Working Paper Series No.2018-2

The Impact of the 2008 Financial Crisis and Regulation Reforms on Loan Growth: Evidence from the Effect of Capital and Liquidity

Chi-Chun Liu, Stephen G. Ryan and Szu-Jung Wu

Chung-Hua Institution for Economic Research
75 Chang-Hsing Street, Taipei, Taiwan,
Republic of China

The Impact of the 2008 Financial Crisis and Regulation Reforms on Loan Growth: Evidence from the Effect of Capital and Liquidity

Chi-Chun Liu, Stephen G. Ryan, Szu-Jung Wu

January 2018

--
*本研究由中華經濟研究院提供研究補助。

The Impact of the 2008 Financial Crisis and Regulation Reforms on Loan Growth: Evidence from the Effect of Capital and Liquidity

Abstract

In the wake of the 2008 financial crisis, bank behavior and banking supervision have been criticized, prompting a series of regulations, such as the Dodd–Frank Act and Basel III reforms. Focusing on the periods before and after the 2008 financial crisis, this study examines whether the lending behavior of banks changed after the 2008 crash. We use a sample composed of U.S. bank holding companies during the period from 2001Q2 to 2015Q1 and find that the effect of capital ratio on loan growth declines dramatically after the financial crisis while the effect of liquidity increases compared to the pre-crisis period. Our results suggest that after the financial crisis, lending behavior may be restricted by the banks themselves and by the stricter regulations.

Keywords: 2008 financial crisis, Loan growth, Lending behavior, Capital adequacy, Liquidity, Dodd–Frank Act, Basel III

1. Introduction

The 2008 financial crisis resulted in enormous losses both in the U.S. and around the world, causing regulators and the public to ask the question: what's wrong with the banking industry and what were the causes of the financial crisis? In the period before the financial crisis, because of tough competition in the lending market, lenders relaxed their lending standards[1] and provided loans to less creditworthy borrowers. These so-called "subprime loans" grew rapidly and ultimately resulted in the financial crisis when the housing bubble burst. In addition to subprime mortgages, the growth of other types of loans (*e.g.*, commercial and industrial loans) also showed an upward trend during the period 2004–2007.[2]

Lending plays a crucial role in the real sector's production and is highly associated with a nation's economic growth (Dell'Ariccia, Detragiache, and Rajan, 2008; Campello, Giambona, Graham, and Harvey, 2011; Miller, Hoffer, and Wille, 2016; Brown and Earle, 2017). Thus, lending information is typically regarded as an important economic indicator. If a country's overall lending is weak or loan growth is slow, the reason might be that banks are less willing to lend or that the demand for loans is weak. Both signal a deteriorating economic environment and an uncertain outlook. While a faster loan growth rate is desirable, if the rate is too rapid, it might signal a higher credit risk. A 1997 study by the Federal Deposit Insurance Corporation (FDIC) called "History of the Eighties—Lessons for the Future" identified three stages

[1] From 1964, the Federal Reserve started to conduct a quarterly-based survey, named the Senior Loan Officer Opinion Survey on Bank Lending Practices, to collect the quarterly change in lending standards and terms, to determine the reason why banks loosen or tighten their standards, to determine the demand of lending, and also to analyze factors that might affect banks' lending behavior, such as regulation changes and economic environment changes. According to this survey, lending standards and terms eased during 2003–2006 because of aggressive competition with other banks and non-bank financial institutions. The survey files are available at: https://www.federalreserve.gov/BoardDocs/snloansurvey/.

[2] Refer to the Assets and Liabilities of Commercial Banks in the United States H.8 Historical Information released by The Federal Reserve. Available at: https://www.federalreserve.gov/releases/h8/current/default.htm.

of a bank's failure and connected a bank's failure with rapid loan growth. However, despite the knowledge of this relation between rapid loan growth and credit failure, it did not prevent the 2008 financial crisis. Other literature also indicates that loan growth might affect banks' future performance and that it is highly correlated with banks' credit risk (Clair, 1992; Keeton, 1999; Foos, Norden, and Weber, 2010; Kohler, 2012; Amador, Gomez-Gonzalez, and Pabon, 2013; Pakhchanyan and Sahakyan, 2014; Fahlenbrach, Prilmeier, and Stulz, 2016).

Because of the enormous losses from the crisis, banks themselves might be more cautious with their operating strategies, including lending strategy, which is usually the core of a bank's operation. Additionally, to prevent another crisis, regulators enacted new rules to provide an overall supervisory mechanism for the banking industry and to maintain financial stability. The main regulations were the Dodd–Frank Wall Street Reform and Consumer Protection Act (the Dodd–Frank Act) and the Basel III reforms.[3] The Dodd–Frank Act, which can be viewed as the most important regulation reforms of financial institutions in the U.S. stemming from the crisis, set new rules to restrict banks' lending behavior directly, such as enhancing consumer protection, ensuring borrowers' ability to repay loans, and requiring additional disclosures. From the lessons of the financial crisis, regulators also realized that when banks encountered sudden and enormous losses, such losses might lead to a liquidity problem in the bank. Therefore, in addition to regulations directly relating to lending behavior, regulators also emphasized the importance of capital requirements and liquidity. For instance, the Dodd-Frank Act emphasized the importance of capital and liquidity and required the Federal Reserve to conduct stress tests of financial institutions. The Federal Reserve also approved implementation of the Basel III capital standards to ensure that banks

[3] The Dodd–Frank Act was enacted in July 2010 and Basel III was implemented in December 2010 (a revised version was published in July 2011).

have a strong capital position and liquidity rules to strengthen the liquidity of large financial institutions.

Due to these regulatory changes, banks might also become more cautious when devising their lending strategies. Some have argued that banks' lending behavior is not as aggressive as that before the financial crisis and that banks have started to care more about their risk control because banks have to follow more rigorous rules. For example, an article in Forbes in 2013 claimed that banks were more cautious with lending due to the new regulations, which resulted in stricter capital requirement, tighter lending limits, and stricter information disclosures.[4] The U.S. president, Donald Trump, also described the Dodd–Frank Act as a "disaster"[5] because the Dodd–Frank Act reduced banks' willingness to lend, and thus rolled it back.[6] However, this claim was not substantiated by the growth in lending[7] and, furthermore, others argued that banks have started to behave in the same way as before the financial crisis. For example, the Los Angeles Times reported in 2014 that "*The largest U.S. banks have lowered their standards for some of the riskiest lending in a sign that weak underwriting is returning to levels seen before the 2008 financial crisis … A particular area of concern is commercial real estate, as examiners cited rapid growth and uncertain collateral.*"[8]

---

[4] Refer to the article "Banks Are Not Lending Like They Should, and With Good Reason" in Forbes, published on May 30th, 2013, by Richard Finger. https://www.forbes.com/sites/richardfinger/2013/05/30/banks-are-not-lending-like-they-should-and-with-good-reason/#15204719519f.

[5] President Trump said, "Dodd–Frank is a disaster" during a session with reporters as he signed an executive order slashing government regulation on February 3rd, 2017.

[6] "*We expect to be cutting a lot out of Dodd–Frank, because frankly I have so many people, friends of mine, that have nice businesses and they can't borrow money. They just can't get any money because the banks just won't let them borrow because of the rules and regulations in Dodd–Frank,*" Trump said in announcing the review of Dodd–Frank on February 3rd, 2017.

[7] For example, "Banks are Lending a Ton, Despite Trump's Claims," by Matt Egan, CNN Money, February 13th, 2017. Egan wrote "*Business lending did take a hit during the 2008 Wall Street meltdown. However, lending bottomed out after the Great Recession ended and bank loans to businesses have nearly doubled from the low.*" Available at: http://money.cnn.com/2017/02/13/investing/bank-business-lending-dodd-frank-trump/.

[8] "Banks Loosen Lending Standards to Levels Seen Before Financial Crisis," by Peter Foley, Los Angeles Times, December 16th, 2014.

Supporting this viewpoint, the Federal Reserve's survey[9] reports that banks and, in particular, larger banks started to ease their lending standards and terms from 2010 onwards. Loan growth also slightly increased from 2012 onwards according to the Federal Reserve's information.[10]In addition, the Federal Reserve chairwoman, Yellen, also claimed that there is no clear evidence to associate the increasing regulation with the reduction of loan availability when she rebutted the criticism that economic growth has been hindered by the regulation reform after the crisis.[11] This leads to the question of whether banks really changed their lending behavior after the financial crisis because they have learned lessons from the crisis or because they have to follow the new regulations.

Loan growth is important, and thus not only regulators and banks themselves care about it, but investors, equity analysts, and credit agencies are also concerned with loan-related information (*e.g.*, Zemel, 2015; Fahlenbrach et al., 2016). To understand more about lending and its growth, the question should be "what would be taken into account when banks decide on lending strategies?" The prior literature provides evidence that such factors might include internal factors—such as capital level, liquidity, and credit risk—and external factors, such as monetary policy changes, economic outlook, and competition from other banks (Berger and Udell, 2004; Gambacorta and Marques-Ibanez, 2011; Laidroo, 2012; Carlson, Shan, and Warusawitharana, 2013; Kapan and Minoiu, 2016). Hence, we are interested in what might lead to the growth in lending and whether the financial crisis really influenced the loan growth and changed banks' lending behavior. More specifically, in this study,

[9] The Senior Loan Officer Opinion Survey on Bank Lending Practices conducted by the Federal Reserve.

[10] Refer to the Assets and Liabilities of Commercial Banks in the United States H.8 Historical Information released by The Federal Reserve.

[11] Refer to "Yellen Warns Against Erasing Regulations Made After Financial Crisis" by Binyamin Appelbaum, The New York Times, August 25th, 2017. Available at: https://nyti.ms/2w45pxm.

we examine the determinants of loan growth and, in particular, focus on whether the determinants of loan growth show different patterns during the pre- and post-crisis periods.

To investigate the determinants of loan growth and to examine the effect of the financial crisis on these determinants, we use the data composed of U.S. bank holding companies during the period 2001Q2 to 2015Q1. We first examine the determinants of loan growth during this period and find that capital ratio, liquidity, profitability, and GDP change are positively related to loan growth while credit risk and bank size are negatively related to loan growth. Second, we use a subsample composed of observations from before the financial crisis (2001–2006) and from after the financial crisis (2011–2015)[12] to examine whether the determinants affect loan growth differently before and after the financial crisis by using a regression model. We particularly focus on the effect of capital and liquidity on lending growth. Banks with a higher capital level are usually regarded as having greater ability to lend and thus a higher capital level will increase banks' lending portfolios. The prior literature also shows a positive relation between capital ratio and loan growth (Berrospide and Edge, 2010; Laidroo, 2012) and that lending for well-capitalized banks would be less sensitive during the crisis or a tightened monetary period (Gambacorta and Mistrulli, 2004; Gambacorta, 2005; Gambacorta and Marques-Ibanez, 2011). Additionally, the capital level is a measure of the banks' ability to absorb the potential losses resulting from banks' exposure, which was a major reason why banking regulators, such as the U.S. Federal Reserve and the Basel Committee, emphasized the importance of capital

[12] After the financial crisis, the banking-related regulators released many new rules, most which were announced in 2010, and thus the effect of the new regulations might start from then and be more obvious from the year 2011. For instance, the Dodd–Frank Act was released on July 10th, 2010, and the Basel III was released in December 2010. Besides, taking SFAS No. 166 and No. 167 into consideration, the definition of loan might be different between 2009 and 2010 and affect the results, and thus we exclude the observations of 2010 and use the year 2011 as the starting year of the post-crisis period.

and proposed enhancing the minimum capital requirement in order to strengthen banks capital holding after the financial crisis. Another purpose of enhancing capital requirements is to reduce the rapid asset growth. The prior literature also shows evidence that capital requirement will affect lending growth because banks might cut their lending after the capital requirement was enhanced (Bridges, Gregory, Nielsen, Pezzini, Radia, and Spaltro, 2014; Gropp, Mosk, Ongena, and Wix, 2016). Thus, because of the lessons from the financial crisis and the stricter capital regulations, banks might tend to hold more capital available in order to protect themselves and to meet the government requirement and further, affect their willingness to lend. Even those banks with relatively sufficient capital and higher capital ratio might also be reluctant to lend. Therefore, we predict and confirm that after the financial crisis, the effect of capital ratio on loan growth will decline.

Like capital adequacy, regulators emphasized the liquidity ability after the financial crisis. In fact, before the financial crisis, the regulations (*e.g.*, Basel II) focused primarily on capital requirements, but the liquidity standards were emphasized less even though liquidity played a very important role in banks' operations. Thus, because the 2008 financial crisis is also regarded as having been a liquidity crisis, the regulators wanted to strengthen banks' capital to minimize the liquidity concern.[13] Liquidity can measure a bank's ability to generate new loans and to react to crises.[14] If banks have higher liquidity or sufficient and stable funding sources, their loan growth will be less restricted even during the crisis (Dahl, Shrieves, and Spivey, 2002; Gambacorta and

[13] "*Capital provides a measure of assurance to the public that an institution will continue to provide financial services even when losses have been incurred, thereby helping to maintain confidence in the banking system and minimize liquidity concerns*," cited from the FDIC Risk Management Manual of Examination Policies Section 2.1 Capital.

[14] "*Liquidity reflects a financial institution's ability to fund assets and meet financial obligations. Liquidity is essential in all banks to meet customer withdrawals, compensate for balance sheet fluctuations, and provide funds for growth*," cited from the FDIC Risk Management Manual of Examination Policies Section 6.1 Liquidity and Funds Management.

Marques-Ibanez, 2011; Kapan and Minoiu, 2016). In addition to enhancing banks' liquidity by strengthening banks' capital, Basel III set minimum liquidity standards to urge banks to hold more high-quality liquid assets and to maintain a stable funding profile related to their assets and off-balance-sheet activities. The Federal Reserve also proposed and finalized the liquidity rules based on Basel III and the Dodd–Frank Act to enhance U.S. banks' liquidity position. In order to meet the even stricter liquidity standards, banks might change their lending behaviors. Cornett, McNutt, Strahan, and Tehranian (2011) find that banks with more illiquid assets will tend to increase their liquid assets and thus decrease their lending. Bonner (2012) and Banerjee and Mio (2014) find no evidence that banks lending will be affected by liquidity requirements. However, the new liquidity standards (*e.g.*, the Net Stable Funding Ratio requirements of Basel III) might increase the funding and capital costs and thus, make banks more cautious with their current liquidity and funding position when devising their lending strategy. Additionally, because of the experiences during the crisis, banks might also give more weight to their liquidity positions when making lending decisions after the crisis. Therefore, we hypothesize and document the evidence that liquidity will play a more important role in lending growth after the 2008 global financial crisis.

