# Did capital requirements in the early 20th century United States promote bank stability?

Michael Gou

University of California at Irvine

mgou@uci.edu

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**Abstract:**

Capital requirements are a fundamental regulation designed to promote bank stability. The structure of the national banking system in the early 20th century United States provides an appropriate regression discontinuity design to study the impact of capital requirements on bank stability. In this study, a sharp regression discontinuity design is exploited to estimate the impact of capital requirements on bank capital, leverage, and suspension rates. Banks subject to higher capital requirements hold on average between 13 to 19% more capital resulting in larger banks. These results are largely being driven by banks operating at the lower end of the capital distribution. By observing the quantile treatment effects, I find that capital requirements increase a bank's capital of up to 28% for banks operating in the lower 10th percentile of the capital distribution. In response, banks increase their assets by 12 to 18%. Ultimately, banks subject to higher capital requirements did not experience less leverage or lower suspension rates. Capital requirements in the early 20th century were not effective in promoting bank stability.

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## Introduction

Capital requirements are a fundamental regulation designed to promote bank stability. After every financial crisis the effectiveness of capital requirements are questioned. The recent financial crisis is no exception. Public concerns about the capital adequacy of banks have led to the proposal of stricter capital requirements. The passing of the Dodd-Frank act, which brought the most significant changes to financial regulation in the United States since the Great Depression, was a response to the recent financial crisis (U.S. Congress, 2010, H. R. 4173). Basel III, which proposes an increase in capital requirements across several countries, was also a response to the recent financial crisis[1]. In addition, the Federal Reserve has recently increased its capital requirements for the largest banks in the United States. The intended goals of these policies are to promote bank stability by forcing banks to hold more capital, decrease the size of their assets, or maintain less risky portfolios which lead to lower bank leverage in the hopes of preventing bank suspensions.

Difficulties arise when studying the impact of capital requirements on bank stability. Changes in capital requirements are often endogenous responses to ongoing economic events such as financial crises. For example, Basel III requires all banks to hold a minimum Tier 1 capital to asset ratio of 6% by 2019[2]. The estimated impact of higher capital requirements on bank outcomes may be biased since these policies are a reaction to economic events. However, studying historical capital requirements in the United States allows me to address this issue.

In the early 20th century, the United States national banking system implemented capital requirements in terms of minimum capital requirements. Banks were required to hold a minimum amount of capital determined by the population of the town a bank was operating in. The intuition is that a town's population represents a measure for a town's business activity and the larger a town's business activity the more capital a bank should hold as a buffer for negative economic shocks (White, 1983). However, these capital requirements were not continuous and instead the minimum amount of capital required doubles at specific population thresholds. For

[1] The Basel Committee on Banking Supervision consists of a committee of banking supervisory authorities representing 28 countries that strive to "strengthen the regulation, supervision and practices of banks worldwide with the purpose of enhancing financial stability" (Bank of International Settlements, 2015).
[2] Tier 1 capital consists of common stock and retained earnings capital (Bank of International Settlements, 2015). In this study, common stock is analogous to paid-up capital and retained earnings consist of surplus. Both paid-up capital and surplus capital make up components of bank capital.

example, banks are required to hold at least $25,000 worth of capital if they are operating in a town with population less than 3,000 and the requirement doubles to $50,000 for banks operating in towns with a population greater than 3,000. These abrupt jumps in capital requirements allow me to estimate the effects of capital requirements on bank stability. The main identifying assumption is that towns very close to these population thresholds should be similar in terms of business activity and other town characteristics. The only difference is that banks operating in towns above a threshold get treated with more capital while banks operating below a threshold are not treated. Comparing differences in bank outcomes for banks operating in towns slightly below and above a population threshold allows me to estimate the effect of capital requirements on bank stability. Specifically, I gather detailed bank-level data and exploit these abrupt changes in capital requirements using a sharp regression discontinuity design to estimate the effect of higher capital requirements on bank capital, leverage, and suspensions (Hahn, Todd, and van der Klaauw, 2001; Lee and Lemieux, 2010).

To summarize, I find that banks subject to higher capital requirements hold 13 to 19% more capital. In addition, these results are largely being driven by banks operating at the lower end of the capital distribution. By observing the quantile treatment effects, I find that capital requirements increase a bank's capital of up to 28% for banks operating in the lower 10$^{th}$ percentile of the capital distribution. In response, banks may keep their assets fixed or increase their assets to maintain their leverage, a measure of bank risk defined as the asset to capital ratio[3]. I find no evidence that banks subject to stricter capital requirements experienced lower leverage. The ultimate goal of capital requirements is to promote bank stability through the prevention of bank suspensions. I find no evidence that banks subject to higher capital requirements experienced lower suspension rates. Capital requirements as a fundamental regulation designed to promote bank stability were ineffective in preventing bank suspensions.

This study contributes to the literature in two ways. First, this study contributes to our understanding of how banks respond to capital requirements. Capital requirements are a fundamental regulation designed to promote financial stability and we typically rethink capital requirements after every financial crises. The effect of capital requirements on bank stability is

[3] Bank leverage is measure of the amount of risk a bank is engaging in. Higher leverage is associated with lower survival rates during financial crises (Berger and Bouwman, 2013). However, banks have an incentive to hold more leverage since they are more profitable and experience more return on their capital (Sylla, 1969).

often challenging to study since capital requirements are typically endogenous responses to financial crises. I exploit the crude nature of capital requirements in the early 20th century United States to adopt a regression discontinuity design to study the impact of capital requirements on bank stability.

Second, this study contributes to the explanation as to why the United States banking system in the early 20th century was characterized as a fragile system consisting of thousands of geographically isolated unit banks that were unstable and prone to failure (Calomiris and Haber, 2014). The United States experienced 29 banking panics from 1865 to 1933[4]. In the face of numerous banking panics occurring throughout this time period, policymakers implemented capital requirements as a fundamental bank regulation to prevent these problems[5]. I find that capital requirements weren't effective in in preventing banks from engaging in excessive risk-taking and failing. Contemporaries during the 1920s argue that the "overdevelopment of banking is more responsible than any other factor for the banking disasters of the 1920s" (American Bankers Association, 1927). Westerfield finds that a disproportionate number of banks failed in the 1930s with very little capital (Westerfield, 1933). Thus, in 1933 the Federal Reserve and OCC increased capital requirements as a response to the collapse of the United States banking system in the 1930s (U.S. Congress, 1933, sec. 17(a)). Capital requirements were ineffective in promoting bank stability through the prevention of bank suspensions.

The rest of this essay analyzes the impact of capital requirements during the early 20th century United States. Section 2 provides a brief literature review on capital requirements. Theoretical works justifying the reason why banks hold capital and governments regulate capital are discussed. In addition, a brief overview of empirical studies on capital requirements is provided. Section 3 describes the structure of the national banking system in the early 20th

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[4] Jalil documents eleven banking panics that occurred from 1873 to 1908, including three major banking panics in 1873, 1893, and 1907 (Jalil, 2013). Davison and Ramirez document fourteen local banking panics that occurred from 1920 to 1929 (Davison and Ramirez, 2014). Lastly, there were four major panics that occurred during the 1930s resulting in the collapse of the US banking system that deepened the Great Depression (Friedman and Schwartz, 1971; Wicker, 2000).

[5] Following the major banking panic of 1907, the National Monetary Commission found that "the prevention of panics such as those occurred in 1893 and 1907" and "the minimizing of losses through bank failures" were two key problems in the US banking system that needed to be addressed (Barnett, 1911). They argue that minimum capital requirements are one of the primary commercial bank regulations designed to help prevent these problems. Barnett states that "the requirement that each bank shall have a specified minimum capital is fundamental in the systems of regulation laid down in the national-bank act and state banking laws" since "the capital of the bank is regarded as a buffer interposed between the bank's creditors and losses which the bank may suffer" (Barnett, 1911).

century and provides a detailed description of these capital requirements, which fits a regression discontinuity design framework. Section 4 describes in detail the data collected for this study. Section 5 describes the regression discontinuity design utilized in this study to estimate the impact of capital requirements on bank outcomes. Section 6, reports the empirical results. Section 7 concludes.

**2. Literature on capital requirements**

In the absence of capital requirements, banks hold positive amounts of capital due to market incentives. On the liability side, holding more capital enhances a bank's ability to acquire more deposits (Calomiris and Powell, 2001; Calomiris and Mason, 2003). On the asset side, holding more capital increases a bank's incentives to make efficient portfolio choices and strengthen incentives to monitor borrowers. Banks with more capital are in a better position to lend (Hohlmstrom and Tirole, 1997; Allen et al., 2009; Thakor, 2014). On the other hand, scholars have suggested that higher capital may directly reduce banks' liquidity…or lead to less efficient contracting resolutions and higher agency costs, thereby leading to lower liquidity creation by banks" (Diamond and Rajan, 2001). Whether positive amounts of capital lead to more assets is still an open question. However, there is a consensus among scholars that holding more capital increases the buffer against economic shocks and reduces the probability of bank distress (Hohlmstrom and Tirole, 1997; Diamond and Rajan, 2001).

