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ABSTRACT

Countercyclical capital buffers (CCyBs) are an old idea recently resurrected. CCyBs compel banks at the core of financial systems to accumulate capital during expansions so that they are better able to sustain operations during downturns. To gauge the potential impact of modern CCyBs, we compare the behavior of large and highly-connected commercial banks during booms before the Great Depression and Great Recession. Before the former, core banks did not expect bailouts and were subject to regulations that incentivized capital accumulation during booms. Before the later, core banks expected bailouts and kept capital levels close to regulatory minima. Our analysis indicates that the pre-Depression regulatory regime induced money-center banks to build capital buffers between 3% and 5% of total assets during economic expansions, which is up to double the maximum modern CCyB. These buffers enabled those banks to continue operations without government assistance during severe crises. This historical analogy indicates that modern countercyclical buffers may achieve their immediate goals of protecting core banks during crises but raises questions about whether they will contribute to overall financial stability.

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The purpose of making bank stock subject to assessment equal to the par value of the stock, in the event of the bank's failure, was to insure careful and prudent management. The idea worked rather well ...

> Jesse Jones, Chairman of the Reconstruction Finance Corporation, in the section of his memoirs describing bank regulation before the Great Depression (Jones 1975 p. 39).

Rep. Stewart McKinney (R-Conn.), waving his arms in exasperation, interrupted to exclaim: "We have a new kind of bank, it's called TBTF - too big to fail."

> Description in the Los Angeles Times of the moment in a Congressional hearing where U.S. Comptroller of the Currency C. T. Conover explained the federal government bailed out Continental-Illinois because the failure of such a large bank threatened the stability of the financial system and that the federal government would bail out other large banks in similar circumstances in the future (20 September 1984, p. H1). McKinney's exclamation popularized the term "too big to fail."

1 Introduction

The financial crisis of 2008 convinced observers that systemically-important commercial banks held insufficient capital at peaks of economic cycles, particularly cycles accompanied by asset price booms (Bernanke, 2013; Blinder, 2014; Jorda, Schularick, and Taylor, 2009; Schularick and Taylor, 2012; Reinhart and Rogoff, 2009). The insufficiency occurred because governments treated banks at the center of financial systems as too big to fail, reducing their incentive to hold capital sufficient to survive adverse shocks using only their own resources (Admati and Hellwig, 2013; Calomiris and Haber, 2014). Solutions to this problem include either (i) altering banks' incentives by requiring them to bear more of the consequences of their choices, which would enhance internal and market discipline of decisions concerning capital; or (ii) stricter regulation, such as requiring systemically-important banks to accumulate capital when the economy expands so that they could survive crises that occur occasionally when the economy contracts. A policy tool along these lines is the Federal Reserve's countercyclical capital buffer (CCyB). The Basel Committee on Banking Supervision (BCBS) recommends that all central banks adopt similar policies. Dozens have done so.[1] The efficacy of CCyBs stems from three widely held beliefs. First, too-big-to-fail incentives dictate capital choices of systemically-important commercial banks. Second, changing banks' incentives can induce them to hold

[1] As of October 2019, 29 nations have adopted CCyBs including the nations with the worlds ten largest economies. For up-to-date details, see the Bank of International Settlements CCyB information page at https://www.bis.org/bcbs/ccyb/.

more capital. Third, increasing capital held by banks at the core of the financial system will mitigate or minimize crises that might periodically occur during contractionary phases of business cycles. The need for and potential impact of these reforms is the subject of recent research.

The theoretical literature emphasizes how expectations of bailouts and limits on liability alter bankers' behavior towards risk (Chari and Kehoe, 2016; Keister 2016; Kashyap, Tsomocos, and Vardoulakis, 2014; Farhi and Tirole, 2012).[2] Bankers who face less downside risk invest in more and riskier assets than they would if they were fully liable for the consequences of their choices (Rochet, 2008, pp. 227-9). Early contributions along these lines include Koehn and Santomero (1980), Diamond and Dybvig (1983), and Blum (1999). Models of the leverage cycle, such as Geanakoplos (2010) and Nuno and Thomas (2017), yield similar results. Commercial bank leverage rises during booms and falls during busts, because bankers receive the upside when risky assets yield high returns, while depositors or the government bear some of the losses when risky assets yield substantially less than book value. Regulations that induce banks – particularly large institutions at the core of the financial system – to accumulate capital during booms may limit misallocation as the economy expands and protect the financial system as the economy contracts (Gersbach and Rochet, 2017; Aikman, Haldane, and Nelson 2013). Optimal regulations may be, however, difficult to design. The first-best rule differs across models (e.g. Chari and Kehoe, 2016 and Keister 2016), and rules regarding capital may have unintended or pernicious impacts (Ennis and Keister, 2009; Diamond and Rajan 2000).

The recent empirical literature has made strides in identification strategies as well as historical scope and breadth. Jimenez, Ongena, Peydro, and Saurina (2017) examine Spain's dynamic capital requirements from 2000 through 2013. They find increasing capital buffers by one percent substantially increases bank lending and firm employment during subsequent contractions. Other scholars have examined leverage patterns for financial institutions in recent decades, typically finding that leverage rises before and falls after financial crises (Aikman, Haldane, and Nelson 2013; Nuno and Thomas, 2017; Adrian and Shin, 2010; Brunnermeier and Pedersen, 2009). Haubrich (2018) observes the same over the last century and a half in the United States. Several scholars examine banks at the center of the United States

[2]The theoretical literature stresses a wide range of institutions that give rise to the phenomenon known as too big to fail. These institutions include bailouts, limited liability, regulatory forbearance, forgiving resolution procedures, deposit insurance, lenders of last resort, and preferential treatment of large versus small banks.

financial system during the 1920s and 1930s. These studies find that those banks increased lending but reduced leverage when the economy expanded (Richardson and Van Horn 2018, 2011, 2010; Calomiris and Wilson 2004).

Despite the breadth of this empirical literature, key insights of the theoretical literature – including that too-big-to-fail incentives distort behavior towards risk - have been difficult to test empirically. The empirical ideal would be to examine a panel of banks operating in an environment without regulations and policy expectations that distorted incentives and then to randomly designate some banks as too-big-to-fail, while tracking the behavior of both groups during economic booms before and after the intervention. Real-world instances that approximate this ideal are hard to find. Too-big-to-fail policies were often implemented as an element of wider reforms following financial crises. It is difficult to distinguish the impact of one reform from others. These reform packages were typically implemented decades ago, in an era for which data may be scarce and is seldom available in electronic form. While the perfect policy experiment may not exist, our empirical strategy is to approximate the empirical ideal as closely as possible.

We compare the capital choices of banks in United States during the largest booms before and after the creation of institutions that give rise to the too-big-to-fail phenomenon. These are the boom from 1921 to 1929, which preceded the Great Depression, and the boom from 2002 to 2007, which preceded the Great Recession. Institutions influencing banks' capital choices differed across those eras. In the former, stockholders of commercial banks had double and in some states unlimited liability for losses incurred if their bank failed. Directors and senior executives typically owned substantial stock in the banks that they managed and personally bore much of the financial cost of failure. Failed banks' senior executives, directors, and stockholders typically faced civil suits and criminal prosecutions: the larger the bank, the more likely investigation and indictment. Regulators at the time argued that these rules ensured large banks would be prudently managed. A key aspect of prudence was accumulating capital during goods times to serve as buffers during bad times, a behavior now called countercyclical capital buffering That environment differs from the too-big-to-fail environment of recent decades, which features deposit insurance, limited liability, bank bailouts, and regulatory and resolution procedures that favor large versus small institutions.

We create a data set containing balance-sheets of the banks at the core of the United States

commercial banking system in both eras and control groups to which they can be compared. In the historical era (1921 to 1929), the core banks operated in the money-center of Manhattan. Due to legal restrictions on branch banking, Manhattan's money-center banks operated only in New York City. Control groups for them include other banks operating in New York City and state. In the modern period (2002 to 2007), the largest banks operated across the United States. The modern control group is, therefore, all other banks in the nation. We standardize balance sheets between the two periods and compare the capital choices of banks over the business cycle and across the size spectrum.

We find important differences in the behavior of the systemically-important commercial banks in the run-ups to the Great Depression and Great Recession. In the run up to the Great Recession, banks at the core of the financial system kept their capital ratios constant and near regulatory minimums, both in absolute terms and relative to smaller institutions unlikely to benefit from too-big-to-fail assistance. In the run up to the Great Depression, core banks raised capital ratios by three to four percent of assets as the boom progressed, which is substantially above the maximum CCyB in the modern U.S. framework. Banks intentionally accumulated these reserves in preparation for the bust that they believed would follow. Their efforts paid off. Banks at the core of the United States financial system survived the depression and operated on a business as usual basis at all times.

The rest of this paper elucidates the evidence and methods underlying our claims. Section 2 describes the evolution of institutions that shape commercial banks' capital choices. Section 3 describes the data extant for the pre-Great-Depression and pre-Great-Recession periods and the Herculean task of standardizing these sources to enable us to make meaningful comparisons over time and to analyze the data simultaneously. Section 4 describes our statistical methods and results. Section 5 discusses the implications of our analysis. Historical experience indicates countercyclical capital buffers will have many of their intended effect, which is to protect the core of the financial system during financial crises, but aspects of our historical analogy suggest that countercyclical capital buffers may have unintended consequences.

2 Historical Background

Institutions shape banks' choices concerning capital and leverage. In the United States over the last two centuries, the relevant regulations evolved through periodic, punctuated equilibria. The commercial-bank regulatory regime remained stable for decades, and then changed substantially, when Congress rewrote national banking laws and state-legislatures followed, often in response to financial crises, before settling into new decades of stability (Komai and Richardson, 2014).

2.1 1920s and 1930s

The institutional foundations for the first period that we examine, the Roaring 20s and Great Depression, formed in response to financial crises in 1893 and 1907 and functioned as a stable system from the early 1920s through the mid-1930s.[3] In this system, banks at the core of the financial system did not anticipate being bailed out. Instead, if they failed, precedent indicated that they would be punished, probably more severely than smaller institutions at the periphery of the financial network. The threat of severe punishment ensured that core banks acted prudently. A key component of prudence was accumulating capital during good times in preparation for the bad times that inevitably followed.

Bank owners and managers faced substantial liability for the fates of their firms. Bank stocks had double liability. When banks failed, stockholders lost the value of their investment and an additional amount, up to the par value of their stock, typically $100 per share, that regulators deemed necessary to cover losses, reimburse liquidators, and repay depositors. Laws required bank directors to own minimum quantities of stocks, ensuring that all had skin in the game. Bank officers also typically owned stock in their institutions.

Senior executives of large banks typically faced civil suits and criminal prosecutions when their banks failed. These punishments had been the norm since the nineteenth century, and were frequent during the 1920s. The public and politicians called for them. In the summer of 1925, for example, after the Carnegie Trust Company failed in Pennsylvania, the governor

[3]This section discusses institutions relevant to state and nationally chartered banks operating in the state of New York during the 1920s and 30s. When specify when rules differed for state and nationally chartered institutions or for Fed member and non-member banks. This section does not detail laws and regulations for state-chartered banks operating in other jurisdictions. For that information, see sources such as Rand McNally Bankers Directory, White (1983), or Komai and Richardson (2014).

publicly pressured prosecutors to indict and imprison the bank's officers, even before the completion of the investigation (New York Times, July 14, 1925, p. 22). A decade earlier, after the failure of New York's Northern Bank, its controlling stockholder, Joseph G. Robin, was initially declared insane and confined in an asylum and later found guilty of overseeing accounting irregularities and sentenced to the state's maximum security penitentiary, Sing Sing (New York Tribune, December 28, 1910, p. 1; New York Times, February 4, 1913, p. 4).

