost, making the change in entry costs after 1880 irrelevant. However, this sort of anticipatory behavior would actually bias the instrument downward. In addition, there is no evidence of national bank entry bunching in the years right before the 1880 census, both in our sample and in the aggregate (Figure A.6).

4 Results

In this section, we present the results on how access to national banks impacted the local economy. We start by studying changes in the agricultural sector before turning to employment and the manufacturing sectors.

4.1 Real effects in the traded sector

Having established the relevance of our instrument, we now turn to the impact of national bank entry on real economic outcomes. Since there are no records of bilateral trade flows between towns in the US during this period, we proxy for traded sector activity using production of traded goods and employment in the traded sector.

We estimate a series of first-differenced regressions of the form:

$$\Delta Y_{i,s} = \beta \widetilde{\mathbb{I}}(\text{National Bank}) + \Gamma' X_{i,s} + \eta_s + \varepsilon_{i,s} \tag{2}$$

where $\Delta Y_{i,s}$ is the change in an outcome in town i in state s in 1890 relative to 1880. $\widetilde{\mathbb{I}}(\text{National Bank})$ is an indicator of having at least one national bank in 1885, instrumented by the indicator variable of a town's population being below the 6,000 cutoff. β is the main coefficient of interest, which measures the change of the output response to having a national bank. X_{is} is a vector of control variables, and η_s denotes state fixed effects. Time-invariant characteristics of the locations are subsumed by the differences.

The county-level outcome variables of interest are calculated as per capita based on the male population above the age of twenty-one.[25] We focus on per capita measures for two reasons: first, county boundaries evolved as new counties were incorporated throughout the 19th century and counties in 1890 could be very different compared to the same county in 1880. Second, this scaling provides a consistent normalization across sectors that makes it straightforward to compare relative magnitudes. We choose adult male population as the denominator as a proxy for employment. While employment by sector was reported in the census, it was often inconsistent both within and across census years while population was accurately reported (Carter and Sutch, 1996). Since national bank entry occurred at the town level but census outcomes are only measured at the county level, we use the ratio of town population to the total population in the county as analytical weights in all regressions with county-level outcomes.

4.1.1 Agricultural production

Our first measure of the impact of monetary stability on real activity in the traded sector is in the agricultural sector. Agricultural production relied on direct bank financing for both short-term expenditures and long-term capital accumulation (fixtures and equipment), but national banks rarely lent to the agricultural sector because they were not allowed to

[25] Our results are robust to using different measures of population, shown in the appendix.

hold land as collateral. Since farmers usually had little else to pledge, their relationships with national banks were weak (Snowden, 1987). In this context, the main channel through which national banks had an impact would have been through monetary stability lowering transactions frictions in the traded sector.

We measure the trade intensity of local agricultural production as the share of traded crops in total output. Traded crops are defined as those listed on the Chicago Board of Trade, which included wheat, oats, buckwheat, and Indian corn. Table 3 columns 1 and 2 present the results for both the OLS and for the second stage of the IV. Column 1 only includes the baseline controls of the pre-period population change and state FEs. Column 2 also controls for pre-period financial development (non-national banks) and physical trade costs (railroads). Both the OLS and IV coefficients are positive and statistically significant at the 5% level. The OLS magnitudes are actually smaller, suggesting that national banks did not selectively enter into locations that would ultimately become more trade-intensive.

The magnitude of the instrumented effects with controls in column 2 (0.10) relative to the pre-entry mean of 0.91 indicates that the share of traded crop production grew by 11% due to national bank entry. The IV results have a first-stage F-stat of over 15 and 10 in the baseline and after including all controls, respectively. We also report 95% conditional likelihood ratio (CLR) confidence intervals in brackets below the standard errors to address concerns that the F-stat may be considered low (Moreira, 2003). These are also positive and do not include zero.

We then examine the impact of national bank entry on total output (columns 3 and 4) and types of capital (columns 5 to 8). In the latter category, we measure the value of farmland and fixtures, which tended to rely on long-term credit granted on mortgage security (Pope, 1914) and fertilizers expenditure, a form of working capital expenditure financed with short-term credit. We find that none of these measures was affected by national banks, as expected given the regulatory barriers for national banks to extend credit to the agricultural sector.

While we cannot completely rule out the possibility that traded crops were more capital-intensive in some ways and did benefit from the direct bank credit channel, the insignificant impact of entry on measures sensitive to both long-term and short-term credit indicates that bank lending likely played little role in the agricultural sector. In addition, as long as traded crops did not differentially rely on these components of production, we would not expect to see the shift in trade intensity to be visible in the factors of production. The results overall are more consistent with national banks changing the relative profitability

of producing traded crops given the lower transactional costs from having access to a more stable monetary base.

Table 3: Agricultural Sector (1880-1890)

	Traded share		Production		Fixtures		Fertilizer	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
$\mathbb{I}$(National Bank)	0.0167*	0.0247**	-11.34	-3.329	12.64	-4.897	0.269	0.0274
	(0.00859)	(0.00953)	(7.167)	(7.848)	(32.50)	(35.42)	(0.244)	(0.272)
IV: Second Stage								
$\tilde{\mathbb{I}}$(National Bank)	0.0710***	0.102***	-9.315	3.686	37.41	31.81	0.185	-0.165
	(0.0268)	(0.0376)	(19.39)	(24.98)	(88.11)	(112.9)	(0.661)	(0.863)
	[0.00, 0.24]	[0.01, 0.27]	[-122.97, 28.17]	[-134.46, 31.03]	[-647.71, 171.19]	[-717.06, 159.29]	[-2.69, 2.46]	[-3.00, 2.54]
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y		Y		Y		Y
Mean of Dep. Var.	0.905	0.905	149.2	149.2	849.9	849.9	1.708	1.708
F-stat	15.61	10.59	15.61	10.59	15.61	10.59	15.61	10.59
N	147	147	147	147	147	147	147	147

Notes: Table 3 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. * p<0.1, ** p<0.05, *** p<0.01.

4.1.2 Employment

We next estimate the impact of national bank entry on transactions-oriented professions relative to placebo professions that would have grown with overall development. There are two occupations that specialized in facilitating trade without being part of the production process: "commission merchants" and "buyers and shippers."[26]

We use the town-level of employment collected from the *Zell's Classified United States Business Directory* published in 1875 and 1887 and the county-level census of population counts of workers in different occupations in 1880 and 1890 to measure these outcomes. Table 4 reports the OLS and IV results for each set of outcomes. "Commission merchants" and "architects" in columns 1–4 are from *Zell's* while "buyers & shippers" and "architects" in columns 5–8 are from the census. Since these measures are from different sources, we transform the variables into comparable units of the share in each profession per 1,000 inhabitants.

[26]These were both occupations where agents sourced products from one place and sold them in another, usually on commission, and without being involved in the production process.

At the town-level (columns 1 and 2), there are 0.73 (se 0.31) more commission merchants per 1,000 inhabitants after national bank entry.[27] The placebo occupation of architects is unaffected. As in the results for the agricultural sector, the OLS appears to be downward biased.

