

# 2008 金融海嘯及金融改革對貸款成長的 衝擊：從銀行資本的角度探討

劉啟群

國立臺灣大學會計學系

吳思蓉\*

國立成功大學會計學系暨財務金融研究所

## 摘要

2008 年金融海嘯對全球經濟所造成的負面衝擊至今仍然存在，為維持金融市場穩定，避免歷史重演，有關金融危機之探討及相關的金融法規改革也持續進行中，當中又以美國政府制定之 Dodd-Frank 法案和巴塞爾委員會提出的巴塞爾資本協定 III 最為大家所熟知。本研究聚焦在 2008 年金融海嘯前後時期，採用 2001 年第 2 季至 2015 年第 1 季的美國銀行控股公司資料，探討金融海嘯後銀行的放款行為是否有所改變。實證結果指出在金融海嘯發生之前，銀行的資本適足率對銀行的貸款成長有正向的影響，當銀行資本適足率愈高時，銀行放款成長率也愈大，但在金融危機過後，銀行資本適足率對貸款成長的影響大幅度減少，資本比率對於放款成長的正向影響較不顯著。整體而言，本研究結果顯示在金融海嘯之後，銀行的放款行為較金融海嘯發生之前更為謹慎保守，應和銀行本身的自我約束及需遵循更為嚴格的相關法規有關，也隱含著在金融海嘯後所進行的一連串金融法規改革對於銀行的營運行為確有影響。

**關鍵詞：**2008 金融海嘯、貸款成長、資本適足、巴塞爾資本協定 III

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\* 通訊作者電話：+886-6-2757575 #53424。電子信箱：d99722006@g.ntu.edu.tw。

收稿日：2018年 1月

接受日：2019年10月

三審後接受

主審領域主編：張元晨教授

DOI: 10.6552/JOAR.202001\_(70).0001

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

**Chi-Chun Liu**

Department of Accounting  
National Taiwan University

**Szu-Jung Wu\***

Department of Accountancy & Graduate Institute of Finance  
National Cheng Kung University

## 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. This study focuses on the periods before and after the 2008 financial crisis and examines whether the banks' lending behavior 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 compared to that before the crisis. The results suggest that after the financial crisis, lending behavior may be restricted by the banks themselves and by the stricter regulations. Our evidence also implies that the regulation reforms might really have an impact on banks' behavior.

**Keywords:** *2008 financial crisis, Loan growth, Capital adequacy, Basel III.*

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\* Corresponding author. Tel: +886-6-2757575 #53424; Email: d99722006@g.ntu.edu.tw

Submitted January 2018

Accepted October 2019

After 3 rounds of review

Field Editor: Professor Yuan-Chen Chang

DOI: 10.6552/JOAR.202001\_(70).0001

## 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 questions: what's wrong with the banking industry and what were the causes of the financial crisis? Because of the rising housing market, the competition in lending market became tough in that period before the 2008 crisis. To react to such a competitive lending market, lenders relaxed their lending standards<sup>1</sup> 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 200–2007.<sup>2</sup>

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 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. Prior 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; Köhler 2012; Skala 2012; Amador, Gómez-González, and Pabón 2013; Pakhchanyan and Sahakyan 2014; Fahlenbrach, Prilmeier, and Stulz 2016). Since lending is important, in addition to regulators and banks, investors, equity analysts, and credit

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<sup>1</sup> 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 and the demand of lending, and 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/>.

<sup>2</sup> 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>.

agencies are also concerned about loan-related information when making decisions and predictions (e.g., Desai, Rajgopal, and Yu 2016; Fahlenbrach et al. 2016; Zemel 2018).

To prevent another crisis, regulators enacted new rules to provide an overall supervisory mechanism for the banking industry and to maintain financial stability. Granja (2018) investigate the impact of disclosure and supervisory regulations on the U.S. commercial banks and find that regulations might reduce the bank failure and maintain the financial stability. The main regulations related to the 2008 crisis were the Dodd–Frank Wall Street Reform and Consumer Protection Act (the Dodd–Frank Act) and the Basel III reforms.<sup>3</sup> The Dodd–Frank Act, which can be viewed as the most important regulation reforms of financial institutions in the U.S. stemming from the 2008 crisis, set new rules to restrict banks’ lending behavior directly, including enhancing consumer protection, ensuring borrowers’ ability to repay loans, and requiring additional disclosures. From the lessons of the financial crisis, regulators also realized that sudden and enormous losses might lead to a serious liquidity problem not only for an individual bank but also for an overall banking industry. Therefore, capital and liquidity are another addressed points of the regulation reforms. The Dodd–Frank Act emphasized the importance of capital and liquidity and required the Federal Reserve to conduct stress tests of financial institutions. Besides, the Basel III reforms enhanced minimum capital requirements and set new liquidity standards. In accordance with the Basel III, the Federal Reserve proposed and approved the implementation of the Basel III capital and liquidity standards to ensure that U.S. banks have a strong capital position and enough liquidity ability.

Due to these regulatory changes, banks might 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 they have to follow more rigorous rules.<sup>4</sup> One of the main reasons why the Dodd–Frank Act was rolled back to review was related to the controversy over the reduction of banks’ willingness to lend due to the Act.<sup>5</sup> However, these claims

<sup>3</sup> The Dodd–Frank Act was enacted in July 2010 and Basel III was announced in December 2010 (a revised version was published in July 2011).

<sup>4</sup> For example, an article “Banks Are Not Lending Like They Should, and With Good Reason” published on May 30<sup>th</sup>, 2013 in Forbes by Richard Finger, 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. The article is available at: <https://www.forbes.com/sites/richardfinger/2013/05/30/banks-are-not-lending-like-they-should-and-with-good-reason/#15204719519f>.

<sup>5</sup> “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,” the U.S. President Donald Trump said in announcing the review of Dodd–Frank on February 3<sup>rd</sup>, 2017. An article of the Washington Post (February 9<sup>th</sup>, 2017) “Trump’s claim that friends ‘can’t borrow money’ because of Dodd–Frank” published by Glenn Kessler showed the video related to this claim and cited this claim in his article. The video and article are both available at: <https://www.washingtonpost.com/news/fact-checker/wp/2017/02/09/trumps-claim-that-friends-cant-borrow-money-because-of-dodd-frank/>

were not substantiated by the growth in lending and, furthermore, others argued that banks have started to behave in the same way as they did before the financial crisis.<sup>6</sup> Supporting this viewpoint, the Federal Reserve's survey<sup>7</sup> reports that banks and, in particular, larger banks started to ease their lending standards and terms from 2010 onwards. The Federal Reserve's information also shows that loan growth slightly increased from 2012.<sup>8</sup> In addition, regulators claimed that the more rigorous rules might not relate to the loan reduction after the 2008 crisis. The former Federal Reserve chair, Yellen, claimed that there was 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.<sup>9</sup> 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.

The prior literature provides evidence that the determinants of lending behavior might include both internal factors—such as capital level, liquidity, and credit risk—and external factors, such as monetary policy changes, economic outlook, and accounting standards (Berger and Udell 2004; Ivashina and Scharfstein 2010; Gambacorta and Marques-Ibanez 2011; Carlson, Shan, and Warusawitharana 2013; Kapan and Minoiu 2013; Laidroo 2014). In this study, 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, 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 from 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

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<sup>6</sup> For instance, the article "Banks Loosen Lending Standards to Levels Seen Before Financial Crisis" published in the Los Angeles Times by Peter Foley on December 16<sup>th</sup>, 2014, said 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.*" (Available at: <http://www.latimes.com/business/la-fi-lending-standards-20141217-story.html>). In 2017, the article "Banks are Lending a Ton, Despite Trump's Claims" published in CNN Money said, "*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*" (By Matt Egan, February 13<sup>th</sup>, 2017 and available at: <http://money.cnn.com/2017/02/13/investing/bank-business-lending-dodd-frank-trump/>).

<sup>7</sup> The Senior Loan Officer Opinion Survey on Bank Lending Practices conducted by the Federal Reserve.

<sup>8</sup> Refer to the Assets and Liabilities of Commercial Banks in the United States H.8 Historical Information released by The Federal Reserve.

