Capital structure, regulation and risk: evidence from Islamic banks and conventional banks

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Abstract

This thesis attempts to broaden the existing empirical research of Islamic banks (IBs) and conventional banks (CBs) by focusing on three distinct aspects: bank capital, risk and regulation.

The findings of Chapter 3 show that IBs are in a disadvantaged position compared to CBs when it comes to capital structure management. It seems that Islamic banks are not able to adjust leverage that easily and quickly to support asset growth, due to more restrictions in liquid funding channels. In terms of regulatory capital, IBs capital's ability to respond to risks is weaker than CBs. The conclusion suggests that IBs need the support of a robust Islamic financial system to broaden their financing instruments and funding sources to reduce adjustment costs, and improve their capability to deal with asset risk.

Chapter 4 finds the risk-weighted assets and minimum required capital of Islamic banks might not be able to significantly capture market-based portfolio risk. The phenomenon is related to the unique feature of Islamic banks because the study reports that investment account deposit and implementation of IFSB standards reduce the risk sensitivity of capital requirements. Then, the findings demonstrate that appropriate policy reforms such as more information disclosure and prompt correction action power could improve sensitivity of required capital and regulatory risk to portfolio risk in Islamic banks.

The results of Chapter 5 suggest the supervisory practices stressed by banking supervision of Basel Committee are more effective in reducing risk-taking of IBs compared to CBs. Therefore, it is necessary for regulators to use international regulations for monitoring Islamic banks. In addition, the liberalized business environment and economic system make bank regulations more effective in reducing risk of IBs and CBs. This research also finds that the regulatory policies related to risk in times of crisis need to be improved.

Table of contents

List of Tables

List of Figures

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Declaration

I declare that the content of this thesis is original. This work has not previously been presented for an award at this, or any other, University. All references to other authors' works are included in the references.

Chapter 1 Introduction

Islamic Finance has grown rapidly in the global financial system in recent decades, contributing to extend corporate and individual financing channels by providing more diversified financial products and promote economic progress. In particular, the recent financial crisis incentivizes policymakers to start paying attention to Islam financial services whose expansion is expected to alleviate the financial turmoil. With rapid growth and increased demand, Islamic banking is likely to provide financial products as a complement to services offered by conventional banks, and to be integrated into the global financial markets while maintains its distinguished feature (Hassan and Aliyu, 2018). Meanwhile, the development of Islamic finance is one step behind the traditional financial model, and there are still many challenges to be solved in terms of operation and regulation.

Although Islamic banks (IBs) behave like conventional banks (CBs) to mobilize deposits and undertake maturity transformation, IBs and CBs differ in some respects. Firstly, the transactions of Islamic banking are conducted on the basis of Sharia guidelines which prohibit bank interest (Riba), and activities such as gambling, speculation, excessive uncertainty (Gharar) etc. (Hasan and Dridi, 2010). Interest is forbidden in the Sharia law because interest does not provide a fair distribution to participants in business activities, and borrowers need to guarantee the amount of interest to lenders regardless of whether they earn profits or suffer losses. This is in contradiction with the core doctrine of fairness in Islamic laws (Iqbal, 2007).

Second, the operation mode of Islamic banks is characterized by risk-sharing. In terms of assets on the balance sheet, Islamic banks are likely to engage in unique profit-loss sharing (PLS) contracts (such as Musharakah[1],

[1] Islamic banks and customers work together to fund projects or businesses. The profits generated by

and Mudaraba[2]) which are similar to equity-based financing products underpinned by real economic activities. The profits generated by these PLS activities are distributed in accordance with prior agreements. In regards to its liabilities, an Islamic bank can offer its depositors a variety of products such as savings account and special investment accounts in which the profits earned by investors are determined by the return on investment (Johnes et al, 2014). Unlike traditional commercial banks which promise the constant return to the principal after accepting deposits, Islamic banks' special investment accounts cannot provide a fixed return, and just share profits with investment account holders, the losses are usually solely borne by the profit-sharing investment account (PSIA) holders.

The practical differences between IBs and CBs provide considerable space for empirical research. This thesis sheds light on the areas of bank capital, risk and regulation of Islamic banks, and makes comparisons between IBs and CBs across countries from new dimensions and complements the emerging literature on banks and Islamic banks in emerging countries.

First, this thesis explores whether modern corporate finance theory are relevant to explain the decision of IBs and CBs regarding capital structure. Past research has avoided the inclusion of financial firms when it comes to the principles of corporate finance, because the capital structure of banks is considered unique and distinct from other industries. The research in chapter 3 attempts to make new evidence in this area, not only to test that the modern capital structure theories can be applied to banks to help them reflect on their own decision-making behaviors, but also to link traditional principles with

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the company or assets are paid in accordance with the pre-signed agreement, and the losses incurred are shared according to the capital share of each partner.

[2] The banks receive funds from depositors or fund holders and they provide clients with funds for projects development. Clients are responsible for managing the business, and provide expertise to facilitate the operation of the project. Profits are distributed according to pre-agreed contracts. Losses are entirely absorbed by banks - the fund providers.

Islamic banks to discover IBs' characteristics.

Second, the risk level of assets represented by risk-weighted assets is directly related to capital requirements, and is also a key indicator that banks need to report to regulators. When the risk-weighted assets is not accurately and correctly assessed, a bank can participate in the regulatory capital arbitrage activities without accruing sufficient capital charges. The consequence of this arbitrage behavior is that at the time of encountering the actual asset losses, the bank is likely to not have enough buffer to offset the negative losses. Therefore, the exploration of the risk sensitivity of the minimum capital seems to bring warnings to regulators and management about risk management. Whether Islamic banks, which are financial intermediaries, are also involved in the same regulatory arbitrage is unknown, and Chapter 4 carries out this specific analysis.

Finally, this thesis relates to understand whether bank supervisory practices in accordance with the international regulatory framework can effectively reduce the risks of Islamic banks. Additionally, how the effectiveness of regulation changes under the influence of the external economic environment or macroeconomic instability will be identified in chapter 5.

This research is important because it can make Islamic banks' performance easier to understand through empirical research, and to provide bank managers, regulators, and decision makers with useful information that influences their decision to promote the development of the banking industry. The first chapter is divided into three parts: Section 1.1 gives a brief introduction to Islamic banking. Section 1.2 summarizes the motivation and contribution of this thesis..

1.1 Islamic banking

1.1.1 The size and growth

Islamic banks have experienced rapid asset expansion in the last two decades and their total assets have exceeded the $2 trillion mark, mainly in the areas of Gulf Cooperation Council, the Middle East, North Africa (formerly the Gulf Cooperation Council) and Asia. Specifically, by 2018, the market share of the Islamic banking industry in several major jurisdictions was: Kuwait 39.3%, Qatar 25.7%, Malaysia 24.9%, United Arab Emirates 20%, Bangladesh 19.8%, Djibouti 19%, and 15.5% in Jordan (IFSB, 2018). Overall, Islamic banking shares in 12 jurisdictions with systemically important Islamic financial markets now account for 92% of global Islamic banks assets (Hussain et al., 2015).

In addition, since January 2018, Islamic banking has also left the footprint in South America because the traditional secondary bank in Suriname has been successfully transformed into a bank that is fully compliant with Islamic principles (IFSB, 2018). With this, Islamic banking products are able to now spread across the world's six livable continents. While the share of Islamic finance in Africa (non-North Africa), the Americas, Australia and other regions is slowly rising, it is still in the early stages of development. Perhaps because of the small Islamic population in these areas, the development of this industry lacks sufficient momentum.

1.1.2 Basic principles

In Islam, religion and the state are considered to be integrated; the state is

seen as a manifestation of religion, and religion constitutes the essence of the state (Mills, 1999). The logical conclusion shared by Islam and other monotheistic beliefs is that all parts of life involves religious and ethical considerations.

Similarly, the business philosophy of Islamic banks and financial services institutions is greatly influenced by Islamic law (Iqbal, 2007). These are reflected in their participation in activities that should not involve interests, and activities that are probably detrimental to society (such as gambling, alcohol, excessive uncertainty, tobacco, pornography and speculative illegal transactions) (Zaher and Kabir Hassan, 2001).

The specific term for interest in Arabic is Riba. According to the Pakistani Islamic Court of Justice, the concept of Riba (1) covers usury and interest; (2) is applicable to all forms of interest, regardless of size. The Islamic-based financial system is committed to eliminating all forms of interest payments and receipts, which makes Islamic banks and other financial institutions different in principle from traditional banks and other financial institutions (Hussain et al, 2015). In addition to the special view regarding interests, Islamic bank supporters summarized the four basic standards that Islamic banks follow: (1) Risk sharing--One of the most important features of Islamic banking is that it promotes risk sharing between fund (investor) providers and fund users (entrepreneurs). In the traditional banking industry, regardless of whether the project generates profits or generates losses, the capital owner will still receive a predetermined return, and all risks are borne by the entrepreneur. In Islam, this is an unfair risk distribution and is not allowed. Therefore, in pure Islamic banking, investors and entrepreneurs share the results of the project in a fair manner. In the case of successful projects, both parties share profits in a pre-agreed proportion. When losses occur, all financial losses are borne by the capital supplier, and the entrepreneur is penalized for not receiving any remuneration (or salary) for his efforts. The

corresponding business model is Mudaraba (see next section).

(2) Real economy—That is, encourage Muslims to spend and / or invest in economic transactions, and do not encourage them to idle funds. Hoarding money is considered unacceptable because in Islam, money represents purchasing power, and this purchasing power (money) should be used to create goods and services.

(3) No uncertainty or speculation—Transactions with uncertainties (gharar) are not allowed because they are excessively risky due to too little information or information asymmetry. For example, a transaction with uncertainty perhaps makes it impossible for the parties involved to predetermine the profit. The return of the forward exchange rate contract is determined by the future interest rate and this kind of activities is therefore considered to be risky and prohibited, similar to options and futures.

(4) Activities not accepted by the Shari'a are prohibited—Businesses that are not approved by Shari'a, such as manufacturing, selling or supplying alcohol, pork, or companies involved in gambling, nightclub activities, pornography, etc. are prohibited (Hasan and Dridi, 2010).

These above basic principles form the basis of Islamic financial products, and the next part introduces contracts/products with Islamic characteristics.

1.1.3 IBs vs CBs

The most basic function of banks is to direct borrowed funds to borrowers with financial needs for productive activities. In general, conventional banks receive funds through borrowing (such as interbank lending, or issuance of bonds) and other forms of liabilities (such as various deposits). They can use these funds to lend, or buy securities and other assets. Because the operation of loans and the holding of securities or other assets may yield return, then

the proceeds minus the interest paid for the liabilities and other expenses are the profits banks obtain. In contrast, the most obvious feature of IBs is that interest is forbidden. It is because the basic principles of Islam mentioned in the section 1.1.2 have been incorporated into the operation of Islamic banks. Additionally, there are many differences between IBs and CBs, as this study explores capital structure, risk and regulation, and then this section further describes these aspects.

1.1.3.1 Balance sheet components

This part compares the Islamic financial transactions that have emerged on Islamic banks' balance sheets with the items listed in CBs (see Table 1.1).

Table 1. 1 Balance sheet items of IBs and CBs

Islamic bank	Conventional banks
Assets	**Assets**
Cash and balances with central banks	Cash and balances with central banks
Profit loss sharing investments:	Securities
Mudaraba financing	Loans and advances
Musharaka financing (equity participation)	Non-trading investments
Non-PLS modes investment:	
Ijara (Leasing)	
Murabaha (Mark-up)	
Fixed assets	Fixed assets
Intangible assets including goodwill	Intangible assets including goodwill
Other assets	Other assets
Liabilities	**Liabilities**
Depositors' account:	Deposits from customers and other banks
Non-investment deposits	
Investment deposits	
Other liabilities	Other liabilities
Equity	**Equity**

Reserves	Reserves
Equity capital	Equity capital

Assets

In terms of assets, IBs and CBs really have some similarities. For example, both of them need to hold cash to meet the funds for customer withdrawals and the statutory reserve requirements of the central bank. Fixed assets (ie, real estate) and other assets only account for a small portion of the total assets of these institutions. On the other hand, the main assets of traditional banks include loans and securities. These banks firstly are trying to find borrowers who can pay high interest rates and are less likely to default on their loans. Second, they try to buy high-yield, low-risk securities and reduce risk by managing decentralized operations. However, these two kinds of transactions (i.e. loans and securities) probably should not be components of IBs' assets from a theoretical point of view. When Islamic standards are applied to specific Islamic financial products, it is observed that Islamic financial products on the asset side can be divided into: equity-based financing and the debt-based products (Hussain et al, 2015).

- Equity-based investment

In fact, the function of Islamic equity-based financing is very similar to the equity financing in Western economies in which investors (the party providing the funds) and lenders (the holder of the investment deposit account) are entitled to a reasonable rate of return; however, the exact amount of the return is uncertain. Risk sharing is involved in this case. This business mode prohibits interest, which means the party that provides the funds becomes an investor rather than a creditor. In the course of operation, the commercial risk is shared by the providers of the financial capital and the entrepreneurs,

resulting in the final profits and losses are distributed to multiple parties (Mills, 1999)

The risk sharing financing here is considered to be the closest to the spirit of Islamic finance as it involves the core principles of fairness and is closely linked to actual economic activity (Hussain et al, 2015). Musharaka and Mudalabah are two popular types of PLS financing contracts.

(1) Musharaka: It is considered to be not only the purest form of Islamic finance but also seems to be very similar to traditional equity. Under this business transaction, banks and customers conduct business cooperation in accordance with the terms of the agreement, and they all need to fund the project. Banks and customers like partners because they all contribute capital to the project. After the project produces profits, the bank and the customer share the profits at a pre-agreed ratio. The losses incurred are apportioned strictly according to their respective capital contribution ratios. This kind of transaction is often used to fund long-term investment projects (Zaher and Kabir Hassan, 2001).

(2) Mudaraba: In this case, banks (i.e. rabb-al-mal) provide the client (i.e. mudarib) with funds for project development, clients are responsible for managing the business, and providing expertise to facilitate the project operation (Hussain et al, 2015). Profits are distributed according to pre-agreed contracts. Losses are entirely absorbed by banks - the fund providers. The Mudaraba business is somewhat similar to the limited partnership in the traditional financial system, in which one party provides funds while the other operates the business, and then profits are distributed according to negotiations (Hassan and Aliyu, 2018).

- Debt-based products

In Islamic economics, interest-based lending is prohibited. But basically

every family needs debt financing when buying cars and other major assets. It is hard to imagine how people and businesses work without the existence of debt products. Therefore, debt-based financing operations become part of the Islamic financial system, and sub-contract products can be used to promote the sale or lease of properties such as houses or cars (Ariff, 2014). For example, if an Islamic bank buys a home and sells it to the buyer in installments, the bank is the owner of the home until the final payment.

Among the various debt-based financing products of Islamic Bank, the most popular are: murabah, and ijara (Iqbal and Llewellyn, 2002). The traditional murabaha transaction is very suitable for trade finance, in which case the bank purchases the goods according to the customer's requirements, but the customer does not need to pay the full purchase price of the goods immediately (Zaher and Kabir Hassan, 2001). For example, a financier purchases goods and pays the supplier the full purchase price at the time of delivery. The financier sells the goods to the customer after receiving the goods (usually the financial service provider instructs the supplier to deliver the product to the location specified by the customer, so sales can be made immediately). The financing terms of the financier and the client should enable the client to pay the financier in a single payment or pre-agreed installment plus pre-agreed profit over a set period of time (for example, usually one year).

On the other hand, Ijara refers to Islamic leasing, similar to financial leasing under Western economy (Kammer et al, 2015). It requires the availability of underlying tangible assets, such as real estate or asset financing. A possible example is as follows: a financier purchases the ownership of a tangible asset owned by the customer, or the client uses the funds of the financial institution to obtain a new tangible asset; then, the financial bank uses a predetermined rent (usually at a floating benchmark interest rate, ie LIBOR+ fixed percentage) leases the purchased assets to the customer to

reflect the customer's use of the assets; and when the ijara contract expires or a default occurs, the financier sells the assets to the customer. The amount should be equal to the original purchase price plus accrued and unpaid rent.

Liability

Traditional bank liabilities include various borrowings and different types of deposit accounts used to fund investments and loans on the balance sheet assets side. The maturity of liabilities, interest payments and deposit insurance coverage vary. In terms of liabilities, like CBs, Islamic banks can provide cash and savings accounts to their depositors. In addition, IBs are able to offer investment and special investment accounts, which are exclusive deposit products of Islamic banks. Traditional commercial banks accept deposits and promise to return the principal and scheduled returns in full, but Islamic banks are different from traditional commercial banks because their investment accounts are unable to provide fixed returns (Iqbal, 2007). In other words, the investment account depositors of IBs will not know their deposit return until the deposit period expires. Islamic banks use these investment deposits on behalf of depositors to invest in various assets, and the return of the depositors depends on the income-sharing agreement between the Islamic banking institutions and the depositors. Usually, the depositor will bear the losses in the event of losses.

Although the characteristics of investment accounts give depositors more choices, the use of PSIAs that do not meet the legal definition of deposits can cause some problems. The bank cannot guarantee the client's capital or any capital gains. Therefore, PSIA is essentially an investment product. PLS holders face similar risks to equity investors, but have no voting rights or even sufficient information rights to obtain financial performance (Archer and Karim, 2009). In addition, the disclosure mechanism requirements for

investment accounts in many countries are not that specific, leading to the basic profit performance of PSIA investments lacks transparency (Bitar and Tarazi, 2018). This lack of transparency makes it difficult for PSIA holders to monitor the performance of their funds, which is very unfavorable for market discipline.

On the right side of the balance sheet, in addition to liabilities, equity capital and reserves are accumulated over time in IBs and CBs. Some people think that Islamic banks do not need to retain a large amount of equity capital because they can pass the profit/loss through the sharing agreement to the depositor based on the "transfer" system of the investment account. This concept may only be mentioned in theory as Islamic banks still need to maintain a certain minimum capital level and retain part of the annual profit as reserves for the economic slowdown (Bitar et al, 2018).

Practical Islamic banking operations

The current Islamic economic philosophy seems to have a tendency to merge with mainstream economic thinking, as many Islamic banking begin to mimic traditional financial services to engage in interest-related transactions (El-Gamal, 2006). Chong and Liu (2009) find that Islamic banks in Malaysia accept the traditional banks' operating model and interest-bearing businesses. Further, while profit and loss sharing transactions are unique to Islamic banks, they do not account for the majority of IBs' transactions, as mark-up sales and leasing constitute up to 70% of the whole business (Khan, 2010). This is mainly because although the risk-sharing business should theoretically account for a major part of IBs assets, these assets have relatively low level of acceptance and demand in the market. Contrary to expectations, in order to pursue profits and reduce risks, PLS activities are not the first choice for IBs who prefer low-risk non-PLS assets.

In terms of liabilities, in theory, IBs share risks with investment account holders. But in fact, even if the investments fail, IBs usually do not choose to transfer the loss to IAHs but still provide attractive returns. It is because once the return to IAHs is not competitive in the market, IAHs might deposit funds into other financial institutions. As a consequence, displaced commercial risk is likely to occur (Elnahass et al, 2014). It reflects that in order to ensure that IAHs can get a satisfactory return, IBs might sacrifice the interests of equity holders. In detail, IBs could transfer profits that should be allocated to equity holders to special reserve accounts, such as profit equal reserves and investment risk reserves (Duqi et al, 2019). By retaining a portion of the current profit in the special reserves, IBs are able to pay IAHs to hedge the future low-income distribution.

1.1.3.2 Risk management and capital requirements

Capital is often considered a key indicator of bank stability because it can act as a safety net to absorb losses, and creditors and depositors have more confidence in banks with strong capital base (Iqbal, 2007). The Basel Committee on Banking Supervision (BCBS) has established a framework for determining the capital adequacy standards of banks in order to promote the stability and stability of the international banking industry. The different versions of the Basel Capital Accord (commonly known as "Basel I, Basel II and Basel III") were announced in 1988, 2004 and 2010 respectively, which laid the framework for "regulatory capital" and offered Guidelines for measuring asset risk exposures. The Basel Accord introduces the concept of assigning risk weights to different asset classes and defines the minimum capital and reserve levels that banks should maintain in response to risk-weighted exposures (Wihlborg, 2005).

However, this series of standards on capital and risk are designed for

traditional banks, and they do not cater to the characteristics of Islamic finance. While Islamic banks hope to make risk-weighted assets and the minimum capital required to be closely related to potential risk through solid risk management, the characteristics of Islamic financial products make their situation somewhat complicated. On the assets side, transactions that follow Islamic teachings present different risk characteristics. For example, the equity-based financing model (PLS model) has higher risks because it does not require physical collaterals, and therefore corresponds to higher capital requirements. The sales and leasing-based project models require less capital requirements because of the lower risks involved. Hussain et al (2015) believes that Islamic banks' assets are mainly operated in the PLS mode, and the risks of these transactions are generally higher than non-PLS transactions. Therefore, the total risky assets percentage of Islamic banks is likely to be higher than that of traditional banks, and the asset model of PLS poses a challenge in the calculation of risk-weighted assets and capital adequacy ratios.

In terms of liabilities, Islamic bank investment account holders provide funds to IBs based on the principle of PLS, meaning they will share the profits from successful investment, but may also suffer some or all of the investment losses. However, if it can be proved that the loss of IBs is poor or fraudulent, IBs are responsible for the funds of investment account holders (IAH). It is probable that IBs only bear operational risks, while IAH is responsible for credit risk and market risk. Therefore, Errico and Farahbaksh (1998) suppose that assets funded by investment account holders do not require capital to absorb losses.

In summary, as the regulatory practices of international financial institutions that apply to traditional banking do not take into account the core principles of risk sharing, Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) has drafted a basic standard for capital

adequacy ratios of Islamic financial institutions. In addition, Islamic Financial Services Board (IFSB) issued the first draft capital adequacy standard in December 2005 for institutions that only provide Islamic financial services (except insurance institutions).

1.2 Motivation and contribution

1.2.1 Motivation

In the past few decades, Islamic banks have made great strides, and while supporting social and economic growth, they are also trying to meet the needs of investors and businesses. The Islamic financial environment has been supported by updated regulation, framework, and research. In order to build a sustainable and comprehensive Islamic banking system, it is not enough to be satisfied with existing achievements. Song and Oosthuizen (2014) suggest that the uniqueness of Islamic banks requires more disclosure to enhance the transparency of the risks and benefits regarding Islamic financial products and transactions. From another perspective, Bitar and Tarazi (2018) conclude that the interbank market and money market of IBs are usually underdeveloped. The lack of Islamic financing instruments is not conducive to IBs' capital management. Therefore, the development space of IBs is actually still very large, and there are many areas worthy of attention from the central bank. This thesis focuses on three aspects to explore the growth direction of Islamic banks.

First, the Islamic nature of IBs is often questioned on the liability side (Khan, 2010). The liabilities of IBs include demand deposits, savings deposits and profit-sharing investment accounts (PSIA) which do not pay interest because Islam prohibits interest. In fact, in order to compete with traditional banks, studies have found that the returns provided by IBs in many countries

actually match the interest-based returns of the former (Kuran, 1995; Khan, 2010). However, previous empirical studies exploring the capital structure of IBs just focus on equity, as this avoids talking about IB's controversial and unique debt composition. From a novel perspective, Chapter 3 analyzes the capital structure of IBs, including debt and regulatory capital, to explore ways to improve their capital management capabilities.

Second, national regulatory agencies have developed adaptive risk management frameworks for IBs, which should enhance the risk control capabilities of these banks. Effective risk management capabilities are critical to enabling IBs to be strategically competitive in the global marketplace, and this capability requires sufficient resources for risk identification and measurement (Sundararajan and Errico, 2002). However, Islamic banks seem to face some challenges. First, in terms of assets, Islamic banks' unique financial products have different risk characteristics, which increases the difficulty of risk-weighting allocation. Secondly, due to the risk-sharing nature of profit-loss sharing investment accounts (PISA), the proposed guidelines for Islamic banks in countries show that regulators have discretion to determine the share of PSIA-funded risk-weighted assets that can be deducted from total risk-weighted assets (Hussain et al, 2015). This makes the steps to identify possible risks in the activities of Islamic financial intermediaries different from traditional banks. In addition, because of the unique nature of IBs operations, there is more uncertainty in the risk calculations for each asset, each portfolio, and the entire intermediary. Islamic banking regulators have realized that in case of establishing a reasonable Islamic bank prudential framework, regulatory capital needs to be more closely linked to underlying asset risks to ensure the stability of financial institutions, but there is little empirical research on this aspect of Islamic banking. Capital requirements and risk management are important components of the regulatory framework that IBs need to follow. Chapter 4

tends to add updated results for the empirical literature of Islamic banks as it seems an interesting research perspective to link RWAs and capital requirements to asset risks in order to promote the risk management framework of Islamic financial institutions.

Finally, in many countries that have dual financial system, regulatory practices stressed by Basel Committee are used by regulators to ensure the financial stability of both CBs and IBs. Bitar et al (2017) find that the core principles of the Basel standards have a quite positive impact on the stability of IBs. This is mainly because these guidelines set an effective basic framework for the regulation of IBs. Archer and Karim (2009) argue that these international guidelines may be effective in improving the performance of IBs because these banks urgently need to develop the industry's information infrastructure to increase transparency, allowing market participants to gain a deep understanding of the operation of Islamic financial institutions and have enough information to make informed judgments. On the other hand, some studies show that their impact on IBs is not that significant. Zins and Weill (2017) find that the specific impact of Basel II on their risk is different in the countries with dual financial systems. After the implementation of Basel II, the bankruptcy risk of IBs has increased, while the bankruptcy risk of CBs has been significantly reduced. The regulatory power framework and practice established by the Basel Committee can be applied to all banks, but it does not provide specific advice and standards for regulators to supervise IBs (Sundararajan and Errico, 2002). Song and Oosthuizen (2014) argue that disclosures that rely solely on the Basel Accord to disclose regulatory changes in reforms may not be sufficient to effectively control the overall risks of Islamic banks. Because according to Basel's disclosure guidelines, market investors and depositors are unable to collect accurate information about Islamic financial products and may not be able to limit Islamic banks' risk-taking strategies and options. In general, the

effectiveness of regulating IBs under the Basel rules is highly controversial. However, little research has concentrated on the influence of these regulatory practices on the stability of IBs compared to CBs. Chapter 5 intends to identify the influence of regulatory environment on risk of Islamic banks and whether there are different effects of these regulatory indexes on risk-taking of IBs and CBs.

1.2.2 Summary of contributions

In this thesis, I present new evidence for a comparative study of IBs and CBs, covering three important aspects which are bank capital, risk, and regulation. The first research chapter mainly sheds light on showing how banks adjust their debts, especially by analyzing the factors that influence their final decision. The second and third chapters look into risk and regulatory factors and assess how bank behavior changes in the existing regulatory context. The summary of contributions in this section consists of two parts. The first part discusses the choice of the estimation model and the contribution of the model. The second part presents in detail the contribution of the research findings to reality.

1.2.2.1 Methodology

Several econometric models are used in three chapters to estimate the results. First, in order to estimate the capital structure behavior of IBs and CBs, the random-effects model, fixed-effects estimation and dynamic GMM are applied to enrich the results. The main method in the Chapter 3 is dynamic GMM, which has the advantage of considering endogeneity issues and thus alleviates the bias caused by the use of fixed-effect regression (Blundell and Bond, 1998). The capital structure of the bank is likely to be driven by

potential forces. Perhaps GMM is more suitable because this method can fully consider the influence of exogenous variables, that is, the factors that jointly drive the bank's capital structure such as bank size, and profits.

Chapter 4 studies the risk management capabilities of IBs and dynamic GMM is also chosen as the estimation method, consistent with Chapter 3. Delis and Staikouras (2011) suppose that the current risk profile of the bank is related to past performance. The advantage of using this method here is that through the inference of GMM, I have found the past performance of IBs does affect their current level of risk. In this case, variables related to endogeneity are included in the assessment of risk, such as deposits and loans, which could drive changes in risk. All in all, the results show that the dynamic GMM does its job well.

The focused methodology of Chapter 5 is OLS regression and does not discuss endogenous issues. It is because this chapter studies the impact of bank supervision on risk, in which the centered variables here are the proxy for regulatory policies. Regulatory reforms are driven by external factors such as the environment. Therefore, in this case, it is almost impossible to see the potential impact of the bank's endogenous variables on bank regulations, resulting in the exogenous considerations are omitted and OLS is the appropriate choice. The results obtained using this method are significant for IBs and CBs, which paves the way for the analysis of the practical significance of regulatory policies.

1.2.2.2 Theoretical and practical contribution

The findings of chapter 3 provides several new insights into capital structure decisions made by Islamic banks and conventional banks as follows. Firstly, by controlling the important factors determining corporate leverage used in Frank and Goyal (2009) and Gropp and Heider (2010), the results

present that book leverage of IBs and CBs respond significantly different to bank-specific factors, especially collateral. When holding more tangible assets on hand, CBs take advantage of reduced information costs and have more intention to borrow compared to IBs. It seems that IBs' greater degree of information asymmetry in collaterals lead them to face higher financing costs and transaction costs. In order to reduce external financing costs, it is necessary for IBs to provide reliable information on collateral and convey more messages to the borrowing market.

Secondly, both IBs and CBs appear to pursue target capital ratios as predicted by trade-off theory, and the adjustment speeds of CBs is higher than IBs in system GMM estimation. My findings imply that IBs are probably in a disadvantaged position in capital structure management compared to CBs. There is a need to build a more robust Islamic financial system and environment, including innovative financial instruments and more mature capital and debt markets to improve Islamic finance's ability to manage capital structure.

Thirdly, CBs show a more aggressive leverage procyclicality than IBs, and CBs can achieve leverage adjustments at faster and low cost to support asset growth. Islamic banks are not able to adjust leverage that easily and quickly, in that they face more restrictions in liquid funding channels. Due to the limited nature of Islamic financing instruments, Islamic banks are at a disadvantaged position compared with traditional banks in terms of fund mobilization. Therefore, it is necessary to create a wide range of innovative Islamic financial instruments. Diversified financing products will not only make Islamic banks more flexible to mobilize funds to support the development of their own assets, but could also reduce information asymmetry since funding suppliers might require banks to improve the accuracy and transparency of information.

Finally, the regulatory capital ratios of IBs are higher than those of CBs and the variation in capital structure of IBs and CBs is shaped by the bank-specific factors (Diamond and Rajan, 1999;Gropp and Heider, 2010). The findings show that CBs are more active to adjust their regulatory capital levels to cope with risk exposure compared to IBs. It is because the regulatory capital of Islamic banks does not show a strong ability to cope with risks when asset risk increases. This result will motivate regulators to ensure that the regulatory framework adequately addresses the key risks inherent in IBs' operations and that IBs has the same stability as CBs in a competitive environment.

The research in chapter 4 contributes to observe the reaction of capital requirement to market-based asset risk in Islamic banks across countries from 2004 to 2015 and analyzing whether the current capital requirements of Islamic banks are suffcient to protect them from potential instability. The model is established by following the strategies developed in the study of Vallascas and Hagendorff (2013) who explore the response of capital requirement to portfolio volatility by paying attention to the relation between risk-weighted assets and asset uncertainty first. This chapter follows the existing empirical analysis that links the minimum capital and risk in Western banking, and proposes new and meaningful suggestions for capital charges and risk management of IBs.

The novel findings reflect that Islamic banks' risk-weighted assets are not able to capture the market asset risk well. As such , Islamic banks appear to have the chance to engage in regulatory capital arbitrage as the minimum required capital may not be closely linked with market perception of portfolio risk which is measured by using the option pricing model applied to company's valuation. On the one hand, this phenomenon is due to the insufficient ability of Islamic banks to identify and classify asset risks. On the other hand, Islamic banks in different countries have adopted divergent

accounting disclosure standards (such as IFSB, AAOIFI or local accounting standards) (Karim, 2001;Kamla and Haque, 2019). These guidelines for certain Islamic financial transactions are not strict enough, which has given some IBs the opportunity to evade the holding of minimum capital by reducing the records of relatively high-risk assets. However, from a positive perspective, Islamic financial business's disclosure mechanism is undergoing reforms, and the introduction of new standards each year might serve to fill potential loopholes.

Then, this research seeks to associate the regulatory arbitrage of Islamic banks with their unique nature such as PSIA[3] which have the feature of absorbing losses and bearing risk, and IFSB standards (i.e. Islamic Financial Reporting Standards) which are guidelines to promote the stability of financial institutions offering Islamic financial products. The findings show that Islamic banks, on average, do not increase required capital in response to higher asset risk when investment deposits increase and IFSB standards are adopted. Since PLS[4] investment deposits are dominant in Islamic banks' funding sources, the risks of Islamic banks theoretically can be transferred to PLS depositors, resulting in the association between required minimum capital and asset risk is not that close (see formula in Appendix B.1). In particular, the IFSB standards specify that the risk of assets supported by PLS deposits can be ignored and these assets do not require corresponding capital regulatory requirements (Archer and Karim, 2009). The results can also be explained from another way. It may be that the capital supervision system of Islamic banking is not mature enough, and the risk sharing of Islamic banks makes the outcome of supervision more ambiguous.

Finally, Islamic banks' minimum required capital are apparently more risk-

[3] Profit-loss sharing investment account

[4] Profit and loss sharing

sensitive in countries where there is more information disclosure and less barriers for private agents to monitor firms. Moreover, the capital requirements of Islamic banks is more risk-sensitive in countries where supervisors are able to take prompt corrective actions to deal with deficiencies in weak banks following pre-agreed standards.

The results have implications for policymakers, regulators and practitioners to clearly standardize the capital requirements of Islamic banks in response to risk sharing transactions, and select suitable regulatory tools for Islamic banks to make them more capable of managing risk, which is crucial for the prospects of Islamic banks around the globe.

The focus of chapter 5 is to investigate whether the influence of bank regulation practices (including capital oversight, restrictions on bank activities, mechanism of disclosing accurate information to the private sector, and supervisory power) is different on various bank risks of CBs and IBs. The novelty of the evidence is banking regulations have different effects on the stability (measured by z-score) of IBs and CBs. It is because stricter restrictions on bank activities, and a higher degree of official regulation can enhance more stability of IBs relative to CBs.

This study predicts that the implementation of these regulations could only reduce the risk of CBs, because these factors are designed for the business of conventional banks and not involve the treatment for Islamic financial services and products. However, the findings firstly show that regulatory factors are more effective in reducing the insolvency risk of IBs. The higher degree of restrictions on non-loan activities and official supervision adopted in the dual financial system could significantly improve the risk control capabilities of IBs from lower level in the short term and effectively help them to reduce insolvency risk. In addition, the impact of official supervision on reducing the insolvency risk of CBs and IBs is more pronounced in the business environment with higher economic freedom. During the 2007-2009

financial crisis, the impact of regulations have been highly heterogeneous among IBs and CBs as these regulatory factors associates with the stability of CBs and are irrelevant to IBs.

Second, IBs is found to face higher idiosyncratic volatility than CBs, reflecting their differences in business model. The results show that stricter restrictions on non-lending activities and more information disclosure can reduce more idiosyncratic risk of IBs compared with CBs. Though Islamic bank's business relies on real economic activities, IBs' businesses in general are less transparent than CBs due to the limited information disclosure of Islamic financial risk-sharing transactions. Compared with CBs, Islamic banks have lower economic of scale and risk management capabilities, so these regulatory implementations can effectively reduce their business uncertainty at a faster rate. Moreover, The liberalized business environment and flexible economic system enable regulatory policies to more effectively control the specific risk in the CBs, while the impact of regulation on IBs' idiosyncratic risk is not affected by the external environment. In addition, these bank regulations are not adequate to protect IBs and CBs from fluctuations in their inherent business risks during the crisis.

The credit risk of IBs is found lower than CBs, implies that IBs have better loan quality compared to CBs, confirmed the evidence reported by Abedifar et al (2013). Besides, increased financial information disclosure to public and private agents is more effective to control the credit risk of IBs compared to CBs.

Finally, characteristics of the bank's capital regulatory environment can help explain the changes in extreme systemic risk of IBs and CBs that proxied by marginal expected shortfall (MES), and more stringent capital regulation actually results in more systemic risk in IBs compared to CBs. The covered regulatory indexes and systemic risks are almost unrelated for IBs and CBs during financial crisis. The findings demonstrate that the regulatory indicators

that stressed by the Basel Committee are limited in curbing the systemic risk of financial institutions in countries that have Islamic banks (Weiß et al, 2014).

The results of this chapter have policy implications in several ways. First, regulatory practices designed for CBs can promote the stability of IBs. This means that national regulators with Islamic banks need to think more about the implementation of international regulatory reforms, in addition to considering the development of effective regulatory standards tailored for the unique features of IBs. Second, the effectiveness of supervision is pronounced in a more liberal economic environment. So improving the regulatory system is an ongoing process that requires regular fine-tuning of existing economic conditions in response to changing regulatory framework. Moreover, due to the limitations of the current international regulatory schemes in the financial crisis, countries with systematic important Islamic banks need to establish crisis management mechanisms for IBs and CBs based on their respective characteristics.

This introductory chapter starts by setting out the motivation of this study and it also provides the implications of the results analysis. As highlighted in the preceding sections, this chapter describes the overall research motivation and contribution. The rest of this thesis contains the following contents. The discussion of the existing literature is emphasized in Chapter 2. Chapter 3 presents the analysis of the capital structure decisions made by IBs and CBs. Chapter 4 attempts to explore the regulatory capital arbitrage in Islamic banks by associating their required minimum capital with their market-based portfolio risk. Chapter 5 provides novel insights into the regulatory strategies' effect on risk of IBs and CBs in a global context covering 20 countries. Finally, chapter 6 provides the brief summary about the contributions of this research, practical implications and directions for future work.

Chapter 2 Literature review

This chapter identifies and assesses the recent literature covering Islamic banking, corporate finance theories, regulation and risk which motivates this research. Section 2.1 summarizes research on several important aspects of IBs, including capital structure, risk and regulatory aspects. Studies on the behavior of IBs and CBs have made great progress in recent decades. However, current research still needs to explore some issues to enhance the reliability of these financial institutions. Section 2.2 reviews the research on capital structure, including empirical studies of popular theories. Section 2.3 provides the analysis of empirical literature on banking regulatory framework, especially the study of the association between capital requirements and risk. Finally, it reviews the literature as to bank regulation and risk in section 2.4. Through analysis and discussion, I intend to find areas that have not yet been investigated for IBs and CBs. The references in this part are also included in each of the following chapters which provide more detailed comments and recent references.

2.1 Islamic banking literature review

The previous literature have compared Islamic banking and traditional banking, and the results show that the similarities and differences between them have been the focus of discussion. Most of the Islamic financial institutions is still functionally indistinguishable from traditional banking (Hussain et al, 2015). Equity investment, for instance, is thought as the mainstream of Islamic financial transactions based on risk-sharing principle, but in fact the leasing business constitutes the main business of Islamic banks. Transactions in accordance with Islamic rules has accounted for only a small

share. Similarly, Beck et al. (2013b) compare the business model of IBs and CBs by listing a number of indicators. Contrary to expectations, IBs and CBs are essentially indistinguishable. Especially, their performance between 1995 and 2009 is highlighted, and there was no significant difference in the results of the quality of the assets, operational efficiency and capital base. However, the situation of these banks during the 2007-2009 financial crisis is an exception, as IBs seem to be more capable than CBs to resist negative shocks. Hasan and Dridi (2010) also find that IBs outperform CBs over 2008-09 in terms of credit supply and asset growth, contributing to compensate and stabilize the economic and financial system turmoil of this particular period.

