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Do Board Characteristics Have Influence on Bank Risk Taking: An Empirical Examination under The Capital Regulations of Basel Accord III

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Abstract

This study examines the association between corporate governance and bank risk taking, especially the association between board characteristics (board independence, financial experts of board) and bank risk taking under the capital regulations of Basel Accord III. Using hand-collected data on banks' non-risk-based leverage and data from COMPUSTAT and Datastream database, our main results are in line with the agency theory. First, there is a positive relation between board independence and bank risk appetite. In addition, the number of financial experts in the board is positively associated with bank risk taking. The results are consistent also when we add control conditions into our regression model. In summary, our results not only narrow the gap in research in the area of corporate governance and financial industry, but also suggest that the validity and reliability of the non-risk-based leverage ratio should be relevant for both regulators and shareholders.

Keywords: Corporate governance, Bank risk taking, Board independence, Financial experts of board, Basel Accord III

Chapter 1

Introduction

Many economists regard the sub-prime financial crisis during 2007-2008 as the worst economic disaster since The Great Depression of 1930s. It is generally believed that this global economic downturn was caused by real estate bubble and reckless subprime mortgage loans. Indeed, these loans were repackaged by financial institutions into the new securities known as collateralized debt obligations (CDOs) and sold to innocent investors. However, this is just part of the story, Bank for International Settlements (2014) highlights that the underlying cause of the global financial crisis was the build-up of excessive on- and off-balance sheet leverage in the banking system. In many cases, banks take risky activities while apparently maintaining strong risk-based capital ratios. Therefore, the downturn was magnified by the excessive risk taking both on- and off-balance sheet activities of banks (Fernandes and Fich, 2009). Due to this financial crisis, a further awareness and need for rigid risk management within the financial industry has to be taken into account (Aebi et al., 2012). For superior monitoring the financial industry and controlling of excessive risk taking, the Basel Accord III introduces a simple, transparent, non-risk based leverage ratio to act as a credible supplementary measure to the risk-weighted capital requirements since banks have discretion to choose their own capital ratio as long as it is above the required minimum capital ratio (Bank for International Settlements, 2014)[1]. The leverage ratio is defined as the "capital measure" (the numerator) divided by the "exposure measure" (the denominator) and is expressed as a percentage, and the exposure measure captures both on- and off-balance sheet activities (the items used to calculate the leverage ratio are presented in *Appendix 1*). Besides, the second pillar of Basel II identifies the role of board of directors as an integral part of risk management[2]. This thesis mainly investigates

[1] ISBN 92-9197-373-4. The police "Basel III Leverage ratio framework and disclosure requirements" from Basel Accord III, was initially published in September 2013, and the final version was reported in January 2014. This publication is available on www.bis.org.

[2] The three pillars of Basel II are: minimum capital requirements, supervisory review, the market discipline. Basel Accord II was firstly published in June 2004, and was implemented before the early of 2008.

the relation between board characteristics (board independence, financial experts of board) and bank risk taking under the capital regulations of Basel Accord III.

1.1 Research motivation

First, there is a transition period and a parallel run period before the Basel III will be fully implemented in 2019. The parallel run period commenced on the 1. January 2013 and runs until 1. January 2017. During this period, the leverage ratio and its components are being tracked as well as its behavior relative to the risk-based capital requirement. Based on the results of the parallel run period, any final adjustments to the definition and calibration of the Basel III leverage ratio will be carried out by 2017. So investigating and understanding what the impacts of the current-implemented regulations will have on bank's risk management before 2019 are quite significant for the regulation drafters (Bank for International Settlements, 2014).

Second, although quite some research has investigated the association between corporate governance and firm risk taking, most of it disregards financial firms. The literature on the valuation of corporate governance in financial industry is still rare. Yermack (1996) and Eisenberg et al. (1998) find an inverse association between board size and firm value within manufacturing industry. However, Adams and Mehran (2011) prove that increasing in board size can increase the value of bank holding company. Mullineux (2006) argues that the duty assigned to bank directors is more extensive than to directors of other industry. Due to the huge difference between financial and non-financial industries, governance regulator should take unique features of bank governance into account. Besides, Minton et al. (2014) provide the evidence that financial expertise among independent directors tend to take riskier activities before the financial crisis. John et al. (2008) find that better quality of investor protection could lead firms to undertake riskier but value-enhancing investments. Saunders et al. (1990) conclude that stockholder controlled boards have incentives to take higher risk than manager controlled boards especially during the deregulation period. Additionally, consistent with Pathan (2009) who shows that the boards which reflect interests of shareholders more are more willing to take higher risk compared to the boards reflecting more power of executives. Based on above, we can conclude different corporate governance structures will impact firms'

performance and risk appetite significantly, so further research on and better understanding of the interaction between corporate governance and financial industry are important.

Third, Kim and Santomero (1988) find that utility-maximizing banks may increase their portfolio risk in order to meet the regulatory minimum risk-weighted capital ratio. Jacques and Nigro (1997) find that the minimum risk-based capital standards do not limit the amount of risk in a bank's portfolio. In fact, the minimum risk weighting ratio may actually cause banks to take higher portfolio risk. In order to compensate for the loss from minimum risk-based capital requirements, banks may invest more in riskier portfolio. As a result, it is interesting to find out the relation between corporate governance and bank risk appetite under the impacts of compulsory regulations.

1.2 Research question

This thesis aims at investigating the relation between corporate governance and bank risk taking. More specifically, we will test the association between board characteristics (board independence, financial experts of board) and bank risk appetites under the capital regulations of Basel Accord III. Even though financial experts and the fraction of outside board-member also belong to the supervisory board, they can impact investment decisions and bank risk taking by giving advice to senior managers (Minton et al., 2014). So the main research question of this thesis will be:

RQ: What is the influence of board characteristics (board independence, financial expertise of board) on banks' risk taking under the disclosure regulation of Basel Accord III?

1.3 Theoretical and practical relevance

There is some previous research about the regulatory ratio and its influence on bank risk taking. For instance, Jacques and Nigro (1997) find that the minimum risk-based capital standards do not limit the amount of risk in a bank's portfolio. However, none of them has empirically tested the interaction between non-risk-based leverage and bank risk taking. This thesis will contribute to the literature of bank risk appetite taking the non-risk-based leverage aspects into account. Besides, the second pillar of Basel II identifies the role of board of

directors as an integral part of risk management, however, the previous paper which research the relation between board characteristics and bank risk taking is limited. This thesis will also contribute to the literature of the relation between board characteristics and bank risk taking through both risk- and non-risk-based regulatory ratio aspects.

The results of this thesis should be of a relevance to capital ratio drafters since the disclosure of non-risk-based leverage ratio has just started. The investigation of the impacts of the current-implemented regulations on bank's risk management before 2019 is quite significant. Additionally, the results should also be relevant for shareholders and investors. Because of the different risk taking appetites, banks will choose various risk-weighted capital ratio as long as it is above the minimum ratio. Based on the results of this thesis, shareholders and investors can better predict how different board characteristics impact the bank risk taking behavior.

1.4 Research method

In order to answer the research question, a quantitative analysis of U.S listed banks on the COMPUSTAT Bank North America database index as well as on the Datastream database during the period between 2014 and 2015 was conducted to understand whether the corporate governance play an important role in bank risk taking. A quantitative analysis was chosen instead of a qualitative analysis, as a qualitative study could not deliver the empirical evidence required to adequately address the research objectives proposed in this thesis. We use two proxies to capture the obscure risk appetites of banks: one is tier-1 capital ratio, another one is non-risk-based leverage ratio under Basel Accord III. The lower the number of tier-1 capital ratio and leverage ratio is, the higher risk the bank takes. In addition, we use OLS regression models as our methodology to test the influence of board characteristics on the bank risk appetite.

1.5 Thesis outline

The remainder of the paper is structured as follows. Chapter 2 reviews relevant literature on (a) determinants of bank portfolio risk and (b) board characteristics effects. Then we will develop the hypothesis and research methodology in Chapter 3, which include the theories

behind the hypothesis as well as sample and variable selection. Chapter 4 reports the data analysis and results and Chapter 5 provides the conclusions and limitations of the thesis.