<sup>9</sup> Refer to "Yellen Warns Against Erasing Regulations Made After Financial Crisis" by Binyamin Appelbaum, The New York Times, August 25<sup>th</sup>, 2017. Available at: <https://nyti.ms/2w45pxm>.

negatively related to loan growth. Second, we use a subsample composed of observations from the pre-crisis period (2001-2006) and from the post-crisis period (2011-2015)<sup>10</sup> to examine whether the determinants affect loan growth differently before and after the financial crisis by using a regression model. Because capital is typically regarded as a crucial determinant of loan growth and is emphasized by both the Dodd-Frank Act and the Basel III, we particularly focus on the relationship between capital and lending growth during the pre- and post-crisis periods. We have observed a relatively lower credit growth and higher capital adequacy of U.S. bank holding companies after the 2008 financial crisis. These might result from both the regulation reforms and banks' own recognition of the importance of risk management. Generally, 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. Acharya and Ryan (2016) mention that banks' ability to generate loans relies on their capital level and liquidity position while they discuss the research designs related to banks' financial reporting, financial system stability, and the lending activities of banks. The prior literature shows a positive relation between capital ratio and loan growth (Berrospide and Edge 2010; Laidroo 2014) and that well-capitalized banks' credit supply would be less sensitive during a crisis or a monetary policy tightened periods compared to other banks (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 and to fund the banks' liquidity,<sup>11</sup> which was a major reason why banking regulators, such as the U.S. Federal Reserve and the Basel Committee, emphasized the importance of capital and proposed enhancing the minimum capital requirement. Since rapid loan growth was regarded as a major cause of the 2008 crisis, another purpose of enhancing capital requirements is to reduce the rapid asset growth. Some prior literature also suggests 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 more rigorous requirement, and reduce their willingness to lend. Even those banks with relatively sufficient capital and higher capital

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<sup>10</sup> After the financial crisis, the banking-related regulators released many new rules, most 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 10<sup>th</sup>, 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.

<sup>11</sup> "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.

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.

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 suggest that the regulation reforms after the financial crisis do, in fact, impact the banks' lending behavior and restrict the rapid loan growth. Gruenberg (2016) claimed that U.S. banks are with stronger capital and substantial loan growth after the financial crisis and a series of regulation reforms.<sup>12</sup> We particularly investigate the effect of capital on lending and our evidence shows that the effect of capital ratio on lending growth declines dramatically after the financial crisis. We also investigate whether larger banks showed different patterns of loan growth determinants compared with other banks and find that the effects of stricter capital requirement 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 when we consider that the effect might be nonlinear. Our results are consistent with prior literature's results that enhancing capital requirements will limit banks' lending growth and suggest that well-capitalized banks might tend to hold more capital and are less willingness to lend after the crisis compared to other banks.

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 transparent information, and to strengthen banks' ability to absorb potential credit losses. In 2010, the

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<sup>12</sup> Martin J. Gruenberg, the Chairman of FDIC, made a speech to the Exchequer Club (Washington DC) in June 15<sup>th</sup>, 2016, and talked about the impact of post-crisis regulation reforms on the U.S. financial system. He discussed about the credit availability, bank profitability, market liquidity and other related issues and claimed that a strong loan growth of FDIC-insured banks was observed in 2016 even though bank lending declined during the crisis and for a few years after the crisis. The speech is available on FDIC website: <https://www.fdic.gov/news/news/speeches/spjun1516.html>.

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.<sup>13</sup> 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 2013, the Consumer Financial Protection Bureau (CFPB) released the rule of “Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act” (ATR/QM rule), which require lenders to make a reasonable determination of a borrower’s ability to pay back the loan.<sup>14</sup> By implementing these stronger lending limits, the U.S. government wanted to prohibit unfair and irresponsible lending and to provide borrowers with more protection.

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),”<sup>15</sup> both of which were effective after November 15<sup>th</sup>, 2009. These two new standards require banks to consolidate off-balance-sheet securitization, which might lead to more opaque information of banks assets and riskiness, and might have impact on banks’ capital adequacy. Furthermore, 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<sup>16</sup> 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,”<sup>17</sup> and all financial companies with more than \$10 billion in total consolidated assets that are supervised by a primary federal financial

<sup>13</sup> 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)

<sup>14</sup> See Appendix 2 (Part II) for more details.

<sup>15</sup> 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). The new accounting treatment requires banks to consolidate off-balance-sheet securitization and would reduce banks’ benefits from securitizing their loans.

<sup>16</sup> For example, “Sec. 171. Leverage and Risk-Based Capital Requirements” of the Dodd–Frank Act.

<sup>17</sup> “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.



regulatory agency are required to conduct company-run stress tests at least annually.<sup>18</sup> The Federal Reserve adopted rules implementing these requirements in October 2012.<sup>19</sup> Through the stress test, regulators can confirm that banks have enough capital to absorb the potential losses related to their risk exposure under different stressful scenarios. Almost at the same time as the Dodd–Frank Act was published, the Basel Committee on Banking Supervision (BCBS) 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 to implement the Basel III capital standards to ensure that banks have a strong capital position. Besides capital regulations, the Federal Reserve and FDIC also developed rules of liquidity standards based on Basel III and the Dodd–Frank Act.<sup>20</sup> In summary, after the 2008 financial crisis, the financial regulation became much stricter than those before the financial crisis.

## 2.2 Relevant Literature

The prior literature suggests that loan growth or a bank's lending behavior can be determined by both external factors and internal factors. For the external determinants, literature finds that monetary policy, regulator supervision, economic environment, and the adoption of accounting standards might have impact on banks' lending supply. Laidroo (2014) investigated lending growth determinants by using banks from CEE countries during the period 2004-2010 and finds that the effect of loan growth determinants will depend on the economic environment and monetary policy. Meder (2015) investigated the effect of marketable security holdings under SFAS No. 115 "Accounting for Certain Investment in Debt and Equity Securities" and finds that the interaction between monetary policy and the accounting standards will result in different impacts on loan growth. Xie (2016) investigates whether fair value accounting has procyclicality effect on bank lending supply but find no evidence. Dou, Ryan, and Xie (2018) examine the effect of FAS 166 and 167 on banks mortgage approval by using the U.S. HMDA loan-level data and find that banks recognizing more securitized assets decrease their loan approval rates more, implying that the adoption of new accounting standards, might lead to a change of banks' lending behavior. Additionally, Curry, Fissel, and Ramirez (2008) and Kupiec, Lee, and Rosenfeld (2017) suggest that bank supervision will have a significant negative effect on loan growth.

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<sup>18</sup> Refer to Sec. 165 (i) Stress Test of the Dodd–Frank Rules.

<sup>19</sup> In fact, the U.S. Federal Reserve has conducted a supervisory capital assessment program (i.e., a stress test) on 19 major banks, such as JPMorgan Chase and Citigroup, in early 2009.

<sup>20</sup> The proposed liquidity rules was developed by the Federal Reserve and FDIC and released to invite comments in October 2013. The U.S. liquidity coverage ratio (LCR) rule was finalized in September 2014 and will apply to large banking organizations. On April 26<sup>th</sup>, 2016, the FDIC and the OCC issued a notice of proposed rulemaking to implement the net stable funding ratio (NSFR). See Appendix 2 (Part III) for more details related to Basel III and U. S. implementation.

However, Berger and Udell (2004) use individual U.S. banks during 1980-2000 to investigate whether a bank's lending increases as time passes after controlling for business cycles and other supply-and-demand factors, and find that banks' internal behavior might be most important for loan growth. Internal factors, such as credit risk, profitability, liquidity and capital adequacy, are related to loan growth. Cole (2012) provides evidence that bank profitability and business lending show a strong and significant negative relation, while Laidroo (2014) 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 2014; Cucinelli 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. Lo (2015) examine the relationship between banks' financial reporting credibility and liquidity ability during monetary policy tightening periods and finds that audited banks' funding ability to credit supply is more stable than unaudited banks and thus, audited banks' lending would be less influenced by the liquidity shock, implying that liquidity is an important determinant of banks loan generation. Consistent with Lo (2015), a stream of literature suggests that stronger liquidity ability and sufficient funding source will have positive effect on lending growth (Dahl, Shrieves, and Spivey 2002; Altunbas et al. 2009; De Haas and van Lelyveld 2010; Ivashina and Scharfstein 2010; Cremers, Huang, and Sautner 2011; Aysun and Hepp 2016).

Among the internal factors of lending behavior, capital is one of the most addressed in the literature. Kishan and Opiela (2000) used U.S. commercial banks' Call Report data from 1980 to 1995 to investigate bank 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. However, there are also some studies showing that enhancing 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).