Banks choose to hold positive amounts of capital as a buffer against economic shocks, but the amount of capital chosen may not be enough to ensure bank stability. Governments implement capital requirements as a way to promote bank stability. Requiring banks to hold sufficient capital reduces bank moral hazard by discouraging banks from taking on excessively risky loan portfolios and reduces bank distress (Mishkin, 2007; Morrison and White 2005; Allen Et al., 2009). Also, an argument for capital requirements is that the socially-optimal level of capital may exceed the privately-optimal level (Thakor, 2014). A handful of bank suspensions can raise issues of financial stability in other banks resulting in a wide-spread banking crisis. Banks do not internalize the social cost of large-scale bank failures induced by contagion effects. Lastly, capital requirements (and bank regulation in general) is motivated by the need to protect small depositors. Monitoring costs are expensive and inefficient for small depositors suggesting a need for a public representative (Tirole, 1995).

A vast amount of empirical research has been devoted to studying the impact of recent capital regulation in the form of ratio requirements. I briefly go over a few existing studies. Ashcraft finds that increasing bank capital to asset ratio requirements from 6% to 7% did not significantly increase their ratios and suggests that there are market based incentives to holding more capital above the regulatory minimum (Ashcraft, 2001). Rime finds that regulatory pressure induces banks to increase their capital, but does not affect their level of risk. Regulatory pressure increases capital to asset ratios, but does not increase their capital to risk-weighted asset ratios. This suggests that banks are reallocating their portfolios to maintain their return on capital (Rime, 2001). Aiyar, Calomiris, and Wieladek utilize time-varying, bank-specific capital requirements to study the impact of capital requirements on bank behavior. They find that regulated banks reduce lending in response to higher requirements, while unregulated banks increase lending (Aiyar, Calomiris, and Wieladek, 2014).

Several studies analyze the impact of historical capital requirements in the form of minimum capital requirements. Wheelock finds that lower minimum capital requirements are positively associated with banks per capita during the 1920s (Wheelock, 1992). Mitchener finds that higher minimum capital requirements lowered county-level suspension rates in the 1930s (Mitchener, 2005). In both studies, state-level variation in state bank capital requirements is exploited to study the impact of capital requirements on county-level suspension rates and banks per capita. Fulford finds that increasing bank capital increases agricultural production per capita at the county level. Prior to 1900, minimum capital requirements were $50,000 for banks operating in towns below a population of 6,000. He imputes the optimal level of capital for each county and the excess amount of capital is estimated to determine the impact on agricultural output per capita (Fulford, 2011).

This study contributes to the literature on capital requirements by providing empirical evidence analyzing the impacts of capital requirements on bank capital, leverage, and suspension rates using a regression discontinuity design. The structure of the national banking system is exploited to analyze the impact of capital requirements (in the form of minimum capital requirements) on bank leverage and suspension rates. Detailed balance sheet information allows for an analysis on how banks adjust their leverage when subject to higher capital requirements and ultimately whether banks with more capital experienced lower suspension rates. The next section describes the historical background of the national banking system and its capital requirements.

## 3. Historical Background of the National Banking System and Minimum Capital Requirements

The National Currency Act of 1863 and National Bank Act of 1864 created the national banking system in 1863 (U.S. Congress, 1864, chapter. 106). The creation of the national banking system was intended to achieve three goals; the establishment of banks that received their charters from the federal government instead of their state governments, the development of a uniform currency that would be widely accepted "where the nominal value was the same across the country", and to use the "uniform bank currency that would trade at par…to help raise funds for the Federal war effort" (Champ, 2007; Fulford, 2011). As a result, national banks were established as financial institutions with national charters operating and regulated by the Office of the Comptroller of the Currency (OCC) under the Treasury department of the United States. These newly established national banks were subject to strict bank regulations written in the National Banking Acts.

Capital requirements were a primary regulation imposed on national banks designed to promote financial stability. The OCC imposed capital requirements in the form of legal minimum capital requirements graded according to town population. These capital requirements "provided a minimum level of security for the holders of a bank's liabilities" (White, 1983). These laws were easy to administer and simply required banks to hold a minimum amount of capital based on the size of the town's population it is operating in. The size of a town's population provides a crude measure of the volume of business activity in a town. The larger the volume of business activity the greater the minimum amount of capital was required to offset the losses that could occur from borrowers defaulting on their loans. However, the minimum amount of capital required for banks to hold was not graded continuously by town population. Instead, the minimum amount of capital required by banks to incorporate and operate doubles at each specific town population cut-off.

From 1863 to 1900, the National Banking Act fixed capital requirements at three population thresholds. For towns with a population under 6,000 banks were required to hold a minimum capital of at least $50,000; in towns between a population of 6,000 and 50,000 banks were required to hold at least $100,000; and in towns above a population of 50,000 banks required were to hold at least $200,000. A lowering in capital requirements occurs in the year 1900 when the Gold Standard Act of 1900 halved the minimum capital required for banks operating in towns with a population less than 3,000 from $50,000 to $25,000. The lowering of capital requirements was a response to state bank regulation setting their capital requirements lower than national bank capital requirements (White, 2009). The capital regulation stayed the same from 1900 to 1933. In 1933, the Banking Act of 1933 raised the minimum capital required for banks operating in towns with a population less than 3,000 back to $50,000. The raising of capital requirement was a response to the banking runs of the 1930s (White, 2009). Table 1 document these changes in capital requirements over time.

Figure 1 provides a visual representation of the impact of capital requirements on bank capital. Each observation represents a bank's capital and the town population that bank is operating in. The red line in figure 1 traces out the capital requirements for banks operating in different town populations. There are discrete jumps in capital requirements at specific town population cut-offs that coincide with large increases in capital. These abrupt changes in capital requirements provide an appropriate setting for sharp regression discontinuity design to study the impact of capital requirements on bank capital, leverage, and suspension rates.

## 4. Data Sources

The OCC published annual reports stating the conditions of the national banking system each year starting from 1864. These records have been preserved and the bank balance sheet for each national bank in operation is known. The bank balance sheets contain detailed disaggregated information on a bank's assets and liabilities. Information on the different categories of assets that banks hold include loans, discounts, and overdrafts, United States bonds, and other bonds, investments, and real estate, and etcetera. On the liability side, the OCC categorizes a bank's liabilities into capital, surplus and undivided profits, circulation, and deposits. Table 2 provides a list of these balance sheet variables. Bank leverage, defined as a bank's asset to capital ratio variable is constructed by summing a bank's total amount of assets and dividing it by its capital and surplus. This variable represents the amount of assets being issued for each dollar of capital a bank holds and is a measure of bank risk. In addition to the detailed balance sheet information, the location of the town and county a bank is operating in is provided. I gather data on all national banks operating in the United States in 1905 and provide a total of over 5600 banks operating in 3,743 towns.

The OCC has also preserved data on bank suspensions from 1865 to 1929. The suspension data includes information on the date of suspension, location and name of bank suspended, reason for suspension, and bank balance sheet characteristics at the time of suspension. I gathered these data on bank suspensions and merge it with the OCC annual report data.

The precise location of each bank given in the OCC allows a bank's corresponding town to be merged with another source that contains data on a town's population. This data source is the United States Population Census of 1910. The population census is published by the Federal government each decade and contains information on population characteristics at the national, state, county, and town level. Each town's population for the years 1910, 1900, and 1890 are provided in the population census of 1910. These town population data is gathered for every bank in the dataset. There are a total of 3,217 towns matched with town populations in our dataset with over 80% of these towns having a population of less than 6,000[6]. There is sufficient amount of town level variation in the study to focus on analyzing the impact of capital requirements on capital, leverage, and suspensions for banks operating in towns with a population of 3,000[7].

**5. Research Design:**

Capital requirements should have a direct impact on bank capital. The first outcome variable of interest is bank capital. Bank capital is a measure of bank size and is positively correlated with town population, which can be taken as a measure of the volume of business activity being conducted in a town. In absence of capital requirements, a positive continuous relationship should be observed between a bank's capital and town population. However, given that there are capital requirements that force banks to hold a minimum amount of a capital,

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[6] There are 3743 towns in total, but many of these are not given a population in the census. These towns tend to be unincorporated places.

[7] There are other town population cut-offs such as one at the town population of 6,000. However, there are not many towns of this size in the year 1905. There are not a sufficient number of observations to exploit the discontinuity at the population cutoff of 6,000 and 50,000.

abrupt increases in capital should be observed at town population cut-offs where the capital requirement doubles. Town population is the forcing variable that determines the minimum amount of capital required for a bank. The forcing variable is described below:

$$Min.\,Capital\ Requirement = \begin{cases} \$25{,}000, if\ Pop_{bis} < 3{,}000 \\ \$50{,}000, if\ Pop_{bis} \geq 3{,}000 \end{cases}$$

The minimum capital requirement doubles from $25,000 to $50,000 if a town's population crosses the threshold of 3,000. In particular, an abrupt increase in bank capital should be observed for banks operating in towns to the right of the population threshold of 3,000 compared to banks operating in towns to the left of this threshold.

The second outcome variable of interest is asset to capital ratios, a measure of bank risk defined as bank leverage. Bank leverage is linked to bank survival rates. Berger and Bouwman find that small banks with lower leverage prior to a financial crises experience higher rates of survival during crises (Berger and Bouwman, 2013). Banks with higher capital requirements may have lower leverage which would imply that they have higher survival rates.