This study contributes to the literature on loan growth, especially on the effect of the 2008 financial crisis on the determinants of loan growth. We provide evidence that after the financial crisis, lending determinants have different impacts on credit change, and thus that the regulations implemented after the financial crisis do, in fact, impact the banks' lending strategy and restrict the rapid loan growth. The evidence shows that the effect of capital ratio on lending growth declines dramatically after the financial crisis while the impact of liquidity on lending growth increases compared to the pre-crisis periods. These results also imply that banks' response to capital requirements

and liquidity requirements might be different. More specifically, to meet stricter capital requirements, banks will limit their lending behavior and thus reduce their future loan growth. On the other hand, under more rigorous liquidity standards, banks tend to adjust their liquid assets holdings but not decrease their lending. We also investigate whether larger banks showed different patterns of loan growth determinants compared with smaller banks and find that the effects of stricter capital requirement and new liquidity standards on lending growth during the post-crisis period are not only for larger banks but also for relatively smaller banks. Furthermore, our results indicate that the negative incremental effect of capital ratio on loan growth is more relevant for banks with a higher level of capital ratio and less so for banks with a higher liquidity position when we consider that the effect might be nonlinear. For the effect of liquidity ratio on credit growth, we also find that the positive effect would be stronger if banks are well-capitalized.

The remainder of this paper is as follows. Section 2 describes the regulations, the relevant literature, and hypotheses development. Section 3 describes the data and empirical methodology, and the empirical results are discussed in Section 4. The conclusion is in Section 5.

2. Regulations, Relevant Literature, and Hypotheses Development

2.1 Regulations

After the financial crisis, the mechanism of supervising banks was extensively discussed. To maintain financial stability, to rebuild market confidence in financial institutions, and to avoid a similar crisis happening again, the U.S. regulators implemented many new rules to restrict banks' lending behavior, to provide more opaque information, and to strengthen banks' ability to absorb potential credit losses. In 2010, the Dodd–Frank Act was announced. This act, which aimed to provide overall

supervision of the banking industry, can be viewed as the most important set of regulations for financial institutions in the U.S. after the financial crisis.[15] To approach the goals regarding financial stability, the Dodd–Frank Act required the establishment of the Financial Stability Oversight Council (FSOC) in order to identify risks that might affect financial stability, to promote market discipline, and to react to any emerging instability in the financial market. The Dodd–Frank Act also provides many regulations to directly limit banks' lending behavior and to provide consumer protections, for example, the Mortgage Reform and Anti-Predatory Lending Act. In 2014, the Consumer Financial Protection Bureau (CFPB) released the mortgage lending guidelines "Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act" (ATR/QM rule), which require lenders to consider and verify a number of different underwriting factors, such as a mortgage applicant's assets or income, debt load, and credit history, and to make a reasonable determination that a borrower will be able to pay back the loan.[16] The U.S. government wanted to use stronger lending limits to prohibit unfair and irresponsible lending and to protect the consumers of financial institutions.

On the other hand, regulators also aimed at strengthening the banks' ability to absorb the potential credit losses. In 2009, the Financial Accounting Standard Boards (FASB) issued SFAS No. 166 "Accounting for Transfers of Financial Assets—an amendment of FASB Statement No. 140" and SFAS No. 167 "Amendments to FASB Interpretation No. 46(R),"[17] both of which were effective after November 15th, 2009.

[15] The main purpose of the Dodd–Frank Act is "*To promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'too big to fail', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes.*" (cited from the Dodd–Frank Wall Street Reform and Consumer Protection Act, full version)

[16] See Appendix B (Part II) for more details.

[17] SFAS No. 166 and No. 167 removed the concept of qualifying special-purpose entities (QSPEs) and amended the consolidation requirements for variable interest entities (VIEs). That is, the new accounting

These two new standards require banks to consolidate off-balance-sheet securitization, which might lead to more opaque information of banks assets and riskiness. The FDIC expected that these two new accounting standards would increase banks' capital requirements and they released a draft proposal to invite comments regarding whether an enhancement of capital requirement is necessary in order to better connect capital requirement with risk disclosure.[18] Although Basel II "International Convergence of Capital Measurement and Capital Standards" was announced in 2004 and was implemented before the crisis, the Dodd–Frank Act re-emphasizes the importance of the capital requirements not only through the rules[19] but also by the real supervisory examination. According to the Dodd–Frank Act, the Federal Reserve is required to conduct an annual supervisory stress test of so-called "covered companies,"[20] and all financial companies with more than $10 billion in total consolidated assets that are supervised by a primary federal financial regulatory agency are required to conduct company-run stress tests at least annually.[21] The Federal Reserve adopted rules implementing these requirements in October 2012.[22] Through the stress test, regulators can confirm that banks have enough capital to absorb their potential losses, which are related to their risk exposure under different scenarios. Almost at the same time as the Dodd–Frank Act was published, the Basel Committee on Banking

---

treatment requires banks to consolidate off-balance-sheet securitization and would reduce banks' benefits from securitizing their loans.

[18] Refer to the article on accountingWEB (http://www.accountingweb.com/) on August 27th, 2009, which said, "*Federal Deposit Insurance Corporation (FDIC) directors agreed at their August 26th board meeting that following implementation of Statements of Financial Accounting Standards Nos. 166 and 167 in January 2010, banking organizations affected by the new accounting standards generally will be subject to higher minimum regulatory capital requirements.*" Available at: http://www.accountingweb.com/aa/standards/fdic-expects-fas-166-and-167-to-increase-bank-capital-requirements.

[19] For example, "Sec. 171. Leverage and Risk-Based Capital Requirements" of the Dodd–Frank Act.

[20] "Covered companies" include any bank holding company with total consolidated assets of $50 billion or more and each non-bank financial company that the FSOC has designated for supervision by the Federal Reserve.

[21] Refer to Sec. 165 (i) Stress Test of the Dodd–Frank Rules.

[22] In fact, the U.S. Federal Reserve has conducted a supervisory capital assessment program on 19 major banks, such as JPMorgan Chase and Citigroup, in early 2009.

Supervision released the new Basel Accord (*i.e.*, Basel III) to enhance the capital adequacy requirement and to emphasize liquidity standards. In 2013, the Federal Reserve approved the final rules that implemented the Basel III capital standards to ensure that banks have a strong capital position. Besides capital regulations, the Federal Reserve and FDIC also developed proposed rules of liquidity standards based on Basel III and the Dodd–Frank Act.[23] In summary, after the 2008 financial crisis, the rules for capital requirement and liquidity became much stricter than those before the financial crisis.

2.2 Relevant Literature

Lending is the core operating business of banks, and thus, loan growth is the most important part of a bank's operation strategies. Loan growth is also regarded as an important measure of credit risk. Foos et al. (2010) use data from individual banks from 16 major countries during 1997 to 2007 to investigate the relation between loan growth and the riskiness of banks and find that loan growth is an important driver of riskiness. Much prior literature also suggests that loan growth is related to future profits and riskiness (Kohler, 2012; Skala, 2012; Amador et al., 2013; Pakhchanyan and Sahakyan, 2014; Fahlenbrach et al., 2016).

The prior literature suggests that loan growth or a bank's lending behavior can be determined by internal factors—such as capital requirement, funding and liquidity, and credit risk or loan quality—and by external factors, such as economic growth or monetary policy. For the external determinants, Laidroo (2012) investigated lending growth determinants and cyclicality by using banks from 15 CEE countries during the

[23]. The proposed liquidity rules was developed by the Federal Reserve and FDIC and released to invite comments in October 2013. The U.S. LCR rule was finalized in September 2014 and will apply to large banking organizations. On April 26th, 2016, the FDIC and the OCC issued a notice of proposed rulemaking to implement the net stable funding ratio (NSFR). See Appendix B (Part III) for more details of Basel III and U. S. implementation.

period 2004–2010 and finds that the effect of loan growth determinants will depend on the economic environment and that monetary policy shows a negative relation with loan growth. Meder (2015) investigated the effect of marketable security holdings under SFAS 115[24] on monetary policy and finds that the interaction between monetary policy and the accounting standards will result in different impacts on loan growth. Curry, Fissel, and Ramirez (2008) and Kupiec, Lee, and Rosenfeld (2017) also suggest that bank supervision will have a significant negative effect on loan growth. However, Berger and Udell (2004) use individual U.S. banks during 1980–2000 to investigate whether a bank's lending increases as time passes since the bank's last loan deterioration after controlling for business cycles and other supply-and-demand factors, and find that banks' internal behavior might be the most important driver of loan growth.

Internal factors, such as credit risk, profitability, and capital, are related to loan growth. Cole (2012) provides evidence that bank profitability and business lending show a strong and significant negative relation, while Laidroo (2012) finds a positive relation between loan growth and profitability. Since loan growth is regarded as a crucial measure of credit risk, the relation between loan growth and credit risk has been examined by prior analyses, and a negative effect of credit risk on lending has been documented previously (Altunbas, Gambacorta, and Marques-Ibanez, 2009; Tracey, 2011; Laidroo, 2012; Cucinelli, 2016). Other than the determinants mentioned above, capital and liquidity, as well as funding ability, are the most addressed in the literature.

There is a significant effect of capital on loan growth. Kishan and Opiela (2000) used U.S. commercial banks' Call Report data from 1980 to 1995 to investigate bank

[24] Statement of Financial Accounting Standards No. 115 "Accounting for Certain Investment in Debt and Equity Securities."

loan supply shifts and they find that the effect of monetary policy on loan growth is dependent upon the bank size and its capital-to-asset level. Gambacorta (2005) investigates a sample of Italian banks and shows that after monetary tightening, well-capitalized banks decrease their lending less than other banks. Gambacorta and Mistrulli (2004) show that capital is important for different types of lending shock because of the existence of regulatory capital constraints and imperfections in the market for bank fund-raising. Berrospide and Edge (2010) study the lending of large bank holding companies and they find that the effect of the capital ratio on loan growth is positive but small. Carlson et al. (2013) use a sample composed of individual banks' Call Report data from 2001 to 2011 to examine the effect of capital ratios on bank lending growth. Their results show that capital ratios have positive effects on loan growth, but this relation is significant only during and shortly after the 2008 financial crisis. They also find that the effect of the capital ratio on loan growth is stronger during the periods of loan contraction than during periods of loan expansion. Gambacorta and Marques-Ibanez (2011) also find evidence that capital affected the loan growth during the 2008 financial crisis. However, there are also some studies that show that enhancing the capital requirement might result in a decrease in lending growth because banks will choose to cut their lending rather than enhance their capital holding to meet the requirement (Hyun and Rhee, 2011; Bridges et al., 2014; Gropp et al., 2016).

The funding and liquidity ability of banks is another crucial factor of loan growth because it can measure a bank's ability to generate new loans. Dahl et al. (2002) and De Haas and Van Lelyveld (2010) show that loan growth at banks affiliated with holding companies is less constrained by capital availability because they are supported by parent holding companies. De Haas and Van Lelyveld (2010) also suggest

that multinational bank subsidiaries with financially strong parent banks are able to expand their lending more rapidly. Cremers, Huang, and Sautner (2011) also find that capital allocations from headquarters will make a bank's loan growth less sensitive to their deposit base. Additionally, using a set of country-level data, Aysun and Hepp (2016) find that funding cost is negatively related to banks' lending growth. Loutskina and Strahan (2009) examine the mortgage applications and originations under provisions of the Home Mortgage Disclosure Act and suggest that securitization might reduce the effect of lenders' financial constraints on lending supply. Altunbas et al. (2009) used a large sample of European banks to investigate the effect of securitization on bank lending. They find that securitization can shelter banks' lending in the event of monetary tightening by increasing banks' liquidity and reducing banks' funding needs and can strengthen banks' capacity to generate new loans. Gambacorta and Marques-Ibanez (2011) also show that securitization can be viewed as a kind of funding source and can increase loan growth. The evidence of both Altunbas et al. (2009) and Gambacorta and Marques-Ibanez (2011) suggest that liquidity is crucially and positively related to lending growth. Cornett et al. (2011) analyzed data composed of U.S. commercial banks during the financial crisis and find that banks with more illiquid assets on their balance sheet will tend to increase their holding of liquid assets and thus decrease their lending.

After the 2008 financial crisis, the relation between lending behavior and the financial crisis has been discussed. Ho, Huang, Ling, and Yen (2016) discuss the possible reasons for the 2008 global financial crisis. They use a sample of U.S. depository institutions and investment banks from 1994 to 2009 and find evidence that banks with an overconfident CEO are more likely to weaken lending standards and to generate more loans during the pre-crisis period, thus making them more vulnerable to

the shock of the crisis. Others discuss whether the lending behavior changed because of the crisis. Cole (2012) used U.S. commercial bank data from 1994–2011 to examine the effect of the financial crisis and lending, and shows that lending declined after the financial crisis, in particular, lending to small businesses. Deyoung, Gron, Torna, and Winton (2015) investigate the lending behavior of community banks with assets of less than $2 billion during the period 1991–2010 and show that U.S. community banks greatly reduced their lending to small and medium enterprises during the crisis. Ramcharan, Verani, and Van den Heuvel (2016) use the data regarding the U.S. credit union industry and find that the financial crisis results in a credit supply shock to consumers. The previously mentioned literature also suggests that stronger capital and sufficient liquidity can prevent loan growth from decreasing dramatically even during the crisis (*e.g.*, Cornett et al. (2011), Gambacorta and Marques-Ibanez (2011), and Carlson et al. (2013)). Moreover, Ivashina and Scharfstein (2010) investigated syndicated lending behavior during the financial crisis and find that banks with more deposits cut their lending less during the crisis period. Their results suggest that funding availability is one of the key determinants of banks' lending strategies and that if banks have a higher liquidity risk, then they cut lending to a greater degree than the relatively healthier banks during the financial crisis. Calem, Covas, and Wu (2013) examine the effect of the 2007 shock on the jumbo mortgage lending market and find that banks that are more dependent on the secondary market and are less well-capitalized decrease their lending dramatically. Kapan and Minoiu (2016) examined the role of a bank's balance sheet strength during the financial crisis and find that banks with stronger balance sheets were better able to maintain lending during the crisis. More specifically, banks with higher dependence on market funding reduce their loan supply more than other banks during the crisis, but this effect is mitigated by

higher and better-quality capital. However, Berrospide (2013) finds that banks tend to hold more liquid assets for the future losses from securities write-down and more than one-fourth of the reduction in bank lending during the crisis might be because of this "precautionary motive hypothesis."

2.3 Hypotheses Development

Whether banks learned the lessons and changed their behavior after the financial crisis has been widely discussed in the years since Lehman Brothers declared bankruptcy in 2008. Some argue that banks have modified their behavior since the financial crisis while some say that banks still behave just like before. Despite some arguments that banks behave in the same way as they did before the financial crisis, we have observed a relatively lower credit growth rate after the financial crisis.[25] The lessons from the financial crisis might be a reason why banks limit their lending and maintain a relatively lower loan growth rate during the post-crisis period. Some also argue that banks have changed their behavior because of the new regulations, such as the stricter capital requirements, the tighter lending limits, and the stricter information disclosures.