After the 2008 financial crisis, the relation between lending behavior and the financial crisis has been discussed. Ho, Huang, Lin, 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. 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, McNutt, Strahan, and Tehranian 2011; Gambacorta and Marques-Ibanez 2011; Carlson et al. 2013). 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 capitalized decrease their lending dramatically. Kapan and Minoiu (2013) examined the role of a bank's balance sheet strength during the financial crisis and their results suggest that if banks hold more high-quality capital could help to maintain banks' lending even during the crisis period.

### 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 they did 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.<sup>21</sup> 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

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<sup>21</sup> 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>.

changed their behavior because of the new regulations, such as the stricter capital requirements, the tighter lending limits, and the stricter information disclosures.

Capital requirement is one of the most addressed points in the regulations because capital can measure 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; Laidroo 2014). 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 2013) 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.<sup>22</sup>

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, to minimize liquidity concern, 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 (Hyun and Rhee 2011; 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 hypothesis is as follow:

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

### **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.<sup>23</sup> We start the sample selecting process from all U.S. bank holding companies' (BHCs') quarterly data

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<sup>22</sup> See Appendix 2 for the implementation timeline of minimum capital requirements under Basel III.

<sup>23</sup> The Bank Regulator is a dataset of the Wharton Research Data Service (WRDS). This dataset provides financial data from bank holding companies included in the FRY-9 reports.

during the period from 2001 to 2015.<sup>24</sup> After deleting firms whose fiscal year does not end on December 31<sup>st</sup>, observations that cannot be combined with the CRSP dataset,<sup>25</sup> and observations with missing values, the final sample is composed of 20,560 bank-quarter data for 585 BHCs during the period from 2001Q2 to 2015Q1. Among these 585 BHCs, 305 of them include observations from both the pre- and post-crisis periods. We also collect the U.S. GDP data from the Bureau of Economic Analysis, which is an agency of the U.S. Department of Commerce. The federal funds rates are collected from the Federal Reserve Bank Reports database on the WRDS platform.<sup>26</sup> 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.

**Table 1 Sample Selection**

	#obs.	#BHCs
All U.S. BHC from Bank Regulator 2001-2015	214,381	8,297
Delete if Fiscal Year End isn't 12/31	(6,854)	(313)
Delete data cannot be combined with CRSP data <sup>a</sup>	(180,457)	(7,189)
Delete if with missing variables used in regression	(6,510)	(210)
Final sample (2001Q2-2015Q1)	20,560	585

*Notes:* a. 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. We match BHCs of Bank Regulator with CRSP dataset based on the *CRSP-FRB Link* which was provided by the Federal Reserve Bank of New York (2016). This *CRSP-FRB Link* helps to link a BHC's unique regulatory identification number (RSSD ID) to a unique identifier of CRSP (PERMCO; CRSP PERMCO identifier). Based on the link, we merge the CRSP PERMCO identifier into our data, and exclude BHCs without the CRSP PERMCO identifier.

The CRSP-FRB Link is available at:

[https://www.newyorkfed.org/research/banking\\_research/datasets.html](https://www.newyorkfed.org/research/banking_research/datasets.html).

<sup>24</sup> We start our sample selecting process from 2001 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.

<sup>25</sup> 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. We match BHCs of Bank Regulator dataset with CRSP dataset based on the *CRSP-FRB Link* which was provided by the Federal Reserve Bank of New York (2016). This *CRSP-FRB Link* helps to link a BHC's unique regulatory identification number (RSSD ID) to a unique identifier of CRSP (PERMCO; CRSP PERMCO identifier). Based on the link, we merge the CRSP PERMCO identifier into our data, and exclude BHCs without the CRSP PERMCO identifier. The CRSP-FRB Link is available at: [https://www.newyorkfed.org/research/banking\\_research/datasets.html](https://www.newyorkfed.org/research/banking_research/datasets.html).

<sup>26</sup> 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.

### 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-Ibanez (2011), Laidroo (2014), and Ho et al. (2016). Furthermore, to investigate the different effects before and after the financial crisis, we use a sample that only contains observations before the crisis (2001-2006) and after the crisis (2011-2015).<sup>27</sup> We incorporate a dummy variable, *After<sub>t</sub>*, 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:

$$\Delta \ln(\text{Loan})_{i,t} = \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times \text{After}_t + \beta_3 \times TCR_{i,t-1} \times \text{After}_t + \text{Controls}_{i,t-1} + \text{Controls}_{i,t-1} \times \text{After}_t + \varepsilon_{i,t} \quad (1)$$

where  $\Delta \ln(\text{Loan})_{i,t}$  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,  $\ln(\text{Loan})_{i,t} - \ln(\text{Loan})_{i,t-1}$  (Gambacorta and Marques-Ibanez 2011; Carlson et al. 2013). Net loan is defined by loans net of allowance.<sup>28</sup> 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).  $\text{Controls}_{i,t-1}$  is a vector of control variables.  $LIQR_{i,t-1}$  is the proxy for liquidity, which is calculated as the ratio of liquid assets to total assets.<sup>29</sup> 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).  $NPLR_{i,t-1}$  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).  $ROA_{i,t-1}$

<sup>27</sup> 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 10<sup>th</sup>, 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 sample starting from 2011 as the post-crisis sample, but if the observations of 2010 are included, the results are still similar.

<sup>28</sup> The loans and leases held for sale are not included here because banks, for example, the Citigroup, usually classify these loans as other assets in their financial reports.

<sup>29</sup> We do not use the Basel III liquidity ratios - 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.

is used as the proxy for a bank's profitability (Cole 2012; Laidroo 2014). We also control for banks' equity ratio, denoted as  $EquityRatio_{i,t-1}$ , which is defined as the ratio of book equity to total assets (Dahl et al., 2002).<sup>30</sup> Following the prior literature to control for previous loan growth because of the persistence of loan growth, we also include  $\Delta Ln(Loan)_{i,t-j}$ , where  $j=1, 2, 3, 4$ , in our empirical model (Berrospide and Edge 2010; Carlson et al. 2013; Meder 2015).<sup>31</sup> Since lending is significantly correlated with the macroeconomic environment, we also include the change in GDP as a control variable, denoted as  $\Delta GDP_{t-1}$  (Tamirisa and Igan 2008; Altunbas et al. 2009). 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 1.

Because we suspect that the effect of capital will decrease after the financial crisis, we predict that the coefficients of  $TCR_{i,t-1} \times After_t$  will be negative.

## 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 asset is \$26,700 million with \$24,100 million in liabilities and \$2,518 million in equity. The average total loan is about \$12,300 million while the average net loan is about \$11,700 million. Average NPL is 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 NPL after the financial crisis is 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

<sup>30</sup> 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.

<sup>31</sup> Some of the prior literature only controls for loan changes during the two prior periods (e.g., Carlson et al. 2013; Meder 2015). However, according to the preliminary test of loan growth determinants, we found that the previous 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.