At the county-level, we find that national bank entry leads to a 1.90 (se 1.08) increase in the share of buyers and shippers per 1,000. While these results are noisier, they are consistent with the town-level results. Both sets of results indicate that gaining access to national banks led to more trade-related activity as measured by employment. We again find no impact on the share of architects. Table A.2 presents the null results for additional placebo occupations of doctors and teachers.

Table 4: Employment in trade-oriented sectors (1880–1890)

	Commission merchants		Architects		Buyers & shippers		Architects	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
$\mathbb{I}$(National Bank)	0.0000772	0.0656	0.285	1.876	-0.225	-0.177	-0.0600	0.0542
	(0.0680)	(0.0756)	(1.249)	(1.336)	(0.262)	(0.274)	(0.305)	(0.317)
IV: Second Stage								
$\tilde{\mathbb{I}}$(National Bank)	0.474**	0.732**	2.690	5.373	1.727*	1.900*	-0.316	-0.238
	(0.217)	(0.308)	(3.429)	(4.358)	(1.005)	(1.076)	(0.972)	(1.026)
	[0.03, 1.74]	[0.07, 1.96]	[-4.53, 113.33]	[-1.35, 127.50]	[-0.22, 7.27]	[-0.20, 8.23]	[-3.72, 2.46]	[-4.03, 2.71]
Sample	Zells	Zells	Zells	Zells	Census	Census	Census	Census
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y		Y		Y		Y
F-stat	15.61	10.59	15.61	10.59	10.92	10.21	10.92	10.21
N	147	147	147	147	147	147	147	147

Notes: Table 4 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. Outcome variables for Columns 1 to 4 are from *Zell's* and outcomes for Columns 5 to 8 are from the Census. * p<0.1, ** p<0.05, *** p<0.01.

4.1.3 Complementary evidence from prices

We also provide some complementary evidence on how national banks reduced transactions costs by comparing price changes in "trade-sensitive" goods versus "local" goods in a town following national bank entry.[28] Sellers of traded products had to bear the price risk

[27] Given the average population of 6,781 in places above the cut-off, this implies an increase of 5 commission merchants in the town.

[28] This analysis does not follow the IV strategy since we do not have a comparison set of towns that could potentially have gained a national bank but did not. We estimate effects using the time series variation of prices within towns before and after observed national bank entry

Table 5: Price level response to national bank entry

	(1) Price of Tea	(2) Price of Molasses	(3) Price of Starch
𝕀(National Bank)	-0.294***	-0.250***	-0.0105
	(0.0844)	(0.0651)	(0.00775)
Year FE	Y	Y	Y
Pre-NB Mean	1.238	1.120	0.120
N	115	105	117

Notes: Table 5 presents results from estimating $P_{it} = \alpha + \beta 1(\text{National Bank})_{it} + \gamma_t + \varepsilon_{it}$ for tea, New Orleans molasses, and starch in 9 towns over 1864 to 1880. The first years of having at least one national bank in these town range from 1866 to 1878. Standard errors are clustered by year. *** p<0.01, ** p<0.05, * p<0.1.

associated with the uncertain currency values between their towns and the towns where they sourced the products. Therefore, price uncertainty was likely to drive up costs, leading to higher sale prices locally. On the other hand, selling locally produced goods did not involve transactions with non-local bank notes.

We collected data on the price of tea, New Orleans molasses, and starch from 1864 to 1880 in 9 towns from the supplementary reports on *The Average Retail Prices of Necessaries of Life* in *Statistics of Wages* published by the census office in 1886. We choose these goods because they are the most consistently available in the data. These 9 towns had their first national banks enter between 1866 and 1878. We categorize tea and New Orleans molasses as "trade-sensitive" goods, as they were either imported and distributed from the ports, or produced specifically in New Orleans. Starch, on the other hands, is categorized as "local" good as it was likely to be locally produced from corn.

We find that the price of tea and New Orleans molasses dropped significantly with the access to national banks, whereas the price of starch was not impacted. As shown in Table 5, the price of tea dropped by about 30 cents after the towns had national banks, relative to the average price of $1.24 per pound (a 25% decrease). Similarly, the price of New Orleans molasses dropped by about 25 cents per gallon from $1.12 per gallon (a 23% decrease).

4.2 Growth in the manufacturing sector

Having shown that national bank entry led to growth in trade-related sectors, we next turn to study the effect of national banks on the production in the manufacturing sector. This sector would benefit from accessing a stable currency for at least two reasons: first, a reduction in transaction frictions boosts trade, increasing potential market access for tradable goods such as those produced by the manufacturing sector; and second, manufacturing activities are dependent on the price, quantity, and quality of inputs and a reduction in

financial transaction costs allows local manufacturers to import more and better inputs in addition to exporting more transformed goods (e.g., Goldberg, Khandelwal, Pavcnik and Topalova, 2010).

We find that the stable private money introduced by national banks led to economically and statistically significant higher growth in manufacturing production per capita between 1880 and 1890. We estimate the main specification in Equation 2 using differences in manufacturing production per capita as the outcome variable. The IV estimates from Table 6 (columns 1 and 2) show that gaining a national bank led to about $229 to $310 higher growth in manufacturing production per capita ($6,360 to $8,620 in 2018 dollars), which represents roughly one-third to one-half of the average of pre-period levels in 1880.

These results are robust to alternative definitions of the labor force, and there are no effects in the pre-entry period. In columns 1 and 2 of Table A.3, we calculate manufacturing production per capita by scaling production by male population between 18-44 years old, or the "prime-age" male labor. In columns 3 and 4, we scale by the total town population. Both sets of robustness checks produce statistically significant results with similar economic magnitudes. In columns 5 and 6, we set the dependent variable as the change in manufacturing production per capita from 1870 to 1880. Here, we find no evidence that gaining a national bank between 1875 and 1885 had an impact on manufacturing growth in the 1870s, which further rules out the possibility of pre-trend in growth having simultaneous effects on town size and subsequent growth.

4.2.1 Decomposing growth in the manufacturing sector

We next decompose manufacturing growth into factors including inputs, employment, and capital in order to isolate the likely sources for growth in overall production. We estimate the baseline specification in Equation 2 with the different components of manufacturing sector as the dependent variable, and present the results in columns 3–8 in Table 6.