To maintain the financial stability and to strengthen banks' capital, capital requirement is one of the most addressed points in the regulations because it measures the ability of the banks to absorb the potential losses from credit exposure and the ability to lend. The prior literature suggests a positive relation between capital ratio and loan growth (*e.g.*, Berrospide and Edge, 2010 and Laidroo, 2012). If banks have more capital, their lending will be less restricted, even during the crisis (Gambacorta and Marques-Ibanez, 2011; Calem et al., 2013; Carlson et al., 2013; Kapan and Minoiu,

[25] Refer to the Assets and Liabilities of Commercial Banks in the United States H.8 Historical Information released by The Federal Reserve. Available at: https://www.federalreserve.gov/releases/h8/current/default.htm.

2016) or during the period of monetary policy tightening (Gambacorta and Mistrulli, 2004; Gambacorta, 2005). The Dodd–Frank Act re-emphasizes the importance of capital and conducting stress tests to ensure that banks have enough capital to absorb their losses even under stressful scenarios. In the meantime, Basel III also emphasized the importance of capital and proposed enhancing the minimum capital requirements in a stepwise fashion.[26]

Both the lessons from the financial crisis and the stricter capital regulations might let banks care more about their capital holdings to ensure they have enough ability to absorb their potential credit losses and to meet the requirements, and thus, change their lending behavior. Some prior studies find evidences that the higher capital requirement might result in a reduction in lending (Bridges et al., 2014; Gropp et al., 2016), which is another goal of the regulators. Additionally, although prior literature shows a positive relation between capital ratio and lending growth, Carlson et al. (2013) find that this positive relation is only significant during and shortly after the financial crisis. Hence, we speculate that even though higher capital ratio will bring in higher loan growth, the effect might be lower after the financial crisis compared to that before the financial crisis. Therefore, our first hypothesis is as follow:

H1: After the financial crisis, the effect of capital ratio on loan growth will decrease.

On the other hand, banks' liquidity ability represents the ability to fund assets and to generate new loans. Prior studies suggest that banks' liquidity is positively related to loan growth (Cornett et al., 2011; Aysun and Hepp, 2016). Additionally, the 2008 financial crisis has been regarded as a liquidity crisis, which might also let banks give more weight to liquidity when making lending decisions. The evidences from prior

[26] See Appendix B for the implementation timeline of minimum capital requirements under Basel III.

literature also support that if banks have higher liquidity or a greater capital source, their loan growth will be less sensitive even during the crisis (Dahl et al., 2002; Ivashina and Scharfstein, 2010; Gambacorta and Marques-Ibanez, 2011; Kapan and Minoiu, 2016). Although liquidity plays an important role in banks and banks' lending, the banking regulators focused primarily on capital requirement before the financial crisis. Due to the 2008 crisis, regulators and financial institutions recognized that liquidity was also important and could not be ignored. Thus, regulators not only emphasized the importance of liquidity but also set standards in order to require banks to hold more high-quality liquid assets and to ensure a more stable funding source.[27]

Under the new liquidity standards and requirements, banks might be more concerned about their liquidity position and thus affect their lending supply. Cornett et al. (2011) find that banks with more illiquid assets on their balance sheet will tend to increase their liquid assets holding and thus decrease their lending. However, Bonner (2012) uses 26 Dutch banks during 2008–2011 to investigate the effect of liquidity requirements similar to the Basel III Liquidity Coverage Ratio (LCR) and suggest that the design of the LCR might not have a negative impact on lending. Consistent with Bonner (2012), Banerjee and Mio (2014) use U.K. banks to examine the effect of tighter liquidity regulations and find no evidence that banks reduce their lending supply to meet the requirement. Their results show that banks tend to replace claims on other financial institutions with cash, central bank reserves, and government bonds to meet the liquidity requirements.

Even though some find no evidence that stricter liquidity requirements might affect the lending supply, the even stricter liquidity standards might increase the banks'

[27] "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems" (July 2011 version) included the concept of liquidity standards. For the more detailed liquidity standards, the Basel Committee also released "Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools" in 2013, and "Basel III: The Net Stable Funding Ratio" in 2014.

funding and capital cost.[28] For example, the minimum standard of the Net Stable Funding Ratio aims to limit the overreliance on short-term wholesale funding, which is viewed as a relatively cheap funding source.[29] Thus, if banks decide on a loan growth strategy, their current liquidity position will be more important since the future potential liquidity becomes uncertain. The evidence of Cornett et al. (2010) also implies that banks' current poor liquidity position will lead to a decrease in loan growth. In other words, if banks' current liquidity ability is better, future lending growth might be stronger. Hence, not only because of the new liquidity requirements but also because of banks' recognition of the importance of liquidity, we argue that the importance of liquidity to lending growth might be enhanced after the financial crisis. According to the above, we argue that after the financial crisis, capital level and liquidity will lead to different effects on banks' loan growth compared to that before the financial crisis. The second hypothesis, therefore, is as follow:

H2: After the financial crisis, the effect of liquidity on loan growth will increase.

3. Data and Research Methodology

3.1 Data

To investigate the loan determinants of loan growth and whether they show a different effect on loan growth during the pre- and post-crisis periods, we use the data collected from the Bank Holding Company Database of the Bank Regulatory dataset.[30] We start the sample selection from all U.S. bank holding companies' (BHCs') quarterly data during the period from 2001 to 2015.[31] After deleting firms whose fiscal year

[28] Refer to the article, "A Defining Moment" of J.P.Morgan, which discusses the effect of Basel III and focuses on the liquidity standards. The article is available at: https://www.jpmorgan.com/country/US/EN/insights/treasury-services/liquidity-regulations.

[29] Refer to "Basel III: The Net Stable Funding Ratio "issued in 2014.

[30] The Bank Regulator dataset is from the Wharton Research Data Service (WRDS). This dataset provides financial data from bank holding companies included in the FRY-9 reports.

[31] Because the capital requirement-related data, such as total risk-based capital ratio and tier 1 capital ratio, were only available after 2001 on the Bank Regulatory dataset.

does not end on December 31st, observations that cannot be combined with the CRSP dataset,[32] and observations with missing values, the final sample is composed of 20,560 bank-quarters data for 585 bank holding companies during the period 2001Q2 to 2015Q1. Among these 585 bank holding companies, 305 bank holding companies include observations from during both the pre- and post-crisis periods. We also collect the U.S. GDP data of the Bureau of Economic Analysis, which is an agency of the U.S. Department of Commerce. The federal funds rate data are collected from the Federal Reserve Bank Reports database on the WRDS platform.[33] The sample used in the regression test was winsorized by 1% to mitigate the effect of outliers. Table 1 shows the sample selection process in detail.

[Insert Table 1]

3.2 The Empirical Model

We first run a preliminary test for determinants of loan growth during the period 2001–2015 based on the entire sample data. The variables of loan growth determinants were selected based on the prior literature, such as Gambacorta and Marques-Ibanzez (2011), Laidroo (2012), and Ho et al. (2016). Furthermore, to investigate the different effects before and after the financial crisis, we use a subsample that only contains observations before the crisis (2001–2006) and after the crisis (2011–2015).[34] We

[32] The Y9-C report should be filed by all bank holding companies (BHCs) with consolidated total assets worth $500 million or more. However, some of the BHCs might be another BHC's subsidiary. For example, J.P. Morgan Equity Holdings, Inc. operates as a BHC and also operates as a subsidiary of JPMorgan Chase & Co., which is another BHC. Thus, in order to limit the sample to only containing the parent holding companies, only the CRSP dataset is used, which provides the stock market data, to obtain the listed BHCs.

[33] This WRDS interest rates database is based upon the Federal Reserve Board's H.15 release that contains selected interest rates for the U.S. Treasuries and private money market and capital market instruments.

[34] We do not include observations during the financial crisis, which is usually defined as the period 2007–2009. Additionally, after the financial crisis, the U.S. regulators released many new rules, and most of them were announced in 2010, and thus the effect of the new regulations might start from then and be more obvious from 2011. For instance, the Dodd–Frank Act was released on July 10th, 2010. In addition, taking SFAS No. 166 and No. 167 into consideration, the definition of loan might be different between 2009 and 2010 and affect the results. Thus, we exclude the observations of 2010 and use the

incorporate a dummy variable, *After*, which is equal to 1 for the period after the financial crisis (2011-2015) and zero for the period before the financial crisis (2001-2006). Thus, the regression model for our main test is:

$$\Delta Ln(Loan)_{\mathrm{i,t}} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times After + \beta_4 \times TCR_{i,t-1} \times After + \beta_5 \times LIQR_{i,t-1} \times After + Controls + Controls \times After + \varepsilon_{i,t}.$$

(Model 1)

where $\Delta Ln(Loan)_{\mathrm{i,t}}$ is the proxy for loan growth, which is defined as the change in the natural log of the bank holding companies' net loan holding, that is, $Ln(Loan)_{\mathrm{i,t}} - Ln(Loan)_{\mathrm{i,t-1}}$ (Gambacorta and Marques-Ibanez, 2011; Carlson et al., 2013). Net loan is defined by loans net of allowance.[35] The total risk-based ratio is used as the proxy for capital ratio, which is denoted as $TCR_{i,t-1}$ (Kupiec et al., 2017). $LIQR_{i,t-1}$ is the proxy for liquidity, which is calculated as the ratio of liquid assets to total assets.[36] The liquid assets are defined as cash and balance-due from depository institutions plus held-to-maturity securities and available-for-sale securities (Altunbas et al., 2009; Gambacorta and Marques-Ibanez, 2011). *Controls* is a vector of variables included to control for some bank-specific characteristics. $NPLR_{i,t-1}$ is the proxy for loan quality and is defined as the ratio of non-performing loans (NPLs) to total gross loans (Carlson et al., 2013; Ho et al., 2016). $SIZE_{i,t-1}$ is calculated as the natural log of total assets (Tamirisa and Igan, 2008; Gambacorta and Marques-Ibanez, 2011). $ROA_{i,t-1}$ is used as the proxy for a bank's profitability (Cole, 2012; Laidroo, 2012). We also control for

sample starting from 2011 as the post-crisis sample, but if the observations of 2010 are included, the results are still similar.

[35] The loans and leases held for sale are not included here, since banks usually classify these loans as other assets in their financial reports, for example, the Citigroup.

[36] We did not use the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) as the liquidity measures but used the traditional measure of liquidity according to the prior literature. Additionally, some of the prior literature also includes or only uses the deposit ratio as another proxy for liquidity and funding, such as Gambacorta and Marques-Ibanez (2011) and Cole (2012). We also include the deposit ratio in the model for robustness and find that the results are similar and that the effect of the deposit ratio on lending is much weaker or even insignificant compared to the effect of the liquid asset ratio when both are incorporated into the model.

banks' book leverage, denoted as $LEV_{i,t-1}$, which is defined as the ratio of book equity to total assets (Dahl et al., 2002).[37] Following the prior literature to control for previous loan growth because of the persistence of loan growth, we also include $\sum_{j=1}^{4} \Delta Ln(loan)_{i,t-j}$ in our empirical model (Berrospide and Edge, 2010; Carlson et al., 2013; Meder, 2015).[38] Since lending is significantly correlated with the macroeconomic environment, we also include the change in GDP as a control variable, denoted as ΔGDP_{t-1} (Tamirisa and Igan, 2008; Altunbas et al., 2009; Tan, 2012). The monetary policy is also a crucial determinant of lending, and thus, the change of federal funds rate, which is denoted as $\Delta FedFundr_{t-1}$, is included in order to control for the change in monetary policy (Gambacorta and Marques-Ibanez, 2011). The variable definitions are presented in detail in Appendix A.

Because we suspect that the effect of capital will decrease while the effect of liquidity will increase after the financial crisis, we are interested in the coefficients of $TCR_{i,t-1} \times After$ (β_4) and $LIQR_{i,t-1} \times After$ (β_5) and we predict that $\beta_4 < 0$ and $\beta_5 > 0$.

4. Empirical Results

4.1 Descriptive Statistics

The descriptive statistics of the sample data are presented in Table 2. Panel A shows the basic financial information of bank holding companies of the sample. The average assets are $26,700 million with $24,100 million in liabilities and $2,518 million in equity. The average total loans are about $12,300 million while the average net loan is

[37] Because of the concern that this proxy might also capture the similar effect of capital ratio on loan growth and influence our results, we also redo the regression test by excluding this proxy and find that the results are not affected.

[38] Some of the prior literature only controls for loan changes during the two prior periods (*e.g.*, Carlson et al., 2013, and Meder, 2015). However, according to the preliminary test of loan growth determinants, we found that the pervious periods' loan growth might have an effect for at least four periods. Thus, we include four previous periods' loan growth as the controls. We also do a robustness test controlling for only two prior periods' loan growth, and the results are similar.

about $11,700 million. Average NPLs are around $352 million while net income is about $50 million. Panel A also shows the financial information before and after the financial crisis and on average, the total assets after the financial crisis ($36,857 million) are about twice that before the financial crisis ($17,692 million). The average net loan is about $14,821 million after the financial crisis while the average net loan is about $8,315 million before the financial crisis. Average NPLs after the financial crisis are about $574 million, which is much higher than that before the financial crisis. Panel B shows the descriptive statistics of variables used in the regressions. The average loan change rate is 2% with a minimum of −9% and a maximum of 26%, and after the financial crisis, the average loan growth rate is less than that during the pre-crisis period (1.5% after the financial crisis and 3.1% before the financial crisis on average), which is consistent with the hypothesis that lending growth is lower after the financial crisis than that before the crisis. The average capital ratio is 0.14 with values of 0.136 before the financial crisis and 0.155 after the crisis. The average leverage is 0.096. The average liquidity ratio is 0.25 and after the financial crisis, the liquidity ratio is slightly higher than that before the crisis (*i.e.*, 0.26 before the crisis and 0.27 after the crisis).[39]

[Insert Table 2]

Table 3 shows the Pearson correlations of the regression variables. Previous loan growth is positively related to current loan growth, and this persistence can last for at least one year. The book leverage (equity-to-asset ratio), capital ratio, and ROA are positively related to loan growth while size and NPL-to-loan ratio are negatively related to loan growth. For the macroeconomic determinants, GDP change shows a

[39] The mean differences of all the variables used in regressions are tested and all the variables show a 1% significant difference between the pre-crisis and post-crisis periods.

positive correlation with loan change while the change in the federal funds rate shows a negative association with loan growth.