Chapter 2

Literature review

2.1 Purpose of literature review

This section explains theory concepts and empirical findings underlying the research question, by examining previous research outcomes related to this thesis topic. One main research element in this thesis is risk taking of banks. Hence in the first subsection, we will pay attention to the risk appetites of banks. First, we will give a brief background about the financial crisis during 2007 and 2008, since the excessive both on- and off-balance sheet risk taking within the financial industry is one of the main triggers leading to the worldwide downturn. Based on this situation, the Basel Accord III explains why we need a more cautionary risk management and how we can better manage both on- and off-balance sheet risk taking as well as portfolio risk. Then we will explain the contents and meanings of the three pillars of Basel Accord II (regulatory ratio, board of director, disclosure), and the first two pillars, especially the second one, are closely relevant to this thesis topic. To provide a more comprehensive literature review, this thesis also includes the previous studies whose research topic relate to the factors that have influence on bank risk taking.

The second research element in this thesis is corporate governance. According to the previous research results, we will discuss some corporate governance factors that may have impacts on bank risk taking. Since the research question in this thesis examines the relation between board characteristics and bank risk taking, we will discuss board independence and financial expertise of board and their influence on bank risk appetite in detail later on. The first subsection focuses on the bank risk taking theory and related prior studies. The second subsection explains the corporate governance in financial industry and the relation between board characteristics and bank risk taking.

2.2 Background and Basel Accord III

It is no secret that the financial crisis during 2007 to 2008 was caused by real estate bubble

and reckless subprime mortgage loans. Indeed, these loans were repackaged by financial institutions into the new securities known as collateralized debt obligations (CDOs) and then sold to innocent investors. This downturn was accompanied by the erosion of capital base quality. However, the deeper reason behind this great downturn was the poor risk management and excessive risk taking within financial industry. Banks needed a sufficient capital base as buffer to lower the risk that they faced.

Based on this situation, Basel Accord II regulates the minimum capital requirements as one of its core pillars in order to better manage and control the level of bank risk. Greater capital base means lower risk but, at the same time, also lower liquidity creation, so banks have to trade off effects on liquidity creation and costs of bank distress (Diamond and Rajan, 2000). However, Kim and Santomero (1988) find that utility-maximizing banks may increase their portfolio risk in order to meet the regulatory minimum risk-weighted capital ratio. Jacques and Nigro (1997) find that the minimum risk-based capital standards do not limit the amount of risk in a bank's portfolio. In fact, the minimum risk weighting ratio may actually cause bank to increase portfolio risk. In order to compensate for the loss from minimum risk-based capital requirements, banks may invest more in risky portfolio. Besides, Laeven and Levine (2009) show that the actual impact of regulations on risk taking depends on the managers' power within the board of directors. Nocco and Stulz (2006) find that in some cases when a firm is practicing enterprise risk management (ERM), the regulatory requirements would not influence the firm's capital decision because it would hold excessive capital in order to maximize shareholders wealth. In this regard, banks may lower the on-balance sheet risk but increase the off-balance sheet risk at the same time in order to beat the minimum standards, so the overall risk is higher. Based on the above, one of the main lessons we should learn from the financial crisis is to broader the risk coverage of capital framework.

For superior monitoring the financial industry and controlling of excessive risk taking, the Basel Accord III introduces a simple, transparent, non-risk based leverage ratio to act as a credible supplementary measure to the risk-weighted capital requirements. This non-risk-based leverage ensures broader and sufficient capture of both on- and off-balance sheet activities of banks' leverage (Bank for International Settlements, 2014).

Bank for International Settlements (2014, p.1) regulates "The Basel III leverage ratio is defined as the capital measure (the numerator) divided by the exposure measure (the denominator)". It is the exposure measure that captures both on- and off-balance sheet activities, *Appendix 1* shows the variables that are used to take leverage ratio. Basel Accord III will be not fully implemented until 2019, based on the results of the parallel run period (1 January 2013 until 1 January 2017), any final adjustments to the definition and calibration of the Basel III leverage ratio will be carried out by 2017. So investigating and understanding what the impacts of the current-implemented regulations will have on bank's risk management before 2019 are quite significant for the regulation drafters.

2.3 Bank risk taking

According to Basel Accord II, there are four general risks that banks have to face: credit risk, liquidity risk, market risk, and operational risk. Banks will choose their own risk appetite based on each bank unique characteristics, however, there are some macro and micro factors that can influence bank risk appetite.

From the macro perspective, prior researches provide evidences that market competition has impacts on bank risk taking. For instance, Boyd and Nicoló (2005) argue that less market competition leads to lower deposits rate which in turn will automatically higher banks' profits, so banks intentionally seek less risk. Most prior studies find that banks will choose more risky activities when they confront with more intense competition, for example, Keeley (1990) finds that banks' charter value will decline when faced with increase competition, which in turn forces banks to increase default risk through increases in asset risk and reductions in capital. Different from what Keeley finds, Boyd and Nicoló (2005) provide evidence that the relationship between bank competition and bank risk appetite is better defined as mixed. They draw this conclusion by showing that the fundamental risk-incentive mechanisms operate in opposite direction, causing banks to become more risky when markets become more concentrated.

Apart from bank competition, prior studies also examine the impacts of regulation have on bank's risk appetite. John et al. (2008) find that better investor protection can lead banks to take higher risk. In this regard, they argue that stakeholders and shareholders are more likely to

undertake more risky investments for their self-interest under better investor protection. By analyzing 155 banks to 9613 firms across 16 countries, Ongena et al. (2013) find that regulation at home will influence bank risk appetite aboard. They prove that bank has lower lending standards abroad when domestic market has lower barrier to entry, tighter supervision on bank investment activities and higher minimum capital requirement.

From the micro perspective, prior studies investigate that bank size as well as executives' attitude have influence on firms and banks risk appetite. Hakenes and Schnabel (2011) prove that bank size will influence the levels of risk that bank choose. Basel Accord II introduces an internal ratings-based approach in order to improve flat capital requirements. However, since this approach is not mandatory, banks have their own discretion to choose either standardized or internal ratings approach which gives competitive advantages to larger banks. Under this circumstance, small banks have no choice but to choose risky activities which leads to the whole risk becoming bigger.

By testing 2790 CEOs of different manufacturing firms in China, Li and Tang (2010) conclude that there is a positive relationship between CEO hubris and firm risk taking. Furthermore, this positive relationship would be magnified when CEOs have stronger managerial discretion. Results are different from Pathan's (2009), who find that CEO's ability to influence board decision is inversely related with bank risk taking. Bases on above, we can infer that the relation between managerial power and bank risk taking may be different between banking industry and manufacturing industry.

2.4 Corporate governance and bank risk taking

According to final version published by Basel Committee, the core content of Basel Accord II is the introduction and application of three pillars: minimum capital requirements, supervisory review process, and market discipline. The main purposes of Basel Accord II are not only to guarantee the sufficient capital requirements, but most importantly, to enhance the quality of risk management and supervision. In this regard, the second pillar of Basel II identifies the role of board of directors as an integral part of risk management. It indicates that it is not enough to just rely on the minimum capital requirements of first pillar to control bank

risk, but board of directors should have an extra eye on bank's capital structure. The second pillar allows board of directors to evaluate bank's risk based on its own circumstances and address risks that are not captured in the first pillar. So it would be relevant and interesting to investigate the relationship between board characteristics and bank risk taking (Basel Committee, 2004).

Although Basel Accord II emphasizes that board of directors does play a very important role in deciding the level of bank risk taking, there are also some other corporate governance factors (e.g. ownership structure, managerial incentives) that have impacts on bank risk appetite.

Caprio et al. (2007) state that ownership structure plays an important role in governing banks. In this regard, Laeven and Levine (2009) further prove that even same regulation will lead to different impacts on bank's risk taking when taking ownership structure into account. They suggest that the actual sign of the marginal effect of capital regulations, deposit insurance policies, and restrictions on bank activities depend critically on each bank's ownership structure. Besides, Saunders et al. (1990) document a positive relationship between stakeholder controlled banks and bank risk taking. However, the authors find a negative relationship between managerial controlled bank and bank risk appetite.