Senior officers of large banks expected penalties like this if their banks failed. Their expectations were born out during the Great Depression. While no New York money-center banks failed during early 1930s, the punishments inflicted on executives, directors, and stockholders of big banks are apparent when examining failures just outside the core of the financial system. Details appear in Table 1. The table indicates all commercial banks in the United States with deposits above $30 million in June 1929 that liquidated involuntarily, like Lehman Brothers in 2008, or merged under duress, like Bear Stearns in 2008, between the summer of 1929 and winter of 1933. All of the banks listed in the table that liquidated belonged to bank holding companies, as did many of those that merged. The table also includes an entry for Bank of Tennessee (BOT), which was the central node of the Caldwell financial empire. BOT's deposits fell below the table's $30 million threshold because BOT served as a bankers' bank, only accepting deposits from commercial banks that used the Caldwell conglomerate as their correspondent. Total assets in the Caldwell conglomerate, which included a chain of banks spanning several states, insurance companies, brokerage houses, and related financial corporations, exceeded total assets held by most of the parent corporations of the banks listed in the table.

The table reveals that the failure of large banks typically triggered investigations by regulators and prosecutors. These investigations resulted in civil suits to recover funds and in most cases also indictments leading to criminal prosecutions. Assessments were imposed on the stockholders of all of the liquidated banks and most of those that merged. The CEOs of most of the banks that liquidated involuntarily declared personal bankruptcy sometime after. These bankruptcies typically involved the loss of almost all of their assets.[4] In several banks, directors who were not officers were indicted or sued for negligence, fraud, or conspiracy. The directors won some of these suits, lost others, and sometimes settled. Directors of the National

[4]Before the bankruptcy reforms of 1938, which created our modern system that allows bankrupts some protection from creditors, bankruptcy judgements were typically much harsher than today.

Bank of Kentucky, for example, paid $2.5 million to settle all claims against them for liability in the failure of the institution. The directors of the Atlantic National Bank settled a similar suit for $350,000. The directors of the First National Bank of Detroit settled the suit against them for liability in their banks' "technical violations of banking laws" for $3.5 million (Wall Street Journal, 9 Jan 1936, p. 7). The fates of the senior executives of the largest banks that failed during the Depression provide instructive examples. Bernard K. Marcus was the chief executive officer (CEO) of the Bank of United States (BUS) of New York City, which was the largest commercial bank to liquidate involuntarily during the 1930s. Marcus was convicted of felony violations of state banking laws and sentenced to three-to-six years in prison. He spent a year and a half in the general prison population at Sing-Sing, the state's maximum-security prison, with some of that time at hard labor, before transferring to a medium security facility. Civil suits consumed his wealth and clawed back funds that he had transferred to his wife. On parole in 1937, he worked for a pajama manufacturing company. His story was not unique. BUS's chief financial officer (CFO), Saul Singer, suffered a similar fate. His son also worked as an executive at the bank, and was indicted along with his father, tried, but acquitted.[5]

Prosecutions like this occurred much less often for smaller banks. Searches of newspaper databases, library catalogs, legal databases, and the legal literature reveal little evidence of systematic prosecutions of small bankers.[6] The annual report of the Office of the Comptroller of Currency (OCC) lists all convictions in the United States for violations of national banking laws. For banks in operation, the OCCs data reveals prosecutions of employees at small and large banks at roughly similar rates for crimes like embezzlement. For failed banks, however, the ratios clearly differed. Small banks failed at high rates, but were seldom prosecuted afterwards. Large banks failed at low rates, and were often pursued by prosecutors in the wake of failure.

For large and small banks, rules regarding capitalization were the same. Capital-ratio requirements did not exist. Instead, banks had to possess minimum levels of capital depending

[5]Information about Bernard Marcus comes from articles that documented his fate in the New York Times on 23 June 1931 (p. 2); 5 April and 27 May 1932 (p. 4 and 10 respectively); 17 January, 6 March, 15 March, 22 March, 14 June 1933 (pp. 10, 11, 9, 13, and 20 respectively), 19 September 1934 (p. 21); 30 June and 10 September 1937 (pp. 9 and 17 respectively); and 11 October 1939 (p. 27). This set of articles is a small fraction of those in the popular press around the United States that tracked his fate.

[6]We performed this experiment by randomly selecting 25 banks with total assets under $1,000,000 and searching for information in the same databases that we searched for information for the large failed banks listed in Table 1. For our sample of smaller banks, we found evidence of assessments, which of course, entailed suits to collect assessments, but no evidence of suits, investigations, or prosecutions outside of the standard receivership.

upon the population of the town in which a bank operated.[7] Above this minimum, capital levels and ratios were regulated solely by market discipline and bank leaders' fears of what would happen if their institutions failed.

Lenders of last resort existed. The plural is appropriate. For banks in the 2nd Federal Reserve District, which is the focus of our historical analysis, the Federal Reserve Bank of New York served as the lender of last resort for banks that belonged to the Federal Reserve System.[8] Non-member banks - particularly small banks operating outside reserve cities, known as country banks - relied New York City's money-center banks for liquidity during periods of pressure (Anderson et al., 2018). The largest banks in New York City, such as Chase and National City, conducted a large correspondent banking business. These banks held deposits of country banks, which served as part of the rural institutions' legal reserves, cleared checks for their country clients, extended lines of credit, and provided an array of other financial services. New York's money center banks stood at the top of a reserve pyramid, which stretched across the United States (Mitchener and Richardson, 2013; Mitchener and Richardson, 2019).

Commercial banks in distress - both members and non-members - could expect authorities to scrutinize their institutions. Regulators could recommend that troubled institutions seek merger partners, and on some occasions, encourage negotiations, but on no occasion did they facilitate mergers with financial assistance. Regulators could intervene more forcefully. When they believed depositors likely to suffer losses, either because the bank experienced asset losses or heavy withdrawals, regulators tended to act swiftly, closing institutions, commencing liquidation, and repaying creditors with proceeds from the receivership. Illiquid banks had the option to suspend payments. Regulators typically seized institutions that could not reopen

[7]The state of New York required state banks in towns with populations less than 2,000 to have $25,000 in capital; in towns of 2,000 to 30,000 to have $50,000 in capital; and in towns over 30,000 to have $100,000. Federal law required national banks operating in towns of population under 3000 to have $25,000; in towns of 3,000 to 6,000 to have $50,000; in towns from 6,000 to 50,000 to have $100,000; and in towns above 50,000 to have $200,000 (OCC Annual Report, 1900 through 1932).

[8]Laws permitted the Reserve Bank to discount only eligible paper, which consisted of standardized, short-term loans issued for industrial, commercial, and agricultural purposes. Should the New York Fed lack resources sufficient to satisfy the demands of its member banks, New York could rediscount eligible assets with other Reserve Banks. These Reserve Banks could, but did not always, accommodate New York's requests. The Federal Reserve Board had the authority to compel one Reserve Bank to rediscount for another, but on some occasions when the Board tried to compel compliance, some Reserve Banks refused to acquiesce. The Federal Reserve Board could also authorize Reserve Banks to accept as collateral for discount loans assets originated by non-member banks, but for most of the period under examination, the Board discouraged Reserve Banks from discounting assets originated by non-member banks. This policy deterred Fed member banks, particularly the money-center institutions in New York and Chicago, from passing Fed liquidity through to their country clients. These bankers' banks had to use their own resources to serve their clients' liquidity needs.

within a few days. The preponderance of bank liquidations involved losses to depositors.

Bailouts of banks did not exist and were not anticipated. In the summer of 1931, New York's money-center banks asked Governor Harrison of the New York Fed if his reserve bank or the federal government would help cover losses on loans to Germany, which New York banks had participated in at the request of politicians in Washington, DC. Governor Harrison indicated that neither the Fed nor Treasury would help. New York banks had to deal with the losses on their own (Richardson and Van Horn, 2018). At that time, neither state nor federal governments helped troubled banks cover their losses. Neither helped banks in distress raise new capital prior to the end of 1933, when Congress authorized the Reconstruction Finance Corporation's recapitalization program. Deposit insurance also did not exist. Congress created the Federal Deposit Insurance Corporation (FDIC) in 1933 and revised its structure to create the FDIC's modern form in 1935, after which most banks in New York State joined the organization. Legal liquidation procedures did not distinguish between institutions of different sizes in any formal way. Regulators had little leeway when shutting down commercial banks, since liquidation occurred under court supervision. Courts took over after depositors filed complaints that banks failed to pay them as required by law or after regulators filed paperwork on depositors' behalf. This system lasted until the Banking Act of 1935 assigned the FDIC the role of liquidator of failed commercial banks, taking the process out of the hands of the court. The heightened scrutiny of large banks discussed in Table 1 occurred outside of the bank resolution process, when federal, state, county, and local prosecutors allocated resources to investigate and prosecute leaders of failed banks.

2.2 Core Outperforms Periphery During 1930s

The regulatory regime clearly influenced capital choices of the nineteen banks at core of the U.S. financial system. These banks held 99% of the interbank deposits in New York City and 40% of the interbank balances in the United States. The set included Chase National (today J.P. Morgan Chase) and National City (today Citibank), which were the largest commercial banks in the nation and among the largest in the world. During the Roaring 20s, both kept dividends flat as profits boomed. Retaining earnings raised capital levels in absolute terms and as a share of assets. This prudent approach enabled Chase to write off losses in 1932 larger than its capital had been in 1927 while continuing to paying dividends (Richardson and

Van Horn, 2018).

The relative performance of the core and periphery of the U.S. financial system are illuminated in Table 2. During the contraction of the 1930s, no core banks failed. All remained in full operation until the New York Fed hit its gold constraint in March 1933 and President Roosevelt declared the national banking holiday. Four core banks merged into other core banks between June 1929 and December 1932. Two merged in the summer of 1929, before the stock market crashed and the economic contraction accelerated. The others merged in late 1931 and early 1932. These mergers continued a process of consolidation at the core that began in the 1920s (Richardson and Van Horn, 2009 and 2018). Nationwide, nearly 21% of all banks liquidated with losses to creditors. Another 20% of banks merged. One-eighth of those mergers involved banks in duress. Owners of these banks received little or no compensation for their shares. In many cases, they paid assessments to cover the banks losses, although lower assessments than they would have paid if their institution was liquidated under court supervision (Richardson 2008). Outcomes for banks at the core of the U.S. banking system were, in other words, much better than those for banks outside of the core.

That conclusion is true even for banks operating within New York City itself. Outcomes for non-core banks in New York City resembled the average outcome for banks nationwide. One-fifth of non-core Fed members liquidated, and one-quarter merged. Four of those ten consolidations involved banks in duress. One-fifth of non-member banks also failed, and another fifth merged. One-third of those consolidations involved banks in distress (Rand McNally Bankers Directory, 1929 and 1932).

The difference between core and peripheral banks appears starker when measured in terms of deposit levels and flows. In June 1929, core banks in New York held 17% of all deposits in the United States. During the initial banking panics in the fall of 1930 and spring of 1931, deposits flowed out of banks in the hinterland and into banks in New York (Mitchener and Richardson, 2019). The flight to quality eventually ebbed. By December 1932, deposits at the core had declined by 8%. By then, however, deposits in the rest of the United States had declined nearly 27%. The proportion of national deposits held in the core hard risen to more than 21% (Board of Governors, 1943).