Lastly, the third outcome variable of interest is suspension rates. This variable represents a measure of bank stability. Capital requirements are implemented to achieve this goal by preventing bank suspensions. Comparing differences in suspensions rates will determine whether capital requirements were effective in promoting bank stability.

A sharp regression discontinuity design is used to the study the impact of capital requirements on bank capital, leverage, and suspensions using bank-level data. I study the lowest cutoff of 3,000 and focus on the range of banks operating in towns between the smallest town population size of 65 and 6,000 leaving out banks operating in the larger towns in the US. An identifying assumption is that towns should be similar just to the left and right of the town population cut-off of 3,000. In addition, a limitation of examining the town population cutoff of 3,000 is that inference can only be made on banks operating in small towns with populations close to 3,000 in the US. These small towns represent "rural areas of the country" where "low population density required, numerous widely, dispersed banking offices" (White, 1983). A significant portion of the US, especially in the Midwest and South, during this time period was characterized as rural farming regions with low population density.

I estimate the impact of capital requirements on bank capital, leverage, and suspension rates using a local-linear estimator for a given bandwidth. The bandwidth proposed is based on Calonico, Cattaneo, and Titiuniks' (CCT, 2014) methodology where "data-driven confidence interval estimators are constructed that exhibit close-to-correct empirical coverage and good empirical interval length on average…improving upon the alternatives available in the literature" (Calonico et al., 2014). In addition, several specifications are conducted using other bandwidth selection criteria proposed in the literature to observe the robustness of my results to different bandwidth choices[8]. Specifically, I regress a bank outcome variable on town population, an indicator for crossing the population threshold, and an interaction term between town population and crossing the threshold. This specification estimates the direct effect of minimum capital requirements. The model is described below:

$$BankOutcome_{bis} = \beta_0 + \beta_1 Pop_{bis} + \beta_2 1(Pop_{bis} \geq 3000)_{bis} + \beta_3 Pop_{bis} 1(Pop_{bis} \geq 3000)_{bis} * Pop_{bis} + \varepsilon_{bis} \quad (1)$$

$$Pop_{bis} \in (3000 - k, 3000 + k)$$

where "b" represents a bank located in town "i" and state "s" for the year 1905 and bandwidth "k" represents the bandwidth chosen for the specification. The variable "*Bank Outcome*" represents a bank outcome variable in the year 1905. The population variable "*Pop*" represents the town population in 1900. The indicator variable $1(Pop_{bis}>3000)_{bis}$ represents if a bank is operating in a town just above the town population cut-off of 3,000 where minimum capital requirements increase from \$25,000 to \$50,000. This is the variable of interest that identifies the direct impact of capital requirements on bank capital. A positive coefficient should be expected for bank capital as the outcome variable. If the outcome variable is bank leverage or suspension rate, then a negative sign should be expected if higher capital requirements are having an effect on reducing leverage and lowering suspension rates, which is the intended goal of minimum capital requirements.

There are several concerns about the validity of the research design. First, banks choose where they want to establish and operate. They may choose to operate in towns slightly below

[8] In addition to the CCT bandwidth selection criteria, bandwidths proposed by Imbens and Kalyanaramans' based on MSE-optimal bandwidth selection criteria and Ludwig and Millers' cross-validation criterion are implemented in my specification. However many of these bandwidths appear to quite large so several arbitrary choices of bandwidths are chosen to observe the robustness of my results to shrinking the bandwidths close to the population threshold.

the population cut-off of 3,000 in order to take advantage of lower capital requirements[9]. Second, since the OCC lowered capital requirements in the year 1900 for towns below a population of 3,000 from $50,000 to $25,000 one might expect newer banks to be established slightly to the left of the population cut-off. Third, local economic conditions may be different for towns slightly to the left and right of the population cut-off.

Concerns about the validity of the research design are tested in three ways. First, a McCrary density test is conducted to test the possibility of banks sorting into towns slightly below the population cut-off of 3,000. Second, I check the smoothness of bank age around the population cut-off. Specifically, I estimate equation 1 and test for significance on $\beta_2$. Third, I merge county data with towns and check for the smoothness of several county covariate means around the population cut-off of 3,000[10]. I estimate equation 1 for several county characteristics and test for significance on $\beta_2$.

## 6. Results

First, I provide evidence that the research design is valid. Figure 2 illustrates a McCrary density test of the running variable, town population. A vertical line is drawn at the town population of 3000 to illustrate the smoothness of the density both to the left and right of the population cut-off. There is little evidence of banks sorting into towns just below the town population cut-off of 3,000. The estimated increase in density is .224 with a standard error of .151 providing little evidence of banks establishing in towns just to the left of the cut-off.

Next, I inspect the smoothness of bank age around the population cut-off of 3,000. Figure 3 illustrates binned local averages of bank age. A $4^{th}$ order local polynomial is superimposed on both sides of the cut-off to illustrate any differences in county characteristics to the left and right of the population cut-off. Visually, there does not appear to be an abrupt increase in bank age slightly to the right of the cut-off. Estimates of $\beta_2$ derived from equation 1 are provided in table 3. Rows 2 to 4 in Column 6 provide estimates from local-linear and local-quadratic estimators. A

[9] One could also think that towns are manipulating their population to be slightly below the population threshold of 3,000 in order to attract more banks. I also conduct a McCrary density test to observe to possibility of towns manipulating their populations and find no evidence of towns sorting below the population threshold.

[10] Besides town population, there is not much information on town characteristics for towns of all sizes in the United States. I use the county census to look at other differences in other characteristics besides population. County characteristics are gathered and merged to each bank. These data is a gathered from Historical Demographic, Economic, and Social Data: The United States, 1790-1970, ICPSR 2896

bandwidth of 865 is determined as the optimal data-driven bandwidth using CCT's method. These estimates range from 1.623 to 1.873 with standard errors being significantly larger than the coefficients. There is no evidence of newer banks choosing to establish in towns slightly to the left of the cut-off.

In addition, I check the smoothness of county covariate means for towns close to the population cut-off of 3,000. The county covariates I inspect are population density, percentage black population, and percentage farmland, and manufacturing output per capita[11]. Figure 4 provides scatterplots of binned, local averages of these county covariates. Again, a $4^{th}$ order local polynomial is superimposed on both sides of the cut-off to illustrate any differences in county covariate means to the left and right of the population cut-off. Visually, there does not appear to be any significant differences in county characteristics around the population cut-off. Table 3 displays results obtained from estimating equation 1. Rows 2 to 4 provide estimates derived from local-linear and local-quadratic estimators for an optimal data-driven bandwidth using CCT's method. I do not find evidence of percentage farmland and percentage black population being statistically different upon crossing the population cut-off. However, I find evidence that population density and manufacturing output per capita appears to be slightly higher to the left of the population cut-off. These differences in manufacturing output per capita and population density raise concerns about the validity of the research design. I address these concerns by conducting specifications where I control for county characteristics. Next, I discuss how I analyze the impact of capital requirements on capital, leverage, and suspension rates.

A scatter plot illustrating the relationship between bank capital and town population is provided in figure 5. Each observation represents a bank's capital and the population of the town that bank is operating in. The red line drawn on the figure represents the national policy of minimum capital requirements. Banks are required to hold at least \$25,000 worth of capital below a town population of 3,000 and the requirement doubles to \$50,000 for towns above a population of 3,000.  There are a few observations one can make from Figure 5. First, there is a positive relationship between town population and bank capital. Since bank capital is a measure of bank- size, it is reasonable to find a positive relationship given larger towns have larger banks.

[11] A county's population density is constructed by dividing total population by square miles. Percentage of black population constructed as the number of black individuals divided by total population. Percentage farmland is constructed by dividing total farm acres by total square acres

Second, the density of banks is higher at towns with smaller populations. A visual examination suggests that these banks tend to have capital very close to the minimum required amount of $25,000. Third, many of these banks hold capital amounts well above the regulatory minimum operating in towns with a population below 3,000. This may be due to the fact that minimum capital requirements were lowered after the year 1900 from $50,000 to $25,000 for these towns. Banks established prior to 1900 were subject to higher capital requirements and kept the same amount when capital requirements were lowered.

A scatter plot of local, binned averages of bank capital provides a clearer graphical representation of the relationship between capital and town population[12]. Figure 6 displays a graph constructed using the same data to construct figure 5. Each observation is an evenly space binned local average of capital for a town population interval of 64. This bin size was determined based on CCT's method to mimic the underlying variability of the data. A vertical line is drawn at the town population of 3000 to illustrate the impact of the law on a bank's average capital operating in a town of a certain bin size. The average capital increases as town population size increases. A vertical line is drawn at the town population cutoff of 3,000. The average capital of a bank is approximately $100,000 operating in a town with a population slightly less than 3,000[13]. On average, banks are holding well above the minimum. However, capital is averaged across banks with all sizes of capital and including banks that hold well above the minimum amount of $25,000 included when constructing these binned local averages. The average capital of a bank is approximately $112,000 operating in towns slightly to the right of the cut-off. There appears to be a jump in capital, but not nearly $25,000 which is the increase in capital requirements described in table 1.