Managerial incentive problems exist in firms due to the separation of ownership and control. Jensen and Meckling (1976) find that equity-based compensation can mitigate managerial incentive problems, which in turn suggests that investment and financing decisions of firms may be influenced by the stock options holding of executives. Consistent with Jensen and Mecklin's (1976) theoretical argument, Agrawal and Mandelker (1987) find that executives are willing to have more changes in financial leverage and firm's variance when holding more stock option. Besides, by investigating that there is a positive relation between ESO (executive stock option) risk incentives and future exploration risk taking, Rajgopal and Shevlin (2002) conclude that equity-based compensation helps to mitigate risk-related incentive problems.

However, when it comes to banking industry, Houston and James (1995) find that the compensation package within banking industry is not designed to encourage executives to take excessive risk. Based on the contracting hypothesis and empirical results in this study, regulated industry such as banking face more rules and restrictions, therefore, the investment

opportunities are limited within these industries. This may imply that moral hazards may be less serious in banking industry compared with other industries, so these is less equity-based compensation owned by executives within banking industry. Due to the huge different characteristics between financial and non-financial industries, governance regulation should take the unique features of bank governance into account.

The research question of this thesis is the relationship between board characteristics and bank risk taking. As we go deeper, developing the corporate governance theory without consideration of internal structure of the organization is inappropriate. In this regard, Baysinger and Butler (1985) state that board of directors, especially the board composition, play a vital role when constructing the theory of corporate governance.

There is a growing literature suggesting that board structure has an influence on firm and bank risk taking. For the manufacture industry, Guner et al. (2008) find that financial expertise in board exerts significant influence on firms' decision making. When investment bankers join boards, the external funding increases, investment-cash flow sensitivity decreases and larger bond issues but worse acquisitions. Hermalin and Weisbach (1991) find there is no relation between board structure and firm performance. They argue this result can be attributed to three reasons. First, the most obvious reason is that board independence does not have an impact on firm performance. Second, the advantages are the same for having more outside directors or more inside directors. Third, the function of board composition to reduce agency problem is the same as residual agency. Fernandes and Fich (2009) show that having financial expertise of board is positively related to bank's stock return and negatively related to the likelihood of bank failure during the financial crisis.

Core et al. (1999) indicate that firms with weaker governance structure perform worse. It shows that corporate governance plays an important role in determining firm performance. Other empirical research examines the relation between board independence and firm performance. Knyazeva, et al. (2013) find that board independence has a positive influence on firm performance, however, in contrast to Knyazeva et al. (2013), Bhagat and Black (2002) find there is negative association between board independence and long-term firm profitability. When it comes to the bank industry, Pathan (2009) shows that boards reflecting more interests

of shareholders are more willing to take higher risk compared to the boards reflecting more power of executives. Regarding the board independence, Bliss (2011) examines the determinants of board independence by showing that the auditing fee pricing varied with CEO duality which provides evidence that CEO duality compromises director independence. While there are mounting evidences of the association between board independence and manufacturing firms, the empirical evidence on the association between board independence and bank industry is still rare.

2.5 Conclusion from the literature review

Overall, banks face a variety of risks (market risk, operation risk, credit risk, and liquidity risk) in their daily activities. Prior academic researches indicate the factors that will have influence on bank risk taking. From the macro perspective, bank market competition as well as regulation both have influence on bank risk taking. However, prior researchers hold mixed views. From the micro perspective, bank appetite can be influenced by bank size. Smaller banks are more willing to choose risky activities. In addition, executives' attitude also has impacts on bank risk taking. Overconfidence of the CEOs causes them to choose more risky financial activities.

The objective of thesis is to find out the association between board characteristics (board independence, financial expertise on board) and bank risk taking under the application of Basel Accord III. Although prior studies indicate that some corporate governance factors have influence on bank risk taking such as, ownership or executive compensation incentives, the empirical evidence to the relation between board independence and bank risk appetite is still limited. This thesis helps to narrow this gap in the literature. Besides, the results of this thesis should be of a relevance to capital ratio drafters since the disclosure of non-risk-based leverage ratio has just started. Moreover, the investigation of the impacts of the current-implemented regulations on bank's risk management before 2019 is quite significant.

Chapter 3

Hypotheses development and research method

3.1 Hypotheses development

3.1.1 Board independence and bank risk taking

After the financial crisis, regulators and scholars realize the importance of controlling the excessive risk taking within the financial industry. There are quite a few prior studies related to the area of bank portfolio risk and regulations; however, prior literature related to the association between board characteristics and bank risk taking is limited. Since the Basel Accord II takes the board of directors as the second pillar of financial industry, this thesis attempts to mitigate this gap by finding out the relationship between board characteristics and bank risk appetite.

The Nasdaq[3] and New York Stock Exchange (NYSE)[4] listing rules indicate the definition and emphasize the importance of board independence. The logic and hypothesis development in this thesis are based on the agency theory (Jensen and Meckling 1976). One of the central issues in the theory are the various levels of risk between shareholders and agents. Applying the agency theory into this thesis, managerial-controlled boards would have different risk appetite compared to shareholder-controlled boards. To be more specific, shareholders have incentives to increase bank risk because they collect the funds from depositors as well as bondholders and do not have a large portion of their private wealth invested in the bank. In contrast, managers in bank tend to advocate less risk due to their bank-specific private benefits of control (Jensen and Meckling 1976).

Beside what describe above, there are two other reasons why shareholders are more willing to take higher risk. The first reason is that equity capital can create barriers to the potential investment opportunities (Aebi et al., 2012). The Committee regulates that banks must meet the

[3] IM-4200, Definition of Independence-Rule 4200(a)(15), on November 4 2003, the Securities and Exchange Commission (SEC) approved this rule.

[4] Section 303A.02 of the NYSE Listed Company Manual. The amendment was filed with the SEC on March 12, 2003.

minimum capital ratios. These capital can be served as a buffer when financial crisis occurs, the more capital bank has, the safer the bank is. But from the shareholders' perspective, having too much capital also means less potential investment opportunities, so they have to choose riskier financial activities to compensate for the loss. The second reason can be owing to the "too-big-to-fail" policy (Jensen and Meckling, 1976; Laeven and Levine, 2009). The bank plays an important role in guaranteeing the capital liquidity in the whole market. Based on this situation, the authority takes a lot of methods and protective regulations to support the stability and prosperity of the banks. However, their protective regulations potentially encourage shareholders to take higher risk to increase the stock price and satisfy their self-interest. Consistent with the "too-big-to-fail" policy, John et al. (2008) indicate that better investor protection regulations can also contribute to higher levels of risk appetite.

When it comes to executives, prior studies indicate three main reasons why managers are risk averse. The first reason is personal costs. Engaging in high risk activities often means spending more personal time on the work, learning new skills to better master the risky projects, recruiting more employees and so on. High risk investments cannot guarantee high profitability, but surely bring high personal costs (Wright et al., 1996). Moreover, similar with the first reason, when choosing the levels of risk, executives also take the career concerns into account. Holmstrom and Costa (1986) indicate that predicting managers' future performance is based on managers' past performance. So managers are more willing to choose less risky but foreseeable activities to signal personal managerial abilities in a good way. The third reason is wealth "undiversification" (Wright et al., 1996). Prior academic studies have concluded that equity-based ownership is negatively associated with managers' risk taking (Jensen and Mecklin, 1976; Agrawal and Mandelker, 1987); Adams and Mehran, 2011). However, when the equity-based ownership takes an extremely large part of managers' own wealth, executives are unwilling to put huge component of their own wealth into high risk projects. Finally, Demirguc-Kunt and Detragiache (2002) find that managers on board have to take the supervisory responsibilities which also lead them to being risk-averse.

Based on the theoretical arguments and previous academic studies, we hypothesize:

H1: Under the capital regulations of Basel Accord III, there is a positive relationship between board independence and the levels of bank risk taking.