First, manufacturing inputs increased significantly more after gaining access to national banks. The IV estimates in column 4 indicate that gaining a national bank increased manufacturing inputs usage per capita by $205 (se $82), which represents a 54% growth relative to the average level in 1880. Second, gaining a national bank also led to significant growth in manufacturing employment. The IV estimates in column 6 that there was a 16 pp increase in employment in the manufacturing sector, which represents a 50% increase relative to the pre-entry mean of 33 pp. In contrast, the impact of national banks on manufacturing capital was positive but not statistically significant (columns 7 and 8), with much smaller

Table 6: Manufacturing Sector (1880-1890)

	Production		Inputs		Employment		Capital	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
𝕀(National Bank)	39.96	57.34	27.07	34.69*	0.0194	0.0351*	2.508	44.05
	(33.09)	(36.30)	(18.48)	(20.61)	(0.0189)	(0.0210)	(37.33)	(41.33)
IV: Second Stage								
$\hat{\mathbb{I}}$(National Bank)	228.6**	309.9**	153.6***	205.3**	0.113**	0.164**	55.87	132.1
	(100.7)	(136.4)	(58.80)	(81.96)	(0.0559)	(0.0763)	(101.8)	(133.6)
	[-3.62, 1154.03]	[18.91, 1297.75]	[17.29, 699.78]	[19.19, 789.01]	[-0.10, 0.38]	[-0.09, 0.42]	[-384.94, 465.50]	[-386.02, 513.25]
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y		Y		Y		Y
Mean of Dep. Var.	626.4	626.4	380.9	380.9	0.329	0.329	373.2	373.2
F-stat	15.61	10.59	15.61	10.59	15.61	10.59	15.61	10.59
N	147	147	147	147	147	147	147	147

Notes: Table 6 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. * p<0.1, ** p<0.05, *** p<0.01.

magnitudes relative to overall production and inputs.

The results above on the decomposition of manufacturing output indicate that national banks led to significant growth by increasing inputs and employment in the sector, but that their impact on capital investment was limited. There are several possible explanations for the null effect on capital. First, regulations encouraged national banks to make short-term loans rather than long-term loans (White, 1998). These loans provided working capital to meet short-term liquidity needs rather than long-term investment demands. The short-term credit may have also facilitated inputs sourcing, and the lack of long-term credit provision limited manufacturers' ability to acquire physical capital. Second, since the national banks were unit banks, their ability to diversify their loan portfolio with borrowers across different places was limited, which could discourage them from expanding their balance sheets. Third, large values of firm investment could not be easily accommodated as a national bank could lend no more than 10% of its capital stock to one entity.[29] These numerous requirements impeded long-term investment in the manufacturing sector, but the sector still benefited from reduced trade frictions and shifted local employment into the sector.

[29]That is to say, a bank with $50,000 of capital stock could lend no more than $5,000 to a firm. Source: National Banking Act of 64, Sec. 29

4.3 Growth in innovation

The reduction in trade costs from the improved stability of the money supply can generate innovation through two channel: first, there is an increase in the number of potential consumers that producers can reach (the "market access" channel) which increases the incentives to innovate; and second, the improvements in sourcing inputs can lead to quality upgrading.

We use the the number of patents obtained by residents within a county as measure for innovation activity (Petralia, Balland and Rigby, 2016).[30] We first show that the number of patents can be a reasonable proxy for the manufacturing sector's research and development outcome by plotting the relationship between manufacturing and agricultural production per capita and the log number of patents obtained by local inventors in the previous decade in Figure A.5. The plots show that local innovation output measured by the number of patents granted is strongly correlated with manufacturing production per capita, but is only weakly correlated with agriculture production per capita. Assuming patents contributed to total factor productivity, these correlations indicate that they were primarily innovations that benefited the manufacturing sector, which is an indirect channel through which they would have impacted output.

We estimate the percent change in the number of patents granted from the decade following 1870 and 1880 using the specification of Equation 2. Since patents data are available annually, we aggregate the total in the ten years between 1871 to 1880, and 1881 to 1890, respectively. Gaining a national bank led to 1.39 (se 0.70) times more patents post-entry (columns 3 and 4 in Table 7. We also conduct placebo tests by replacing the outcome variable with percent changes in number of patents between the previous two decades (1870s and 1880s) and report the results in Table A.4. The insignificant results imply that the difference in innovation output growth was not due to pre-existing trends.

4.4 Long-term effects

The immediate effects on the manufacturing sector, in conjunction with the increased patenting activity, due to the increased market through trade, are a potential driver for agglomeration economies in manufacturing that persist over time (Kline and Moretti, 2014).

To measure the long-term effects of national banks, we estimate a dynamic differences-in-differences model from 1860 to 1900, which makes it possible to visualize any pre-trends before the 1880 census was published and the persistence afterward. Specifically, we estimate

[30] Plant- or sector-level innovation measure is not available for our sample period.

Table 7: Patenting Activity (1880–1890)

	Patents			
	(1)	(2)	(3)	(4)
OLS				
$\mathbb{I}$(National Bank)	0.352*	0.419**		
	(0.179)	(0.202)		
IV: Second Stage				
$\tilde{\mathbb{I}}$(National Bank)			1.051**	1.388**
			(0.515)	(0.700)
			[0.01, 3.99]	[0.02, 4.48]
State FE	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y
Controls		Y		Y
F-stat			15.61	10.59
N	147	147	147	147

Notes: Table 7 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. * p<0.1, ** p<0.05, *** p<0.01.

the following:

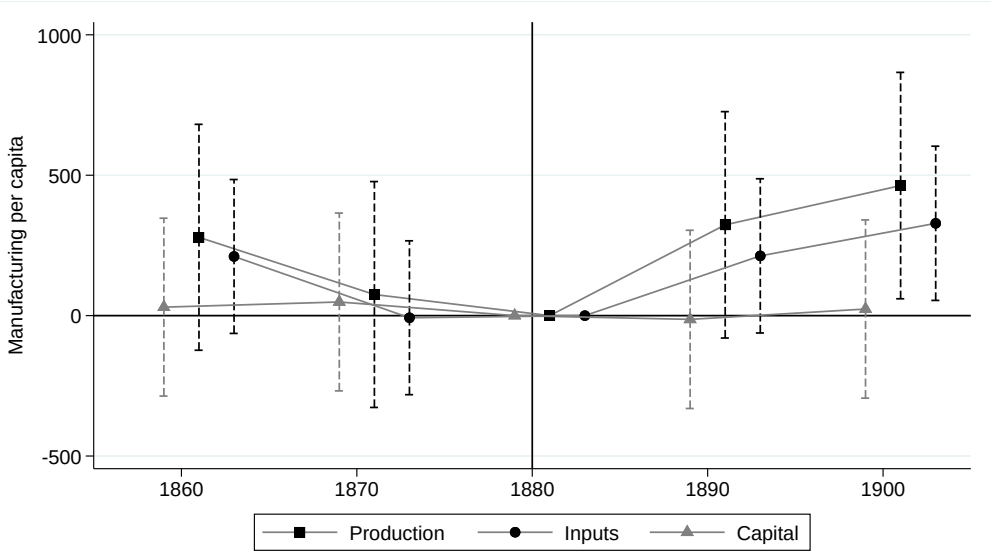
$$Y_{ist} = \sum_k \beta_k \widetilde{\mathbb{I}}(\text{National Bank}) \times \mathbb{I}_{\{year=k\}} + \sum_k \gamma_k X' \times \mathbb{I}_{\{year=k\}} + \eta_{st} + \alpha_i + \varepsilon_{it}, \quad (3)$$

where Y_{ist} is the outcome in town i in state s at year t. We include leads and lags before and after 1880, and omit 1880 so that all outcomes are relative to the treatment period. β_k is the coefficient of interest, and it measures the elasticity of the output response to gaining a national bank in each of the lead and lag years. As before, $\widetilde{\mathbb{I}}$(National Bank) is the instrumented variable. γ_k allow the control variables X' to have time-varying effects. η_{st} are state-year fixed effects so that we compare outcomes within states and years, and α_i are location fixed effects that control for time-invariant characteristics such as geographical location and land quality.