Figure 7 displays a scatter plot of binned, local averages of assets. Each observation is a binned local average of assets for a town interval of 65. The bin size of 65 was determined based on CCT's method to mimic the underlying variability of the data. The average assets of a bank operating in a town slightly below the population cut-off is approximately $360,000 while the average assets of a bank operating in towns slightly to the right of the cut-off are approximately $385,000[14]. There may be an increase in assets when banks are subject to higher capital

[12] These local, binned averages are constructed using methods describes in CCT, 2014 (Calonico et al., 2014)
[13] The exact value is $100,846 and $112,303 to the left and right of the cutoff, respectively
[14] The exact values are $359,503 and $384,530.

requirements. Lastly, figure 8 displays binned, local averages of bank leverage defined as the assets to capital ratio. Since it is observed that both capital and assets increase when subject to higher capital requirements there shouldn't be too much of change in bank leverage when banks are subject to higher capital requirements. Figure 8 provides visual evidence that bank leverage is not changing. There doesn't seem to be much evidence of stricter capital requirements decreasing bank leverage.

Next, I estimate the impact of capital requirements on bank capital, leverage, and suspension rates using several local-polynomial regressions for various bandwidth choices. Table 4 displays the results of higher capital requirements on log bank capital derived from equation 1 for bandwidth choices of ±1000, ±900, ±800, ±700, and ±600. Row 2 in Column 2 reports the average treatment effect of higher capital requirements for a bandwidth of ±1000. I estimate a positive coefficient of 0.184 with a standard error of 0.07. These estimates are significant at the 5% significance level. On average, banks subject to higher capital requirements hold 18% more capital and are more able to withstand economic shocks. Row 2 in Columns 3 to 6 illustrates these results for smaller bandwidth choices. I find significant results ranging from 16% to 23% for 4 out of the 5 specifications. These results become less significant as I shrink the bandwidth to ±600. This finding may be due to a lack of observations as I narrow the bandwidth.

Table 5 reports the estimates of higher capital requirements on log bank capital for higher order polynomial specifications and various bandwidth choices proposed in the bandwidth selection literature. Information on the average treatment effect of higher capital requirements on log bank capital is reported in Columns 2, 4, and 6. Information on the bandwidth chosen for each selection criteria is reported in Columns 3, 5, and 7. Rows 2, 3, and 4 specify the average treatment effect for a local-linear specification, local-quadratic specification, and local-quadratic with robust standard errors specification, respectively. For example, estimates provided in row 2 of column 2 reports the treatment effect obtained from a local-linear specification and CCT's bandwidth selection criteria. Row 2 of column 2 suggests that higher capital requirements on average increase a bank's capital by 18.4%. A bandwidth of ±1051 was determined as the optimal data-driven bandwidth for a local-linear specification using CCT's method reported in row 2 of column 3. Overall, these results range from 16% to 19% depending on the local-polynomial specification estimated along with the bandwidth selected. Banks respond to higher capital requirements by increasing their amount of capital.

Banks have an incentive to increase their assets when they are required to increase their capital in order to maintain their return on capital. Table 6 displays results of increasing capital requirements on log bank assets derived from equation 1 for bandwidth choices of ±1000, ±900, ±800, ±700, and ±600. For bandwidths of ±1000, ±900, and ±800 I find modest evidence of banks increasing their amount of assets ranging from 12% to 18%. The results are not significant when I narrow the bandwidth, but this may be due to an insufficient number of observations. Table 7 displays the results of capital requirements on log bank assets for bandwidth choices proposed in the bandwidth selection literature. These results are similar to the results presented in table 6. The data suggests that banks may be increasing their amount of assets as a response to holding more capital.

The next set of results focus on the impact of capital requirements on bank leverage defined as the asset to capital ratio. Tables 8 and 9 report estimates on the impact of higher capital requirements on bank leverage for various bandwidths and local-polynomial specifications. There is no statistically significant evidence of banks reducing their leverage when they are subject to higher capital requirements. This result is not surprising since previous results provide evidence of banks increasing their assets when they are required to hold more capital. Banks pursue the same level of risk when they are required to hold more capital.

Although banks do not experience a change in their leverage, holding more capital could decrease a bank's suspension rate. Larger banks, in terms of capital, have a larger buffer for economic shocks and may experience lower suspension rates. Tables 10 and 11 illustrate the impact of higher capital requirements on suspension rates for various bandwidth and local-polynomial specifications. A probit model is estimated for columns 2 to 6 in table 10. The coefficients are negative, but not statistically significant. Banks subject to higher capital requirements failed at the same rate as those with lower capital requirements. Although banks have larger amounts of capital, there is no evidence of minimum capital requirements reducing bank leverage and lowering suspension rates. The data suggests that capital requirements were not effective in reducing bank distress.

Concerns about the validity of the research design are raised by observing differences in population density and manufacturing output per capita in table 3. Table 12 addresses these concerns by including bank and county characteristics as control variables in estimating the impact of capital requirements on log capital. Row 3 in columns 2 to 6 show the results from equation 1 controlling for bank and county characteristics for bandwidth choices of ±1000, ±900, and ±800. I find that controlling for bank and county characteristics reduces the statistical significance of the majority of the estimates, but many are still significant at the 5% level. There is still strong evidence of capital requirements increasing bank capital. Table 13 provides estimates of the impact of capital requirements on capital, leverage and suspension rates controlling for bank and county characteristics for the optimal bandwidth based on CCT's method. The main results do not drastically change when I include bank and county characteristics. Banks subject to higher capital requirements held higher levels of capital, but did not experience lower leverage and suspension rates.

Minimum capital requirements are intended to insure banks have an adequate amount of capital to prevent them from engaging in excessive risk-taking. These policies should have the largest impact on banks operating very close to the regulatory minimum. Table 14 illustrates the impact of capital requirements for banks operating at each decile of the capital distribution. Banks operating at the lower $10^{th}$ and $20^{th}$ deciles of the capital distribution experience a 28 and 12 percent increase in capital respectively. These coefficients are statistically significant at the five percent level. However, banks operating at higher deciles of the distribution do not experience a statistically significant increase in capital. The data suggests capital requirements increase a bank's capital for banks operating at the lower end of the capital distribution.

In addition, I do not find any evidence of capital requirements significantly decreasing a bank's leverage and lowering their suspension rates at any decile of the capital distribution. The same results hold for banks subject to higher capital requirements; these requirements did not prevent bank failures.

## 7. Conclusion

Capital requirements are a fundamental regulation designed to promote bank stability. The structure of the national banking system in the early $20^{th}$ century is exploited to construct a sharp regression discontinuity design to study the impact of capital requirements. I find significant evidence that banks subject to higher capital requirements on average held higher amounts of capital. However, banks subject to higher capital requirements did not experience significantly lower leverage or suspension rates. Capital requirements weren't sufficient enough to prevent banks from engaging in excessive risk-taking and preventing them from failing. Contemporaries during the 1920s argue that the "overdevelopment of banking is more responsible than any other factor for the banking disasters of the 1920s" (American Bankers Association, 1927). Westerfield argues that a disproportionate number of banks failed in the 1930s with very little capital (Westerfield, 1933). Thus, in 1933 the Federal Reserve and OCC increased capital requirements as a response to the collapse of the United States banking system in the 1930s (U.S. Congress, 1933, sec. 17(a)). Capital requirements were ineffective in promoting bank stability through the prevention of bank suspensions.

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Table 1: Capital requirements for National Banks, 1864-1933

| Minimum capital required to establish a bank, by federal laws | | | | |
|---|---|---|---|---|
| | Town Population | | | |
| | Population<3,000 | 3,000≤Population<6,000 | 6,000≤Population<50,000 | 50,000≤Population |
| 1863-1900 | $50,000 | $50,000 | $100,000 | $200,000 |
| 1900-1933 | $25,000 | $50,000 | $100,000 | $200,000 |
| 1933- | $50,000 | $50,000 | $100,000 | $200,000 |

*Source: OCC Annual Reports, 1900 and 1910; White, 1983; Banking Act of 1933

Table 2: Bank balance sheet variables collected from OCC annual reports, 1905

| **Bank Characteristics, OCC Annual Report of 1905** |
|---|
| **Assets:** |
| Loans, discounts, and overdrafts |
| United States Bonds |
| Other bonds, investments, and real estate |
| Lawful money |
| **Liabilities:** |
| Capital |
| Surplus, undivided profits |
| Circulation |
| Deposits |
| Bank leverage= total assets/capital & surplus |
| Source: OCC Annual Reports, 1905 |

Table 3: Observing differences in county characteristics

| Dependent Variable: | Pop. density | | Pct. black | | Manu. output per capita | | Pct. farmland | | Bank age | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Treatment | BW | Treatment | BW | Treatment | BW | Treatment | BW | Treatment | BW |
| Linear | -25.04* | ±790 | -0.0143 | ±1170 | -32.61** | ±733 | -0.0297 | ±1168 | 1.873 | ±1005 |
| | (14.39) | | (0.0253) | | (15.26) | | (0.0401) | | (2.538) | |
| Quadratic | -24.25* | ±1335 | -0.0195 | ±1763 | -35.71** | ±1197 | -0.0314 | ±1794 | 1.623 | ±1539 |
| | (14.39) | | (0.0253) | | (15.26) | | (0.0401) | | (2.538) | |
| Quadratic with robust s.e's | -24.25 | ±1335 | -0.0195 | ±1763 | -35.71** | ±1197 | -0.0314 | ±1794 | 1.623 | ±1539 |
| | (16.30) | | (0.0306) | | (17.64) | | (0.0477) | | (2.999) | |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Optimal data-driven bandwidth is chosen for each dependent variable based on Calonico, Cattaneo, Titiunik, 2014.