To test the first hypothesis, we take the board independence as explanatory variable (X), bank risk appetite as dependent variables (Y). In this thesis, we use two proxies to measure board independence. Consistent with Bliss (2011) and Knyazeva et al. (2013), the first proxy is the proportion of outside directors on board. The higher the proportion of outsiders, the more independent the board is. The second proxy we use to measure board independence is CEO duality. The CEO duality is a dummy variable, equals 1 when CEO holds the position of the chairman of the board, 0 otherwise. Both Pathan (2009) and Bliss (2011) use CEO duality to measure the board independence, they argue that if CEO also holds the position of the chairman in the board can reflect CEO's efficient power of the board and compromise the independence of board of directors. We use two proxies to measure the dependent variable (Y). Consistent with Jacques and Nigro (1997), we first choose the Tier-1 capital ratio to measure the bank risk taking. Banks take more risk if tier-1 capital ratio goes down because lower tier-1 capital ratio means banks store less fund as buffer. The Committee regulates the minimum capital that banks should have themselves. However, banks can choose their own risk-weighted capital ratio as long as it is above the minimum requirements (Minton et al., 2014). Based on this situation, banks may choose to higher the complementary capital, lower the core capital (common equity and retained earnings). Given that equity capital serves as a buffer, capital ratios are direct measures of the willingness of the bank to take on a risk-based capital profile. However, since the variables used to take tier-1 capital ratio exclude off-balance sheet items, so it is possible that bank maintains high tier-1 capital ratio but takes risky off-balance sheet activities at the same time. In this regard, we use the non-risk-based leverage (LEVERAGE) which captures both on- and off-balance sheet items as our second proxy to measure bank risk appetite. The leverage ratio is equal to the Capital measure divided by the Exposure measure. The capital measure used for the leverage ratio at any particular point in time is the Tier 1 capital measure applying at that time under the risk-based framework. Tier 1 capital is consistent of common equity tier 1 and additional tier 1. So basically, for the capital measure (numerator) of leverage

ratio, the items for calculation are same as the items for calculation for tier-1 capital ratio. For the exposure measure, the variables used to calculate it includes: on-balance sheet exposures, derivative exposures, securities financing transaction exposures and off-balance sheet items. The *Appendix 1* shows the variables that are used to take the leverage ratio. We can learn from these variables that the non-risk-based leverage is a complementary to risk-based capital framework since it capture both on- and off-balance sheet sources of bank leverages (Bank for International Settlements, 2014). Bank takes more risk if the leverage ratio goes down because lower leverage ratio means bank stores less capital as buffer, so safer banks would choose higher leverage ratio. Taken together, we assume board independence is negatively associated with Tier-1 capital ratio and non-risk-based leverage ratio.

Besides, we also add board size, executives equity-based ownership and bank size as control variables to test the first hypothesis. Adams and Mehran (2011) as well as Aebi et al., (2012) find that managers' compensation structure have influence on the levels of bank risk taking. According to Sah and Stiglitz (1991) as well as Bliss (2011), board size has significant association with bank risk taking. Saunders et al. (1990) indicate bank size is one of the factors that influences bank appetite.

3.1.2 Financial expertise and bank risk taking

In this thesis, we define the financial experts following the listing rules of Sarbanes Oxley[5]. The data of financial expert are collected from ISS (formerly RiskMetrics) database. ISS defines the financial expert according to the Section 407 of the Sarbanes-Oxley act (2002, p.790): "Generally, a financial expert is a person who, through education and experience, have an understanding of and experience in applying generally accepted accounting principles and preparing financial statements, experience with internal controls and procedures for financial reporting, and an understanding of audit committee function." This statement shows that the directors of the companies might be also identified as financial experts.

Minton et al. (2014) find that having financial expertise on board can significantly

[5] Sarbanes–Oxley Act of 2002, Pub.L. 107–204, 116 Stat. 790, enacted July 30, 2002

influence board decisions, they argue that having financial experts on board can offer more professional advice to managers and lower information risk which can benefit shareholders and enhance firm value. Aebi et al. (2012) find that the number of financial experts in the board is positively related to the bank risk taking measured by tier-1 capital ratio and total risk-weighted capital ratio. Fernandes and Fich (2009) indicate that banks with more financial experts in the board perform better during the financial crisis. In order to avoid other external and internal factors on the results, Fernandes and Fich (2009) also investigate the events of Bear Stearns and Lehman Brothers. They find that the outcome holds and is consistent with their prediction. Guner et al. (2008) test the influence of financial expertise on both commercial and investment banks' risk appetite. They find that having financial expertise on the board, makes commercial banks less sensitive to cash flow and are more likely to give out more loans. Investment banks are exposed to larger debt issues as well as worse acquisitions. However, the results do not hold for the financially constrained banks. Moreover, Minton et al. (2014) indicate that having financial expertise within independent directors, banks are willing to take more risk during the crisis compared to banks without financial expertise on board.

One explanation for the reason why banks with more financial expertise in the board tend to engage in riskier activities is that financial experts can better realize the residual nature of shareholders' claim is protected and guaranteed by the authority. So it is much safer for shareholders of financial industries to choose risky investment compared with shareholders of other industries (Minton et al. 2014).

Based on the description of previous studies above, the second hypothesis is as follows:

H2: Under the capital regulations of Basel Accord III, there is a positive relationship between financial expertise on board of directors and the levels of bank risk taking.

Similar to Minton et al. (2014), we use the fraction of financial expertise in the board of directors as the proxy to measure the independent variable – financial expertise. First, we count the number of financial experts and the number of board of directors for each of the company. Second, we use the number of financial experts divided by the number of directors and then we

get the fraction of financial experts on the board. The other proxies to measure the dependent variable and control variables are the same as for the hypothesis one.

3.1.3 Control variables

In this thesis, we use three control variables to test the hypotheses. Based on the previous studies and what was described in chapter 2, these three factors are found to have association with bank risk taking. The first control variable is executive equity-based ownership. We define this control variable as the natural logarithm of the US dollar value of all shares owned by the CEO. Adams and Mehran (2011) argue that equity-based compensation can incentivize bank managers to avoid excessive risk exposure. Houston and James (1995) indicate that there is a different compensation structure between financial and non-financial industry, the executives in bank tend to hold more cash salary and bonuses. However, they find little evidence which would prove that this compensation structure in banking would encourage managers to take excessive risk. They argue this relation can be explained by lower moral hazard that is happening in bank industry.

The second control variable is board size, we define this variable as the number of directors on board. Monitoring and decision-making process cost more in a large board compared to the expense in small boards, which implies that large boards tend to have more inefficient and worse performance (Bliss, 2011). Sah and Stiglitz (1991) find that the decisions made by large boards are often more conservative and less risky. This is because the decisions made by large boards have to be settled with a compromise among different individual directors.

The last control variable is bank size, measured by the logarithm of total assets of banks (Guner et al., 2008). From the investors' perspective, Saunders et al. (1990) find it is safer for shareholders to hold large banks' stock. One of the explanatory reasons is the "too-big-to-fail" theory. Because of the vital role played by large bank in market, regulators are unwilling to let the large banks fail. Besides, large banks tend to have more outside directors which can lower the information risk within banks.

3.2 Research method

3.2.1 Research method model

This thesis examines the association between corporate governance and bank risk taking, to be more specific, the association between board characteristics (board independence and financial expertise of a board) and bank risk taking. Basel Accord II highlights the integral role of board of directors, however, Sabato (n.d.) and Bank for International Settlements (2014) indicate the inappropriate risk governance structure is one of the main reasons leading to bank failure during the financial crisis. In this regard, Basel Accord III introduces a new non-risk-based leverage ratio to serve as the supplement of risk-based capital ratio. This thesis studies the board characteristics and bank risk taking under Basel Accord III and the results may help to inform the evolution of Basel Accord III. The following subsections will explain the measurement as well as the sample selection related to the research question.