The full IV dynamic difference-in-difference coefficients for manufacturing production plotted in Figure 5 show that the positive effect of national banks on manufacturing production between 1880 and 1890 persisted beyond a decade into 1890s as well. As in the short-run results, these effects are predominantly due to growth in inputs rather than capital. The figure also indicates that there were no differential pre-trends between the places that received

national banks versus those that did not.[31] Data from the 1910 Census of Manufacturers is not available, so we stop our analysis before 1920 given the disruptions due to WWI and the establishment of the Federal Reserve System.

Figure 5: Persistent positive effect on manufacturing outcomes



Notes: Figure 5 shows the dynamic diff-in-diff coefficients for the second stage IV estimates of the effect of having a national bank on county-level manufacturing production value, inputs, and capital. The specification for the IV estimates is $Y_{ist} = \sum_k \beta_k \widetilde{\mathbb{1}}(\text{National Bank}) \times \mathbb{1}_{\{year=k\}} + \sum_k \gamma_k X' \times \mathbb{1}_{\{year=k\}} + \eta_{st} + \alpha_i + \varepsilon_{it}$. 1880 is the omitted year, and the vertical bars represent the 95% confidence intervals.

5 Conclusion

This paper studies the late 19th century United States after the passage of the National Bank Act of 1864, and exploits a population-based capital requirement of national banks to provide empirical evidence on the importance of stability in the value of currency used for payments in the real economy.

We establish that a lower regulatory capital requirement defined discretely by town population strongly and robustly predicts a higher likelihood of national bank entry. The national banks significantly shifted from non-traded crops to traded crops despite having little impact on overall agricultural production, access to long-term credit, or short-term credit. This change in the composition of economic activity through non-credit channels

[31] We only show 2 pre-shock period coefficients here, but including the 1840 and 1850 census does not change the flat patters of the pre-shock trend.

provides evidence that the stability of these private bank currencies had first-order effects on the composition of output.

We also find that other measures of local trade activity increased following national bank entry. There was significant and persistent greater increase in manufacturing production per capita following national bank entry while capital did not significantly scale up. The results indicate that national banks extended limited long-term credit for capital acquisition, and the effect of national bank entry on manufacturing sector growth likely comes from the increased supply of stable bank notes. Consistent with market access and trade activity growing from the lower monetary transactions costs, we also find that innovation activity, proxied by patents granted, increased significantly as well. Together, the initial significant growth in the manufacturing sector as well as increased trade and innovation could contribute to the persistently higher level of manufacturing production for at least two decades.

Overall, our results indicate that stabilizing the value of privately created money was economically beneficial, especially for sectors that were likely more exposed to payments frictions. As financial technology progresses and new digital currencies present alternative payment methods, these lessons from the national banking era can provide policymakers additional guidance on the costs of transactions frictions arising from reducing the liquidity of monetary instruments.

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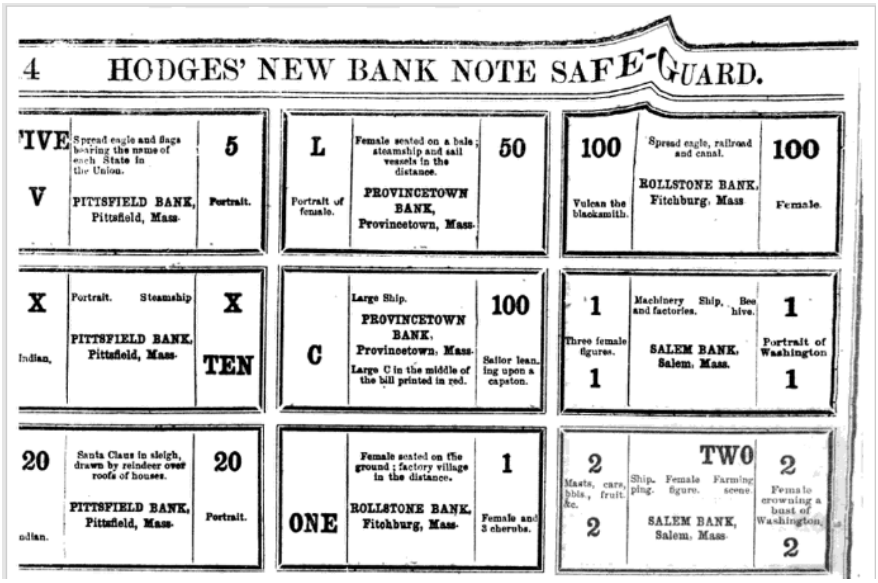
A Additional Figures and Tables

Figure A.1: Bank note from the Pittsfield Bank in Massachusetts

(a) Bank note from the Pittsfield Bank in Massachusetts

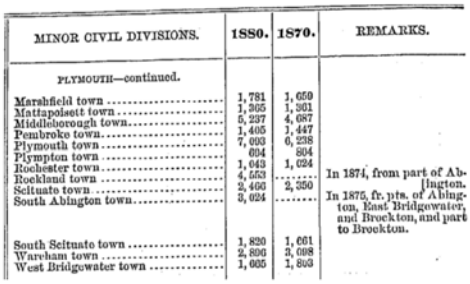
(b) Page from *Hodges' New Bank Note Safe-Guard*



Notes: Figure A.1a gives an example of a private banknote that was printed in 1853. The note is for twenty dollars, redeemable for specie at the Pittsfield bank. Figure A.1b displays an page from the *Hodges' New Bank Note Safe-Guard*, first published in 1859. It is an example of one of the many publications dedicated in helping merchants and brokers to detect counterfeit bank notes. It describes the physical appearance of over 10,000 bank notes, "embracing every genuine note issued in the United States and Canada." The description for the Pittsfield bank $20 note from figure A.1a is shown in the bottom row of the first column and accurately describes the note.