Other empirical literature has further revealed the divergence between the two bank types. The objective of Olson and Zoubi (2008) is to evaluate the financial characteristics of banks in the GCC[5] countries by considering 26 financial ratios as the indicators. They argue that accounting information is very useful for analyzing the financial characteristics of financial institutions because the empirical results demonstrate that IBs and CBs perform significantly differently in perception of profitability, efficiency ratio, asset quality indicators and cash/liability ratio. For instance, IBs hold more cash than CBs and generate higher incomes.

In the extensive research regarding Islamic finance, studies concentrating on capital structure, banking regulation and risk have made some progress in recent years. The following sections discuss the research in these aspects.

2.1.1 Capital structure

Unlike CBs, IBs provide investment account deposits in addition to customer deposits, which makes their capital structure components different in essence. Chong and Liu (2009) argue that although Islamic banks in

[5] Gulf Cooperation Council

Malaysia operate mainly in non-PLS mode in terms of assets, investment deposit accounts still account for 70% of total deposits in terms of liabilities. In theory, investment deposits should be similar to equity and not related to interest. However, the evidence suggests that these deposits are not interest-free, but are very similar to traditional bank deposits, as reflected in the positive correlation between return on investment deposits and traditional bank deposit rates. Khan (2010) agrees that there are differences between the Islamic banking theory and the real practice. Not only has interest-related operations become a common practice in IBs, but the amount of funds invested by depositors has never been used to offset asset loss. Besides, even if Islamic banks themselves face financial difficulties, they are likely to provide attractive returns for investment depositors in order to avoid withdrawal risks and maintain the confidence of depositors.

In addition, the capital that can absorb unexpected asset losses is also important for IBs. Bitar et al. (2018) analyse the Islamic financial system in 33 countries and assert that the development of the economic and financial systems have an impact on the capital strategy of IBs. In countries with greater market transparency and information disclosure, Islamic banks are better able to increase capital ratios. Specifically, low levels of corruption, more open markets, and strict legal governance could help Islamic banks increase and strengthen their capital base. In terms of capital structure management, Alzahrani (2018) state that the Islamic banks' financing instruments are relatively limited and these banks might not quickly get funding by using Islamic financial instruments, which increases the cost of raising funds in banking, bonds and stock markets. These issues are very important when focusing on the unique aspects of Islamic finance.

Further, Bitar and Tarazi (2018) make the pioneering discovery in associating external environmental factors with the capital behavior of IBs. The focused external factor is creditor rights which significantly relates to the

capital ratios of IBs and CBs in the developing country sample. In particular, they find the difference between IBs and CBs. In the case of creditors facing a highly protected environment, CBs' managers might decide not to use deposits as the primary tool for debt financing and, as a result, these banks experience a corresponding decrease in leverage. Meanwhile, CBs may perhaps increase the proportion of capital accordingly, in order to get the trust of the depositors. On the contrary, the depositors of Islamic banks (called investment account holders (IAHs)) are not worried about the rights of creditors because these depositors intend to share the losses with shareholders under PLS principle in Islamic law, as such, their capital will not be affected by the existence of creditors.

2.1.2 Regulation

The growth of Islamic banking needs to be accompanied by the development of effective regulation. According to the findings of Song and Oosthuizen (2014), in order to better integrate IBs into the international financial market and improve their competitiveness, more and more countries have begun to adopt the Basel regulatory standards for IBs. Recent literature explores how Islamic banks respond to the regulatory framework guidelines recommended by international regulation body such as Basel Committee. Mejia et al (2014) find the Basel principles are the basis of regulation for Islamic banks and suggest that IBs need the same sound regulatory framework as CBs because these frameworks are a key prerequisite for IBs stablized development. In their discussions, Basel's advancement from II to III will benefit most banks. However, the positive role of implementing Basel II and III in Islamic banks seems limited because these rules do not contain guidance on the specific characteristics of the Islamic banking system. Zins

and Weill (2017) question that the Basel II standard will always have a beneficial impact on the IBs. While the implementation of the standard helps to lower the insolvency risk of CBs, it seems less useful to reduce the risk-taking of IBs. Consistently, in another study, Bitar et al (2017) have greatly expanded the scope of analysis of Islamic banking supervision issues from an empirical perspective. IBs and CBs operating in developing and emerging countries are compared. From the regulatory view, they assert that although the stability of traditional banks has improved after following Basel Core Principles (BCP), the effectiveness of these regulatory standards in increasing the stability of Islamic banks is not as obvious as expected. Therefore, compliance agencies seem to need to think more about how to technically apply the Basel rules to the supervision of Islamic banks.

At the same time, the risk sharing characteristics of IBs have brought certain challenges to their supervision. PLS investment accounts are a unique source of Islamic banking, and the owners of these accounts are responsible for sharing the losses caused by the investment. However, in some cases, IBs are likely to increase the return of investment account holders to persuade them to retain funds in financial institutions (Sundararajan and Errico, 2002). Then, displaced commercial risk could happen. In order to stabilize the income of these account holders and avoid withdrawal risk, IBs usually set up investment risk reserves and profit distribution reserves to increase the profit distribution of investment accounts. Rosly and Zaini (2008) argue that while these reserves bring benefits, such accounts lack sufficient disclosure and regulation, and it is likely that IBs use these funds for other purposes because of moral hazard. Therefore, AAOIFI and IFSB appeared (Archer and Karim, 2017). In 1990s, the Islamic Financial Institutions Accounting and Auditing Organization (AAOIFI) was established to meet the special regulatory needs of Islamic financial institutions and to define Islamic financial products used in some countries. This institution is a non-profit

organization that sets up accounting standards and disclosure guidelines that are consistent with Islamic laws. On the other hand, under the assistance of IMF, the specialized regulatory organization, namely the Islamic Financial Services Commission (IFSB), has been formed to ensure the stability of IBs and to address various governance and regulatory issues of IBs.

2.1.3 Risk

IBs and CBs somehow have similarities since they both carry out the basic business of attracting depositors' deposits and lending funds. Song and Oosthuizen (2014) suppose that some of the risk measures that apply to CBs can also be used to capture the risk level of Islamic banks as IBs and CBs are faced with risks as credit, market and operations. For instance, liability-based investments such as Murabahah, other sales-based facilities and leasing-based facilities (ijarah) dominate Islamic Bank assets, accounting for 80% to 100% of total assets (Khan, 2010). In most banks, equity-type (such as Musharaka and mudrarabah) transactions still account for a small percentage of assets. Therefore, the credit risk in the usual sense (such as the default of the borrower or the risk of loss when the borrower's repayment ability deteriorates) is the most common source of risk for Islamic banks (such as CBs).

Because Islamic banks need to follow Islamic law, Errico and Farahbaksh (1998) argue that their credit risk level may be different from traditional banks and is likely to be greater. For example, for the asset transactions with PLS nature in IBs, there is no strict requirement for physical collateral, which will lead to insufficient risk mitigants in case of losses (Čihák and Hesse, 2010). Additionally, there is a lot of asymmetric information in the PLS contract, and Islamic banks might be unable to obtain accurate information about the

project from the debtor, resulting in an increased probability of default. On the contrary, traditional banks usually require collateral as a guarantee for loans and usually do not participate in PLS activities.

In contrast, there are also views that IBs are less risky than CBs. Farook et al (2014) claim that capital is at the time of the protective layer of traditional banks as their risks increase. PLS investment accounts of IBs that can cover losses are considered to be an additional protection in addition to capital when risk increases, as they can pass on the negative consequences of the assets to the investment depositors. In addition, in order to retain those investment account holders, IBs need to provide them with competitive returns (Archer and Karim, 2009). The failure of investment will put a lot of pressure on IBs' profit distribution, which makes them financially conservative in asset investment and the expansion of risk could be limited. On the other hand, the results of Čihák and Hesse (2010) show that traditional banks are more likely to participate in high-risk projects in order to chase profits and have higher insolvency risk.

Some empirical studies have made significant contributions from a new dimension in the risk area of IBs. Abedifar et al (2013)'s analysis covers the multiple risks and financial stability of IBs and CBs in 24 countries from 1999 to 2009. It is the first paper to carry out the extensive and convincing discussion of the risks in Islamic banks. The CBs' financial stability and credit risk are higher than IBs in their findings. Further, the risks of IBs and CBs are significantly different in response to individual bank variables. This article can be seen as a seminal research of the risk in Islamic banks, and it inspires subsequent work. For example, Saeed and Izzeldin (2014) explores the effect of the cost control and increased efficiency on the default risk of IBs and CBs across countries. Their findings show that CBs weigh efficiency against risk because when the efficiency of the banks increases, the exposure of default increases. In contrast, Islamic banks have not linked efficiency to risk.

The above literature describes the current research of Islamic finance and Section 2.1.4 is added to present the studies that have been reviewed regarding Islamic banking.

2.1.4 Literature list

Table 2. 1 This table illustrates the empirical research carried out for Islamic banks

Authors	Research summary	Main findings
Hasan, M. M. and Dridi, J. (2010)	It compares the credit ratings, asset growth capabilities, and profitability of IBs and CBs during the non-crisis and crisis years.	In times of crisis, IBs' assets grow fast and they provide more lending to clients than CBs; IBs' average profitability from 2008 to 2009 is similar to CBs.
Khan, F. (2010).	It analyzes the divergence in Islamic banks' theory and its practices. This study compares the transactions in IBs and CBs.	It is previously believed that equity investment is the mainstream of Islamic financial transactions based on risk-sharing principle, but in fact the leasing business constitutes the main business of Islamic banks. Transactions in accordance with Islamic rules has accounted for a small share.
Elnahass et al (2014)	Investigation of the arrangement of loan loss provisions in IBs and CBs within the North Africa and Middle East region during 2006-2011.	Loan loss provision comprise discretionary and non-discretionary components; investors of IBs and CBs have different valuations of the two components.
Song and Oosthuizen (2014)	To identify the legal frameworks that govern Islamic banking activities.	This study explores the challenges of Islamic banking regulation through surveys. The results show that significant divergences exist in the regulatory framework of IBs in different countries and regions, and the techniques of supervision framework designed for Islamic banking needs further targeted improvement.
Abedifar et al (2013)	The analysis covers the multiple risks and financial stability of IBs and CBs from 24 countries from 1999 to 2009.	The bankruptcy risk and credit risk of CBs are higher than those of IBs. The risks of IBs and CBs are significantly different in response to individual bank variables.

Authors	Research summary	Main findings
Daher et al (2015)	To get an insight into the Islamic banks' capital buffers by analyzing a bank sample from countries where both IBs and CBs provide services and products to the society, from 2005 to 2012.	State-owned Islamic banks are shown to have higher risk tolerance. Islamic banks with greater equity investment risks are more inclined to increase capital buffers.
Beck et al (2013b)	This study focuses on the differences in efficiency, business models and asset quality between CBs and IBs between 1995 and 2009.	The study finds no significant differences in the operation of assets and liabilities between the two bank types. But Islamic banks seem to be more conservative about taking risks.
Mollah and Zaman (2015)	Comparing the returns of IBs and CBs investors during 2005-2011, and exploring the effect of the Islamic supervision board on the market performance of IBs.	Investors of Islamic banks are found to have a positive response to the establishment of the Shariah Oversight Board. Executives of IBs have different control and guidance over bank operations relative to CBs.
Cakir and Raei (2007)	This paper first measures risk in the form of risk value (VaR) and then evaluates the impact of issued Islamic bonds (Sukuk) on portfolio risk.	It has been found that the investment portfolio's VaR (value at risk) is lower when investors allocate a certain amount of funds in Sukuk as diversification.
Bitar and Tarazi (2018)	Regulators are concerned about capital that can absorb losses. The study assesses whether IBs and CBs change the core regulatory capitals in repsonse to the protection creditors' rights.	Conventional banks have a stronger capital base than Islamic banks in countries where the credit rights index is higher.
Olson and Zoubi (2008)	It evaluates the financial characteristics of IBs and CBs in the Gulf Cooperation Council countries and then compares the financial characteristics of the two different banks in many ways. They consider 26 financial ratios as the indicators.	The results show that IBs hold more cash than CBs and generate higher incomes, reflecting the different operating characteristics of the two types of banks. On the other hand, the main accounting ratios in IBs and CBs' financial statements are similar, and central bank supervisors in many countries of the GCC region sets the same requirements for IBs and CBs.
Saeed and Izzeldin (2014)	This study explores the impact of the cost control and increased competitiveness of IBs and CBs on the risk of default in the Gulf Cooperation Countries and non-GCC countries.	CBs weigh efficiency against risk because when the efficiency of the banks increases, the exposure of default increases. In contrast, Islamic banks have not linked efficiency to risk.
Bitar et al (2018)	This research explores the capital structure decisions made by Islamic	Bank-level factors and the external environment of the country are drivers

Authors	Research summary	Main findings
	banks over the period 1999-2014.	of IBs' variation in capital structure. For example, in countries with better economic conditions, Islamic banks tend to maintain higher capital base.

2.1.5 Summary

After decades of development, the Islamic financial system has become a dynamic industry, and its progress in capital, risk and regulation has been the focus of many central banks. Therefore, in the above literature on the characteristics of Islamic finance, these three aspects are also the center of discussion. However, the current trend is that IBs are gradually building a global business model and learning from financial institutions that are more competitive than themselves. In order to improve the international competitiveness of IBs, central regulators have increasingly applied approaches suitable for CBs to promote the stability of Islamic banks. While such an approach is probably able to help Islamic banks overcome their weaknesses, it may expose new problems that make IBs fall behind CBs. As for discovering and solving these new problems, it is not enough to only review the literature on IBs. The following literature mainly present the discussion of interesting topics in the traditional financial field, with the aim of finding innovative breakthroughs in improving the competitiveness of IBs.

2.2 Capital structure theories

2.2.1 The optimal capital structure and adjustment costs

From the perspective of maintaining capital structure targets, the company's decision on capital structure is based on the consideration of the benefits and costs of raising debt (Ross, 2009). When a company undertakes too much debt, it may experience financial distress once this company finds it difficult to pay the creditors. This financial distress will incur a number of costs. For example, conservative managers may cut R&D, market research and other investments to save cash to absorb risks, and companies may also generate opportunity costs. In many countries, debt interest can be tax deductible, which is an advantage for companies using debt financing under the tax system. The trade-off between the cost and benefit of raising debt drives the company to obtain optimal debt ratio, which is the basic idea rooted in the trade-off theory and is popular among corporate finance research (Leary and Roberts, 2005).

There is evidence that companies have set their own target leverage after weighing benefits and costs, and partial adjustment models are considered to be appropriate to estimate the average adjustment speed of the company towards the desired level (Fama and French, 2002; Flannery and Rangan, 2006; Cotei et al, 2011; Hovakimian and Li, 2012). Öztekin and Flannery (2012) find that companies in many countries have set target capital structure through the use of partial adjustment models, and that the pace of adjustment towards target leverage by these companies is determined by external circumstances. For example, companies in countries with sound financial systems can more flexibly adjust their financing structures because companies have more choices in using debt or equity to obtain funds. By contrast, in countries with high levels of information asymmetry in the market,

companies have to pay higher costs in order to issue debt or equity, which leads to a corresponding reduction in the company's adjustment speed. López-Gracia and Sogorb-Mira (2008) apply the dynamic partial adjustment model to verify the optimal capital structure in small companies, and the results support the trade-off theory assumption. Small companies tend to maintain the cost of the target leverage because the cost of doing so is probably lower than the burden of not pursuing optimal debt. They observe that company-specific variables,such as size and profitability, can indeed influence the desired capital structures for small companies. In addition, Gropp and Heider (2010) and Hoque and Pour (2018) have conducted extensive research on banks around the world, and confirm that the change in leverage of financial institutions is consistent with the assertion of trade-off theory.

2.2.2 Leverage procyclicality

Adrian and Shin (2010) first proposed the concept of pro-cyclical leverage in financial institution by observing the positive association between increase in leverage and asset growth. They argue that financial intermediaries, such as banks, being largely funded through borrowing, are highly leveraged and their leverage should be very sensitive to the value of their assets. The results of investment banks in US show that the leverage of the bank is pro-cyclical, because the increase in assets corresponds to an increase in leverage, indicating that these banks are actively adjusting to respond to growth opportunity changes.

Current empirical research not only confirms the relationship between leverage and assets, but also comes up with many meaningful ideas for real-life situations (Acharya and Viswanathan, 2011;Damar et al, 2013;Dewally and Shao, 2013;Laux and Rauter, 2017). In particular, Damar et al (2013) are

concerned about the changing of Canadian bank assets and leverage, and try to confirm the existence of leverage pro-cyclicality. They found that Canadian banks' leverage are generally pro-cyclical, and that wholesale financing provided by capital markets has a significant impact on cyclicality. The starting point for their research is that Canadian banks are subject to leverage regulation. The conclusions of the article suggest that the restriction on leverage is necessary since the procyclical behavior of leverage will impede the economic development.

Moreover, Dewally and Shao (2013) expand the previous research sample to include bank data from 49 countries, and the procyclical leverage of financial institutions' leverage was also observed. It appears that in the international context, financial institutions are actively managing assets as leverage and asset growth are closely associated. They believe that regulators should consider the impact of wholesale financing on the pro-cyclical leverage, because pro-cyclicality, with the dependence on wholesale financing, will make the financial system accumulate a large amount of credit and could increase the instability when the crisis occurs. Therefore, in addition to setting up leverage caps on banks, regulators may have to set a ceiling on banks' dependence on wholesale financing.

2.2.3 Capital structure of banks

The evidence regarding bank capital has been analyzed in prior studies. Berger et al. (2008) observe that US banks are motivated to adjust their required regulatory capital ratios towards desired level over multiple periods and claim the predicted bank target capital ratio can be affected by bank-specific factors. Harding et al (2013) agree with the view that banks theoretically have optimal capital structure. Further, Hoque and Pour (2018)

argue that besides bank-specific variables, more importantly, the national regulatory and national-level variables are also the determining factors of global banks' capital structure. In the results, banks in countries that value bankruptcy protection and deposit insurance gain more protection when borrowing, so they will be more reassured to increase their book leverage.

Regulatory capital constitutes an integral part of the bank's capital structure, such as capital buffers and Tier 1 capital, which is the minimum amount a bank must hold in compliance with the requirements of the authorities. These capitals are expected to protect depositors from accidental portfolio losses (Benink et al, 2008; Cihak et al, 2013). Prior empirical literature has concentrated on regulatory capital and bank capital buffers. Ayuso et al. (2004) find the procyclicality of the buffer capital in Spanish savings and commercial banks, implying banks tend to increase capital buffers as the economy becomes more prosperous. This accumulation of excess capital may be seen as banks consider that asset risk may increase during the boom. Similarly, Jokipii and Milne (2008) link the capital buffers of commercial banks in 25 EU countries to the business cycle and find that the capital buffer shows a pro-cyclical trend.

However, the role of bank capital in maintaining bank stability might be limited. Abou-El-Sood (2016) find that the regulatory capital reserves of banks which suffer huge losses and nearly close down have exceeded the minimum regulatory requirements. They conclude that regulatory capital might not be the only reason for bank distress because bank size and loan quality have more significant effect. Distinguin et al. (2013) suppose that banks hold illiquid assets because they need to provide loans for some long-term projects and they find that US banks have reduced regulatory capital in the face of reduced liquidity. This results indicates that US banks have not increased their solvency standards in a timely manner in response to increase in illiquid assets.

While recent research has begun to focus on the capital decisions and behaviors of Islamic banks, there is still little discussion in the academic world about whether modern corporate finance theory can explain their behavior. In addition, while some studies are devoted to discovering the financing structure of traditional banks, most of these insights come from developed countries, and financial institutions in emerging countries are rarely being considered. Moreover, I turn the attention to the existence of leverage procyclicality among IBs and CBs, and attempt to discover whether compared to IBs, CBs are able to use more leverage to support asset expansion. Chapter 3 will compare the capital structure of IBs and CBs and explore ways to promote IBs capital management.

2.3 Capital requirements and risk

The previous research has done a lot of exploration on the reasons and development of capital requirements. The analysis by Berger et al. (1995) speculates that concerns about systemic risk may be an important motivation for setting regulatory capital requirements. When a series of banks are in trouble because of the liquidity problem, the funds they can provide for the development of the market economy will be significantly reduced, and bank borrowers may find it difficult to continue to obtain credit funds. The reduction in credit may hinder regional or macroeconomic progress, and from another perspective, systemic risk spreads to non-financial sectors. Concerns about these social costs of systemic crises may lead regulators to try to achieve greater bank security by requiring higher capital ratios.

The 1998 Basel Accord international capital standards recommend banks to maintain at least 8% of risk-weighted assets to protect depositors' deposits, and prevent systemic instability from large-scale bank failures. But this

capital requirement has been criticized for being too general and not cater to the ongoing development of bank management and performance evaluation (Von Thadden, 2004). Basel II, published in June 2004, establishes more sophisticated risk and capital management requirements based on the 1988 Accord to ensure that banks are capable of dealing with the risks in lending, investment and trading activities (Kaufman, 2005). Although Basel II tend to accurately measure the uncertainty of bank assets by emphasizing quantitative indicators of risk, the 2008 global financial crisis shows that the framework has weaknesses in several respects. In November 2010, the G20 member states formally approve Basel III which introduces a set of macro-prudential tools such as universal leverage ratio and countercyclical buffer to to complement capital standards (King and Tarbert, 2011).

Regulators in many countries often link minimum capital to risk under the guidelines of Basel rules. Banks with higher risky activities usually need to maintain more bank capital. In June 2004, Basel II is released to guide banks, and Von Thadden (2004) suggest the development of Basel II is mainly to correct two obvious weaknesses in Basel I. First, in addition to credit risk, it contains measurement of market risk and operational risk to improve the accuracy of risk-based capital requirements. Second, it introduces guidelines that impose banks to focus on the implementation of minimum regulatory capital ratios. While RWA is the basis for calculating capital adequacy, it seems that the increase in regulatory risk coverage does not enhance its ability to capture market-based risks. Le Leslé and Avramova (2012) observe market participants often think that the capital ratios is not quite convincing. They also suppose that banks lack experience in assigning risk weights to specific financial assets and loopholes in risk management policy can cause inaccuracies in calculating RWA (Le Leslé and Avramova, 2012).

Some studies have found that risk manipulation exists, and others take the view that due to regulatory risk deficiencies, there is insufficient increase in

risk-based capital requirements when market-based risk increases. Mariathasan and Merrouche (2014) note that there is a significant reduction in banks' risk-weighted assets (RWA) after the implementation of advanced risk measurement methods. They believe the risk weight manipulation theory is the most reliable explanation and conclude that the risk reduction partly arise from the bank's strategic risk model, reflecting the loopholes in bank risk management. One way to alleviate risk concerns is to have third parties, such as auditors, monitor and ensure that the calculations are reasonable.

Similarly, Ferri and Pesic (2016) and Beltratti and Paladino (2016) claim that while regulators already focus on a wide variety of risk types under the RWAs formula, they need to consider more about the evolution of banking activities and keep the measurement technique up to date. They make such suggestions because even advanced models would be imperfect. The results indicate that the internal rating mechanism of the bank – especially the advanced risk model – can understate its RWAs through risk-weight manipulation, thereby reducing its capital requirements. Another studies are conducted by Vallascas and Hagendorff (2013) and Johnes et al (2014) whose empirical findings show that regulatory risk in the form of risk-weighted assets is only loosely associated with market-based bank portfolio risk. Since regulatory risk and capital requirements are closely related, it is possible that changes in required capital are inadequate in response to a significant increase in portfolio risk, resulting in the regulatory capital arbitrage.

The CBs' business is mainly based on the interest-based debtor-creditor relationship, while the IBs' business is relatively complex. First, in terms of assets, Islamic banks' unique financial products have different risk characteristics, which increases the difficulty of risk-weighting allocation. The contractual types of IBs ranges from low-risk sales (such as lease-based contracts) to high-risk equity financing transactions. Secondly, due to the risk-

sharing nature of profit-loss sharing investment accounts (PISA), the proposed guidelines for Islamic banks in countries show that regulators have discretion to determine the share of PSIA-funded risk-weighted assets that can be deducted from total risk-weighted assets. This makes the steps to identify possible risks in the activities of Islamic financial intermediaries different from traditional banks.

Therefore, the risk management infrastructure of Islamic financial institutions must be in place to identify, disaggregate, measure, monitor and manage all the specific risks in Islamic financial transactions and instruments to provide effective quantification and management. Islamic banking regulators have realized that in case of establishing a reasonable Islamic bank prudential framework, regulatory capital needs to be more closely linked to underlying asset risks to ensure the stability of financial institutions, but there is little empirical research on this aspect of Islamic banking. Capital requirements and risk management are important components of the regulatory framework that IBs need to follow. Chapter 4 tends to add updated results for the empirical literature of Islamic banks as it seems an interesting research perspective to link RWAs and capital requirements to asset risks in order to promote the risk management framework of Islamic financial institutions.

2.4 Regulation and risk

2.4.1 Risk

The recent financial crisis shows that financial institutions face risk management challenges. In fact, risk management is not a new challenge. Financial institutions have always been responsible for managing risk exposure while striving to maintain profitability and competitiveness. In past

empirical studies, researchers have identified factors that drive banks to face higher risks. Stiroh (2006) investigates the determinants of the stock market risk of banks in US for the period 1997- 2004. The results show that greater reliance on commercial and industrial loans and activities that generate non-interest income can put banks at greater risk. As U.S. financial institutions steadily expand into new activities including investment banking, services, securitization and other non-interest fees which are particularly unstable, stock market investors concentrate on these changes and identifying bank risks through related revenues. Beck et al (2013a) find that increased competition associates with banks' fragility. There is evidence demonstrating that increased competition has led banks to increase default risk by increasing asset risk and reducing capital (Keeley, 1990). Haq and Heaney (2012) suggest that although off-balance sheet activities contain many flexible contingent businesses that generate revenues, additional bank risks will arise from these transactions. Off-balance-sheet activities include contingent assets or contingent debts such as letters of credit. If the debtor who entrusts the bank to handle the letter of credit defaults, the contingent debt will become debt, which may result in insufficient liquidity and increase the opportunity cost incurred by the bank.

Alternatively, some factors may help banks reduce risk. In the investigation of Demirgüç-Kunt and Huizinga (2010), banks with high levels of equity, non-deposit funds and operate in countries with better economic development experience less insolvency risk. Leung et al (2015) state that the fundamental variables show their importance to the risk of bank holding companies in the 2007-2009 financial crisis. The bank holding companies with high net income, low non-performing loans, and high Tier 1 capital buffer undertake less market risk, which provides a basis for investment researchers and regulators to monitor bank uncertainties.

2.4.2 Regulation

The banking industry is subject to more regulation than other industries. The original intention of regulation is to discipline the behavior of banks and to control their risks to a certain extent (Busch, 2009). However, the outcomes of the regulation are uncertain and controversial. A lot of empirical analysis demonstrate that bank regulations bring positive effects to the development of banks (Angkinand, 2009;Cihak et al, 2013;Klomp and de Haan, 2015). James R. Barth et al (2004) make a striking contribution to research in the regulatory field as they design and build a database covering national regulatory conditions in 107 countries. They specifically investigate the role of regulation by categorizing regulatory practices and find that the performance of banks has been greatly promoted (i.e. such as decreased non-performing loans) in cases where more accurate information needs to be disclosed and private companies can become controllable shareholders. Subsequent studies have found inspiration from this research, and the information in this regulatory database is often used as a source of data.

For instance, Chortareas et al (2012) report that banks become more efficient (i.e. decreased costs and increased output) under the imposition of stricter capital requirements and regulatory powers in 22 European countries over the period 2000 to 2008. On the one hand, strict capital requirements could increase the core capital of banks, which are mainly from shareholders. Shareholders have more incentive to monitor banks to improve efficiency in order to ensure the safety of their funds. On the other hand, countries with professionally competent regulators may be able to deal with the internal governance of banks, so that they can identify problems in time such as corruption in bank loans and then promote the effective operation of banks. Consistently, Barth et al (2013) systematically observe more banks around the world, and understand that bank efficiency increases in countries where the

bank capital imposed by stricter requirements and official regulators with more power.

However, certain bank regulatory practices might not be capable of promoting the performance of banks. The regulation of banking activities and information disclosure seems to have a negative impact on the effective operation of banks while making bank transactions more transparent and reducing the possibility of corruption (Chortareas et al, 2012). It is because strict information disclosure will cause banks to spend a lot of manpower and funds to meet regulatory requirements.

Pelster et al (2018) investigate how regulation affects the behavior of banks in the stock market around the world. The findings show that when banks face increased pressure on capital requirements and more mandatory disclosure rules, profits will shrink and the stock value will decrease. A possible explanation is that the cost of capital is generally considered to be higher than debt, and the increased capital cannot be used to lend, resulting in an increase in borrowing costs faced by bank customers, and reduction in bank profit margins. On the other hand, the transparency of information will make the private sector more able to get news about bank investments, which make banks not take risks to make aggressive investment decisions. Because banks don't take excessive risks, they might have a relatively reduced return on investment, leading to the market performance that is not very satisfactory.

Even though the details of the guidelines in the Basel standards do not apply to all products of Islamic Banking, the relevance of the overall direction of these regulatory elements cannot be denied. Therefore, it is more appropriate to say that the spirit of these guidelines is universally applicable to the Islamic financial industry. However, regulators and bank operators could find the effectiveness of these international regulatory approaches in the process of adaptation, and there are unexpected obstacles as well, which are covered in Chapter 5.

2.4.3 Relation between regulation and risk

The effects of bank regulations on risk can be analyzed from two aspects. On the one hand, some regulatory measures have actually improved the bank's ability to respond to risks through appropriate guidelines, and on the other hand, banks could undertake greater uncertainty after adopting these reforms (James R. Barth et al, 2004;Beck et al, 2006;Behr et al, 2010;Beltratti and Stulz, 2012;Borio and Zhu, 2012;Harding et al, 2013;Hoque et al, 2014). The literature covered in this section discusses capital regulation, non-lending transaction control, official supervision, and regulation of information disclosure to private agents, which are popular regulatory practices in previous studies.

When the bank engages in activities other than loans, such as underwriting of securities, insurance underwriting and investment projects for real estate, more income will be generated while conflicts of interest may arise because banks may make commercial decisions that sacrifice the interests of investors for their own benefit. If banks are allowed to participate in a wider range of activities, they are likely to undertake higher risk. Demirgüç-Kunt and Huizinga (2010) conclude the negative association between activities restriction and bank risk. They suggest more regulations on activity restrictions could motivate banks to restructure their assets and reduce their reliance on fee-based activities, resulting in banks having to risk some investment activities in order to pursue profits within a limited business scope. In contrast, encouraging banks to carry out a wider range of activities might give them more freedom to access diverse sources of income and contribute to a more stable banking system. Agoraki et al (2011) find more stringent restrictions on banking activities in Central and Eastern European countries

can effectively reduce bankruptcy risk of banks. For example, banks with strong market power could obtain more non-interest income, and as competition intensifies, these banks are able to lend to low-risk clients and depend on reliable borrowers as a way to increase market share.

The contagious instability among banks in recent years has made regulators more concerned about the impact of capital regulation. Financial institutions are often required by regulators to hold a certain amount of equity capital as a buffer for accidental losses, as capital is seen as a tool to maintain the stability of the financial system. Taking a similar perspective, Laeven and Levine (2009) firstly find capital stringency can directly promote bank stability. While capital regulations do have an impact on risk behavior of banks, the impact is dependent on banks' shareholder structure. Their findings display that when the majority of banks' shares are held by one shareholder, the stricter capital regulation will increase bank risk. Major shareholders have the control of the bank's investment strategy, so they are more willing to participate in high-risk transactions in order to offset the cost of increased capital threshold. Nevertheless, some studies have found that the adjustment of capital requirements have a positive effect. The results of Anginer et al (2014) present higher capital stringency could minimize the spread of crises and systemic risk in US banks. Consistently, Hoque et al (2014) suggest that stricter capital supervision plays a positive role in the financial crisis since strengthening capital base can effectively reduce systemic risk and idiosyncratic risk of the world's largest banks.

The official oversight power indicates that supervisory authorities have the responsibility to adopt specific plans to discipline banks' operations. Private regulatory policies are designed to increase information disclosure and then provide private agents with access to banking information. These two regulatory factors also appear to be linked to bank risk. Firstly, Barth et al (2004) state that stricter private monitoring which relates to increased

information disclosure allow banks to undertake less credit risk. It is because more information gives banks creditors powerful tools and incentives to put pressure on banks to lend to more reliable institutions. Further, Beltratti and Stulz (2012) support the view that a strong regulatory body that directly oversees and manages banks can strengthen the stability of banks. In fact, banks could face lower insolvency risk in countries where bank regulators have the motivation and expertise to overcome imperfect information and thereby influence bank credit allocation schemes.

As the above four regulatory practices stressed by Basel Committee are designed for ensuring the financial stability of CBs. Archer and Karim (2009) argue that these guidelines can also be applied to IBs because these banks urgently need to develop the industry's information infrastructure to increase transparency, allowing market participants to gain a deep understanding of the operation of Islamic financial institutions and have enough information to make informed judgments. Bitar et al (2017) find that the core principles of the Basel standards have a quite positive impact on the stability of IBs. This is mainly because these guidelines set an effective basic framework for the regulation of IBs. On the other hand, some studies show that their impact on IBs is not that significant. Zins and Weill (2017) find that the specific impact of Basel II on their risk is different in the countries with dual financial systems. After the implementation of Basel II, the bankruptcy risk of IBs has increased, while the bankruptcy risk of CBs has been significantly reduced. The regulatory power framework and practice established by the Basel Committee can be applied to all banks, but it does not provide specific advice and standards for regulators to supervise IBs (Sundararajan and Errico, 2002). Song and Oosthuizen (2014) argue that disclosures that rely solely on the Basel Accord to disclose regulatory changes in reforms may not be sufficient to effectively control the overall risks of Islamic banks. Because according to Basel's disclosure guidelines, market investors and depositors are unable to

collect accurate information about Islamic financial products and may not be able to limit Islamic banks' risk-taking strategies and options. In general, the effectiveness of regulating IBs under the Basel rules is highly controversial. However, little research has concentrated on the influence of these regulatory practices on the stability of IBs compared to CBs. Chapter 5 intends to identify the influence of regulatory environment on risk of Islamic banks and whether there are different effects of these regulatory indexes on risk-taking of IBs and CBs.

2.5 Brief summary

At the end of sections 2.1, 2.2, 2.3, and 2.4, a brief description of the gaps that need to be filled is made after reviewing the latest and important research. The following investigation, based on these above theories and interesting empirical analysis, tends to effectively identify and provide constructive suggestions to the problems encountered by IBs and CBs, and try to come up with useful insights into the development of Islamic banks and traditional banks.

Chapter 3 How IBs and CBs make different capital structure decisions

3.1 Introduction

The number of studies in Islamic finance is increasing as Islamic finance is growing fast and has been estimated to be worth more than $2.4 trillion globally (Vizcaino, 2018). Likewise, the total assets of Islamic banks at the global level had increased to 1.6 trillion dollars at the end of 2017 (Islamic Financial Services Board, 2017). The IBs have grown significantly over the years, and have strongly supported the creation of wealth and economic development. Capital structure is often the focus of CBs because it can be seen as the basis for bank development. For IBs, the capital structure is equally important, but research on this aspect is relatively limited.The question focused in this chapter is: How do IBs adjust their capital structure? Do the IBs perform in the disadvantaged position or have unequal opportunities in adjustment capital structure compared to CBs? By discovering capital structure behavior of these banks, this research is conducive to improving IBs competitiveness and future development.

The differences of IBs and CBs have been examined in previous empirical studies(Al-Deehani, 1999; Khan, 2010; Beck et al, 2013b; Abedifar et al, 2013; Mollah and Zaman, 2015). In the results of Beck et al. (2013b), CBs and IBs are found not significantly different in financial stability during normal periods and the global financial crisis, but IBs have better capital market performance than CBs. Abedifar et al (2013) report that provision for expected loan losses is lower for small IBs which are also less fragile. Pappas et al (2016) obtain that risk of failure is lower for IBs than CBs. Olson and Zoubi (2008) conclude that IBs hold more cash than CBs and generate higher

incomes, reflecting the different operating characteristics of them. Čihák and Hesse (2010) claim that the advantages of IBs are questionable because large CBs are more resilient than large IBs during times of crisis. Unlike previous studies, this study concentrates on the capital structure decisions made by IBs and CBs because little empirical research focus on the difference in capital structure of IBs and CBs.

Previous empirical studies exploring the capital structure of Islamic banks have focused on equity, as this avoids talking about the unique debt composition of IBs. The liability structure of IBs are somehow theoretically different compared to the CBs. The liability side of Islamic banks constitutes of demand deposits (*amanah* or *qard*), savings deposits, and profit sharing investment account (PSIA) which do not pay interest as interest is prohibited in Islam. Though PSIA's is based on PLS principle and as such should be treated as equity, many Islamic banks overwhelmingly engage in non-PLS transactions (Khan, 2010). The profit-sharing deposits constructed according to the PLS paradigm should theoretically be interest-free and fair. However, in fact, in order to compete with traditional banks, Islamic banks in many countries provide returns that are actually match the former's interest-based returns (Kuran, 1995;Khan, 2010). In addition, Chong and Liu (2009) find new evidence that Islamic deposits are not truly interest-free, but are very similar to traditional bank deposits and is actually closely linked to the deposit interest rate of traditional banking industry. The PSIA is treated as part of the debt for Islamic banks following evidence in the sample banks' annual report and websites. It claims that Islamic deposits constitute debt liabilities on the balance sheet and instead of mentioning profit loss sharing nature in investment account, the descriptions in websites and annual reports introduce these products as liability and promise to provide guaranteed attractive returns without losses. As a result, the economic substance of financing products

provided by the two might be very similar, which lay out the foundation of this research.

This research extends the literature on the empirical results of Islamic banking by providing the following new insights. Firstly, it shows that book leverage of IBs is significantly lower than CBs, which could be due to Islamic banks' own features to have less diversified external financing sources. By controlling the important factors determining corporate leverage used in Rajan and Zingales (1995), Frank and Goyal (2009) and Gropp and Heider (2010), the findings present the book leverage of IBs and CBs respond significantly different to financial stability, collateral, and profits. Especially, when holding more tangible assets on hand, CBs take advantage of reduced information costs and have more intention to borrow compared to IBs. Compared with CBs, the Islamic banking system seems to face higher financing costs and transaction costs because of the greater degree of information asymmetry and the opacity of the pledge's credit rating information. It is therefore necessary to promote the information infrastructure of IBs to provide reliable information on collateral and convey more messages to the borrowing market.