Table 4: Impact of capital requirements on log capital, bandwidth of ±1000, ±900, ±800, ±700, ±600

| Dependent Variable: Log (Capital & Surplus) | | | | | |
|---|---|---|---|---|---|
| (Pop-3000) | 0.000125 | 3.87e-05 | -7.65e-05 | 5.98e-05 | 0.000189 |
| | (8.42e-05) | (0.000102) | (0.000120) | (0.000145) | (0.000195) |
| 1(Pop>3000) | 0.181*** | 0.228*** | 0.247*** | 0.167** | 0.141 |
| | (0.0677) | (0.0708) | (0.0760) | (0.0817) | (0.0899) |
| (Pop-3000)*1(Pop>3000) | -2.06e-05 | -7.19e-06 | 0.000139 | 0.000167 | -2.55e-05 |
| | (0.000123) | (0.000137) | (0.000168) | (0.000212) | (0.000258) |
| Constant | 11.11*** | 11.49*** | 11.18*** | 11.88*** | 11.73*** |
| | (0.0807) | (0.158) | (0.0832) | (0.288) | (0.0783) |
| State Effects | Yes | Yes | Yes | Yes | Yes |
| Bandwidth | ±1000 | ±900 | ±800 | ±700 | ±600 |
| Observations | 856 | 749 | 669 | 598 | 512 |
| R-squared | 0.242 | 0.228 | 0.235 | 0.262 | 0.286 |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE', excluding 3 banks holding capital and surplus greater than 700,000.

Table 5: Impact of capital requirements on log capital, bandwidth choices based on CCT, Imbens and Kalynamaran, and Ludwig and Miller

| Dependent Variable: Log(Capital & Surplus) | | | | | | |
|---|---|---|---|---|---|---|
| | CCT BW selector | | IK BW selector | | CV BW selector | |
| | Treatment | BW | Treatment | BW | Treatment | BW |
| Linear | 0.184** | ±1051 | 0.163** | ±1421 | 0.169** | ±1341 |
| | (0.0770) | | (0.0652) | | (0.0671) | |
| Quadratic | 0.192** | ±1620 | 0.191*** | ±1486 | 0.185*** | ±1341 |
| | (0.0770) | | (0.0652) | | (0.0671) | |
| Quadratic | 0.192** | ±1620 | 0.191** | ±1486 | 0.185* | ±1341 |
| w. robust s.e. | (0.0920) | | (0.0943) | | (0.1000) | |

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 represent significance levels. 3 banks are excluded that hold capital and surplus greater than 700,000, Column 1 represent BW derived from Calonico et al., 2014. Column 2 represents bandwidth derived from Imbens and Kalyanaraman, 2012. Column 3 represents bandwidth chosen from Cross Validation procedures as constructed in Ludwig and Miller, 2007.

Table 6: Impact of capital requirements on log assets, bandwidths of 1000, 900, 800, 700, 600

| Dependent Variable: Log(Assets) | | | | | |
|---|---|---|---|---|---|
| (Pop-3000) | 0.000194** | 6.68e-05 | 4.88e-05 | 0.000161 | 0.000197 |
| | (9.05e-05) | (0.000111) | (0.000134) | (0.000159) | (0.000196) |
| 1(Pop>3000) | 0.125* | 0.185** | 0.175** | 0.148 | 0.134 |
| | (0.0735) | (0.0777) | (0.0843) | (0.0908) | (0.0979) |
| (Pop-3000)* 1(Pop>3000) | -7.06e-08 | 5.13e-05 | 0.000104 | -1.41e-05 | -3.86e-05 |
| | (0.000132) | (0.000153) | (0.000191) | (0.000230) | (0.000267) |
| Constant | 11.95*** | 12.80*** | 11.89*** | 13.19*** | 12.91*** |
| | (0.0858) | (0.0834) | (0.0904) | (0.214) | (0.0836) |
| State Effects | Yes | Yes | Yes | Yes | Yes |
| | ±1000 | ±900 | ±800 | ±700 | ±600 |
| Bandwidth | 856 | 749 | 669 | 598 | 512 |
| Observations | 0.224 | 0.196 | 0.195 | 0.205 | 0.216 |
| R-squared | 0.203 | 0.178 | 0.179 | 0.194 | 0.217 |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's, excluding 3 banks holding capital and surplus greater than 700,000

Table 7: Impact of capital requirements on log assets, bandwidth choices based on CCT, Imbens and Kalynamaran, and Ludwig and Miller

| Dependent Variable: Log(Assets) | | | | | | |
|---|---|---|---|---|---|---|
| | CCT BW selector | | IK BW selector | | CV BW selector | |
| | Treatment | BW | Treatment | BW | Treatment | BW |
| Linear | 0.138* | ±1080 | 0.115* | ±1454 | 0.121* | ±1341 |
| | (0.0779) | | (0.0673) | | (0.0698) | |
| Quadratic | 0.148* | ±1683 | 0.143** | ±1560 | 0.157** | ±1341 |
| | (0.0779) | | (0.0673) | | (0.0698) | |
| Quadratic | 0.148 | ±1683 | 0.143 | ±1560 | 0.157 | ±1341 |
| w. robust s.e. | (0.0921) | | (0.0928) | | (0.100) | |

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 represent significance levels. I Exclude 3 banks holding greater capital and surplus greater than 700,000, Column 1 represent BW derived from Calonico et al., 2014. Column 2 represents bandwidth derived from Imbens and Kalyanaraman, 2012. Column 3 Represents bandwidth chosen from Cross Validation procedures as constructed in Ludwig and Miller, 2007.

Table 8: Impact of capital requirements on leverage, bandwidths of 1000, 900, 800, 700, 600

| Dependent Variable: Leverage=Asset/Capital & Surplus | | | | | |
|---|---|---|---|---|---|
| (Pop-3000) | 0.0001 | -0.0001 | 0.0004 | 0.0003 | -0.0002 |
| | (0.0002) | (0.0003) | (0.0003) | (0.0003) | (0.0005) |
| 1(Pop>3000) | -0.127 | -0.0483 | -0.187 | 0.0189 | 0.110 |
| | (0.199) | (0.219) | (0.227) | (0.227) | (0.244) |
| (Pop-3000)*1(Pop>3000) | 0.0002 | 0.0004 | -0.0001 | -0.0007 | 9.55e-05 |
| | (0.0004) | (0.0005) | (0.0005) | (0.0005) | (0.0006) |
| Constant | 3.591*** | 3.640*** | 1.980*** | 5.627*** | 3.206*** |
| | (0.293) | (0.348) | (0.240) | (0.0513) | (0.206) |
| State Effects | Yes | Yes | Yes | Yes | Yes |
| Bandwidth | 1000 | 900 | 800 | 700 | 600 |
| Observations | 856 | 749 | 669 | 598 | 512 |
| R-squared | 0.183 | 0.173 | 0.185 | 0.208 | 0.225 |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's, excluding 3 banks holding capital and surplus greater than 700,000

Table 9: Impact of capital requirements on bank leverage, bandwidth choices based on CCT, Imbens and Kalynamaran, and Ludwig and Miller

| Dependent Variable: Leverage=Asset/Capital & Surplus | | | | | | |
|---|---|---|---|---|---|---|
| | CCT BW selector | | IK BW selector | | CV BW selector | |
| | Treatment | BW | Treatment | BW | Treatment | BW |
| Linear | -0.131 | ±1189 | -0.144 | ±1636 | -0.141 | ±2934 |
| | (0.176) | | (0.156) | | (0.126) | |
| Quadratic | -0.119 | ±1917 | -0.0835 | ±1733 | -0.130 | ±2934 |
| | (0.176) | | (0.156) | | (0.126) | |
| Quadratic | -0.119 | ±1917 | -0.0835 | ±1733 | -0.130 | ±2934 |
| w. robust s.e. | (0.205) | | (0.205) | | (0.171) | |

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 represent significance levels. I Exclude 3 banks holding greater capital and surplus greater than 700,000, Column 1 represent BW derived from Calonico et al., 2014. Column 2 represents bandwidth derived from Imbens and Kalyanaraman, 2012. Column 3 represents bandwidth chosen from cross validation procedures as constructed in Ludwig and Miller, 2007.