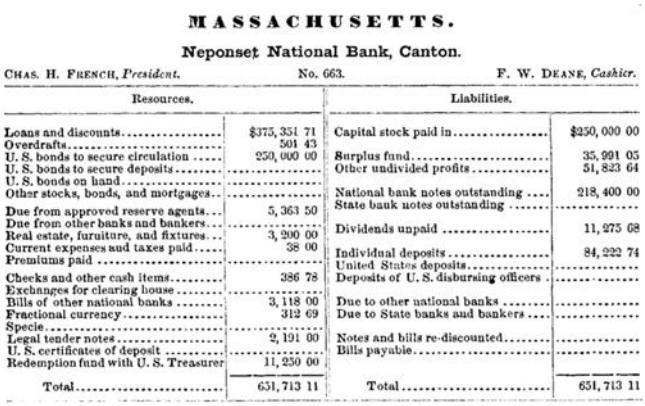
Figure A.2: Exhibits of Data Sources

(a) Decennial Census: 1880 and 1890



MINOR CIVIL DIVISIONS.	1880.	1870.	REMARKS.
PLYMOUTH—continued.			
Marshfield town	1,781	1,659	
Mattapoisett town	1,365	1,361	
Middleborough town	5,237	4,687	
Pembroke town	1,405	1,447	
Plymouth town	7,003	6,238	
Plympton town	694	804	
Rochester town	1,043	1,024	
Rockland town	4,553	.....	In 1874, from part of Abington.
Scituate town	2,466	2,350	
South Abington town	3,024	.....	In 1875, fr. pts. of Abington, East Bridgewater, and Brockton, and part to Brockton.
South Scituate town	1,820	1,661	
Wareham town	2,890	3,008	
West Bridgewater town	1,695	1,803	

(b) Annual Report of the Comptroller of Currency (1875)



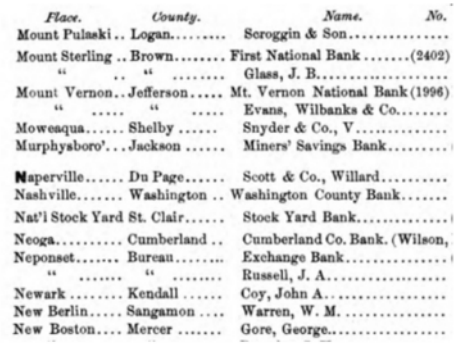
MASSACHUSETTS.

Neponset National Bank, Canton.

CHAS. H. FRENCH, *President.* No. 663. F. W. DEANE, *Cashier.*

Resources.		Liabilities.	
Loans and discounts	$375,351 71	Capital stock paid in	$250,000 00
Overdrafts	501 43		
U. S. bonds to secure circulation	250,000 00	Surplus fund	35,991 05
U. S. bonds to secure deposits		Other undivided profits	51,823 64
U. S. bonds on hand			
Other stocks, bonds, and mortgages		National bank notes outstanding	218,400 00
		State bank notes outstanding	
Due from approved reserve agents	5,363 50		
Due from other banks and bankers		Dividends unpaid	11,275 68
Real estate, furniture, and fixtures	3,200 00		
Current expenses and taxes paid	38 00	Individual deposits	84,222 74
Premiums paid		United States deposits	
		Deposits of U. S. disbursing officers	
Checks and other cash items	386 78		
Exchanges for clearing house			
Bills of other national banks	3,118 00	Due to other national banks	
Fractional currency	312 69	Due to State banks and bankers	
Specie			
Legal tender notes	2,191 00	Notes and bills re-discounted	
U. S. certificates of deposit		Bills payable	
Redemption fund with U. S. Treasurer	11,250 00		
Total	651,713 11	Total	651,713 11

(c) The Banker's Almanac and Register (1885)



Place.	*County.*	*Name.*	*No.*
Mount Pulaski	Logan	Scroggin & Son	
Mount Sterling	Brown	First National Bank	(2402)
"	"	Glass, J. B.	
Mount Vernon	Jefferson	Mt. Vernon National Bank	(1996)
"	"	Evans, Wilbanks & Co.	
Mowequa	Shelby	Snyder & Co., V	
Murphysboro'	Jackson	Miners' Savings Bank	
Naperville	Du Page	Scott & Co., Willard	
Nashville	Washington	Washington County Bank	
Nat'l Stock Yard	St. Clair	Stock Yard Bank	
Neoga	Cumberland	Cumberland Co. Bank. (Wilson,	
Neponset	Bureau	Exchange Bank	
"	"	Russell, J. A.	
Newark	Kendall	Coy, John A.	
New Berlin	Sangamon	Warren, W. M.	
New Boston	Mercer	Gore, George	

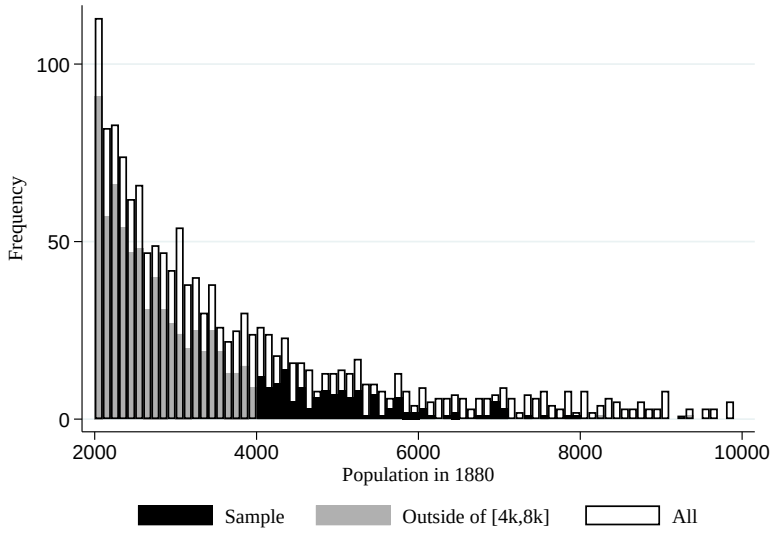
(d) Zell's Business Directory (1875 and 1887)

MAINE.

Bangor.—Ayer & Plummer—Cram G.—Lord H.—McConville P.—McLaughlin H.—Prescott R. S.—Quimby H. C. & Co.—Sands H. S. & Co.—Stetson & Co.—**STEWART T. J. & CO.**—Veazie A. P. & Co.
Bath.—Woodward S. T.
Calais.—Boardman Bros.
Eastport.—Buxton E. S.—Wadsworth S. L.
Gardiner.—Neal B. A. & Son.
Lewiston.—Crowell C. S. & Co. (prod.)—Maxwell O. M. & Co.