Secondly, both IBs and CBs appear to pursue target capital ratios, and the adjustment speeds of CBs is higher than IBs in system GMM estimation. It is possible that the external financing cost and adjustment costs of IBs might be higher than CBs because De Jonghe and Öztekin (2015) find that transaction costs may prevent banks from adjusting towards their target capital structure, and the rising external financing costs will slow the banks' capital structure adjustment speed. My findings imply that IBs are probably in a disadvantaged position in capital structure management compared to CBs. There is a need to build a more robust Islamic financial system and environment, including innovative financial instruments and more mature capital and debt markets to improve Islamic finance's ability to manage capital structure.Thirdly, IBs

show a more aggressive leverage procyclicality than IBs, because they have an advantage in external funding sources and can achieve leverage adjustments at faster and low cost. Islamic banks are not able to adjust leverage that easily and quickly, in that they face more restrictions in liquid funding channels. Due to the limited nature of Islamic financing instruments, Islamic banks are at a disadvantaged position compared with traditional banks in terms of fund mobilization. Therefore, it is necessary to create a wide range of innovative Islamic financial instruments. Diversified financing products will not only make Islamic banks more flexible to mobilize funds to support the development of their own assets, but could also reduce information asymmetry since funding suppliers might require banks to improve the accuracy and transparency of information.

Finally, the regulatory capital ratios of IBs are higher than those of CBs and the variation in capital structure of IBs and CBs is shaped by the bank-specific factors (Diamond and Rajan, 1999;Gropp and Heider, 2010). The findings show that CBs are more active to adjust their regulatory capital levels to cope with risk exposure compared to IBs. It is because the regulatory capital of Islamic banks does not show a strong ability to cope with risks when asset risk increases. This result will motivate regulators to ensure that the regulatory framework adequately addresses the key risks inherent in IBs' operations and that IBs has the same stability as CBs in a competitive environment.

This research builds on the practice in which the liability components of Islamic banks and conventional banks are basically the same. It is because we observe that Islamic banks' investment deposit accounts are more likely to have the nature of non-profit-losses sharing. The implication of the research indicates that Islamic financial institutions need the support of regulators to expand limited debt financing instruments by introducing more debt-based instruments (such as sukuk), reduce relatively high adjustment costs, improve

its ability to mobilize resources to support growth activities. Additionally, enhance IBs' ability to respond to asset risks by increasing the depth and breadth of IB's participation in capital markets activities. The rest of this chapter is shown below. Comparison of the characteristics of IBs and CBs on the balance sheet is given in Section 3.2. Part 3.3 analyzes the literature review. The data is described in Section 3.4. Section 3.5 presents our models and findings. Finally, Section 3.6 summarizes.

3.2 Comparison of IBs and CBs

3.2.1 Assets

Islamic banks act either as partners or financiers for customers in their unique profit-loss sharing transactions. When acting as a partner (i.e. Mushārakah in table 3.1), an Islamic bank and an customer contribute the funds to a project, and profits produced will be shared in accordance with the pre-agreed terms and losses will be shared on the basis of each partners' share of capital. When playing the role of a financier, an Islamic bank makes a contract with a skilled entrepreneur and provides capital to the entrepreneur. While earnings generated by the enterprise are shared on the basis of contract, losses are usually absorbed completely by the funds provider (The Islamic banking terminology is presented in Appendix A.1)

Some authors argue that the distinction between IBs and CBs is related to the constraints imposed by Shariah rules (Elnahass et al., 2014). For instance, transactions that are based on interest (riba) are not acceptable, and Islamic banks are only allowed to undertake activities that are backed by real transactions. Errico and Farahbaksh (1998) suppose that IBs bear higher losses arising from assets portfolios than CBs because of the characteristics of PLS transactions. PLS transactions do not involve collateral and are similar

to equity financing, which makes them riskier than non-PLS transactions that require collateral operations. However, Beck et al. (2013b) use variables obtained from financial statements to gauge the financial stability and quality of CBs and IBs business models, and conclude that although the two models might be dissimilar in mode, they are identical in nature. Interest-based financing still plays a predominant position in Islamic banks, reflecting the divergence between Islamic banking theory and business practice (Khan, 2010).

Table 3. 1 Balance sheet reflecting the characteristics of IBs and CBs

Islamic bank	Conventional banks
Assets	**Assets**
Cash and balances with central banks	Cash and balances with central banks
Profit loss sharing investments:	Securities
Mudaraba financing	Loans and advances
Musharaka financing (equity participation contract)	Non-trading investments
Non-PLS modes investment:	
Bai' Mua' jjal (deferred payment sales)	
Bal' Salam (purchase with deferred delivery)	
Ijara (Leasing)	
Murabaha (Mark-up)	
Fixed assets	Fixed assets
Intangible assets including goodwill	Intangible assets including goodwill
Other assets	Other assets
Liabilities	**Liabilities**
Depositors' account:	Deposits from customers and other banks
Non-investment deposits	
Investment deposits	
Other liabilities	Other liabilities
Equity	**Equity**
Reserves	Reserves
Equity capital	Equity capital

Note: the information in the parenthesis is the other way to interpret the Islamic finance terminology and the descriptions are presented in appendix B. Sources: Obaidullah (2005), Errico and Farahbaksh (1998), and Al-Deehani et al (1999).

3.2.2 Liability and equity

Similar to conventional banks providing funds for the development of the real economy in society, Islamic banks need to collect deposits and external funds, and then mobilize them to finance available assets, such as commercial loans and mortgages (Grais and Kulathunga, 2007). The liability side of Islamic banks constitutes of demand deposits (*amanah* or *qard*), savings deposits, and profit sharing investment account (PSIA, see table 3.1). The capital structure of IBs should theoretically be different from CBs because Islamic banks use the PSIA as the financing source. Profit-loss sharing (PLS) investment accounts are in compliance with Shariah principles and can be used as a substitute for traditional interest-bearing deposits, but they have no control or governance rights to Islamic banks. Usually, PLS account holders expect to receive market competitive returns regardless of the investment outcome of banks, increasing the financing costs of Islamic banks.

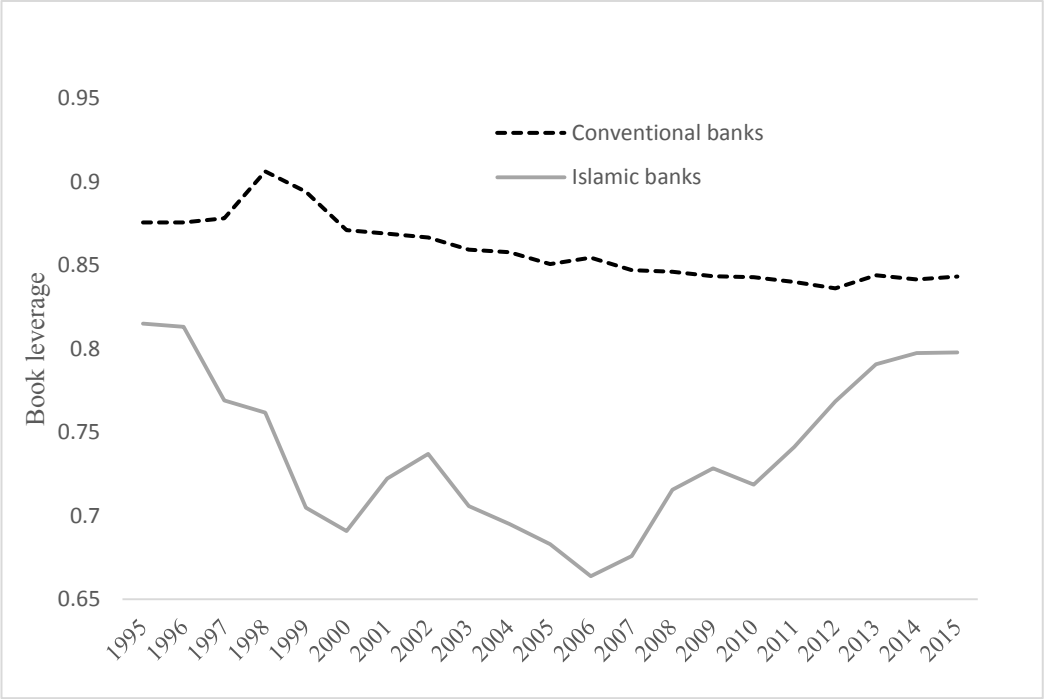


Figure 3. 1 The debt comparison between IBs and CBs.

The debt ratio is measured by the ratio of debt (i.e. total assets - total equity) to total book assets. The graph shows the ratio of 821 bank datasets between 1995 and 2015, of which 110 are IBs and 711 are CBs. The data comes from Bankscope.

As shown in Figure 3.1, the debt of Islamic banks (i.e. measured by the ratio of total bank debt) is much lower than the ratio of conventional banks. IBs and CBs mainly rely on debt for raising funds, suggested by Aggarwal and Yousef (2000). When the 2007-2009 global financial crisis caused the huge losses across countries, Islamic banks' debt levels have risen since then. The leverage gap between IBs and CBs has subsequently narrowed.

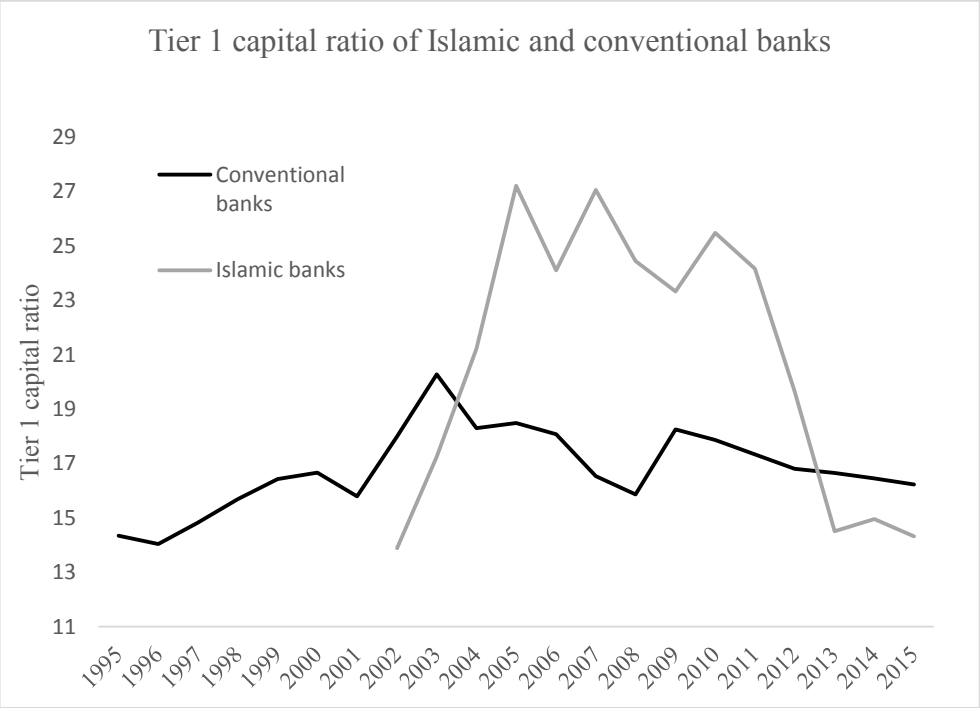


Figure 3. 2 A chart of Tier 1 capital ratios for IBs and CBs.

The graph shows the average Tier 1 capital ratio for 112 Islamic banks and 711 traditional banks from 1995 to 2015. From the Bankscope database, 1995-2015.

In addition to the debt borrowed from external sources, Islamic banks require regulatory capital for the purpose of absorbing unexpected asset losses. In figure 3.2, Islamic banks held more regulatory capital from 2004 to around 2013, while conventional banks held a higher level of Tier 1 regulatory capital before 2004, and from 2014 to 2015. However, insights into the regulatory capital in both banking sectors have not been widely studied. This study will also model IBs and CBs' regulatory capital ratios on a set of factors.

3.3 Literature review

3.3.1 Determinants of capital structure

Previous corporate financial empirical studies explore how companies decide to raise funds based on their business conditions. Rajan and Zingales (1995), Acharya et al. (2015) and Frank and Goyal (2009) find changes in

market valuations, proportions of tangible assets, profitability and total assets drive companies to make different financing choices. Octavia and Brown (2010) argue that factors determining non-financial companies' capital structure could survive many tests, and Gropp and Heider (2010) and Hoque and Pour (2018) suggest that these factors are equally important for financial institutions' leverage.

Some studies have attempted to apply variables from traditional fields to Islamic banks. Bitar et al. (2018) and Bitar and Tarazi (2018) argue that these bank-specific variables, widely used in corporate and traditional bank research, have a significant impact on the capital adequacy of IBs. Specifically, large Islamic banks are less likely to rely on equity in raising funds because they have more advantages in attracting debt financing and deposit. Different from previous studies, this chapter firstly focuses on the debt financing of Islamic banks. By focusing on the impact of popular bank characteristics on IBs liabilities, I intend to find out if it is possible for IBs to improve their external financing conditions by adjusting their internal management.

3.3.2 Optimal capital structure and adjustment costs

According to the principle of target equilibrium, the company's decision on capital structure is based on the consideration of the benefits and costs of raising debt (Ross, 2009). In many countries, debt interest can be tax deductible, which is an advantage for companies using debt financing under the tax system. When a company has difficulty making payments to creditors, it is considered to be in financial distress and several costs would arise due to financial distress. The costs and benefits of raising debt drive an optimal amount of debt for firms, which is the basic idea rooted in the trade-off theory

and is popular among corporate finance research (Leary and Roberts, 2005). The results of De Jonghe and Öztekin (2015) confirm that banks are also pursuing a target capital structure on an international scale.

There is evidence that companies have set their own target leverage after weighing benefits and costs, and the partial adjustment model is often used to estimate their average adjustment speeds toward the desired level (Fama and French, 2002; Flannery and Rangan, 2006; Cotei et al, 2011; Hovakimian and Li, 2012). Fama and French (2002) demonstrate the desired debt ratio of firms in US and target debt ratios is higher in firms that have more tangible assets and are less risky. Öztekin and Flannery (2012) and Hovakimian and Li (2011) estimate the two-step adjustment model in which the first step is to model the predicted target debt ratios from a set of determinants, and then regress the partial adjustment estimation. Firms would take adjustment costs into account when rebalancing their capital structures (Leary and Roberts, 2005). Moreover, Hovakimian and Li (2011) provide a novel interpretation of the results of tradeoff theory, suggesting excessive adjustment costs lead to companies to slow down the adjustment speed or prevent companies from constantly adjusting their target capital structure.

The current literature has linked the tradeoff theory model to financial institutions. Gropp and Heider (2010) estimate a partial adjustment model for the largest banks in US and Europe and find evidence in favour of corproate finance view of capital structure. In particuar, they estimate a speed of adjustment 45%. Hoque and Pour (2018) extend the analysis of Gropp and Heider (2010) and examine the largest 347 banks across 57 countries. They obtain banks' speed of adjustment towards desired capital struture between 50.6-53.7%. Traditional banks have relatively mature debt product markets and capital markets, and they can sell the products to raise funding at a low cost. The capital structure of IBs is more complicated than CBs because they need to comply with Islamic law when using financing products to obtain

funds, which makes them subject to some restrictions on the issuance of financing products. Khan (2010) find that certain products such overnight financing instruments which have risk-return characteristics and are comply with Islamic teachings are released into the capital market and then are withdrawn due to commercially unviable, while other products were still under development. Moreover, the stocks issued by Islamic banks need to be in accordance with Islamic teachings, and the degree of compliance of these stocks is often the object of concern. Johnes et al (2014) suppose that the transparency of stock information of traditional banks is higher than that of IBs because the activities they participate in are disclosed in accordance with international standards (such as the Basel rules), and the transparency of Islamic banking's disclosure of Islamic financial activities is not high enough and the information sharing mechanism is underdeveloped. This results in investors have not yet fully recognized these products and IBs have to pay more to issue stocks for recognition, reflecting there is not enough willingness to invest and support the development of the Islamic financial products market. From this point of view, the ability of IBs to adjust their capital structure may not be as flexible as CBs. However, there is no literature to compare and study the capital structure adjustment of IBs and CBs. This chapter intends to use the desirable capital structure described by tradeoff theory as a starting point to observe whether IBs will also set target capital, and then use a partial adjustment model to quantify their capital management.

3.3.3 Procyclical leverage

Adrian and Shin (2010) first proposed the concept of pro-cyclical leverage in financial institution by observing the positive association between increase in leverage and asset growth. They argue that financial intermediaries, such as banks, are largely funded through borrowing, so they are highly leveraged

and their leverage should be very sensitive to the management of their asset prices or assets. Their results of investment banks in US show that the leverage of the bank is pro-cyclical, because the increase in assets corresponds to an increase in leverage, indicating that these banks are actively adjusting to respond to growth opportunity changes. There are empirical studies not only confirm the relationship between leverage and assets, but also give the practical meaning of the connection between the two (Acharya and Viswanathan, 2011;Damar et al, 2013;Dewally and Shao, 2013;Laux and Rauter, 2017).

In particular, Damar et al (2013) are concerned about the changing of Canadian bank assets and leverage, and try to confirm the existence of leverage pro-cyclicality. They found that Canadian banks' leverage are generally pro-cyclical, and that wholesale financing provided by capital markets has a significant impact on cyclicality. The conclusions of their article suggest that the procyclical behavior of leverage will impede the economic development, so the restriction on leverage is necessary.

Moreover, Dewally and Shao (2013) expand the previous research sample to include bank data from 49 countries, and the procyclical leverage of financial institutions' leverage was also observed. It appears that in the international context, financial institutions are actively managing assets as leverage and asset growth are closely associated. They believe that regulators should consider the impact of wholesale financing on the pro-cyclical leverage, because natural pro-cyclicality, together with the dependence on wholesale financing, will make the financial system accumulate a large amount of credit and could increase the instability when the crisis occurs. Therefore, in addition to setting up leverage caps on banks, regulators may have to set a ceiling on banks' dependence on wholesale financing.

For Islamic banks, the relationship between asset growth and leverage is also worthy of attention. In addition to taking deposits as a source of funds,

Islamic banks can increase their liquidity and reduce debt costs by participating in interbank markets or other capital markets, but such markets are only mature in a few countries such as Malaysia and Bahrain (Chong and Liu, 2009). The interbank and capital markets of CBs in the same region have been internationally integrated after many years of development. For example, debt rates are generally linked to LIBOR (the London Interbank Offered Rate). This chapter turns its attention to IBs and CBs to observe the existence of leverage pro-cyclicality and to try to find out whether the sensitivity of leverage growth to asset changes is different.

3.3.4 Regulatory capital

A strong economy needs a safe banking industry, and this means banks needs to have strong regulatory capital base to support itself. Regulatory capital ratios, such as capital buffers, and Tier 1 capital, are minimum funds that a bank have to hold as required by the regulators and they are expected to protect depositors from absorbing unexpected portfolio losses (Benink et al, 2008;Cihak et al, 2013). Islamic financial services board (IFSB) which issues prudential standards for stability of Islamic financial industry and Basel Committee have suggested the minimum capital adequacy requirments based on banks' asset risk (Ng and Roychowdhury, 2013).

Prior empirical literature has concentrated on regulatory capital and bank capital buffers in CBs. Abou-El-Sood (2016) find that the regulatory capital reserves of banks which suffer huge losses and nearly close down have exceeded the minimum regulatory requirements. They conclude that regulatory capital should not be considered the only driving reason for bank distress because bank size and loan quality have more significant effect. Distinguin et al. (2013) suppose that banks hold illiquid assets because they

need to provide loans for some long-term projects and they note that solvency standards of US banks do not increase their in a timely manner in response to increase in illiquid assets. Another related study, Ayuso et al. (2004) link capital buffers to GDP ratio that represents economic health, and find that banks will increase capital cushions as the economic outlook prosper in Spain. Similarly, Jokipii and Milne (2008) confirm the association the capital buffers of commercial banks in 25 EU countries with the business cycle and obtain that the capital buffer shows a pro-cyclical trend.

Islamic banks offer the same deposit accounts as traditional banks, but in order to provide deposit services to people with Islamic beliefs, they have established investment account deposits. The risk sharing nature of investment account means that the losses arising from the assets funded by this investment deposits will be absorbed by investment account holders (Elnahass et al, 2014). Therefore, the assets financed by investment account might not require regulatry capital charges as the cushion for potential losses. Then, the regulatory capital of IBs is predicted to differ significantly from CBs. Additionally, in order to ensure sufficient capital, Islamic banks also need to go to the capital market to issue stocks for equity financing. In theory, equity financing is consistent with Islamic law because it is risk sharing and there is no fixed return. Therefore, Islamic banks should have no problem in equity financing. Modern capital markets provide a way for risk management and market information dissemination, and the common stocks issued by banks in the capital market are an important part of regulatory capital. However, the depth and breadth of IBs' participation in capital market activities are not as good as CBs, which makes it very likely that they need to undertake more costs to manage the regulatory capital compared to CBs.This chapter finally compares the regulatory capital of IBs and CBs, and then explore the ability of these banks' regulatory capitals to respond to bank characteristic variables. It is expected that due to the limited IBs' ability to

engage in the activities of the capital market, the capability of IBs to mobilize regulatory capital in resonse to some variables (such as risk) is weaker than CBs.

3.4 Data

The sample used for this study is based on the research sample inspired by Beck et al (2013b) who conduct analysis for 510 banks in 22 countries with 88 IBs and 422 CBs over the period 1995-2009. Banks are checked in Bankscope and the selection process specifies banks with the obtainability of publicly available disclosures from countries where the two bank types coexist. It results in a final sample of 112 IBs and 711 CBs from 1995 to 2015. The distribution of the sample banks are exhibited in Table 3.2. To exclude the effects of outliers, values beyond the 1st and 99th percentiles in each bank type are winsorized. The negative Tier 1 capital ratio, regulatory capital and capital buffers are excluded as they violate the capital adequacy requirements (Daher et al, 2015). The data on market information related to the banks are downloaded from Datastream.

Table 3.4 displays summary statistics for IBs and CBs and all banks. It indicates that CBs have significantly higher book leverage than IBs. In column 5, the differences in value between variables of IBs and CBs are shown. The P-values of a T-test on averages illustrate that except Tier 1 capital, regulatory capital, capital buffer, loan loss provision and collateral, all other variables in CBs are significantly higher than IBs. Consistent with the findings of Daher et al. (2015), the mean value of capital buffer in Islamic banks is 14.93% and the average value of capital buffer in conventional banks is 12.12%, implying IBs have kept excessive regulatory capital above CBs. The value of collateralized assets in IBs are higher than that of CBs because

Islamic finance operates on the basis of real economic activities in accordance with Islamic law, leading to the fund raising of Islamic banks is more dependent on the support of tangible assets, as mentioned by Alzahrani (2018). The descriptions of all variables mentioned are listed in the Table 3.3.

Table 3. 2 Distribution of banks

The distribution of CBs and IBs in different regions.

Country Name	Islamic bank	Conventional bank	Total
Bahrain	20	15	35
Bangladesh	5	30	35
Cayman Islands	1	35	36
Egypt	3	31	34
France	1	1	2
Gambia	3	6	7
Indonesia	1	107	110
Jordan	2	10	12
Kuwait	8	6	14
Lebanon	2	57	59
Malaysia	14	50	64
Mauritania	1	6	7
Pakistan	11	25	36
Qatar	4	7	11
Saudi Arabia	3	11	14
Singapore	1	28	29
Sudan	10	14	24
Syrian Arab Republic	1	9	10
Tunisia	1	15	16
Turkey	6	59	65
United Arab Emirates	8	18	26
United Kingdom	2	165	167
Yemen	4	6	10
Total	112	711	825

Table 3. 3 Variable description

Name	Ratio construction	Citation
Book leverage	One minus the ratio of the book value of total equity to the book value of total assets	Flannery and Rangan (2006)
Tier 1 Capital ratio	Tier 1 capital to total assets	De Jonghe and Öztekin (2015)
Regulatory capital	Sum of Tier 1 and Tier 2 to risk-weighted assets	Berger et al (2008)
Capital buffer	Total Tier 1 plus Tier 2 capital to risk-weighted capital ratio minus the Basel minimum requirements of 8%	Jokipii and Milne (2008)
Profitability	(pre-tax profit + interest expenses)/book value of assets	Gropp and Heider (2010)
Size	Log of total assets	Flannery and Rangan (2006)
Collateral	Collateral = (total securities + treasury bills + cash and due from banks + fixed assets) / book value of assets	Gropp and Heider (2010)
Market-to-book ratio	(Book value of total assets-book value of equity + market value of equity) / total assets; Market value of equity=number of shares*end of year stock price;	Rajan and Zingales (1995)

Name	Ratio construction	Citation
Risk	Annualised standard deviation of daily stock price returns ∗ (market value of equity/market value of bank)	Gropp and Heider (2010).
Dividend dummy	Equal to one if banks pay the dividend in a given year	Gropp and Heider (2010)
LLP (loan loss provision)	The ratio of loan loss provision to average gross loans.	Abedifar, Molyneux, and Tarazi, (2013)
Log Z	log Z is the distance to default estimated as Z=mean(ROA+CAR)/volatility(ROA) where CAR is the equity-to-asset ratio and ROA is return on assets for the period 1995–2015.	Beltratti and Stulz (2012).

Table 3. 4 Summary statistics

The definition of all the variables are listed in the Table 3.3. ***, **, * represents significant at 1, 5 and 10 percent level respectively.

	Conventional banks		Islamic banks		Diff	P-value	Full sample	
	N	Mean	N	Mean			N	Mean
Dependent variables								
Book leverage	6723	0.858	1020	0.740	0.117***	0.000	7743	0.842
Tier 1 Capital ratio (%)	2388	18.391	390	20.943	-2.552***	0.009	2801	18.152
Regulatory capital (%)	3579	20.120	540	22.936	-2.816***	0.000	4119	20.489
Capital buffer (%)	3579	12.120	540	14.936	-2.816***	0.000	4119	12.489
Independent variables								
Profitability	5907	0.054	754	0.040	0.015***	0.000	6661	0.053
Size	6283	21.087	930	20.653	0.434***	0.000	7213	21.032
MTB	1655	1.132	427	1.044	0.087***	0.009	2082	1.114
Collateral	5417	0.305	830	0.324	-0.019**	0.013	6247	0.307
Risk	1507	0.170	382	0.246	-0.076***	0.000	1889	0.186
Dividend	14931	0.179	2352	0.159	0.020**	0.017	17283	0.176
LLP	5105	0.017	688	0.092	-0.075***	0.000	5793	0.026
LogZ	13480	2.927	2140	2.952	-0.024	0.397	15460	2.931

3.5 Methodology and empirical results

3.5.1 Traditional regression

Rajan and Zingales (1995) choose four variables which are: return on assets, firm size, fixed assets , market-to-book and find they can explain the variation of non-financial firms' leverage. Gropp and Heider (2010) emphasize the prominent role of traditional factors on financial institutions' capital structure, and they add natural logarithm of risk and dividend dummy as explanatory variables to empirical specification. To assess the different impacts of traditional factors on capital structure for IBs and CBs, the following model is used:

$$Leverage_{i,j,t} = \alpha + \gamma IB_i + \beta_1 B_{i,j,t-1} + \beta_2 IB_i * B_{i,j,t-1} + \varepsilon_{i,j,t} \quad , \qquad (3.1)$$

where book leverage is the dependent variable. IB_i is a dummy variable which takes the value of one when bank *i* is Islamic and zero otherwise. $B_{i,j,t-1}$ is a vector of lagged explanatory variables that contain profitability, the log of total assets (size), collateral, market-to-book ratio (MTB) , dividend dummy, and natural logarithm of risk for bank *i* in country *j* in year *t-1* which are the important factors determining corporate leverage used in Rajan and Zingales (1995), Frank and Goyal (2009) and Gropp and Heider (2010). The lagged control variables are incorporated to address reverse causality and simultaneity problem. This study also considers Z-score that is frequently regarded as a measure of bank stability and loan loss provision (Beltratti and Stulz, 2012; Bouvatier and Lepetit, 2008). A higher Z-score corresponds to a lower probability of insolvency risk.

The variable of interest is the interaction terms $IB_t*B_{i,j,t-1}$ which are introduced to emphasize whether the book leverage of IBs and CBs respond differently to these bank-specific factors. For example, when the coefficient of IB*profitability is significant, it

illustrates that the bank leverage of IBs is more sensitive to increased profits compared to CBs.

Following Gropp and Heider (2010), several estimation techniques are used such as the fixed effects and random effects models. The random effects estimation is included in this research since fixed effects model might not be the best choice when coefficient of time-invariant variables is the focus, and under these circumstances, the coefficient of the IB dummy (i.e.time-invariant variable) needs to be observed (Abedifar et al., 2013; Greene, 2012). The dummy variable is included to identify whether Islamic banks still have significant different capital ratios from conventional banks when additional control variables are controlled. However, when the model has independent variables that are not strictly exogenous in the short panel time, the coefficients of variables obtained from using random-effects method would be biased.

On the basis of previous studies, Blundell and Bond (1998) build a system of two equations, which generate the system GMM estimator. This estimator that considers the dynamic nature of dependent variables provide valid instruments which address the issues of unobserved heterogeneity and simultaneity (Cameron and Trivedi, 2005). Arellano and Bond (1991) focus on the serial correlation test for GMM residuals as well as Sargan test that is usually used to test over-identifying restrictions. Dynamic GMM panel estimation is then used in this study to mitigate bias and improve estimator consistency. The dynamic process refers that the dependent variable's current realizations could be impacted by its past ones. Comparisons of results obtained from fixed effects, random effects and the dynamic GMM estimations are presented.

3.5.1.1 Results

This section first emphasizes on the motivation behind the financing decisions of IBs relative to CBs. The current research follows Rajan and Zingales (1995) and Gropp and Heider (2010) who empirically analyze the attributes that may affect corporate debt-

equity selection. The Table 3.5 reports the results derived from equation (1) and book leverage is the dependent variable. In column 1-3 and column 4-6, the book leverage is regressed on IBs and CBs separately. The results in columns 7-9 report regression findings for the full bank sample and include all explanatory variables interacting with Islamic bank dummy. The impact of additional variables such as loan loss provision and logZ are considered in column 10-12. Results are obtained from three estimation techniques: random effects (column 1, 4, 7, 10), fixed effects (column 2, 5, 8, 11) and system GMM (column 3, 6, 9, 12).

The coefficient of Islamic bank dummy enters negative across random effects and dynamic GMM estimations. An advantage of random effects is that variables do not change over time could be included (Wooldridge, 2010). The Islamic bank dummy has significant negative coefficient sign in column 1 by using random effects estimation, but this variable is omitted in fixed effects estimation in regression 2. It is because that in the fixed effect model, time-invariant variables are automatically moved into the intercept (Wooldridge, 2010). Islamic banks have lower debts and the magnitude of the difference from CBs is meaningful, which is identical to the evidence found in Beck et al (2013b). It is because the conventional banks have diversified debt structures which contain a mix of deposits, sources of wholesale markets and bonds, and deposit and short-term funding (Bank and Lawrenz, 2013). Apart from deposits in funding, conventional banks might rely on short-term wholesale funding raised from other financial institutions (Babihuga and Spaltro, 2014). On the contrary, Islamic banks have limited access to the inter-bank market products and debt products in line with Islamic ethics. Only large banks with strong strengths are eligible to issue Islamic bonds like sukuk.

In column 2 which reports the fixed effects estimation for Islamic banks, the coefficients of size and profits are consistent with the analysis of Gropp and Heider (2010). Large IBs are more capable of obtaining Islamic-compliant debt instruments and leveraged investment accounts due to the financial diversity and economies of scale

(Song and Oosthuizen, 2014). The positive coefficient of asset size suggests that larger Islamic banks may use debt more aggressively and use less common and preferred stock to cope with the remaining funding needs. Islamic banks' profits and leverage are negatively associated, suggesting that profitable banks might not have the intention of raising debt, but tend to accumulate profits (Frank and Goyal, 2009).

By comparing the fixed effect estimates of IBs (column 2) and CBs (column 5), it shows the different effect of collateralized assets on the capital structure of the two bank types. Similarly, the coefficient of IB*collateral is significant and this interaction has a negative value of -0.023, suggesting the book leverage of IBs and CBs respond significantly differently to the increase in collateral. Interactions between Islamic bank dummy and bank-specific variables are included in column 7-9 to identify whether the book leverage of IBs and CBs would react differently to certain factors. The interest here is the coefficients of interaction terms. The results are described on the basis of results from system GMM estimation in column 9 because it improves the estimation by mitigating endogeneity.

For CBs, the increase in the value of fixed assets makes them tend to increase their debt ratio. If banks have more assets that can be collateralized, the information costs and agency costs of their debts will be reduced since these assets have high liquidity and can be easily sold for cash (Faulkender and Petersen, 2006). As the value of collateral increases, the network advantage of CBs financial systems allows them to quickly provide information to fund providers, making it easier to obtain debt. For IBs, although they are actively integrating into the mainstream financial market, non-professionals have difficulty understanding their business forms. As a consequence, when they have more collateral, their cost of information transmission is higher because of the lack of effective Information sharing mechanism. Compared with traditional banks, the Islamic banking system seems to face higher financing costs and transaction costs because of the greater degree of information asymmetry and the opacity of the collaterals' credit rating information. It is therefore necessary to promote the

information infrastructure of IBs to enable fund providers to obtain and understand reliable information about collateral and asset valuation.

Further, in column 10-12, loan loss provision, logZ and country dummies are added to the model. The country dummies are included to control for unobserved heterogeneity across countries. It shows that the adjusted R-squared value increase from 0.402 in column 7 to 0.669 in column 10 by using random effects estimation. The higher adjusted R-squared value is obtained due to the added bank variables and country fixed effects.

Table 3. 5 Test of traditional capital structure model

Book leverage is the dependent variable. The regressions are obtained following model $Leverage_{i,j,t} = \alpha + \gamma IB_i + \beta_1 B_{i,j,t-1} + \beta_2 IB_i * B_{i,j,t-1} + \varepsilon_{i,j,t}$ (3.1). IB is one for Islamic banks and zero for conventional banks. The definition of all the variables are listed in the Table 3.3. The standard errors are robust in random effects and fixed effects estimation. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

	(1) IB	(2) IB	(3) IB	(4) CB	(5) CB	(6) CB	(7) FULL	(8) FULL	(9) FULL	(10) FULL	(11) FULL	(12) FULL
Variables	RE	FE	GMM	RE	FE	GMM	RE	FE	GMM	RE	FE	GMM
IB							-1.178***		-0.279*	-1.087***		0.077
							(0.118)		(0.182)	(0.124)		(0.166)
Profitability	-0.095	-0.252*	0.058	0.067	0.023	0.243***	0.061	0.023	0.181*	0.12	0.08	0.195*
	(0.123)	(0.120)	(0.159)	(0.051)	(0.053)	(0.068)	(0.063)	(0.063)	(0.075)	(0.062)	(0.061)	(0.079)
IB*profitability							-0.159	-0.275**	-0.348*	-0.215*	-0.300**	-0.215*
							(0.1)	(0.1)	(0.151)	(0.096)	(0.096)	(0.089)
Size	0.048***	0.056***	0.007	-0.001	-0.002	0.004	-0.001	-0.002	0.005	0	0	0.004
	(0.008)	(0.010)	(0.01)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
IB*Size							0.049***	0.057***	0.012	0.038***	0.044***	-0.006
							(0.005)	(0.007)	(0.008)	(0.005)	(0.007)	(0.006)
Collateral	-0.121***	-0.118***	-0.03	0.032**	0.022*	-0.012	0.030*	0.022	-0.023	0.02*	0.013	-0.017
	(0.034)	(0.035)	(0.052)	(0.01)	(0.011)	(0.017)	(0.013)	(0.013)	(0.018)	(0.012)	(0.012)	(0.018)
IB*Collateral							-0.151***	-0.140***	-0.120**	-0.113***	-0.121***	0.003
							(0.025)	(0.026)	(0.044)	(0.029)	(0.031)	(0.043)
MTB	0.034*	0.026	0.025**	-0.006*	-0.009**	-0.006*	-0.007*	-0.009**	-0.005	-0.007*	-0.009**	-0.006
	(0.014)	(0.013)	(0.008)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
IB*MTB							0.040***	0.035***	0.031***	0.053***	0.037**	0.041**
							(0.009)	(0.009)	(0.008)	(0.013)	(0.013)	(0.015)
Dividend	0.001	-0.002	0.006	0.004	0.005*	0.01	0.004	0.005	0.002	0.003	0.004	0.002

	(1) IB	(2) IB	(3) IB	(4) CB	(5) CB	(6) CB	(7) FULL	(8) FULL	(9) FULL	(10) FULL	(11) FULL	(12) FULL
Variables	RE	FE	GMM	RE	FE	GMM	RE	FE	GMM	RE	FE	GMM
	(0.011)	(0.010)	(0.007)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
IB*Dividend							-0.003	-0.006	0.009	0	-0.003	0
							(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Log(Risk)	-0.028**	-0.005	-0.005	-0.003*	-0.002	0.001	-0.003	-0.002	0	-0.002	-0.001	0.001
	(0.008)	(0.009)	(0.006)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
IB* log(Risk)							-0.025***	-0.003	-0.012	-0.030***	-0.01	-0.008
							(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.01)
LLP										0.017	0.002	-0.122
										(0.078)	(0.077)	(0.083)
IB*LLP										0.111	0.112	0.137
										(0.082)	(0.08)	(0.085)
LogZ										-0.011*	0	-0.001*
										(0.006)	(0)	(0.004)
IB*logZ										0.044***	0	0.005*
										(0.012)	(0)	(0.017)
Constant	-0.285	-0.411*	-0.057	0.887***	0.915***	0.263**	0.892***	0.660***	0.253**	0.893***	0.704***	0.159
	(0.166)	(0.208)	(0.171)	(0.044)	(0.053)	(0.079)	(0.055)	(0.057)	(0.095)	(0.053)	(0.051)	(0.084)
Time dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Country	NO	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES	NO
Adjusted R-	0.493	0.324		0.018	0.037		0.402	0.134		0.669	0.139	
Hansen J-statistics (p-value)			0.424			0.112			0.293			0.454
Number of Instruments			23			22			41			49
AR(1) test (*p*-value)			0.021			0.045			0.003			0
AR(2) test (*p*-value)			0.612			0.173			0.302			0.525
N	215	215	215	905	905	899	1120	1120	1114	1055	1055	1053

3.5.2 Desired capital structure

Gropp and Heider (2010) and De Jonghe and Öztekin (2015) predict that target capital structure exists in different banks, and obtain the range of leverage adjustment speeds for EU and US banks by applying partial adjustment models. Following Gungoraydinoglu and Öztekin (2011), this study tests the tradeoff theory in IBs and CBs by displaying the partial adjustment model:

$$Leverage_{ij,t} - Leverage_{ij,t-1} = \lambda(Leverage^{*}_{ij,t} - Leverage_{ij,t-1}) + \varepsilon_{ij,t}\ , \qquad (3.2)$$

where $Leverage_{ij,t}$ refers to the ratio of debt to bank assets in year t of bank i in country j, $Leverage_{ij,t-1}$ is the lagged debt ratio, and $Leverage^{*}_{ij,t}$ is the desired debt level. In the course of a year, banks would close the relative λ distance between their current and desired leverage ratios. The estimates of the adjustment parameter is the centre of analysis and it should be reliably positive in the range of zero to one if banks pursue the desired capital structure (Fama and French, 2002). $\varepsilon_{ij,t}$ indicates the error term.