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

**Table 2 Descriptive Statistics**

<b>Panel A: BHC Characteristics (in \$million)</b>									
Variables	2001Q2-2015Q1 (#obs.=20,560)				2001Q2-2006Q4 (#obs.=9,515)		2011Q1-2015Q1 (#obs.=5,293)		Diff.
	Mean	SD.	Min	Max	Mean	SD.	Mean	SD.	
<i>Asset</i>	26,700	165,000	55	2,480,000	17,692	105,400	36,857	209,200	-19,165***
<i>Liability</i>	24,100	150,000	52	2,260,000	16,118	96,627	33,068	189,000	-16,950***
<i>Equity</i>	2,518	14,900	-510	258,000	1,574	8,870	3,789	20,457	-2,215***
<i>NI</i>	50	455	-23,700	7,143	58	359	72	455	-14**
<i>TLoan</i>	12,300	68,900	25	1,020,000	8,903	47,700	15,484	82,166	-6,581***
<i>NetLoan</i>	11,700	64,800	25	955,000	8,315	44,737	14,821	78,058	-6,506***
<i>NPL</i>	352	3,228	0	75,300	111	809	574	4,513	-463***
<b>Panel B: Variables used in regressions (#BHC=585)</b>									
Variables	2001Q2-2015Q1 (#obs.=20,560)				2001Q2-2006Q4 (#obs.=9,515)		2011Q1-2015Q1 (#obs.=5,293)		Diff.
	Mean	SD.	Min	Max	Mean	SD.	Mean	SD.	
$\Delta \ln(\text{loan})_{i,t}$	0.020	0.049	-0.092	0.256	0.031	0.049	0.015	0.047	0.016***
$\Delta \ln(\text{loan})_{i,t-1}$	0.021	0.049	-0.091	0.264	0.031	0.049	0.014	0.048	0.017***
$\Delta \ln(\text{loan})_{i,t-2}$	0.021	0.050	-0.092	0.270	0.031	0.051	0.012	0.048	0.019***
$\Delta \ln(\text{loan})_{i,t-3}$	0.022	0.050	-0.090	0.273	0.031	0.051	0.01	0.048	0.021***
$\Delta \ln(\text{loan})_{i,t-4}$	0.022	0.050	-0.089	0.272	0.031	0.051	0.008	0.048	0.023***
$NPLR_{i,t-1}$	0.017	0.020	0.000	0.111	0.008	0.009	0.026	0.023	-0.018***
$TCR_{i,t-1}$	0.140	0.033	0.056	0.274	0.136	0.031	0.155	0.035	-0.019***
$LIQR_{i,t-1}$	0.251	0.113	0.047	0.599	0.26	0.116	0.272	0.108	-0.012***
$EquityRatio_{i,t-1}$	0.096	0.025	0.030	0.181	0.093	0.021	0.103	0.027	-0.01***
$SIZE_{i,t-1}$	14.592	1.580	12.301	20.434	14.275	1.573	14.958	1.56	-0.683***
$ROA_{i,t-1}$	0.002	0.003	-0.018	0.006	0.003	0.002	0.002	0.003	0.001***
$\Delta GDP_{t-1}$	0.041	0.029	-0.077	0.093	0.054	0.02	0.038	0.019	0.016***
$\Delta FedFundr_{t-1}$	0.000	0.004	-0.005	0.014	-0.001	0.005	0.000	0.000	-0.001***

Notes: a. *Asset* is total assets. *Liability* is total liabilities. *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.  $\Delta \ln(\text{Loan})$  is the proxy for loan growth, defined as the change of natural log of loans. *NPLR* is defined as the ratio of *NPL* to *TLoans*. *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. *EquityRatio* is defined as the ratio of total equity to total assets.  $\Delta GDP$  is the percent change of GDP.  $\Delta FedFundr$  is the change of federal funds rate. Refer to Appendix 1 about the details of variable definitions.

b. \*\* and \*\*\* indicate that the mean difference is significant at the 5% and 1% level, respectively.



Table 3 shows the 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 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 positive correlation with loan change while the change in the federal funds rate shows a negative association with loan growth.<sup>32</sup>

#### 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 (2) 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 four quarters.

#### 4.3 Main Test: Determinants of Loan Growth During the Pre-crisis and Post-crisis Periods

We use the sample composed of 14,808 bank-quarter observations (#obs.=9,515 for 2001-2006 and #obs.=5,293 for 2011-2015) to examine determinants of credit growth before versus after the financial crisis and the results of are presented in Table 5. We are especially interested in the effect of the capital ratio on lending growth after the financial crisis and thus we focus on the coefficients of  $TCR_{i,t-1} \times After_t$ . Columns (1) and (2) show the results with the year fixed effect.<sup>33</sup> According to our results, a positive relation between loan growth and capital ratio exists before the financial crisis. For example, the coefficient of  $TCR_{i,t-1}$  is 0.2818 (*t*-statistic=7.19) in column (1) and 0.3632 (*t*-statistic=8.43) in column (2). However, a negative incremental relation can be observed by the coefficient of  $TCR_{i,t-1} \times After_t$ , that is, the coefficient is -0.0928 (*t*-statistic=-2.55) in column (1) and -0.32 (*t*-statistic=-5.94) in column (2). The result is consistent with our hypothesis, 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 (2) for example, a 1% increase in the capital ratio will result in a 0.04% increase in lending growth after the crisis ( $\beta_1 + \beta_3$  is 0.0432 with *t*-statistic=1.03), which is much less than that during the pre-crisis period

<sup>32</sup> Most of the results of Pearson correlations and Spearman correlations are consistent but the spearman test shows a negative correlation between loan growth and capital ratio.

<sup>33</sup> Year mean adjusted on regression variables is used as the year fixed effect in this study.

Table 3 Correlations of Regression Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) $\Delta \ln(\text{loan})_{it}$		0.4737*	0.4288*	0.3722*	0.3971*	-0.4354*	-0.0849*	0.2705*	-0.0107	-0.0506*	-0.0494*	0.2210*	-0.1176*
(2) $\Delta \ln(\text{loan})_{i,t-1}$	0.3004*		0.4728*	0.4260*	0.3713*	-0.4374*	-0.0673*	0.2468*	-0.0391*	-0.1188*	-0.1472*	0.1970*	-0.1364*
(3) $\Delta \ln(\text{loan})_{i,t-2}$	0.2775*	0.2952*		0.4685*	0.4254*	-0.4249*	-0.0645*	0.2243*	-0.0564*	-0.1515*	-0.1709*	0.1439*	-0.1096*
(4) $\Delta \ln(\text{loan})_{i,t-3}$	0.2495*	0.2745*	0.2898*		0.4691*	-0.4129*	-0.0638*	0.1945*	-0.0711*	-0.1749*	-0.1887*	0.1152*	-0.0915*
(5) $\Delta \ln(\text{loan})_{i,t-4}$	0.2673*	0.2488*	0.2756*	0.2946*		-0.3932*	-0.0702*	0.1749*	-0.0859*	-0.1921*	-0.2017*	0.0993*	-0.0854*
(6) $NPLR_{i,t-1}$	-0.3564*	-0.3432*	-0.3205*	-0.2950*	-0.2682*		0.1717*	-0.4335*	0.0800*	-0.0417*	0.1233*	-0.2799*	0.1862*
(7) $SIZE_{i,t-1}$	-0.0415*	-0.0185*	-0.0186*	-0.0185*	-0.0230*	0.0730*		0.1033*	0.1883*	0.0168*	-0.0029	-0.0911*	-0.0050
(8) $ROA_{i,t-1}$	0.2581*	0.2436*	0.1971*	0.1689*	0.1349*	-0.5379*	0.0537*		0.1825*	0.0658*	0.0570*	0.2176*	-0.1457*
(9) $EquityRatio_{i,t-1}$	0.0599*	0.0438*	0.0341*	0.0235*	0.0081	-0.1049*	0.1771*	0.2416*		0.0113	0.5331*	-0.0517*	0.0520*
(10) $LQOR_{i,t-1}$	-0.0208*	-0.0821*	-0.1083*	-0.1247*	-0.1382*	-0.0573*	0.0202*	0.0873*	0.0015		0.4010*	0.0561*	-0.0211*
(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*		-0.0097	-0.0388*
(12) $\Delta GDP_{t-1}$	0.1771*	0.1443*	0.0994*	0.0656*	0.0553*	-0.2241*	-0.0615*	0.2499*	-0.0100	0.0766*	0.0252*		-0.4817*
(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*	

Notes: a. The upper right part of the diagonal shows the Spearman correlations while the lower left part shows the Pearson correlations.

b.  $\Delta \ln(\text{Loan})$  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.  $LQOR$  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.  $EquityRatio$  is defined as the ratio of total equity to total assets.  $\Delta GDP$  is the percent change of GDP.  $\Delta FedFundr$  is the change of federal funds rate. Refer to Appendix 1 about the details of variable definitions.

\* indicates that correlation is significant at the 5% level.

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

	(1)	(2)
$TCR_{i,t-1}$	0.2024*** (7.42)	0.2206*** (8.11)
$\Delta Ln(loan)_{i,t-1}$	0.0798*** (8.73)	0.0761*** (8.38)
$\Delta Ln(loan)_{i,t-2}$	0.0673*** (7.56)	0.0606*** (6.85)
$\Delta Ln(loan)_{i,t-3}$		0.0377*** (4.38)
$\Delta Ln(loan)_{i,t-4}$		0.0826*** (9.62)
$LIQR_{i,t-1}$	0.0241*** (3.53)	0.0311*** (4.56)
$NPLR_{i,t-1}$	-0.5786*** (-21.75)	-0.5332*** (-19.98)
$SIZE_{i,t-1}$	-0.0228*** (-13.25)	-0.0241*** (-14.02)
$ROA_{i,t-1}$	0.8027*** (6.55)	0.7433*** (6.16)
$EquityRatio_{i,t-1}$	-0.0021 (-0.06)	-0.0202 (-0.59)
$\Delta GDP_{t-1}$	0.0887*** (4.97)	0.0908*** (5.11)
$\Delta FedFundr_{t-1}$	0.1744 (1.40)	0.1757 (1.43)
Intercept	0.3063*** (12.67)	0.3176*** (13.18)
Firm Fixed	Yes	Yes
Year Fixed	Yes	Yes
#obs.	20,560	20,560
adj. $R^2$	25.65%	26.36%

Notes: 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.  $EquityRatio$  is defined as the ratio of total equity to total assets.  $\Delta GDP$  is the percent change of GDP.  $\Delta FedFundr$  is the percent change of federal funds rate. Refer to Appendix 1 about the details of variable definitions.