Consistent with Aebi (2012), this thesis uses the ordinary least squares (OLS) regression to test the relationship between board characteristics and bank risk taking. OLS regression is an efficient method to examine the association between dependent variables and independent variables. To test our hypotheses, we specify the following model which once used by Saunders et al. (1990). In addition, we specify this model in detail as equation (1) and equation (2) to test our hypotheses, given the literatures and variables discussed above:

$$Tier1\_w_{i,t} = \alpha + \beta * F_{outsider_{i,t}} + F_{expert_{i,t}} + \theta * CEOD_{i,t} + \delta * BANKS_{i,t} + \mu * BOARDS_{i,t} + \partial * Ownership_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$Leverage_{i,t} = \alpha + \beta * F_{outsider_{i,t}} + F_{expert_{i,t}} + \theta * CEOD_{i,t} + \delta * BANKS_{i,t} + \mu * BOARDS_{i,t} + \partial * Ownership_{i,t} + \varepsilon_{i,t} \quad (2)$$

Tier1_w = tier-1 capital ratio under the capital regulation of Basel Accord III

Leverage = non-risk-based leverage ratio under the capital regulation of Basel Accord III

F_outsider = fraction of outside directors of board

F_expert = fraction of financial experts of board

CEOD = CEO duality, equal to 1 when CEO is also the chairman on board, 0 otherwise

BANKS = logarithm of total assets of bank

BOARDS = number of directors on board

Ownership = logarithm of the US dollar value of all shares owned by the CEO

i = bank

t = year

The predictive validity framework (Libby, 1981) is presented in the following *Figure 1* to show the conceptual relations that are examined in this thesis.

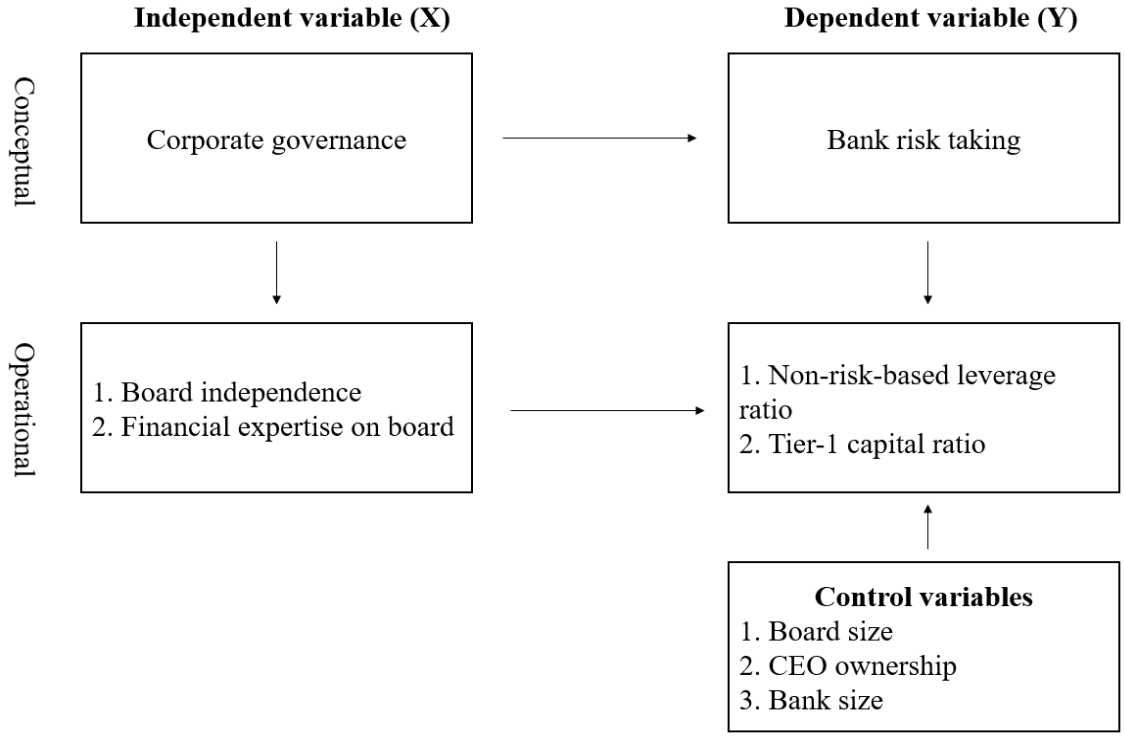

Figure 1 The Predictive Validity Framework: Libby's (1981) boxes

3.2.2 Sample selection

The sample of this thesis is consisted with 92 active American banks. And we use 181 firm-year observations during the period 2014 to 2015 as our final sample to address the research question. The reason why we limit our sample period to 2014 to 2015 is because Basel Accord III has been only implemented since 2013. Since this thesis tests the effectiveness of Basel Accord III, the currently implemented regulations on bank risk taking, we have to choose

the time period after 2013.

Our sampling criteria are as follows. First, we obtained board-related data (board independence, fraction of financial experts of board, CEO duality, board size, CEO equity-based ownership) from Institutional Shareholder Services (ISS) and Execucomp. Then we collected tier-1 capital ratio, total assets and book value per share data from Datastream database. The observations we chose are active American banks and the initial sample is 852 banks. After merging the initial sample with board-related database, only 145 observations are matched. Since we have 6 parameters all together, we assumed this sample size is relatively too small. To address this problem, we also collected tier-1 capital ratio, total assets and book value per share data from COMPUSTAT North America Bank, which consists of annual and quarterly report data of listed American and Canadian companies. The initial number of observations within COMPUSTAT North America Bank is 1120. After combing with board-related database, 266 observations are left. We combined the merged sample from Datastream and merged sample from COMPUSTAT to draw our final sample. Our final sample is consisted with 181 observations after dropping the overlapped banks list on both databases. Until now, we have obtained all the data that we needed except for the leverage ratio. Then we hand collected the non-risk-based leverage ratio from SEC annual reports and 10-k reports.

Chapter 4

Results and data analysis

This chapter presents the empirical results of hypotheses. In the first subsection, the descriptive statistics provide the detailed information related to all the variables, including the mean, standard deviation, as well as the maximum and the minimum values of all variables, which are presented in *Table 1*. Next, we use Spearman test to measure the linear correlation between variables and the results are presented in the *Table 2*. In the second subsection, we first use several models to test whether the assumptions for using OLS regression are met or not. Then, our main empirical results are presented in this subsection. Not only do we present the association between board characteristics and bank risk taking, but also further analysis is made to explore the reasons behind this association. The main results of this thesis are presented in *Table 3* and *Table 4*.

4.1 Univariate analysis

4.1.1 Descriptive statistics

Table 2 presents the descriptive statistics for all the dependent variables, independent variables as well as control variables over the period of 2014-2015. The first two rows are dependent variables. The mean values of tier-1 capital ratio and non-risk-based leverage ratio are 12.72% and 9.82%, respectively. Both are higher than the minimum capital regulations under Basel Accord III (7% for tier-1 capital ratio, 3% for non-risk-based leverage ratio). The minimum and maximum values of tier-1 capital ratio in our sample are 8.81% and 20.19%, respectively. Besides, the minimum and maximum values of non-risk-based leverage ratio are 5.6% and 17.89%, respectively.

The mean value of the fraction of outside directors is 60%, which is consistent with previous literatures. Adams and Mehran (2011) find that because of the complexity within the financial industry, most banks tend to have larger proportion of outside directors. In addition, American banks also have large proportion of financial experts. The mean value of the fraction

of financial experts on board is 41%, and the maximum value is 1 which means in some banks, all the board members are financial experts. When it comes to control variables, the mean value of board size is 5.4, and the minimum and maximum values are 3 and 8, respectively. The mean value of bank size which we measured by logarithm of total assets of banks, is 15.36. The standard deviation of bank size is 3 which indicates that both large banks and small banks are contained in the sample. We use logarithm of the total shares owned by executives times book value per share as proxy to measure executives equity-based ownership, the mean value of executives equity-based ownership is 9.12, and the minimum and maximum value are 6.46 and 13.42, respectively.