It is expected that Islamic banks alter various characteristics to adjust towards their long-term target level. However, the target leverage is not observed, which motivates me to use the time-varying corporate finance variables as the determinants of target capital of banks in equation (3.3):

$$Leverage^{*}_{i,j,t} = \beta X_{i,j,t-1}\ , \qquad (3.3)$$

where $X_{i,j,t-1}$ is a vector of lagged bank attributes which are defined in table 3.3. This study models the target capital by using a set of corporate finance variables that appear in previous section including risk， size, collateral, MTB ratio, dividend dummy, profitability, loan loss provision and Zscore (Flannery and Rangan, 2006;Gropp and Heider, 2010;Lemmon et al, 2008).

Inserting equation (3.3) into (3.2) gives:

$$Leverage_{ij,t} - Leverage_{ij,t-1} = \lambda(\beta X_{ij,t-1} - Leverage_{ij,t-1}) + \varepsilon_{ij,t} \quad , \quad (3.4)$$

by moving $Leverage_{ij,t-1}$ to the right hand side, it turns into

$$Leverage_{i,j,t} = \lambda\beta X_{ij,t} + (1-\lambda)Leverage_{ij,t-1} + \varepsilon_{ij,t} \quad (3.5).$$

The specification in equation (3.5) is used for estimation in CBs and IBs separately. Interaction term $IB_i * X_{ij,t-1}$ is added to equation 3.5 to identify whether the roles of bank characteristics for determining target leverage could be different in the two bank types and get:

$$Leverage_{ij,t} = \lambda(\beta X_{ij,t-1} + \alpha IB_i * X_{ij,t-1}) + (1-\lambda) Leverage_{ij,t-1} + \varepsilon_{ij,t} \quad (3.6).$$

In this model the adjustment of speed is λ. If $IB_i = 0$, the long run impact[6] of $X_{ij,t-1}$ on the leverage in CBs is shown in its coefficient divided by λ (Flannery and Rangan, 2006). When the Islamic bank dummy equals to one, the coefficient of $X_{ij,t-1}$ is $\lambda(\beta+\alpha)$ and the long-term influence of explanatory variables on the leverage ratio in IBs is $(\beta+\alpha)$. If the coefficient α is significant, it indicates the impact of bank-specific variables on IBs' and CBs' desired debt are distinguished.

Fixed effects estimation has been used in partial adjustment model by studies such as Huang and Ritter (2009), who assume the company's target debt is determined by company heterogeneous characteristics captured by the unobserved time-invariant variables. Flannery and Rangan (2006) set out the factors including firm characteristics, time-invariant and time dummy variables that can lead to changes in the target capital structure, following Fama and French (2002). This study first uses the fixed effects estimation with year dummies to cover the changing elements in the bank leverage model.

[6] The meaning of the determinants of target debt in model 4 in the research of Flannery and Rangan (2006) is explained in a similar way.

While the fixed effects estimation does not concentrate on the solving of endogeneity problems, GMM uses instruments to reduce biases (Blundell and Bond, 1998). Hovakimian and Li (2012) and Lemmon (2008) expect to obtain more accurate results, so the system GMM method is used to estimate the speed of adjustments in international companies. Another instance is that De Jonghe and Öztekin (2015) model the dynamic movement of capital for banks in different countries by including the lagged dependent variable and the unobservable fixed effect, following Blundell and Bond's (1998) two-step GMM estimation. In order to reduce the bias and improve the quality of the results, the dynamic GMM method[7] is chosen to estimate the partial adjustment model for IBs and CBs, respectively. However, one disadvantage of system GMM is that it could be complicated and produce invalid estimates. This research intends to confirm the validation of specification by firstly observing correlated residuals in first difference form (AR(1)), and expecting that the correlation does not exist in the second differenced residuals (AR(2)). The next step is to identify the Hansen *J* statistic for testing whether the instruments are over-identified (Wintoki et al., 2012).

3.5.2.1 Results

Table 3.6 presents parameter estimates and standard errors for estimating different partial adjustment specifications for book leverage in IBs (column 1-3) and CBs (column 4-6). Regressions specified in column 7-9 incorporate interaction term between Islamic bank dummy and bank-specific variables. The results shown are obtained from random effects estimates, fixed effects estimates and two-step system GMM estimation. The fixed effects estimation is preferred over random effects based on Hausman tests[8]. The dynamic panel data model is estimated in table 3.6 following

[7] The command xtabond2 introduced by Roodman (2006) is used in the Stata software.

[8] This test can also be used to distinguish between fixed effect models and random effects models in panel data. The results of our tests indicate that fixed effect estimates are preferred.

Blundell and Bond (1998). The estimators are consistent since the AR(2) statistic is non-significant which illustrates no evidence of model misspecification (Daher et al, 2015). The insignificant results of Hansen *J* test demonstrate that instruments included are valid. Therefore, our specifications are robust.

The coefficients of all the lagged leverage ratios are significantly positive and less than one, implying that both IBs and CBs in the sample strive to maintain target capital structures. It is possibly in that the cost of having a target leverage is less than the burden of maintaining an untargeted capital structure for both IBs and CBs. In the fixed effects estimation, the adjustment speeds among IBs and CBs are apparently not the same. For Islamic banks, fixed effects regression in column 2 illustrates that the speed of adjustment is approximately 55.6% per year while conventional banks close 42.6% of the gap to achieve targets a year in column 4. When fixed effects model is used, adjustment speed of conventional banks is 42.6% which closely match the findings of Gropp and Heider (2010) as they suggest banks close 45% to 46.8% of the distance between last period's leverage and desired capital structure by using fixed effects estimation.

The GMM techniques for estimating dynamic panel coefficients are reported in column 3 and 6. The speed of adjustment is 25.1% in column 3 which appears to be consistent in magnitude with the results from Öztekin and Flannery (2012) who obtain the mean estimated adjustment speed (21.11%) for book leverage in non-financial firms across 37 countries. It means that the Islamic banks in the sample actively behave to close their leverage gap by approximately 25.1% per year. On the other hand, conventional banks close 34% of the gap between the last period's leverage and the target of current period. It reveals higher adjustment speed of conventional banks. The reason of this evidence might be that the debt sources of conventional banks is more diversified and flexible than Islamic banks as CBs can easily get access to wholesale funding markets and capital markets.

It is also possible that the external financing cost of IBs is higher than CBs as De Jonghe and Öztekin (2015) suppose that the rise in external financing costs leads to slowdown in the adjustment speed of bank capital structure. The outcome of Islamic bank's risk-sharing transactions are uncertain and the extent of its disclosure is limited. Moreover, the interbank and monetary markets of Islamic banks are usually not that mature, and even some Islamic banks are unable to obtain funds quickly through inter-bank lending, resulting in fewer opportunities for IBs to obtain funds than CBs. It is very likely that IBs have to work harder and spend more time looking for and getting funding. Therefore, IBs are probably more prone to transaction costs and information asymmetry than CBs, resulting in that Islamic banks may face higher external financing costs and adjustment costs when they need to raise funds through debt.

High financing costs will erode IBs' profits in the long run and reduce investor returns. What is needed is that regulators can promote the financial flexibility of the Islamic banking industry by expanding the financing channels for Islamic banks, establishing a sound Sharia-compliant liquid capital market and reducing the cost of raising funds. If IBs are not able to accept funding from CBs because of Islamic doctrine, then building a strong Islamic finance system may be a desirable option. The enhancement of the linkages between Islamic banks, capital markets, insurance and fund companies could facilitate the flow of funds and the convenience of financing. In summary, the growth of Islamic finance in capital management capabilities requires a more robust financial system and environment, including innovative financial instruments and more mature capital and debt markets.

In column 9 of dynamic GMM estimation, profit's coefficient enters positive and is statistically different from zero, indicating the increase in profits of CBs motivate them to target higher leverage in the long term. In opposite, the sum of profit's coefficient and the coefficient on the interaction of profit with Islamic bank dummy enters negative, suggesting profitable Islamic banks are not likely to set higher desired debt level.

Table 3. 6 Test of partial adjustment model for tradeoff theory

The dependent variable for all columns are the book leverage. The column 1, 2, 3 present the results for IBs while column 4, 5, 6 show the results for CBs by estimating model $Leverage_{i,j,t} = \lambda\beta X_{ij,t} + (1-\lambda)Leverage_{ij,t-1} + \varepsilon_{ij,t}$ (3.5). In column 7-9 for model (3.6) are estimated. IB is one for Islamic banks and zero for CBs. Standard errors are in parentheses $***$, $**$ and $*$ denote statistical significance at the 1%, the 5% and the 10% level respectively.

	(1) IB	(2)IB	(3) IB	(4) CB	(5) CB	(6) CB	(7) Full sample	(8)	(9) full sample
Variables	RE	FE	System GMM	RE	FE	System GMM	RE	FE	System GMM
Speed of adjustment	0.011***	0.556***	0.251***	0.199***	0.426***	0.340***	0.211***	0.438***	0.265***
	(0.040)	(0.075)	(0.105)	(0.015)	(0.026)	(0.037)	(0.095)	(0.024)	(0.043)
Profitability	0.041	-0.194	-0.069	0.02	-0.01	0.068	0.435	0.07	0.186*
	(0.088)	(0.106)	(0.094)	(0.034)	(0.053)	(0.096)	(0.280)	(0.052)	(0.077)
IB*profitability							-0.328	-0.135	-0.223*
							(0.282)	(0.079)	(0.088)
Size	0.002	0.064***	0.021	0.000	-0.001	0.009	0.004	-0.003	0.008
	(0.004)	(0.015)	(0.012)	(0.001)	(0.003)	(0.005)	(0.002)	(0.002)	(0.006)
IB*size							-0.003	0.024***	-0.008
							(0.004)	(0.005)	(0.004)
Collateral	0.028	-0.04	0.118	0.020***	0.013	0.001	-0.006	0.008	-0.015
	(0.023)	(0.039)	(0.068)	(0.006)	(0.008)	(0.016)	(0.013)	(0.009)	(0.018)
IB*collateral							-0.013	-0.053*	0.006
							(0.026)	(0.025)	(0.042)
MTB	0.022	0.023	0.056	-0.003**	-0.004	-0.004	-0.005**	-0.003	-0.006
	(0.017)	(0.018)	(0.034)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
IB*MTB							0.034	0.012	0.041**
							(0.022)	(0.010)	(0.015)

	(1) IB	(2)IB	(3) IB	(4) CB	(5) CB	(6) CB	(7) Full sample	(8)	(9) full sample
Variables	RE	FE	System GMM	RE	FE	System GMM	RE	FE	System GMM
Dividend dummy	0.005	0.000	0.001	-0.001	0.003	-0.001	-0.001	0.003	0.002
	(0.008)	(0.008)	(0.009)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
IB* Dividend dummy							0.009	0.002	0.000
							(0.008)	(0.005)	(0.005)
Log(Risk)	0.005	0.000	0.027*	0.000	0.000	0.000	-0.003	-0.001	0.002
	(0.006)	(0.009)	(0.013)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.004)
IB*log(Risk)							-0.033	0.006	-0.009
LLP	0.063	0.082*	0.027	-0.032	-0.035	-0.008	0.169	-0.049	-0.123
	(0.037)	(0.032)	(0.023)	(0.042)	(0.053)	(0.082)	(0.349)	(0.061)	(0.083)
IB* LLP							-0.070	0.136*	0.135
							(0.351)	(0.064)	(0.085)
LogZ	0.004	0.000	0.065**	-0.002**	0.000	0.005	-0.004	0.000	-0.002
	(0.004)	(0.000)	(0.019)	(0.001)	(0.000)	(0.005)	(0.003)	(0.000)	(0.008)
IB*LogZ							0.004	0.000	0.023
							(0.010)	(0.000)	(0.033)
constant	-0.076	-0.992**	-0.492	0.281**	0.416***	0.000	0.109*	0.345***	0.161*
	(0.078)	(0.306)	(0.304)	(0.088)	(0.064)	(0.000)	(0.055)	(0.044)	(0.071)
Time dummies	YES	YES	YES	YES	YES	YES	NO	NO	NO
Country dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
R-squared	0.913	0.444		0.862	0.846		0.784	0.0009	
Hansen J-statistics(pvalue)			0.187			0.170			0.483
Number of Instruments			39			46			49
AR(1) test (*p*-value)			0.027			0.000			0.000
AR(2) test (*p*-value)			0.844			0.426			0.496
N	189	209	189	864	864	864	1083	1053	1053

3.5.3 Procyclical leverage

There are two main purposes in this section: (1) documenting the linkages between leverage growth and asset growth among IBs and CBs; and (2) observing whether asset growth and leverage growth in IBs and CBs are different. We first did a simple correlation test for leverage increase and asset growth, and the result was that they were significantly positively correlated. This initial result motivated us to explore one step further. I attempt to combine other variables that explain the change in leverage with asset growth and add them together to the leverage growth regression. The purpose of this is to observe whether the effect of asset growth is still significant, after other variables have been considered. The model is built following the work of Adrian and Shin (2010) and Dewally and Shao (2013) as follows:

$$\Delta Leverage_{i,j,t} = \beta_1 X_{i,j,t-1} + \beta_2 Leverage_{i,j,t-1} + \gamma_1 Asset\_growth_{i,j,t} + \gamma_2 Asset\_growth_{i,j,t} * IB + \varepsilon_{i,j,t}, \quad , \qquad (3.7)$$

where $\Delta Leverage_{i,j,t}$ refers to change in debt for bank i at time t in country j (defined by the ratio of current bank debt over total bank assets), $Asset\_growth_{i,j,t}$ is the growth in assets for bank i at time t (defined as the ratio of difference between the change in assets over the total bank assets). ε is the error term. If the coefficient of the asset growth is significant, it implies that banks actively seek funding to satisfy growth opportunities.

$Leverage_{i,j,t-1}$ refers to the lagged debt to total assets ratio for bank i in year t-1 and λ measures how adjustment costs deviate banks' leverage from the target (Fama and French, 2002). A set of bank characteristics $X_{i,t}$ which are the same in section 5.1 is used to model the target debt ratio (Fama and French, 2002; Gropp and Heider, 2010; Rajan and Zingales, 1995). The change in leverage is the dependent variable in specification (7) and the lagged leverage is included to confirm the robustness of optimal capital structure pattern. The specification of model (3.7) shows that the adjustment speed is the coefficient of lagged leverage divided by (-1). IB dummy refers

to the Islamic banks and if the value of γ_2 is significant, it illustrates the difference in leverage between IBs and CBs in case of asset growth. Fixed effects (including bank fixed effects), random effects and dynamic GMM techniques are used for estimation.

3.5.3.1 Results for comparison

The findings of this section link changes in leverage with asset growth because we tend to obtain answers to two questions: (1) What is the relationship between the leverage change and asset growth of IBs; (2) Is the relationship between the two variables different among IBs and CBs? Table 3.7 reports the findings. We run the regression for IBs and CBs separately in column 1-4 and 5-8 in table 3.7. For full sample, the equation is regressed by using dynamic GMM panel data model in Arellano and Bond (1991) in column 9-11 which incorporates interaction terms between asset growth and Islamic bank dummy. In the GMM regression, the Hansen test statistics confirm the instruments of the model are valid and the first-difference residuals (AR(2)) have no second-order correlation. Our model survives the specification test.

Column 1-2 and column 5-6 show what happens when the asset growth is added to the leverage change model among IBs and CBs. The value of R-squares increases from 0.246 in column 1 (i.e. regression without asset growth) to 0.956 in column 2 (i.e. regression with asset growth), and asset growth in column 5-6 regressions' findings on CBs also shows its importance. It implies that adding the asset growth variable is able to increase the explanatory power of the model for IBs and CBs. Even though the results are not absolutely accurate, it can be seen that leverage are probably the main source for banks to grow their business which might include expanding the lending size or increasing the volume of securities investment.

In all regressions, the results display that the effect of the asset growth on leverage is significantly and economically positive at the 1% level. Further, the coefficients of lagged leverage in model (3.7) are shown as the adjustment of speed and the values are

significantly negative in columns 4 and 8, indicating that IBs and CBs are actively adjusting towards the desired capital structure and it supports results confirmed in table 5. The results show that both IBs and CBs show leverage procyclicality, as leverage changes and increase in asset are positively associated. IBs and CBs are likely to actively manage assets and liabilities and use adjustment leverage to increase investment in valuable assets. It may be because the benefits gained in the future drive banks to implement strategies to increase leverage. The findings are consistent with the evidence obtained from studies of Adrian and Shin (2010), Damar et al (2013) and Dewally and Shao (2013) in which procyclical leverage is proved to be an international phenomenon. It reveals the leverage procyclicality not only exists among financial institutions in developed economies.

Column 9-10 presents estimation containing interaction between Islamic bank dummy and asset growth. The interactions between the Islamic bank dummy and grow opportunities are included to see whether IBs and CBs hold separate views regarding using external debt to support growth opportunities. This coefficients obtained from the GMM regressions are significant across specifications.

In the evidence of GMM estimation, the coefficient of IB dummy and asset growth is significantly negative. Conventional banks show a more aggressive leverage procyclicality than IBs, because they have an advantage in external funding sources and can achieve leverage adjustments at faster and low cost. Islamic banks are not able to adjust leverage that easily and quickly, in that they face more restrictions in liquid funding channels. In the financial statements, the IBs' debt structure is relatively simple since the main source of funds is deposits. By contrast, in addition to deposits, traditional banks also have debt securities and various short-term borrowing funds. For CBs, the funding markets they face are more mature, which promotes leverage adjustments and their funding needs can be met more timely. It confirms the arguments of Dewally and Shao (2013) who assert that source of funding used by financial institutions does have an impact on the pro-cyclical leverage characteristics.

Due to the limited nature of Islamic financing instruments, Islamic banks are at a disadvantaged position compared with traditional banks in terms of fund mobilization. Therefore, it is necessary to create a wide range of innovative Islamic financial instruments. Diversified financing products will not only make Islamic banks more flexible to mobilize funds to support the development of their own assets, but could also reduce information asymmetry since funding suppliers might require banks to improve the accuracy and transparency of information. At the same time, regulators need to pay close attention to the pro-cyclical leverage of banks, especially in the economic booms and downturn, because improper leverage adjustment will bring great cost pressure to banks, thus increasing bank instability.

Table 3. 7 Leverage growth and asset growth

Column 1 and 5 are the results of following model (4). Column 2-4 and column 6-8 show the result of estimating model $\Delta Leverage_{i,j,t} = \beta_1 X_{i,j,t-1} + \beta_2 Leverage_{i,j,t-1} + \gamma_1 Asset\_growth_{i,j,t} + \gamma_2 Asset\_growth_{i,j,t} * IB + \varepsilon_{i,j,t}$, (3.7).

The definition of all the independent variables are listed in the Appendix A. FE, RE, GMM, and Full refers to fixed effects, random effects, dynamic GMM and full sample respectively. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Variables	(1)IB	(2) IB	(3) IB	(4) IB	(5) CB	(6) CB	(7) CB	(8) CB	(9) Full	(10) Full	(11) Full
	FE	FE	RE	GMM	FE	FE	RE	GMM	FE	RE	GMM
Speed of adjustment	0.495	0.125	0.083	0.253**	0.623***	0.150*	0.046**	0.316*	0.121*	0.049*	0.278**
	(0.301)	(0.074)	(0.048)	(0.077)	(0.168)	(0.070)	(0.016)	(0.175)	(0.054)	(0.022)	(0.086)
Profitability	0.174	0.335**	0.137	-0.051	-0.899**	0.136	0.114***	-0.205	0.260*	0.238***	-0.103
	(0.424)	(0.103)	(0.088)	(0.042)	(0.003)	(0.125)	(0.032)	(0.139)	(0.113)	(0.056)	(0.105)
IB *Profitability									0.113	-0.158*	
									(0.167)	(0.070)	
Size	-0.126***	0.032***	0.005	0.001	-0.122***	-0.014**	0.001	-0.001	-0.006	-0.001	-0.005
	(0.036)	(0.009)	(0.004)	(0.005)	(0.011)	(0.005)	(0.001)	(0.005)	(0.004)	(0.001)	(0.005)
IB*size											0.005***
											(0.001)
Collateral	-0.011	-0.029	0.004	0.026	0.053	-0.049*	0.009	-0.008	-0.035	-0.006	0.052
	(0.167)	(0.041)	(0.026)	(0.028)	(0.051)	(0.021)	(0.006)	(0.024)	(0.019)	(0.011)	(0.041)
IB*collateral											-0.470***
											(0.109)
Market-to-book	-0.109	0.001	-0.001	0.027	0.026*	-0.020***	-0.004**	0.004	-0.020***	-0.004	0
	(0.070)	(0.017)	(0.016)	(0.015)	(0.013)	(0.005)	(0.001)	(0.005)	(0.005)	(0.002)	(0.006)
IB *market to book											
Dividend dummy	0.019	-0.002	0	-0.004	0.041***	-0.001	-0.001	-0.008*	0	0	-0.006
	(0.035)	(0.008)	(0.008)	(0.006)	(0.011)	(0.005)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)

Variables	(1)IB	(2) IB	(3) IB	(4) IB	(5) CB	(6) CB	(7) CB	(8) CB	(9) Full	(10) Full	(11) Full
	FE	FE	RE	GMM	FE	FE	RE	GMM	FE	RE	GMM
IB* Dividend dummy											
Risk	0.045	0.007	0.002	-0.002	-0.003	0		0.004	0.001		0.012
	(0.034)	(0.008)	(0.007)	(0.006)	(0.007)	(0.003)		(0.002)	(0.003)		(0.003)
IB*risk											
								.			
Loan loss provision	0.340*	-0.002	0.038	0.022	-0.972**	-0.202	0		-0.002	0.049	
	(0.142)	(0.035)	(0.036)	(0.012)	(0.346)	(0.144)	(0.048)		(0.044)	(0.036)	
IB*loan loss provision											
LogZ			0.006				-0.003***				
			(0.006)				(0.001)				
IB*LogZ											.
Asset growth		0.912***	0.871***	0.874***		0.790***	0.892***	0.858***	0.798***	0.801***	0.887***
		(0.019)	(0.017)	(0.017)		(0.013)	(0.006)	(0.015)	(0.012)	(0.011)	(0.024)
IB*asset growth									0.080**	0.069***	-0.138*
									(0.025)	(0.020)	(0.055)
constant	3.507***	-0.607**	-0.05	0.156	3.405***	0.488***	0.029	0.238	0.262*	0.059*	0.352*
	(0.742)	(0.200)	(0.092)	(0.090)	(0.292)	(0.130)	(0.018)	(0.164)	(0.107)	(0.028)	(0.154)
Time fixed effects	NO	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO
Country fixed effects	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
Adjusted R-squared	0.246	0.956	0.951		0.197	0.863	0.967		0.883	0.879	
Hansen J-statistics (p-value)				0.569				0.12			0.457
Instruments				25				28			28
AR(1) (p-value)				0.099				0.001			0.003
AR(2) (p-value)				0.349				0.141			0.471
N	189	189	189	189	886	886	866	903	1075	1075	1118

3.5.4 Regulatory capital

The purpose of this section is to evaluate the influence of bank-level factors on the regulatory capital ratios of CBs and IBs. The regulatory capital ratios is relevant to bank capital structure because regulatory capital contains the common equity and other reserves. The national authorities impose minimum capital requirements on banks to ensure that banks maintain sufficient capital during unexpected losses and extreme economic downturns, and can continue to fund reputable clients (Altman and Sabato, 2005). Like traditional banks, Islamic banks are regulated by authorities and need to maintain capital at a certain level.

The Basel committee specifies Tier 1 capital ratio at least 4% and the sum of Tier 1 plus Tier 2 capital at least 8% of risk-weighted assets as the minimally acceptable capital ratios (Berger et al., 2008). Researchers expect banks to achieve the regulatory capitals close to the required minimum level as raising funds will increase the cost burden on banks (Ferri and Pesic, 2016). However, the IBs and CBs are observed to sustain the regulatory ratios significantly exceeding the required minimum ratio over the sample period (see table 3.4), motivating me to analyze the explanation for the variation of their capitals.

The bank regulatory capitals are regressed on IB dummy and a set of factors in the form of empirical specification as follows:

$$CAP_{i,j,t} = \alpha + \beta\ Islamic\_dummy_i + \gamma_1 B_{i,j,t-1} + \gamma_2 Islamic\_dummy_i * B_{i,j,t-1} + \varepsilon_{i,j,t,} \quad (3.8)$$

where $CAP_{\mathrm{i,j,t}}$ refers to the regulatory capital ratios of bank *i* in country j in year t. This study considers several measures of the regulatory capital ratios such as the sum of Tier 1 plus Tier 2 capital , Tier 1 capital[9] and capital buffer which are defined in Table 3.3.

[9] It consists of retained earnings and common equity.

$B_{i,j,t-1}$ is a set of time-varying variables including determinants of non-financial institutions' capital structure in section 3.5.1. Loan loss provisions reflect the cushion for the expected losses arising from banks loans, and it is predicted that banks with poor loan quality tend to increase their regulatory capital base.

The dummy variable IB equals one for Islamic banks and $\varepsilon_{i,j,t}$ is an error term. The coefficient of interaction term (i.e. the value of γ_2 in model 3.8) between Islamic bank dummy with bank characteristics is focused to identify whether IBs and CBs would manage the elements of regulatory capital in response to changes in bank characteristics. The advantage of including an interaction term is that its presence reduces the bias caused by missing variables.

3.5.4.1 Results

The empirical findings from model (3.8) estimation are presented in table 3.8. The interaction terms between IB dummy and bank-characteristic variables are incorporated. Regressions of Table 3.8 set sum of Tier 1 and Tier 2 (columns 1-4), Tier 1 (columns 5-8), and capital buffer (columns 9-12) as dependent variables to observe the regulatory capital difference in IBs and CBs. The results of random effects estimation, fixed effects estimation and dynamic GMM estimation are reported. Considering endogeneity issues, the GMM results (i.e. columns 3,6,9) are the focus of interpretation. The test for specifications show that estimation is valid because the regression estimated by dynamic GMM pass the AR(2) and Hansen *J* specification tests.

The Profit sharing investment account (PSIA) is unique to Islamic banks. Losses incurred by assets funded by the PSIA will be borne by the PSIA holders and might not affect the bank's own funds (Pappas et al, 2017). Because of holding the loss-absorbing investment account deposits as cushion, IBs may require less regulatory capital as

cushion compared to CBs. In addition, Islamic banks may have lower Tier 2 capital[10] ratios as they are prohibited from using debt tools that require interest payments. However, it is striking that the coefficients of Islamic bank dummy is positive across the regressions, implying the regulatory capital ratios of IBs in general are higher than CBs.

In columns 3 and 9, the coefficients of collaterals are significantly positive, indicating that the increase in the value of collateral is related to the increase in regulatory capital and capital buffers of CBs. The sum of coefficients of collateral and the term that interacts IB dummy and collateral show the negative association between collateralized assets and regulatory capital ratios of Islamic banks in regressions 3 and 9. For instance, the results display that an increase in collateral by 1% is linked to decreased regulatory capital by 0.09% in column 3. It implies that Islamic banks having more collateralized assets possibly don't need higher regulatory capital and capital buffer as these assets can be easily sold and are beneficial to Islamic banks' stability during financial stress. The coefficient of loan loss provision enters positive and is statistically significant by using dynamic GMM estimation in columns 3, 6, and 9, indicating conventional banks hold more regulatory capitals when loan quality deteriorates. The results are consistent with Distinguin et al (2013) who find that tier 1 regulatory capital increases in response to the increased loan loss provision[11]. The sum of coefficients of loan loss provision and interaction terms between IB dummy and loan loss provision is significantly negative across the regressions. It indicates that in contrast to conventional banks, Islamic banks don't raise additional regulatory capital ratios when credit risk increases, reflecting that IBs are less sensitive to the quality of loans than CBs.

[10] The Tier 2 capital is supplementary capital, including debt instruments such as mixed debt instruments, subordinated term debts, and general loan loss reserves.

[11] When the bank's loan quality is lower, the value of loan loss provision is higher.

In order to understand the sensitivity of bank regulatory capital to asset risk, this study pays attention to the coefficient of risk. In column 3 and column 9, the coefficient of asset risk is significantly positive, implying that the regulatory capital and capital buffer of conventional banks increase as asset risk increases. On the other hand, the increase in risk of IBs is not significantly related to increase in regulatory capital and capital buffer. Based on Islamic law, IBs' assets are centered on risk sharing, and the results here show that risk-based capital might not capture the risky characteristics of Islamic bank assets. It indicates that IBs are less able to adjust their regulatory capital levels to cope with risk exposure than CBs. Alternatively, this result may indicate that because investment account depositors share the risk of transactions, Islamic banks do not use regulatory capitals to offset the negative impact related to bank risks.

The results of this section show that IBs have more regulatory capital than CBs, but CBs are better than IBs in their ability to deal with loan quality and asset risk, in part because of the complex unique nature of IBs' transactions. It suggests the importance of strengthening the regulatory framework compliant with Islamic financial operations and improving the ability of IBs' regulated capital to adjust in reaction to risk.

Table 3. 8 Regulatory capital regressions

The table follows model $CAP_{i,j,t} = \alpha + \beta\, Islamic\_dummy_i + \gamma_1 B_{i,j,t-1} + \gamma_2 Islamic\_dummy_i * B_{i,j,t-1} + \varepsilon_{i,j,t,}$ (3.8).Tier 1 capital, capital buffer and regulatory capital are dependent variable. The fixed effects, random effects and system GMM estimation techniques are used. Standard errors are in parentheses. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

	(1) Regulatory	(2) Regulatory	(3) Regulatory	(4) Tier 1	(5) Tier 1	(6) Tier 1	(7) Capital buffer	(8) Capital buffer	(9) Capital buffer
	RE	FE	GMM	RE	FE	GMM	RE	FE	GMM
IB	0.342*		0.216	0.179		0.161	0.358*		0.218
	(0.158)		(0.152)	(0.171)		(0.134)	(0.157)		(0.148)
Profitability	-0.047	0.041	0.156	-0.154	0.004	0.299*	0.003	0.097	0.265
	(0.079)	(0.085)	(0.153)	(0.097)	(0.110)	(0.142)	(0.078)	(0.084)	(0.157)
IB*Profitability	-0.624**	-0.041	0.014	-0.151	0.471	-0.315	-0.674**	-0.097	-0.114
	(0.217)	(0.304)	(0.325)	(0.246)	(0.357)	(0.180)	(0.214)	(0.297)	(0.324)
Size	-0.005*	-0.013***	0.001	-0.005*	-0.012**	0.001	-0.005*	-0.012**	0.003
	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)	(0.005)
IB*size	-0.014*	-0.02	0.005	-0.006	-0.016	-0.005	-0.015*	-0.022	-0.004
	(0.007)	(0.013)	(0.003)	(0.008)	(0.014)	(0.006)	(0.007)	(0.012)	(0.007)
Collateral	0.021	0.052**	0.093***	0.013	0.029	0.106***	0.018	0.048*	0.099***
	(0.019)	(0.020)	(0.027)	(0.020)	(0.021)	(0.023)	(0.019)	(0.019)	(0.027)
IB*Collateral	-0.037	-0.037	-0.180*	-0.042	-0.059	-0.099	-0.034	-0.033	-0.178*
	(0.055)	(0.061)	(0.078)	(0.064)	(0.075)	(0.057)	(0.054)	(0.059)	(0.086)
MTB	0.001	0.005	-0.002	0.006	0.012**	-0.001	0	0.003	-0.003
	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)
IB*MTB	0.009	0.005	0	0.003	-0.003	0.005	0.01	0.007	0.001
	(0.017)	(0.018)	(0.010)	(0.017)	(0.018)	(0.009)	(0.017)	(0.018)	(0.011)
Dividend dummy	-0.002	-0.007	-0.008**	0	-0.006	-0.004	-0.002	-0.006	-0.007*
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
IB *dividend dummy	0.015	0.005	-0.007	-0.003	-0.019	-0.007	0.015	0.005	-0.008

	(1) Regulatory	(2) Regulatory	(3) Regulatory	(4) Tier 1	(5) Tier 1	(6) Tier 1	(7) Capital buffer	(8) Capital buffer	(9) Capital buffer
	(0.01)	(0.011)	(0.009)	(0.011)	(0.013)	(0.008)	(0.010)	(0.011)	(0.009)
Log(Risk)	0.003*	-0.001	0.009**	0.003*	-0.003	0.005*	0.003	-0.002	0.008**
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)
IB *log(risk)	0.017*	-0.014	-0.021***	0.015	-0.007	-0.003	0.017*	-0.014	-0.022**
	(0.008)	(0.011)	(0.005)	(0.009)	(0.012)	(0.007)	(0.008)	(0.011)	(0.007)
Loan loss provision	0.141	0.245*	0.875***	0.1	0.412**	0.619***	0.158*	0.260*	0.821***
	(0.100)	(0.106)	(0.135)	(0.136)	(0.149)	(0.126)	(0.099)	(0.104)	(0.118)
IB*loan loss provision	1.516***	-0.965*	-2.103***	-1.000*	-1.162*	-1.568***	1.492***	-0.980*	-2.080***
	(0.236)	(0.463)	(0.254)	(0.466)	(0.506)	(0.194)	(0.234)	(0.453)	(0.246)
Loans	-0.088***	-0.069**	0.083*	-0.095***	-0.098***	0.053*	-0.092***	-0.078***	0.081*
	(0.021)	(0.023)	(0.037)	(0.022)	(0.025)	(0.025)	(0.020)	(0.023)	(0.037)
IB*loans	0.04	0.166*	-0.159	0.042	0.140*	-0.007	0.047	0.174**	-0.151
	(0.051)	(0.065)	(0.095)	(0.054)	(0.065)	(0.045)	(0.050)	(0.063)	(0.098)
Constant	0.345***	0.552***	-0.028	0.318***	0.490***	-0.009	0.252***	0.440***	-0.116
	(0.053)	(0.081)	(0.092)	(0.058)	(0.089)	(0.093)	(0.053)	(0.079)	(0.101)
Time dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
Country dummies	YES	NO	NO	YES	NO	NO	NO	NO	NO
R-squared	0.27	0.115		0.113	0.129		0.278	0.128	
Hansen J-statistics (p-			0.534			0.502			0.419
Instruments			22			22			23
AR(1) (p-value)			0.082			0.874			0
AR(2) (p-value)		.	0.534			0.677			0.908
N	934	934	898	824	824	766	932	932	890

3.6 Conclusion

This study carries out the investigation to analyze the determinants of IBs and CBs' capital decisions in 22 countries between 1995 and 2015. This research contributes to bank capital structure literature by comparing the two different bank types and provides novel insights as follows. Firstly, IBs have lower book leverage than CBs, which could be due to Islamic banks' own features to have less diversified external financing sources. The book leverage of IBs and CBs respond significantly different to bank-specific factors, especially collateral. For CBs, the increase in the value of fixed assets makes them tend to increase their debt ratio. For IBs, although they are actively integrating into the mainstream financial market, non-professionals have difficulty understanding their business forms. As a consequence, when they have more collateral, their cost of information transmission is higher because of the lack of effective Information sharing mechanism.

Secondly, the evidence shows that IBs and CBs actively move towards the desired capital structure. It is in line with the view of Flannery (2012) who argue that even though many prior corporate finance studies exclude financial institutions because of their unique business model, traditional corporate finance theory perhaps work well to banks. In the findings, adjustment speed of IBs is lower compared to CBs, implying Islamic banks may face higher external financing costs and adjustment costs when they need to raise funds.

Third, it seems that both IBs and CBs choose to significantly increase debt when they intend to capture potential investment opportunities. Conventional banks are more incentivized to rely on debt financing as the funding source because they have more active interbank markets and various debt instruments compared to Islamic banks. It is necessary to create a wide range of innovative Islamic financial instruments. Diversified financing products will not only make Islamic banks more flexible to

mobilize funds to support the development of their own assets, but could also reduce information asymmetry by conveying the message to the market.

Finally, IBs have higher regulatory capital ratios than CBs and the regulatory capital, on average, exceeds the minimum required capital ratio in both IBs and CBs. The regulatory capital of CBs is more active and timely in responding to the asset risk exposure and deteriorated loan quality than IBs, reflecting the weakness of the Islamic banking regulatory framework to deal with asset uncertainty. While Islamic financial products have increased the complexity of regulation, it shows that IBs need a regulatory framework to help address the major risks inherent in IB operations and to establish a level playing field with CBs.

This research has practical implication for regulators, policymakers and bankers who need to understand the different capital structure behaviors of banks. The limited financing channels and relatively high capital costs of Islamic financial institutions need the support of regulators to expand the financing sources of Islamic financial institutions, design more debt instruments in line with Islamic rules, and reduce the financing costs of Islamic banks. In addition to implementing a unified regulatory framework and standards for all banks within countries having dual banking systems, it is necessary to implement specific guidelines to address the inherent asset risk issues of IBs.

Chapter 4 Risk sensitivity analysis of Islamic Bank's minimum regulatory capital

4.1 Introduction

After the global financial crisis, cautious investors are looking for alternative forms of financial products that are more ethical, not involving speculation and are less prone to crisis. In addition, the global Muslim population is growing, and religious customers have more demand for Islamic-compliant financial products and services. So in recent years, the Islamic financial market share has grown rapidly. Although the development of Islamic finance offers customers more choices in terms of products and services, the unique profit-sharing transactions of Islamic banks has increased the complexity of capital adequacy framwork designed for Islamic financial institutions. Islamic banks need a strong regulatory framework, and capital requirements and risk management are important components of the regulatory system. RWA and capital requirements which are key indicators disclosed in the annual reports play a crucial role in establishing a dynamic regulatory framework and enhancing their linkages to risk will promote stability in Islamic banking services. The question focused by this work is: can the risk-weighted assets and capital requirements among IBs be able to sufficiently capture the market-based asset risk? Further, whether bank regulations can make RWA of IBs more risk-sensitive.

Abedifar et al (2013) focus on the analysis of the main risks faced by Islamic banks (such as credit risk and financial stability risk) and find that Islamic banks do not seem to emulate traditional banks to manage risk and stability. This provides policymakers with an inspiration to consider how to develop separate regulatory rules for IBs. Based on past research, this chapter incorporates the exploration of regulated risk and capital requirements of Islamic banks because from the experience of the 2007 financial crisis, when capital requirements are not closely related to market-based asset risks, the capital

adequacy of banks often fails to ensure the soundness of financial institutions. In order to promote the stability of Islamic financial institutions, this seems to be an interesting research perspective. This article will take into account the uniqueness of Islamic banks and hopes to draw constructive conclusions.

Current research has questioned the risk-weighting methodology and effectiveness of capital requirements designed for conventional banks.For instance, banks in the US and in European countries suffered huge losses during financial crisis and have been found to have little or no corresponding increase in the minimum required capital when facing substantial increases in overall economic risk (Vallascas and Hagendorff, 2013). It is because current capital calculation methods and risk management might not capture the exposure of the underlying transactions in complex financial innovation transactions (Ferri and Pesic, 2016). The loopholes in the risk assessments can overstate regulatory capital and provide space for banks to engage in high risk transactions while hold less required capital (Rime, 2001; Mariathasan and Merrouche, 2014). Additionally, insufficient required capital in response to increased asset risk might also expose banks to severe vulnerability in the case of adverse shocks, finally causing expensive bailout for goverments. Nevertheless, the reaction of capital requirement to asset risk in Islamic banks have almost not been examined. Whether capital requirements give Islamic banks a strong protective shell depends heavily on the state of risk management. Only by arranging appropriate risk weights for different transactions, it is possible to maximize the positive effects of capital requirements.