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

**Table 5 Determinants of Loan Growth during Pre-crisis and Post-crisis Periods**

	Expected Sign	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$		0.2818*** (7.19)	0.3632*** (8.43)	0.2984*** (7.66)	0.3765*** (8.82)
$TCR_{i,t-1} \times After_t$	-	<b>-0.0928***</b> <b>(-2.55)</b>	<b>-0.3200***</b> <b>(-5.94)</b>	<b>-0.1055***</b> <b>(-2.88)</b>	<b>-0.3352***</b> <b>(-6.18)</b>
$LIQR_{i,t-1}$		0.0231*** (2.93)	-0.0006 (-0.06)	0.0267*** (3.46)	0.0042 (0.46)
$LIQR_{i,t-1} \times After_t$			0.0631*** (5.70)		0.0624*** (5.67)
$NPLR_{i,t-1}$		-0.5348*** (-13.96)	-0.6209*** (-6.52)	-0.6241*** (-17.24)	-0.6701*** (-7.18)
$NPLR_{i,t-1} \times After_t$			0.1700* (1.73)		0.1304 (1.34)
$SIZE_{i,t-1}$		-0.0183*** (-10.00)	-0.0200*** (-10.04)	-0.0172*** (-9.42)	-0.0199*** (-10.01)
$SIZE_{i,t-1} \times After_t$			-0.0004 (-0.56)		-0.0005 (-0.84)
$ROA_{i,t-1}$		0.8191*** (3.85)	0.5418 (1.17)	0.7968*** (3.73)	0.4144 (0.91)
$ROA_{i,t-1} \times After_t$			0.2971 (0.59)		0.4557 (0.92)
$EquityRatio_{i,t-1}$		-0.0391 (-0.93)	-0.1532*** (-3.01)	-0.0552 (-1.35)	-0.1737*** (-3.51)
$EquityRatio_{i,t-1} \times After_t$			0.3305*** (5.32)		0.3476*** (5.59)
$\Delta GDP_{t-1}$		0.1054*** (4.87)	0.2269*** (8.24)	0.1407*** (7.22)	0.2570*** (10.45)
$\Delta GDP_{t-1} \times After_t$			-0.3266*** (-7.25)		-0.2896*** (-7.23)
$\Delta FedFundr_{t-1}$		-0.0804*** (-2.70)	-0.0703** (-2.36)	-0.4936*** (-3.92)	-0.2928** (-2.15)
$\Delta FedFundr_{t-1} \times After_t$			-7.1348*** (-4.46)		5.9758*** (2.87)
$After_t$		-0.0045*** (-4.00)	0.0034 (1.56)	0.0237*** (4.29)	0.0228* (1.95)
Intercept		0.0029*** (3.28)	0.0027*** (3.10)	0.2226*** (8.56)	0.2636*** (9.24)
$\sum_{j=t-4}^{t-1} \Delta \ln(Loan)_{i,j}$		Include	Include	Include	Include
$\sum_{j=t-4}^{t-1} \Delta \ln(Loan)_{i,j} \times After_t$		No	Include	No	Include
Firm Fixed		Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	No	No
#obs.		14,808	14,808	14,808	14,808
adj. $R^2$		19.02%	19.78%	23.02%	23.78%

Notes: 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.  $NPLR$  is defined as the ratio of  $NPL$  to  $TLoan$ .  $SIZE$  is the natural log of total assets and  $ROA$  is defined as  $NI$  divided by average total asset.  $EquityRatio$  is defined as the ratio of total equity to total assets.  $\Delta GDP$  is the percent change of GDP.  $\Delta FedFundr$  is the percent change of federal funds rate. Refer to Appendix 1 about the details of variable definitions. Because the observations of 2007-2010 are not included here,  $After$  is equal to 1 if during 2011-2015, and zero if during 2001-2006. Refer to Appendix 1 for more details of variables.

b. Year mean adjusted on regression variables is used as the year fixed effect.

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).

and is statistically insignificant ( $\beta_1$  is 0.3632 with  $t$ -statistic=8.43).<sup>34</sup> 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  $LQR_{i,t-1} \times After_t$  is 0.0631 ( $t$ -statistic=5.70) in column (2). These results suggest that liquidity becomes a more crucial determinant of credit growth after the crisis relative to that before the crisis. The results also show that NPL ratio shows a significantly negative effect on lending growth both in pre-crisis and post-crisis period. Columns (3) and (4) show the results with a model that does not incorporate the year fixed effect and the results are similar to columns (1) and (2).<sup>35</sup>

#### 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. Similar to our main results, after the financial crisis, the effect of the total risk-based capital ratio on loan growth decreases.

Loan growth might result from bank holding companies' natural growth and merger and acquisition (M&A) activity. To mitigate the concern that these two types of loan growth might be different and may influence the results, the second set of robustness tests use two ways to deal with the observations with such concern by: (1) excluding observations with a total equity increase of more than 10% and (2) excluding observations with non-loan asset growth exceeding 10%.<sup>36</sup> By excluding observations with equity growth more than 10% (columns (1) & (2) of Table 6), we find that after the financial crisis, the effect of capital ratio decreases (e.g., coefficient of  $TCR_{i,t-1} \times After_t = -0.2452$ ,  $t$ -statistic=-5.30 in column (2)). The results of excluding observations with non-loan asset growth of more than 10% are shown in columns (3-4) and are also similar to our original results.

<sup>34</sup> We also run a regression test by year and test the effect of capital ratio ( $TCR$ ) on loan growth. We find a positive relation between  $TCR$  and loan growth before the crisis. For the post-crisis period, the results show that  $TCR$  is negatively related to lending growth for 2010 and 2011 but positively correlated with loan growth since 2012. Additionally, although  $TCR$  shows a positive relationship with credit growth since 2012, the coefficient of  $TCR$  on loan growth is much lower than that during the pre-crisis period. For instance, the coefficient of  $TCR$ =1.268 ( $t$ -statistic=7.39), 1.171 ( $t$ -statistic=9.32), and 0.748 ( $t$ -statistic=4.75) for year 2003, 2004 and 2005, respectively, while the coefficient of  $TCR$ =0.67 ( $t$ -statistic=3.05), 0.626 ( $t$ -statistic=2.80), and 0.428 ( $t$ -statistic=1.46) for year 2012, 2013, and 2014. These results are consistent with our main result that the effect of  $TCR$  on loan growth declined significantly after the 2008 global financial crisis.

<sup>35</sup> 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.

<sup>36</sup> 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)'s method, we exclude 3,308 observations, which is about 16% of our full sample.

**Table 6 Robustness Test: Determinants of Loan Growth during Pre-crisis and Post-crisis Periods - Mitigating the Concern of M&A Activity**