Table 1

Descriptive statistics for regression analysis

Variables	Observation	Mean	Std. Dev	Min	Max
Leverage	181	9.817	1.953	5.6	17.89
Tier1	181	12.72	2.335	8.81	20.19
F_outsider	181	0.605	0.238	0.333	0.875
F_expert	181	0.41	0.231	0.143	1
CEOD	181	0.492	0.501	0	1
BOARDS	181	5.409	0.737	3	8
BANKS	181	15.362	2.996	7.753	21.668
Ownership	181	9.12	1.211	6.456	13.417

Variable Definitions:

Leverage = the non-risk-based leverage ratio under the regulation of Basel Accord III

Tier1 = the tier-1 capital ratio under the regulation of Basel Accord III

F_outsider = the fraction of outside directors on board

F_expert = the fraction of financial experts on board

CEOD = the CEO duality, equal to 1 when CEO is also the chairman on board, 0 otherwise

BOARDS = board size, measured by the number of directors on board

BANKS = bank size, measured by the logarithm of the total assets of banks

Ownership = CEO equity-based salary, equal to the book value per share times the total shares owned by CEO

4.1.2 Correlation test

In this thesis, we use Spearman test to measure the linear correlation between two variables that is important for identifying possible highly intercorrelated variables. Spearman model means that before computing the correlations, all variables are first ranked and assigned a new value based on the rank. One advantage to use the Spearman rank correlations is to make sure that the observed correlations are not driven by a few extreme outliers or other nonlinearities in the data. The results of the correlation test are between -1 and +1, where 0 represents no correlation, and the higher the absolute value is, the higher the correction will be. Each variable has two values, the upper of which shows how much the variables are correlated and the other one is the p-value, which shows the significance of the correlation. Table 2 presents the results of Spearman test.

Table 2

Pearson correlation matrix

	Leverage	**Tier1**	**F_outsider**	**F_expert**	**CEOD**	**BOARDS**	**BANKS**	**Ownership**
Leverage	1							
Tier1	0.214***	1						
	(0.004)							
F_outsider	-0.064	0.12	1					
	(0.391)	(0.106)						
F_expert	-0.142*	-0.055	-0.17**	1				
	(0.056)	(0.463)	(0.022)					
CEOD	-0.042	0.105	0.052	0.136*	1			
	(0.575)	(0.162)	(0.485)	(0.069)				

BOARDS	-0.084	0.115	0.298***	0.273***	0.033	1		
	(0.263)	(0.123)	(0.000)	(0.000)	(0.656)			
BANKS	-0.021	-0.138*	0.054	0.139*	0.176**	0.026	1	
	(0.784)	(0.064)	(0.469)	(0.062)	(0.018)	(0.734)		
Ownership	-0.044	0.029	-0.054	0.123*	0.509***	-0.008	0.346***	1
	(0.557)	(0.701)	(0.468)	(0.097)	(0.000)	(0.917)	(0.000)	

Asterisk (*, **,***) denotes statistical significance at 10% level, 5% level and 1% level, respectively

Variable Definitions:

Leverage = the non-risk-based leverage ratio under the regulation of Basel Accord III

Tier1 = the tier-1 capital ratio under the regulation of Basel Accord III

F_outsider = the fraction of outside directors on board

F_expert = the fraction of financial experts on board

CEOD = the CEO duality, equal to 1 when CEO is also the chairman on board, 0 otherwise

BOARDS = board size, measured by the number of directors on board

BANKS = bank size, measured by the logarithm of the total assets of banks

Ownership = CEO equity-based salary, equal to the book value per share times the total shares owned by CEO

The correlation between board characteristics and bank risk taking is consistent with the literature review. The proportion of financial experts in the board is negatively and significantly correlated with leverage ratio, with p-value equals to 0.056. Consistent with our second hypothesis, banks which having more financial experts in the board often tend to take higher risk compared to banks that have less financial experts in the board. CEO duality is positively correlatated with both variables F_outsider and F_expert, but the coefficient of outside directors is not significant (p-value equals to 0.485). This could be interpreted that powerful CEO may choose more outside directors and financial experts to satisfy their own risk appetite. However, according to the prior researches, Aebi et al. (2012) and Minton et al. (2014) both find no evidence that powerful CEO choose the directors with financial expertise to satisfy their own risk appetite.

Because of the "too big to fail" theory, bank size is negatively and significantly associated with tier-1 capital ratio, with p-value equals to 0.064. Besides, bank size is positively and significantly correlated with CEO duality (with p-value equals to 0.018). Due to the complexity of daily managements, large banks have to hire CEOs with high individual abilities in order to manage the banks better, and CEOs who have high individual abilities tend more to be the chairman of board.

4.2 Multivariate Analysis

4.2.1 Testing OLS assumptions

As mentioned before, we use OLS regression model as our methodology to test the hypothesis. Before using the OLS regression, the dataset that we use need to meet several OLS conditions: there is random sampling, there is no multicollinearity or heteroskedasticity, and the error terms should be normally distributed. We performed some tests to guarantee that our dataset meet these conditions. The results of these tests are presented in *Appendix*.

Since the complete datasets collected from WRDS and Datastream are used in the sample selection process and only observations with missing data are dropped, the assumption of random sampling is met. Looking at the VIF value and tolerance can help us to find out whether the assumption of no multicollinearity is met or. VIF provides a coefficient that measures how much variance of estimated regression increases because of multicollinearity. Normally, the given rule of thumb is that VIFs equal to10 or higher (or equivalently, tolerances equal to 0.1 or less) may be reason for a concern. However, Allison says he gets concerned when the VIF is over 2.5 and the tolerance is under 0.4. In our test, the mean value of VIF is 1.2 which is much lower than the rule of thumb. Besides, the tolerance of variables is all higher than 0.4. All these numbers indicate that there is no multicollinearity in our datasets. Next, we use Breusch–Pagan / Cook-Weisburg test for heteroskedasticity. The null hypothesis of Breusch–Pagan / Cook-Weisburg test is that the error variances are all equal. So when the null hypothesis is true (p-value is not significant) and Chi-squared is relatively small, there is no heteroskedasticity concern. We can learn from the *Table 6* in *Appendix* , that the value of Chi-squared is small and not significant (Chi-squared equals to 2.09, p-value equals to 0.149) for equation (1), which

means the assumption of no heteroskedasticity is met. In contrast, the p-value is significant for equation (2), so we need to consider the existence of heteroskedasticity here. However, heteroskedasticity is often a by-product of other violation of assumptions and itself does not result in biased parameter estimates. Besides, the Chi-squared value of equation (2) is still relatively small (14.89), which means the heteroskedasticity concern in equation (2) is not serious at all. In order to test for normal distribution of the error terms, the Skewness/Kurtosis test is performed. Since this test for equation (1) shows significant results, with p-value equal to 0.00 and 0.01 respectively, so the condition for normal distribution of the error terms is not met. However, this test is extremely sensitive for relatively large samples, and our sample is relevantly small, so the influence of this issue on the results could be limited. The test for equation (2) shows insignificant results (p-value of Kurtosis equal to 0.113), so the error terms of this equation are normally distributed. Taken together, the assumptions for OLS regression are all met.

4.2.2 Testing hypotheses

In this subsection, we not only present the main results of our research question, but also the analysis of the reasons behind the results. The association between board characteristics and bank risk taking is examined using a cross-sectional multiple regression. The regression equation includes a dependent variable either the Tier-1 capital ratio or non-risk-based leverage ratio, which are the measures of bank risk appetite. Moreover, the regression includes the independent variables defined in *Chapter 3* as proxies for board independence and financial experts on board. Besides, the regression equation also contains three control variables (bank size, board size, executive equity-based compensation) to prevent any potential bias of our results. *Table 3* presents the association between board characteristics and bank risk taking when excluding control variables.

Table 3

Main regression results exclude control variables

This table presents the regression results of main research question without control variables. The sample consists of 181 annual observation between 2014 and 2015.