2.3 1930s to 2000s: Evolution of Too-Big-To-Fail

The institutions underlying bank regulation changed substantially from the 1930s to the 1990s. The institutional foundations for the second period that we analyze, the boom of the early twenty-first century and Great Recession which followed, formed in response to the Great Depression of the 1930s, the Savings and Loan Crisis of the 1970s and 80s, and the international movement towards deregulation and competition during the 1980s and 90s.[9] During the 1930s, Congress created the Federal Deposit Insurance Corporate (FDIC) with its role as resolver of failed banks, expanded lending authority of the Federal Reserve System, empowered federal agencies to inject capital into distressed banks, eliminated double liability for commercial-bank stock, reduced directors' liability in case of banks failures, and changed a wide array of regulations for commercial banks and bank holding companies. Few of these technical reforms directly impacted New York's state-chartered commercial banks, since these reforms imposed on commercial banks and their competitors (e.g. building and loans and mutual savings banks) rules which were already in place in New York (Anderson, Richardson, Yang, 2017). A key exception is Title 1 of the Banking Act of 1935, which created the permanent, modern FDIC, and affected all commercial banks in New York. Another exception comes from Title 2 of the Banking Act of 1935, which limited the Fed's open-market operations to a single trading desk at the Federal Reserve Bank of New York, which triggered the formation of the Fed's primary-dealers network consisting of the largest commercial banks in New York City (Garbade, 2012). These reforms reinforced the money-market prominence of New York's largest commercial banks and led them to be treated as too big to fail. Federal legislation of the 1930s did impose additional reforms on Fed member banks and bank holding companies in New York, such as rules requiring commercial banks to divest securities affiliates. These reforms, however, were largely undone by subsequent reform legislation in the 1980s and 1990s, and therefore, had limited or no impact on New York banks in the periods which we study. Studies that compare bank regulations before the Great Depression and Great Recession find striking similarities along many dimensions for banks in New York State, except for the aforementioned changes underlying too-big-to-fail incentives (Komai and Richardson 2014).

In the 1970s and 1980s, the differential impact of these policies on large versus small

[9] Komai and Richardson (2014) provide a concise history of financial legislation in the twentieth century. Descriptions of many of the major acts can be found at www.federalreservehistory.org.

banks became apparent. When small banks became distressed, the FDIC typically closed the institution and paid off insured depositors. The banks' stockholders and uninsured depositors (i.e. those holding funds above the insurance threshold) suffered losses. When large banks became distressed, the FDIC typically resolved their affairs by arranging for a healthy institution to purchase the troubled bank and assume all of its liabilities, including uninsured deposits. When very large and interconnected banks suffered distress, such as Franklin in 1974, Penn Square in 1982, and Continental Illinois in 1984, the FDIC along with the Fed (and at times other regulators) bailed out the institution, providing loans at below-market rates and other assistance to enable these institutions to reorganize and remain in operation. The differential treatment of small, large, and extremely large and connected banks engenders incentives of a type commonly called too big to fail (Feldman and Stern, 2004).

Regulatory reform continued in the decades that followed. In 1982, the Garn-St. Germain Depository Institutions Act expanded the FDIC's powers to aid troubled banks and to delay closing failing institutions, which allowed those firms to gamble for recovery, typically leading to larger losses. In reaction, the FDIC Improvement Act of 1991 (FDICIA) required the FDIC to take prompt corrective action, close institutions before they became book-value insolvent, and use the least costly method of resolution. FDICIA also weakened restrictions on bank branching. In 1994, the Riegle-Neal Interstate Banking Act authorized interstate branch banking. In 1999, The Financial Services Modernization Act (commonly called Gramm-Leach-Bliley) expanded the integration of financial services, by authorizing the creation of financial holding companies, which could own subsidiaries involved in different financial activities, including commercial banking, investment banking, and insurance underwriting and sales.

Beginning in 1978, Congress passed a series of acts that required banks to fulfill capital-ratio requirements.[10] Like commercial banks in all countries adhering to the guidelines of the Basel Committee on Capital Supervision, U.S. regulators required commercial banks to keep

[10]The Financial Institutions Regulatory and Interest Rate Control Act of 1978 created the Federal Financial Institutions Examination Council (FFIEC). This organization was tasked with establishing uniform standards across U.S. regulatory agencies such as the Fed, OCC, and FDIC. It standardized capital ratios required for U.S. commercial banks. In 1988, the US adopted policies established by the Basel Committee on Bank Supervision known as Basel 1. In 2004, the Basel Committee released its initial recommendations for Basel II, which updated procedures for calculating capital requirements for the largest commercial banks. After several rounds of revisions, US regulators implemented Basel II in 2008. The Basel Committees initial recommendations for Basel III came out in 2010 with implementation schedule for 2013-5, although amendments and revisions have pushed implementation to the 2016-8 time frame. For details about current regulations, see http://www.federalreserve.gov/bankinforeg/basel/.

their ratio of capital to risk-weighted assets above a threshold, at which they would be deemed adequately capitalized. Banks falling below that threshold faced additional oversight, corrective action, and regulatory intervention that could include the seizure and liquidation of the institution (a subsequent section of this essay describes these ratios, weights, and calculations in greater detail).

During the twenty-first century, banks' owners and managers faced substantially less liability if their institutions failed than their predecessors had in the past. By the late 1990s, commercial banks were limited liability corporations. Stockholders had no liability for institutions' losses above the price they paid for their stock. Owners, directors, and managers seldom faced prosecution following the failure of their institution. The nation's largest commercial banks received preferential treatment when distressed. Regulators and central bankers had the ability and authority to bail-out banks and the motivation and mindset to treat systemically-important institutions specially. Their tools include the ability to (a) inject capital into financial institutions, (b) loan funds to any institution in unlimited quantities collateralized by assets of any type, (c) pay depositors (whether insured or not) in failing banks, and (d) resolve failing institutions in different ways.

Aggregate evidence suggests the evolution of these institutions influenced banks' capital choice over the last century. Figures 1 and 2 illustrate this point. Figure 1 plots capital ratios of Fed-member commercial banks operating in financial centers during the boom before the Great Depression. One line plots the aggregate capital ratio in New York City, which reflects the leverage choices of the banks in Manhattan, which included the largest commercial banks in the United States (and the world) at that time. The other lines represent aggregate capital ratio in Chicago and all other financial centers. The ratios evolved in sync until 1926, when the asset-market boom of the Roaring 20s accelerated. Then, capital ratios in New York rose relative to those of other banks, primary due to the deleveraging of Manhattan's money-center banks including Chase National Bank, the ancestor of today's J.P. Morgan Chase, and National City, the ancestor of Citibank. The graph makes it clear that money-center banks built capital buffers more rapidly than other institutions when stock prices soared at the end of America's gilded age.

Figure 2 plots capital ratios of commercial banks operating in the United States during the boom before the Great Recession. For the largest banks, the ratios remain near 8%, the

minimum allowed by law, throughout the boom. The ratios rise only after the financial crisis following the collapse of Lehman Brothers in the fall of 2008, which is marked by the vertical dashed line. Capital ratios for mid-tier and community banks followed a similar trajectory, rising during the recovery from the recession of 2001 but plateauing or falling as the expansion continued in 2006 and 2007. Capital ratios for all banks rose after the financial crisis and continued to rise after Dodd-Frank regulatory reforms in 2010.

Figures 1 and 2 foreshadow the fact that we will establish below. Institutions at financial systems' core behave differently when they and the individuals who own and operate them bear much (or most) of the risk of their failure than when they bear little (or no) risk. The figures also illustrate many of the difficulties of systematically comparing the behavior of banks separated by eight decades. The nature of banks and their balance sheets, including key outcome variables, differ for many reasons. In the past, for example, the typical measure of leverage was the book capital ratio. Today, the typical measure is a risk-weighted capital ratio. Measures of interconnectedness also differ, largely due to differences in the nature of financial networks. Then, interbank transactions typically took place through correspondent networks. Today, interbank transactions typically take place through repo and fed funds markets. In the past, banks kept most of their activities on their own balance sheets. The largest banks did have affiliates and operate within holding companies, but most of their risk remained on the bank's balance sheets, while in the modern day, banks and their holding companies frequently shift leverage and risk off their balance sheets. The structure of banking has changed substantially over time. In the past, most banks operated within a single city. Branch networks were uncommon and often illegal. It made sense to aggregate banking data by city. Today, leading banks have branching networks spanning several states. It is difficult to aggregate data by location, and common to aggregate by size. Similar complications arise when comparing business cycles and macroeconomic data across eras. The efforts required to create meaningful comparisons between banks in the 1920s and 2000s is the subject of the next section.

3 Data and Dating Business Cycles

This section describes data sources and information necessary for understanding our analysis. The discussion proceeds from historical sources, to modern sources, to methods of merging the

former and the latter. The discussion concludes with a description of data on macroeconomic aggregates and our methods for consistently dating the troughs and peaks of the economic expansions immediately preceding the Great Recession and the Great Depression. The key issues are identifying systemically important financial institutions in the past and present, creating a quasi-panel of data that spans the two time-periods that we analyze, and convincing readers that our methods overcome the obstacles to making reasonable statistical comparisons between the past and the present.

3.1 Historical Banks

In the 1920s and 30s, New York's banks played a key role in the national financial system and were representative of the range of institutions operating throughout the United States at that time. Before the Great Depression, New York possessed roughly 375 state-chartered banks and 400 nationally-chartered banks. The number varied from year to year with frequent entries, exits, and mergers, particularly among smaller institutions. These banks included the full spectrum of institutions that operated at that time in the United States, ranging from small country banks serving local clientele in rural communities; to larger institutions financing industry and trade; to money-center banks operating in Manhattan, serving as correspondents for thousands of banks in the U.S. and hundreds overseas, and operating networks of foreign branches. In 1930, New York banks held about 30% percent of all bank assets in the United States, 30% of all deposits, and 45% of interbank deposits.

We limit our historical sample to New York State for several reasons. A coherent comparison to the present requires limiting the historical sample to a single Federal Reserve District and, if possible, a single state. In the 1920s, Federal Reserve banks were able to pursue independent monetary and credit policies (Richardson and Troost, 2009). Laws prohibiting branching required commercial banks to operate in particular locations. None operated across state lines. Markets for goods, labor, and services were less integrated than they are today. Banks in different Reserve Districts, therefore, experienced business cycles with different peaks, troughs, and amplitudes as well as different policies. Financial institutions and regulations also varied across states. Supervision was stricter in some states and looser in others.

Of all states, New York has the most appealing characteristics for our purposes. It was the only state whose banks represented the full spectrum of institutions in operation, from massive money center banks to tiny institutions operating in rural locations. Many banks operating in New York in the 1920s remain in operation today. This includes several of the largest banks in the world, then and now, such as Citibank (National City Bank of New York in the 1920s) and J.P. Morgan Chase (Chase National Bank in the 1920s). Substantial data exists about banks operating in the state, and sufficient data exists to date the peaks and troughs of economic cycles that those banks were exposed too. The New York Fed pursued polices most similar to modern ones (Chandler, 1971). No other state possesses all of these characteristics. New York has an additional advantage. Relative to other states, limited regulatory reforms took place in New York during the 1930s and subsequent decades. These advantages allow us to make reasonable statistical comparisons between banks in New York during the 1920s and banks throughout the United States today.

For the 1920s and 1930s, data on banks comes from the Office of the Comptroller of Currency (OCC) and New York's state Superintendent of Banks. The former published balance sheets once each year for all nationally-chartered banks, based on the September call prior to 1925 and the December call thereafter. The latter published bank-level data for all calls (typically four) each year during the period of our study except for the years 1933 and 1934, when the state legislature suspended the collection and publication of that information. For both national and state banks, we also draw data about interbank networks from Rand McNally Bankers Directory.

3.2 Modern Bank Data Sources

The modern era differs from our historical period in several ways. Today, the Federal Open Market Committee sets monetary policy for the entire nation, in response to national economic cycles. Markets for goods, labor, and services are nationally integrated. Large commercial banks operation nationwide, possessing branches in, accepting deposits from, and making loans to firms and individuals in many and for the largest banks most states. When we examine the behavior of modern systemically-important financial institutions, therefore, the appropriate comparison group is all commercial banks operating in the United States,

Data for modern banks comes from the Federal Reserve, Federal Deposit Insurance Corporation (FDIC), and Federal Financial Institutions Examination Council (FFIEC).[11] The principal information that we analyze appears on FFIEC reporting forms 031 (Consolidated Reports of Condition and Income for a Bank with Domestic and Foreign Offices) and 041 (Consolidated Reports of Condition and Income for a Bank with Domestic Offices Only). From these forms, we measure banks' size, leverage, interconnectedness, and other characteristics. Size is nominal total assets (call code rcfd2170). Leverage is the inverse of the tier 1 capital ratio (call code rcfd7206). Interconnectedness is measured in two ways. The first is total deposits due to commercial banks and other depository institutions located in the United States (rconb551 plus rconb552). The second is the sum of banks' interbank deposit liabilities (rconb551 plus rconb552), loans to depository institutions (rconb531), balances due from depository institutions in the United States (rcon0082), federal funds borrowed and lent, and funds received and disbursed under repurchase and reverse repurchase agreements (rconb993, rcfdb995, rconb987, and rcfdb989). We refer to this sum as gross interconnectedness. We restrict our analysis to commercial banks (rssd9331=1, call8786=1 or 2, rssd9048=250, rssd9424=1,2,6, or 7) and those physically located in the contiguous United States (rssd9210<57).