The contribution of this empirical study is firstly to find out whether regulatory risk and capital requirements can actively respond to increased risk of Islamic banks' assets. Then, it figures out the regulatory reform practices that enhance the risk sensitivity of RWA and minimum capital of Islamic banks. Regulatory risk (i.e. measured by risk-weighted assets) constitutes the basis for processing capital requirements because the minimum required capital is equal to the risk-weighted asset multiplied by a certain ratio (ie, the ratio recommended by the Basel Rules is at least 8%). The investigation

strategy used to measure portfolio risk follows the model developed by Vallascas and Hagendorff (2013) which is the application of option pricing model in valuation.

The results of this chapter first show that the relationship between the regulatory risk (i.e. risk-weighted assets) of Islamic banks and the risk of bank portfolios is weak, which means that the ability of these regulated variables to capture asset risks is not as strong as expected. On the one hand, this phenomenon is due to the insufficient ability of Islamic banks to identify and classify asset risks. On the other hand, Islamic banks in different countries have adopted divergent accounting disclosure standards (such as IFSB, AAOIFI or local accounting standards) (Karim, 2001;Kamla and Haque, 2019). These guidelines for certain Islamic financial transactions are not strict enough, which has given some IBs the opportunity to evade the holding of minimum capital by reducing the records of relatively high-risk assets. Therefore, the relatively weak connections of these variables may be related to the unique characteristics of Islamic banks, and such speculation seems reasonable from the results derived below.

Secondly, the study finds that the increase of risk-based capital is insufficient in response to the increased portfolio risk when Islamic banks have more investment deposits. The risk-sharing Investment deposits are Islamic banks' unique product (Obaidullah, 2005). Since investment deposits based on PLS are dominant in Islamic banks, the risks of Islamic banks theoretically can be transferred to PLS depositors, resulting in the relationship between required minimum capital and asset risk not that close (see formula in Appendix B.1). Apart from that, the results show that Islamic banks with high-risk asset portfolios do not need to hold significantly more minimum required capital when adopting IFSB standards[12] (i.e. Islamic Financial Services Board). It is because the IFSB standards specify that the risk of assets supported by PLS deposits can be ignored and these assets do not require corresponding capital charges (Archer and Karim, 2009). The results can also be explained from another way. It may

[12] The Islamic Financial Services Board (IFSB) provides global prudential and guidelines to enhance the stability of the Islamic financial industry.

be that the Islamic banking capital supervision system is not mature enough, and the risk sharing nature of Islamic banks makes the outcome of supervision more ambiguous.

Finally, regulatory reforms really matter to the capital requirements of Islamic banks because Islamic banks' minimum regulatory capital becomes more risk-sensitive in countries where there are less barriers for private agents to monitor firms and supervisors have powers to take prompt actions according to the pre-agreed standards to change behavior in weak banks.

The findings have the implication to improve the understanding of policymakers and regulators about the reason of weak association between capital requirements and asset risk in Islamic banks. Due to the nature of risk sharing, the issues that Islamic banks face seem more complicated regarding risk management and capital requirements. In order to provide greater certainty and confidence to investors and consumers, it makes the financial reporting of Islamic banking institutions more important in providing information about their specific transactions. Islamic banks probably should pay more attention on "how to" strengthen risk governance, increase the transparency of information and adapt to the changes of Islamic financial capital frameworks. On the other hand, regulators are expected to combine risk-sensitive methods with flexible regulatory instruments to improve the stability of Islamic banks.

This section has the following structure. Section 4.2 summarizes the literature review and presents hypotheses. Section 4.3 shows description of the data and variables. The methodology is discussed in Section 4.4. Section 4.5 provides the the results analysis the study. Section 4.6 displays the conclusions.

4.2 literature review and hypothesis development

The Basel regulatory capital framework relies heavily on the calculation of risk-weighted assets (RWAs) and sets the RWAs as the denominator for the risk-capital ratio,

which places measuring risks at the centre of determining the capital adequacy of banks (Von Thadden, 2004). Risk-weighted assets provide a reasonable measure of a bank's risk to ensure that the capital allocated to the asset is consistent with the risk (Le Leslé and Avramova, 2012). However, the robustness of risk evaluations is often questioned, which causes the doubts in the accuracy of capital levels. If the risk-weighted assets could not track the market measure of actual risk, banks have the incentive to use the gap between regulatory treatment of transactions and economic substance to reduce the cost of regulatory capital (Heid, 2007). Theoretically, Jones (2000) acknowledges that innovative financial products and asset-based securities have allowed banks of the US and EU to escape the reach of financial regulators in risk measurement. Such actions could boost the regulatory capital and give the illusion that banks have the ability to absorb potential unexpected losses caused by high-risk products. On the other hand, Mariathasan and Merrouche (2014) find that the bank's RWAs do not reflect the actual risky assets, questioning the accuracy of risk-weighted asset calculations and inferring that risk measurement models need improvement.

By reviewing the annual reports of Islamic banks in various countries, I find that they disclose the results of risk management and capital requirements as separate parts and consider these to be an integral part of the bank's decision-making process. Sundararajan and Errico (2002) suppose that national regulatory agencies have developed adaptive risk management frameworks for IBs, which could enhance the risk control capabilities of these banks.

While the original intention of regulators is to ensure the safety of Islamic banks by establishing various frameworks, implementation may be less effective because of the certain issues. Firstly, in terms of assets, Islamic banks' unique financial products have different risk characteristics, which increases the difficulty of risk-weighting allocation. A leasing-based financial business (i.e. based on non-PLS model) is considered less risky, while the PLS modes of Islamic financing (such as equity investment) is more risky (Sundararajan and Errico, 2002). It is because in PLS transactions, the lack of

control over investment projects and allowing for absence of collateral and other guarantees could increases the overall risk of Islamic banking. This makes the steps to identify possible risks in the activities of Islamic financial intermediaries different from traditional banks. In addition, because of the unique nature of IBs operations, there is more uncertainty in the risk calculations for each asset, each portfolio, and the entire intermediary.

Secondly, due to the risk-sharing nature of profit-loss sharing investment accounts (PISA), the proposed guidelines for Islamic banks in countries show that regulators have discretion to determine the share of PSIA-funded risk-weighted assets that can be deducted from total risk-weighted assets (Hussain et al, 2015). The PSIA is treated this way because the investment account owner is considered to be responsible for the loss of the investment, so the assets supported by these investment funds are not at risk. This particular regulatory treatment might make it impossible for RWAs to have the ability to sufficiently (i.e. sufficient here means that one percent of the increase in asset risk corresponds to an increase of one percent of RWAs) capture changes in asset risk.

As a consequence, on the one hand, the risk weighting to which Islamic financial products are allocated may sometimes not capture the risk nature of the product, and on the other hand these banks' RWAs have a special treatment for products conducted under Islamic principles. All these hinder the RWAs of IBs to adequately respond to changes in portfolio risk, so the assumption is proposed as:

Hypothesis 1: Risk-weighted assets do not sufficiently capture changes portfolio risk in Islamic banks.

Some authors suppose that bank negligence in risk-weighted asset management can cause the corrosion of capital requirements (Jones, 2000;Vallascas and Hagendorff, 2013). For instance, Vallascas and Hagendorff (2013) find the relationship between regulatory capital requirements and asset risk is weak through empirical research, and

they suggest that the weak association diminish the effectiveness of bank capital rules because the emergence of asset securitization and other financial innovations may escape the calculation of risk-weighted assets, and the shortcomings of RWAs (i.e. it is the denominator of regulatory capital) may result in no increase in regulatory capital when the actual risk of innovative assets increases. From this result, it can be seen that risk management outcome and effectivenes of capital requirements are inseparable.

Similarly, for Islamic banks, their risk management and capital requirements are also relevant because the central banks of some countries where Islamic banks are located have adopted the standards established by Basel Committee to set capital adequacy guidelines on the basis of risk-weighted assets. In other cases, some countries follow the way recommended by IFSB to calculate capital adequacy ratios which ensure that Islamic banks have sufficient funds to capture asset risk (Muljawan et al, 2004). According to the broad international standards defined by the Basel Committee and the IFSB, the Islamic banks' capital adequacy ratio should be at least 8% of the risk-weighted assets.

There is a view that capital requirement ratios are not that relevant to IBs because the PISA business can absorb losses and help reduce the risk of these banks. However, this is only a theoretical perception, Abdul Karim et al (2014) found that capital requirements of IBs should not be underestimated, since this requirement actually affect the bank lending behavior. Even though the minimum capital requirement derserves attention, due to the risk challenges faced by Islamic Bank, there is reason to believe that the minimum capital under supervision has limited ability to capture asset risks. Firstly, as discussed in Hypothesis 1 for risk-weighted assets, the deficiencies in the risk classification of Islamic financial operations can also hinder the allocation of reasonable regulatory capital to the corresponding assets. In addition, assets supported by PISA are allowed to have capital relief, which makes the relationship between capital requirements and asset risks not that close. Based on the above discussion, the second hypothesis is proposed as:

Hypothesis 2: The minimum capital requirement does not adequately capture changes Islamic Bank's portfolio risk.

4.2.1 Investment deposit and IFSB standards

Unlike deposit sources of CBs, Islamic banks' funds can come from PSIA. The proceeds from the Islamic bank's investment by using the funds of this investment account are shared with the account fund holders (Elnahass et al, 2014). The capital requirements of banks inevitably need to adapt to the risk and profit sharing model of Islamic finance, creating a favorable environment for the Islamic banking industry and improving their competitiveness (Archer and Karim, 2009).

There are some empirical studies that explore the role of PISA in the regulatory framework. Muljawan et al (2004) come up with the approaches for standardizing the capital framework of Islamic banks by taking the PISA into consideration, and suggest the Basel Capital Adequacy Framework to carry out special regulatory design for Islamic banks to improve the quality of Islamic financial business information. In opposite to the optimistic perspective, Song and Oosthuizen (2014) and Daher et al (2015) observe that when assessing RWAs and capital adequacy ratios, national regulators have the power to decide whether to deduct PLS-funded risk assets from risk-weighted assets. However, each country's calculation method for processing this deduction is inconsistent, and the whole process lacks sufficient information disclosure. As a result, the inaccurate assessment of the regulated risk factors caused by PISA is likely to result in insufficient capital for Islamic banks, which ultimately poses a threat to their stability.

Given the intention of using the profit-sharing investment account as a powerful risk mitigation, investment deposit accounts inevitably have an impact on regulatory capital and RWA. It is expected that Islamic banks don't need to hold sufficient required capital

in response to increased portfolo risk when they have more investment account deposits (Archer et al, 2010). Because the risk-sharing investment deposits owned by Islamic banks provide another layer of protection (Ariss and Sarieddine, 2007;Mollah et al, 2016), the hypothesis is constructed as follows:

Hypothesis 3: When the investment deposits increase, minimum regulatory capital required by Islamic banks is significantly associated with portfolio risk.

In December 2005, IFSB publishes standards for banking institutions that provide Islamic financial services and products based on the Sharī`ah rules and Basel II guidelines (Archer and Karim, 2007;Bourkhis and Nabi, 2013). The objective the IFSB is to guide financial institutions offering Islamic financial services and provide supervisors with principles to implement. While following Basel rules to set out sound practices to measure credit, market and operational risks of financial institutions, IFSB provides a discretionary formula to calculate capital adequacy and risk weighting assets that are consistent with the Sharī`ah risk−sharing principles.

In theory, assets financed by PLS investment accounts are allowed to enjoy capital relief, as the loss of assets funded by the investment account will be borne by IAH. Correspondingly, guidelines in the IFSB practically approve that the proportion of RWAs financed by investment account can be excluded from the total RWAs when calculating capital adequacy ratios (Archer and Karim, 2009). Hassan and Aliyu (2018) support the view that the establishment of IFSB ensures the stability of Islamic financial institutions because the international standards conforming to Islamic Shariah principles have been widely accepted by countries with Islamic banks. In contrast, due to the lack of mandatory enforcement, Archer and Karim (2009) find voluntary adoption of the IFSB Principles is the most common practice in Islamic financial practice countries, which creates uncertainty for the impact of IFSB on Islamic banks' risk management. These discussions are still at the theoretical level, and empirical

research has not yet tested the role of IFSB.

Based on the above views regarding the impact of IFSB in Islamic banks' risk management and capital requirements, this study assesses empirically whether implementation of IFSB affects the ability of minimum required capital in capturing portfolio risk among Islamic banks. This research test the hypotheses as follows:

Hypothesis 4: the influence of IFSB on the association between capital requirement and portfolio risk of Islamic banks is significant.

4.2.2 The bank regulation

Past research has found that bank regulations have positive effect on bank performance (Anginer et al, 2014;Baker and Wurgler, 2015;Barth et al, 2013;Fernández et al, 2010). In the findings of Barth et al (2004), bank development will be improved in a more transparent information environment, and when the prevention or corrective actions imposed by regulators are reduced. Capital regulation can effectively reduce the bankruptcy risk of banks because banks are required to have enough funds to absorb losses (Beltratti and Stulz, 2012). Although these regulations are usually designed for CBs, IBs are often affected by these regulatory reforms. This is because the sharing of information through the same regulatory approach to IBs and CBs can help Islamic banks understand the changes in the international financial regulatory environment, and better integrate IBs into international financial markets.

On the other hand, the effectiveness of these regulatory approaches on IBs are controversial. Song and Oosthuizen (2014) suppose that in the dual banking system, the regulatory practices supported by the central bank and the Basel core principles apply to all financial institutions. However, these requirements do not address the particularities of Islamic banking operations, so the impact of these regulations in strengthening IBs risk management may be very limited. In opposite, there are some

empirical studies that demonstrate the positive impact of international regulation elements on IBs (Abedifar et al, 2013;Alam, 2014). For instance, Alam (2014) find that less information barrier will decrease the credit risk of Islamic banks. This research also predict the influence of regulatory practices recommended by Basel Committee is positive. It is because the development of Islamic banks is slightly backward to conventional banks, which requires reasonable supervision to help them improve their risk system. By learning the traditional bank's experience with capital requirements and risk frameworks, Islamic banks might be able to increase their capabilities in these areas and become more competitive. In detail, this section tends to analyze whether bank regulations (including capital regulation, regulatory power, restrictions on transactions, private monitoring, prompt corrective action power) affect the ability of IBs' capital requirements to capture portfolio risk and the final hypothesis expects that:

Hypothesis 5: Bank regulations could increase the ability of Islamic banks' capital requirements in capturing portfolio risk.

4.3 Data and variables

This study first obtains data from 189 Islamic banks in Bankscope. Owing to the constraint of data availability, the final sample include 112 banks from 22 countries covering the period between 2004 and 2015 on a yearly basis. The distribution of banks in countries is presented in Table 4.1. Data related to financial statements are derived from the Bankscope database, the equity return data is obtained from Datastream and the source of data for macroeconomic variables is the World Bank database. In addition, I hand collected the data of investment account deposits and IFSB information from annual reports of the period 2004-2015. The extreme outlier observations are removed at the 1% and 99% levels. The descriptions of variables are shown in table 4.2.

Table 4. 1 Sample distribution by country and year

This table describes the distribution of samples in various countries. It contains 112 banks that exist between 2004 and 2015. The percentage of banks and the number across countries are given in columns 2 and 3.

country	Banks N (%)	Number
Bahrain	17.86%	20
Bangladesh	4.46%	5
Cayman Islands	0.89%	1
Egypt, Arab Rep.	2.68%	3
Gambia, The	0.89%	1
Indonesia	2.68%	3
Jordan	1.79%	2
Kuwait	7.14%	8
Lebanon	1.79%	2
Malaysia	12.50%	14
Mauritania	0.89%	1
Pakistan	10.71%	12
Qatar	3.57%	4
Saudi Arabia	2.68%	3
Singapore	0.89%	1
Sudan	8.93%	10
Syrian Arab Republic	0.89%	1
Tunisia	0.89%	1
Turkey	5.36%	6
United Arab Emirates	7.14%	8
United Kingdom	1.79%	2
Yemen, Rep.	3.57%	4
total	100.00%	112

Table 4. 2 The description of variables

Variable	Description	Source
RWATA	Measured by the ratio of risk-weighted assets to total assets.	Vallascas and Hagendorff (2013)
Volatility	This variable represents the risk of a bank's portfolio derived from the calculation of the option pricing theory model. (see Black Scholes method for equity valuation in section 4.3.3).	Esty (1998);Löffler and N. Posch (2007); Vallascas and Hagendorff (2013)
Minium required capital	The minimum total capital required to be held by banks.	Annual reports.
Size	Natural logarithm of total assets	Vallascas and Hagendorff (2013)
Profitability	Operating income over total assets	Jokipii and Milne (2011)
Buffer	Total regulatory capital ratio minus minimum required capital ratio (i.e. the minimum capital requirement ratio of different countries are not the same, and time might not be the reason for the varied ratios. For example, some banks strictly follow the requirements of Basel II to set a minimum capital ratio of 8%, while some will accept 11.5% or 12.5%.).	Jokipii and Milne (2011)
Deposit	The ratio of total deposits over total bank assets.	Vallascas and Hagendorff (2013)
Loan ratio	Total loans divided by total assets.	Vallascas and Hagendorff (2013)
Noninterest rate	The ratio of noninterest income to total operating income.	Vallascas and Hagendorff (2013)
Basel II	This is a dummy variable. Its value is equal to 1 for banks following the Basel II standard and zero otherwise.	Vallascas and Hagendorff (2013)
Basel III	This is a dummy variable. Its value is equal to 1 if the bank adopts the Basel III standard or in the transition period to the Basel III, and otherwise it is equal to zero.	Annual reports and the central bank information.
IFSB	It is a dummy variable. Its value is equal to 1 if the bank follows the IFSB standard, and zero otherwise.	Annual reports and the information in the central banks.

Variable	Description	Source
Investment account deposit	Profit loss sharing investment account ratio is measured by the ratio of total investment deposits to total assets.	Daher et al (2015). Annual reports data.
GDP growth	Annual growth rate of GDP	World bank data

4.3.1 Risk-weighted assets

Islamic Bank's risk-weighted assets (RWAs) are often required to be disclosed in the annual report. A deeper understanding of RWA's sensitivity to portfolio risk will help to strengthen the convergence of Islamic banks' RWAs calculation and improve RWAs disclosure and monitoring. The data of RWAs are obtained from checking the annual reports of individual banks. The reported risk-weighted assets reflect Islamic banks' real world exposure to potential losses, and the results are calculated by allocating risk weights to each asset class in accordance with the risk weighting methodology in Basel guidelines and IFSB standards (Ariss and Sarieddine, 2007;Song and Oosthuizen, 2014).

4.3.2 Capital requirements

Regulators require Islamic banks to hold minimum capital as buffer against unexpected losses (Acharya and Richardson, 2009). The minimum capital ratio in many countries should be at least at 8% of the banks' risk-weighted assets. However, Jokipii and Milne (2008) find that the capital requirements of different countries are divergent due to the strictness of bank capital regulation. The study considers changes in the minimum capital required between jurisdictions and find that countries with sample banks set the minimum regulatory capital ratio between 8% and 12.5%. Then, the minimum capital requirement ratio of individual banks was obtained from the annual

reports.

4.3.3 Portfolio risk

Merton (1974) calculates asset volatility through the application of option pricing model in firm valuation, and asset volatility refers to the standard deviation of fluctuations in asset value. I intend to obtain the market-based asset risk following Merton's model :

$$\sigma_{Equity} = \sigma N(d_{1,t})\, Asset_t / Equity_t \quad , \qquad (3.1)$$

where $Asset_t$ is face value of the company's total assets at time t; $Equity_t$ is the value of firm equity at time t; σ_{Equity} represents the equity volatility, and σ stands for the market-based asset volatility. N(.) is the cumulative normal distribution , $d_{1,t} = \frac{\ln(Asset_t/Liability_t)+(r_f+\sigma^2/2)T}{\sigma\sqrt{T}}$, $N(d_{1,t})$ denotes the probability that the present value of total assets exceeds the current liability, and T is the maturity date, which equals one (Nielsen, 1992). Nevertheless, the value of market-based asset fluctuations is unobservable and the model (3.1) alone cannot calculate asset volatility, which makes the second equation necessary (Flannery and Giacomini, 2015;Vallascas and Hagendorff, 2013).

The second formula links the value of firm's equity with the volatility of firm's value as introduced by Merton (1974). The model shows that the company's equity and value are related because the value of the company's equity is a function of the company's value and it is presented as follows:

$$Equity_t = Asset_t N(d_{1,t}) - Liability_t e^{-r_f T} N(d_{2,t}) \quad , \qquad (3.2)$$

where $Equity_t$ is the value of market equity for a firm at time *t*, which is calculated by multiplying the stock price in the market by the number of outstanding shares; $Asset_t$ is face value of the company's total assets at time t; $Liability_t$ is the value of firm

debt at time t. $d_{2,t} = d_{1,t} - \sigma\sqrt{T}$ and $N(d_{2,t})$ refers to probability rate that the option will be exercised (Nielsen, 1992). $e^{-r_f T}$ is a discounted factor where r_f is the risk-free rate.

To calculate the asset volatility, an iterative procedure is required and two non-linear equations (i.e. equation 3.1 and equation 3.2) can be used to produce the outcome. It has been mentioned by Bharath and Shumway (2008) that it needs an iterative process for solving nonlinear equations. It takes several steps to use the above equations (3.1) and (3.2) to determine the asset volatility (Vassalou and Xing, 2004). the Excel solver is adopted in this study to find the best values for the volatility for the preceding system of equations. The volatility is proxied as the market-based indicator for the overall asset portfolio risk of Islamic banks.

4.3.4 Others factors

Bank-specific variables

Besides focusing on the portfolio risk measured by asset volatility as the independent variable, I have briefly considered the theory relating to the effects of other underlying factors. Table 4.3 summarizes the variables included in the empirical study.

Table 4. 3 Summary statistics

	N	Mean	Median	Standard deviation (SD)
RWATA	604	0.782	0.705	0.46
Volatility	440	0.11	0.074	0.124
Size	822	14.09	14.299	1.843
Profitability	822	0.01	0.01	0.062
Buffer	473	0.123	0.049	0.224
Deposit	786	0.803	0.911	0.239
Loan ratio	817	0.443	0.491	0.28
Noninterest rate	803	0.494	0.301	2.124

	N	Mean	Median	Standard deviation (SD)
Basel II	1344	0.262	0	0.438
Basel III	1343	0.056	0	0.229
IFSB	1343	0.284	0	0.203
GDP growth	1323	0.014	0.022	0.045

Size: equals to the log of total assets of banks. Large banks may report lower RWA values because they can participate in diverse activities to spread the risk.

Profitability: measured by the return on assets. This variable could have an ambiguous anticipated sign and it is possible that banks with higher profits may be required to hold higher minimum capital ratio (Jokipii and Milne, 2008).

Deposit: defined as the ratio of deposits and short-term funding to total bank assets, and banks with more deposits have a more stable funding base (Beltratti and Stulz, 2009).

Loans: refers to ratio of total loans to total assets. Lending activities usually involve risks and thus increase regulatory risk assets (Guidara et al, 2013). Banks expanding their loan portfolios could build up their regulatory capital (Stolz and Wedow, 2011).

Non-interest income: generated from Non-interest activities such as service fees, fee income and other types of transactions (Stiroh, 2004). Increased non-interest income can provide diversified returns to traditional income portfolios to avoid potential losses. It may be reasonable to predict lower capital requirements for banks with a diversified portfolio.

Capital buffer: the ratio of excess capital to total assets according to Ferri and Pesic (2016). Capital_buffer/total_assets is the ratio provided by annual reports and the Bankscope database according to the following formula:

$$\frac{\text{Capital buffer}}{\text{RWAs}} = \frac{\text{Capital buffer}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{RWAs}}$$

$$\frac{\text{Capital buffer}}{\text{Total assets}} = \frac{\text{Capital buffer}}{\text{RWAs}} \times \frac{\text{RWAs}}{\text{Total assets}}$$

Macroeconomic variables

Basel dummies: If an Islamic bank adopts Basel II in a given year, then the dummy variable is equal to one, otherwise zero. Similarly, when an Islamic bank adopts the Basel III capital framework, the value of the Basel III dummy variable is one, otherwise zero. These two variables are obtained by observing the annual report of the sample banks.

IFSB: The dummy variable IFSB equals one if an Islamic bank follows the capital requirements of Islamic Financial Services Board (IFSB), and zero otherwise.

GDP growth: this variable is a proxy for changing economic conditions. The GDP growth of countries is controlled to capture movements in RWA over the business cycle (Mariathasan and Merrouche, 2014).

4.3.5 Description of data

Table 4.4 focuses on the impact of asset volatility on RWA and capital requirements across individual Islamic banks. The banks were sorted into two groups asset volatility. The first group consisted of those banks whose asset volatility is higher than the median value. The second group comprises those banks with lower than the median asset volatility (the median asset volatility is 7.38%).

Table 4. 4 Univariate test

The definition of RWATA is given in table 4.2. Asset volatility is calculated from application of option pricing model in company valuation, and it refers to the market-based bank portfolio risk. This study divides banks into two sets based on the median value of asset volatility.

Panel A	Low asset volatility	High asset volatility	Mean test
Mean asset volatility (%)	3.98	21.05	
N	159	158	
Mean RWATA (%)	65.41	82.93	16.51***
N	134	468	
Mean capital requirements (%)	7.14	8.71	1.56***
N	133	406	

Panel B	Low asset volatility	High asset volatility	Mean test
Basel II			
Mean RWATA (%)	78.65	79.8	1.15
N	370	553	
Mean capital requirements (%)	8.47	8.51	0.04
N	360	491	
Basel III			
Mean RWATA (%)	70.99	81.06	10.07
N	180	491	
Mean capital requirements (%)	7.55	8.62	1.07
N	179	429	

The RWAs (i.e. risk-weighted assets) of banks with high portfolio risk (82.93%) are significantly higher than banks with low portfolio risk (65.41%) in Panel A of Table 4.3. The results support the idea that regulatory risk assessment of Islamic banks is positively related to market-based asset risk. When this research compares the capital requirements between high asset volatility banks (capital requirement = 8.71%) and low asset volatility banks (capital requirement = 7.14%), it finds Islamic banks with high-risk assets have higher levels of capital requirements.

With the development of international financial standards and changes in requirements, IBs are gradually being required to accept the same rules as CBs, which also promotes the integration of Islamic banks into the international market (Mejia et

al, 2014). For example, although Basel standards are designed to regulate conventional banking operations and risk management, Islamic banks in the same country are subject to this regulatory framework. This research covers the impact of Basel II and Basel III[13] on Islamic banks. The results of Group B in Table 4.3 indicate that when portfolio risk increases, capital requirements under Basel III (1.07%) increase more than under Basel II (0.04%). It seems that Basel III is more able to improve the association between Islamic banks' capital requirements and asset risk (Sundararajan, 2008).

4.4 Methodology

In countries where Islamic banks have systemic influence, the minimum capital requirement is at least 8% of RWAs (Mariathasan and Merrouche, 2014). The current focus on capital rules also involves a more fundamental issue: regulatory capital is not set and exist out of thin air, it relies on the risk management of banks. Therefore, the relationship between capital requirements and market asset risk is based on the assocation between regulatory risk and market asset risk. Whether regulatory measure of bank portfolio risk reflects the true portfolio risk of banks is worth studying. If these two risks do not have signification association, Islamic banks might try to circumvent the capital system by investing in risky assets, thereby maximizing returns while reducing capital requirements. In the regressions below, risk weighted assets and capital requirements are both used as the dependent variables. Because of the close relationship between the two variables, risk-weighted assets is used here as a representative.

The following model is used to observe the relationship between RWA and asset risk :

$$\text{RWATA}_{i,t} = \alpha + \beta_1 \text{RWATA}_{i,t-1} + \beta_2 \text{Volatility}_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad , \quad (4.1)$$

[13] Basel III, which is gradually implemented in phases from January 2013 to January 2019, aims to improve the quality and quantity of minimum capital requirements for banks.

where $RWATA_{i,t}$ is the ratio of risk weighted assets to total assets. X is a vector of control variables including bank-specific variables and macroeconomic characteristics. Table 4.2 describes the definition and source of the variables.

The two-step generalized moment method (GMM) is the main method of this study to link asset volatility to RWA and capital requirements of IBs. The advantage of this model is that it can deal with unobserved heterogeneity and simultaneity, which are two sources of endogeneity (Wintoki *et al.,* 2012). The estimation procedure contains two equations. In the first stage, equation (4.1) is written in the first-differenced form:

$$\Delta RWATA_{i,t} = \alpha + \beta_1 \Delta RWATA_{i,t-1} + \beta_2 \Delta \text{Volatility}_{i,t} + \gamma \Delta X_{i,t} + \Delta \varepsilon_{i,t} \quad , \quad (4.2)$$

where first differencing reduces the bias that stems from time-invariant unobserved heterogeneity. However, it is possible that differencing equations could reduce the power of tests owing to the reduction of variation in the independent variables. Arellano and Bover (1995) argue that by including two equations and including valid instrumental variables in the estimation process, the disadvantages can be mitigated to improve the dynamic GMM estimation. This leads to a system GMM estimator by regressing the following for hypothesis one:

$$\begin{pmatrix} RWATA_{i,t} \\ \Delta RWATA_{i,t} \end{pmatrix} = \alpha + \gamma \begin{pmatrix} RWATA_{i,t-1} \\ \Delta RWATA_{i,t\text{-}1} \end{pmatrix} + \beta \begin{pmatrix} \text{asset volatility}_{i,t} \\ \Delta\text{asset volatility}_{i,t} \end{pmatrix} + \varphi \begin{pmatrix} X_{i,t} \\ \Delta X_{i,t} \end{pmatrix} + \begin{pmatrix} \varepsilon_{i,t} \\ \Delta \varepsilon_{i,t} \end{pmatrix} (4.3).$$

The test for second-order serial correlation of first differenced residuals AR(2) and Hansen J tests for valid instruments are used to ensure the consistency of estimators according to Arellano and Bond (1991) and Blundell and Bond (1998). The investment deposits and interaction of investment deposit and asset volatility is added to equation 4.3 for testing hypothesis 3 as in equation (4.4). The testing of hypothesis 4 will be similar to equation 4.4 by replacing investment deposit with IFSB variable.

$$\begin{pmatrix} RWATA_{i,t} \\ \Delta RWATA_{i,t} \end{pmatrix} = \alpha + \gamma \begin{pmatrix} RWATA_{i,t-1} \\ \Delta RWATA_{i,t\text{-}1} \end{pmatrix} + \beta \begin{pmatrix} \text{asset volatility}_{i,t} \\ \Delta\text{asset volatility}_{i,t} \end{pmatrix} + \vartheta_1 \begin{pmatrix} Investment\_deposit_{i,t} \\ \Delta Investment\_deposit_{i,t} \end{pmatrix}$$
$$+\vartheta_2 \begin{pmatrix} investment\_depsit_{i,t} * asset\_volatility_{i,t} \\ \Delta investment\_deposit_{i,t} * \Delta\text{asset volatility}_{i,t} \end{pmatrix} + \varphi \begin{pmatrix} X \\ \Delta X \end{pmatrix} + \begin{pmatrix} \varepsilon_{i,t} \\ \Delta\varepsilon_{i,t} \end{pmatrix}$$

, (4.4)

where the interpretation of the interaction between investment deposit and asset volatility is crucial. If the value of ϑ_2 is negative, it means that capital requirements' ability to respond to asset risk is reduced when Islamic banks holder more profit-loss sharing investment deposits.

When it comes to the final hypothesis, the bank regulation factors and interactions of bank regulation indexes and asset volatility are added to equation 4.3. It is expected that the coefficients of the interaction terms are significant, implying banking regulation can promote the ability of capital requirements for IBs to capture the portfolio risk.

4.5 Results

4.5.1 Benchmark estimation

The main purpose of this section is to observe that whether the risk-weighted assets and capital requirements of Islamic banks are capable of capturing the potential risk of portfolio assets. If the risk indicators that supervisors tend to monitor can closely track the fluctuation of the market value of bank assets, the role of minimum required capital to ensure the stability of banks will also be enhanced (Beltratti and Paladino, 2016). Table 4.5 lists the regression results using the dynamic GMM estimation method. The diagnostic tests show that the results of the diagnostic tests are not statistically significant for the test of AR(2) second-order differenced autocorrelation and the Hansen *J*-statistics for testing over-identifying restrictions (Wintoki et al, 2012). In all specifications, test results indicate that the included instrumental variables are valid and that the lags of the instrumental variables is appropriate..

The coefficient of the asset volatility (from 0.108 to 0.337) is significant at the 1% and 5% significance levels in columns 1–4. RWATA is the ratio that regulators use to assess banks' risk and it indicates that a 1% increase in portfolio risk would match a 0.337% increase in RWA in column (1), which reveals that regulatory risks of Islamic banks have not adequately increased in response to changes in market asset risk (Acharya *et al.,* 2014). It would be perfect if the 1% increase in asset risk could cause RWA to increase by 1%, but this is almost impossible in reality because there is always room for improvement in banks' risk management. The evidence implies that the regulatory assessment of Islamic banks, in general, significantly captures only part of the variation within the asset portfolio volatility, supporting hypothesis 1.

The result is similar to the findings of Vallascas and Hagendorff (2013) who find the risk-weighted assets of banks in developed countries are not that sensitive to market-based asset risk. They suppose the limitation of current risk-weighted assets calculation exist because certain high-risk derivatives of large banks in the US and EU are not covered by calculation methods. The findings are also in accordance with the study by Mariathasan and Merrouche (2014) whose empirical results show that the reported bank asset risk may not necessarily reflect the bank's real asset risk.

However, the reason behind the weak association between regulatory risk and asset risk of IBs might be quite different from the previous interpretations provided for CBs. The RWATA of Islamic banks are calculated by taking the Islamic banks services and products into consideration. Some Islamic financial transactions that follow the principle of profit-and-loss sharing and have the function of loss-absorbing are not included in RWA calcualtion, which increases the complexity of IBs in handling risksTherefore, on the one hand, this weak relationship is due to the insufficient ability of Islamic banks to identify and classify asset risks. On the other hand, Islamic banks in different countries have adopted divergent accounting disclosure standards (such as IFSB, AAOIFI or local accounting standards) (Karim, 2001;Kamla and Haque, 2019). These guidelines for certain Islamic financial transactions are not strict enough, which

has given some IBs the opportunity to evade the holding of minimum capital by reducing the records of relatively high-risk assets. However, from a positive perspective, Islamic financial business's disclosure mechanism is undergoing reforms, and the introduction of new standards each year might serve to fill potential loopholes.

In terms of the control variables, RWA is positively associated with non-interest income (at the 1% and 10% levels), which implies that the non-loan activities of Islamic banks, such as fees and dividends from securities, are included as risky assets and assigned by corresponding regulatory risk weights.

The results in columns 5-8 illustrate the association between Islamic banks' capital requirements and asset risks. The results show that minimum required capital, which is the product of RWA and minimum capital requirement ratio, is statistically significant in association with asset volatility in IBs. It implies that Islamic banks have the opportunity to engage in regulatory capital arbitrage as a 1% increase in portfolio risk only links to additional required capital holdings of between 0.009% and 0.051%, well below the minimum 8% establised in Basel rules and IFSB standards. These findings seem to be consistent with the work of Jones (2000) who argues that if a bank engages in regulatory arbitrage activities, theoretically, a 1% increase in portfolio risk does not require banks to substantially increase regulatory required capital.

The prior studies argue risk weights assessment cannot be trusted and large banks in US and UK game the capital requirements of Basel rules, but the interpretation might be suitable for Islamic banks. The findings of this section show that Islamic banks' RWA and capital requirements do not have the strong ability to capture portfolio risk, which might be related to the fact that profit loss sharing feature of Shari'ah-compliant products add complexity to the calculation of risk and capital. Consistently, Hussain et al (2015) argue that the risk management of IBs cannot be separated from their uniqueness. Because of these characteristics, new systems and new procedures (such as accounting disclosure procedures and audit procedures) need to be developed to further strengthen IBs' risk management practices. The next section promotes research by

associating the unique characteristics of Islamic banks to regulatory arbitrage participation (Errico and Farahbaksh, 1998).

Table 4. 5 Main results

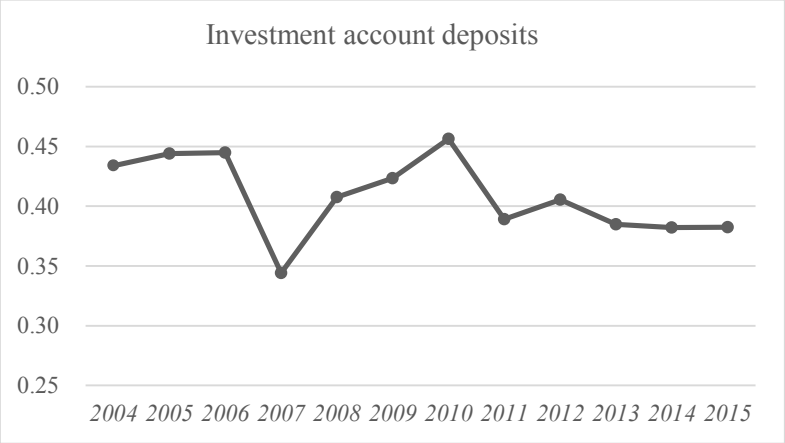
This table shows the sensitivity of RWATAs (defined in table 4.2) and minimum required capital (CAP) to the portfolio volatility according to model (4.3). Standard errors are below the coefficients. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RWATA	RWATA	RWATA	RWATA	CAP	CAP	CAP	CAP
Lagged dependent variable	0.408***	0.513***	0.383***	0.455***	0.462***	0.577***	0.513***	0.51***
	(0.063)	(0.04)	(0.05)	(0.035)	(0.047)	(0.049)	(0.053)	(0.054)
Volatility	0.337***	0.109***	0.112*	0.108*	0.053***	0.009***	0.014***	0.011***
	(0.088)	(0.014)	(0.046)	(0.047)	(0.007)	(0.001)	(0.001)	(0.00217)
Size	-0.034	-0.038*	-0.026	-0.019	-0.004	-0.008*	-0.005	-0.001
	(0.033)	(0.017)	(0.028)	(0.039)	(0.003)	(0.003)	(0.003)	(0.00235)
Profitability	0.934***	-0.530***	-0.191	-0.205	-0.111***	-0.051***	-0.016	-0.035
	(0.104)	(0.076)	(0.125)	(0.134)	(0.010)	(0.005)	(0.041)	(0.0198)
Buffer	0.588***	-0.067	0.062	0.045	0.011	-0.090***	-0.100***	-0.057
	(0.140)	(0.116)	(0.288)	(0.263)	(0.012)	(0.012)	(0.020)	(0.0381)
Loans	0.0739	-0.326*	0.492***	-0.440*	0.016	-0.025	-0.061***	-0.048**
	(0.154)	(0.144)	(0.144)	(0.204)	(0.014)	(0.018)	(0.012)	(0.0166)
Deposit		-0.312**	-0.288	-0.236		-0.054***	-0.061***	-0.048*
		(0.085)	(0.141)	(0.157)		(0.018)	(0.013)	(0.0185)
Noninterest income		0.005***	0.003*	0.003*		0.001***	0.0004***	0.001***
		(0.001)	(0.001)	(0.001)		(0.000)	(0.001)	(0.0001)
Basel II		-0.010		0.001		-0.003		-0.015*
		(0.020)		(0.043)		(0.002)		(0.007)
Basel III			-0.037	-0.014			0.001	-0.018*
			(0.255)	(0.052)			(0.001)	(0.008)
GDP growth			-0.907**	-0.797**			-0.072**	-0.052
			(0.255)	(0.240)			(0.024)	(0.027)
Constant	0.853	1.448***	1.436*	1.187	0.0847	0.231***	0.212***	0.156*
	(0.598)	(0.273)	(0.537)	(0.688)	(0.052)	(0.051)	(0.057)	(0.058)
N	288	259	257	257	285	258	256	256
AR (1) (p-value)	0.25	0.24	0.26	0.249	0.279	0.258	0.257	0.277
AR (2) (p-value)	0.449	0.347	0.366	0.353	0.489	0.32	0.33	0.35
Hansen J-statistic	0.135	0.729	0.823	0.857	0.161	0.561	0.685	0.849

4.5.2 Profit-sharing investment account

This section explores whether the weak association between RWA and asseti risk of IBs can be related to the characteristics of profit sharing, and the investment deposit account variable is included in the econometric model (Sundararajan, 2007). One of the main differences between IBs and CBs is that the former provides PSIA. In this risky product, fixed income is not guaranteed because it is based on the profit and loss sharing system. In principle, only when the bank's investment generate earnings can the investment deposit account holders be allocated profits, and if the investment ends with losses, the holders' funds may be reduced. Figure 4.1 shows that the share of investment deposit has changed over time, and the time trend of this variable is for 2004-2015. These deposits have an important position in Islamic banks' funding sources since the sample Islamic banks' profit-sharing investment account deposits account for about 30% of total assets, consistent with Sundararajan (2008)'s survey for Islamic Bank in Middle East and Southeast Asia countries. It can be seen that the average investment account deposit share reaches its lowest value in 2007 and then increases from 34% in 2007 to 46% in 2010. This may be due to the fact that the global financial credit crisis that began in 2007 affects depositors' confidence in traditional banks, making Islamic banks which operate in different financial system from conventional banks more attractive to profit-sharing depositors. After the financial crisis, the proportion of investment deposits declined gradually. On the one hand, the performance of traditional banks began to regain the trust of the public. On the other hand, in addition to attracting religious depositors' savings, islamic banks start to expand the channels of their funds (Daher et al, 2015).