Independent variables	Pre. Sign	(1)	(2)
		Leverage	Tier1
F_outsider	-	-1.487**	0.665
		(2.41)	(0.89)
F_expert	-	-1.312**	-0.606
		(-2.05)	(-0.78)
CEOD	+	0.158	0.51
		(0.55)	(1.45)
No. of Obs		181	181
P-value of F-test		0.043	0.298
Adjusted R2		0.045	0.004

Asterisk (*, **,***) denotes statistical significance at 10% level, 5% level and 1% level, respectively

Variable Definitions:

Leverage = the non-risk-based leverage ratio under the regulation of Basel Accord III

Tier1 = the tier-1 capital ratio under the regulation of Basel Accord III

F_outsider = the fraction of outside directors on board

F_expert = the fraction of financial experts on board

CEOD = the CEO duality, equal to 1 when CEO is also the chairman on board, 0 otherwise

The column (1) presents the results when using non-risk-based leverage ratio as proxy to measure bank risk appetite. The column (2) presents the results when using tier-1 capital ratio as proxy to measure bank risk appetite. Bank takes more risk if the tier-1 ratio and the leverage ratio go down because lower ratios means bank stores less capital as buffer. The coefficient for

F_outsider to Leverage is negative and significant at 95% significance level (t-statistics > 1.96, p-value equals to 0.017), and this results supports for the first hypothesis that there is a positive relation between board independence and bank risk taking. The lower the non-risk-based leverage ratio is, the higher the risk of banks is. The magnitude of this coefficient suggests that one unit increase in the fraction of outside directors which is translates into a 1.487 decrease in bank non-risk-based leverage ratio. This is in line with Aebi et al. (2012) that shareholder-controlled boards are willing to take higher risk. On the one hand, having too much capital buffer means less potential investment opportunities, so shareholders have to choose riskier financial activities to compensate for the loss. On the other hand, since bank plays a vital role in guaranteeing the liquidity of financial market, the authority takes lots of methods to protect the bank industry. However, their protective regulations potentially encourage shareholders to take higher risk to increase the stock price and satisfy their self-interest. However, the coefficient for F_outsider to tier-1capital ratio is not significant (p-value equals to 0.375, t-statistic equals to 0.89).

The coefficients for CEOD are positive to dependent variables (0.158 and 0.51, respectively) but not statistically significant (with p-value equal to 0.148 and 0.585, respectively). One potential possibility is that there is no relation between board independence and bank risk taking. But since the coefficient for F_outsider to leverage ratio is significant, so we already proved that leverage ratio and board independence do have an association. Another potential explanation is that some typical corporate governance measurements as used in lots of previous literatures may fall short in capturing the internal validity of relevant governance structure of banks (Aebi et al. 2012).

Next we move to the interpretation for the relation between bank risk taking and financial experts of board. The coefficient for F_expert to Leverage is negative and statistically significant (p-value equals to 0.042, t-statistic > 1.96), and this result supports for the second hypothesis that there is a positive relation between bank risk appetite and number of financial experts of board. The magnitude of this coefficient implies that an increase in the proportion of financial experts on board which are from the internal management translates into a 1.312 decrease in non-risk-based leverage ratio. The results are in line with Minton et al. (2012) that

banks tend to take higher risk when having more financial experts on board. The potential reason behind this phenomenon is that financial expertise can better understand and realize the residual nature of shareholders' claim is protected and guaranteed by the authority. So it is much safer for shareholders of financial industries to choose risky investment compared with shareholders of other industries. However, the coefficient for F_expert to Tier1_w is still not significant (with p-value equals to 0.436 and t-statistic < -1.96).

Based on the results showing in *Table 3*, the coefficients between tier-1 capital ratio and the main independent variables are all not statistically significant (t-statistics < 1.96), even some directions of main coefficients are in line with what we predicted before. The explanation behind this phenomenon is that the tier-1 capital ratio only captures the on-balance sheet activities and cannot fully reflects the risk appetite of banks. Banks can still remain high tier-1 capital ratio as long as they put more risk weights on off-balance items. In contrast, we can notice that the results between leverage ratio and main explanatory variables (F_outsider, CEOD, F_expert) are all statistically significant (t-statistic > 1.96). This phenomenon further proves that the non-risk-based leverage ratio is superior compared with the tier-1 capital ratio when measuring the true risk appetite of banks, since it captures both on- and off-balance sheet activities.

However, Aebi et al. (2012) find that some typical corporate governance measurements used in lots of previous literatures may fall short in capturing the internal validity of relevant governance structure of banks. So it is also possible that the insignificant results between tier-1 capital ratio and independent variables are due to the inappropriate board characteristics' measurements. But based on what is shown in *Table 3* and *Table 4*, we can reject this potential explanation. One reason is that the results between leverage ratio and the main explanatory variables are statistically significant which means the measurements that we use do capture the underlying internal validity of board characteristics. In addition, Pathan (2009), Bliss (2011), Knyazeva et al. (2013) and Minton et al. (2014) all prove the validity and reliability of the proxies that we used to measure the board characteristics in their previous studies. In conclusion, it makes sense that the Committee regulates the leverage ratio as a supplement to tier-1 capital ratio when measuring the risks, since this non-risk-based leverage ratio under Basel Accord III

can better reflect the true risk appetite of banks.

Table 4 presents the main results related to our research question when including the control variables. We want to know whether the associations between board characteristics and bank risk appetite still hold when adding some variables that might potentially have a relation with dependent variables. The column (1) presents the results when using non-risk-based leverage ratio as proxy to measure bank risk appetite. The column (2) presents the results when using tier-1 capital ratio as proxy to measure bank risk appetite.

Table 4

Main regression results include control variables

This table presents the regression results of main research question when including control variables. The sample consists of 181 annual observation between 2014 and 2015.

Independent variables	**Pre. Sign**	**(1)**	**(2)**
		Leverage	**Tier1**
F_outsider	**-**	-1.267**	0.67
		(-2.00)	(0.86)
F_expert	**-**	-1.569**	-0.656
		(-2.42)	(-0.82)
CEOD	+	0.294	0.636
		(0.89)	(1.57)
BOARDS	**-**	-0.441**	-0.105
		(-2.16)	(-0.42)
BANKS	**-**	0.009	-0.008
		(0.18)	(-0.13)
Ownership	**?**	-0.097	-0.098
		(-0.69)	(0.57)
No. of Obs		181	181

P-value of F-test	0.042	0.647
Adjusted R2	0.04	-0.01

Asterisk (*, **,***) denotes statistical significance at 10% level, 5% level and 1% level, respectively

Variable Definitions:

Leverage = the non-risk-based leverage ratio under the regulation of Basel Accord III

Tier1 = the tier-1 capital ratio under the regulation of Basel Accord III

F_outsider = the fraction of outside directors on board

F_expert = the fraction of financial experts on board

CEOD = the CEO duality, equal to 1 when CEO is also the chairman on board, 0 otherwise

BOARDS = board size, measured by the number of directors on board

F_expert = the fraction of financial experts on board

Ownership = CEO equity-based salary, equal to the book value per share times the total shares owned by CEO

The main results still hold when adding control variables into the regression model. The coefficient for F_outsider to Leverage is negative and statistically significant (p-value equals to 0.047, t-statistics > 1.96), and the magnitude of this coefficient suggests that an increase in the fraction of outside directors translates into a 1.267 decrease in bank non-risk-based leverage ratio. In line with previous discussion, the result supports the first hypothesis that there is a positive relation between board independence and bank risk taking. The coefficients for CEOD are positive (0.294 and 0.636, respectively) but the coefficients are still not significant, with p-value equal to 0.38 and 0.12 respectively.

The coefficient for F_expert to Leverage is negative and significant (p-value equals to 0.017, t-statistic < -1.96), and the magnitude of this coefficient implies that an increase in the fraction of financial experts in the board translates into a 1.569 decrease in non-risk-based leverage ratio.

When it comes to control variables, the coefficient for BOARDS to Leverage is negative and statistically significant (p-value equals to 0.032, t-statistics < -1.96), and the magnitude of this coefficient suggests that one unit increase in board size translates into a 0.441 decrease in

bank non-risk-based leverage ratio. This is in line with our previous prediction. The results show that there is no association between bank size and dependent variables. In addition, there is negative but insignificant relation between equity-based compensation and dependent variables (p-value equal to 0.491 and 0.569, respectively). This outcome is consistent with Core et al., (1999), who claim that there is no relation between equity-based compensation and improved corporate governance.

Chapter 5

Conclusion and discussion

5.1 Discussion and contribution

It is generally believed that global economic downturn during the period 2007-2008 was caused by real-estate bubble and reckless subprime mortgage loans. However, Bank for International Settlements (2014) highlights that an underlying cause of the global financial crisis was the build-up of excessive on- and off-balance sheet leverage in the banking system. Based on this situation, banks needed sufficient capital base as a buffer to lower the risk that they faced. For superior monitoring the financial industry and controlling of excessive risk taking, the Basel Accord III introduced a simple, transparent, non-risk based leverage ratio to act as a credible supplementary measure to the risk-weighted capital requirements since banks have discretion to choose their own capital ratio as long as it is above the required minimum capital ratio (Bank for International Settlements 2014). This leverage ratio equals to Capital measure divided by Exposure measure, and the Exposure measure captures both on- and off-balance sheet items (*Appendix 1* shows the variables used to take the leverage ratio). In addition, Basel Accord II highlights corporate governance as an important role within financial industry. The second pillar of Basel II identifies the role of board of directors as an integral part of risk management.