3.3 Measuring Systemic Importance, Capital Ratios, and Leverage

We measure banks' systemic importance using measures that commonly appear in the literature and that often are used by regulatory agencies: size and interconnectedness. Size is measured by banks' total assets. Interconnectedness is measured in several ways. Some measures can be constructed for both the historical and modern periods. These include deposits due to other banks, deposits due from other banks, and the sum of deposits due to and from. In our historical panel, we can also measure the percentage of all banks in the United States that possessed a correspondent account with each bank our data set. For our modern period, we can measure gross interconnectedness, which is the sum of all short-term (primarily interbank) borrowing and lending on a commercial banks' balance sheet. Key measures of

[11] FFIEC forms and instructions can be found at its web site, http://www.ffiec.gov/. Federal Reserve information on commercial banks, including call report codes and item descriptions, can be found at the Micro Data Reference Manual, http://www.federalreserve.gov/apps/mdrm/. Reporting forms may be found at http://www.federalreserve.gov/apps/reportforms/. Links to agency data appears at http://www.federalreserve.gov/apps/mdrm/series/list/reportform. The FDIC's publicly available data can be found at https://www.fdic.gov/bank/statistical/.

interconnectedness evolved over time. The evolution occurred due to changes in the structure of the financial system, particularly New York's money markets. In the earlier era, correspondent relationships facilitated by deposits of funds were the dominant interbank link. These relationships materialize in the due to and due from categories of banks' balance sheets. In the modern era, funds typically flow between financial institutions via the Fed funds market and repurchase agreements. To capture these changes, we vary our measure of interconnectedness over time.

Table 3 provides a summary of systemic importance for our historical panel on 31 December 1928. It indicates the 20 largest banks as measured by total assets plus three banks outside that group that are among the top 20 most interconnected banks as measured by deposits due to. The column %DT indicates percent of liabilities due to other banks, or 100(due to banks/assets). %R indicates percent of respondents that listed the New York bank in question as a correspondent in a stratified random sample drawn from the January 1929 Rand McNally Bankers' Directory. Our stratified random sample consisted of two pages chosen randomly from each state's section in the Directory. From these pages, we recorded the correspondents listed for each commercial bank, and then we calculated the fraction of all banks in our sample that listed each bank in our New York data set as correspondent. The last column indicates the row number of each bank's modern successor in Table 4. Table 4 provides a snapshot of our modern panel on 31 December 2007. It indicates the 20 largest banks as measured by total assets plus five banks outside that group that are among the top 20 as measured by gross interconnectedness. The column %DT indicates percent of liabilities due to other banks, or 100x(due to/assets). The columns GI and %GI indicate gross interconnectedness and gross interconnectedness as a fraction of total assets respectively.

Capital ratios and their inverse, leverage, can be measured in both periods. For the historical period, we typically measure the capital ratio as ratio of owners' equity (paid-in capital plus surplus plus other retained earnings) over total assets. This was the form of the capital ratio most frequently discussed by regulators or in books like Ferdinand L. Garcia's 1935 book How to Analyze a Bank Statement. Modern regulation of commercial banks' capital relies on measuring the ratio of capital to risk-weighted assets. The Basel Capital Accords separate assets into four categories. The first, considered risk-free and perfectly liquid, includes cash and home-country national debt. It receives a weight of 0%. The second category receives a

weight of 20%. It includes assets deemed safe and liquid, such as securities with the highest rating, AAA. The third category receives a weight of 50%. It consists of secured and relatively safe assets such as municipal debt and mortgage loans. The last category receives a weight of 100%. This includes most other loans and assets without ratings or deemed unrateable. We create analogs to this measure for banks in the Roaring 20s by risk-weighing assets at historical commercial banks using criteria equivalent to the Basel criteria.[12]

3.4 Mergers and Call Report Dating

Merging the data into panels requires decisions about how to treat call-report dates and bank mergers. Call reports for the commercial banks occurred roughly quarterly during our historical and modern periods, although some reporting intervals were longer and others were shorter. We observe data from all calls for all banks in the modern era and observe all calls for state-chartered banks in the historical era. For nationally-chartered banks in the historical era, we observe all calls in banks in New York City and only a single call each year for most national banks upstate. When we initially analyze our data panel, we treat the call-reports for modern and historical state-chartered banks as quarterly, or in other words, assume the intervals between the call reports were of equal length. This is the assumption most often employed in the literature. You could think of this assumption as one in which we analyze the data in call-report time. When we pool historical state and national bank data from the historical era, we include state-bank data at all dates and include national-bank data into the estimates only for the dates on which it is available. We check all of our results by rerunning them in calendar time, where we allow the spacing between calls to vary, and also in business cycle time, where time represents the fraction of the expansion (from peak to trough) which

[12]Complications arise from the insufficient granularity of the historical balance sheets. For less granular balance sheets, we make assumptions about the appropriate risk weights of the equivalent. State bank balance sheets, for example, aggregate all bonds into a single category, "securities." This category includes U.S. government bonds, whose risk weight is zero; securitized assets, whose risk weight is 20%; and municipal and corporate bonds, whose risk weight is 50% in the modern data. To these composition categories, we assign a weighted average of modern risk weights, based upon the share of each type of asset in the composition category as reported for all banks in the United States by the Comptroller of Currency in 1929. For items considered assets in the past, but not classified as assets today, we assign the risk weight of 100%. An example is cash items. The principle component of cash items is drafts in the process of collection. Today and in the past, the Federal Reserve counts these items neither as assets nor liabilities of the bank until they clear or until the passage of days sufficient to enable them to clear in normal circumstances. Yet, state authorizes did consider them an asset in the 1920s and 30s. Since cash items are both risky and illiquid particularly during financial crises, we assign them a risk-weight of 100% (Richardson, 2007).

has passed.

All of the largest and most interconnected banks from the 1920s have modern descendants. The last column of Table 3 indicates these by listing the row number of the modern successor in Table 4. For example, Chase National is now the core of JPMorgan Chase, which absorbed another 13 of the largest historical banks in New York. National City Bank is now the core of Citibank, which absorbed 3 other banks in our list. American Exchange Irving Trust Company (historically 5th largest) now belongs to Bank of New York Mellon (16). Some of largest modern banks have ancestors in our data set. This is true for those ranked 1, 3, 7, 16, 19, and 21. Most of the other largest banks in the United States evolved from institutions in other regions of the U.S.. Wells Fargo and Bank of America, for example, originated in California. Wachovia (now part of Wells Fargo) came from North Carolina.

While many of the smaller banks in our historical data set have modern descendants (and vice versa), high rates of failure and entry for small banks over the last century mean that many do not. The small banks still serve as an appropriate control group. In our historical sample, institutions outside the top 25 operated in the same environment, under the same constraints, and supervised by the same regulators as their larger and better connected counterparts. All of the banks operated in the state of New York with their operations and branches restricted to a single municipality. In our modern population, the thousands of smaller institutions operate throughout the United States, in all markets in which the largest banks operate, supervised at the national level by the same agencies (Federal Reserve, Federal Deposit Insurance Corporation, and Comptroller of Currency) and supervised at the local level by state regulators. The largest banks operate nearly nationwide. JP Morgan Chase, Wells Fargo, and Bank of America operate thousands of branches spread across most states. Citibank operates roughly 800 branches in 15 states.

3.5 Dating Business Cycle Peaks and Troughs

To compare capital choices over business expansions, we need to date business cycle peaks and troughs consistently over time. Dating is complicated by four factors. First, the business cycles length and properties differed in the interwar and modern eras (Romer, 1994). Second, Stock (1987) has argued that the NBER's standard business cycle dating, pioneered by Burns

and Mitchell (1947), distorts the economic time scale, particularly in the interwar era. Third, during the 1920s, we examine data from banks in New York. That state experienced a longer and stronger expansion than most of the rest of the nation, in part because of asset and consumption booms in Manhattan, America's financial and fashion capital. Fourth, a limited number of data series exist for New York during the 1920s.

To overcome these problems, we collect all time series that could be used to date the business cycle in New York in the 1920s and compare the dates that we derive to their equivalents for the modern era. Table 5 summarizes the results. Column (1) indicates dates of the national business cycle from the NBER. Column (2) dates the business cycle using the short-term commercial paper rate, which Stock (1987) found to be the best metric for the economic time scale from 1869 through 1975. The short-term rate that Stock used was the commercial-paper rate prevailing in New York City (Board of Governors 1943, Table 120, p. 450). Columns (3) through (6) indicate dates for data series on economic activity in New York State. Column (3) reports dates from the Federal Reserve's consumption index for the Second District, essentially the state of New York. Column (4) reports dates from the Dow Jones Industrial Average, based upon prices of stocks sold on the New York Stock Exchange. Column (5) reports dates based upon the volume of payments processed by financial institutions in the Second Federal Reserve District, primarily New York City. Column (6) reports dates based on the deviation from trend of factory employment in New York State. The length and amplitude of the cycle in New York in the 1920s exceeds the expansion from November 2001 to December 2007, which lasted 73 months. Macroeconomic data for the modern era come from standard sources. Business cycle peaks and troughs are from the NBER. GNP and other data about the cycle come from the Federal Reserve's Economic Data System (FRED).

4 Methods and Results

This section describes our statistical methods and results. We begin by summarizing patterns in the data. Then, we analyze how capital choices changed over the business cycle for SIFIs and smaller banks. Since the length of these expansions differed, we compare banks' choices in business-cycle time, where the length of the expansion is normalized to the unit interval and our time variable indicates the fraction of expansion which has passed. This transformation

allows us to account for idiosyncrasies in the frequency and timing of bank-balance sheet reporting. Extensions of our method demonstrate the robustness of our result.

4.1 A First Look at the Data

Table 6 illuminates patterns in the data. Before the Great Depression and Recession, capital ratios for small banks exceeded those for large banks, particularly the largest institutions with the most interbank connections at the center of the financial system, the SIFIs. On average during the Roaring 20s, capital ratios of banks in the smallest decile declined slightly, while ratios of banks in the largest decile rose substantially, with the ratios of the top-ten banks rising the most. In contrast, from 2002 to 2007, capital ratios of the largest ten banks changed little over the business cycle. They began the boom near the regulatory minimum, ended the boom near the regulatory minimum, and stayed close to the regulatory constraint at every point between. In contrast, capital ratios of smaller banks rose slightly.

The contrast appears starkest when calculating the difference in the differences of capital ratios over these expansions. During the Roaring 20s, the capital ratio of the largest commercial banks increased by 2.6 percentage points, while the capital ratio of the smallest commercial banks declined by 0.3 percent. While these ratios had differed substantially at the beginning of the boom, they converged as the economy expanded. During the Roaring 2000s, the opposite occurred. The capital ratio of large commercial banks changed little, while the capital ratio of the small commercial banks increased by 0.7 percentage points. The difference in these differences is 3.3 percentage points. This difference in differences underlies our estimation strategy. Small banks serve as benchmark against which we assess the behavior of systemically important institutions.

While our analysis has the spirit of a difference in difference estimation, history has not given us a data set and historical experiment to which we can apply a statistical difference in difference estimator. Instead, we rely on the logic of treatment and control, clearly state the assumptions that we must make when generating a result, and perform extensive robustness checks to determine that our result arises due to patterns in the underlying data and not assumptions that we make when generating our estimates. Key issues that we must address are how to date the boom and bust in New York State during the 1920s and 30s; how to

identify the largest and most connected banks, which are those whose behavior should have been influenced by the advent of too-big-to-fail; how to illuminate patterns from trough to peak of the business cycle; and how to standardize historical and modern business cycle time so that we can use statistical tests to compare the behavior of banks across different eras.