[Insert Table 3]

4.2 Preliminary Test: Determinants of Loan Growth

Table 4 presents the results of the loan growth determinants during 2001–2015 by using all 20,560 bank-quarter observations. The capital ratio, ROA, and liquidity ratio are positively related to loan growth, while size and NPL ratio show a negative relation with loan growth. The persistence of loan growth is also documented in our results. Taking column (4) as an example, the coefficient is 0.0761 (*t*-statistic = 8.38), 0.0606 (*t*-statistic = 6.85), 0.0377 (*t*-statistic = 4.38), and 0.0826 (*t*-statistic = 9.62) for periods *t-1, t-2, t-3,* and *t-4,* respectively. In summary, banks' capital level, liquidity, profitability, and loan quality or potential credit risk are significantly related to the bank's loan growth strategy. Furthermore, loan growth is persistent for a period of at least one year.

[Insert Table 4]

4.3 Main Test: Determinants of Loan Growth during the Pre- and Post-Crisis Periods

Table 5 presents the results of loan growth determinants before versus after the financial crisis. We are especially interested in the effect of the capital ratio and liquidity ratio after the financial crisis and thus we focus on the coefficients of $TCR_{i,t-1} \times After$ (β_4) and $LIQR_{i,t-1} \times After$ (β_5). Columns (1–3) show the results with the year fixed effect.[40] According to our results, a positive relation between loan growth and capital ratio exists before the financial crisis. For example, the coefficient of $TCR_{i,t-1}$ (β_1) is 0.2818 (*t*-statistic = 7.19) in column (1) and 0.3632 (*t*-statistic =

[40] Year mean adjusted on regression variables was used as the year fixed effect in this study.

8.43) in column (3). However, a negative incremental relation can be observed by the coefficient of $TCR_{i,t-1} \times After$ (β_4), that is, the coefficient is −0.0928 (*t*-statistic = −2.55) in column (1) and −0.32 (*t*-statistic = −5.94) in column (3). The result is consistent with hypothesis H1, which stated that after the financial crisis, the effect of capital ratio on credit growth decreases. The results also indicate that the effect of capital ratio is still positive but not as significant as that before the crisis. Taking column (3), for example, a 1% increase in the capital ratio will result in a 0.04% increase in lending growth after the crisis ($\beta_1 + \beta_4$ is 0.0432 with *t*-statistic = 1.03), which is much less than that during the pre-crisis period and is also statistically insignificant ($\beta_1$is 0.3632 with *t*-statistic = 8.43). Additionally, although the literature suggests a positive relationship between liquidity and loan growth (*e.g.,* Altunbas et al., 2009, and Gambacorta and Marques-Ibanez, 2011), our results find no significant effect of liquidity during the pre-crisis period. However, after the financial crisis, the effect of liquidity on lending increases; for example, the coefficient of $LIQR_{i,t-1} \times After$ (β_5) is 0.0227 (*t*-statistic = 2.42) in column (2) and 0.0631 (*t*-statistic = 5.70) in column (3), which is also consistent with hypothesis H2. This positive incremental effect also results in a much stronger relation between liquidity and lending after the financial crisis; for example, a 1% increase in liquidity ratio will result in a 0.06% increase in credit growth ($\beta_2 + \beta_5$ is 0.0625 with *t*-statistic = 6.25). These results suggest that liquidity becomes a more crucial determinant of credit growth after the crisis relative to that before the crisis. Columns (4–6) show the results with a model that does not incorporate the year fixed effect and the results are similar to columns (1–3).[41]

[Insert Table 5]

[41] All the variables used in our regression test have been winsorized by 1%. For robustness, we also estimate our regression model by dropping 1% outliers and the results are similar to our main results.

4.4 Robustness Tests

For the robustness tests, first, we use a subsample that only includes banks with observations in both the pre- and post-crisis periods to redo our main test. Table 6 shows the results. Similar to our main results, after the financial crisis, the effect of the total risk-based capital ratio on loan growth decreases. For example, the coefficient of $TCR_{i,t-1} \times After\ (\beta_4)$ is −0.2862 (*t*-statistic = −4.86) in column (3), which is consistent with hypothesis H1. The effect of liquidity on lending growth increases after the financial crisis. For example, the coefficient of $LIQR_{i,t-1} \times After\ (\beta_5)$ is 0.0619 (*t*-statistic = 5.47) in column (3). We also find that for those banks that existed from the pre-crisis period to the post-crisis period, the effect of liquidity on loan growth is insignificant before the financial crisis. Columns (4–6) present the results without controlling for year fixed effect and the results are similar.

[Insert Table 6]

Loan growth might result from bank holding companies' natural growth and merger and acquisition (M&A) activity. Thus, for the second set of robustness tests and to mitigate the concern that these two types of loan growth might be different and may influence the results, we use two methods: (1) we exclude observations with a total equity increase of more than 10% and (2) we exclude observations with non-loan asset growth exceeding 10%.[42] By excluding observations with equity growth more than 10% (columns (1–3) of Table 7), we find that after the financial crisis, the effect of capital ratio decreases (*e.g.*, coefficient of $TCR_{i,t-1} \times After\ (\beta_4)$ = −0.2452, *t*-statistic = −5.30 in column (3)), while the effect of liquidity increases (*e.g.*,

[42] Foos et al. (2010) define M&A activity as the total equity increases of more than 40%, which corresponds to the 95%-quantile of equity growth rate distribution. Based on this prior literature, we exclude 1,365 observations with equity growth higher than 10%, and these observations account for about 6% of our full sample. Additionally, Meder (2015) excludes observations with non-loan asset growth of more than 10% to mitigate the concern of M&A activity. Following Meder (2015), we exclude 3,308 observations, which is about 16% of our full sample.

coefficient of $LIQR_{i,t-1} \times After$ (β_5) = 0.0524, *t*-statistic = 5.53 in column (3)). The results of excluding observations with non-loan asset growth of more than 10% are shown in columns (4–6) and are also similar to our original results.

[Insert Table 7]

Thirdly, when testing the determinants before and after the financial crisis, we only incorporate data from during the pre-crisis period and during the post-crisis period, and thus we further test all 20,560 bank-quarter observations and an expanded model to estimate the results.[43] The expanded model is as follows:

$$\Delta Ln(Loan)_{i,t} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times Crisis + \beta_4 \times TCR_{i,t-1} \times Crisis + \beta_5 \times LIQR_{i,t-1} \times Crisis + \beta_6 \times After + \beta_7 \times TCR_{i,t-1} \times After + \beta_8 \times LIQR_{i,t-1} \times After + Controls + Controls \times Crisis + Controls \times After + \varepsilon_{i,t}. \quad \text{(Model 2)}$$

Crisis is set to 1 during the crisis period (2007–2009) and zero otherwise. Table 8 presents the results of loan growth determinants over time. After the financial crisis, the relation between capital ratio and loan growth is much weaker than that during the pre-crisis period, and even during the financial crisis, because of the larger negative effect after the financial crisis. For example, the coefficient of $TCR_{i,t-1} \times After$ is −0.2978 (*t*-statistic = −6.24) in column (3). After the financial crisis, liquidity seems to be more important to lending compared to that before the crisis. For example, the coefficient of $LIQR_{i,t-1} \times After$ is 0.0599 (*t*-statistic = 6.13) in column (3). In sum, our two hypotheses are supported.

[Insert Table 8]

[43] This robustness test includes the observations from 2010 as the post-crisis observations. And thus, in this model, the indicator variable *After* is equal to one if during 2010-2015, and zero if during 2001-2006.

Additionally, the results of Table 8 also show that the effect of capital ratio on loan growth decreases while the effect of liquidity ratio increases during the crisis period. Thus, to mitigate the concern that our results might capture the effect of a trend over time but not the effect of the financial crisis, we also include a variable, *Time*, which is to capture the time effect and is equal to 1 for 2001, 2 for 2002, 3 for 2003, and so on, and we redo our test using the following model:

$$\Delta Ln(Loan)_{i,t} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times After + \beta_4 \times TCR_{i,t-1} \times After + \beta_5 \times LIQR_{i,t-1} \times After + \beta_6 \times Time + \beta_7 \times TCR_{i,t-1} \times Time + \beta_8 \times LIQR_{i,t-1} \times Time + Controls + Controls \times After + Controls \times Time + \varepsilon_{i,t}. \quad \text{(Model 3)}$$

The results are shown in Table 9. After the financial crisis, the effect of capital ratio on lending growth is significantly decreased (*e.g.*, the coefficient of $TCR_{i,t-1} \times After$ is −0.4888 (*t*-statistic = −3.18) in column (2)) and the effect of liquidity on loan growth increases after the financial crisis (*e.g.*, the coefficient of $LIQR_{i,t-1} \times After$ is 0.0505 (*t*-statistic = 1.67) in column (2)) after controlling for the time-trend effect. In sum, our original results might not only influenced by the time trend.

[Insert Table 9]

Moreover, the 2008 financial crisis showed the market and regulators that large banks were not as safe as they thought, and once those large financial institutions encounter sudden and enormous losses, it can lead to a crisis. Thus, the Dodd–Frank Act was set to provide a stable financial system and to end this "too big to fail" problem, which might lead to a significant impact on large financial institutions. For example, according to the Dodd–Frank Act, all financial companies with more than $10 billion in total consolidated assets that are supervised by a primary federal financial regulatory agency are required to conduct company-run stress tests at least

annually to ensure their capital is sufficient to meet their potential losses. Additionally, the new liquidity standard rules primarily apply to large banks,[44] and thus might urge large financial institutions to invest more in their liquidity and to cut their lending. Hence, to further test whether large banks are especially affected, we redo our test using the following expanded model:

$$\Delta Ln(Loan)_{i,t} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times After + \beta_4 \times TCR_{i,t-1} \times After + \beta_5 \times LIQR_{i,t-1} \times After + \beta_6 \times Large + \beta_7 \times TCR_{i,t-1} \times Large + \beta_8 \times TCR_{i,t-1} \times Large \times After + \beta_9 \times LIQR_{i,t-1} \times Large + \beta_{10} \times LIQR_{i,t-1} \times Large \times After + Controls + Controls \times After + Controls \times Large + Controls \times Large \times After + \varepsilon_{i,t}. \quad \text{(Model 4)}$$

Large is defined as 1 if a bank's total consolidated asset size is more than $10 billion and zero otherwise.[45] The results are presented in Table 10 and show that the effect of capital ratio decreases (*e.g.*, the coefficient of $TCR_{i,t-1} \times After$ (β_4) is -0.3289 with *t*-statistic = -5.4 in column (2)), while the effect of liquidity increases after the financial crisis (*e.g.*, the coefficient of $LIQR_{i,t-1} \times After$ (β_5) is 0.0582 with *t*-statistic = 4.64 in column (2)). Our results also show that there is no significant difference in the incremental effect between large banks and other banks (*e.g.*, the coefficient of $TCR_{i,t-1} \times Large \times After$ (β_8) is 0.1263 with *t*-statistic = 0.9 in

[44] According to the U.S. proposed rule of liquidity standards, both LCR and NFSR would not apply to community banking and savings institutions. The Chairwoman of the Federal Reserve, Yellen, also said that large banks have shifted to a more stable mix of financing due to the regulation change after the financial crisis when she rebutted the criticism of the financial regulation on August 25th, 2017 (refer to "Yellen Warns Against Erasing Regulations Made After Financial Crisis" by Binyamin Appelbaum, The New York Times, August 25th, 2017).

[45] According to the Dodd–Frank Act, the Federal Reserve is required to conduct an annual supervisory stress test of bank holding companies with total consolidated assets of $50 billion or more, and all financial companies with more than $10 billion in total consolidated assets that are supervised by a primary federal financial regulatory agency are required to conduct company-run stress tests at least annually. Hence, we use the consolidated assets of US$10 billion as the threshold of large BHCs and define the indicator variable. About 15% of the observations of our sample are classified as large BHCs.

column (2); the coefficient of $LIQR_{i,t-1} \times Large \times After$ (β_{10}) is 0.0191 with *t*-statistic = 0.65 in column (2)). The results are consistent with our main results.

[Insert Table 10]

Furthermore, Carlson et al. (2013) suggest that the impact of capital ratio on credit growth is nonlinear, and thus we also modify our Model 1 by incorporating an indicator variable, *Well*, which is equal to 1 if well-capitalized and zero otherwise. Well-capitalized is defined as total risk-based capital ratio exceeding 15%.[46] The modified model is as follows:

$$\Delta Ln(Loan)_{i,t} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times After + \beta_4 \times TCR_{i,t-1} \times After + \beta_5 \times LIQR_{i,t-1} \times After + \beta_6 \times Well + \beta_7 \times TCR_{i,t-1} \times Well + \beta_8 \times TCR_{i,t-1} \times Well \times After + \beta_9 \times LIQR_{i,t-1} \times Well + \beta_{10} \times LIQR_{i,t-1} \times Well \times After + Controls + Controls \times After + Controls \times Well + Controls \times Well \times After + \varepsilon_{i,t}. \quad \text{(Model 5)}$$

Table 11 presents the results. Columns (1–4) are the results that define well-capitalized as lagged *TCR* exceeding 15% while columns (5–8) use average *TCR* of the prior two years to define the indicator variable.[47] The effect of capital ratio on credit growth declines dramatically after the financial crisis, especially for well-capitalized banks. For example, the coefficient of $TCR_{i,t-1} \times After$ is -0.3426 (*t*-statistic = -4.09) and the coefficient of $TCR_{i,t-1} \times Well \times After$ is -0.2471 (*t*-statistic = -1.90) in column (8). Additionally, consistent with our hypothesis 2, the effect of liquidity ability on lending growth is enhanced after the financial crisis, and this positive effect will also be stronger if banks are defined as well-capitalized. In column (8), for example,

[46] In our sample, the average total risk-based capital ratio is 14%, and 13.6% (15.5%) during the pre-crisis (post-crisis) period. Although most regard banks with total risk-based capital ratio as well-capitalized, we define 15% as well-capitalized and do the test. For robustness, we also run the test using 12% as the threshold and obtain similar results.

[47] The well-capitalized observations account for about 29% of our sample if well-capitalized is defined as lagged *TCR* exceeding 15% and for about 26% if well-capitalized is defined as prior-two-years average *TCR* exceeding 15%.

the coefficient of $LIQR_{i,t-1} \times After$ is 0.0317 (*t*-statistic = 2.28) and the coefficient of $LIQR_{i,t-1} \times Well \times After$ is 0.0959` (*t*-statistic = 3.32).