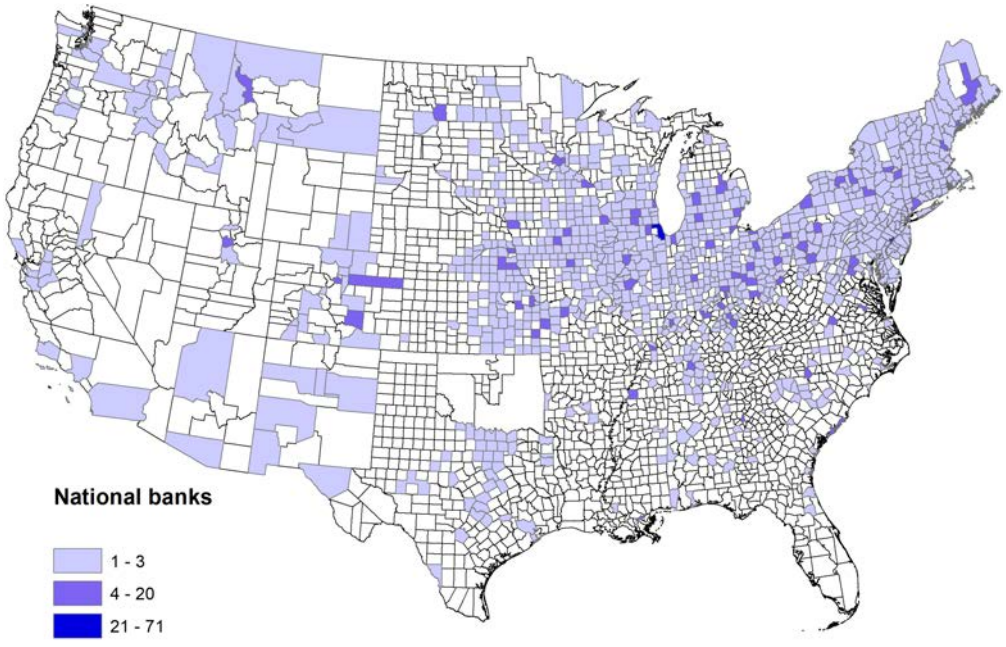
Notes: Figure A.2 displays screenshots of data sources that require hand-digitization used in this study. Figure A.2a shows the town-level population data source, A.2b shows an example from the 1875 Annual Report of the Comptroller of the Currency, where banks reported their location and balance sheet conditions. A.2c shows bank location information from the *Banker's Almanac and Register* in 1885, and A.2d displays example from *Zell's* local business directories.

Figure A.3: Distribution of town population in 1880



Notes: Figure A.3 plots the frequency of all towns with 2,000 to 10,000 population in 1880 census (labeled "All"), as well as after restricting the sample to having below 6,000 population in 1870 and not having a national bank in 1875 (black and gray). The final sample (black bars) consist of the subset that have population between 4,000 and 8,000 people in 1880.

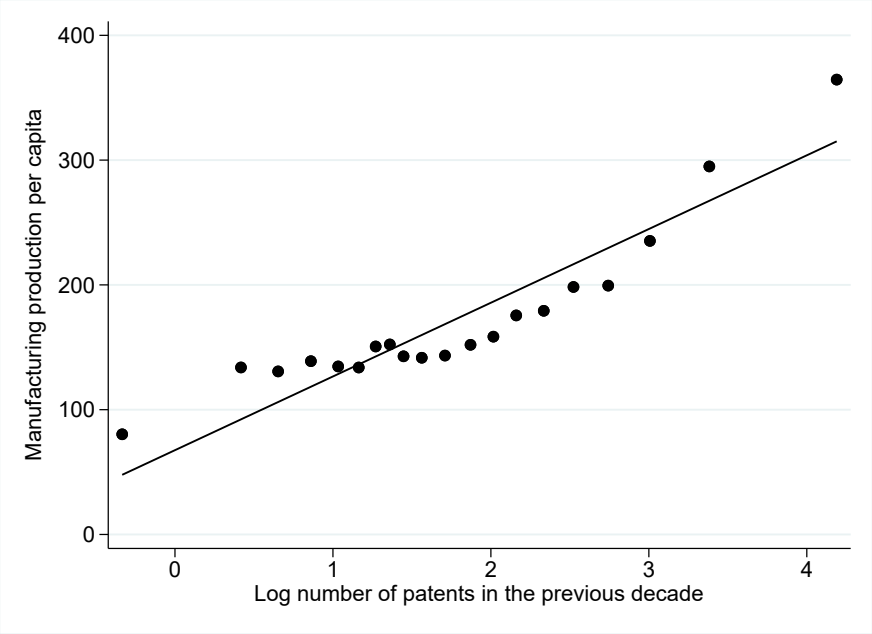
Figure A.4: Distribution of national banks in 1885



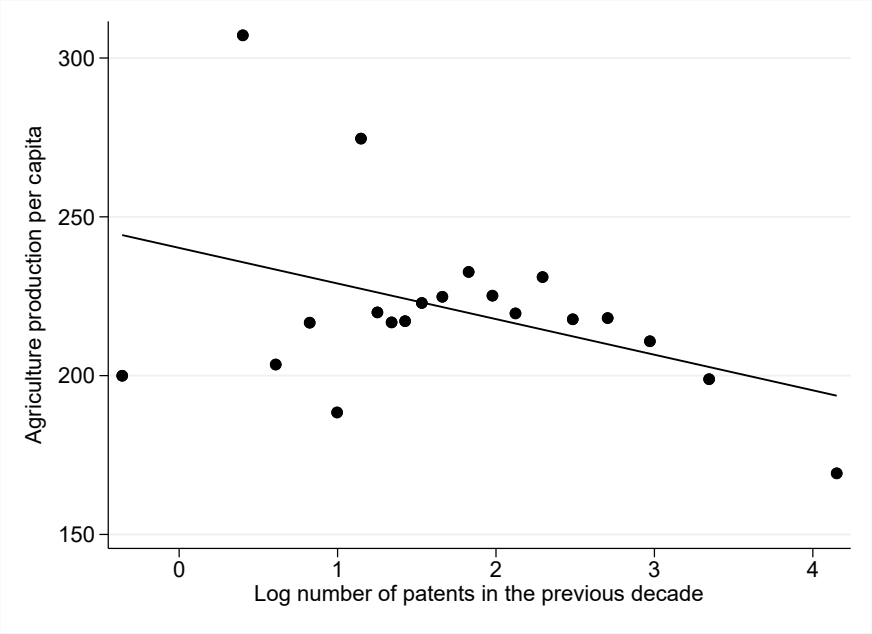
Notes: Figure A.4 plots the location distribution of all national banks as of 1885. Each area represents a county. The white areas did not have a national bank as of 1885, and the lighter to darker shades represent 1-3, 4-20, and 21 or more national banks within the county.

Figure A.5: Production per capita and Innovation

(a) Manufacturing production per capita and log number of patents



(b) Agriculture production per capita and log number of patents



Notes: Figure A.5 presents binscatter plots between manufacturing/agriculture production per capita in 1860-1900 census and log number of patents per county in the previous decade. The plots control for total county population, as well as state-year fixed effects.

Table A.1: Comparison of national banks and state banks

	State banks	**National banks**
Bank notes	various backing	backed 110% by federal bonds → uniform value
Capital requirement	low	high → more costly to establish
Monitoring	2 reports/year to state	5 reports/year to OCC → more oversight
Stability	2.5% failure rate	0.25% failure rate → more stable
Lending	no restrictions	high restrictions → less lending to farms

Notes: Table A.1 lists key distinctions between national banks and state banks. Bank failure rates are calculated for the period between 1875 and 1890.

Table A.2: Placebo tests of employment effects

	Doctors		Teachers	
	(1)	(2)	(3)	(4)
OLS				
$\mathbb{I}$(National Bank)	-0.0286	-0.00509	0.0184	-0.0348
	(0.0315)	(0.0323)	(0.0827)	(0.0854)
IV: Second Stage				
$\tilde{\mathbb{I}}$(National Bank)	0.0412	0.0641	-0.0757	-0.123
	(0.102)	(0.106)	(0.264)	(0.277)
	[-0.26, 0.41]	[-0.26, 0.45]	[-0.92, 0.79]	[-1.02, 0.82]
State FE	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y
Controls		Y		Y
F-stat	10.92	10.21	10.92	10.21
N	147	147	147	147

Notes: Table A.2 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. Outcome variables are from the Census. * p<0.1, ** p<0.05, *** p<0.01.