	Expected Sign	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$		0.1377*** (4.30)	0.1998*** (5.67)	0.1152*** (3.85)	0.1721*** (5.28)
$TCR_{i,t-1} \times After_t$	-	-0.0724*** (-2.24)	-0.2452*** (-5.30)	-0.0460* (-1.61)	-0.1966*** (-4.77)
$LIQR_{i,t-1}$		0.0407*** (5.97)	0.0202** (2.51)	0.0356*** (5.13)	0.0135* (1.66)
$LIQR_{i,t-1} \times After_t$			0.0524*** (5.53)		0.0541*** (5.70)
$NPLR_{i,t-1}$		-0.4509*** (-13.63)	-0.5545*** (-6.22)	-0.5000*** (-15.66)	-0.6936*** (-8.29)
$NPLR_{i,t-1} \times After_t$			0.1716* (1.90)		0.2704*** (3.12)
$SIZE_{i,t-1}$		-0.0140*** (-9.57)	-0.0151*** (-9.57)	-0.0141*** (-9.22)	-0.0150*** (-9.46)
$SIZE_{i,t-1} \times After_t$			0.0010* (1.83)		0.0014*** (2.72)
$ROA_{i,t-1}$		0.8337*** (4.41)	0.7644** (2.15)	0.8782*** (4.98)	0.9203*** (2.59)
$ROA_{i,t-1} \times After_t$			0.0561 (0.14)		-0.1056 (-0.26)
$EquityRatio_{i,t-1}$		0.0910*** (2.89)	-0.0060 (-0.16)	0.0307 (0.96)	-0.0507 (-1.37)
$EquityRatio_{i,t-1} \times After_t$			0.2595*** (5.52)		0.2197*** (4.87)
$\Delta GDP_{t-1}$		0.1113*** (6.34)	0.2179*** (9.23)	0.1287*** (7.31)	0.2386*** (9.98)
$\Delta GDP_{t-1} \times After_t$			-0.2755*** (-7.85)		-0.2870*** (-8.21)
$\Delta FedFundr_{t-1}$		-0.1034*** (-4.43)	-0.0966*** (-4.14)	-0.0752*** (-3.07)	-0.0651*** (-2.65)
$\Delta FedFundr_{t-1} \times After_t$			-4.0139*** (-3.03)		-6.0774*** (-5.03)
$After_t$		-0.0037*** (-4.23)	0.0005 (0.28)	-0.0043*** (-4.63)	0.0025 (1.49)
$Intercept$		-0.0016** (-2.21)	-0.0016** (-2.22)	0.0028*** (3.72)	0.0026*** (3.51)
$\sum_{i=1}^{t-1} \Delta \ln(Loan)_{i,j}$		Include	Include	Include	Include
$\sum_{i=1}^{t-1} \Delta \ln(Loan)_{i,j} \times After_t$		No	Include	No	Include
Firm Fixed		Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	Yes	Yes
#obs.		13,825	13,825	12,538	12,538
adj. $R^2$		24.57%	25.35%	27.75%	28.70%

Notes: 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.  $NPLR$  is defined as the ratio of  $NPL$  to  $TLoan$ .  $SIZE$  is the natural log of total assets and  $ROA$  is defined as  $NI$  divided by average total asset.  $EquityRatio$  is defined as the ratio of total equity to total assets.  $\Delta GDP$  is the percent change of GDP.  $\Delta FedFundr$  is the percent change of federal funds rate. Refer to Appendix 1 about the details of variable definitions. Because the observations of 2007-2010 are not included here,  $After$  is equal to 1 if during 2011-2015, and zero if during 2001-2006. Refer to Appendix 1 for more details of variables.

b. Column (1) & (2) present the results of excluding observations with equity growth exceeding 10% while column (3) & (4) are the results of excluding observations with non-loan asset growth exceeding 10%.

c. Year mean adjusted on regression variables is used as the year fixed effect.

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

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. The expanded model is as follows:

$$\begin{aligned} \Delta \ln(\text{Loan})_{i,t} = & \alpha_i + \beta_1 \times \text{TCR}_{i,t-1} + \beta_2 \times \text{Crisis}_t + \beta_3 \times \text{TCR}_{i,t-1} \times \text{Crisis}_t + \beta_4 \times \\ & \text{After}_t + \beta_5 \times \text{TCR}_{i,t-1} \times \text{After}_t + \text{Controls}_{i,t-1} + \text{Controls}_{i,t-1} \times \\ & \text{Crisis}_t + \text{Controls}_{i,t-1} \times \text{After}_t + \varepsilon_{i,t}. \end{aligned} \quad (2)$$

$\text{Crisis}_t$  is set to 1 during the crisis period (2007-2009) and zero otherwise while  $\text{After}_t$  is set to 1 during the post-crisis period (2010-2015) and zero otherwise.<sup>37</sup> Table 7 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. For example, the coefficient of  $\text{TCR}_{i,t-1} \times \text{After}_t$  is -0.2978 ( $t$ -statistic=-6.24) in column (2).

Additionally, the results of Table 7 also provide some evidences that the effect of capital ratio on loan growth decreases during the crisis period. Thus, to mitigate the concern that our results might only capture the effect of a trend over time but not the effect of the financial crisis, we also include a variable,  $\text{Time}_t$ , 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:

$$\begin{aligned} \Delta \ln(\text{Loan})_{i,t} = & \alpha_i + \beta_1 \times \text{TCR}_{i,t-1} + \beta_2 \times \text{After}_t + \beta_3 \times \text{TCR}_{i,t-1} \times \text{After}_t + \beta_4 \times \text{Time}_t + \\ & \beta_5 \times \text{TCR}_{i,t-1} \times \text{Time}_t + \text{Controls}_{i,t-1} + \text{Controls}_{i,t-1} \times \text{After}_t + \\ & \text{Controls}_{i,t-1} \times \text{Time}_t + \varepsilon_{i,t}. \end{aligned} \quad (3)$$

The results are shown in Table 8. After the financial crisis, the effect of capital ratio on lending growth is significantly decreased (e.g., the coefficient of  $\text{TCR}_{i,t-1} \times \text{After}_t$  is -0.4888 ( $t$ -statistic=-3.18) in column (2)) after controlling for the time-trend effect. In sum, our original results might not only be influenced by the time trend.

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

<sup>37</sup> This robustness test includes all the observations from 2001 to 2015, and 2010 is set as the onset of post-crisis period. Therefore, in this model, the indicator variable  $\text{After}$  is equal to one if during 2010-2015, and zero otherwise.

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. Hence, to further test whether large banks are especially affected, we redo our test using the following expanded model:

$$\begin{aligned} \Delta \ln(\text{Loan})_{i,t} = & \alpha_i + \beta_1 \times \text{TCR}_{i,t-1} + \beta_2 \times \text{After}_t + \beta_3 \times \text{TCR}_{i,t-1} \times \text{After}_t + \beta_4 \times \text{Large} + \\ & \beta_5 \times \text{TCR}_{i,t-1} \times \text{Large} + \beta_6 \times \text{Large} \times \text{After}_t + \beta_7 \times \text{TCR}_{i,t-1} \times \text{Large} \times \\ & \text{After}_t + \text{Controls}_{i,t-1} + \text{Controls}_{i,t-1} \times \text{After}_t + \text{Controls}_{i,t-1} \times \text{Large} + \\ & \text{Controls}_{i,t-1} \times \text{Large} \times \text{After}_t + \varepsilon_{i,t}. \end{aligned} \quad (4)$$

**Table 7 Robustness Test: Determinants of Loan Growth Before, During and After the Financial Crisis**

	Expected Sign	(1)	(2)	(3)	(4)
$\text{TCR}_{i,t-1}$		0.2477*** (7.38)	0.3494*** (8.91)	0.2666*** (7.93)	0.3617*** (9.30)
$\text{TCR}_{i,t-1} \times \text{Crisis}_t$		0.0151 (0.34)	-0.1316** (-2.14)	0.0072 (0.16)	-0.1465*** (-2.39)
$\text{TCR}_{i,t-1} \times \text{After}_t$	-	<b>-0.0634**</b> <b>(-1.96)</b>	<b>-0.2978***</b> <b>(-6.24)</b>	<b>-0.0489*</b> <b>(-1.52)</b>	<b>-0.3131***</b> <b>(-6.54)</b>
$\text{Crisis}_t$		-0.0029*** (-3.57)	-0.0040*** (-3.17)	0.0058 (1.00)	0.0250** (2.06)
$\text{After}_t$		-0.0037*** (-4.11)	0.0001 (0.03)	0.0137*** (2.90)	0.0162 (1.53)
Intercept		0.0024*** (3.48)	0.0029*** (3.25)	0.2342*** (10.60)	0.3049*** (11.89)
Controls		Yes	Yes	Yes	Yes
Controls × Crisis		No	Yes	No	Yes
Controls × After		No	Yes	No	Yes
Firm Fixed		Yes	Yes	Yes	Yes
Year Fixed		Yes	Yes	No	No
#obs.		20,560	20,560	20,560	20,560
adj. $R^2$		18.88%	19.56%	25.67%	26.64%

Notes: a. Dependent variable is  $\Delta \ln(\text{loan})_{i,t}$ .  $\Delta \ln(\text{loan})_{i,t}$  is the proxy for loan growth, defined as the change of natural log of loans. TCR is total risk-based capital ratio. Crisis equals to 1 if during the crisis period (2007-2009), and zero, otherwise. After is equal to 1 if during the post-crisis period (2010-2015), and zero, otherwise. Refer to Appendix 1 for more details of other control variables.

b. Year mean adjusted on regression variables is used as the year fixed effect.