4.2 Analysis

To investigate how capital choices differed between SIFIs and other commercial banks, we consider equations of form (1).

$$C_{it} = \alpha_i + \mu_t + \gamma X_{it} + \beta(\mathbb{I}(SIFI_i)(cycle_t)) + \epsilon_{it} \tag{1}$$

C_{it} is the capital ratio for bank i at call report t, where i $\in [1, \ldots, I]$ and $t \in [1, \ldots, T]$. I is the total number of banks in each sample. T is the total number of call reports under examination. α_i is a bank fixed effect. μ_t is a call report (i.e. time) fixed effect. $X_i t$ is a vector of variables that vary by bank and call report. These variables indicate the fraction of banks' assets invested in cash, bonds, or loans. γ is the vector of coefficients for these control variables, which indicate the different composition and risk of banks' portfolios. $\mathbb{I}(SIFI_i)$ is an indicator variable that indicates whether a bank belongs to the group of systemically important financial institutions. The variable $cycle_t \in [0, 1]$ indicates call date t's position in the business cycle. If the call occurred during the month at the trough of the cycle, *cycle* equals 0. If the call occurred during the month at the peak of the cycle, *cycle* equals 1. If the call occurred between trough and peak, *cycle* equals the fraction of months of the economic expansion that passed prior the call. For example, if an expansion spanned 12 months from a trough in January to the peak in the next January, the variable cycle would equal $\frac{1}{3}$ for calls in April, $\frac{1}{2}$ for calls in July, and $\frac{3}{4}$ for calls in October. β is the coefficient indicating how capital levels of SIFIs changed over the cycle relative to capital levels of other financial institutions. ϵ_{it} is an error term clustered by bank. We estimate equation (1) using the within transformation which yields equation (2).

$$\ddot{C_{it}} = \alpha_i + \mu_t + \gamma \ddot{X_{it}} + \beta(\mathbb{I}(SIFI_i)(cycle_t)) + \ddot{\epsilon_{it}} \tag{2}$$

where each variable above, $\ddot{z} = z_{it} - \Sigma_1^T z_{it}/T$.

Table 7 reports results of regressions on historical data in the first three columns. Column (1) regressions the deviation in a banks' current from average capital ratio, $\ddot{C}_{it}$ on a dummy for systemically-important banks, $\mathbb{I}(SIFI_i)$, and the product of that indicator and a variable indicating when the call occurred during the economic expansion, $\mathbb{I}(SIFI_i)(cycle_t)$. The coefficient on that interaction term, 4.11, indicates the average increase in the capital ratio of systemically important banks relative to smaller banks during the boom of the Roaring 20s. In this regression, the measure of capital is the book equity ratio, which was the standard measure of commercial-bank leverage in use at that time. The business cycle is defined by the short-term interest rate in New York State, which Stock (1987) indicates is the best measure of the business cycle during the interwar period. The dummy for systemically important commercial bank indicates the largest 10 banks operating in New York in 1929. Column (2) reports a regression identical except for the inclusion of time fixed effects. The coefficient on the interaction of interest, 3.51, remains statistically significant at the 99% level. It is a 0.6 less than the coefficient on the preceding regression. This is representative of including time fixed effects in all the regressions that we run. Column (3) reports a regression using the same variables but which also includes variables indicating the share of each banks' portfolio held in liquid assets (cash, reserves at the Fed, etcetera), less liquid but typically safe assets (bonds), and illiquid by higher returning assets (loans). These variables reflect changes in the riskiness of the assets in which a bank invests. Along with fixed effects for each bank, these variables provide a parsimonious specification that captures the influence of banks' characteristics (both observed and unobserved) on decisions about leverage and capital. The standard errors for this regression are clustered at the bank level and estimated via the Hubert-White method to control for heteroskedasticity and autocorrelation. The key coefficient from this regression, 3.76, is slightly higher than the coefficient on the equivalent regression without controls for the structure of banks' portfolios. This increase reflects the fact that as large banks raised capital ratios as the economy expanded, they also shifted out of loans and into safer assets, such as cash, interbank balances, and government bonds (Richardson and Van Horn, 2018; Mitchener and Richardson, 2019). As the economy roared during the 1920s, in other words, the banks at the center of the United States financial system reduced the riskiness of both the liability and asset sides of their balance sheets.

Table 7 reports results of regressions on modern data in the last three columns. These

regressions define the business cycle using NBER dates. These are the most commonly used modern dates, and the length of the modern NBER cycle corresponds closely with the length of the historical interest-rate cycle. The capital ratio is defined by book equity, which is the measure used in our historical regressions. SIFIs are defined as the 5 largest banks. This narrow modern grouping reflects the growing concentration of the financial system. Other than these differences in definition of variables, the regressions in columns four to six are identical to the regressions in columns one to three. Column (4) includes an indicator for SIFI and its interaction with our variable for the business cycle expansion. Column (5) adds time fixed effects. Column (6) adds controls for the composition of banks' portfolios. These regressions indicate that capital ratios of modern banks changed little over the business cycle. In regressions with controls (columns 5 and 6), the null hypothesis that during the economic expansion, capital levels of systemically-important banks did not change relative to capital ratios of smaller banks cannot be rejected.

4.3 Robustness

The coefficients presented in Table 7 depend upon the assumptions underlying the analysis. Figure 3 examines how those assumptions effect our estimates on historical data. Panel 3(a) plots coefficients on interaction terms indicating how systemically-important institutions adjusted capital levels from 12 regressions equivalent to Table 7, Column 3. The regressions vary on the measure of systemically-important institutions and the definition of the business cycle. The black dots indicate coefficients on regressions in which SIFIs are defined as the ten largest banks in 1929 (as indicated in Table 3), while the length of the economic expansion varies (as indicated in Table 5). The cycles are listed from left (shortest) to right (longest) in order of their length. The dots are solid, indicating that all are statistically significant at the 95% level. The triangles indicate coefficients on regression in which the SIFIs are defined as banks at the core of the United States commercial system, as indicated by high levels of deposits due to other banks and large numbers of respondent banks (as indicated in Table 4). Five of the triangles are solid, indicating that they are statistically significant at the 95% level. One is hollow, indicating that it was not statistically significant.

Panel 3(a) illustrates several important points. One is that our conclusion does not differ if you define systemically important banks as the largest or most connected institutions. These

identities of these groups overlapped to a large degree. The largest banks were generally the most connected, and vice versa. The set of 'connected' banks in this figure is larger than the set of 'biggest' banks, which accounts for the slight difference in average estimate. This is because the larger and more connected the bank, the more they increased their capital ratio as the economy expanded. Two is that the plausible measures of the economic expansion's starting and ending dates yield similar conclusions. This result is reassuring because lack of data creates uncertainty about the starting and ending dates of the economic expansion in New York in the 1920s. The result arises because big banks increased capital ratios most rapidly from 1927 to 1929, when equity markets and industrial activity reached unprecedented levels, and that span of time is included in all plausible measures of the economic expansion.

Panel 3(b) asks whether our results depend upon our measure of equity. It does this by comparing coefficients from regressions like those in Table 7, Column 3 with coefficients from identical regressions where capital ratios have been computed according to modern methods. In 3(b), the black dots have been estimated using the historic capital ratio (and thus, are identical to the black dots in 3(a)). The gray dots have been estimated for the risk-weighted tier 1 leverage ratios of these historical banks. Five of the coefficients for these new regressions are statistically significant and statistically different than their non-risk weighted analogs. All these coefficients are larger than their non-risk weighted analogs. They are larger, because banks at the core of the financial system in the 1920s shifted into safer assets (particularly government bonds, cash, and cash equivalents) as the boom progressed. This shift toward safety results in an increase in their risk-weighted capital ratio.

Panel 3(c) also plots coefficients indicating how systemically-important institutions adjusted capital levels during the economic expansion of the 1920s based upon Table 7, Column 3. Each vertical strip pertains to a definition of the financial core. The definitions are the five largest banks by total assets, the ten largest banks, and the twenty largest banks. The dots and lines in each column indicate point estimates for the different definitions of business cycles. The magnitudes of the cycles can be inferred, since they vary in the same order as 3(a). Dots represent coefficients significant at the 95% level. Lines represent insignificant coefficients. The panel demonstrates that our conclusions are robust to different definitions of the financial core. The magnitude of the estimate drops when the core groups of banks expands, because banks ranked 11 to 20 in total assets raised capital levels less during the boom than banks with

size ranked 1 to 10, but our statistical result still holds.

Panel 3(d) asks if our results could be driven by some unobserved shock that differentially impacted banks at the core and periphery of the financial system. The figure plots coefficients for five groups of six regressions. The group identities are indicated on the horizontal axis. Each group consists of regressions for each business cycle. The cycles can be inferred in most cases, since their magnitudes typically vary in the same order as Panel 3(a). The dots and lines in each column indicate point estimates for the different definitions of business cycles. Dots represent coefficients significant at the 95% level. Lines represent insignificant coefficients. SIFIs are defined as the ten largest banks in each group. The first group consists of all banks in New York State. This is the same group (and same values) represented by the black dots in Panel 3(a). The second group consists of Fed member banks. Relative to nonmembers, regulations required Fed members to invest in safer assets, to hold more (and more liquid) reserves, and to undergo more rigorous examinations. In return, Fed members received direct access to the discount window.

Fed members were also on average larger, better capitalized, and operated in larger municipalities. The core banks in Fed-member group were identical to the core banks for New York as a whole (since all banks in the core for the state as a whole belonged to the Federal Reserve). The comparison group, however, shrinks and becomes more similar to the core. The result remains the same. With the exception of an outlier, regressions for different business cycles yield coefficients that differ significantly from zero but not from the corresponding coefficient in the regression on the entire sample.

The third group consists only of state-chartered banks. These banks obviously operated under uniform rules and a signal regulator, reducing the danger that our inferences might be driven by unobserved shocks that differed between the core and comparison groups. The core in this group consists of the largest state members listed in Table 3. It overlaps in part with the core group in the previous regressions but contains several banks the previous regressions comparison group (and which the regressions in Panel 3(c) reveal increased capital less than the larger, national banks which we exclude from this regression). Given this, the slight decline in coefficients for regressions on most business cycles is not surprising.

The fourth group consists of banks operating only inside New York City. The core group for this regression is identical to the core group for the regression including all banks. The

comparison group is substantially smaller, however, since it excludes most of the banks in the state. The decline in sample size explains the increase in standard errors. Surprisingly, coefficients for half of the regressions remain significant at the 95% level. The magnitudes of all the coefficients are lower than in the full sample. This reflects the fact that in this sample, a substantial share of the comparison group consists large, connected banks listed in Table 3 which did cross the threshold for inclusion in our core group of top-ten largest banks. The top-ten banks did increase capital ratios quicker than banks in the eleven-to-thirty range and the rest of New York City, but the difference was not as dramatic as with smaller banks in the rest of the state.

The last group consists of banks outside of New York City. The "core" top-ten group in this regression consists of banks in the reserve cities of Albany and Buffalo. Only one of these, Manufacturers and Traders-Peoples Trust Company of Buffalo, appears in Table 3. All these banks served as intermediate nodes in the financial network. They provided correspondent services to country-bank clients who found it easier to deal with them than with banks farther away in New York. Banks in these intermediate nodes did increase capital ratios relative to smaller and rural banks during the boom of the 1920s, but the difference in behavior between rural banks and them was much smaller than the difference between rural banks and banks in the money center of Manhattan.

Figure 4 illustrate a series of robustness checks for modern banks. All panels present coefficients on the interaction term of interest from versions of the regression in Table 7, Column 6. All panels present coefficients from regressions for all six business cycle definitions and for sets of regressions in which the core banks are defined as either those with more than $100 billion in assets or more than $250 billion.