Table A.3: Robustness for manufacturing production

	18–44 pop		Total pop		1870–1880 placebo	
	(1)	(2)	(3)	(4)	(5)	(6)
OLS						
$\mathbb{I}$(National Bank)	69.52	83.25	31.12	47.06	-44.06	-32.52
	(50.04)	(53.03)	(35.62)	(37.47)	(37.06)	(40.04)
IV: Second Stage						
$\tilde{\mathbb{I}}$(National Bank)	375.3**	509.7**	506.3**	596.3**	-184.6*	-198.8
	(145.9)	(201.0)	(208.6)	(253.4)	(109.9)	(132.9)
	[22.80, 1612.69]	[52.76, 1815.76]	[1.87, 1779.45]	[27.28, 1892.89]	[-566.34, 372.50]	[-584.36, 392.87]
State FE	Y	Y	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y	Y	Y
Controls		Y		Y		Y
Mean of Dep. Var.	851.8	851.8	468.0	468.0	675.6	675.6
F-stat	15.61	10.59	13.63	10.53	13.63	10.53
N	147	147	141	141	141	141

Notes: Table A.3 presents the OLS and instrumented second stage of the regression in Equation 2. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. In columns 1 and 2, manufacturing output is scaled by the male population aged 18 to 44. In columns 3 and 4, it is scaled by total population. In columns 5 and 6, outcomes are measured from 1870 to 1880. * p<0.1, ** p<0.05, *** p<0.01.

Table A.4: Patenting activity: pre-entry placebo

	Patents			
	(1)	(2)	(3)	(4)
OLS				
$\mathbb{I}$(National Bank)	-0.780	-1.095**		
	(0.491)	(0.551)		
IV: Second Stage				
$\tilde{\mathbb{I}}$(National Bank)			-0.501	-0.851
			(1.329)	(1.748)
			[-3.85, 4.12]	[-4.22, 4.59]
State FE	Y	Y	Y	Y
Δ Pop	Y	Y	Y	Y
Controls		Y		Y
F-stat			15.61	10.59
N	147	147	147	147

Notes: Table A.4 presents the OLS and instrumented second stage of the regression in Equation 2. The dependent variable is the change in patents from the from the 1870s to the 1880s, before national bank entry. Control variables include the number of railroads and state banks measured in 1875 and 1876, respectively. Conditional likelihood ratio (CLR) standard errors from Moreira (2003) are reported in brackets for the second stage results. * p<0.1, ** p<0.05, *** p<0.01.

B Supplementary notes on the first stage results

B.1 First stage regressions with placebo population cutoffs

We show that the first stage results are not coming from the fact that smaller places are systematically different by estimating the effects at placebo cut-offs around the true 6,000 mark. The only cut-off that is statistically significant (at the 10%) is 6,500 which is actually larger than the true placebo.

Table A.5: First stage: placebo cut-offs

	5000	5500	6000	6500	7000
	(1)	(2)	(3)	(4)	(5)
Population Cutoff	0.0475	0.0789	0.281***	0.200*	0.141
	(0.0727)	(0.0897)	(0.100)	(0.109)	(0.143)
Δ Pop	Y	Y	Y	Y	Y
Railroads (1875)	Y	Y	Y	Y	Y
State banks (1876)	Y	Y	Y	Y	Y
Market access cost	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y
F-stat	4.331	4.413	6.074	5.023	4.457
N	147	147	147	147	147

Notes: Table A.5 presents results of the first stage regression using indicator of having at least one national banks in 1885 as dependent variable, and various population cutoffs as the RHS variable. * p< 0.10, ** p<0.05, *** p<0.01.

B.2 First stage regressions in alternative samples

We choose the 4,000 to 8,000 population range in order to obtain a sample of towns that are largely comparable and hence less likely to be subject to omitted variable bias. The first stage regressions are robust and more statistically significant with wider population ranges. In Table A.6, we present first stage regression results for 1880 population between 2,000 and 10,000, as well as between 3,000 and 9,000 in 1880, respectively. In both cases, having fewer than 6,000 population is strongly associated with the likelihood of obtaining a national bank once we control for population levels or changes.

B.3 Measurement of entry

We show that our baseline specification where we measure entry in 1885 conditional on not having a national bank in 1875 does not drive the results. We construct two alternative samples choosing different years in the pre-entry decade (1870s) and the entry decade (1880s) and present the results in Table A.7.

Table A.6: Alternative population samples for first stage regressions

	2k to 10k		3k to 9k	
	(1)	(2)	(3)	(4)
$\mathbb{I}$(pop<6k)	0.331***	0.240***	0.298***	0.294***
	(0.0708)	(0.0669)	(0.0861)	(0.0835)
Δ Pop	Y	Y	Y	Y
State FE		Y		Y
F-stat	73.71	26.78	31.07	15.75
N	826	826	333	333

Notes: Table A.6 presents first stage results with alternative population ranges around the 6,000 cutoff. Columns 1 and 2 use the sample where 1880 population $\in [2,000, 10,000]$ and columns 3 and 4 use the sample where 1880 population $\in [3,000, 9,000]$. The different sample sizes reflects the additional towns that meet these requirements, from the distribution shown in Figure A.3.

Table A.7: Alternative sample periods for first stage regressions

	$\mathbb{I}$(National Bank)	
	(1)	(2)
1(pop<6k)	0.185**	0.274***
	(0.0904)	(0.0848)
Δ Pop	Y	Y
State FE	Y	Y
Start Year	1873	1877
End Year	1883	1887
N	155	147

Notes: A.7 presents first stage results with alternative sample periods. The first column shows national bank entry likelihood between 1873 and 1883, and the second between 1877 and 1887. In both samples, town population was below 6,000 in 1870, and between 4,000 and 8,000 in 1880. Additionally, there was no national bank as of the start year (1873 and 1877, respectively).

B.4 Timing of entry

After being created, national banks were allowed to maintain the same capital levels from their charter, and they did not have to follow the capital requirements for a larger population. One particular endogeneity concern is that banks could accurately forecast economic and population growth, and would rush to obtain a charter before the 1880 census was published. For example, a town with population below 6,000 in 1870 correctly anticipated that it would cross the population threshold in 1880 and established a bank in 1879 before the census was updated. This behavior of "racing the census" would bias the OLS estimates upward because the bank entry would be correlated with the outcomes. However, it would actually weaken the first stage relationship in the instrument.