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 during Pre-crisis and Post-crisis Periods - Mitigating the Concern of Time Trend Effect**

	Expected Sign	(1)	(2)
$TCR_{i,t-1}$		0.2431*** (3.90)	0.3139*** (3.76)
$TCR_{i,t-1} \times After_t$	-	-0.3493*** (-3.17)	-0.4888*** (-3.18)
$TCR_{i,t-1} \times Time_t$		0.0210* (1.73)	0.0166 (0.95)
$After_t$		0.0290** (2.03)	-0.0046 (-0.15)
$Time_t$		-0.0009 (-0.56)	0.0028 (0.78)
Intercept		0.2605*** (9.75)	0.2646*** (8.00)
Controls		Yes	Yes
Controls $\times$ After		No	Yes
Controls $\times$ Time		No	Yes
Firm Fixed		Yes	Yes
#obs.		14,808	14,808
adj. $R^2$		23.44%	24.22%

Notes: 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. Because the observations of 2007-2010 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 1 for year 2001, 2 for year 2002, 3 for year 2003, and so on. Refer to Appendix 1 for more details of other control 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).

*Large* is defined as 1 if a bank's total consolidated asset size is more than \$10 billion and zero otherwise.<sup>38</sup> The results are presented in Table 9. 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\$10 billion. The results show that the effect of capital ratio decreases (e.g., the coefficient of  $TCR_{i,t-1} \times After_t$  is -0.3289 with  $t$ -statistic=-5.40 in column (2)). Our results also show that there is no significant difference in the incremental effect between larger

<sup>38</sup> 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.

banks and other banks (e.g., the coefficient of  $TCR_{i,t-1} \times Large \times After_t$  is 0.1263 with  $t$ -statistic=0.90 in column (2)). The results are consistent with our main results.

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%.<sup>39</sup> The modified model is as follows:

$$\begin{aligned} \Delta \ln(Loan)_{i,t} = & \alpha_i + \beta_1 \times TCR_{i,t-1} + \beta_2 \times After_t + \beta_3 \times TCR_{i,t-1} \times After_t + \beta_4 \times Well + \\ & \beta_5 \times TCR_{i,t-1} \times Well + \beta_6 \times Well \times After_t + \beta_7 \times TCR_{i,t-1} \times Well \times After_t + \\ & Controls_{i,t-1} + Controls_{i,t-1} \times After_t + Controls_{i,t-1} \times Well + \\ & Controls_{i,t-1} \times Well \times After_t + \varepsilon_{i,t}. \end{aligned} \quad (5)$$

Table 10 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 exceeding 15% to define well-capitalized banks.<sup>40</sup> The effect of capital ratio on credit growth declines dramatically after the financial crisis, especially for well-capitalized banks. For example, the coefficient of  $TCR_{i,t-1} \times After_t$  is -0.3426 ( $t$ -statistic=-4.09) and the coefficient of  $TCR_{i,t-1} \times Well \times After_t$  is -0.2471 ( $t$ -statistic=-1.90) in column (8).<sup>41</sup>

<sup>39</sup> In our sample, the average total risk-based capital ratio is 14%, and 13.6% (15.5%) during the pre-crisis (post-crisis) period. Thus, although banks with total risk-based capital ratio higher than 12% are usually regarded as well-capitalized banks, 15% is used as well-capitalization threshold. For robustness, we also run the test using 12% as the threshold and obtain similar results.

<sup>40</sup> 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%.

<sup>41</sup> We also use the BHCs lasting from the pre-crisis period to the post-crisis period and calculate each bank's average capital ratio of pre-crisis and post-crisis periods, respectively. We still use 15% as a threshold to define well-capitalized banks (or higher-capital banks) and divide our sample into four groups: (1) H-to-H, which means the BHC remains at the higher-*TCR* group for both periods, (2) H-to-L, which means the BHC was in the higher-*TCR* group before the crisis but transferred to the lower-*TCR* group after the crisis, (3) L-to-H, which means the BHC was in the lower-*TCR* group before the crisis but transferred to the higher-*TCR* group after the crisis, and (4) L-to-L, which means the BHC remains at the lower-*TCR* group for both periods. We then run regressions of these four groups separately by Model 1 and find that the negative incremental effect of *TCR* on lending growth after the crisis is especially significant for the groups H-to-H and L-to-H. This result indicates that the negative incremental effect of *TCR* on credit growth is especially significant and strong for those remaining well-capitalized (i.e., higher capital adequacy) or those transferring to well-capitalized after the crisis. This result is also consistent with the result that the effect of capital ratio on lending growth declined significantly especially for well-capitalized banks.

**Table 9 Robustness Test: The Effect of Large BHCs**

	(1)	(2)	(3)	(4)
$TCR_{i,t-1}$	0.3965*** (8.60)	0.3804*** (8.08)	0.3865*** (8.40)	0.3709*** (7.93)
$TCR_{i,t-1} \times Large$	-0.1799 (-1.54)	-0.1616 (-1.37)	-0.1505 (-0.98)	-0.1327 (-0.85)
$TCR_{i,t-1} \times After_t$	-0.3468*** (-5.68)	-0.3289*** (-5.40)	-0.3316*** (-5.44)	-0.3143*** (-5.19)
$TCR_{i,t-1} \times Large \times After_t$	0.1002 (0.71)	0.1263 (0.90)	0.0478 (0.29)	0.0960 (0.58)
$After_t$	0.0052 (0.26)	0.0041* (1.73)	0.0087 (0.44)	0.0037 (1.56)
$Large$	0.0654* (1.84)	0.0082 (1.44)	-0.0242 (-0.18)	-0.0047 (-0.29)
$Large \times After_t$	0.0307 (0.74)	-0.0029 (-0.40)	0.0842 (1.45)	0.0090 (0.97)
Intercept	0.2611*** (8.70)	0.0036*** (3.24)	0.2625*** (8.71)	0.0024 (1.30)
Controls	Yes	Yes	Yes	Yes
Controls $\times$ After	Yes	Yes	Yes	Yes
Controls $\times$ Large	Yes	Yes	Yes	Yes
Controls $\times$ Large $\times$ After	Yes	Yes	Yes	Yes
Firm Fixed	Yes	Yes	Yes	Yes
Year Fixed	No	Yes	No	Yes
#obs.	14,808	14,808	14,808	14,808
adj. $R^2$	24.00%	19.95%	24.00%	19.93%

Notes: 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. Because the observations of 2007-2010 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 1 for more details of other control variables.

b. Year mean adjusted on regression variables is used as the year fixed effect.

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

Table 10 Robustness Test: The Effect of Well-Capitalized BHCs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$TCR_{i,t-1}$	0.4165 (7.91)	0.3754 (7.10)	0.3850 (7.27)	0.3532 (6.66)	0.5167 (8.70)	0.4931 (8.18)	0.4980 (8.38)	0.4788 (7.93)
$TCR_{i,t-1} \times Well$	-0.0544 (-0.66)	0.0606 (0.60)	-0.0391 (-0.47)	0.0529 (0.52)	-0.1289 (-1.65)	0.0013 (0.01)	-0.1221 (-1.56)	0.0029 (0.03)
$TCR_{i,t-1} \times After_t$	-0.2149 (-2.53)	-0.2142 (-2.30)	-0.1607 (-1.90)	-0.1609 (-1.74)	-0.4613 (-5.90)	-0.3820 (-4.51)	-0.4148 (-5.34)	-0.3426 (-4.09)
$TCR_{i,t-1} \times Well \times After_t$	-0.1666 (-1.59)	-0.2427 (-1.81)	-0.2144 (-2.04)	-0.2881 (-2.15)	0.0536 (0.57)	-0.2405 (-1.83)	0.0294 (0.31)	-0.2471 (-1.90)
$After_t$	0.0086 (0.61)	0.0135 (0.88)	0.0071 (2.70)	0.0064 (2.38)	0.0326 (2.32)	0.0119 (0.81)	0.0001 (0.04)	-0.0022 (-0.88)
$Well$	0.0068 (0.53)	-0.0040 (-0.15)	0.0001 (0.02)	-0.0038 (-0.87)	0.0113 (0.97)	-0.0175 (-0.54)	-0.0059 (-2.36)	-0.0108 (-1.94)
$Well \times After_t$	0.0246 (1.55)	0.0209 (0.65)	-0.0031 (-0.90)	0.0004 (0.08)	0.0049 (0.34)	0.0817 (2.10)	0.0084 (2.77)	0.0109 (1.73)
Intercept	0.2631 (9.06)	0.2608 (8.94)	0.0032 (2.83)	0.0030 (2.66)	0.2316 (6.79)	0.2383 (6.93)	0.0062 (4.97)	0.0072 (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.	14,808	14,808	14,808	14,808	12,499	12,499	12,499	12,499
adj. $R^2$	23.81%	24.10%	19.82%	20.11%	24.51%	24.88%	19.88%	20.31%

Notes: 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. Because the observations of 2007-2010 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 1 for more details of other control variables.

b. Year mean adjusted on regression variables is used as the year fixed effect.