Panel 4(a) plots coefficients for regressions using four different definitions of the capital ratio: the common equity ratio, the tier 1 leverage ratio, the tier 1 risk-based ratio, and the total risk-based ratio. For most of these coefficients, we cannot reject the null hypothesis that the coefficients equal zero. In the few cases where the coefficient is rejected, the coefficient is negative, reflecting the fact that large banks' capital ratios remained roughly constant during the boom of the 2000s, while ratios of some small banks rose, particularly using the tier leverage ratio. So, in some specifications, large and small (or core and peripheral) banks' capital ratios appear to diverge. Overall, 4(a) demonstrates that our results do not depend

upon how we measure capital.

Panels 4(b), 4(c), and 4(d) reach the same conclusion for other assumptions underlying our analysis. Panel 4(b) divides the set of regressions examined in 4(a) by business-cycle definition. For most regressions, we cannot reject the null hypothesis that the key coefficient equals zero. There is no systematic difference between the estimates for the different definitions of the cycle. This pattern indicates that our conclusion does not depend upon the definition of the business cycle. Panel 4(c) examines a larger set of regressions, which includes all regressions examined in 4(a) and 4(b) and also regressions on banks where the core is defined as all banks with more than $50 billion in assets. 4(b) divides the regressions by definition of banks at the core of the financial system. For most regressions, we cannot reject the null hypothesis that the key coefficient equal zero. This pattern indicates that our conclusions due not depend upon the way in which we define the core group. Panel 4(d) examines two related set of regressions. The first includes all the regressions in Panels 4(c) estimated only for banks what do not belong to holding companies. The second includes all of those regressions but estimated only for banks operating within holding companies. The coefficients for these two sets of regressions do not differ significantly from each other or from zero. This pattern indicates that our results are not driven by the nature and behavior of holding companies or the differential incidence of holding companies between large and small banks.

4.4 Difference-in-Difference Estimates

To clearly compare capital choices of commercial banks in the past and the present, we pool the sample estimate the following difference-in-difference regression:

$$\begin{aligned} C_{i,t} = \alpha i &+ \delta_{h,b} \cdot \mathbb{I}(SIFI_i) \cdot \mathbb{I}(historic)(cycle_t) \\ &+ \delta_{h,s} \cdot \mathbb{I}(\neg SIFI_i) \cdot \mathbb{I}(historic)(cycle_t) \\ &+ \delta_{h,b} \cdot \mathbb{I}(SIFI_i) \cdot \mathbb{I}(modern)(cycle_t) \\ &+ \delta_{h,s} \cdot \mathbb{I}(\neg SIFI_i) \cdot \mathbb{I}(modern)(cycle_t) \\ &+ X'_{i,t}\beta + \epsilon_{i,t} \end{aligned} \tag{3}$$

where $C_{i,t}$ denotes the capital ratio in the historical or modern sample respectively. αi are bank fixed effects, $X'_{i,t}$ are asset-side bank level controls as in (1). $cycle_t$ denotes that

business cycle measure that runs continuously through the unit interval from trough (=0) to peak (=1). $\mathbb{I}(SIFI_i)$ is a unit dummy when the bank is systemically important, that is for the historical period whether it is among the top 10 banks and in the modern period as to whether it is above the $250bn size cutoff. $\mathbb{I}(\neg SIFI_i)$ is a unit dummy for the complementary set, i.e. all smaller, non-systematically important banks. $\mathbb{I}(historic)$ and $\mathbb{I}(modern)$ are unit dummies respectively for the pre-Great Depression period and the pre-Great Recession period. We run this regression for the six different definitions of the business cycle and for the four modern measures of the capital ratio.

Equation (3) enables us to directly test how the behavior of systemically-important banks relative to smaller banks differed before the Great Depression and Recession. The null hypothesis for this test is $H_{0,3}$ below. Previously, we tested the null hypotheses $H_{0,1}$ and $H_{0,2}$, which asked respectively if the behavior of pre-Depression large and small banks differed and if the behavior of pre-Recession large and small banks differed respectively.

$$\begin{aligned} \mathrm{H}_{0,1} &= (\delta_{h,b} - \delta_{h,s}) = 0 \\ \mathrm{H}_{0,2} &= (\delta_{m,b} - \delta_{m,s}) = 0 \\ \mathrm{H}_{0,3} &= (\delta_{h,b} - \delta_{h,s}) - (\delta_{m,b} - \delta_{m,s}) = 0 \end{aligned}$$

Table 8 summarizes results for the different definitions of business cycle and capital ratio. The smallest coefficient is 2.6. This indicates that banks at the core of the financial system before the Great Depression increased their capital ratios by 2.6 percentage points more relative to the average bank than banks at the core of the financial system did relative to their contemporaries before the Great Recession. The largest coefficient was 5.1. The average coefficient was 4.0. To put these estimates in context, the Bank for International Settlements recommends that nations adopt maximum CCyBs (BCBS, 2010) of 2.5 percentage points. [13] The Fed's maximum CCyB is 2.5 percentage points. So, modern regulatory CCyBs will offset a substantial portion but not the entire distortion induced by modern too-big-to-fail incentives, which discourage banks at the core of financial systems from accumulating the capital buffers which were common practice in the past.

[13] See Basel Committee on Bank Supervision (2010) "Basel III phase-in arrangements" https://www.bis.org/bcbs/basel3/basel3_phase_in_arrangements.pdf.

5 Discussion

The Basel Committee on Banking Supervision recommends that central banks adopt policies generating countercyclical capital buffers for financial institutions at the core of their financial systems. Numerous nations – including those with the worlds' ten largest economies – have done so. To gain insight into the likely impact of these modern CCyBs, we compare the behavior of banks before the Great Depression and Great Recession. During the Roaring 20s, regulations encouraged banks at the core of the financial system to accumulate capital sufficient to operate without interruption during the contraction that followed. These historical CCyBs were as large or larger than the Fed's maximum CCyB today. America's historical experience with CCyBs suggests that modern CCyB's could offset distortion's due to too-big-to-fail policies and induce core banks to hold levels of capital closer to those that they would hold if they faced the consequences of failure. These CCyBs would probably help core banks weather financial crises without government assistance, as their predecessors did in the past.

While historical countercyclical capital buffers seem to have been successful, at least at first glance, our historical analogy raises several red flags. While historical CCyBs helped the core of the financial system weather financial crisis, they did not prevent financial crises from afflicting the periphery. Small banking panics struck the hinterland repeatedly during the 1920s (Jalil 2010). Seven large regional panics erupted during the early 1930s (Mitchener and Richardson, 2019). Historical CCyBs may also not have reduced the frequency of crises at the core. In 1929, 1931, 1933, crises afflicted New York's stock markets and commercial banks. Similar crises occurred about every 20 years in the past (Jalil, 2010). So, while CCyBs might help to keep core banks in operation during crises, they are certainly not a sufficient condition to eliminate these events, may not be a necessary condition, and may in some unanticipated way, be part of the problem. Financial crises recurred regularly in the era when countercyclical capital buffering played a prominent role in bank regulation.

Another red flag is that in the 1930s, regulators, bankers, and policymakers became convinced that rules which induced countercyclical capital buffering and the buffers themselves had pernicious and unintended effects. Their costs outweighed their benefits. So, policymakers eliminated these policies. The most significant changes at the federal level came through the Banking Act of 1935. The act eliminated stockholders' and directors' liability for failures

of banks. The act also assigned to the Federal Deposit Insurance Corporation the role of liquidator for all insured banks. These changes resulted in resolution procedures that favored large relative to small banks (Richardson and Yang, 2019).

The sparse legislative history makes it difficult to precisely describe the rationales underlying these reforms. One concern appears to have been the cost of capital. Regulations that induced capital buffering raised the cost of capital for large financial institutions. High capital costs reduced the quantity of capital held by commercial banks, limited banks' ability to extend loans, prevented them from raising additional capital during the downturn, and slowed the pace of recovery after financial crises. Inhibition of recapitalization was the most frequently discussed concern.

Another concern was the dynamics of deposits in financial networks. Since banks at the core of the financial system accumulated capital during booms, they were the safest place to deposit funds during busts. During most financial crises, deposits fled from the periphery toward the core of the network (Richardson and Van Horn, 2018; Mitchener and Richardson, 2019). This flight to quality reduced credit supplied to businesses and consumers in the hinterland, without an offsetting increase in loan supply at the core, because core banks used the inflow of deposits to raise holdings of cash, bonds, and reserves at the Fed (Mitchener and Richardson, 2019).

It would be useful to understand why after the Great Depression, regulators believed rules that induced countercyclical capital buffering were part of the problem and should be eliminated, while after the Great Recession, regulators believed the lack of the rules that their predecessors discontinued was part of the problem and that those rules should be reinstated. It would also be useful to understand the spectrum of impacts that countercyclical capital buffers might have in general equilibrium. One model along these lines is Diamond and Rajan (2000), which describes potential perverse consequences from macroprudential capital regulation. In their model, capital requirements impact banks' liquidity choices and vice versa. Increasing capital requirements differentially impacts banks facing different liquidity constraints. The greater safety induced by countercyclical capital buffers can have adverse liquidity and distributional consequences. The issues raised in Diamond and Rajan's model resemble regulators' concerns long ago about the complex consequences of capital regulation.