Table 10: Impact of capital requirements on bank suspension rates, bandwidth choices of ±1000, ±900, ±800, ±700, ±600

| Dependent Variable: Pr(Suspension=1) | | | | | |
|---|---|---|---|---|---|
| (Pop-3000) | -0.0001* | -0.0006 | -0.0002 | -0.0006 | -0.0003 |
| | (0.0003) | (0.0005) | (0.0004) | (0.0005) | (0.0007) |
| 1(Pop>3000) | -0.108 | -0.181 | -0.400 | -0.297 | -0.349 |
| | (0.307) | (0.337) | (0.371) | (0.427) | (0.444) |
| (Pop-3000)*1(Pop>3000) | 0.0007 | 0.0010 | 0.0009 | 0.0014 | 0.0011 |
| | (0.0005) | (0.0006) | (0.0008) | (0.0010) | (0.0011) |
| Constant | -1.653*** | -1.655*** | -1.53*** | -1.661*** | -1.59*** |
| | (0.188) | (0.206) | (0.20) | (0.239) | (0.25) |
| State Effects | | | | | |
| Bandwidth | 1000 | 900 | 800 | 700 | 600 |
| Observations | 856 | 749 | 669 | 598 | 512 |
| R-squared | 0.025 | 0.020 | 0.011 | 0.019 | 0.011 |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's, excluding 3 banks holding capital and surplus greater than 700,000, Columns 3-8 are estimates from a probit model

Table 11: Impact of capital requirements on bank suspension rates, bandwidth choices based on CCT, Imbens and Kalynamaran, and Ludwig and Miller

| Dependent Variable: Pr(Suspension=1) | | | | | | |
|---|---|---|---|---|---|---|
| | CCT BW selector | | IK BW selector | | CV BW selector | |
| | Treatment | BW | Treatment | BW | Treatment | BW |
| Linear | -0.0224 | ±995 | -0.0317 | ±1461 | -0.0180 | ±2934 |
| | (0.0339) | | (0.0277) | | (0.0203) | |
| Quadratic | -0.0172 | ±1531 | -0.0385 | ±2428 | -0.0429** | ±2934 |
| | (0.0339) | | (0.0277) | | (0.0203) | |
| Quadratic | -0.0172 | ±1531 | -0.0385 | ±2428 | -0.0429 | ±2934 |
| w. robust s.e. | (0.0402) | | (0.0321) | | (0.0289) | |

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 represent significance levels. I Exclude 3 banks holding greater capital and surplus greater than 700,000, Column 1 represent BW derived from Calonico et al., 2014. Column 2 represents bandwidth derived from Imbens and Kalyanaraman, 2012. Column 3Represents bandwidth chosen from cross validation procedures as constructed in Ludwig and Miller, 2007.

Table 12: Impact of capital requirements on capital, controlling for bank and county characteristics

| | Dependent Variable: Log(Capital & Surplus) | | | | | |
|---|---|---|---|---|---|---|
| (Pop-3000) | 0.000111 | 0.000132* | 7.31e-05 | 0.000112 | -4.20e-05 | 1.06e-05 |
| | (7.05e-05) | (7.23e-05) | (9.06e-05) | (9.01e-05) | (0.000104) | (0.000103) |
| 1(Pop>3000) | 0.128** | 0.102* | 0.158** | 0.127* | 0.190*** | 0.154** |
| | (0.0601) | (0.0617) | (0.0633) | (0.0648) | (0.0674) | (0.0688) |
| (Pop-3000)*1(Pop>3000) | -2.86e-05 | -4.94e-05 | -5.00e-05 | -9.17e-05 | 6.63e-05 | 1.33e-05 |
| | (0.000108) | (0.000110) | (0.000124) | (0.000126) | (0.000148) | (0.000150) |
| Bank age | 0.0182*** | 0.0183*** | 0.0177*** | 0.0176*** | 0.0178*** | 0.0180*** |
| | (0.00115) | (0.00111) | (0.00124) | (0.00118) | (0.00132) | (0.00125) |
| Pop per sq. mile | | -0.000308* | | -0.000376** | | -0.000395** |
| | | (0.000174) | | (0.000176) | | (0.000180) |
| Pct. farmland(acres) | | 0.0809 | | 0.138 | | 0.107 |
| | | (0.101) | | (0.106) | | (0.112) |
| Pct. black pop | | -0.220 | | -0.281 | | -0.284 |
| | | (0.212) | | (0.229) | | (0.246) |
| Manu. output per capita | | 0.000278 | | 0.000336* | | 0.000326* |
| | | (0.000185) | | (0.000186) | | (0.000197) |
| Constant | 10.97*** | 11.47*** | 11.25*** | 11.48*** | 10.91*** | 11.06*** |
| | (0.0633) | (0.253) | (0.219) | (0.247) | (0.0739) | (0.199) |
| State Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Bandwidth | 1000 | 1000 | 900 | 900 | 800 | 800 |
| Observations | 856 | 827 | 749 | 725 | 669 | 647 |
| R-squared | 0.458 | 0.465 | 0.440 | 0.455 | 0.453 | 0.472 |

Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's

Table 13: Impact of capital requirements on capital, leverage and suspensions, controlling for bank and county characteristics

| Dependent Variable: | Log(Capital Surplus) | | Log(Assets) | | Log(Leverage) | | Suspension=1 | |
|---|---|---|---|---|---|---|---|---|
| (Pop-3000) | 5.08e-05 | 8.68e-05 | 0.0002** | 0.0002** | 5.58e-05 | 6.80e-05* | -0.001* | -0.0004 |
| | (9.28e-05) | (9.23e-05) | (7.66e-05) | (7.85e-05) | (3.9e-05) | (4.13e-05) | (0.0003) | (0.0003) |
| 1(Pop>3000) | 0.165*** | 0.135** | 0.0755 | 0.0488 | -0.0332 | -0.0371 | -0.124 | -0.231 |
| | (0.0637) | (0.0652) | (0.0680) | (0.0695) | (0.0448) | (0.0466) | (0.309) | (0.318) |
| (Pop-3000)*1(Pop>3000) | -2.80e-05 | -6.79e-05 | 1.27e-05 | 4.03e-06 | -5.90e-06 | -2.31e-05 | 0.0007 | 0.0008 |
| | (0.0001) | (0.00013) | (0.0001) | (0.0001) | (6.7e-05) | (6.84e-05) | (0.0005) | (0.0005) |
| Bank age | 0.0178*** | 0.0178*** | 0.0166*** | 0.0165*** | -0.002** | -0.002** | -0.0026 | -0.0031 |
| | (0.0013) | (0.00119) | (0.001) | (0.00129) | (0.0008) | (0.0008) | (0.0035) | (0.0044) |
| Pop. Per sq. mile | | -0.0004** | | -0.00023 | | -3.91e-05 | | -0.008** |
| | | (0.00018) | | (0.0002) | | (0.00012) | | (0.0032) |
| Pct. farmland(acres) | | 0.145 | | 0.0665 | | 0.0338 | | 0.913** |
| | | (0.105) | | (0.118) | | (0.0652) | | (0.362) |
| Pct. black pop | | -0.277 | | -0.575*** | | -0.279** | | -0.604 |
| | | (0.229) | | (0.207) | | (0.127) | | (0.619) |
| Manu. output per capita | | 0.000368* | | 0.0005** | | 0.000271* | | -0.0017 |
| | | (0.00019) | | (0.0002) | | (0.00015) | | (0.0013) |
| Constant | 11.24*** | 11.05*** | 12.32*** | 12.56*** | 1.34*** | 3.97*** | -1.59*** | -1.74*** |
| | (0.220) | (0.184) | (0.379) | (0.390) | (0.313) | (0.453) | (0.199) | (0.379) |
| Bandwidth | 895 | 895 | 1055 | 1055 | 1189 | 1189 | 995 | 995 |
| Observations | 744 | 720 | 906 | 875 | 1,049 | 1,011 | 851 | 822 |
| R-squared | 0.441 | 0.457 | 0.375 | 0.380 | 0.193 | 0.206 | | |

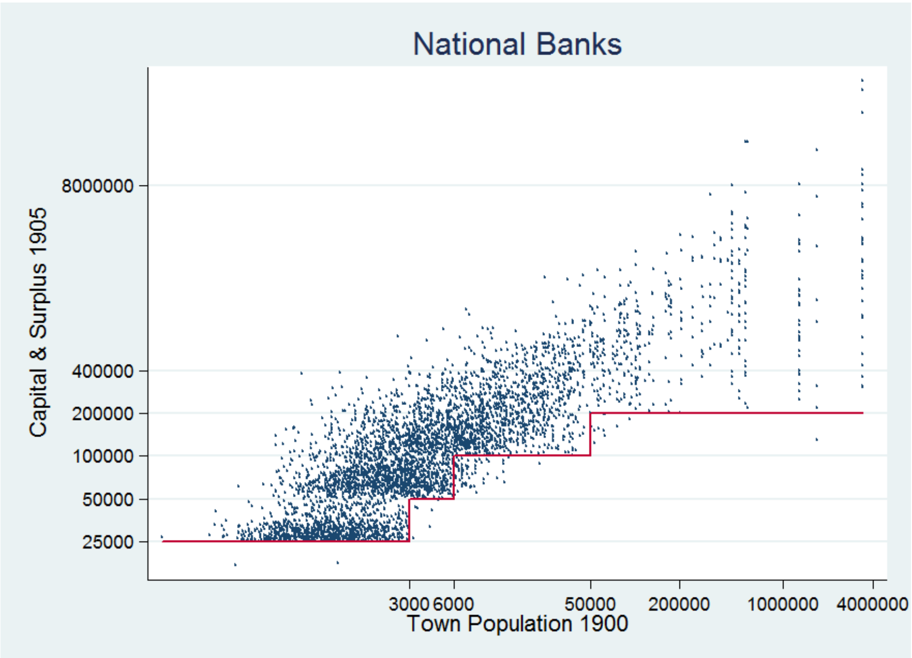
Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's, displaying results from optimal data-driven bandwidth, Columns 7-8 are estimates from a probit model. Leverage is defined as asset/capital & surplus