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

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.<sup>42</sup> The results show that the effect of capital ratio on loan growth decreases and are similar to our main results. 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; 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, we divide banks' total loans into two types: (1) loans secured by real estate and (2) other loans.<sup>43</sup> 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*) to substitute for capital ratio, and obtain a similar result to that when using the total risk-based ratio, for example, the coefficient of  $Tier1R_{i,t-1} \times After_t$  is -0.2829 ( $t$ -statistic=-5.40) if we change *TCR* into *Tier1R* and re-estimate Model 1.

<sup>42</sup> Cukierman (2013) documents that since the Lehman Brothers' collapse in 2008, credit growth in the U.S. declined dramatically until 2012. Additionally, 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. More specifically, we re-define an indicator variable as 1 if during 2013-2015 and zero if during 2001-2006, and use a subsample only composed of observations during 2001-2006 and 2013-2015 to re-do our main test.

<sup>43</sup> 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).

## 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 as the Dodd–Frank Act and the Basel III reforms, were implemented to strengthen the supervisory mechanism by enhancing the capital requirement and setting new 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 find that after the financial crisis, the effect of capital ratio on lending growth decreased dramatically. The reason might be that banks tend to hold more capital to ensure their safety or to meet the much stricter capital requirements, and thus, affect their lending. Additionally, although we focus on the effect of capital, we also find that liquidity shows a much more positive relation with lending growth after the financial crisis than before the crisis, which indicates that liquidity ability might become more important when banks consider their lending strategy.

In conclusion, our evidences suggest that after the financial crisis, the banks become more cautious about lending from the perspective of capital. Our evidence also implies that the regulation reforms did, in fact, have an impact on the banks' behavior.

## Appendix 1

### Variable Definitions

Variables	Definition
<i>Asset</i>	Total assets (BHCK 2170).
<i>Liability</i>	Total liabilities (BHCK 2948).
<i>Equity</i>	Total equity capital (BHCK G105); if not available, <i>Asset</i> minus <i>Liability</i> .
<i>NI</i>	Net income (loss) attributable to holding company (BHCK 4340).
<i>TLoan</i>	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).
<i>NetLoan</i>	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).
<i>NPL</i>	Sum of total nonaccrual loans (BHCK 5526) and loans past due 90 days or more and still accruing (BHCK 5525).
<i>LiquidAsset</i>	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 ( <i>NetLoan</i> ).
<i>LIQR</i>	Liquidity ratio, defined as the ratio of liquid asset ( <i>LiquidAsset</i> ) to total assets ( <i>Asset</i> ).
<i>TCR</i>	Total risk-based capital ratio (BHCK 7205), or total risk-based capital (BHCK 3792) divided by total risk-weighted assets (BHCK A223).
<i>NPLR</i>	NPL ratio, defined as the ratio of <i>NPL</i> to total loans ( <i>TLoan</i> ).
<i>SIZE</i>	The natural log of total assets.

Variables	Definition
<i>ROA</i>	Proxy for profitability, defined as <i>NI</i> divided by average total asset.
<i>EquityRatio</i>	Equity ratio, defined as the ratio of total equity to total assets.
$\Delta GDP$	The GDP percent change.
$\Delta FedFundr$	The change of federal funds rate.
<i>After</i>	For Equal to 1 if during the post-crisis period (2011-2015), and zero if during the pre-crisis period (2001-2006) for Model 1, 3, 4, and 5,
<i>Crisis</i>	Equal to 1 if during the post-crisis period (2010-2015), and zero otherwise (2001-2009) for Model 2.
<i>Time</i>	Equal to 1 if during the crisis period (2007-2009), and zero, otherwise.
<i>Large</i>	Equal to 1 for year 2001, 2 for year 2002, 3 for 2003, and so on.
<i>Well</i>	Equal to 1 if total consolidated asset ( <i>Asset</i> ) size is more than US\$10 billion, and zero, otherwise. Average <i>Asset</i> of prior two years and lagged <i>Asset</i> are used, respectively.
<i>Tier1R</i>	Equal to 1 if well-capitalized ( $TCR > 15\%$ ), and zero, otherwise. Average <i>TCR</i> of prior two years and lagged <i>TCR</i> are used, respectively.
<i>DAS</i>	Tier 1 risk-based capital ratio (BHCK 7206), or Tier 1 capital (BHCK 8274) divided by total risk-weighted assets (BHCK A223).
	Equal to 1 if with outstanding assets sold and securitized, and zero, otherwise.



## Appendix 2

### Related Regulatory Events and Regulation Reforms after 2008 Financial Crisis

#### Part I. Time Line

Time	Regulatory Events /Regulation Reforms
May 2009	<b>Supervisory Capital Assessment Program</b> (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	<b>SFAS No. 166-<i>Accounting for Transfers of Financial Assets—an amendment of FASB Statement No. 140</i></b>
June 2009	<b>SFAS No. 167-<i>Amendments to FASB Interpretation No. 46(R)</i></b>
July 2009	<b>Mortgage Disclosure Improvement Act</b>
July 2010	<b>Dodd-Frank Wall Street Reform and Consumer Protection Act</b> (see Part II. Dodd-Frank Wall Street Reform and Consumer Protection Act)
December 2010	<b>“Basel III: A global regulatory framework for more resilient banks and banking systems”</b> (released in December 2010, and revised in June 2011)
October 2012	<b>Federal Reserve’s Dodd-Frank Stress Test</b> - 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	<b>“Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tool”</b> was released.
July 2013	The final rules of U.S. Basel III capital standard implementing were approved.
January 2014	<b>“Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act (ATR/QM rule)”</b> was effective.
September 2014	The U.S. Liquidity Coverage Ratio (LCR) rule was finalized.
October 2014	<b>“Basel III: The Net Stable Funding Ratio”</b> was released.
April 2016	On April 26 <sup>th</sup> , 2016, the FDIC and the OCC issued a notice of proposed rulemaking to implement the net stable funding ratio (NSFR).
February 2017	Dodd-Frank Wall Street Reform and Consumer Protection Act was rolled back for review.
June 2017	<b>The Financial CHOICE Act</b> was passed by the House on June 8 <sup>th</sup> .

#### 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.<sup>44</sup> In 2013, the Consumer Financial Protection Bureau (CFPB) released the rule of “Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act” (ATR/QM rule),<sup>45</sup> which require lenders to make a reasonable determination of a borrower’s ability to pay back the loan. The ATR/QM rule was effective on January 10<sup>th</sup>, 2014. In 2014, the CFPB also released a guide of ATR/QM rule to provide guidelines of the ATR/QM rule.

The Dodd–Frank Act also re-emphasizes the importance of the capital requirements not only through the rules<sup>46</sup> 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.<sup>47</sup> 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.

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<sup>44</sup> 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).

<sup>45</sup> 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.

<sup>46</sup> For example, “Sec. 171. Leverage and Risk-Based Capital Requirements” of the Dodd–Frank Act.

<sup>47</sup> Refer to Sec. 165 (i) Stress Test of the Dodd–Frank Rules.

However, in 2017, the Dodd–Frank Act was rolled back for review in February, and on June 8<sup>th</sup>, 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 capital requirement and liquidity standards.<sup>48</sup>

### **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. 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, 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

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<sup>48</sup> Refer to Sec. 601-605 of Title VI—Regulatory Relief For Strongly Capitalized, Well Managed Banking Organizations.

strengthen the liquidity position of large financial institutions, internationally active banking organizations and non-bank financial companies designated by the FSOC 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. U.S. firms will be required to be fully compliant with the LCR rule by January 1, 2017. On April 26<sup>th</sup>, 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. The NSFR would become effective on January 1, 2018, and is consistent with the liquidity standard agreed to by the Basel Committee on Banking Supervision.<sup>49</sup>

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	

**Figure 1 Basel III Minimum Capital Requirements**

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

<sup>49</sup> 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>.)

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