Based on this background, this paper examines the association between corporate governance and bank risk taking, to be more specific, the association between board characteristics (board independence, financial experts of board) and bank risk taking under the capital regulations of Basel Accord III. The underlying theory behind our research question is agency theory (Jensen and Meckling, 1976), especially one of the central issues in it which is the various levels of risk between shareholders and agents. In addition, financial experts and the fraction of outside board-member belong to the supervisory board, and therefore they can impact investment decisions and bank risk taking by giving advice to senior managers (Minton et al., 2014). In this thesis, we use 181 firm-year observations during the period 2014 to 2015

as our final sample to address the research questions. All the data are collected from the WRDS and Datastream databases, then we use the Stata software to help us process the data. After testing all the assumptions of OLS regression are met, we then use the OLS regression as our methodology to investigate the research question. We choose two proxies to measure board independence. In line with Bliss (2011) and Knyazeva et al. (2013), the first proxy is the proportion of outside directors on board. The higher the proportion of outsiders, the more independent the board is. The second proxy we use to measure board independence is CEO duality. The CEO duality is a dummy variable, equals 1 when CEO holds the position of the chairman of the board, 0 otherwise (Pathan, 2009; Bliss, 2011). For the dependent variables, we first use the tier-1 capital ratio under the regulation of Basel Accord III as proxy to measure the risk appetite of banks. Since the tier-1 capital ratio only captures the on-balance sheet activities, we argue the non-risk-based leverage ratio can better reflect the true risk appetite of banks since it is capturing both on- and off-balance sheet activities. Then we use the non-risk-based leverage ratio as our second proxy to measure bank risk appetite. We also add board size, bank size, CEO equity-based ownership as control variables in our regression models.

There are several important implications in this study. First, consistent with Jensen and Meckling (1976), Wright et al. (1996), Demirguc-Kunt and Detragiache (2002), John et al. (2008), Aebi et al. (2012), there is a positive relation between board independence and bank risk taking under the capital regulation of Basel Accord III. On the one hand, because of the personal costs and career concern, executives tend to take less risk. On the other hand, having too much capital buffer means less potential investment opportunities, so shareholders have to choose more risky financial activities to compensate for the loss. Besides, the protective regulations of the authorities potentially encourage shareholders to take higher risk to increase the stock price and satisfy their self-interest. Second, our results suggest that there is a positive association between the number of financial experts in a board and bank risk taking. The potential reason behind this phenomenon is that financial experts better understand the residual nature of shareholders' claim and therefore is protected and guaranteed by the authority. It is then safer for shareholders of financial industries to choose risky investment compared with shareholders of other industries (Minton et al., 2014). Third, Basel Accord III introduces the

non-risk-based leverage ratio as a supplementary to tier-1 capital ratio, the results of leverage ratio with independent variables are significant, in contrast, the results of tier-1 capital ratio with independent variables are not significant. This phenomenon further proves that the non-risk-based leverage ratio is superior to tier-1 capital ratio when capturing the internal validity of bank risk appetite. Based on this reality, accounting professionals can better analyze the true risk appetite of banks through the leverage ratio. In addition, since the non-risk-based leverage ratio can better reflect the true risk appetite of banks compared with tier-1 capital ratio, it should be of relevance for shareholders to make wiser investment choices.

Although quite some research has investigated the correlation between corporate governance and firm risk taking, most of it disregards financial firms. Our results narrow the gap of this. In addition, our results suggest the current reliability and validity of the non-risk-based leverage ratio and prove that the leverage ratio can better reflect the true risk appetite of banks compared with tier-1 capital ratio, which should be of a relevance for both regulators and shareholders.

5.2 Limitations and future research

This study is subject to several limitations. Firstly, one potential caveat is the generalization concern. Since we only choose the active U.S banks, therefore, we cannot completely rule out the possibility that certain idiosyncrasies of our sample limit the generalizability of our findings. Besides, because of the availability of data as well as the specific time period (2014-2015), our sample size is relevantly small, only 181 firm-year observations. This may compromise the reliability of our research outcomes. In addition, when examining research questions related to corporate governance, endogeneity concerns always exist. For instance, CEO duality may have relation with bank size in our regression model. Due to the complexity of daily managements, larger banks tend to hire CEO with high individual abilities in order to better manage the banks, CEOs with high individual abilities tend to be the chairman of board.

For the future research, there are two ways to improve our thesis. First of all, we can add more banks from other countries into our sample, which should enhance the generalizability of

our results. Besides, since the time period that we choose in this thesis is still under the parallel run period for the leverage ratio, so it should be interesting to restudy the relation between corporate governance and bank risk taking after all the regulatory ratios of Basel Accord III are fully implemented.

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Appendices

Appendix 1

Table 5 shows the variables that are used to take the leverage ratio

Capital measure (common equity tier-1):

1.common shares issued by the bank that meet the criteria for classification as common shares for regulatory purposes

2.stock surplus (share premium) resulting from the issue of instruments included Common Equity Tier 1

3. retained earnings

4. Accumulated OCI and other disclosed reserves

5. common shares issued by consolidated subsidiaries of the bank and held by third parties

6. Regulatory adjustments applied in the calculation of Common Equity Tier 1

Capital measure (additional tier-1):

1. Instruments issued by the bank that meet the criteria for inclusion in Additional Tier 1 capital (and are not included in Common Equity Tier 1)

2. Stock surplus (share premium) resulting from the issue of instruments included in Additional Tier 1 capital

3. Instruments issued by consolidated subsidiaries of the bank and held by third parties that meet the criteria for inclusion in Additional Tier 1 capital and are not included in Common Equity Tier 1

4. Regulatory adjustments applied in the calculation of Additional Tier 1 Capital

Exposure measure:

1. on-balance sheet exposures

2. derivative exposures

3. securities financing transaction (SFT) exposures

4. off- balance sheet (OBS) items

Appendix 2 – Collinearity Test

Table 6 shows the results of multicollinearity test for equation (1) and equation (2). Normally, the given rule of thumb is that VIFs of 10 or higher (or equivalently, tolerances of .10 or less) may be reason for concern.

Variables	Collinearity equation (1)		Collinearity equation (2)	
	Tolerance	VIF	Tolerance	VIF
Ownership	0.703	1.42	0.703	1.42
CEOD	0.742	1.35	0.742	1.35
F_outsider	0.895	1.12	0.895	1.12
BOARDS	0.897	1.11	0.897	1.11
F_expert	0.904	1.11	0.904	1.11
BANKS	0.925	1.08	0.925	1.08
Mean		1.2		1.2

Appendix 3 – Heteroskedasticity Test

Table 7 shows the results of heteroskedasticity test for equation (1) and equation (2). We use Breusch–Pagan /Cook-Weisburg test for heteroskedasticity. The null hypothesis of Breusch–Pagan / Cook-Weisburg test is that the error variances are all equal. When the null hypothesis is true (p-value is not significant) and Chi-squared is relevant small, there is no heteroskedasticity concern. Asterisk (***) denotes statistical significance at 1% level.

Heteroskedasticity equation (1)		Heteroskedasticity equation (2)	
Chi-Squared	**P-value**	**Chi-Squared**	**P-value**
2.09	0.149	14.89	0.000***

Appendix 4 – Skewness/Kurtosis Test

Table 8 shows the results of Skewness/Kurtosis test for equation (1) and equation (2). The Skewness/Kurtosis test is performed in order to test for normal distribution of the error terms. If the p-value of Skewness/Kurtosis is significant, the error terms are not normally distributed. Asterisk (***) denotes statistical significance at 1% level.

	Equation(1)	Equation(2)
Observations	181	181
Chi-Squared(Skewness)	25.3	16.52
Chi-Squared(Kurtosis)	6.82	2.26
Pr(Skewness)	0.000***	0.011***
Pr(Kurtosis)	0.009***	0.133