[Insert Table 11]

We also further consider the nonlinear effect of liquidity on loan growth and thus divide our sample into two groups: one is with a liquidity ratio higher than the quarterly mean of the liquidity ratio and the other is those with a ratio less than the mean. We re-estimate our results by using the following model:

$$\Delta Ln(Loan)_{\mathrm{i,t}} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times LIQR_{i,t-1} + \beta_3 \times After + \beta_4 \times TCR_{i,t-1} \times After + \beta_5 \times LIQR_{i,t-1} \times After + \beta_6 \times High + \beta_7 \times TCR_{i,t-1} \times High + \beta_8 \times TCR_{i,t-1} \times High \times After + \beta_9 \times LIQR_{i,t-1} \times High + \beta_{10} \times LIQR_{i,t-1} \times High \times After + Controls + Controls \times After + Controls \times High + Controls \times High \times After + \varepsilon_{i,t}. \quad \text{(Model 6)}$$

High is equal to 1 if the liquidity ratio is higher than the quarterly mean and zero otherwise. The results are shown in Table 12. The effect of liquidity on loan growth is positive and after the financial crisis, this positive effect increases for both high- and low-liquid banks (*e.g.*, in column (4), coefficient of $LIQR_{i,t-1} \times After$ is 0.052 (*t*-statistic = 2.05) and $LIQR_{i,t-1} \times High \times After$ is 0.0134 (*t*-statistic = 0.39)). Moreover, consistent with our hypothesis 1, the effect of capital ratio on credit growth decreases after the crisis. However, this negative incremental effect will be less for banks with relatively high liquidity than that for banks with a relatively low liquidity position.

[Insert Table 12]

Additionally, banks' behavior during the period right after the financial crisis (2010–2012) might still be influenced by the crisis and thus banks' lending may be affected due to the lessons from the crisis but not directly due to the policy change;

therefore, we use the year 2013 as the onset of the post-crisis period and redo our main test.[48] More specifically, we re-define an indicator variable *After1* as 1 if during 2013–2015 and zero if during 2001–2006.[49] The results show that the effect of capital ratio on loan growth decreases and the effect of liquidity on lending growth increases after the financial crisis. Both are similar to our main results and are consistent with our hypothesis. Furthermore, since the prior literature suggests that loan sales and securitization might affect banks' lending strategy by providing additional funding sources or transferring credit risk from banks (*e.g.*, Altunbas et al. (2009) and Gambacorta and Marques-Ibanez (2011)), we first take the secondary market activity of loans into consideration by including a dummy variable, *DAS*, which is equal to 1 for banks with loan sales and securitization activity and zero otherwise to control for the securitization activity and re-estimate our main regression model. Secondly, although our main tests have excluded the observations of 2010, to mitigate the concern that the effect of SFAS No. 166 and No. 167 on loan definition might still influence our results, we drop all the observations with securitized assets and redo our main test. Both results are robust and similar to our original results.

Finally, we carry out other robustness tests by changing proxies. We first change the loan definition by including loans held-for-sale into total loans and re-calculating the loan growth rate to redo our test, and the results are similar to our original results. Additionally, in our main test, we do not classify banks' loans into different loan types. However, because of the concern that different loan types might show different patterns of their loan growth determinants and different effects of the financial crisis,

[48] Cukierman (2013) documents that since the Lehman Brothers' collapse in 2008, credit growth in the U.S. declined dramatically until 2012. And according to the Federal Reserve information H.8, loan growth has slightly increased from 2012. Thus, we choose 2013 as another onset of post-crisis period.

[49] That is, a subsample that only contains observations during 2001Q2-2006Q4 and 2013Q1-2015Q1 is used in this robustness test.

we divide banks' total loans into two types: (1) loans secured by real estate (real estate loans) and (2) other loans.[50] We calculate the growth rate of these two loan types and re-estimate Model 1, which shows that the re-estimated results are similar to the main results, especially for the loans secured by real estate. We also use the tier 1 risk-based capital ratio (*Tier1R*) as the capital ratio, and obtain a similar result to that when using the total risk-based ratio, for example, the coefficient of $Tier1R_{i,t-1} \times After$ is −0.2829 (*t*-statistic = −5.40) if we change *TCR* into *Tier1R* and re-estimate Model 1.

5. Conclusions

The 2008 financial crisis resulted in enormous losses and destroyed global financial stability, and thus made regulators, bankers, and the markets rethink the supervision of the banking industry. Before the financial crisis, the lending increased greatly and the loan growth rate was even higher, which is regarded as an important cause of the 2008 financial crisis. Many new regulations, such the Dodd–Frank Act and the Basel III reforms, were implemented to strengthen the supervisory mechanism by enhancing the capital requirement and liquidity standards. The Dodd–Frank Act also set rules that directly limit banks' lending behavior. The main purpose of these new and much stricter regulations was to maintain financial stability and to rebuild confidence in the banking industry. The regulators aimed to ensure that banks have enough liquidity and good-quality capital available to absorb potential losses and to restrict rapid asset growth. Our results show that after the financial crisis, the overall loan growth was lower than that before the financial crisis, although the loan growth rate has increased slightly since 2012 compared with that just after the crisis. Our results also show that after the financial crisis, the effect of capital ratio on lending growth decreased

[50] In our sample, we find that the percentage of loans secured by real estate is about 73% of total loans and thus, we divide total loans into loans secured by real estate and other loans (including commercial and industrial loans, loans to individuals, and other loans).

dramatically. The reason might be because banks tend to hold more capital to ensure their safety or to meet the much stricter capital requirements, and thus, affect their lending. Additionally, liquidity shows a much more positive relation with lending growth after the financial crisis than before the crisis, which indicates that liquidity ability is of great importance when banks consider their lending strategy. Together, our results suggest that after the financial crisis, the banks become more cautious about lending from the perspective of capital and liquidity. Our evidence also implies that the regulation reforms did, in fact, have an impact on the banks' behavior.

Appendix A Variable Definitions

Variables	Definition
Asset	Total assets (BHCK 2170).
Liability	Total liabilities (BHCK 2948).
Equity	Total equity capital (BHCK G105); if not available, BHCK 2170-BHCK 2948).
NI	Net income (loss) attributable to holding company (BHCK 4340).
TLoan	Total loans (BHCK 2122); if not available, loans and leases held for sale (BHCK 5369) plus loans and leases, net of unearned income (BHCK B528).
NetLoan	Loans and leases, net of unearned income and allowance (BHCK B529); if not available, loans and leases, net of unearned income (BHCK B528) minus allowance for loan and lease losses (BHCK3123).
NPL	Sum of total nonaccrual loans (BHCK 5526) and loans past due 90 days or more and still accruing (BHCK 5525).
LiquidAsset	Cash and balances due from depository institutions (sum of BHCK0081, and BHCK 0395 and BHCK 0397) plus held-to-maturity securities (BHCK 1754) and available-for-sale securities (BHCK 1733).
$\Delta Ln(Loan)$	Proxy for loan growth, defined as the change of natural log of net loans.
$LIQR$	Liquidity ratio, defined as the ratio of liquid asset (*LiquidAsset*) to total assets (*Asset*).
TCR	Total risk-based capital ratio (BHCK 7205), or total risk-based capital (BHCK 3792) divided by total risk-weighted assets (BHCK A223).
$NPLR$	NPL ratio, defined as the ratio of *NPL* to total loans (*TLoan*).
$SIZE$	The natural log of total assets.
ROA	Proxy for profitability, defined as *NI* divided by average total asset.
LEV	Leverage ratio, defined as the ratio of total equity to total assets.
ΔGDP	The GDP percent change.
$\Delta FedFundr$	The change of federal funds rate.

After	Equal to 1 if during the post-crisis period (2011-2015), and zero if during the pre-crisis period (2001-2006).
After1	Equal to 1 if during the post-crisis period (2013-2015), and zero if during the pre-crisis period (2001-2006).
Crisis	Equal to 1 if during the crisis period (2007-2009), and zero, otherwise.
Time	Equal to 1for year 2001, 2 for year 2002, 3 for 2003, and so on.
Tier1R	Tier 1 risk-based capital ratio (BHCK 7206), or Tier 1 capital (BHCK 8274) divided by total risk-weighted assets(BHCK A223).
DAS	Equal to 1 if with outstanding assets sold and securitized, and zero, otherwise.
Large	Equal to 1 if total consolidated asset (*Asset*) size is more than US$10 billion, and zero, otherwise. Average *Asset* of prior two years and lagged *Asset* are used, respectively.
Well	Equal to 1 if well-capitalized (*TCR*>15%), and zero, otherwise. Average *TCR* of prior two years and lagged *TCR* are used, respectively.
High	Equal to 1 if lagged *LIQR* is higher than quarterly mean, and zero, otherwise.

Appendix B

Related Regulatory Events and Regulation Reforms after 2008 Financial Crisis

Part I. Time Line

Date	Regulatory Events /Regulation Reforms
May 2009	**Supervisory Capital Assessment Program** (Bank Stress Test) -The U.S. Federal Reserve conducted a supervisory capital assessment program on 19 major banks, such as JPMorgan Chase and Citigroup, and the results were released in May.
June 2009	**SFAS No. 166-*Accounting for Transfers of Financial Assets—an amendment of FASB Statement No. 140***
June 2009	**SFAS No. 167-*Amendments to FASB Interpretation No. 46(R)***
July 2009	**Mortgage Disclosure Improvement Act**
July 2010	**Dodd-Frank Wall Street Reform and Consumer Protection Act** (see Part II. Dodd–Frank Wall Street Reform and Consumer Protection Act)
December 2010	**Basel III: A global regulatory framework for more resilient banks and banking systems** (released in December 2010, and revised in June 2011)
October 2012	**Federal Reserve's Dodd-Frank Stress Test** - The Dodd-Frank Act requires the Federal Reserve to conduct an annual stress test of large BHCs and all nonbank financial companies designated by the Financial Stability Oversight Council (FSOC) for Federal Reserve supervision to evaluate whether they have sufficient capital to absorb losses resulting from adverse economic conditions. The Dodd-Frank Act also requires BHCs and other financial companies supervised by the Federal Reserve to conduct their own stress tests. The Federal Reserve adopted rules implementing these requirements in October 2012.
January 2013	**Basel III: The Liquidity Coverage Ratio and liquidity Risk Monitoring Tool**
July 2013	The final rules of U.S. Basel III capital standard implementing were approved.
October 2014	**Basel III: The Net Stable Funding Ratio**
January 2014	**Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act (ATR/QM rule)**

September 2014	The U.S. Liquidity Coverage Ratio (LCR) rule was finalized.
April 2016	On April 26th, 2016, the FDIC and the OCC issued a notice of proposed rulemaking to implement the net stable funding ratio (NSFR).
June 2017	**The Financial CHOICE Act** (the House passed rules on June 8th).

Part II. Dodd–Frank Wall Street Reform and Consumer Protection Act

The Dodd–Frank Act was enacted in July 2010. The main purpose of the Dodd–Frank Act is "*To promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'too big to fail', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes.*" (Cited from the Dodd–Frank Act). To approach the goals regarding financial stability, the Dodd–Frank Act required the establishment of the Financial Stability Oversight Council (FSOC) in order to identify risks that might affect financial stability, to promote market discipline, and to react to any emerging instability in the financial market. The Dodd–Frank Act also provides many regulations to directly limit banks' lending behavior and to provide consumer protections, for example, the Mortgage Reform and Anti-Predatory Lending Act.[i] In 2014, the Consumer Financial Protection Bureau (CFPB) released the mortgage lending guidelines "Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act" (ATR/QM rule),[ii] which require

[i] Title XIV-Mortgage Reform and Anti-Predatory Lending Act (Sec. 1400–1498) of the Dodd–Frank Act regulates lenders' behavior and protects consumers. For example, it requires lenders to ensure borrowers' ability to repay their loan (Sec. 1411), to provide additional disclosures for consumers of mortgages (Sec. 1419), and to enhance the consumer protection for high-cost lending (Sec.1431–1433). The Amendment of The Truth in Lending Act is also included in this act (Sec. 1464).

[ii] The Truth in Lending Act was enacted in 1968 and substantially revised by the Truth in Lending Simplification Act of 1980. It was revised and reorganized to implement the new law and became effective in 1982. Since then, the regulation has not been comprehensively reviewed, but the amendments of the individual rules have still been processed. This amendment by CFPB implements sections 1411 and 1412 of the Dodd–Frank Act, which generally require lenders to make a reasonable determination of a consumer's ability to repay and establishes certain protections from liability under this requirement for "qualified mortgages." The final rule also implements section 1414 of the Dodd–Frank Act, which limits prepayment penalties.

lenders to consider and verify a number of different underwriting factors, such as a mortgage applicant's assets or income, debt load, and credit history, and to make a reasonable determination that a borrower will be able to pay back the loan.

The Dodd–Frank Act also re-emphasizes the importance of the capital requirements not only through the rules[iii] but also by the real supervisory examination. According to the Dodd–Frank Act, the Federal Reserve is required to conduct an annual supervisory stress test of so-called "covered companies," which include any bank holding company with total consolidated assets of $50 billion or more and each non-bank financial company that the FSOC has designated for supervision by the Federal Reserve. Besides, all financial companies with more than $10 billion in total consolidated assets that are supervised by a primary federal financial regulatory agency are required to conduct company-run stress tests at least annually.[iv] The Federal Reserve adopted rules implementing these Dodd-Frank requirements on October 2012. Through the stress test, regulators can confirm that banks have enough capital to absorb their potential losses, which are related to their risk exposure under different scenarios. If the banks cannot pass this test, they will receive a warning and some limitations, such as they might not be able to allocate dividends to their stockholders or buy back stocks from stockholders.[v]

However, the Dodd–Frank Act was rolled back for review in February, and on June 8th, 2017, the House passed the Financial CHOICE Act, which will provide some regulatory relief for the financial institutions. For example, the Financial CHOICE Act offers qualifying bank organizations an "off-ramp" from the Dodd–Frank supervision and Basel

[iii] For example, "Sec. 171. Leverage and Risk-Based Capital Requirements" of the Dodd–Frank Act.
[iv] Refer to Sec. 165 (i) Stress Test of the Dodd–Frank Rules.
[v] Taking Citigroup as an example, a news item in the New York Times said, "*In a report, the Fed rejected Citigroup's plans to manage its capital, citing concerns about the overall reliability of Citigroup's capital planning process … It was the only one of the nation's top five banks that failed to persuade the Fed to bless its plans for shareholder payouts,*" cited from the news "Citigroup Fails Federal Reserve's Stress Test for 2nd Time in 3 Years" in the New York Times, March 26th, 2014.

III capital requirement and liquidity standards.[vi]

Part III. Basel III and the U.S. Implementation of Basel III

Basel III was implemented in December 2010 and a revised version was published in July 2011. "Basel III: A global regulatory framework for more resilient banks and banking systems" (July 2011 version) claimed that "*The objective of the reforms is to improve the banking sector's ability to absorb shocks arising from financial and economic stress, whatever the source, thus reducing the risk of spillover from the financial sector to the real economy.*" This Basel Reforms includes the concept of a capital strengthening framework, liquidity standards, and risk coverage. In this version, the capital was especially emphasized and some of the minimum capital requirements were renewed. For example, the minimum Tier 1 capital ratio should increase from 4.5% to 6% and maintain at all times by the banks since 2015. See Figure 1 for the time line of Basel III minimum capital requirement.