Figure 4. 1 Investment account deposits



Note: The investment account deposit is the ratio of investment account deposit to total assets from annual reports.

Table 4.6 reports the results of dynamic GMM estimates that follow model 4.4 to explore the response of regulatory risk and minimum required capital to increased portfolio risk when Islamic banks hold more investment deposits. The coefficient of interaction between profit-loss sharing deposits (PLS) and asset volatility is significantly negative at the 10% level in columns 1 and 2 of table 4.6, implying that when holding more investment amount deposits, Islamic banks generally don't increase the risk-weighted assets in reaction to increased banks' portfolio volatility. Since the losses of assets supported by investment deposits are borne by the investment deposit holders themselves, when the portfolio risk increases, the increase in investment deposits represents an increase in risk-taking capacity, in which case Islamic banks might not actively raise risk-weighted assets. In the previous section 4.5.1, RWA's sensitivity to portfolio risk is less than one, showing the limitations of RWA calculation in Islamic banks. But from the results of this section, the weak relationship between risk-weighted assets and actual portfolio risk is related to investment deposits account. The existence of PLS investment accounts increases the complexity of RWA calculations as Islamic banks' risk-weighted assets usually do not need to include risky assets supported by investment deposits under the current Islamic financial regulatory

framework (Archer and Karim, 2009). Profit-sharing investment account (PSIA) is available to absorb losses arising from credit risk or market risk exposures of assets funded by PSIA, and the findings reflect that Islamic banks actually use the investment accounts as the risk mitigant to manage regulatory risk. The findings confirm the view of Archer and Karim (2009) who argue that appropriate management of profit-sharing investment account (PSIA) can be a powerful risk mitigant instrument in Islamic finance and thus reduce risk-weighted assets (RWA).

The coefficient of interaction term between investment deposits and portfolio volatility is significantly negative at the 10% level in columns 3 and 4. This means that as the holdings of investment account deposits increase, changes in portfolio risk have a significant impact on Islamic banks' capital requirements, consistent with the hypothesis 3. However, Islamic banks do not appear to have significantly increased capital requirements to cope with increased portfolio risk, which is due to the increased risk tolerance of IBs as investment deposits increase, and the risk-sharing characteristics of Islamic bank deposits add another layer of protection beyond book capital. Although Jones (2000) suggest that if the minimum required capital does not match the real economic risks of bank assets, banks could become vulnerable and the effectiveness of the capital regulatory framework would be eroded. For Islamic banks, the outcome may not be that serious, because in addition to using capital as buffer, they can pass on uncertainty to investment account holders when actual risks increase.

Although investment account can be seen as another layer of protection for asset losses, disclosure and interpretation in the IBs' annual report does not link this account to risk management. In fact, IBs can provide more information about investment accounts' impact on risk management, which not only enhances the transparency of Islamic financial services, but also increases the understanding and confidence of IAHs and the market in the IBs risk control system.

Table 4. 6 The investment deposits

The table shows the results from model (4.5). The rows below the coefficients of variables is the standard errors. The volatility is the deviation from the mean value. Standard errors are below the coefficients. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

	(1)	(2)	(3)	(4)
	RWATA	RWATA	CAP	CAP
Lagged dependent variable	0.516***	0.488***	0.559***	0.543***
	(0.043)	(0.040)	(0.043)	(0.004)
Volatility	0.715***	0.560**	0.044***	0.044***
	(0.174)	(0.178)	(0.012)	(0.012)
PLS	0.138	0.114	0.009	0.010
	(0.045)	(0.049)	(0.004)	(0.004)
PLS*Volatility	-1.774**	-1.442*	-0.111*	-0.114*
	(0.607)	(0.651)	(0.053)	(0.049)
Size	0.017	0.028	0.021	0.015
	(0.024)	(0.023)	(0.003)	(0.003)
Profitability	-1.461***	-1.363***	-0.171***	-0.164***
	(0.085)	(0.092)	(0.011)	(0.011)
Buffer	1.823***	1.561***	0.183***	0.168***
	(0.154)	(0.132)	(0.026)	(0.022)
Loans	-0.094	-0.044	-0.013	-0.012
	(0.068)	(0.059)	(0.007)	(0.007)
Deposit	-0.352***	-0.408***	-0.028*	-0.035***
	(0.088)	(0.075)	(0.011)	(0.008)
Noninterest income	0.009***	0.008***	0.001***	0.001***
	(0.001)	(0.001)	(0.00)	(0.00)
Basel II	-0.006	-0.042	-0.003	-0.004
	(0.018)	(0.022)	(0.002)	(0.002)
Basel III		-0.046		-0.002
		(0.025)		(0.002)
GDP growth		-0.239		-0.032
		(0.174)		(0.02)
Constant	0.322	0.245	0.055	0.061
	(0.434)	(0.403)	(0.053)	(0.043)
N	258	258	255	255
Instruments	37	31	31	37
AR (1) (p-value)	0.146	0.157	0.225	0.235
AR (2) (p-value)	0.592	0.641	0.311	0.273
Hansen J-statistic	0.373	0.664	0.33	0.565

4.5.3 IFSB rules

Islamic Financial Service Board (IFSB) is a non-profit organization whose mission is to promote the stability and resilience of the Islamic financial institutions. IFSB has issued prudential regulatory standards for Islamic financial services and products to regulate Islamic banking operations in compliance with the Sharī`ah and Basel II guidelines. This section tests the impact of IFSB rules on risk sensitivity of capital requirements and regulatory risk in Islamic banks. The dependent variables of regressions in columns 1-3 columns are risk-weighted assets, and the minimum required capital is the dependent variable in columns 4-6.

Regressions of columns 2 and 3 of table 4.7 incorporate the interaction between asset volatility and the IFSB dummy variable which is equal to 1 for every Islamic bank that adopted IFSB standards. The coefficients of IFSB is significantly positive, indicating IFSB rules help Islamic banks to improve their risk regulatory framework by assigning the risk weights to assets. On the other hand, the significantly negative coefficients on the IFSB interaction terms indicate that the IFSB rules reduce the sensitivity of RWA to asset volatility, which supports hypothesis 4. This suggests that Islamic banks following IFSB principles have an incentive to understate their risk when actual portfolio volatility increase.

The coefficients on the IFSB interaction terms are significantly negative in columns 5 and 6. As to the magnitude of the effect, when IFSB is implemented, one percentage point increase in market-based portfolio risk will associate with 4% decline of minimum regulatory capital in column 6 . It implies that Islamic banks following IFSB standards don’t sufficiently increase the required capital when market-based portfolio risk increases. IFSB's independent regulatory framework include consideration of the risk sharing of Islamic financial transactions (Ariss and Sarieddine, 2007;Daher et al, 2015;Ferri and Pesic, 2016). For example, losses caused by investments supported by profit-loss sharing investment deposit accounts can be transferred to investment deposit

accounts holders. This results in that when the risk of market-based investment in Islamic banks increases, the banks using the IFSB criteria do not actually need to bear that much risk. So the calculated values of RWA and capital requirements do not match the changes in asset volatility.

However, IFSB's disclosure standards for risk-sharing Islamic financial transactions are not specific enough, and there are still many aspects that banks can decide on their own. More explicit risk management and capital regulatory standards may help reduce bank regulatory arbitrage and enable outsiders understand the stability of Islamic banks. It may be possible to encourage IBs to report to the public about the progress of Islamic financial activities following AAOIFI standards and disclosure requirements, as suggested by Ahmed et al (2019). By constantly updating the disclosure of Shariah-compliant businesses and approaching international standards, IBs can pass more information to the international market and move closer to a sound regulatory system without violating the teachings of Islam.

Table 4. 7 IFSB rules

This table shows the impact of IFSB standards on the association between RWATA and CAP according to model in section 4.4. IFSB is the dummy variable IFSB equals one if an Islamic bank follows IFSB standards, and zero otherwise. Standard errors are below the coefficients. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	RWATA	RWATA	RWATA	CAP	CAP	CAP
Lagged dependent	0.438***	0.643***	0.645***	0.609***	0.575***	0.623***
	(0.043)	(0.039)	(0.041)	(0.066)	(0.032)	(0.044)
Volatility	0.879**	1.280***	1.352***	0.110***	0.125***	0.154***
	(0.256)	(0.143)	(0.163)	(0.031)	(0.009)	(0.014)
Size	-0.027	0.059**	0.056*	0.002	0.006**	0.003
	(0.017)	(0.022)	(0.023)	(0.002)	(0.002)	(0.002)
Profitability	-0.474***	-0.735***	-0.761***	-0.045**	-0.102***	-0.100***
	(0.115)	(0.067)	(0.076)	(0.013)	(0.008)	(0.008)
Buffer	-0.434***	-0.002	-0.002**	-0.068***	-0.070*	-0.000*
	(0.012)	(0.001)	(0.001)	(0.014)	(0.005)	(0.045)
Loans	0.158*	-0.275***	-0.270***	-0.006	-0.032***	-0.036***
	(0.092)	(0.058)	(0.069)	(0.001)	(0.007)	(0.007)
Deposit	-0.280**	-0.375**	-0.386**	-0.061***	-0.034**	-0.035*
	(0.093)	(0.120)	(0.122)	(0.013)	(0.011)	(0.015)
Noninterest income	0.009	0.007***	0.007***	0.001	0.001***	0.001***
	(0.006)	(0.001)	(0.001)	(0.001)	(0.032)	(0.021)
Basel II	0.089	-0.060**	-0.046	0.011*	-0.008***	0.002
	(0.067)	(0.020)	(0.027)	(0.006)	(0.002)	(0.003)
Basel II*Volatility	-0.665*		-0.164	-0.125**		-0.098***
	(0.492)		(0.133)	(0.046)		(0.014)
Basel III		-0.040**	-0.038*		-0.006***	-0.001
		(0.014)	(0.017)		(0.002)	(0.002)
GDP growth		-0.222	-0.222		-0.027*	-0.01
		(0.123)	(0.127)		(0.013)	(0.014)
IFSB		0.238***	0.231***		0.032***	0.024***
		(0.040)	(0.040)		(0.003)	(0.003)
IFSB*Volatility		-1.221***	-1.181***		-0.111***	-0.043**
		(0.142)	(0.155)		(0.011)	(0.015)
Constant	0.898***	-0.291	-0.248	0.057	-0.032	0.012
	(0.256)	(0.411)	(0.419)	(0.032)	(0.037)	(0.038)
N	278	296	296	296	286	286
AR (1) (p-value)	0.053	0.195	0.198	0.122	0.246	0.256
AR (2) (p-value)	0.224	0.268	0.273	0.364	0.286	0.319
Hansen J-statistic	0.372	0.452	0.398	0.711	0.45	0.453

4.5.4 Bank regulation

After understanding the reasons why Islamic banks' capital requirements are not that sensitive to market asset risk, this section examines whether the regulation factors could make capital requirements more risk-sensitive. Prior studies find that bank regulation can effectively improve banks' performance and help banks become more stable (Chortareas et al, 2012;Cihak et al, 2013;Demirgüç-Kunt and Huizinga, 2010). The regulation indexes included in this research are capital regulation, supervisory power, bank restrictions index, private monitoring, and prompt corrective action. *Capital regulation* (i.e.Capital_regulation variable) shows the extent of capital stringency. More strict capital requirements are indicated when the capital stringency's value is higher (Agoraki et al, 2011). *Power* represents the power of regulators to exert pressure on bank management and disclosure. A higher supervisory power value indicates greater authority of the supervisors (Delis and Kouretas, 2011). *Restriction* reveal constraints on non-lending bank activities, that is, whether banks participate in underwriting securities, insurance products, real estate projects, and non-financial company transactions. A higher value means more restrictions. *Private monitoring* (i.e. Private variable) can be used to demonstrate the ability of private agents to obtain banking information and overcome information barriers to monitor bank performance (Barth et al, 2004). Higher index value means more incentives and tools are provided for private sectors to monitor bank risk. *Prompt corrective action power* (i.e. Prompt variable) refers the power of supervisors to compel banks to take immediate remedial action if banks engage in unsound banking practices and suffer financial weaknesses. Supervisors have a range of correction action plans at their disposal and the effective tools include "automatic" rules for pre-agreed supervisory actions with flexible space in particular cases (Barth et al, 2004). Higher prompt corrective action index implies supervisors are more powerful to take prompt action in dealing with the financial weakness of banks. Measurement of these variables are presented in Appendix B.2.

The regression specifications follow equation (3.3) by including the regulatory factors and the interaction terms between bank regulation indexes and asset volatility. Table 4.8 presents the results for the dynamic two-step GMM estimation in which the non-significance of the AR(2) statistic implies no second-order serial correlation in the first-differenced errors and Hansen *J* test is passed across all specifications, which indicates the valid instruments in the GMM estimation.

The role of different regulatory practices is heterogeneous. In column 2 and 7, the coefficients of interaction term between capital regulation index and volatility are insignificant. Contrary to the original expectation, it means that although Islamic banks are actively integrating into the global financial system by accepting capital requirements that are consistent with international regulatory frameworks, weaknesses in risk measurement and risk management may not allow them to respond reasonably to fluctuations in the market value of assets. Therefore, when capital regulation is stricter, there is no obvious relationship between capital requirements and portfolio risk.

Similarly, interaction terms regarding power (i.e. column 9) and restrictions (i.e. column 10) are not significant. From the power perspective, regulators may not pay enough attention to the bank's risk-capturing capabilities. The shortcomings shown here can also be opportunities, because supervisors can use power to introduce regulatory policies to improve the risk system of Islamic banks. As for the supervision of activity restrictions, perhaps changes in the policy of restricting banking activities is not accompanied by the specific risk guidance. In fact, the combination of the two may have a better effect.

On the other hand, the results of other regulatory practices show a positive side. The interaction term between private monitoring index and portfolio risk enters significantly positive in column 1 and column 6, indicating that imposition of information disclosure enhances the ability of required capital to capture portfolio risk in Islamic banks. In regressions 3 and 8, the interactions of portfolio risk and prompt correction power index obtain positive coefficients that are significant. It suggests that

prompt corrective plans established by supervisors could help align capital requirements with actual level of asset risk in Islamic banks. The findings implies that regulatory reforms really matter to make the capital requirements of Islamic banks more risk-sensitive, and these financial refoms are essential to prevent regulatory arbitrage, and ensure a safer external environment for Islamic banks.

Table 4. 8 Bank regulation

This table shows the impact of regulation on the ability of RWATA and CAP to capture the asset volatility. Prompt is the prompt corrective action power index, Capital_regulation refers to the overall capital strengency index, and Private is the private monitoring index，following Barth et al. (2004). Standard errors are below the coefficients. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RWA	RWA	RWA	RWA	RWA	CAP	CAP	CAP	CAP	CAP
Lagged dependent variable	0.072***	0.679***	0.194***	0.240***	0.051**	0.509***	0.365***	0.240***	0.413***	0.568***
	(0.019)	(0.049)	(0.026)	(0.019)	(0.017)	(0.09)	(0.099)	(0.055)	(0.087)	(0.08)
Volatility	0.657***	0.032	0.289***	0.2***	0.392*	0.065	0.006	0.032***	0.105	-0.01
	（0.788）	(0.145)	(0.073)	(0.513)	(0.166)	(0.152)	(0.031)	(0.009)	(0.221)	(0.054)
Size	-0.003	-0.027	0.051***	-0.040***	-0.058***	-0.003	0.004	-0.006**	-0.006*	0.003
	(0.018)	(0.018)	(0.014)	(0.007)	(0.016)	(0.002)	(0.016)	(0.002)	(0.003)	(0.006)
Profitability	-0.331***	-1.550*	-0.418***	-0.594***	-0.424***	-0.127***	-0.014	-0.138***	-0.206***	-0.162***
	(0.08)	(0.645)	(0.075)	(0.045)	(0.055)	(0.025)	(0.358)	(0.014)	(0.022)	(0.02)
Buffer	0.209***	0.496***	-0.218	-0.024	0.293**	0.01	0.066	0.186***	0.2	0.04
	(0.063)	(0.106)	(0.145)	(0.093)	(0.11)	(0.019)	(0.114)	(0.034)	(0.103)	(0.033)
Loans	-0.212***	0.039	-0.281**	0.213*	-0.205**	0.013	0.012	0.012	0.011	0.007
	(0.047)	(0.178)	(0.086)	(0.087)	(0.072)	(0.016)	(0.039)	(0.019)	(0.016)	(0.018)
Deposit	-0.294	0.033	0.13	-0.324***	-0.137*	-0.015	0.012	-0.01	-0.007	-0.009
	(0.175)	(0.175)	(0.124)	(0.081)	(0.059)	(0.035)	(0.043)	(0.022)	(0.015)	(0.014)
Noninterest income	0.002	-0.033***	-0.001	0.003***	0.003***	0.001*	-0.006	0.0001**	0.001***	0.001***
	(0.002)	(0.008)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.03)	(0.001)	(0.006)
Basel II	0.101***	0.038	0.088***	0.014	0.129***	0.007	0.006	0.024***	0.001	-0.002
	(0.02)	(0.051)	(0.02)	(0.016)	(0.019)	(0.004)	(0.024)	(0.003)	(0.004)	(0.004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RWA	RWA	RWA	RWA	RWA	CAP	CAP	CAP	CAP	CAP
Basel III	0.064**	0.087	0.05	0.059*	0.169***	0.011*	0.005	0.027***	0.006	-0.007
	(0.022)	(0.047)	(0.04)	(0.025)	(0.034)	(0.005)	(0.027)	(0.004)	(0.004)	(0.005)
GDP growth	-0.296*	-0.467	-0.27	-0.098	-0.062	-0.102***	-0.147	-0.130***	-0.054*	-0.155**
	(0.121)	(0.567)	(0.195)	(0.199)	(0.265)	(0.030)	(0.155)	(0.029)	(0.024)	(0.05)
Capital_regulation		-0.007					-0.006			
		(0.013)					(0.019)			
Capital_regulation*volatility		0.125					0.012			
		(0.065)					(0.02)			
Power				0.119***					-0.004	
				(0.015)					(0.004)	
Power*volatility				-0.167***					-0.008	
				(0.045)					(0.02)	
Restrictions					0.012					-0.003**
					(0.01)					(0.001)
Restrictions*volatility					-0.032*					0.001
					(0.015)					(0.005)
Private	0.015*					-0.001				
	(0.007)					(0.001)				
Private*volatility	0.338***					0.037*				
	(0.099)					(0.020)				
Prompt			-0.004					0.002*		
			(0.006)					(0.001)		
Prompt*volatility			0.075***					0.002**		

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RWA	RWA	RWA	RWA	RWA	CAP	CAP	CAP	CAP	CAP
			(0.021)			.	.	(0.002)		
constant	0.881*	0.524*	-0.266	0.006	1.538***	0.093*	-0.034	0.116***	0.171*	0.031
	(0.39)	(0.224)	(0.269)	(0.314)	(0.255)	(0.046)	(0.248)	(0.029)	(0.070)	(0.087)
N	243	127	225	189	206	229	252	246	149	160
AR (1) (p-value)	0.124	0.114	0.162	0.175	0.184	0.276	0.534	0.324	0.301	0.29
AR (2) (p-value)	0.462	0.777	0.383	0.227	0.459	0.38	0.322	0.552	0.45	0.349
Hansen J-statistic	0.611	0.994	0.88	0.941	0.595	0.725	0.778	0.676	0.901	0.889

4.5.5 Robustness check

The previous empirical results shows that the risk-weighted assets and capital requirements of Islamic banks have limited ability to catch up with market portfolio risks. In this section, robustness testing is used to ensure that the results of the particular period are consistent with the primary findings. The financial crisis is a key moment to reflect the bank's risk management capabilities, so this section explores the performance of Islamic banks in the financial crisis.

Table 4.9 provides the results during 2007-2009 financial crisis. The financial crisis dummy variable[14] and the interaction between crisis and volatility are added. In columns 1-3, the risk weighted asset is the dependent variable. The coefficient of interaction term between crisis and volatility is insignificant, implying that Islamic banks may not be able to adjust their regulatory risks in a timely manner according to the risk exposure of their assets in the market and it is possible that the regulatory risk indicators at this time probably are unreliable.

In columns 4-6, the capital requirement is focused, and it is set as the dependent variable. The sum of the volatility's coefficient and the interaction's coefficient which reflects the association between required minimum capital and portfolio uncertainty during crisis is significantly negative. It demonstrates that during the crisis, banks with higher portfolio risk did not significantly increase required capital to cope with asset market value fluctuations. The results may reveal weaknesses in bank risk management capabilities and regulatory loopholes are more apparent during the crisis period (Kammer et al, 2015). On the other hand, through the significant coefficient of interaction between volatility and crisis across regressions, it indicates that Islamic banks' minimum regulatory capital react differently to portfolio risk during crisis and

[14] It is a dummy variable, which equals one for the 2007-2009 financial crisis and zero otherwise.

non-crisis period. When portfolio risk increases, Islamic banks are required to hold less minimum regulatory capital in crisis years compared with non-crisis periods.

All of these additional tests provide further support for the main evidence above. The findings in the recent financial crisis can be viewed as a wake-up call. Although Islamic banks seem to have sufficient capital adequacy ratio that exceeds the minimum requirements, it might only mask the true health of these banks, because the risk-weighting assets that determine capital adequacy in the crisis are delinked from market asset risks. The current crisis highlights shortcomings in risk measurement of Islamic banks. Such a situation can lead to potential losses, and eventually banks and regulators may have to deal with unhealthy consequences. It is expected that greater risks will be accompanied by higher capital cushion, and the idea that capital requirements are risk-sensitive should be rooted in day-to-day operations of Islamic banks.

Table 4. 9 Robustness test : financial crisis

This table shows the sensitivity of RWATAs (defined in table 4.2) and minimum required capital (CAP) to the portfolio volatility during 2007-2009 financial crisis. Standard errors are below the coefficients. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	RWA	RWA	RWA	CAP	CAP	CAP
Lagged dependent	0.328***	0.431***	0.337***	0.465***	0.614***	0.513***
	(0.06)	(0.065)	(0.037)	(0.062)	(0.080)	(0.046)
Volatility	0.102	0.008	-0.034	0.036***	0.042*	-0.014
	(0.078)	(0.019)	(0.031)	(0.006)	(0.015)	(0.008)
Crisis_volatility	0.096	0.114	-0.067	-0.009*	-0.054***	-0.111**
	(0.079)	(0.064)	(0.115)	(0.013)	(0.014)	(0.031)
Size	-0.102**	-0.100**	-0.095**	-0.012***	-0.015***	-0.013***
	(0.034)	(0.03)	(0.027)	(0.003)	(0.002)	(0.003)
Profitability	-0.753***	-0.889***	-0.770***	-0.114***	-0.131***	-0.124***
	(0.077)	(0.075)	(0.069)	(0.007)	(0.015)	(0.011)
Buffer	0.12	-0.155	-0.243	-0.022	-0.04	-0.066***
	(0.137)	(0.133)	(0.142)	(0.011)	(0.029)	(0.017)
Loans	-0.225*	-0.218*	-0.240**	0.02	0.028	0.01
	(0.106)	(0.083)	(0.083)	(0.014)	(0.024)	(0.012)
Deposit		-0.245*	-0.412***		-0.010	-0.032**
		(0.099)	(0.108)		(0.009)	(0.009)
Noninterest income		0.005***	0.005***		0.001***	0.001***
		(0.001)	(0.001)		(0.010)	(0.002)
Basel II		-0.080***	-0.069***		-0.016***	-0.012**
		(0.021)	(0.018)		(0.004)	(0.003)
Basel III			-0.041			-0.006
			(0.022)			(0.004)
GDP growth			-0.432			-0.128***
			(0.295)			(0.031)
Constant	2.198***	2.376***	2.541***	0.217***	0.272***	0.283***
	(0.553)	(0.508)	(0.460)	(0.045)	(0.047)	(0.049)
N	201	200	200	197	196	196
AR1	0.236	0.207	0.212	0.284	0.29	0.274
AR2	0.348	0.324	0.323	0.394	0.422	0.395
Hansen J-statistic	0.116	0.398	0.297	0.112	0.347	0.23

4.6 Conclusion

Although the development of Islamic finance offers customers more choices in terms of products and services, the existence of Islamic financial products pose challenges for

regulators in promoting risk management and capital regulatory framework catering for Islamic finance. Therefore, it is quite necessary to study the risk related assessment of IBs. This chapter explores the sensitivity of capital requirement to portfolio risk in Islamic banks across countries from 2004 to 2015 and investigate the ways to make capital requirements more risk-sensitive.

This study contributes to the banking literature by first observing whether the increases in RWA are not closely linked to increases portfolio risk that obtained from application of option pricing model in valuation (Merton, 1974; Flannery and Giacomini, 2015). It appears that risk-weighted assets cannot actively capture market asset risk. The findings also show that Islamic banks don't hold sufficient required capital when taking on more asset risk, which means that Islamic banks are likely to engage in regulatory capital arbitrage.

Then, the study finds that when holding more investment account deposits, Islamic banks do not appear to have significantly increased risk-weighted assets and minimum required capital to cope with increased portfolio risk. In addition, Islamic banks following the IFSB (i.e. Islamic Financial Services Board) standards don't sufficiently increase minimum required capital in response to increased portfolio risk (Archer and Karim, 2009). Therefore, the inconsistency between capital requirements and portfolio risk is not necessarily the result of their participation in regulatory capital arbitrage, but is related to the profit-sharing characteristics of Islamic financial transactions.

Finally, regulatory practice of increased information disclosure will enhance the risk-sensitivity of Islamic banks' capital requirements. Moreover, the capital requirements of Islamic banks is more risk-sensitive in countries where supervisors are able to take prompt corrective actions following pre-agreed standards to deal with deficiencies in weak banks.

The findings explain why capital requirements and RWAs of Islamic banks are less sensitive to market portfolio risk. The risk-sharing transactions of Islamic banks has significant impact on response of the capital requirements towards asset risk, but the

disclosures and regulations of these businesses are not very specific. In addition, the requirements of regulators in different countries are also inconsistent, which brings uncertainty to the effect of the capital regulatory framework. It is necessary to increase the transparency of regulatory indicators and promote an international Islamic financial regulatory framework. This chapter also provide implications for policymakers and regulators to strengthen the risk-sensitivity capital framework by establishing effecitve supervisory practices.

Chapter 5 The impact of bank regulation on risk: empiricial analysis for IBs and CBs

5.1 Introduction

With the rapid growth of Islamic financial services in Muslim countries and other parts of the world, Islamic banks is increasingly attracting attention from investors and policy regulators (World Bank, 2018). The facts in Table 5.1 indicate that Islamic banks' market share continues to increase in recent years, which makes it meaningful to maintain this prospects in a safe manner. The goal of bank regulation is to ensure the soundness of banks and prior studies have displayed how regulation has a positive impact on banks (Beck et al, 2006;Chortareas et al, 2012;Cihak et al, 2013;Pelster et al, 2018). Beltratti and Stulz (2012) suggest that bank regulations that are stressed by Basel Committee can significantly reduce the risks faced by banks around the world. In many countries, banks adopt the Basel regulatory framework which is designed for CBs, and when these regulations are implemented uniformly, Islamic banks are also bound by this regulatory practices (El-Gamal, 2006). However, little research has concentrated on the influence of these regulatory practices on the stability of Islamic banks. This research aims to identify the influence of regulatory environment on risk of Islamic banks and whether there are different effects of these regulatory indexes on risk-taking of IBs and CBs. Moreover, it attempts to investigate whether countries' economic environment could strengthen the impact of bank regulation on risk reduction. To conduct the empirical study, the study uses the country's economic freedom index to capture the overall economic environment of a particular region.

Table 5. 1 Asset growth of selected IBs and CBs

year	Growth rate of assets (Islamic banks)	Growth rate of assets (conventional banks)
2005	0.48	0.23
2006	0.97	0.37
2007	0.46	0.36
2008	0.74	0.25
2009	0.09	0.18
2010	0.12	0.54
2011	0.08	0.09
2012	-0.01	0.11
2013	0.14	0.08
2014	0.10	0.11
2015	0.04	0.04

Source: Bankscope.

Islamic banks, like traditional banks, contribute to the prosperity of businesses and the country's economy as they collect funds from depositors and shareholders on one hand, and provide funds for companies and individuals on the other hand. Therefore, Islamic financial institutions are exposed to many risks similar to those encountered by CB because of their similar functional nature. Abedifar et al (2013) investigate the risk profile of the two bank types and find they take different credit risk and insolvency risk. For example, small IBs have lower credit risk and insolvency risk than traditional banks, but their research does not involve regulatory factors. Based on previous findings, this chapter expands the scope of risk investigation by including idiosyncratic risk, and systemic risk in addition to credit risk and insolvency risk. Distinguished from the focus of previous empirical analysis, the new insights have been produced in this study to demonstrate the differed influence of regulation on risk-taking of CBs and IBs.

The findings firstly show that banking regulations have different effects on the stability of IBs and CBs. It is because stricter restrictions on bank activities, and a higher degree of official regulation can enhance more stability of IBs relative to CBs. It is expected that bank regulations have different banks for IBs and CBs' financial stability,

and the implementation of these regulations are expected to further reduce the risk of CBs, because these factors are designed for the business of conventional banks and not involve the treatment for Islamic financial services and products. However, the results show that regulatory factors are more effective in reducing the insolvency risk of IBs and these indexes are the main driving force behind the Z-scores of IBs. It reflects that since the starting point of risk management of Islamic banks lags behind traditional banks, effective regulatory incentives will help Islamic banks to greatly improve stability, so it seems that these regulatory measures have more obvious impact on the insolvency risk of Islamic banks than traditional banks. In addition, the impact of official supervision on reducing the insolvency risk of CBs and IBs is more pronounced in the business environment with higher economic freedom. During the 2007-2009 global financial crisis, the impact of regulations have been highly heterogeneous among IBs and CBs as these regulatory factors associates with the stability of CBs and are irrelevant to the risk of IBs.

Second, this study finds that IBs have higher idiosyncratic volatility compared to CBs, reflecting their differences in business model. The results show that stricter restrictions on non-lending activities and more information disclosure can reduce more idiosyncratic risk of IBs compared with CBs. Though Islamic bank's business relies on real economic activities, IBs' businesses in general are less transparent than CBs due to the risk-sharing features of Islamic financial transactions and the limitations of Islamic financial institutions' information disclosure. Compared with CBs, Islamic banks' own business, including Islamic financial transactions and non-Islamic financial transactions, lead them to face greater risk management pressures and more operational uncertainties. The Basel Committee's regulatory framework includes solid risk management governance guidelines which help Islamic banks efficiently clear their minds about risk management, so these regulatory implementations are more effective in magnitude to reduce their business uncertainties from a lower level. Moreover, the liberalized business environment and flexible economic system enable regulatory

policies to more effectively control the specific risk in the CBs, while the impact of regulation on IBs doesn't rely on the external environment. In addition, these bank regulations are not adequate to protect IBs and CBs from fluctuations in their inherent business risks during the crisis.

Finally, only characteristics of the bank's capital regulatory environment can help explain the changes in extreme systemic risk of IBs and CBs that proxied by marginal expected shortfall (MES), and more stringent capital regulation actually results in more systemic risk in IBs compared to CBs. The covered regulatory indexes and systemic risks are almost unrelated for IBs and CBs during financial crisis. The findings demonstrate that the regulatory indicators that stressed by the Basel Committee are limited in curbing the systemic risk of financial institutions in countries that have Islamic banks (Weiß et al, 2014).

The regulatory factors highlighted in the Basel rules are generally aimed at reducing the risks borne by conventional banks. The findings of this study show that the regulatory factors highlighted by Basel rules can actually help Islamic banks achieve stable goals and reduce risks, mainly because Islamic banks have a relatively weak risk management framework, so regulation is more effective. The results of the chapter have several policy implications. First, regulatory practices designed for conventional banks can promote the stability of Islamic banks. This means that national regulators with Islamic banks need to think more about the implementation of international regulatory reforms, in addition to considering the development of effective regulatory standards tailored for the unique characteristics of IBs. Second, the effectiveness of supervision depends to a certain extent on the freedom of the economic environment. So improving the regulatory system is an ongoing process that requires regular fine-tuning of existing economic conditions in respond to the changing regulatory framework. Moreover, due to the limitations of the current international regulatory schemes in the financial crisis, countries with systematic importance of Islamic banks need to introduce crisis

management mechanisms to improve the risk management of financial institutions for IBs and CBs based on their respective characteristics.

The research structure of this chapter is arranged as follows. Section 5.2 presents the literature review and hypotheses development. Section 5.3 and Section 5.4 introduce the data collection method and the methodology. Section 5.5 demonstrates the empirical findings. The conclusive analysis is provided in Section 5.6.

5.2 Literature review and hypotheses

Islamic financial institutions face many risks similar to those faced by CBs as they acccept deposits and provide funds to the society. This chapter discusses some of the risks, including bankruptcy risk, credit risk, idiosyncratic risk, and systemic risk (Hoque et al, 2014; Al-Wesabi and Ahmad, 2013;Bitar et al, 2017;Elnahass et al, 2014;Rosly and Zaini, 2008;Zins and Weill, 2017). This section presents the literature associated with the research topic and sets out the hypotheses. This review encompasses studies concerning the association between bank risk and (1) capital oversight; (2) restrictions on bank activities; (3) private monitoring; and (4) supervisory power, which are key elements highlighted by the core principles of Basel Committee supervision (Laeven and Levine, 2009). The study below describes why it is expected that the bank regulations have different effects on risk of IBs and CBs.

5.2.1 Capital oversight

Regulators usually require financial institutions to hold a certain amount of equity capital as buffer for unexpected losses because bank capital is related to maintaining the stability of the financial system. Capital buffers could protect banks by absorbing losses and reduce the likelihood of bank failures when adverse shocks occur (Laeven

and Levine, 2009). There have been theoretical papers focusing on the topic of bank capital regulation (Calem and LaCour-Little, 2004;Drumond, 2009;Hellwig, 2010;Karim et al, 2014). Gauthier et al. (2012) and Baker and Wurgler (2015) argue that strict capital regulation can bring benefits to the entire financial system because the increase in bank capital can alleviate the burden of taxpayers to bail out banks.

Some researchers argue that capital requirement might be linked with bank risk (Hoque et al, 2014; Beltratti and Stulz, 2012; Agoraki et al, 2011; Weiß et al, 2014; Laeven and Levine, 2009; Baker and Wurgler, 2015). If the capital requirement is relatively high, the funds used by the bank for investment will decrease, and at the same time, the forced increase in the amount of holding funds may increase the capital cost of the bank and reduce the expected return (Kim and Santomero, 1988). Therefore, in order to pursue higher profits, bank managers may participate in transactions with high return and high risk. The empirical findings of Furlong and Keeley (1989) and Aiyar et al (2014) also illustrate that more regulations on capital levels drives banks to seek out high risk activities.

Many countries have established a risk management framework for Islamic banks, and regulatory capital is an important part of the framework. Sundararajan and Errico (2002) claim that due to the asymmetry of information in Islamic PLS financial products (such as the Mudaraba contract), IBs need sufficient capital to maintain the depositor's confidence in the bank and provide psychological assurance. However, both PLS and non-PLS services exist in the operation of IBs, increasing the complexity of regulatory capital controls. In theory, non-PLS operations are not the mainstream model of IBs, while PLS business that often exists in the form of unsecured equity financing is the core of IBs. As PLS transactions are essentially businesses that don’t require collateral, the risk of these businesses is considered greater than the non-PLS modes assets (Errico and Farahbaksh, 1998).

Although the capital requirements of the Basel rules do not specifically highlight Islamic financial products, they provide a modern basic capital regulatory framework

for IBs. Since the modern management of IBs starts later than CBs, the establishment of this framework may help IBs to quickly identify the thoughts of capital management and make IBs gain more than CBs in risk control in a short period of time. In contrast, Zins and Weill (2017) find that Basel II, at the expense of IBs, widened the bankruptcy risk gap between traditional banks and Islamic banks. The specific impact of Basel II on their risk is different, because in the countries with dual financial systems, after the implementation of Basel II, the bankruptcy risk of IBs has increased, while the bankruptcy risk of CBs has been significantly reduced. Similarly, it seems difficult to apply international capital standards designed for CBs to IBs (Hassan and Aliyu, 2018). First of all, in terms of assets, compared with traditional banks, Islamic banks' PLS financing modes have become more risky assets because of risk sharing and the characteristics of not involving collaterals. Second, because of risk-sharing feature, investment accounts on the side of IBs' liability affect the calculation of risk-weighted assets and capital adequacy ratio. Therefore, it might not be enough to simply rely on the Basel Committee capital requirements to help control the risk of IBs, and the influence of these capital standards on CBs' risk management can be more effective. This study aims to analyze the impact of capital regulation on bank risk exposure and develops the hypothesis as follows:

Hypothesis 1: The influence of capital requirements index is different on the risk-taking of IBs and CBs.