Table 14: Impact of capital requirements on log capital and surplus for different quantiles, bandwidth=1500

| | Dependent variable: Log(Capital & Surplus) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Quantiles | | | | | | | | |
| Variable | OLS | .10 | .20 | .30 | .40 | .50 | .60 | .70 | .80 | .90 |
| Pop-3000 | 0.000131*** | 0.000136** | 9.46e-05* | 0.000169*** | 0.000183*** | 0.000162*** | 0.000182*** | 0.000130*** | 0.000139*** | 3.51e-05 |
| | (3.83e-05) | (6.90e-05) | (5.21e-05) | (5.70e-05) | (6.00e-05) | (5.85e-05) | (5.68e-05) | (4.64e-05) | (5.17e-05) | (6.17e-05) |
| 1(Pop>3000) | 0.125** | 0.278*** | 0.152** | 0.119* | 0.0894 | 0.0695 | 0.0625 | 0.0262 | 0.0657 | 0.135* |
| | (0.0486) | (0.0875) | (0.0756) | (0.0680) | (0.0717) | (0.0730) | (0.0705) | (0.0595) | (0.0747) | (0.0805) |
| Pop-3000*1(Pop>3000) | -6.47e-05 | -0.000136 | -5.58e-05 | -0.000183** | -0.000182** | -0.000128 | -0.000119 | 3.78e-05 | 1.62e-05 | 0.000138 |
| | (5.99e-05) | (9.10e-05) | (7.61e-05) | (8.20e-05) | (9.24e-05) | (7.95e-05) | (8.53e-05) | (8.81e-05) | (9.80e-05) | (8.82e-05) |
| Bank age | 0.0190*** | 0.0176*** | 0.0192*** | 0.0190*** | 0.0201*** | 0.0200*** | 0.0213*** | 0.0218*** | 0.0219*** | 0.0205*** |
| | (0.000895) | (0.00152) | (0.00116) | (0.00113) | (0.00129) | (0.00127) | (0.00156) | (0.00127) | (0.00149) | (0.00190) |
| Constant | 11.15*** | 11.14*** | 11.09*** | 11.18*** | 11.20*** | 11.17*** | 11.19*** | 11.13*** | 11.14*** | 11.01*** |
| | (0.309) | (0.218) | (0.188) | (0.167) | (0.157) | (0.140) | (0.116) | (0.0869) | (0.0781) | (0.0791) |
| State Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bandwidth | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 | ±1500 |
| R-squared | 0.465 | 0.429 | 0.447 | 0.443 | 0.450 | 0.454 | 0.451 | 0.443 | 0.447 | 0.433 |

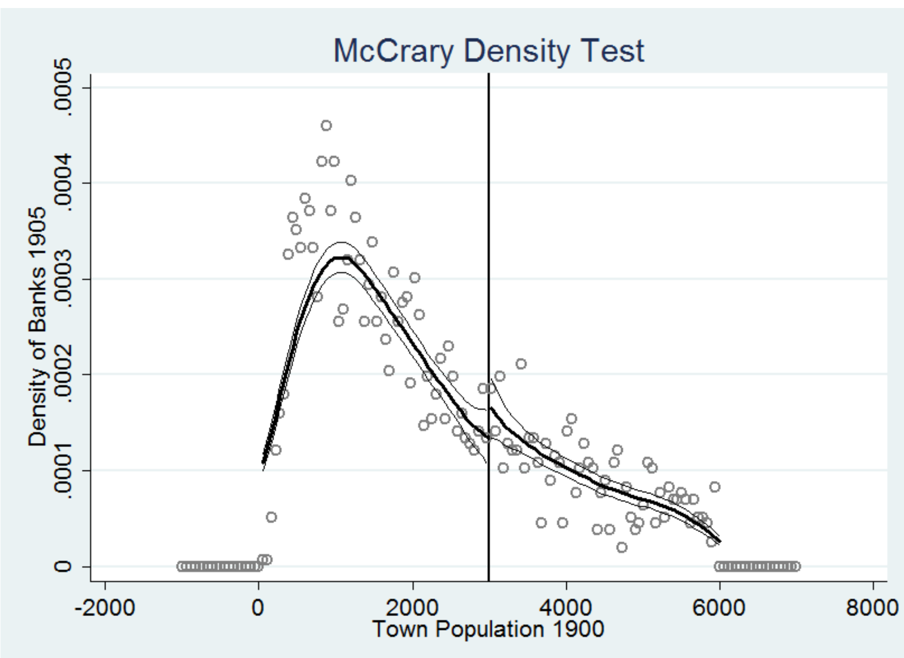
Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Town Clustered SE's

Figure 1: Bank capital across town populations, 1905



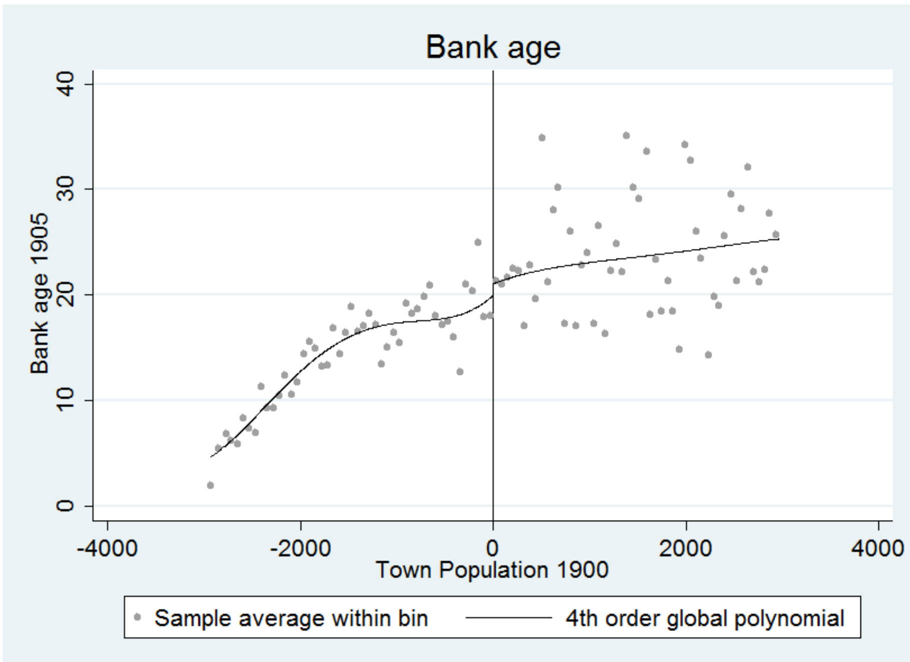

Source: *US Population Census of 1910*, OCC Annual Report of 1905

Figure 2: Histogram of national banks operating in towns, sorted by town population