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Tables and Figures

Figure 1: Capital Ratios of Fed Member Banks in Financial Centers, 1920 to 1932

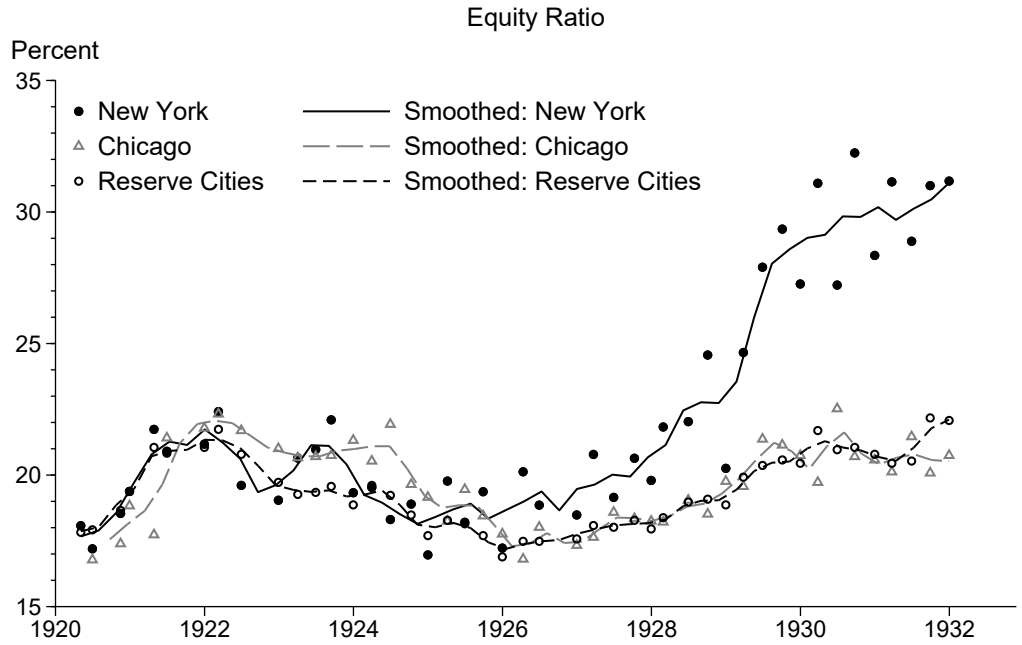


Figure 2: Capital Ratios of Commercial Banks in United States, 2001 to 2011

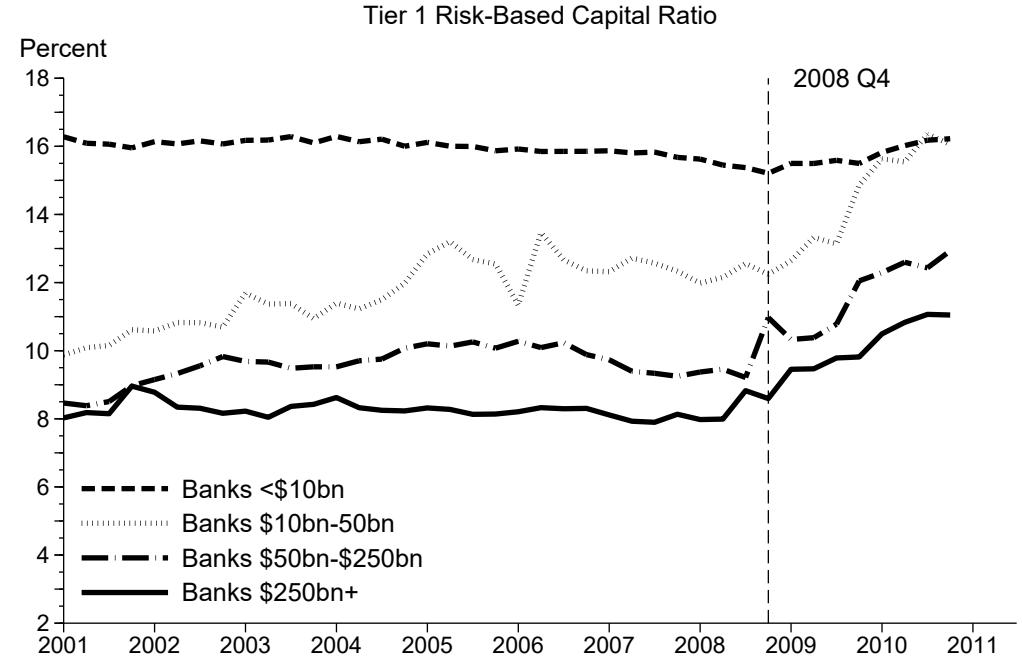
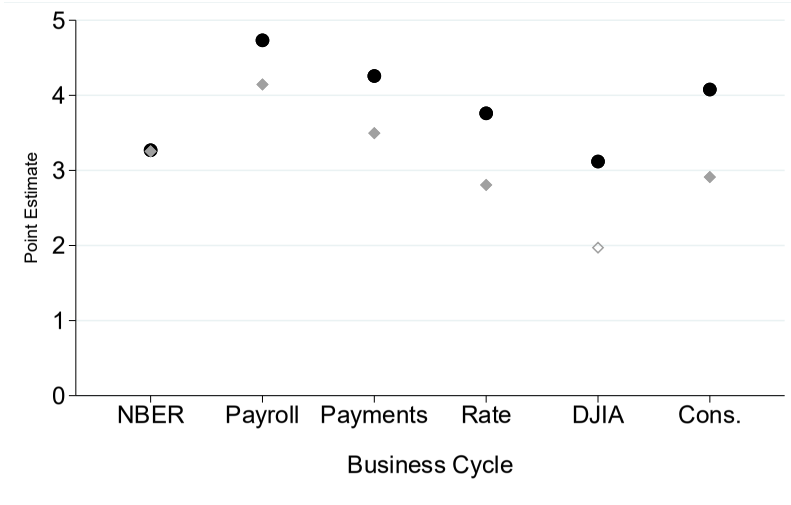
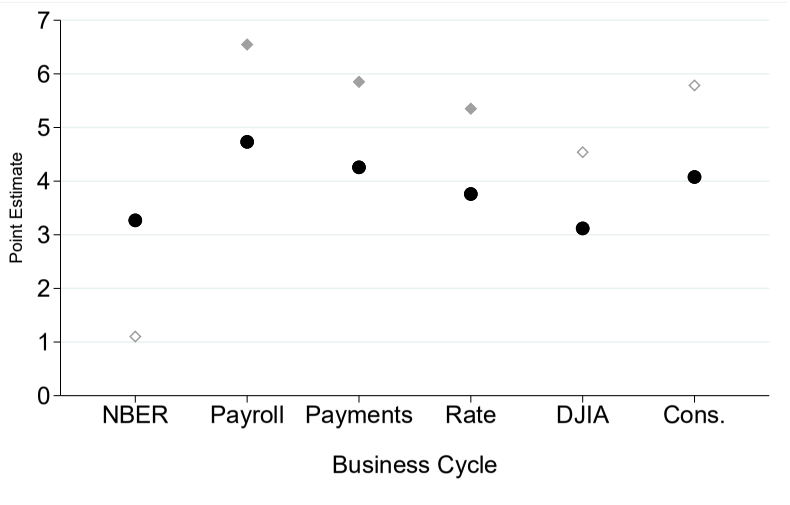


Figure 3: Capital Accumulation of Core Banks During Economic Expansion of the 1920s, Robustness

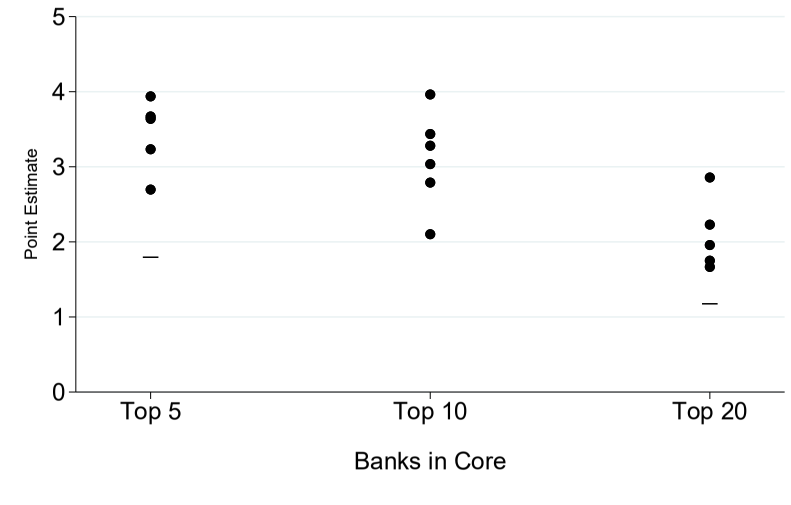
(a) Measures of Centrality and Cycle



(b) Modern versus Historic Measures of Equity



(c) Size Cutoff for Core Banks



(d) Samples Exposed to Similar Shocks

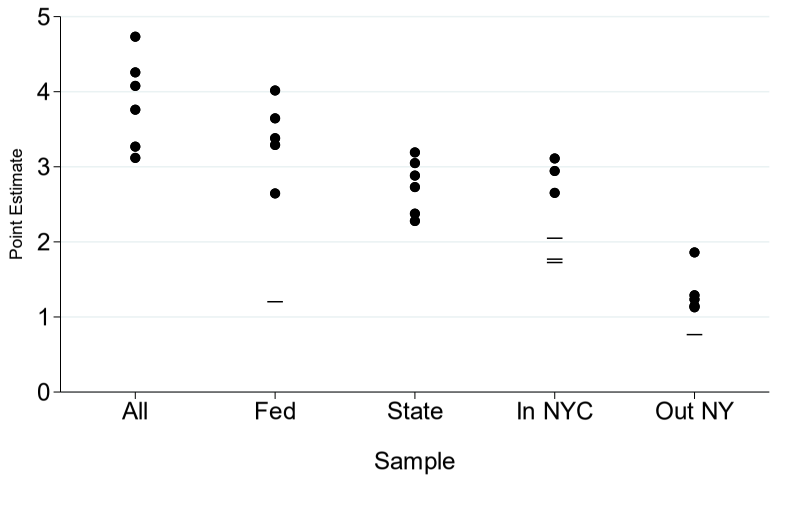
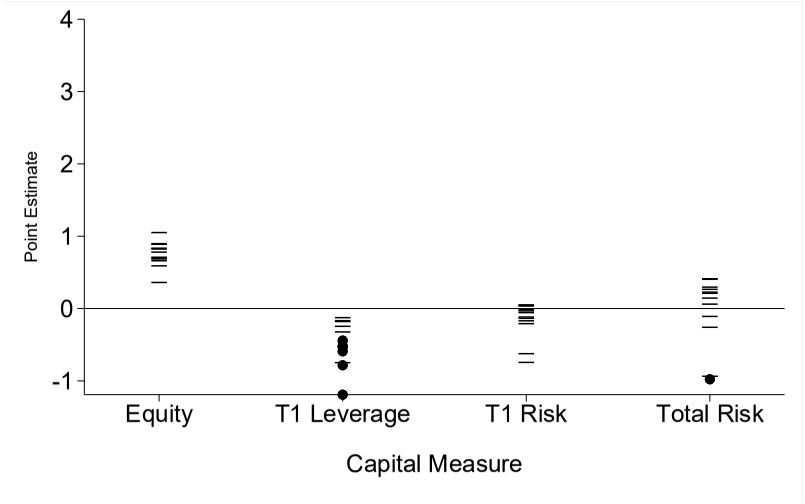
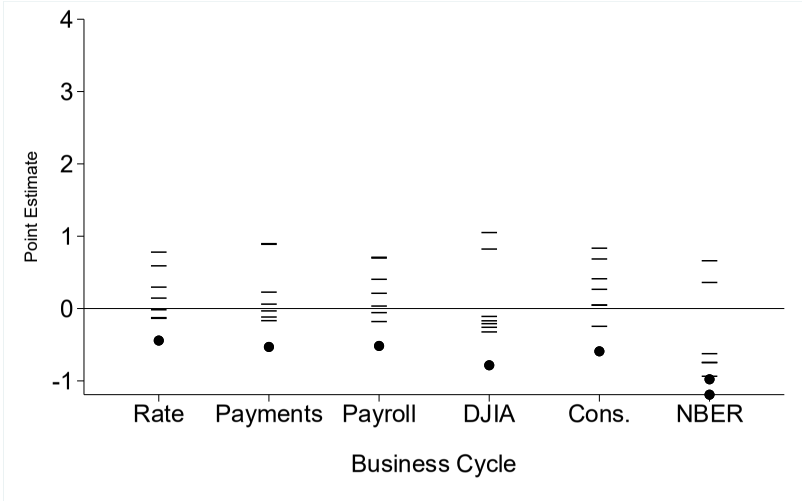


Figure 4: Capital Accumulation of Core Banks During Economic Expansion of the 2000s, Robustness

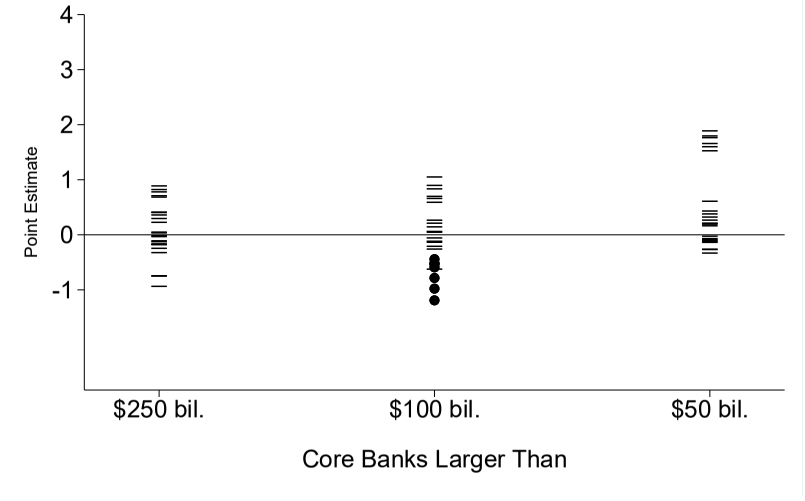
(a) Definition of Equity



(b) Business Cycle Definition



(c) Size Cutoff for Core Banks



(d) Holding Companies

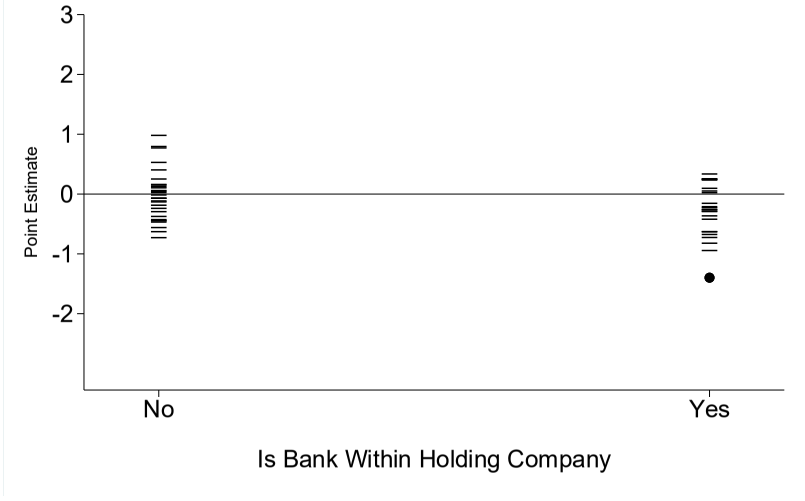


Table 1: Fate of Owners and Executives of Largest Bank Failures During the Great Depression