In addition, we empirically correlate the new national bank entries to the years around

the new census publication. First we compare new national bank entries right before the 1880 census in our sample of towns, and then we look at the towns in the entire country. Figure A.6 presents the results. In Panel A, we compare number of new national bank entries by population in 1880 census for the towns in our sample. The first and third bars shows the number of new entries right after the new census was published, and the second and fourth bars shows the number of new entries right before it. For towns below the threshold, there is more entry, which is consistent with our first stage results. For both population groups, more entry occurred *after* the new census was published rather than before.

In Panel B, we look at national bank entry in the entire country. We present coefficients on year dummy variables from the following equation:

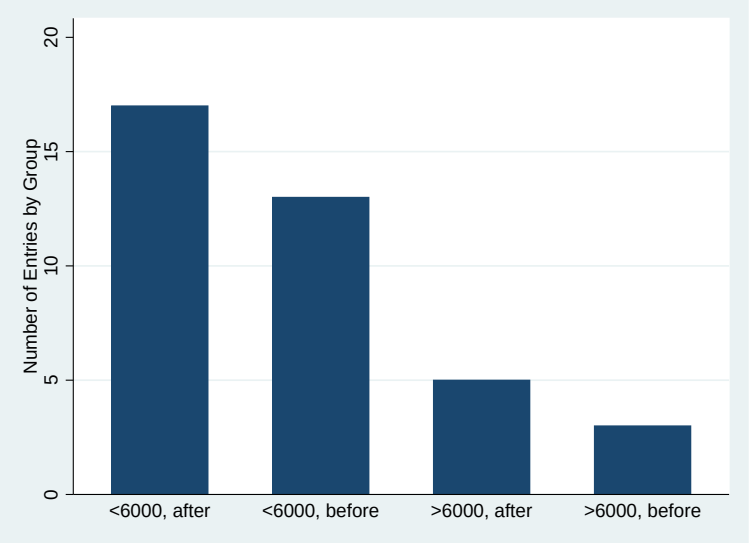
$$NumberNewBanks_{s,y} = \beta_y * 1(year = y) + \gamma_s * 1(state = s) + \epsilon_{s,y}, \tag{4}$$

and compare the coefficients relative to 1880. The result also show that there was no spike in entry before the new census and that in fact, more new national banks established after 1881 than before. The empirical evidence suggests that there was no census racing behavior.

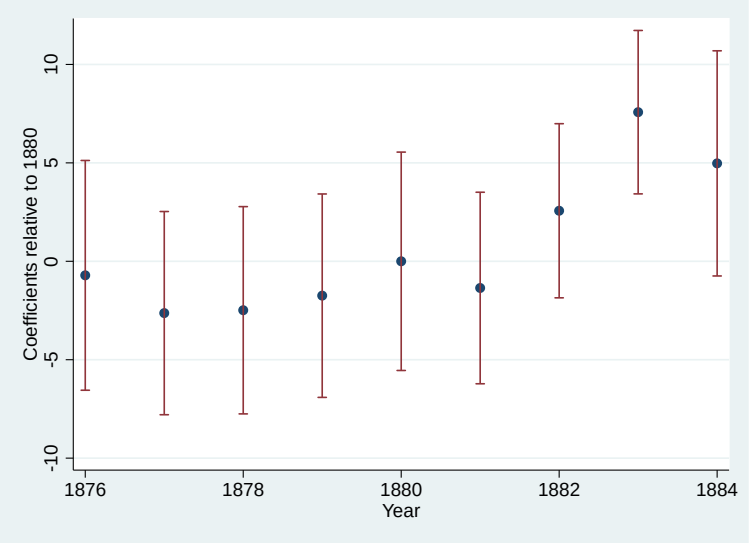
In fact, our first stage results are robust to selecting any year ranges that starts prior to the 1880 census and ends in the 1880s. We choose the range from 1875 to 1885 to capture a relatively stable time period in terms of economic activities and relative growth in national and state banks.

Figure A.6: Timing of Entry

(a) New national banks in sample



(b) All new national banks between 1876 and 1884



Notes: Panel A of Figure A.6 shows number of new national banks in our main sample before or after census publication year, and whether population in 1880 census crossed the 6,000 threshold. Panel B shows coefficients and standard error bars of coefficients on year dummy variables from the following regression:
$NumberNewBanks_{s,y} = \beta_y * 1(year = y) + \gamma_s * 1(state = s) + \epsilon_{s,y}$.

C Additional historical context

C.1 Banking system before the National Banking Act

The idea of establishing a unified banking system across the United States was several decades earlier than the passage of the National Banking Act. The First Bank of the United States, charted for a term of twenty years by the Congress on February, 1791, operated in Philadelphia and was the nation's *de facto* central bank. Alexander Hamilton, the first Secretary of the Treasury, believed a national bank was necessary to stabilize and improve the nation's credit, and proposed federal mint as common currency. However, the bank faced widespread resistance due to concerns of expanding federal power, which was famously led by the Secretary of State Thomas Jefferson. The bank charter was not renewed and expired in 1811.

In 1816, the Second National Bank started operation with similar functions as the First Bank of the United States. As of 1832, the Second National Bank operated more than 30 branches nationwide. During this period, the paper money circulation was comprised of private bank notes issued by state-regulated banks, plus the notes of the Bank of the United States. While the state banks were formally regulated by their individual state governments, the national network of the Bank of the United States could better enforce those regulations. In particular, the Bank of the United States could return notes to issuing banks and demand specie, which it did for any notes that traded at a discount. Therefore the presence of this pseudo central bank prevented the competing private monies of this period from exhibiting the instability of the Free Banking Era.

However, this system with its centralized control of the banking system, was unpopular with many bankers, and there were many objections to it. The end of the Second Bank of the United States occurred when President Andrew Jackson failed to renew the bank's charter in 1836, which marked the beginning of the Free Banking Era.

C.2 Additional evidence of bank debt illiquidity in the Free Banking Era

The large number of floating exchange rates created inconvenience in economic activity. For example, a case record compilation of the United States supreme court between 1843 and 1846 (Stephen K. Williams, 1901) contains a case regarding the value of a loan, and how its value had changed over time:

> [...] the defendant did [...] receive the amount of said loans from the plaintiffs

> in the bank notes of Virginia and of other States, which, [...] were depreciated considerably below the current value of the bank notes of this district [...]

The frictions stemmed from state bank notes illiquidity was especially detrimental to interstate transactions. As a contemporary traveler illustrated the magnitude of the cost in his diary (Dewey, 1910):

> Started from Virginia with Virginia money; reached the Ohio River; exchanged $20 Virginia note for shinplasters and a $3 note of the Bank of West Union
>
> [...] At Maysville wanted Virginia money; couldn't get it.
>
> [...] reached Fredericktown; there neither Virginia nor Kentucky money current; paid a $5 Wheeling note for breakfast and dinner; received in change two $1 notes of some Pennsylvania bank, $1 Baltimore and Ohio Railroad, and balance in Good Intent shinplasters; 100 yards from the tavern door all notes refused. [...]

Monetary frictions were also present in coins, which made them an unsuitable substitute for payments (Ware, 1990):

> In routine business transactions Americans had to calculate in three currencies: one decimal; another based on halves, quarters, and eighths; and another on twelfths and twentieths.