5.2.2 Restriction on activities

In the traditional business model, banks take deposits and other sources of funds and use them to fund loans to consumers and businesses. Banks are expanding into services such as insurance, underwriting services and asset management which are constrained by regulation due to the concerns about exposure of banks to unacceptable risk

(Mishkin and Eakins, 2012). For instance, banks guarantee financial risks when they provide underwriting services, so they are usually liable in the event of damage or economic loss.

The impact of restrictions on banking practice have been studied in the literature. Demirgüç-Kunt and Huizinga (2010) suggest the diversified activities could lead to riskier behavior performed by banks. The empirical evidence produced by Claessens and Laeven (2004) and Agoraki et al (2011) state that the limitation of bank participation in diversified businesses is associated with more competition, and that increased competition among banks could have a negative impact on the profits generated, which incentivize banks to take greater risk-taking for profit maximization. The results of Barth et al (2004) show that diversified non-traditional banking transactions improve bank stability and correlate to decreased non-performance loans.

Islamic banks are involved in a variety of different non-lending businesses. They can package clients' existing assets and then help clients meet the funding needs by issuing Islamic financial bonds (such as sukuk) (Obaidullah, 2005). IBs can also act as stockbrokers in accordance with the Shariah mechanism to provide market information to clients and make investment decisions on behalf of customers. Moreover, those interest-free insurance products whose purpose is to compensate specific losses due to an unexpected situation are allowed. On the other hand, due to the high degree of uncertainty in derivatives, derivatives trading in Islamic finance is theoretically prohibited. But the modern interpretation of Islamic laws suggest that certain derivatives are essentially developed to mitigate uncertainty rather than speculation (Ariff, 2014). Therefore, Islamic financial institutions that face foreign exchange risk are able to use currency forwards, currency futures, and options to hedge risks in accordance with regulatory regulations. And three kind of institutions: international organizations, local authorities, and Islamic advisory committees and advisory committees establish regulations in accordance with Sharia law to regulate and limit Islamic financial operations.

Because the nature of Islam is integrated into financial products, there are differences between the Islamic banks' non-traditional financial products and traditional banks. The operation of these Islamic banks' products has exceeded the scope of Basel rules, which are international guidelines designed for traditional banks, leading to the activities restriction regulatory practices is expected to be more effective for traditional banks' risk management. Thus, regulation of restrictions on bank activities is expected to be more effective for CBs' risk management. Based on the previous discussion, the assumption is formulated as follows:

Hypothesis 2: The influence of restriction on bank activities is not the same on the risk-taking of IBs and CBs.

5.2.3 Private monitoring

Banks collect funds from money suppliers and then invest these in various risky assets such as loans and securities. The information asymmetry between banks and funding suppliers could result in the moral hazard behavior in which banks may engage in businesses that do not put the interests of depositors first (Howells, 1994). The Basel Committee has developed guidelines that need financial institutions across countries to disclose the key information for market participant to assess and monitor banks' performance. For instance, banks are suggested to get certified audits from international rating agencies and publish information about all activities they perform (Barth et al, 2013). As a result, private agents can make decisions based on disclosed information about asset quality and exposure to risk of banks.

There are different views based on the effect of private monitoring practice. Lower information asymmetry have been found to reduce the systemic risk of banks, and increased disclosure of information can protect investors (Agoraki et al, 2011). However, in a less competitive market, the depth of information disclosure has less

impact on reducing systemic risk of banks (Anginer et al, 2014). Another example is that in countries that require more information disclosure, banks still take on more idiosyncratic risks (Beltratti and Stulz, 2012).

Due to the risk-sharing characteristics of Islamic banks (which exist between banks and borrowers on the one hand and between banks and depositors on the other), they need an effective regulatory and information transparency system. Mejia et al (2014) state that the protection provided by Islamic banks to risk-taking investment depositors is very limited, as the income from investment deposits is neither fixed nor guaranteed by banks, but depends on the performance of banks using investment deposits (Sundararajan and Errico, 2002). This allows investment depositors to have more incentives to monitor bank performance than other account depositors and to require more public disclosure of Islamic bank's operating strategies for PLS funds. Song and Oosthuizen (2014) argue that comprehensive disclosure of Islamic banking transactions and increased business transparency are beneficial to their risk profile and returns.

The disclosure rules emphasized by the Basel principles provide modern disclosure requirements for financial institutions. Farooq and Zaheer (2015) state that these disclosure spirits are also applicable to IBs. By obtaining more information from the market, market participants can take action to monitor the operations of Islamic banks. Since the modern risk management foundation of IBs might be weaker compared to CBs, frequent transparency of its operating conditions may allow shareholders or stakeholders to limit the high-risk behavior of IBs, thus reducing more risk of IBs in a short period of time compared to CBs. However, the disclosure framework and details of the Basel rules were not developed for IBs. As a result, if Islamic banks provide information to the public in accordance with Basel's disclosure requirements, market investors and depositors may not be able to constrain Islamic banks' risk-taking strategies and choices since they cannot collect accurate information about Islamic financial products. In other words, relying solely on the disclosure of regulatory changes in the Basel principles' disclosure reforms may not be sufficient to effectively

control the overall risks of Islamic banks. Given the above discussions, the hypothesis is established as:

Hypothesis 3: The influence of private monitoring is different on risk-taking of IBs and CBs.

5.2.4 Supervisory power

Supervision action is motivated by two broad considerations (Flannery, 1998). First, there is the belief that due to the high information costs and moral hazard incentives of banks, bank depositors and shareholders cannot effectively protect themselves. Keeley (1990) argue that small depositors and shareholders cannot effectively identify or control bank risk. The second basis for prudential supervision is the nature of bank assets which could be customized and privately negotiated (Chortareas et al, 2012). Supervisors are able to understand a bank's situation more accurately because they have unique access to private information. Supervisory agents need to ensure that the evidence provided by banks is relevant, accurate and illustrated in an un-misleading way so that public confidence is maintained (Errico and Farahbaksh, 1998;Farooq and Zaheer, 2015). If supervisors with sufficient power are able to force higher-quality information disclosure, private agents can benefit from it by monitoring banks more easily (Beck et al, 2006).

The probability of experiencing the global financial crisis was lower in countries with a higher supervisory index since regulators have the power to obtain information from financial institutions and then take corrective actions that affect bank behavior (Barth et al, 2013;Čihák and Hesse, 2010). Similarly, Agoraki et al (2011) find that a strong and independent supervisor could prevent managers from taking excessive risks by bringing timely corrective actions. On the other hand, Alam (2014) find official supervision might not significantly reduce the credit risk of IBs and CBs. It appears that

the impact of supervisory policies recommended by international regulators on IBs and CBs is ambigous (Song and Oosthuizen, 2014).

Like traditional banking, regulators use power to prudently monitor Islamic banks, which is key to helping Islamic banks reduce risk. In order to monitor the effective risk management of Islamic banks, regulators must understand the products, contracts and services provided by Islamic companies (Archer and Karim, 2007). The regulatory power framework and practice established by the Basel Committee can be applied to all banks, but it does not provide advice and standards for regulators to supervise IBs (Sundararajan and Errico, 2002). In the process of changing the scope of regulatory power promoted by international standards, there are more requirements on third-party monitoring and information disclosure of traditional financial services. Nevertheless, such changes do not motivate regulators to understand the products and risks associated with Islamic finance, and it is sometimes limited to incentive regulators to carry out the most appropriate IBs regulatory approach to constrain excessive risk-taking behavior of banks (Song and Oosthuizen, 2014). This chapter attempts to further explore the role of official supervisory power and observe its impact on various risks of IBs and CBs. The final hypothesis is developed:

Hypothesis 4: The influence of official supervision is different on risk of IBs and CBs.

5.3 Data and variables

5.3.1 Sample construction

The banks that are included in the sample used for this research are chosen as follows: first, a sample of 823 CBs and IBs is selected from banks lists in Bankscope. Of these, 273 are eliminated due to missing market data or bank level accounting information. Outliers for the 1st and 99th percentiles of each country are removed from the variables.

The final sample includes 550 banks: 455 CBs and 95 IBs from 22 countries. The observation period of the sample is covered from 2004 to 2015.

The data of bank-specific variables, including the information extracted from each bank's financial statements, are obtained from Bankscope. The country-level variables and the GDP per capita growth rate come from the World Bank website, while the economic freedom index is derived from the Heritage Foundation website. Stock price data and the MSCI World Bank Index are downloaded from Datastream database. The regulatory indexes used in this study are from the World Bank's surveys for banks across countries. Given the slow pace of national-level regulatory reforms; I would like to use the previous available survey data until there are new observations. For example, the 2005 survey data is used for the years 2005–2007, the survey data of 2008 is used for the years 2008–2011 and survey data of 2012 is used for the years 2012–2015 (Anginer et al, 2014;Barth et al, 2004).

The variables included in this chpater are presented in table 5.2 ,and the following subsections contain definitions and discussions of dependent and independent variables used in this empirical research.

Table 5. 2 Variables

Variable	Ratio construction	Source
IB	equals one for Islamic banks and zero otherwise	Bankscope
Idiosyncratic risk	annualized standard deviation of the residual of a regression of daily returns on the MCSCI World Bank excess return for the period 2004–2015	Datastream
Systemic risk	measured by marginal expected shortfall (MES) following Acharya et al (2012) and Brownlees and Engle (2016).	Datastream
Insolvency risk	natural logarithm of the Z-score is used to measure the distance from insolvency. The Z-score equals average return on assets (ROA) plus capital to asset ratio, divided by the standard deviation of ROA	Bankscope
Credit risk	measured by loan loss provision to total assets.	Bankscope
Capital	an index of regulatory oversight of bank capital	Appendix C.1; World bank; Barth et.al (2004)
Private	an index measure reflecting accurate information disclosures give private agents the right to monitor banks	Appendix C.1; World bank; Barth et.al (2004)
Restrictions	an index of regulatory restrictions on the non-traditional activities of banks	Appendix C.1; World bank; Barth et.al (2004)
Power	an index of the power of the bank supervisory agency	Appendix C.1; World bank; Barth et.al (2004)
Size	The natural logarithm of bank assets	Bankscope
Loans	Ratio of total loans to total assets	Bankscope
Noninterest expenses	The ratio of noninterest expense to total assets.	Bankscope
ROA	is the return on assets	Bankscope
Asset growth	the annual growth rate of total assets	Bankscope
Liquid assets	liquid assets to total assets	Bankscope

Variable	Ratio construction	Source
Economic freedom index	is a composite of ten indicators in the fields of property rights, government integrity, judicial effectiveness, tax, government spending, fiscal health, business freedom, labor, monetary freedom, trade, investment and financial activities	Heritage Foundation
GDP growth per capita	a measure of overall level of economic development activity	World bank
Islamic_REG	a dummy variable, and its value equals one for countries that have set out the rules to regulate Islamic banking services and zero otherwise	Annual reports; Central banks

5.3.2 Risk measures

The bank risk variables include four risk measures. Idiosyncratic risk and systemic risk are calculated based on bank stock market information, while insolvency risk (i.e. logarithm of Z-score) and credit risk are obtained on the basis of changes in financial statements.

5.3.2.1 Insolvency risk

In line with Roy (1952) and Lepetit and Strobel (2015), the Z-score can be used to measure the risk of insolvency. The calculation method is as follows

$$Z_{i,t} = \frac{\text{Return\_on\_assets}_{i,t} + \text{Capital}_{i,t}}{\sigma\left(\text{return\_on\_assets}_{i,t}\right)} \quad ,$$

where *Return_on_assets* is the ratio of pre-tax earnings to total assets, Capital denotes total book equity divided by bank assets and $\sigma(ROA)$ refers to the standard deviation of the return on assets of individual banks over the sample period.

This study takes a natural logarithm of the Z-score to smooth out high values because the Z-score is highly skewed (Beck et al, 2013a). The logarithm of the Z-score can be calculated using only accounting information, and this value can also reflect the bank's probability of insolvency. Because when a bank is insolvent, the return on assets and capital should be relatively low and, at the same time, the return volatility is high. Higher values of Z-score indicates a higher financial stability of banks. For simplicity, the "Z-score" is used to refer to the logged Z-score in this chapter.

Islamic bank's investment account deposits which act as the protection layer for the potential asset losses are characterized by profit sharing and losses. The existence of a PLS (profit and loss sharing) account may also increase the uncertainty of Islamic bank returns, banks' capital and return on asset will still be affected when the cushion

exhausts and then instability will be reflected in the value of Z-score (Čihák and Hesse, 2010).

5.3.2.2 Credit risk

The ratio of loan loss provision to total assets can be used to represent the credit risk, that is, the possibility that the borrowers don't repay the loan on time or at all. The aim of credit risk management is to maximize banks' return by limiting the exposure of expected loan losses within acceptable range. The loan loss provisions (LLPs) are the difference between the funds that bank borrowers' agree to pay and banks' estimation of the amount they are likely to receive. A higher value of loan loss provision indicates that the bank bears more credit risk, as adopted by Abedifar et al (2013) and Haq and Heaney (2012). Sharia principles forbid the interests (Riba) in the business transactions of Islamic finance, but Islamic banks actually carry out transactions such as lending, trade financing and other financial services just like their conventional counterparts while maintain their unique financial products (Al-Wesabi and Ahmad, 2013). Farook et al (2014) find that the LLPs of IBs is lower than that of CBs, resulting from the fact that Islamic banks may naturally be risk-averse because of restrictions on asset investments in Islamic law. The investment scope of IBs in trade and corporate finance activities is also limited relative to CBs. This reseach tends to pay attention to whether financial regulation has widened the credit risk gap between IBs and CBs.

5.3.2.3 Idiosyncratic risk

Idiosyncratic risk reflects an important component of the financial performance of banks. Mishra and Modi (2013) argue that nearly 80% of total stock risk can be accounted for by idiosyncratic risk and lower idiosyncratic volatility reduces the variance in the expected cash flows of firms which enables managers to pursue more strategic opportunities. Idiosyncratic volatility for each stock is studied by regressing

excess stock returns (i.e. the market return of stocks less the risk-free rate) on the returns of the market index (i.e. the return of market index minus the risk-free rate) using daily return data and all observations within the year (Abdoh and Varela, 2017). Following Beltratti and Stulz (2012), this study calculates the idiosyncratic volatility as:

$$r_{id} = \alpha + \beta r_m + e_{id} \quad , (5.1)$$

where r_m is the MSCI world banks index[15] excess return and r_{id} refers to the daily returns. The estimate daily residual value e_{id} is obtained using a simple OLS regression. The idiosyncratic volatility is estimated using the annualized standard deviation of the daily residuals. The annual idiosyncratic volatility is then calculated by multiplying the standard deviation of the daily residuals by the square root of the number of trading days for that given year (i.e. the number of days is assumed to be 252 in one year).

Idiosyncratic risk is sometimes called unsystematic risk, which is the inherent risk rooted in individual banks and not affected by the entire market (Campbell et al, 2001). IBs and CBs are slightly different in terms of business philosophy, and the latter is mainly based on the concept of interest. The assets of Islamic banks must be invested in real economic enterprises, and trade and equity investment are the most important forms of transactions. Because of these restrictions, Islamic banks use different contracts from CBs in terms of the sources and use of funds (Aggarwal and Yousef, 2000). The study, therefore, predicts different idiosyncratic risks between IBs and CBs.

5.3.2.4 Systemic risk

Prior studies have created various measures for capturing the systemic exposure of banks. Brownlees and Engle (2016) and Acharya et al. (2012) propose to use SRISK measuring systemic risk because this proxy can calculate the general capital shortfall

[15] MSCI world banks index is made up of large and mid-capitalized stocks across 23 developed markets countries.

of financial institutions through accounting information and market information when the global financial system as a whole is undercapitalized. However, SRISK might not be suitable for measuring systemic volatility of Islamic banks because banks in countries other than US and EU areas probably have not experienced that extreme capital shortage (Brownlees and Engle, 2016). This research explores the systemic risk of Islamic banks by using the popular indicator of a financial institution's exposure to systemic uncertainty, the MES (i.e. marginal expected shortfall). The bank's MES appears to be an index that effectively predicts the risk of extreme market crash in the short term (Bierth et al, 2015;Weiß et al, 2014).

Following the research of Acharya et al. (2017), this study calculates the average of bank returns in the worst 5% days of market returns in a given year:

$$MES_{it} = E\left(R_{it} \middle| R_{mt} < 5\%\right)$$

, where R_{it} is bank i's market stock return and R_{mt} refers to the return of selected market index which gauged by the MSCI world banks index returns at daily frequency. The daily bank share price and market index was obtained from Datastream. When the value of MES is high, it means that banks have lower systemic risk.

Previous studies have investigated whether macro factors can control systemic risk of banks. Due to the moral hazard issue, the implementation of the deposit insurance plan motivates bank managers to use deposits to invest in assets with high risk and return, resulting in an increase in systemic risk (Hoque et al, 2014). Weiß et al (2014)'s results unexpectedly demonstrate that stricter requirements for capital seem to have successfully reduced the systemic volatility of banks during the subprime crisis. Perhaps because of the capital regulation, banks inject capital in a timely manner. Berger et al (2019) analyze the impact of government aid on the contribution of banks to systemic risks in US. Their findings demonstrate that the Troubled Asset Relief Program (TARP)[16] can help banks reduce systemic risk in the short term, but it will

[16] The Troubled Asset Relief Program (TARP) is part of the US government's plan to respond to the subprime

make them more unstable in the long run. However, there is no clear literature support whether bank regulation envrionment prevents Islamic banks from systemic risk or increases their instability. This paper provides empirical evidence to help clarify whether the impact of banking regulation on the systematic risks is different for IBs and CBs.

5.3.3 Explanatory variables

5.3.3.1 Regulation variables

Beck et al. (2006), Caprio et al. (2007) and Barth et al. (2004) conduct empirical studies on various regulatory indicators. This paper contains four types of regulatory indicators based on previous research which are capital requirements, private monitoring, non-loan bank activity restrictions, and supervisory power. The questions used to calculate the relevant regulatory indicators can be found in Appendix C.1.

Capital requirements is the regulation of the bank's minimum capital base. More stringent capital requirements are indicated when the capital stringency's value is higher. A higher capital requirement index indicates more stringent capital regulation, with values ranging from 0 to 10 (Agoraki et al, 2011). In this chapter, the values ranged from 4.25 (e.g. Malaysia) to 10 (e.g. Turkey).

Restrictions on non-loan bank activities reveal whether banks participate in activities such as underwriting securities, insurance products, real estate projects and transactions of non-financial companies. Higher values means more restrictions. In this study, the activities restrictions index ranged from 4.58 (e.g. United Kingdom) to 16 (e.g. Bangladesh).

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mortgage crisis in 2008. In this program, the government purchases toxic speculative assets and equity from the financial institutions that suffered huge losses to enrich the funds of the financial sector, thus achieving the goal of stabilizing the market.

Private monitoring stresses the extent to which banks are required by regulators to disclose their information to the public and reflects the ability of the private sector to monitor banks. Higher value of this index means more incentives and tools are provided for private-sector to monitor, and the index ranges from 1.42 (Sudan) to 8.25 (Singapore).

Supervisory power is measured to reveal the official regulators have power to take action to intervene in banking activities, such as the appointment and dismissal of senior managers, the ability to stop dividends, access information, etc. A higher supervisory power value indicates higher supervisory power (Delis and Kouretas, 2011). In this study, the index of supervisory power takes values between 8 (e.g. Cayman Islands) and 14.5 (e.g. Indonesia).

5.3.3.2 Other independent variables

Some control variables are used in this chapter. The analysis attempted to capture the key characteristics suggested by Beltratti and Stulz (2012) and Delis and Staikouras (2011) as potential factors of bank risk. This research therefore includes in bank size, loans, noninterest expenses, liquid assets, return on assets, asset growth, Freedom index and GDP growth per capita.

Specifically, the six main bank-level controls are used. The log of total bank assets represents the size of the bank. Larger banks are assumed to be more stable and riskier (Panousi and Papanikolaou, 2012). The loan is measured by the ratio of the loan amount to assets (Hoque et al, 2014). Noninterest activities are constructed as the ratio of noninterest expense to assets to explore whether concentration in noninterest activities is associated with risk indicators. The liquidity of bank assets is represented by the ratio of liquid assets to total bank assets. Banks with higher liquid assets seem to have lower risk portfolios (Delis and Staikouras, 2011). The return on assets indicator is used to represent the profitability. Higher profits can act as a cushion to prevent banks from

adverse shocks and are expected to link with bank performance. Asset growth is used as an indicator for the growth rate of real bank assets because fast-growth banks have different risk and return outcomes.

Macroeconomic variables include GDP growth per capita and economic freedom index. The index of economic freedom (collected from the website of the Heritage Foundation) is a synthesis of ten indicators in the areas of government integrity, judicial effectiveness, property rights, taxation, fiscal health, commercial freedom, government spending, labor, currency freedom, investment, trade and financial activities. Higher values mean that the policy supports a higher level of economic freedom. Although greater freedom will allow banks to participate in diversification activities, it could also lead to banks taking up risky activities and becoming more fragile. The rate of GDP growth per capita is used to measure the growth of a country's economic output that accounts for the population. Islamic_REG is a dummy variable and its value is equal to one in a country that has established specific rules to regulate Islamic banking services, otherwise its value is zero.

5.3.4 Descriptive statistics

Figure 5.1 indicates that the risks of CBs and IBs vary in different time intervals. In particular, Islamic bank’s loan loss provision is higher than that of CBs during the period from 2008 to 2011. It may be that during this time period, the asset quality of Islamic banks is worse than that of CBs, or that Islamic banks are more aggressive in adjusting their loan loss provisions and making arrangements for the expected future losses of their loan portfolios.

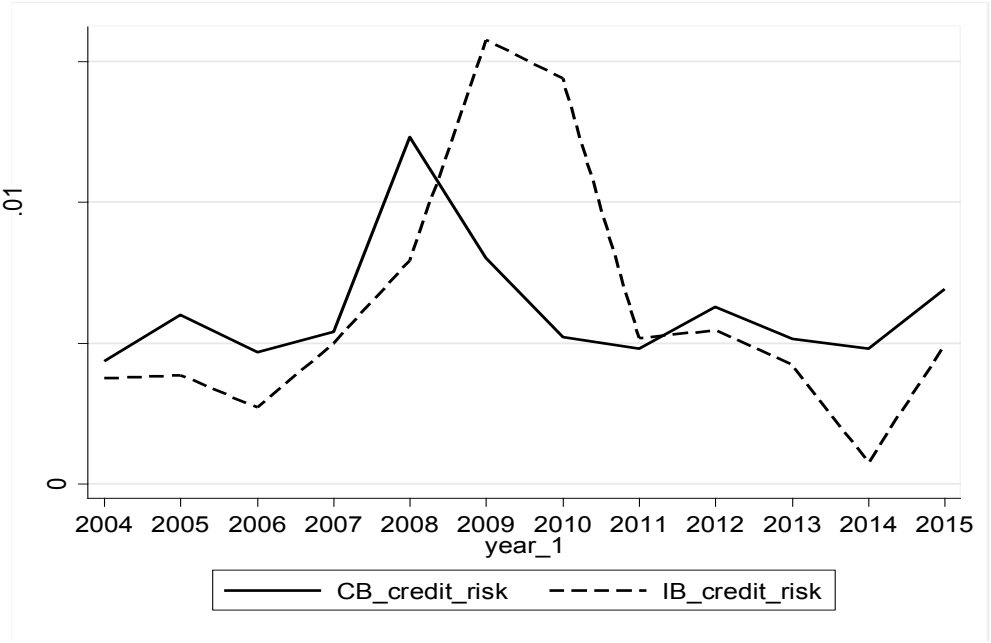

Figure 5. 1 Credit risk of banks

The left vertical axis measures the linear average credit risk (i.e. loan loss provisions) for CBs and IBs in each year for the period 2004-2015. Note: CB_credit_risk refers to the credit risk of CBs and IB_credit_risk refers to the credit risk of Islamic banks.

Figure 5.2 shows the variation trend of systemic risk (i. e. measured by MES) during the period 2004-2015. The high MES represents the lower systemic risk of banks. In 2008, the MES values of IBs and CBs reached a minimum point, meaning that systemic risk is highest at this time. It appears that Islamic banks also experience market instability during the global financial crisis, which is similar to the results obtained by Archer and Karim (2007) who suggest Islamic banks significantly contribute to systemic risk mainly during unstable periods. Following the crisis, the average MES of both IBs and CBs increased once again, implying the systemic risk reduces afterwards.

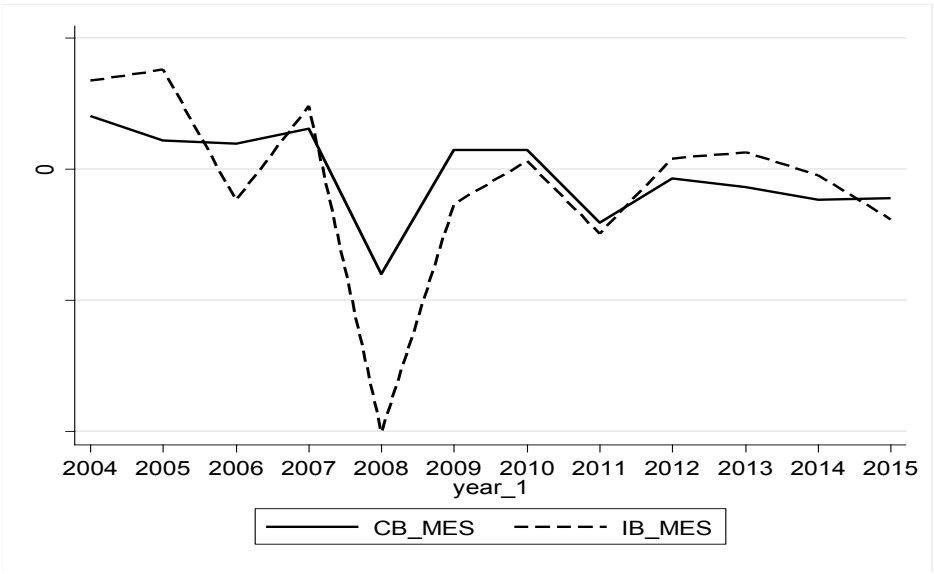

Figure 5. 2 Systemic risk of banks

The left vertical axis measures the linear average systemic risk for CBs and IBs in each year during 2004-2015. Note: CB_MES refers to the credit risk of CBs and IB_MES refers to Islamic banks' credit risk.

The overall sample data presents a considerable change over the time path of the Insolvency risk among IBs and CBs, as shown in Figure 5.3. Overall, the stability of IBs is significantly lower than CBs. During the 2007-2009 financial crisis, the z-scores of both IBs and CBs showed a downward trend, indicating that the insolvency risk during this period is larger than other time periods. Further, the IBs are not more resilient and stable than CBs in the financial turmoil, contrary to the views of Farooq and Zaheer (2015).

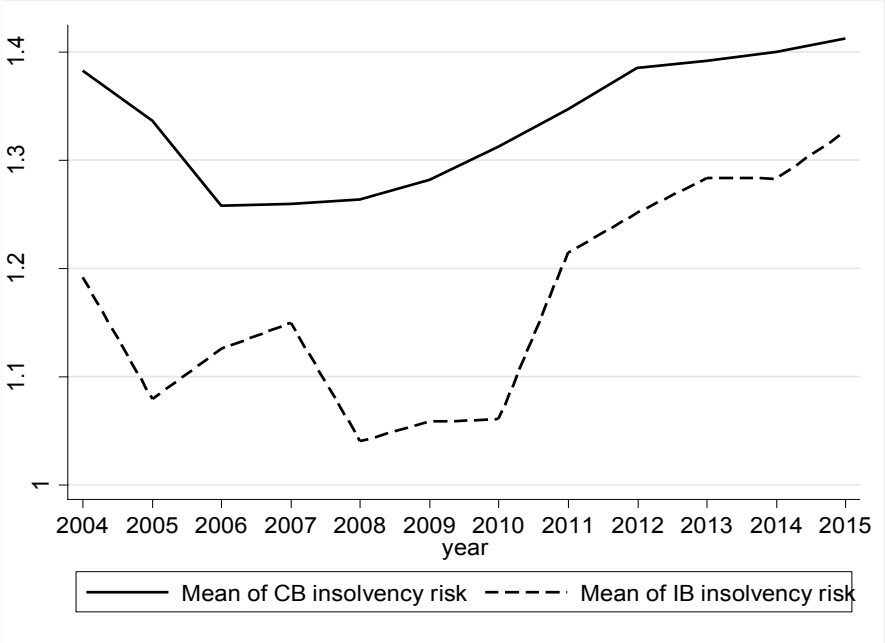

Figure 5. 3 Insolvency risk

The left vertical axis measures the linear average insolvency risk for CBs and IBs in each year during 2004-2015. Note: mean of CB insolvency risk refers to the risk of CBs and mean of IB insolvency risk refers to Islamic banks' risk.

Figure 5.4 shows the case of idiosyncratic risk for the entire sample. Due to the operation of Islamic financial transactions, the idiosyncratic risk of IBs is indeed different from that of CBs. Between 2011 and 2014, the risk of IBs is greater than that of CBs, exposing the Islamic bank's high inherent risk profile. In contrast, during the 2007-2009 financial crisis, the inherent instability of CBs is basically greater than that of IBs, consistent with the argument that observers have discovered the outstanding performance of IBs during the crisis. Academics and policymakers emphasize that risk-sharing factors make Islamic financial products gain advantages during financial panics because uncertainties between mismatched short-term deposit contracts and long-term

uncertain loan contracts can be mitigated by the risk sharing.

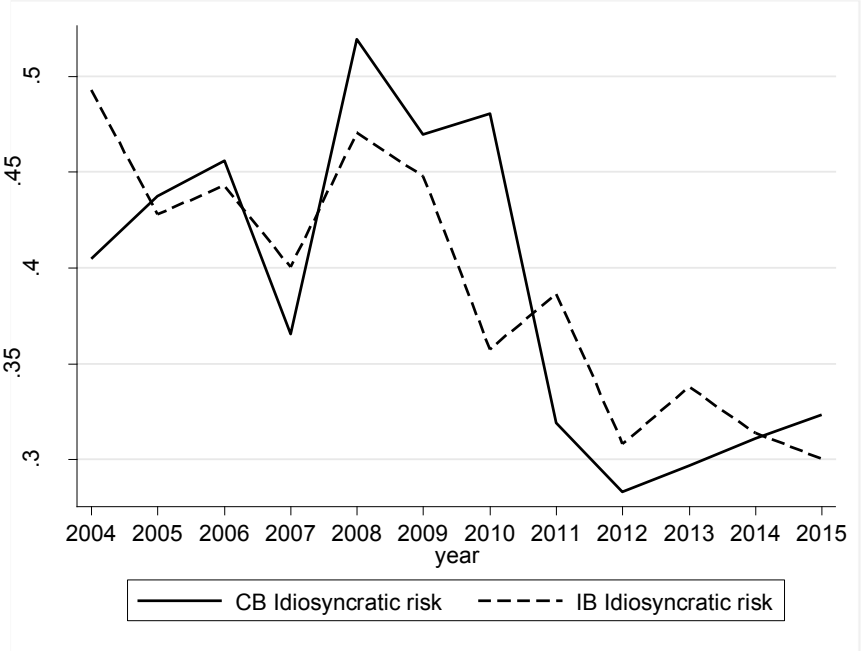

Figure 5. 4 Idiosyncratic risk

The left vertical axis measures the linear average idiosyncratic risk for CBs and IBs in each year during 2004-2015. Note: CB idiosyncratic risk refers to the risk of CBs and IB idiosyncratic risk refers to Islamic banks' uncertainty.

Some scholars believe that the diversified risk characteristics of IBs will make it more adaptive in the financial crisis than the CBs. But contrary to these claims, findings reported in this section demonstrate that, in general, the risk management ability of IBs is weaker than CBs, especially in the crisis (Farooq and Zaheer, 2015). The risk trends of IBs and CBs present different patterns in the 2007-2009 financial crisis, which motivates this study to further explore the impact of regulation on the impact of bank risks among crisis years. The results shown in the figures are also reflected in the analyzed data. Table 5.3 underlines summary of descriptive statistics. It shows that Islamic banks have higher idiosyncratic risk, systemic risk, insolvency risk and credit risk compared with CBs, indicating that Islamic banks need to establish a sound operating foundation for risk management.

Table 5. 3 Summary statistics for IBs and CBs

Summary statistics for the period 2004-2015 for CBs and IBs. The table shows the results for 550 sample banks in which 455 are conventional ones and 95 are Islamic banks.

	N	mean	std.dev	min	max	Islamic banks	Conventional banks
Panel A: Bank risk measures							
Idiosyncratic risk (%)	2809	38.06	0.35	0.23	97.49	38.95	37.87
Systemic risk (MES)	2785	-0.02	0.003	-9.90	6.93	-0.035	-0.01
LogZ	2941	1.33	0.45	-1.35	4.53	1.21	1.35
Credit risk (%)	3920	0.62	0.03	-5	17.43	0.65	0.63
Panel B: The explanatory variables							
Size	4539	14.78	1.97	3.65	22.06	14.25	14.88
Loans	4399	0.48	0.22	0	1.49	0.49	0.48
Non-interest expenses	4409	0.02	0.05	-1.72	1.25	0.039	0.015
Liquid assets	4497	0.28	0.21	0	1	0.22	0.292***
ROA	4522	0.009	0.19	-11.93	2.099	0.0097	0.009
Asset growth	3942	0.168	1.72	-1	98.92	0.187	0.164
Index of economic freedom	6236	63.15	9.69	40.6	89.4	63.97	62.99
GDP per capita growth	6419	2.07	3.94	-29.89	15.55	1.39	2.22
Capital regulation index	4138	8	2.3	3	10	8	8
Private monitoring	6587	7	1.83	0	9	8	7
Restrictions on bank activities	5447	11	3.37	4	16	11	11
Supervisory power index	4298	12	2.3	8	16	12	12

5.4 Model

This empirical study analyzes whether bank regulations (including capital requirements, activity restrictions, supervisory power and private monitoring) have different effects on the risks of IBs and CBs after controlling for bank and country level variables by using the following regression specification:

$$Risk_{i,j,t} = \beta_0 + \beta_1 \mathrm{IB}_i + \beta_2 \mathrm{IB}_i * X_{it} + \beta_3 * X_{it} + \varphi \mathrm{Controls}_{it} + \varepsilon_{it} \quad , \quad (5.1)$$

where $Risk_{i,j,t}$ refers to the value of insolvency risk, credit risk, idiosyncratic risk, and systemic risk measures for bank *i* in year *t* at country *j*. IB is a dummy variable which equals one for Islamic banks and zero otherwise. X_{it} is a set of regulatory indexes, including $\mathrm{Capital}_{i,j,t-1}, \mathrm{Private}_{i,j,t-1}, \mathrm{Restrictions}_{i,j,t-1}, \text{and } \mathrm{Power}_{i,j,t-1}$, and it reflects regulatory conditions in the banking systems of country j that the individual banks locate. The interaction terms between regulatory indexes and Islamic bank dummy (i.e. $\mathrm{IB}_i * X_{it}$) are incorporated to reflect the differences as to the effect of regulatory reforms on IBs and CBs. The $Controls_{i,j,t-1}$ contain a set of bank-level and macro-level independent variables which are motivated by prior studies on factors that affect the various bank risks (Delis and Staikouras, 2011). To capture the bank-specific differences, the bank level variables incorporate size, loans, noninterest expenses, liquid assets, profitability, and asset growth. The country level variables include GDP growth per capita and economic freedom index. The variable ε is the error term or disturbance which contains the unobservable elements that affect bank risk. In order to reduce the possibility of reverse causal relationship between bank risk and independent variables, all explanatory variables are lagged by one year.

The estimation of equation (5.1) starts by using ordinary least squares and random-effects estimation, following Barth et al (2004) and Hoque et al (2014). The random effects estimation is used in this study since fixed effects model might not be the best choice when coefficient of time-invariant variables is the focus , and in this case, the

coefficient of the Islamic bank dummy (i.e.time-invariant variable) needs to be observed (Abedifar et al., 2013; Greene, 2012). The dummy variable is included to identify whether Islamic banks still have significant different risk from conventional banks when additional variables are controlled.

The main contribution of this chapter is to interpret the following coefficients. The coefficient of regulation indexes (i.e. β_3) informs about the impact of regulation factors on conventional banks, while the sum value of β_3 and β_2 (i.e. the coefficient on the interaction of Islamic bank dummy and regulation) measures the impact of regulation practices on increasing the stability of IBs. The interaction terms between regulatory indexes and IB dummy (i.e.$IB_i * X_{it}$) are incorporated and if the coefficients of interaction terms are significant, it reflects the impact of regulatory reforms are not identical for IBs and CBs.

The business and economic environment is important to the development of banks. Sufian and Zulkhibri (2015) find greater financial and economic freedom has played a positive role in the profitability of IBs and Gropper et al (2015) demonstrates the importance of national economic freedom to the performance of US banks. This study further investigates whether bank regulations are more likely to reduce risks of IBs and CBs in a more liberalized business environment (Krishnan et al, 2005). The following model is used for the analysis:

$$\text{Risk}_{i,j,t} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} * Freedom + \varphi Control_{it} + \varepsilon_{it} \ , \qquad (5.2)$$

where $Risk_{i,t}$ is the risk measure in Equation (4.1). X_{it} refers to a set of regulatory indexes. The $X_{it} * Freedom$ is the interaction term between bank regulation indexes and economic freedom variable. Whether the overall effect of banking regulations can be changed according to the degree of business freedom is the reason for adding interaction variables. Estimation of Equation (5.2) is then carried out using the OLS method for IBs and CBs separately. What this equation shows is that the effectiveness of regulations in reducing risk-taking depending on the degree of freedom in the economic market (Behr et al, 2010).

In addition to considering the external environment, this study intends to further explore the performance of regulatory practices in the financial crisis. The global 2007-

2009 financial crisis is triggered by the growing problem of the US mortgage industry in 2007, which has raised intensive debates about the appropriateness of current regulations and regulatory approaches (Cihak et al, 2013;Cull and Martínez Pería, 2013;González, 2016;Vazquez and Federico, 2015). For instance, Cihak et al (2013)'s survey demonstrate that there is room for regulatory improvement in reducing bank risk, especially in the turmoil period. However, there is lack of up-to-date empirical information about what impact the regulations have in Islamic banks and traditional banks in crisis. The following model is used to analyze how bank supervision affects the risks of these banks during the recent financial crisis:

$$\text{Risk}_{i,j,t} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} * Crisis + \varphi Control_{it} + \varepsilon_{it} \quad , \qquad (5.3)$$

where all of the dependent variables are the same as the above equations, and the factors related to crisis are added to the explanatory variables. Crisis is a dummy variable which equals one in 2007-2009 and zero otherwise. If the interaction coefficients $X_{it} * Crisis$ between crisis dummy and bank supervision indicators are significant, it means that bank supervisory variables have different effects on bank risks in crisis and non-crisis periods. The sum of coefficients of X_{it} and interaction of regulatory indicators with crisis dummy $X_{it} * Crisis$ captures the impact of banking regulation during the crisis, and the behaviors of IBs and CBs throughout the period are considered separately.