Bank			Balance Sheet 30 June 1929					
Name	State	Town	Deposits ($ mil.)	Assets ($ mil.)	Date of Suspension	Civil	Criminal	Collateral
Involuntary Liquidations								
Bank of United States	New York	New York	247	308	12/11/1930	a,s	i,c	f,o
Ohio Savings Bank and Trust Co.	Ohio	Toledo	57	72	8/17/1931	a	i	
Bank of Pittsburgh N.A.	Pennsylvania	Pittsburgh	54	71	9/19/1931	a	i	
National Bank of Kentucky	Kentucky	Louisville	49	59	11/17/1930	a,s	i	
Franklin Trust Company	Pennsylvania	Philadelphia	40	52	10/6/1931	a,s	i,c	
Federal National Bank	Massachusetts	Boston	33	39	12/15/1931	a,s	i,c	
Bank of Tennessee / Caldwell & Co.	Tennessee	Nashville	5	7	11/7/1930	a,s	i,c	f,b
Mergers Under Duress								
Peoples Wayne County Bank	Michigan	Detroit	272	322	12/31/1931	a,s	i,c	
First National Bank	Michigan	Detroit	154	182	12/31/1931	a,s	i	
Atlantic National Bank	Massachusetts	Boston	107	142	5/4/1932	a,s		
Foreman-State National Bank	Illinois	Chicago	100	122	6/8/1931	a	i	
Nashville Trust Company	Tennessee	Nashville	40	80	5/5/1931		i,c	f
American State Bank	Michigan	Detroit	40	49	6/2/1931	a,s	i,c	l
Midland Bank	Ohio	Cleveland	33	41	1/12/1932			

Notes: Column "civil" indicates legal actions against the owners and executives in civil court, including assessments, a, and other suits, s, typically to recoup losses due to executives' or directors' negligence. Column "criminal" indicates investigations and indictments, i, undertaken by attorneys general or grand juries in response to the banks' failure and any resulting convictions, c, some of which were overturned on appeal. Column "collateral" indicates legal issues that impacted individuals related to or acquainted with executives at the failed bank including: f, family caught up in suits or has property or funds clawed back or seized through legal processes; b, business partners caught up in dragnet; l, surety company that bonded executive officers found liable for their negligence; o, other including bank superintendents investigated for negligence in supervision of bank.

Sources: Information from historical newspapers accessed via Proquest, regulators' reports, and other sources cited in text.

Table 2: Performance of Core Versus Periphery During the Great Depression

	New York City			United States
	Core	Other Member	Non Member	
	Number of Banks			
June 1929	19	40	29	24,504
Liquidate	0	8	6	5,103
Merge	4	10	6	4,961
December 1932	15	22	17	14,440
	Percent of Banks in June 1929			
June 1929	100.0	100.0	100.0	100.0
Liquidate	0.0	-20.0	-20.7	-20.8
Merge	-21.1	-25.0	-20.7	-20.2
December 1932	78.9	55.0	58.6	58.9

Table 3: Systemically Important Commercial Banks in New York, 31 December 1928

	Name of Bank	Charter	Assets $ mil	Due To $ mil	%DT	%R	Successor Row Table 2
1	Chase National Bank	N	1,421	402	28.3	13.1	1
2	National City Bank	N	1,172	322	27.5	7.8	3
3	Guaranty Trust Company	S	1,050	127	12.1	3.1	1
4	National Bank of Commerce	N	934	289	30.9	5.2	1
5	American Exchange Irving T.C.	S	895	131	14.6	5.2	16
6	Bankers Trust Company	S	773	86	11.1	1.8	D.B.
7	Equitable Trust Company	S	672	73	10.8	1.5	1
8	First National Bank	N	628	206	32.7	1.8	3
9	Manhattan Company	S	538	36	6.8	0.0	1
10	New York Trust Company	S	474	122	25.8	1.2	1
11	Bank of America, New York	N	426	105	24.8	0.9	3
12	Central Union Trust Company	S	402	26	6.5	0.2	1
13	Manufacturers Trust Company	S	390	4	1.1	0.1	1
14	Seaboard National Bank	N	330	116	35.2	1.7	1
15	Chatham and Phenix National Bank	N	330	41	12.3	0.9	1
16	Hanover National Bank	N	321	187	58.4	11.5	1
17	National Park Bank	N	314	82	26.0	7.1	1
18	Corn Exchange Bank	S	313	6	1.8	0.1	1
19	Chemical National Bank	N	289	63	21.8	3.4	1
20	Marine Trust Company, Buffalo	S	267	7	2.5	0.0	7
21	Farmers Loan and Trust Company	S	251	20	8.0	0.0	3
22	Bank of New York And T.C.	S	198	17	8.5	1.7	16
23	Manufacturers and Traders-Peoples Trust Company, Buffalo	S	160	9	5.5	0.0	M&T

Notes: %DT indicates percent of liabilities due to other banks, or (100 * due to)/assets. %R indicates percent of respondents that listed the New York bank in question as a correspondent in a stratified random sample drawn from the September 1928 Polk's Bankers' Encyclopedia. For charter, N indicates national. S indicates state. T.C. indicates Trust Company. Successor indicates modern successor's row number in Table 2. D.B indicates Deutsche Bank.

Sources: See text.

Table 4: Largest Commercial Banks in the United States, 31 December 2007

	Name of Bank	RSSD	Assets $ bil	Due To $ bil	%DT	GI $ bil	%GI
1	JPMorgan Chase Bank, N.A.	852218	1,319	4	0.3	364	27.6
2	Bank of America, N.A.	480228	1,313	7	0.5	354	26.9
3	Citibank, N.A.	476810	1,252	1	0.1	61	4.9
4	Wachovia Bank, N.A.	484422	653	2	0.3	33	5.0
5	Wells Fargo Bank, N.A.	451965	468	2	0.5	55	11.8
6	U.S. Bank, N.A.	504713	233	2	0.9	20	8.7
7	HSBC Bank USA, N.A.	413208	184	0	0.1	19	10.3
8	Suntrust Bank	675332	175	1	0.4	14	7.9
9	FIA Card Services, N.A.	1830035	162	0	0.3	66	40.7
10	National City Bank (Cleveland)	259518	139	0	0.1	7	5.3
11	Regions Bank	233031	137	0	0.0	8	6.0
12	State Street Bank & T.C	35301	134	0	0.0	26	19.7
13	RBS Citizens, N.A.	3303298	129	0	0.4	16	12.1
14	Branch Banking & T.C	852320	128	0	0.0	3	2.4
15	PNC Bank, N.A.	817824	125	0	0.1	13	10.2
16	Bank of New York	541101	116	0	0.1	9	8.0
17	Capital One, N.A.	112837	98	0	0.0	7	7.4
18	Keybank N.A.	280110	96	0	0.0	5	4.8
19	Citibank (South Dakota) , N.A.	486752	79	0	0.4	17	21.4
20	Merrill Lynch Bank USA	1225800	78	0	0.0	18	23.7
21	Chase Bank USA, N.A.	489913	78	0	0.0	9	11.9
22	LaSalle Bank N.A.	455534	74	1	0.9	12	15.9
23	Fifth Third Bank	723112	61	0	0.6	12	19.5
24	Northern Trust Company	210434	58	0	0.1	8	14.7
25	WF National Bank South Central	2362458	30	0	0.0	11	35.4

Source: See text.

Table 5: Dating Business Cycle Expansions

	Information Used to Date Peaks and Troughs					
	NBER	Short-term interest rate	Consumption	DJIA	Volume of Payments	Total Payroll
	(1)	(2)	(3)	(4)	(5)	(6)
	Business Cycles in New York State, 1921 to 1930					
Trough	1927: Nov	1922: Aug	1921: Sep	1921: Aug	1923: Aug	1924: Jul
Peak	1929: Aug	1929: Sep	1930: May	1929: Sept	1929: Oct	1929: Sep
Length in months	21	85	104	97	74	62
	Business Cycles Nationwide, 2001 to 2007					
Trough	2001: Nov	2004: Mar	2003: May	2002: Oct	2003: Jul	2003: Aug
Peak	2007: Dec	2007: Aug	2008: Jun	2007: Oct	2007: Dec	2008: Jan
Length in months	73	41	61	60	52	53

Sources: See text.

Table 6: Capital Ratios of Commercial Banks

	Charter			10 Largest Banks		Largest Decile		Smallest Decile	
	S	N	S+N	Mean	SD	Mean	SD	Mean	SD
1921 Q3	328	471	799	12.1	3.7	13.0	5.7	16.8	5.6
1929 Q4	387	546	933	14.7	2.4	15.2	6.3	16.5	6.5
Δ during boom				2.6		2.2		-0.3	
2001 Q4	5,925	2,138	7,791	8.1	0.7	8.9	4.8	12.6	7.9
2007 Q4	5,629	1,631	6,950	8.2	2.3	9.3	3.9	13.3	7.3
Δ during boom				0.1		0.4		0.7	

Sources: See text.

Table 7: Core Banks Capital Ratios During Economic Expansions

	1920s			2000s		
	(1)	(2)	(3)	(4)	(5)	(6)
SIFI * Cycle	4.11***	3.51***	3.76***	1.26***	0.74	0.71
	(0.45)	(0.45)	(1.05)	(0.48)	(0.48)	(0.72)
SIFI	-0.52	-0.20	-0.25	-1.95***	-1.81***	-1.60***
	(1.55)	(1.54)	(1.05)	(0.52)	(0.51)	(0.52)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Time FE		Yes	Yes		Yes	Yes
Controls			Yes			Yes
SE Robust			Yes			Yes
SE Clustered			Yes			Yes
F Dist	(2, 10436)	(29, 10409)	(33,899)	(2,163416)	(26,163392)	(29,8087)
F Stat	42.48	9.69	229.00	7.79	102.86	106.27
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
# obs.	11,338	11,338	11,338	171,506	171,506	171,506
# calls	28	28	28	25	25	25
# banks	900	900	900	8,088	8,088	8,088

Notes: For 1920s, ratio is book equity divided by assets. For 2000s, ratio is tier 1 capital.
Charters are issued by state governments, S, or national government, N. SD indicates standard deviation.

Sources: See text.

Table 8: Capital Ratio Increases in Core Banks, 1920s versus 2000s

	NBER	Short-Term Interest Rate	Consumption	DJIA	Volume of Payments	Total Payroll
	(1)	(2)	(3)	(4)	(5)	(6)
EQTY	3.21***	3.32***	3.85***	2.56**	3.57***	4.22***
S.E.	(1.16)	(1.11)	(1.34)	(1.22)	(1.08)	(1.02)
T1LR	4.25***	4.06***	4.63***	3.69***	4.48***	4.98***
S.E.	(0.97)	(1.03)	(1.25)	(1.11)	(1.01)	(0.96)
T1RB	3.72***	4.28***	4.34***	3.70***	4.56***	5.14***
S.E.	(1.15)	(1.04)	(1.23)	(1.16)	(0.89)	(0.88)
TRBR	3.55***	3.74***	3.92***	3.43***	4.00***	4.49***
S.E.	(1.15)	(1.02)	(1.31)	(1.20)	(0.94)	(0.97)