In addition to capital requirement, Basel III also emphasize the importance of liquidity and set two major liquidity standards-the liquidity coverage ratio and the net stable funding ratio. For the more detailed liquidity standards, the Basel Committee also released "Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools" in 2013, and "Basel III: The Net Stable Funding Ratio" in 2014. The liquidity coverage ratio regulation has been implemented in 2015, and the minimum requirement was set as 60% in 2015 and set to rise in equal annual steps to 100% by 2019.[vii] The net stable funding ratio will be met until 2018.

In U.S., the Basel III requirements were implemented. The Federal Reserve started to discuss and invite comments regarding implementing capital requirement of Basel III in June 2012, The proposed rules included Regulatory Capital Rules: Regulatory Capital,

[vi] Refer to Sec. 601–605 of Title VI—Regulatory Relief For Strongly Capitalized, Well Managed Banking Organizations.

[vii] See Figure 2 for the time line of Basel III minimum requirement of Liquidity Coverage Ratio.

Implementation of Basel III, Minimum Regulatory Capital Ratios, Capital Adequacy, and Transition Provisions, Regulatory Capital Rules: Standardized Approach for Risk-weighted Assets; Market Discipline and Disclosure Requirements, and Regulatory Capital Rules: Advanced Approaches Risk-based Capital Rule; Market Risk Capital Rule. The final rules of Basel III capital standard implementing were approved in July 2013. Besides capital regulations, the Federal Reserve and FDIC also developed proposed rules of liquidity standards based on Basel III and the Dodd–Frank Act. The proposed rules to strengthen the liquidity position of large financial institutions, internationally active banking organizations and non-bank financial companies designated by the Financial Stability Oversight Council was developed by the Federal Reserve and FDIC and released to invite comments in October 2013. The proposed rules established the liquidity coverage ratio (LCR) based on Basel III to urge large and international active banks to hold more high-quality liquid assets. This U.S. LCR rule was finalized in September 2014 and will apply to large banking organizations. On April 26th, 2016, the FDIC and the OCC issued a notice of proposed rulemaking to implement the net stable funding ratio (NSFR). Similar to the LCR, the proposed NSFR standard would not apply to community banking and savings institutions.[viii]

[viii] Refer to the following websites:
(1) Basel Regulatory Framework of the Federal Reserve (https://www.federalreserve.gov/supervisionreg/basel/USImplementation.htm.) and
(2) FDIC regulation information (https://www.fdic.gov/regulations/capital/liquidity/index.html.)

Figure 1 Basel III Minimum Capital Requirements

Phase-in arrangements

(shading indicates transition periods - all dates are as of 1 January)

	2011	2012	2013	2014	2015	2016	2017	2018	As of 1 January 2019
Leverage Ratio	Supervisory monitoring		Parallel run 1 Jan 2013 – 1 Jan 2017 Disclosure starts 1 Jan 2015					Migration to Pillar 1	
Minimum Common Equity Capital Ratio			3.5%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%
Capital Conservation Buffer						0.625%	1.25%	1.875%	2.50%
Minimum common equity plus capital conservation buffer			3.5%	4.0%	4.5%	5.125%	5.75%	6.375%	7.0%
Phase-in of deductions from CET1 (including amounts exceeding the limit for DTAs, MSRs and financials)				20%	40%	60%	80%	100%	100%
Minimum Tier 1 Capital			4.5%	5.5%	6.0%	6.0%	6.0%	6.0%	6.0%
Minimum Total Capital			8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Minimum Total Capital plus conservation buffer			8.0%	8.0%	8.0%	8.625%	9.25%	9.875%	10.5%
Capital instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital			Phased out over 10 year horizon beginning 2013						
Liquidity coverage ratio	Observation period begins				Introduce minimum standard				
Net stable funding ratio	Observation period begins							Introduce minimum standard	

(Source: Annex 4 Phase-in arrangements of Basel III: A global regulatory framework for more resilient banks and banking systems. (rev July 2011))

Figure 2 Basel III Minimum Requirement of Liquidity Coverage Ratio

10. Specifically, the LCR will be introduced as planned on 1 January 2015, but the minimum requirement will be set at 60% and rise in equal annual steps to reach 100% on 1 January 2019. This graduated approach, coupled with the revisions made to the 2010 publication of the liquidity standards,[3] are designed to ensure that the LCR can be introduced without material disruption to the orderly strengthening of banking systems or the ongoing financing of economic activity.

	1 January 2015	1 January 2016	1 January 2017	1 January 2018	1 January 2019
Minimum LCR	60%	70%	80%	90%	100%

(Source: Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools)

References

Altunbas, Y., L. Gambacorta, and D. Marques-Ibanez. 2009. Securitisation and the bank lending channel. *European Economic Review* 53, 996-1009.

Amador, J. S., J. E. Gomez-Gonzalez, and A. M. Pabon. 2013. Loan growth and bank risk: new evidence. *Financial Market Portfolio Management* 27, 365-379.

Appelbaum, B. August 25, 2017. Yellen warns against erasing regulations made after financial crisis. The New York Times. Available at: https://nyti.ms/2w45pxm.

Aysun, U., and R. Hepp. 2016. The determinants of global bank loans: Evidence from bilateral cross-country data. *Journal of Banking and Finance* 66, 35-52.

Banerjee, R. N., and H. Mio. 2014. The impact of liquidity regulation on banks. BIS Working Papers No 470.

Basel Committee on Banking Supervision. 2010. Basel III: A global regulatory framework for more resilient banks and banking systems. (rev July 2011)

Basel Committee on Banking Supervision. 2013. Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools. (January 2013)

Basel Committee on Banking Supervision. 2014. Basel III: The Net Stable Funding Ratio. (October 2014).

Berger, A. N., and G. F. Udell. 2004. The institutional memory hypothesis and the procyclicality of bank lending behavior. *Journal of Financial Intermediation* 13, 458-495.

Berrospide, J. M., and R. M. Edge. 2010. The effects of bank capital on lending: What do we know, and what does it mean? Working paper. Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Berrospide, J. M. 2013. Bank liquidity hoarding and the financial crisis: An empirical evaluation. Working paper. Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Bonner, C. 2012. Liquidity Regulation, Funding Costs and Corporate Lending. DNB Working Paper No. 361 / December 2012.

Bridges, J., D. Gregory, M. Nielsen, S. Pezzini, A. Radia, and M. Spaltro. 2014. The impact of capital requirements on bank lending. Bank of England, Working Paper No. 486.

Brown, J. D., J. S. Earle. 2017. Finance and growth at the firm level: Evidence from SBA loans. *The Journal of Finance* 72(3), 1039-1080.

Calem, P., F. Covas, J. Wu. 2013. The impact of the 2007 liquidity shock on bank jumbo mortgage lending. *Journal of Money, Credit and Banking* 45(1), 59-91.

Campello, M., E. Giambona, J. R. Graham, and C. R. Harvey. 2011. Liquidity

management and corporate investment during a financial crisis. *The Review of Financial Studies* 24(6), 1944-1979.

Carlson, M., H. Shan, and M. Warusawitharana. 2013. Capital ratios and bank lending: A matched bank approach. *Journal of Financial Intermediation* 22(4), 663-687.

Clair, R. T. 1992. Loan growth and loan quality: Some preliminary evidences from Texas banks. *Economic Review - Federal Reserve Bank of Dallas;* Third Quarter 1992, 9-22.

Cole, R. A. 2012. How did the financial crisis affect small business lending in the United States? SBA Office of Advocacy.

Corkery, M. March 26, 2014. Citigroup Fails Federal Reserve's Stress Test for 2nd Time in 3 Years**.** New York Times**.** Available at: https://dealbook.nytimes.com/2014/03/26/fed-rebuffs-citigroup-on-capital-plans/?_r=0.

Cornett, M. M., J. J. McNutt, P. E. Strahan, and H. Tehranian. 2011. Liquidity Risk Management and Credit Supply in the Financial Crisis. *Journal of Financial Economics*, 101(2): 297-312.

Cremers, K. J. M., R. Huang, and Z. Sautner. 2011. Internal capital markets and corporate politics in a banking group. *The Review of Financial Studies* 24(2), 358-401.

Cucinelli, D. 2016. Can speed kill? The cyclical effect of rapid credit growth: evidence from bank lending behavior in Italy. *The Journal of Risk Finance* 17(5), 562-584.

Cukierman, A. 2013. Monetary policy and institutions before, during, and after the global financial crisis. *Journal of Financial Stability* 9, 373-384.

Curry, T. J., G. S. Fissel, and C. D. Ramirez. 2008. The impact of bank supervision on loan growth. *North American Journal of Economics and Finance* 19, 113-134.

Dahl, D., R. E. Shrieves, and M. F. Spivey. 2002. Financing loan growth at banks. *Journal of Financial Services Research* 22(3), 189-202.

De Haas, R., and I. van Lelyveld. 2010. Internal capital markets and lending by multinational bank subsidiaries. *Journal of Financial Intermediation* 19, 1-25.

Dell'Ariccia, G., E. Detragiache, and R. Rajan. 2008. The real effect of banking crises. *Journal of Financial Intermediation* 17(1), 89-112.

Deyoung, R., A. Gron, G. Torna, and A. Winton. 2015. Risk overhang and loan portfolio decisions: Small business loan supply before and during the financial crisis. *The Journal of Finance* 70(6), 2451-2488.

Dodd-Frank Wall Street Reform and Consumer Protection Act. 2010. Available at: http://www.cftc.gov/idc/groups/public/@swaps/documents/file/hr4173_enrolledbill.pdf.

Egan, M. February 13, 2017. Banks are lending a ton, despite Trump's claims. Available at:

http://money.cnn.com/2017/02/13/investing/bank-business-lending-dodd-frank-trump/.

Fahlenbrach, R., R. Prilmeier, and R. M. Stulz. 2016. Why does fast loan growth predict poor performance for banks. Fisher College of Business Working Paper Series.

Financial Accounting Standard Boards (FASB). 2009. Statement of Financial Accounting Standards No. 166 Accounting for Transfers of Financial Assets- an amendment of FASB Statement No. 140. (June 2009)

Financial Accounting Standard Boards (FASB). 2009. Statement of Financial Accounting Standards No. 167 Amendments to FASB Interpretation No. 46(R). (June 2009).

Financial CHOICE Act. 2017. Available at: https://financialservices.house.gov/uploadedfiles/hr_10_the_financial_choice_act.pdf.

Finger, R. May 30, 2013. Banks are not lending like they should, and with good reason. Forbes. Available at : https://www.forbes.com/sites/richardfinger/2013/05/30/banks-are-not-lending-like-they-should-and-with-good-reason/#15204719519f.

Federal Deposit Insurance Corporation (FDIC).1997. History of the Eighties - Lessons for the Future. Available at: https://www.fdic.gov/bank/historical/history/.

Federal Deposit Insurance Corporation (FDIC). Risk Management Manual of Examination Policies. Available at: https://www.fdic.gov/regulations/safety/manual/.

Foley, P. December 16, 2014. Banks loosen lending standards to levels seen before financial crisis. Available at: http://www.latimes.com/business/la-fi-lending-standards-20141217-story.html.

Foos, D., L. Norden, and M. Weber. 2010. Loan growth and riskiness of banks. *Journal of Banking &Finance* 34, 2929-2940.

Gambacorta, L. 2005. Inside the bank lending channel. *European Economic Review* 49(7), 1737-1759.

Gambacorta, L., and D. Marques-Ibanez, 2011. The bank lending channel: Lessons from the crisis. *Economic Policy* April 2011, 135-182.

Gambacorta, L.,and P. E. Mistrulli. 2004. Does bank capital affect lending behavior? *Journal of Financial Intermediation* 13(4), 436-457.

Gropp, R., T. Mosk, S. Ongena, and C. Wix. 2016. Bank response to higher capital requirements: Evidence from a quasi-natural experiment. Working paper.

Ho, P. H., C. W. Huang, C. Y. Lin, and J. F. Yen. 2016. CEO overconfidence and financial crisis: Evidence from bank lending and leverage. *Journal of Financial Economic* 120(1), 194-209.

Hyun, J. S., and B. K. Rhee. 2011. Bank capital regulation and credit supply. *Journal of Banking and Finance* 35(2), 323-330.

Ivashina V., and D. Scharfstein. 2010. Bank lending during the financial crisis of 2008. *Journal of Financial Economics* 97(3), 319-338.

J.P.Morgan. A Defining Moment. Available at: https://www.jpmorgan.com/country/US/EN/insights/treasury-services/liquidity-regulations.

Kapan, T., and C. Minoiu. 2016. Balance sheet strength and bank lending during the global financial crisis. IMF Working Paper.

Keeton, W. R. 1999. Does faster loan growth lead to higher loan losses? *Economic Review - Federal Reserve Bank of Kansas City;* Second Quarter 1999, 57-75.

Kishan, R. P., and T. P. Opiela. 2000. Bank size, bank capital, and the bank lending channel. *Journal of Money, Credit and Banking* 32(1), 121-141.

Kohler, M. 2012. Which banks are more risky? The impact of loan growth and business model on bank risk-taking. Discussion Paper of Deutsche Bundesbank No33/2012.

Kupiec, P. H., Y. Lee, and C. Rosenfeld. 2017. Does bank supervision impact bank loan growth? *Journal of Financial Stability* 28, 29-48.

Laidroo, L. 2012. Lending growth determinants and cyclicality: Evidence from CEE banks. Working paper.

Loutskina, E., and P. E. Strahan. 2009. Securitization and the declining impact of bank finance on loan supply: Evidence from mortgage originations. *The Journal of Finance* 64(2), 861-889.

Meder, A. A. 2015. Interaction between accounting standards and monetary policy: The effect of SFAS 115. *The Accounting Review* 90(5), 2031-2056.

Miller, S. M., A. Hoffer, and D. Wille. 2016. Small-business financing after the financial crisis. Mercatus working paper. Mercatus Center of George Mason University.

Pakhchanyan, S., and G. Sahakyan. 2014. Drivers of bank risk, solvency, and profitability in the Armenian banking system. Zentra Working Papers of Transnational Studies No. 44/2014.

Ramcharan, R., S. Verani, and S. J. Van den Heuvel. 2016. From Wall Street to Main Street: The impact of the financial crisis on consumer credit supply. *The Journal of Finance* 71 (3), 1323-1356.

Skala, D. 2012. Loan growth in banks: Origins and consequences. University of Szczecin, No. 54, str. 113-124.

Tamirisa, N. T., and D. O. Igan. 2008. Are weak banks leading credit booms? Evidence from emerging Europe. IMF Working paper.