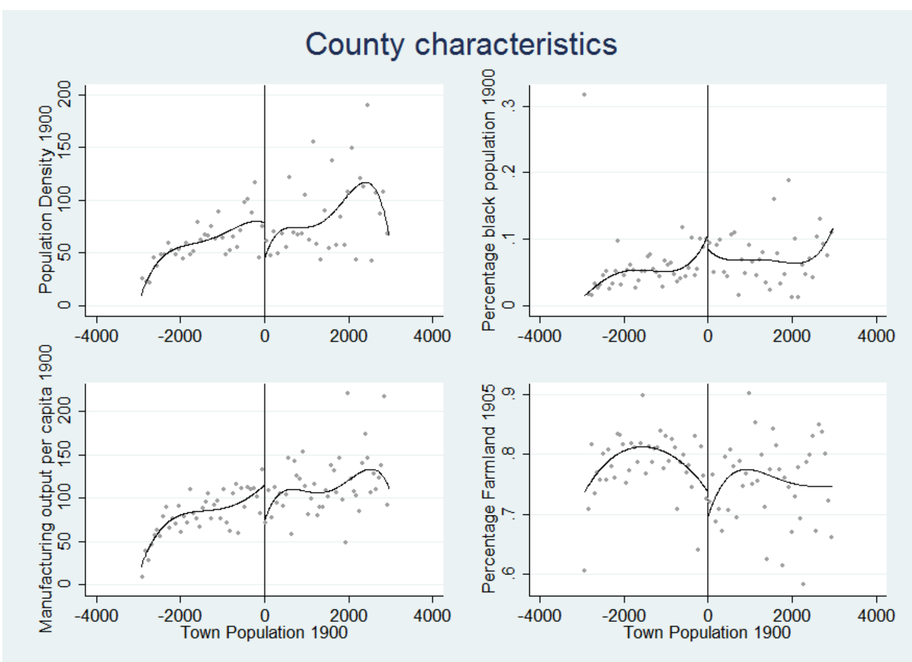

Source: *US Population Census of 1910*, OCC Annual Reports of 1905

Figure 3: Binned, local averages of bank age, 1905



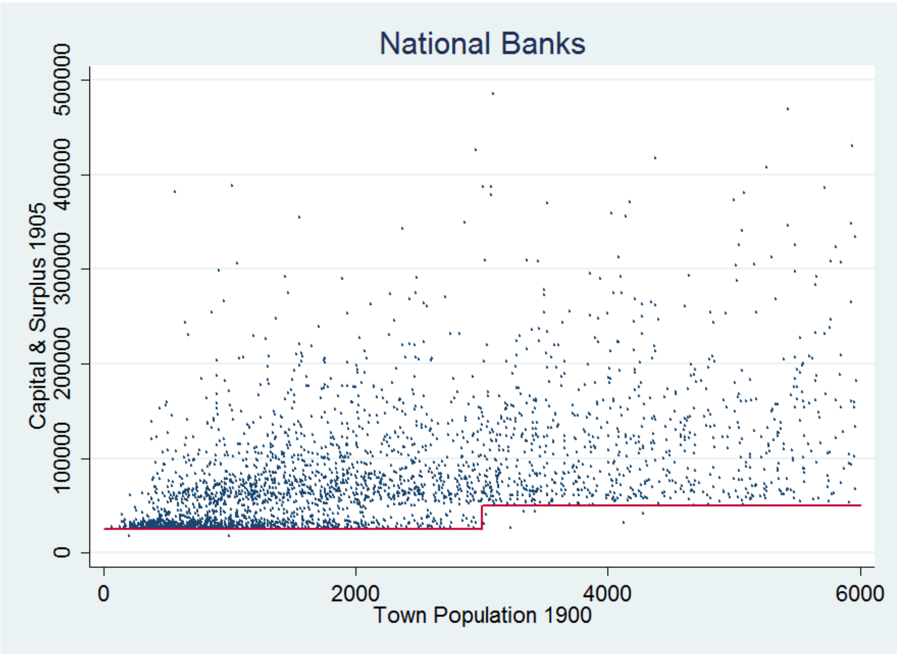

Source: *US Population Census of 1910*, OCC Annual Reports of 1905, Rand McNally 1910

Figure 4: Binned local averages of county characteristics, 1905



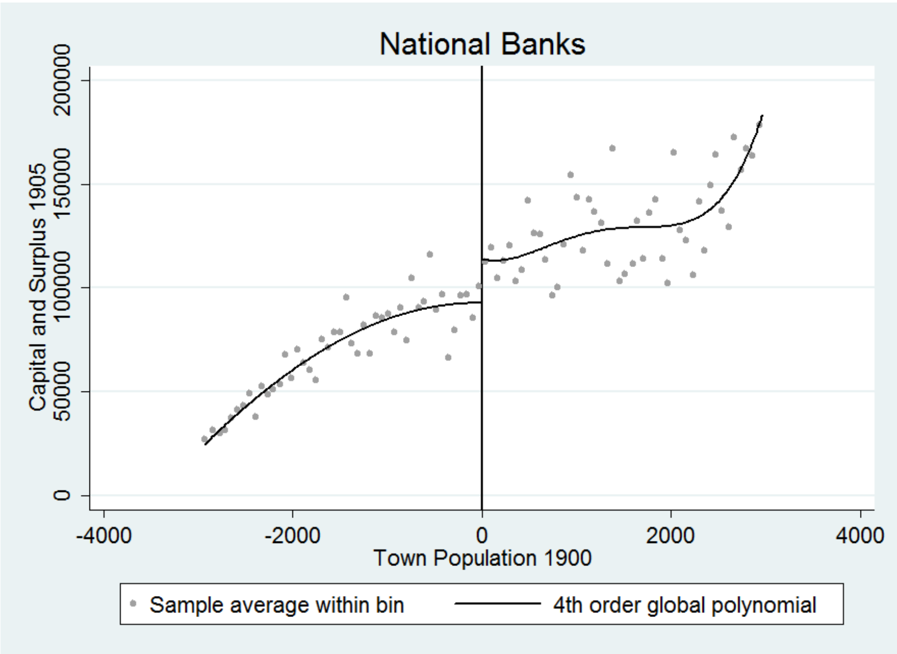

Source: *US Population Census of 1910*, OCC Annual Reports of 1905, ICPSR 2896

Figure 5: Bank capital across town populations, 1905, town population<6000



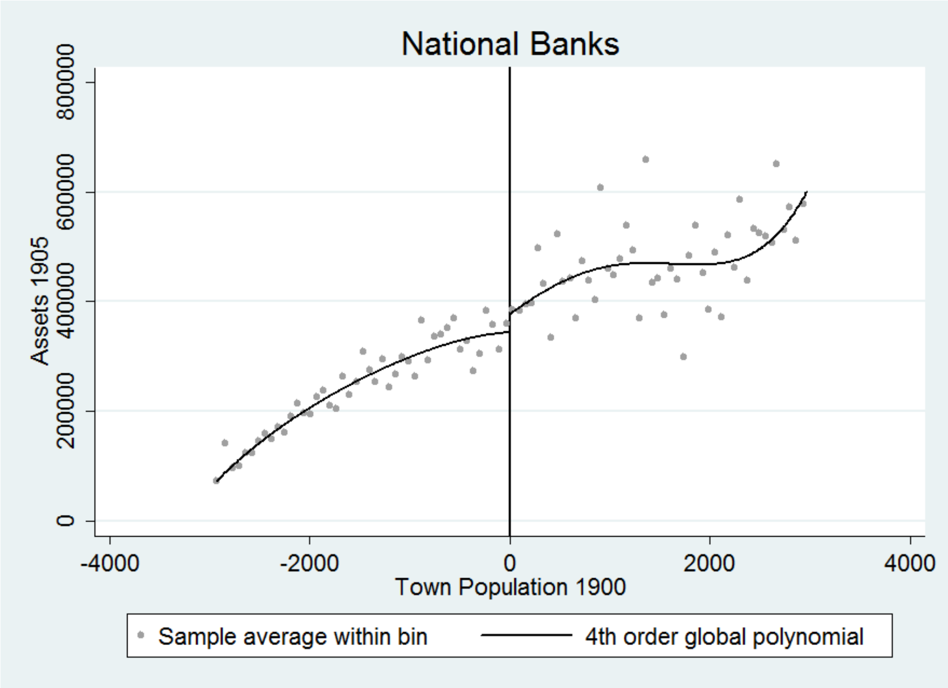

Source: *US Population Census of 1910*, OCC Annual Reports of 1905

Figure 6: Binned, local averages of capital & surplus, 1905



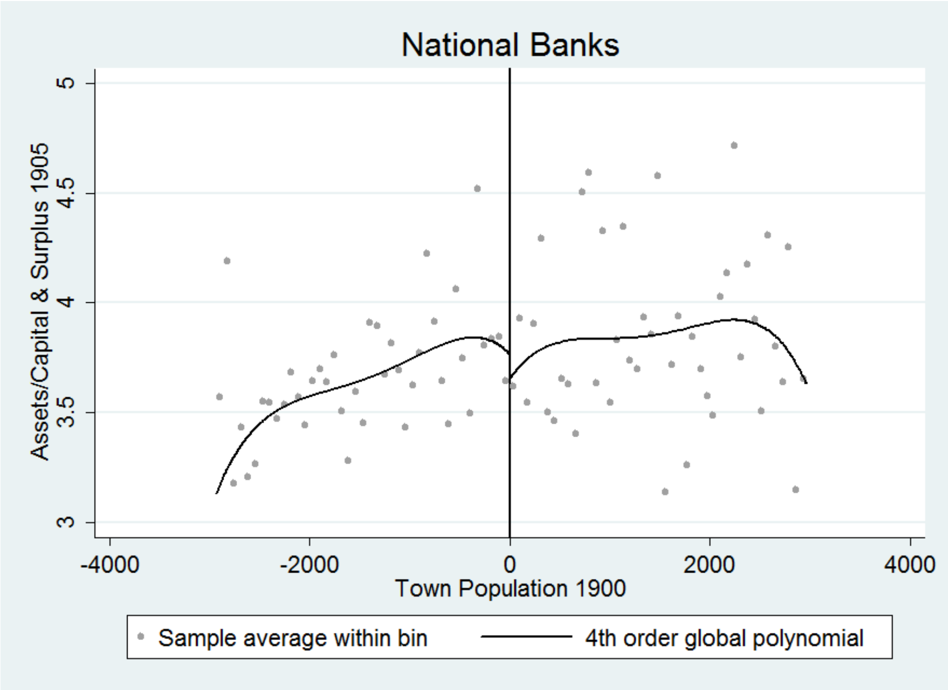

Source: *US Population Census of 1910*, OCC Annual Reports of 1905

Figure 7: Binned, local averages of assets, 1905




Source: *US Population Census of 1910*, OCC Annual Reports of 1905

Figure 8: Binned, local averages of bank leverage (assets/capital & surplus), 1905




Source: *US Population Census of 1910*, OCC Annual Reports of 1905