Tracey, M. 2011. The impact of non-performing loans on loan growth: an econometric case study of Jamaica and Trinidad and Tobago. Working paper.

Zemel, M. 2015. The information content of loan growth in banks. Working paper.

Table 1 Sample Selection

	#obs.	#BHCs
All U.S. BHC from Bank Regulator 2001-2015	214,381	8,297
Delete Fiscal Year End isn't 12/31	(6,854)	(313)
Delete Data cannot combined with CRSP data	(180,457)	(7,189)
Delete if with missing variables used in regression	(6510)	(210)
Final sample (2001Q2-2015Q4)	20560	585

Table 2 Descriptive Statistics

Panel A: BHC Characteristics (in $million)								
	2001Q2-2015Q1 (#obs.=20560)				2001Q2-2006Q4 (#obs.=9515)		2011Q1-2015Q1 (#obs.=5293)	
Variables	Mean	SD.	Min	Max	Mean	SD.	Mean	SD.
Asset	26700	165000	55	2480000	17692	105400	36857	209200
Liability	24100	150000	52	2260000	16118	96627	33068	189000
Equity	2518	14900	-510	258000	1574	8870	3789	20457
NI	50	455	-23700	7143	58	359	72	455
TLoan	12300	68900	25	1020000	8903	47700	15484	82166
NetLoan	11700	64800	25	955000	8315	44737	14821	78058
NPL	352	3228	0	75300	111	809	574	4513
Panel B: Variables used in regressions (#BHC=585)								
	2001Q2-2015Q1 (#obs.=20560)				2001Q2-2006Q4 (#obs.=9515)		2011Q1-2015Q1 (#obs.=5293)	
Variables	Mean	SD.	Min	Max	Mean	SD.	Mean	SD.
$\Delta Ln(loan)_{i,t}$	0.020	0.049	-0.092	0.256	0.031	0.049	0.015	0.047
$\Delta Ln(loan)_{i,t-1}$	0.021	0.049	-0.091	0.264	0.031	0.049	0.014	0.048
$\Delta Ln(loan)_{i,t-2}$	0.021	0.050	-0.092	0.270	0.031	0.051	0.012	0.048
$\Delta Ln(loan)_{i,t-3}$	0.022	0.050	-0.090	0.273	0.031	0.051	0.01	0.048
$\Delta Ln(loan)_{i,t-4}$	0.022	0.050	-0.089	0.272	0.031	0.051	0.008	0.048
$NPLR_{i,t-1}$	0.017	0.020	0.000	0.111	0.008	0.009	0.026	0.023
$TCR_{i,t-1}$	0.140	0.033	0.056	0.274	0.136	0.031	0.155	0.035
$LIQR_{i,t-1}$	0.251	0.113	0.047	0.599	0.26	0.116	0.272	0.108
$LEV_{i,t-1}$	0.096	0.025	0.030	0.181	0.093	0.021	0.103	0.027
$SIZE_{i,t-1}$	14.592	1.580	12.301	20.434	14.275	1.573	14.958	1.56
$ROA_{i,t-1}$	0.002	0.003	-0.018	0.006	0.003	0.002	0.002	0.003
$\Delta GDP_{i,t-1}$	0.041	0.029	-0.077	0.093	0.054	0.02	0.038	0.019
$\Delta FedFundr_{i,t-1}$	0.000	0. 004	-0.005	0.014	-0.001	0.005	0.000	0.000

Asset is total assets. *Liability* is total liability. *Equity* is total equity capital. *NI* is net income (loss) attributable to holding company. *TLoan* is total loans and *NetLoan* is loans and leases, net of unearned income and allowance. *NPL* is nonperforming loans. $\Delta Ln(Loan)$ is the proxy for loan growth, defined as the change of natural log of loans. *NPLR* is defined as the ratio of *NPL* to *TLoan*. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. *SIZE* is the natural log of total assets and *ROA* is defined as *NI* divided by average total asset. *LEV* is defined as the ratio of total equity to total assets. ΔGDP is the percent change of GDP. $\Delta FedFundr$ is the change of Federal Funds rate. Refer to Appendix A about the details of variable definitions.

Table 3 Pearson Correlations of Regression Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) $\Delta Ln(loan)_{i,t}$	1.0000												
(2) $\Delta Ln(loan)_{i,t-1}$	0.3004*	1.0000											
(3) $\Delta Ln(loan)_{i,t-2}$	0.2775*	0.2952*	1.0000										
(4) $\Delta Ln(loan)_{i,t-3}$	0.2495*	0.2745*	0.2898*	1.0000									
(5) $\Delta Ln(loan)_{i,t-4}$	0.2673*	0.2488*	0.2756*	0.2946*	1.0000								
(6) $NPLR_{i,t-1}$	-0.3564*	-0.3432*	-0.3205*	-0.2950*	-0.2682*	1.0000							
(7) $SIZE_{i,t-1}$	-0.0415*	-0.0185*	-0.0186*	-0.0185*	-0.0230*	0.0730*	1.0000						
(8) $ROA_{i,t-1}$	0.2581*	0.2436*	0.1971*	0.1689*	0.1349*	-0.5379*	0.0537*	1.0000					
(9) $LEV_{i,t-1}$	0.0599*	0.0438*	0.0341*	0.0235*	0.0081	-0.1049*	0.1771*	0.2416*	1.0000				
(10) $LIQR_{i,t-1}$	-0.0208*	-0.0821*	-0.1083*	-0.1247*	-0.1382*	-0.0573*	0.0202*	0.0873*	0.0015	1.0000			
(11) $TCR_{i,t-1}$	0.0449*	-0.0582*	-0.0714*	-0.0839*	-0.0965*	-0.0120	-0.0223*	0.1788*	0.5753*	0.4084*	1.0000		
(12) $\Delta \mathrm{GDP}_{t-1}$	0.1771*	0.1443*	0.0994*	0.0656*	0.0553*	-0.2241*	-0.0615*	0.2499*	-0.0100	0.0766*	0.0252*	1.0000	
(13)$\Delta Fedfundr_{t-1}$	-0.0889*	-0.0796*	-0.0677*	-0.0411*	-0.0447*	0.0741*	-0.0151*	-0.1315*	0.0199*	-0.0389*	-0.0505*	-0.5498*	1.0000

a. $\Delta Ln(Loan)$ is the proxy for loan growth, defined as the change of natural log of loans. *NPLR* is defined as the ratio of *NPL* to *TLoan*. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. *SIZE* is the natural log of total assets and *ROA* is defined as *NI* divided by average total asset. *LEV* is defined as the ratio of total equity to total assets. ΔGDP is the percent change of GDP. $\Delta FedFundr$ is the change of Federal Funds rate. Refer to Appendix A about the details of variable definitions.
b. * Indicates that correlation is significant at the 5% level.

Table 4 Regression on Determinants of Loan Growth during 2001-2015

	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$		0.2024***		0.2206***
		(7.42)		(8.11)
$LIQR_{i,t-1}$		0.0241***		0.0311***
		(3.53)		(4.56)
$\Delta Ln(loan)_{i,t-1}$	0.0710***	0.0798***	0.0671***	0.0761***
	(7.78)	(8.73)	(7.37)	(8.38)
$\Delta Ln(loan)_{i,t-2}$	0.0582***	0.0673***	0.0515***	0.0606***
	(6.55)	(7.56)	(5.81)	(6.85)
$\Delta Ln(loan)_{i,t-3}$			0.0287***	0.0377***
			(3.33)	(4.38)
$\Delta Ln(loan)_{i,t-4}$			0.0732***	0.0826***
			(8.54)	(9.62)
$NPLR_{i,t-1}$	-0.5519***	-0.5786***	-0.5106***	-0.5332***
	(-20.71)	(-21.75)	(-19.08)	(-19.98)
$SIZE_{i,t-1}$	-0.0250***	-0.0228***	-0.0263***	-0.0241***
	(-14.48)	(-13.25)	(-15.23)	(-14.02)
$ROA_{i,t-1}$	0.9532***	0.8027***	0.9186***	0.7433***
	(7.78)	(6.55)	(7.59)	(6.16)
$LEV_{i,t-1}$	0.1540***	-0.0021	0.1487***	-0.0202
	(6.65)	(-0.06)	(6.44)	(-0.59)
$\Delta GDP_{i,t-1}$	0.0913***	0.0887***	0.0933***	0.0908***
	(5.10)	(4.97)	(5.23)	(5.11)
$\Delta FedFundr_{i,t-1}$	0.1462	0.1744	0.1468	0.1757
	(1.17)	(1.40)	(1.19)	(1.43)
Intercept	0.3561***	0.3063***	0.3710***	0.3176***
	(14.71)	(12.67)	(15.34)	(13.18)
Firm Fixed	Yes	Yes	Yes	Yes
Year Fixed	Yes	Yes	Yes	Yes
#obs.	20560	20560	20560	20560
adj. R^2	25.01%	25.65%	25.55%	26.36%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *NPLR* is defined as the ratio of *NPL* to *TLoan*. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. *SIZE* is the natural log of total assets and *ROA* is defined as *NI* divided by average total asset. *LEV* is defined as the ratio of total equity to total assets. ΔGDP is the percent change of GDP. $\Delta FedFundr$ is the percent change of federal funds rate. Refer to Appendix A about the details of variable definitions.
b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively.

Table 5 Main Test: Determinants of Loan Growth during Pre-crisis and Post-crisis Periods

	Expect Sign	(1)	(2)	(3)	(4)	(5)	(6)
$TCR_{i,t-1}$		0.2818***	0.2457***	0.3632***	0.2984***	0.2550***	0.3765***
		(7.19)	(7.29)	(8.43)	(7.66)	(7.70)	(8.82)
$\boldsymbol{TCR_{i,t-1} \times After}$	-	**-0.0928*** **		**-0.3200*** **	**-0.1055*** **		**-0.3352*** **
		(-2.55)		**(-5.94)**	**(-2.88)**		**(-6.18)**
$LIQR_{i,t-1}$		0.0231***	0.0138	-0.0006	0.0267***	0.0199**	0. 0042
		(2.93)	(1.55)	(-0.06)	(3.46)	(2.29)	(0.46)
$\boldsymbol{LIQR_{i,t-1} \times After}$	+		**0.0227*** **	**0.0631*** **		**0.0177** **	**0.0624*** **
			(2.42)	**(5.70)**		**(1.88)**	**(5.67)**
$After$		-0.0045***	-0.0046***	0.0034	0.0237***	0.0025	0.0228*
		(-4.00)	(-4.18)	(1.56)	(4.29)	(0.79)	(1.95)
Intercept		0.0029***	0.0030***	0.0027***	0.2226***	0.2196***	0.2636***
		(3.28)	(3.38)	(3.10)	(8.56)	(8.42)	(9.24)
Controls		Yes	Yes	Yes	Yes	Yes	Yes
Controls × *After*		No	No	Yes	No	No	Yes
Firm Fixed		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	Yes	No	No	No
#obs.		14808	14808	14808	14808	14808	14808
adj. R^2		19.02%	19.01%	19.78%	23.02%	22.98%	23.78%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. Refer to Appendix A for more details of other controls variables.

b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively (one-tailed if the sign is in the predicted direction, and two-tailed otherwise).

Table 6 Robustness Test: Determinants of Loan Growth during Pre-crisis and Post-crisis Periods (Only 305 BHCs lasted from pre-crisis period to post-crisis period)

	Expected Sign	(1)	(2)	(3)	(4)	(5)	(6)
$TCR_{i,t-1}$		0.2514***	0.2269***	0.3564***	0.2689***	0.2400***	0.3707***
		(5.75)	(6.15)	(7.20)	(6.14)	(6.59)	(7.52)
$\boldsymbol{TCR_{i,t-1} \times After}$	**-**	**-0.0626***		**-0.2862*****	**-0.0681****		**-0.2937*****
		(-1.59)		**(-4.86)**	**(-1.70)**		**(-4.94)**
$LIQR_{i,t-1}$		0.0097	-0.0019	-0.0178*	0.0124	0.0032	-0.0136
		(1.18)	(-0.20)	(-1.79)	(1.56)	(0.35)	(-1.41)
$\boldsymbol{LIQR_{i,t-1} \times After}$	**+**		**0.0251*****	**0.0619*****		**0.0211****	**0.0611*****
			(2.65)	**(5.47)**		**(2.23)**	**(5.44)**
$After$		-0.0010	-0.0011	0.0075***	0.0173***	0.0006	0.0174
		(-0.90)	(-0.94)	(3.41)	(2.89)	(0.20)	(1.45)
Intercept		0.0008	0.0008	0.0005	0.1784***	0.1741***	0.2247
		(0.78)	(0.82)	(0.52)	(6.61)	(6.42)	(7.47)
Controls		Yes	Yes	Yes	Yes	Yes	Yes
Controls × *After*		No	No	Yes	No	No	Yes
Firm Fixed		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	Yes	No	No	No
#obs		10463	10463	10463	10463	10463	10463
adj. R^2		16.31%	16.35%	17.32%	21.75%	21.77%	22.73%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. Refer to Appendix A for more details of other controls variables.

b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively (one-tailed if the sign is in the predicted direction, and two-tailed otherwise).

Table 7 Robustness Test: Determinants of Loan Growth during Pre-crisis and Post-crisis Periods (mitigate the effect of M&A activity)

	Expected Sign	(1)	(2)	(3)	(4)	(5)	(6)
$TCR_{i,t-1}$		0.1377***	0.1101***	0.1998***	0.1152***	0.0988***	0.1721***
		(4.30)	(4.04)	(5.67)	(3.85)	(3.84)	(5.28)
$\boldsymbol{TCR_{i,t-1} \times After}$	-	**-0.0724*** **		**-0.2452*** **	**-0.0460***		**-0.1966*** **
		(-2.24)		**(-5.30)**	**(-1.61)**		**(-4.77)**
$LIQR_{i,t-1}$		0.0407***	0.0323***	0.0202**	0.0356***	0.0253***	0.0135*
		(5.97)	(4.14)	(2.51)	(5.13)	(3.20)	(1.66)
$\boldsymbol{LIQR_{i,t-1} \times After}$	+		**0.0205*** **	**0.0524*** **		**0.0251*** **	**0.0541*** **
			(2.49)	**(5.53)**		**(3.02)**	**(5.70)**
$After$		-0.0037***	-0.0040***	0.0005	-0.0043***	-0.0044***	0.0025
		(-4.23)	(-4.51)	(0.28)	(-4.63)	(-4.83)	(1.49)
Intercept		-0.0016**	-0.0015**	-0.0016**	0.0028***	0.0029***	0.0026***
		(-2.21)	(-2.05)	(-2.22)	(3.72)	(3.81)	(3.51)
Controls		Yes	Yes	Yes	Yes	Yes	Yes
Controls × *After*		No	No	Yes	No	No	Yes
Firm Fixed		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	Yes	Yes	Yes	Yes
#obs.		13825	13825	13825	12538	12538	12538
adj. R^2		24.57%	24.57%	25.35%	27.75%	27.81%	28.70%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. Refer to Appendix A for more details of other controls variables.

b. Column (1)~(3) exclude observations with equity growth exceeding 10% while column (4)~(6) exclude observations with non-loan asset growth exceeding 10%.

c. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively (one-tailed if the sign is in the predicted direction, and two-tailed otherwise).

Table 8 Robustness Test: Determinants of Loan Growth Before, During and After the Financial Crisis

	Expected Sign	(1)	(2)	(3)	(4)	(5)	(6)
$TCR_{i,t-1}$		0.2477***	0.2296***	0.3494***	0.2666***	0.2522***	0.3617***
		(7.38)	(8.41)	(8.91)	(7.93)	(9.38)	(9.30)
$TCR_{i,t-1} \times Crisis$		0.0151		-0.1316**	0.0072		-0.1465***
		(0.34)		(-2.14)	(0.16)		(-2.39)
$\boldsymbol{TCR_{i,t-1} \times After}$	-	**-0.0634****		**-0.2978*****	**-0.0489***		**-0.3131*****
		(-1.96)		**(-6.24)**	**(-1.52)**		**(-6.54)**
$LIQR_{i,t-1}$		0.0293***	0.0171**	0.0044	0.0307***	0.0174**	0.0075
		(4.32)	(2.16)	(0.53)	(4.68)	(2.29)	(0.95)
$LIQR_{i,t-1} \times Crisis$			0.0257***	0.0413***		0.0264***	0.0428***
			(2.65)	(3.66)		(2.74)	(3.85)
$\boldsymbol{LIQR_{i,t-1} \times After}$	+		**0.0226*****	**0.0599*****		**0.0261*****	**0.0625*****
			(2.71)	**(6.13)**		**(3.16)**	**(6.44)**
Crisis		-0.0029***	-0.0029***	-0.0040***	0.0058	-0.0000	0.0250**
		(-3.57)	(-3.55)	(-3.17)	(1.00)	(-0.00)	(2.06)
After		-0.0037***	-0.0037***	0.0001	0.0137***	-0.0012	0.0162
		(-4.11)	(-4.21)	(0.03)	(2.90)	(-0.45)	(1.53)
Intercept		0.0024***	0.0024***	0.0029***	0.2342***	0.2308***	0.3049***
		(3.48)	(3.51)	(3.25)	(10.60)	(10.33)	(11.89)
Control		Yes	Yes	Yes	Yes	Yes	Yes
Control × *Crisis*		No	No	Yes	No	No	Yes
Control × *After*		No	No	Yes	No	No	Yes
Firm Fixed		Yes	Yes	Yes	Yes	Yes	Yes

Year Fixed	Yes	Yes	Yes	No	No	No
#obs.	20560	20560	20560	20560	20560	20560
adj. R^2	18.88%	18.90%	19.56%	25.67%	25.72%	26.64%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. *After* is equal to 1 if during the post-crisis period (2010-2015), and zero if during the pre-crisis period (2001-2006). *Crisis* equals to 1 if during the crisis period (2007-2009), and zero, otherwise. Refer to Appendix A for more details of other controls variables.
b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively (one-tailed if the sign is in the predicted direction, and two-tailed otherwise).

Table 9 Robustness Test: Determinants of Loan Growth during Pre-crisis and Post-crisis Periods (mitigate the concern of Time Trend effect)

	Expected Sign	(1)	(2)
$TCR_{i,t-1}$		0.2431***	0.3139***
		(3.90)	(3.76)
$\boldsymbol{TCR_{i,t-1} \times After}$	**-**	**-0.3493*** **	**-0.4888*** **
		(-3.17)	**(-3.18)**
$TCR_{i,t-1} \times Time$		0.0210*	0.0166
		(1.73)	(0.95)
$LIQR_{i,t-1}$		0.0009	-0.0068
		(0.06)	(-0.43)
$\boldsymbol{LIQR_{i,t-1} \times After}$	**+**	**0.0074**	**0. 0505** **
		(0.26)	**(1.67)**
$LIQR_{i,t-1} \times Time$		0.0034	0.0017
		(1.07)	(0.53)
After		0.0290**	-0.0046
		(2.03)	(-0.15)
Time		-0.0009	0.0028
		(-0.56)	(0.78)
Intercept		0.2605***	0.2646***
		(9.75)	(8.00)
Controls		Yes	Yes
Controls × *After*		No	Yes
Controls× *Time*		No	Yes
Firm Fixed		Yes	Yes
#obs.		14808	14808
adj. R^2		23.44%	24.22%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. *Time* captures the effect of the year and equals to 1for year 2001, 2 for year 2002, 3 for year 2003, and so on. Refer to Appendix A for more details of other controls variables.

b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively (one-tailed if the sign is in the predicted direction, and two-tailed otherwise).

Table 10 Robustness Test: The Effect of Large BHCs

	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$	0.3965***	0.3804***	0.3865***	0.3709***
	(8.60)	(8.08)	(8.40)	(7.93)
$TCR_{i,t-1} \times Large$	-0.1799	-0.1616	-0.1505	-0.1327
	(-1.54)	(-1.37)	(-0.98)	(-0.85)
$\boldsymbol{TCR_{i,t-1} \times After}$	**-0.3468*** **	**-0.3289*** **	**-0.3316*** **	**-0.3143*** **
	(-5.68)	**(-5.40)**	**(-5.44)**	**(-5.19)**
$\boldsymbol{TCR_{i,t-1} \times Large \times After}$	**0.1002**	**0.1263**	**0.0478**	**0.0960**
	(0.71)	**(0.90)**	**(0.29)**	**(0.58)**
$LIQR_{i,t-1}$	0.0030	-0.0000	0. 0027	-0.0007
	(0.32)	(-0.00)	(0.29)	(-0.07)
$LIQR_{i,t-1} \times Large$	0.0224	0.0125	0.0379	0.0303
	(0.83)	(0.46)	(1.08)	(0.83)
$\boldsymbol{LIQR_{i,t-1} \times After}$	**0.0604*** **	**0.0582*** **	**0.0606*** **	**0.0584*** **
	(4.87)	**(4.64)**	**(5.05)**	**(4.82)**
$\boldsymbol{LIQR_{i,t-1} \times Large \times After}$	**0.0078**	**0.0191**	**-0.0128**	**-0.0046**
	(0.27)	**(0.65)**	**(-0.38)**	**(-0.13)**
After	0.0052	0.0041*	0.0087	0.0037
	(0.26)	(1.73)	(0.44)	(1.56)
Large	0.0654*	0.0082	-0.0242	-0.0047
	(1.84)	(1.44)	(-0.18)	(-0.29)
After × *Large*	0.0307	-0.0029	0.0842	0.0090
	(0.74)	(-0.40)	(1.45)	(0.97)
Intercept	0.2611***	0.0036***	0. 2625***	0.0024
	(8.70)	(3.24)	(8.71)	(1.30)
Controls	Yes	Yes	Yes	Yes
Controls × *After*	Yes	Yes	Yes	Yes
Controls × *Large*	Yes	Yes	Yes	Yes
Controls× *Large*× *After*	Yes	Yes	Yes	Yes
Firm Fixed	Yes	Yes	Yes	Yes
Year Fixed	No	Yes	No	Yes
#obs.	14808	14808	14808	14808
adj. R^2	24.00%	19.95%	24.00%	19.93%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. In column (1) and (2), *Large* equals to 1 if average total consolidated asset size of prior two years is more than US$10

billion, and zero, otherwise. In column (3) and (4), *Large* equals to 1 if the lagged *Asset* is more than US$10billion. Refer to Appendix A for more details of other controls variables.
b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively.

Table 11 Robustness Test: The Effect of Well-Capitalized BHCs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$TCR_{i,t-1}$	0.4165***	0.3754***	0.3850***	0.3532***	0.5167***	0.4931***	0.4980***	0.4788***
	(7.91)	(7.10)	(7.27)	(6.66)	(8.70)	(8.18)	(8.38)	(7.93)
$TCR_{i,t-1} \times Well$	-0.0544	0.0606	-0.0391	0.0529	-0.1289*	0.0013	-0.1221	0.0029
	(-0.66)	(0.60)	(-0.47)	(0.52)	(-1.65)	(0.01)	(-1.56)	(0.03)
$\boldsymbol{TCR_{i,t-1} \times After}$	**-0.2149*** **	**-0.2142** **	**-0.1607** **	**-0.1609** **	**-0.4613*** **	**-0.3820*** **	**-0.4148*** **	**-0.3426*** **
	(-2.53)	**(-2.30)**	**(-1.90)**	**(-1.74)**	**(-5.90)**	**(-4.51)**	**(-5.34)**	**(-4.09)**
$\boldsymbol{TCR_{i,t-1} \times Well \times After}$	**-0.1666**	**-0.2427***	**-0.2144** **	**-0.2881** **	**0.0536**	**-0.2405***	**0.0294**	**-0.2471***
	(-1.59)	**(-1.81)**	**(-2.04)**	**(-2.15)**	**(0.57)**	**(-1.83)**	**(0.31)**	**(-1.90)**
$LIQR_{i,t-1}$	0.0037	0. 0193**	-0.0013	0.0134	0.0011	0.0190*	-0.0030	0.0149
	(0.41)	(2.03)	(-0.14)	(1.37)	(0.10)	(1.79)	(-0.29)	(1.37)
$LIQR_{i,t-1} \times Well$		-0.0477***		-0.0442**		-0.0693***		-0.0713***
		(-2.68)		(-2.43)		(-2.98)		(-3.04)
$LIQR_{i,t-1} \times After$	0.0641***	0.0333**	0.0652***	0.0331**	0.0563***	0.0301**	0.0585***	0.0317**
	(5.85)	(2.44)	(5.90)	(2.40)	(4.74)	(2.18)	(4.88)	(2.28)
$LIQR_{i,t-1} \times Well \times After$		0.0778***		0.0798***		0.0925***		0.0959***
		(3.25)		(3.31)		(3.22)		(3.32)
After	0.0086	0.0135	0.0071***	0.0064**	0.0326**	0.0119	0.0001	-0.0022
	(0.61)	(0.88)	(2.70)	(2.38)	(2.32)	(0.81)	(0.04)	(-0.88)
Well	0.0068	-0.0040	0.0001	-0.0038	0.0113	-0.0175	-0.0059**	-0.0108*
	(0.53)	(-0.15)	(0.02)	(-0.87)	(0.97)	(-0.54)	(-2.36)	(-1.94)
After × Well	0.0246	0.0209	-0.0031	0.0004	0.0049	0.0817**	0.0084***	0.0109*
	(1.55)	(0.65)	(-0.90)	(0.08)	(0.34)	(2.10)	(2.77)	(1.73)

Intercept	0.2631***	0.2608***	0.0032***	0.0030***	0.2316***	0.2383***	0.0062***	0.0072***
	(9.06)	(8.94)	(2.83)	(2.66)	(6.79)	(6.93)	(4.97)	(5.58)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls × *After*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls × *Well*	No	Yes	No	Yes	No	Yes	No	Yes
Controls× *Well*× *After*	No	Yes	No	Yes	No	Yes	No	Yes
Firm Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed	No	No	Yes	Yes	No	No	Yes	Yes
#obs.	14808	14808	14808	14808	12499	12499	12499	12499
adj. R^2	23.81%	24.10%	19.82%	20.11%	24.51%	24.88%	19.88%	20.31%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. In column (1) -(4), , *Well* equals to 1 if the lagged *TCR* exceeds 15%, and zero otherwise; in column (5) -(8), *Well* equals to 1 if the average *TCR* of prior two years exceeds 15%, and zero otherwise. Refer to Appendix A for more details of other controls variables.

b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively.

Table 12 Robustness Test: The Effect of Higher-Liquidity BHCs

	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$	0.3751***	0.4772***	0.3615***	0.4731***
	(8.67)	(8.60)	(8.27)	(8.44)
$TCR_{i,t-1} \times High$		-0.1626**		-0.1782**
		(-2.13)		(-2.29)
$TCR_{i,t-1} \times After$	-0.3424***	-0.4731***	-0.3275***	-0.4404***
	(-6.16)	(-6.59)	(-5.92)	(-6.15)
$TCR_{i,t-1} \times High \times After$		0.2340**		0.1989*
		(2.32)		(1.96)
$LIQR_{i,t-1}$	-0.0254	-0.0382**	-0.0333**	-0.0444***
	(-1.55)	(-2.26)	(-1.99)	(-2.62)
$LIQR_{i,t-1} \times High$	0.0398*	0.0642***	0.0451*	0.0682***
	(1.81)	(2.68)	(1.96)	(2.73)
$\boldsymbol{LIQR_{i,t-1} \times After}$	**0.0485****	**0.0537****	**0.0504****	**0.0520****
	(1.95)	**(2.14)**	**(1.99)**	**(2.05)**
$\boldsymbol{LIQR_{i,t-1} \times High \times After}$	**0.0311**	**0.0098**	**0.0302**	**0.0134**
	(0.97)	**(0.29)**	**(0.93)**	**(0.39)**
After	0.0303**	0.0530***	0.0036	0.0018
	(2.38)	(3.73)	(1.22)	(0.59)
$High$	-0.0078	0.0260	0.0027	-0.0027
	(-1.31)	(1.39)	(1.42)	(-0.85)
After $\times High$	-0.0108	-0.0554**	-0.0020	-0.0003
	(-1.23)	(-2.16)	(-0.66)	(-0.06)
Intercept	0.2784***	0.2584***	-0.0007	-0.0009
	(9.64)	(8.75)	(-0.45)	(-0.53)
Controls	Yes	Yes	Yes	Yes
Controls × *After*	Yes	Yes	Yes	Yes
Controls $\times High$	No	Yes	No	Yes
Controls$\times High\times$ *After*	No	Yes	No	Yes
Firm Fixed	Yes	Yes	Yes	Yes
Year Fixed	No	No	Yes	Yes
#obs.	14808	14808	14808	14808
adj. R^2	23.82%	24.04%	19.83%	20.04%

a. Dependent variable is $\Delta Ln(loan)_{i,t}$. $\Delta Ln(loan)_{i,t}$ is the proxy for loan growth, defined as the change of natural log of loans. *TCR* is total risk-based capital ratio. *LIQR* is defined as the ratio of liquid asset to total assets. Because the observations of 2010 are not included here, *After* is equal to 1 if during 2011-2015, and zero if during 2001-2006. *High* equals to 1 if lagged *LIQR* is higher than quarterly mean, and zero, otherwise. For more details of other controls variables, refer to Appendix A.

b. *, **,*** indicate coefficient is in 10%, 5%, and 1% significant, respectively.