5.5 Results

5.5.1 Insolvency risk

This section examines how regulatory factors influence IBs and CBs' stability. Table 5.4 summarizes the estimation when the Z-score that measures insolvency risk is the dependent variable. When the value of z-score is higher, a bank has higher stability. Regression 1-8 are estimated using OLS while the rest regressions uses random effects model. The sign of Islamic bank dummy is significantly negative across regressions, indicating that the operation of IBs is not as stable as CBs, consistent with the results of Čihák and Hesse (2010). It is because that IBs participate in real economic

activities by holding commodities as collaterals and are likely to maintain liquidity by relying on cash reserves, which makes them more vulnerable to macroeconomic changes and generate less earnings relative to total assets.

In column 5, the level of restrictions increases by 1%, Islamic banks' insolvency risk decreases by 0.062% (i.e.the cofficient sum of restrictions and interaction term between IB dummy and restrictions). The findings suggest that regulatory restrictions on insurance, securities and investment banking activities could improve IBs' financial stability. While the principles of Islamic law forbid complex derivatives, and speculation activities, Islamic banks could engage in the investment banking and insurance transactions which avoid any linkage with prohibited and unlawful activities. It implies the restrictions on bank's engagement in non-interest generating transactions lead to Islamic banks focusing on loans or other Islamic financial services which have less volatility and generate relatively stable returns, supporting the findings of Agoraki et al (2011). The results also demonstrate that increasing capital threshold have exerted a significant positive impact on financial stability of IBs in regressions 3 and 9, suggesting the higher level of required capital may stablize IBs.

The another novel result of this study is shown in the regressions 3-8 and 9-14 where the interaction of Islamic bank dummy and regulatory indexes are incorporated. From the OLS and random effect regressions, the significant positive coefficients of the interaction terms IB*capital, IB*restrict, and IB*power are obtained. It appears that the stricter restrictions on non-loan activities, and strengthening official supervision may result in greater reduction in IB's insolvency risk compared to CBs. More stringent official supervision and business activities improve the financial stability of CBs and IBs by addressing the issue of adverse selection (Song and Oosthuizen, 2014). It is in line with the findings of Laeven and Levine (2009) and Hoque et al. (2014) for large active international banks, and they state that more restrictions on the transaction scope of banking could effectively reduce bank bankruptcy risk across countries.

Originally, this study predicts that bank regulations have different banks for IBs and CBs' financial stability, and the implementation of these regulations are expected to further reduce the risk of CBs, because these factors are designed for the business of

conventional banks and not involve the treatment for Islamic financial services and products. However, the results of this section show that regulatory factors are more effective in reducing the insolvency risk of IBs. This is a phenomenon worth explaining. Islamic banks have a relatively weak foundation in risk management, so their insolvency risk has been significantly controlled after understanding and implementing these principles, reflecting the effectiveness of certain regulation practices is even more obvious than that in CBs. The higher degree of restrictions on non-loan activities and official supervision adopted in the dual financial system could significantly improve the risk management capabilities of Islamic banks and help them to reduce insolvency risk. These regulatory practices might have reduced the overall risk of IBs by strengthening transactions in non-Islamic financial sectors.

The impact of other control variables on bank risk cannot be ignored in Table 5.4. In more detail, the z-score increases significantly when the GDP per capita increase by one-percentage-point. It implies the rise in GDP is considered a signal of good economic conditions, and it also promotes the bank's customers to operate well and obtain more profits, bringing benefits to the stability of banks. In columns 8 and 14, the sum of the coefficients of Islamic_REG and the interaction between IB dummy and Islamic_REG is significantly negative, indicating special regulations related to Islamic financial activities may not present the expected effect to actively improve the financial stability of IBs.

Gropper et al (2015) find that in countries with a higher degree of free economic and trading environment, the performance of the financial system and the overall economic growth will possibly move in a good direction. In the next step, this study examines whether economic freedom could strengthen the effect of bank regulation on reducing insolvency risk of banks and the empirical results are presented in Table 5.5. The first four columns are regression results of IBs, and the last four columns are the regression results of CBs.

Another striking finding of this section is that this study includes interaction terms between bank regulation and the degree of economic freedom to analyze IBs and CBs separately. The coefficents of Power*Freedom is significantly positive in columns 4

and 8, implying that the positive impact of official supervision on risk reduction increase when IBs and CBs are located in regions with higher economic degrees of freedom. It appears that the combination of bank supervision policies and economic freedom policies is conducive to the reduction of bank insolvency risk. Regulators also need to pay attention to policies about economic freedom when using bank supervision strategies to control risks.

Table 5.6 reflects whether the impact of regulation on IBs (i.e. column 1-5) and CBs (i.e. column 6-10) is different during the financial crisis. The coefficients of the crisis dummy is negative in columns 1 and 6, showing that IBs and CBs become less stable during periods of turmoil. These banks have made a lot of efforts to actively integrate into the international financial system, but they will also be affected when the global economic environment is unstable, and they have to pay for the business they have participated in. For CBs in column 7-10, private monitoring and supervisory power have exerted significant effect on reducing insolvency risk in the crisis. For instance, the sum of coefficients of supervision power and interaction between official supervision and crisis dummy is statistically positive, implying that the supervisors have shown their experience and ability to contribute to the stability of the bank at this critical moment. From another perspective, the crisis evidence also illustrates the inadequacy of the supervision safety net as capital requirements, for instance, increases the instability of traditional banks, showing the limitations of the high-profile regulatory strategy in times of crisis. However, the impact of regulations have been highly heterogeneous among IBs and CBs as these regulatory factors are not related to the risk of IBs during the crisis in column 2-5 where interaction terms' coefficients are insignificant. It appears that these regulatory approaches might not be enough to protect IBs from financial vulnerability in times of crisis. In addition to following the existing international regulatory framework, regulators of countries with Islamic banks probably need to establish suitable financial policies to respond to sudden crisis situations.

Table 5. 4 Insolvency risk and bank regulation

The table presents the effect of regulation variables on bank's insolvency risk (i.e. measured by z-score) by estimating model 5.1, including interactions between Islamic bank dummy and regulation variables. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
IB	-0.186***	-0.114**	-0.836**	-0.528	-0.452***	-0.322	-0.618**	-0.433**	-1.323***	-1.550***	-0.004	0.439*	-1.153	-1.369*
	(0.036)	(0.038)	(0.309)	(0.418)	(0.132)	(0.233)	(0.656)	(0.677)	(0.201)	(0.352)	(0.120)	(0.203)	(0.793)	(0.795)
Capital	-0.035**	-0.034**	-0.042***	-0.036**	-0.033**	-0.033**	-0.039**	-0.028*	-0.001*	-0.017*	-0.015*	-0.015*	-0.002*	0.001
	(0.012)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Private	0.086***	0.096***	0.101***	0.105***	0.100***	0.096***	0.105***	0.093***	0.067**	0.043*	0.062*	0.059*	0.072**	0.068**
	(0.02)	(0.020)	(0.020)	(0.021)	(0.020)	(0.020)	(0.021)	(0.021)	(0.024)	(0.025)	(0.024)	(0.024)	(0.026)	(0.026)
Restrictions	0.039***	0.035***	0.034***	0.034***	0.030***	0.035***	0.029***	0.031***	0.004*	0.005*	0.011*	0.007*	0.004*	0.004***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Power	-0.024**	-0.021*	-0.019*	-0.020*	-0.018*	-0.023*	-0.07*	-0.015	-0.006*	-0.006*	-0.011*	-0.005*	-0.006*	-0.005**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
IB*capital			0.082**				4.137***	-0.018	0.125***				0.143***	0.119***
			(0.035)				(0.556)	(0.040)	(0.021)				(0.034)	(0.035)
IB*private				-0.085			-0.032*	0.025		-0.172			-0.044	0.013
				(0.055)			(0.013)	(0.065)		(0.045)			(0.076)	(0.079)
IB*restrict					0.032**		0.003**	0.046**			0.023**		0.003**	0.044*
					(0.012)		(0.002)	(0.023)			(0.009)		(0.019)	(0.020)
IB*power						0.047**	0.017***	0.008*				0.058***	0.002***	0.024**
						(0.019)	(0.004)	(0.027)				(0.016)	(0.041)	(0.042)
Size	-0.001	-0.006	-0.008	-0.007	-0.007	-0.006	0.053	-0.008	-0.069***	-0.068***	-0.067***	-0.069***	-0.069***	-0.069***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.039)	(0.007)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Loans	0.303***	0.155*	0.145	0.152*	0.125	0.150	0.250	0.187*	0.144*	0.137*	0.150**	0.148**	0.143*	0.146*
	(0.077)	(0.077)	(0.077)	(0.077)	(0.078)	(0.077)	(0.065)	(0.080)	(0.056)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
Liquid assets	0.264**	0.175*	0.161	0.174	0.150	0.172	0.028	0.160	0.053	0.056	0.064	0.060	0.052	0.051

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
	(0.09)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.017)	(0.089)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
Asset growth	-0.029*	-0.032*	-0.032*	-0.032*	-0.032*	-0.032*	-0.005*	-0.033**	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.027)	(0.013)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Freedom	0.002	0.003	0.003	0.003	0.003	0.003	-0.008	0.003	0.001	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
GDP per capita	0.015***	0.016***	0.016***	0.016***	0.017***	0.016***	0.123***	0.013**	0.023**	0.013**	0.031**	0.025**	0.017**	0.010
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.078)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Noninterest		-3.983***	-3.843***	-3.865***	-3.809***	-3.997***	0.145	-3.654***	1.315**	1.290**	1.369***	1.316**	1.331**	1.330**
		(0.789)	(0.790)	(0.793)	(0.790)	(0.790)	(0.089)	(0.791)	(0.411)	(0.415)	(0.416)	(0.415)	(0.413)	(0.413)
ROA		4.026***	4.067***	4.016***	4.140***	4.063***	-3.704***	4.263***	0.331	0.344	0.344	0.346	0.327	0.339
		(0.555)	(0.554)	(0.555)	(0.555)	(0.557)	(0.794)	(0.555)	(0.199)	(0.201)	(0.202)	(0.201)	(0.199)	(0.199)
Islamic_REG								0.132**						0.099**
								(0.042)						(0.083)
IB*Islamic_REG								-0.739***						-0.513**
								(0.131)						(0.195)
Constant	0.482	0.574*	0.623*	0.524*	0.600*	0.579*	0.612*	0.467	1.751***	1.754***	1.599***	1.615***	1.738***	1.681***
	(0.267)	(0.262)	(0.262)	(0.264)	(0.261)	(0.262)	(0.266)	(0.267)	(0.278)	(0.282)	(0.280)	(0.280)	(0.283)	(0.284)
R-squared	0.1	0.144	0.148	0.146	0.149	0.145	0.151	0.0252	0.0252	0.0165	0.0195	0.021	0.0265	0.045
N	1343	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338

Table 5. 5 Insolvency risk, bank regulation and economic freedom

This table reports the results from model 5.2. IB refers to Islamic banks and CB refers to conventional banks. Freedom stands for economic freedom index. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
Capital	0.159				-0.208***			
	(0.171)				(0.052)			
Capital*Freedom	-0.004				0.003***			
	(0.003)				(0.001)			
Private		0.571***				0.163*		
		(0.148)				(0.076)		
Private*Freedom		-0.009***				-0.003*		
		(0.002)				(0.001)		
Restrictions			-0.094				-0.023	
			(0.082)				(0.025)	
Restrictions*Freedom			0.002				0.001	
			(0.001)				(0.014)	
Power				0.293*				-0.179***
				(0.132)				(0.034)
Power*Freedom				0.004*				0.003***
				(0.002)				(0.001)
Size	-0.008	-0.018	-0.001	0.012	-0.034***	-0.022***	-0.031***	-0.016*
	(0.022)	(0.016)	(0.016)	(0.017)	(0.006)	(0.005)	(0.006)	(0.007)
Loans	0.435**	0.722***	0.822***	0.672***	0.013	-0.142*	-0.146*	0.002

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
	(0.134)	(0.119)	(0.122)	(0.127)	(0.070)	(0.061)	(0.065)	(0.075)
Liquid assets	0.314	0.632**	0.842***	0.431	-0.134	-0.178**	-0.054	-0.028
	(0.245)	(0.215)	(0.220)	(0.245)	(0.074)	(0.065)	(0.071)	(0.085)
Asset growth	-0.229**	-0.117*	-0.085	-0.145*	-0.033**	-0.008*	-0.008*	-0.008*
	(0.077)	(0.052)	(0.056)	(0.061)	(0.012)	(0.004)	(0.004)	(0.004)
Freedom	0.016	0.067***	-0.023	-0.061*	-0.017**	0.022*	0.001	-0.031***
	(0.021)	(0.019)	(0.013)	(0.025)	(0.006)	(0.009)	(0.004)	(0.006)
GDP per capita	0.005	0.008	0.008	0.020*	0.025***	0.007**	0.004	0.006
	(0.010)	(0.005)	(0.007)	(0.008)	(0.004)	(0.002)	(0.003)	(0.003)
Noninterest	-7.804***	-3.985***	-2.180**	-3.652***	-5.156***	-6.021***	-6.165***	-5.718***
	(0.712)	(0.822)	(0.803)	(0.860)	(0.747)	(0.585)	(0.716)	(0.815)
ROA	0.067	0.004	0.196	0.130	11.057***	8.191***	9.109***	8.537***
	(0.679)	(0.415)	(0.394)	(0.417)	(0.755)	(0.556)	(0.638)	(0.717)
Constant	0.905	-3.026**	2.058*	4.911**	3.155***	0.396	1.703***	3.501***
	(0.050)	(0.074)	(0.039)	(0.731)	(0.441)	(0.558)	(0.301)	(0.415)
R-squared	0.462	0.312	0.319	0.353	0.181	0.108	0.142	0.125
N	218	361	267	278	1573	2170	1842	1583

Table 5. 6 Insolvency risk, bank regulation and crisis

This table reports the results from model 5.3. Crisis is a dummy variables and it stands for 2007-2009 financial crisis. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Capital		-0.089***					-0.022***			
		(0.013)					(0.005)			
Capital*Crisis		-0.015					-0.009*			
		(0.012)					(0.004)			
Private			0.004					0.003		
			(0.014)					(0.007)		
Private*Crisis			-0.005					-0.010***		
			(0.009)					(0.003)		
Restrictions				0.012					0.019***	
				(0.010)					(0.004)	
Restrictions*Crisis				-0.006					-0.006**	
				(0.006)					(0.002)	
Power					-0.002					0.018**
					(0.018)					(0.006)
Power*Crisis					-0.006					-0.008***
					(0.006)					(0.002)
Crisis	-0.044					-0.071***				
	(0.062)					0.021				

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Size	0.001	-0.019	0.001	0.005	0.016	-0.023***	-0.036***	-0.022***	-0.031***	-0.013
	(0.015)	(0.023)	(0.015)	(0.015)	(0.017)	0.005	(0.006)	(0.005)	(0.006)	(0.007)
Loans	0.865***	0.476***	0.859***	0.850***	0.627***	-0.111	-0.022	-0.113	-0.160*	-0.125
	(0.118)	(0.137)	(0.118)	(0.123)	(0.126)	0.059	(0.070)	(0.060)	(0.065)	(0.073)
Liquid assets	0.713**	0.322	0.705**	0.866***	0.342	-0.147*	-0.170*	-0.148*	-0.057	-0.125
	(0.220)	(0.247)	(0.22)	(0.221)	(0.242)	0.064	(0.074)	(0.064)	(0.071)	(0.083)
Asset growth	-0.120*	-0.230**	-0.122*	-0.088	-0.164**	-0.008*	-0.029*	-0.008*	-0.008*	-0.008
	(0.053)	(0.077)	(0.053)	(0.056)	(0.060)	0.004	(0.012)	(0.004)	(0.004)	(0.004)
Freedom	-0.004	-0.016***	-0.004	-0.007*	-0.008*	0.003*	0.005**	0.003*	0.007***	0.003*
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	0.001	(0.002)	(0.001)	(0.002)	(0.001)
GDP per capita	0.008	0.004	0.008	0.005	0.016	0.005*	0.025***	0.005*	0.004	0.005
	(0.006)	(0.010)	(0.006)	(0.007)	(0.008)	0.002	(0.004)	(0.002)	(0.003)	(0.003)
Noninterest	-	-7.995***	-3.598***	-1.906*	-3.657***	-5.931***	-5.302***	-5.937***	-6.227***	-5.917***
	(0.861)	(0.724)	(0.872)	(0.830)	(0.890)	0.583	(0.748)	(0.584)	(0.715)	(0.820)
ROA	0.029	-0.137	0.030	0.26	0.189	8.004***	11.311***	8.001***	9.118***	8.718***
	(0.425)	(0.686)	(0.426)	(0.395)	(0.425)	0.549	(0.750)	(0.550)	(0.634)	(0.721)
Constant	0.971**	3.222***	0.932**	0.817*	1.250*	1.611***	1.718***	1.587***	1.264***	1.213***
	(0.324)	(0.487)	(0.326)	(0.372)	(0.525)	0.097	(0.151)	(0.109)	(0.153)	(0.159)
R-squared	0.283	0.46	0.283	0.318	0.344	0.111	0.177	0.111	0.144	0.114
N	361	218	361	267	278	2170	1573	2170	1842	1583

5.5.2 Idiosyncratic risk

The idiosyncratic risk is viewed as the dependent variable in this section, which is the inherent risk relative to banks business model and is not affected by the entire market or external environment (Bley and Saad, 2012). The results of table 5.7 report whether bank regulation is related to idiosyncratic risk of IBs and CBs by following Equation (5.1). IBs face higher idiosyncratic risk than CBs in Table 5.7 because the coefficients of Islamic bank dummy are significantly positive, reflecting their differences in business model. Islamic banks often provide financing to valuable companies in the form of Non-PLS and PLS for profits. When Islamic banks participate in PLS projects, they may not require collateral as the basis for funding. As a result, when losses occur, they probably face more overall uncertainty (Aggarwal and Yousef, 2000).

The effect of supervision power (i.e. the cofficient sum of power and interaction term between IB dummy and power) is significantly negative for IBs in column 6-12. This finding implies that more powerful supervisiors lead Islamic banks to take less non-systematic volatility as supervisors who could identify and monitor the risk trends can take proactive actions to stabilize Islamic banks, consistent with the view of Laeven and Levine (2009).

Bank regulation and supervision appear to have different impact on idiosyncratic risk among IBs and CBs because the coefficients of IB*private and IB*power are significantly negative. The results indicate that regulatory standards regarding disclosure of information and incentives for private agents to monitor banks is more effective in reducing the idiosyncratic risk of IBs compared to CBs.

Though Islamic bank's business relies on real economic activities, IBs' businesses in general are less transparent than CBs because of the characteristics of Islamic financial risk-sharing transactions and the limitations of Islamic financial institutions' information disclosure. While the accounting and financial reporting framework

specifically designed for IBs can help IBs disclose various information about Islamic financial services to the public, the disclosure principles have not been widely accepted, resulting in that the information provided by Islamic banks is incompletely reflecting their own business conditions. The adoption of the accounting system is also related to the country's attitude towards Islam. Only a few countries' IBs have adopted AAOIFI[17] requirements, and most countries' Islamic Bank follow the International Financial Reporting Standards (IFRS) to process business information. The results of this section show that the increased regulatory requirements for information disclosure and the strengthening of official regulations will result in more reductions in the risks posed by Islamic banks arising from their own business. Compared with CBs, Islamic banks' own business, including Islamic financial transactions and non-Islamic financial transactions, lead them to face greater risk management pressures. Clear regulatory instructions could help Islamic banks clarify the ideas of risk management efficiently, so these regulatory implementations are more effective in reduce their business uncertainties from a lower level at a faster rate.

As for the control variables, the results illustrate that banks with more noninterest transactions and operating in countries with more economic freedom have lower idiosyncratic volatility. In column 8 and 14, the sum of coefficients of Islamic_REG and the interaction variable between IB (i.e. Islamic bank dummy) and Islamic_REG is significantly negative, indicating that Islamic banks in countries that have specific regulatory principles for Islamic financial services and products have less idiosyncratic risk. Therefore, regulation guidelines involving Islamic financial services and products can effectively control idiosyncratic risks.

The results in table 5.8 present the influence of economic freedom on the association between regulations and idiosyncratic risk for IBs and CBs separately. In column 1-4, the coefficient of interaction terms is insignificant for IBs, indicating that the effect of regulation on the idiosyncratic risk of IBs does not rely on the economic environment.

[17] AAOIFI is a non-profit corporate body that provides standards for Islamic financial institutions and industry in areas such as accounting, auditing, corporate governance, ethics issues and Islamic law.

On the other hand, in the regressions 6-8, the coefficients of terms including Private*Freedom, Restrictions*Freedom and Power*Freedom are significantly negative for CBs. It implies that regulation may have an indirect impact on the non-systemic risk of CBs, and this indirect effect depends on the degree of economic freedom. Liberalized business environment and flexible economic system will make regulatory policies more effective in controlling idiosyncratic risk in CBs, while the impact of regulations on IBs' risk is not affected by the external environment.

Table 5.9 shows the performance of the sample banks' risk in crisis. It can be seen from columns 1-5 that during the crisis, the impact of regulation on the idiosyncratic risk of IBs is almost negligible. On the other hand, regulation still shows its presence in traditional banks because the coefficients of the interaction conditions are significant. The results offer the evidence that the conventional banks suffer greater idiosyncratic volatility in countries with stricter requirements in private monitoring, non-lending bank activities and power of official supervision. Therefore, the regulations contained in this chapter are not sufficient to protect IBs and CBs from fluctuations in their inherent business risks during the crisis. As Freixas (2010) argues, the Basel Committee's output establishes a framework for a unified international banking business. However, in addition to the minimum rules, the design of banking supervision in countries with Islamic banks needs to add additional contingency plans during times of crisis, tailored for the characteristics of the country's banking system.

Table 5. 7 Idiosyncratic risk and bank regulation

This table presents the relation between bank's idiosyncratic risk and regulation variables by estimating model 5.1, including interactions between Islamic bank dummy and regulation variables. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
IB	0.006*	0.022*	0.571*	0.895*	0.159*	0.942**	2.089**	0.886	0.137*	0.745*	0.08*	0.707*	1.079**	0.074**
	(0.04)	(0.043)	(0.412)	(0.443)	(0.137)	(0.305)	0.783	0.908	0.478	0.607	0.181	0.421	0.902	1.076
Capital	-0.032*	-0.030*	-0.024	-0.034*	-0.028	-0.025	-0.024	-0.048**	-0.029	-0.034*	-0.03	-0.026	-0.029	-0.051**
	(0.015)	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	0.016	0.017	0.018	0.017	0.017	0.017	0.018	0.019
Private	0.034	0.039	0.036	0.051*	0.039	0.044*	0.051*	0.060**	0.039	0.049	0.04	0.044	0.049	0.056*
	(0.02)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	0.022	0.022	0.026	0.027	0.026	0.026	0.027	0.027
Restrictions	-0.022***	-0.022**	-0.020**	-0.023***	-0.019*	-0.022**	-0.022**	-0.035***	-0.017*	-0.018*	-0.017*	-0.018*	-0.019*	-0.028**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	0.007	0.008	0.008	0.008	0.009	0.008	0.009	0.01
Power	0.046***	0.047***	0.048***	0.048***	0.046***	0.053***	0.053***	0.049***	0.041***	0.042***	0.040***	0.046***	0.047***	0.043***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	0.009	0.009	0.012	0.012	0.012	0.012	0.013	0.013
IB*capital			**-0.061**				**-0.072**	0.005	-0.013				-0.003	0.061
			(0.046)				0.059	0.065	0.053				0.065	0.075
IB*private				-0.116**			-0.11	-0.005**		-0.095**			-0.059**	0.037**
				(0.059)			0.074	0.101		0.08			0.092	0.13
IB*restrict					**-0.014**		**0.004**	-0.017			-0.006		0.004	-0.017
					(0.013)		0.016	0.028			0.017		0.02	0.037
IB*power						-0.084**	-0.056	-0.059				-0.061**	-0.055	-0.059
						(0.027)	0.035	0.034				0.037	0.046	0.045
Size	-0.037***	-0.039***	-0.037***	-0.039***	-0.038***	-0.037***	-0.036***	-0.039***	-0.039**	-0.040**	-0.039**	-0.039**	-0.039**	-0.041**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	0.009	0.009	0.013	0.012	0.013	0.012	0.013	0.012
Loans	0.309***	0.266**	0.259**	0.274**	0.270**	0.233*	0.242**	0.209*	0.218	0.226*	0.223	0.199	0.202	0.171

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
	(0.083)	(0.091)	(0.091)	(0.091)	(0.091)	(0.091)	0.092	0.092	0.114	0.113	0.114	0.113	0.115	0.115
Liquid assets	-0.046	-0.071	-0.112	-0.063	-0.091	-0.142	-0.154	-0.085	-0.017	-0.01	-0.016	-0.047	-0.04	-0.001
	(0.123)	(0.130)	(0.133)	(0.130)	(0.131)	(0.131)	0.134	0.138	0.142	0.14	0.141	0.142	0.143	0.145
Asset growth	0.021	0.016	0.012	0.018	0.015	0.011	-0.008	0.001	-0.657	-0.564	-0.62	-0.459	-0.449	-0.065
	(0.052)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	0.465	0.053	0.524	0.519	0.52	0.527	0.545	0.047
Freedom	-0.010***	-0.010***	-0.011***	-0.011***	-0.010***	-0.011***	0.028	-0.012***	-0.051	-0.052	-0.05	-0.039	-0.041	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	0.268	0.002	0.238	0.238	0.238	0.238	0.238	0.003
GDP per capita	0.012*	0.013**	0.013**	0.013**	0.013**	0.014**	0.01	0.014**	-0.064	-0.061	-0.064	-0.064	-0.063	0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	0.053	0.005	0.047	0.047	0.047	0.047	0.047	0.005
Noninterest		-0.43*	-0.474***	-0.253**	-0.341**	0.051	-0.011***	-0.347	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.634
		(0.428)	(0.429)	(0.436)	(0.436)	(0.454)	0.002	0.491	0.003	0.003	0.003	0.003	0.003	0.552
ROA		-0.018	-0.004	-0.012	-0.006	0.023	0.013**	0.078	0.007	0.007	0.007	0.008	0.007	-0.036
		(0.269)	(0.269)	(0.268)	(0.269)	(0.268)	0.005	0.266	0.005	0.005	0.005	0.005	0.005	0.238
Islamic_REG								-0.211***						-0.216**
								0.057						0.075
IB*Islamic_RE														
G								-0.049**						-0.033
								0.187						0.25
								1.433**						1.472**
Constant	1.174***	1.153***	1.088***	1.124***	1.094***	1.014**	0.969**	*	1.179**	1.164**	1.170**	1.078**	1.083**	*
	(0.31)	(0.321)	(0.324)	(0.320)	(0.326)	(0.322)	0.327	0.349	0.405	0.396	0.405	0.402	0.409	0.431
R-squared	0.181	0.184	0.185	0.187	0.185	0.192	0.195	0.211	0.179	0.182	0.179	0.186	0.187	0.2034
N	869	862	862	862	862	862	862	862	862	862	862	862	862	862

Table 5. 8 Idiosyncratic risk, bank regulation and economic freedom

This table reports the results from model 5.2. IB refers to Islamic banks and CB refers to conventional banks. Freedom stands for economic freedom index. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
Capital	0.270*				-0.006			
	(0.117)				(0.070)			
Capital*Freedom	-0.005*				0.002			
	(0.002)				(0.001)			
Private		-0.131				0.298***		
		(0.239)				0.077		
Private*Freedom		0.002				-0.004***		
		(0.004)				0.001		
Restrictions			0.12				0.102***	
			(0.084)				0.024	
Restrictions*Freedom			-0.002				-0.001***	
			(0.001)				0.011	
Power				-0.15**				0.280***
				(0.176)				0.036
Power*Freedom				0.003				-0.004***
				(0.003)				0.001
Size	-0.046***	-0.054***	-0.052**	-0.061**	-0.040***	-0.021***	-0.029***	-0.033***
	(0.011)	(0.016)	(0.019)	(0.020)	(0.008)	0.006	0.007	0.007
Loans	0.001	0.001	0.013	-0.024)	0.408***	0.308***	0.255**	0.276**

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
	(0.071)	(0.094)	(0.115)	(0.123)	(0.104)	0.068	0.078	0.084
Liquid assets	0.026	0.337*	0.254	0.387*	-0.151	-0.088	-0.048	-0.18
	(0.109)	(0.147)	(0.168)	(0.179)	(0.135)	0.089	0.101	0.121
Asset growth	0.003	0.056	0.015	-0.011	0.032	-0.001	0	-0.001
	(0.035)	(0.032)	(0.045)	(0.049)	(0.021)	0.003	0.003	0.003
Freedom	0.038*	-0.016	0.02	-0.025	-0.009	0.021*	0.008	0.042***
	(0.017)	(0.030)	(0.013)	(0.029)	(0.009)	0.01	0.004	0.007
GDP per capita	0.009*	-0.003	-0.006	-0.001	0.017**	0.004	0.011***	0.009**
	(0.004)	(0.004)	(0.006)	(0.006)	(0.005)	0.002	0.003	0.003
Noninterest	0.232	0.131	0.046	0.01	-4.541**	-2.113**	-2.913**	-2.845**
	(0.218)	(0.335)	(0.365)	(0.402)	(0.400)	0.811	0.925	1.054
ROA	-1.427**	-0.537	-0.421	-0.471	-0.006	0.078	0.174	0.243
	(0.507)	(0.348)	(0.391)	(0.412)	(0.274)	0.222	0.24	0.24
Constant	-1.072	2.116	-0.23	2.736	1.401*	-1.008	0.057	-2.299***
	(0.998)	(0.881)	(1.011)	(0.128)	(0.576)	0.59	0.27	0.443
R-squared	0.496	0.126	0.129	0.147	0.159	0.156	0.143	0.237
N	134	285	233	209	909	1449	1250	1015

Table 5. 9 Idiosyncratic risk, bank regulation and crisis

This table reports the results from model 5.3. Crisis is a dummy variables and it stands for 2007-2009 financial crisis. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Capital		-0.005					0.008			
		(0.009)					(0.008)			
Capital*Crisis		0.006					0.015***			
		(0.005)					(0.004)			
Private			0.003					0.044***		
			(0.012)					(0.006)		
Private*Crisis			0.003					0.017***		
			(0.006)					(0.003)		
Restrictions				0.002					0.011**	
				(0.010)					(0.004)	
Restrictions*Crisis				0.001					0.007***	
				(0.005)					(0.002)	
Power					0.024					0.039***
					(0.016)					(0.006)
Power*Crisis					-0.001					0.005*
					(0.005)					(0.002)
Crisis	0.024					0.104***				
	(0.043)					0.02				
Size	-0.054***	-0.048***	-0.053**	-0.062***	-0.055**	-0.028***	-0.037***	-0.018**	-0.025***	-0.027***
	(0.015)	(0.011)	(0.016)	(0.018)	(0.020)	0.006	(0.008)	(0.006)	(0.007)	(0.008)

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Loans	0	-0.042	-0.003	0.021	-0.027	0.266***	0.419***	0.300***	0.270***	0.376***
	(0.093)	(0.069)	(0.094)	(0.116)	(0.123)	0.069	(0.102)	(0.068)	(0.078)	(0.084)
Liquid assets	0.304*	0.113	0.308*	0.308	0.362*	-0.12	-0.176	-0.171	-0.091	-0.085
	(0.146)	(0.102)	(0.146)	(0.165)	(0.178)	0.092	(0.134)	(0.090)	(0.102)	(0.123)
Asset growth	0.057	0.017	0.056	0.017	-0.009	0.002	0.034	0.0001	0.0001	-0.001
	(0.032)	(0.036)	(0.032)	(0.045)	(0.049)	0.003	(0.021)	(0.003)	(0.003)	(0.003)
Freedom	0.001	-0.001	0.001	0.002	0.004	-0.009***	-0.008***	-0.011***	-0.007***	-0.006***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	0.001	(0.002)	(0.001)	(0.001)	(0.002)
GDP per capita	-0.002	0.009*	-0.002	-0.004	-0.003	0.007**	0.015**	0.007***	0.012***	0.011**
	(0.004)	(0.004)	(0.004)	(0.006)	(0.007)	0.002	(0.005)	(0.002)	(0.003)	(0.004)
Noninterest	0.1	0.217	0.107	0.008	-0.079	-2.645**	-4.345**	-2.410**	-2.792**	-3.390**
	(0.335)	(0.222)	(0.336)	(0.367)	(0.392)	0.819	(0.38)	(0.800)	(0.925)	(0.071)
ROA	-0.541	-1.604**	-0.541	-0.503	-0.528	0.194	0.100	0.2	0.173	0.21
	(0.347)	(0.509)	(0.348)	(0.389)	(0.409)	0.226	(0.274)	(0.221)	(0.240)	(0.246)
Constant	1.086***	1.178***	1.054***	1.121**	0.667	1.239***	1.198***	0.884***	0.922***	0.557***
	(0.267)	(0.194)	(0.294)	(0.337)	(0.447)	0.111	(0.188)	(0.117)	(0.146)	(0.165)
R-squared	0.126	0.48	0.126	0.121	0.144	0.129	0.17	0.17	0.141	0.206
N	285	134	285	233	209	1449	909	1449	1250	1015

5.5.3 Credit risk

This section examines whether the regulatory tools discussed in section 5.2 affect loan loss provision of IBs during the period 2004-2015 and makes comparisions between IBs and CBs in table 5.10. Banks have always been concerned about the credit risk caused by loans because poor loan quality could result in a deterioration in banks' profitability. When the borrower fails to pay interests and loans on time according to the agreement, the bank faces high credit risk. Following Abedifar et al. (2013), this study uses loan loss provisions to represent the bank's credit risk. The negative coefficent of Islamic bank dummy indicates that IB's credit risk is significantly lower than CB's credit risk, indicating better loan quality of IBs during this period.

The coefficient of private monitoring enters significantly negative (at 5% level) across regressions, implying the effect of enforcement in information disclosure on reducing non-performing loans in conventional banks, consistent with findings provided by Barth et.al (2004). In addition, the results show that the coefficient of the interaction between IB dummy and private monitoring is also significantly negative. It suggests that forcing banks to provide transparent and comparable information to the public can induce the private sector to monitor banks and is more effective to control the credit risk of IBs compared to CBs. This can provide preliminary empirical evidence that the effective role of the Basel regulatory framework supported by the supervision of international regulators could motivate Islamic banks to review and process loans in a more rigorous manner.

With regards to control variables, banks that have smaller size and engage in less loan transactions will have less credit risk. The relationship between GDP per capita and loan loss provisions is found to be insignificant, suggesting that banks in this sample, on average, do not provision in reaction to the phases of economic cycles. This is in contrast with Laeven and Majnoni (2003)'s study on banks in 45 countries.

The empirical findings in table 5.11 provide the influence of economic freedom on the assocation between regulations and credit risk for IBs (i.e. columns 1-4) and CBs (i.e. columns 5-8) separately. The coefficents of interaction terms between regulatory indexes and economic freedom is insignificant in regressions 1-4, implying bank regulations almost have direct impact on enhancing loan quality for IBs. In contrast, the coefficients of these interactions are significant for CBs across specifications, implying bank regulations in combination with degree of economic freedom to affect the credit risk of CBs.

In table 5.12, the results illustrate how regulation affects the credit risk of IBs and CBs during crisis. The influence of capital regulation on IBs and CBs seems to be similar because the sum of coefficients of capital regulatory interactions and capital regulatory variables is significantly positive across regressions. It is confirmed that strict capital requirements drive banks to carry out high-risk and high-yield lending activities, which ends up with increased credit risk (Diamond and Rajan, 2000). Another possible explanation is that the bank's capital cost might increase with the strict capital requirements, but they can pass the cost pressure on the lender, which might increase the borrower's default rate and the bank may face an increase in non-performing loans. So in crisis management, reducing the bank's capital cost can be a strategy for regulators to control risk. On the other hand, the policy that improve private agents to get more information to effectively monitor bank behaviors can significantly reduce the credit risk of IBs while changes in the remaining regulatory variables have not contributed to the their improvement of credit risk (Hasan and Dridi, 2010). Increased transparency of information will make private agents more capable and motivated to reduce risk by imposing influence on banks to change their credit allocation.

Table 5. 10 Credit risk and bank regulation

This table presents association between bank's credit risk and regulation variables by estimating model 5.1. The whole bank sample consists of 551 banks from 22 countries in which 95 are Islamic banks and 455 are conventional banks. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
IB	-0.231**	-1.130***	-3.461***	3.646**	-2.066***	-1.089**	-1.282**	0.006	-2.178	-2.626	-2.304***	-2.106*	-0.859*	-0.003*
	(0.269)	(0.119)	(0.974)	(0.329)	(0.403)	(0.727)	2.009	0.02	1.185	1.857	0.534	1.01	2.561	0.026
Capital	-0.117	0.028	0.007	0.018	0.031	0.028	0.013	0.001	0.005	0.003	0.015	0.017	-0.008	0.013
	(0.082)	(0.034)	(0.035)	(0.034)	(0.034)	(0.035)	0.036	0.005	0.046	0.045	0.045	0.045	0.047	0.052
Private	-0.259***	-0.262***	-0.247***	-0.196**	-0.252***	-0.262***	-0.198**	-0.003***	-0.230**	-0.175*	-0.236**	-0.236**	-0.176*	-0.002**
	(0.141)	(0.06)	(0.060)	(0.062)	(0.060)	(0.060)	0.062	0.001	0.08	0.083	0.08	0.08	0.084	0.001
Restrictions	-0.025	0.028	0.027	0.024	0.015	0.028	0.012	0.014	0.011	0.011	-0.003	0.013	-0.001	0.032
	(0.049)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	0.022	0.055	0.028	0.028	0.029	0.028	0.03	0.005
Power	0.042	0.031	0.035	0.034	0.04	0.031	0.046	0.001*	0.036	0.035	0.046	0.03	0.043	0.001
	(0.062)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	0.028	0.021	0.038	0.038	0.038	0.038	0.041	0.006
IB*capital			0.264*				0.108	0.002	0.11**				0.146	0.002
			(0.110)				0.12	0.001	0.134				0.146	0.002
IB*private				-0.630***			-0.480*	-0.006**		-0.635**			-0.556*	-0.006*
				(0.175)			0.198	0.002		0.242			0.262	0.003
IB*restrict					0.090*		0.079	0.002**			0.106*		0.07	0.002*
					(0.037)		0.053	0.001			0.049		0.072	0.001
IB*power						-0.003	-0.046	-0.001				0.075	0.015	-0.001
						(0.060)	0.085	0.001				0.084	0.124	0.001
Size	-0.08	0.102***	0.099***	0.097***	0.102***	0.102***	0.097***	0.001***	0.154***	0.152***	0.157***	0.157***	0.151***	0.001***
	(0.05)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	0.021	0.006	0.004	0.034	0.034	0.035	0.035	0.075

variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE	RE
Loans	1.645**	2.209***	2.191***	2.185***	2.114***	2.210***	2.110***	0.024***	1.820***	1.800***	1.720***	1.800***	1.736***	0.019***
	(0.535)	(0.226)	(0.226)	(0.225)	(0.229)	(0.227)	0.229	0.002	0.305	0.304	0.308	0.306	0.308	0.003
Liquid assets	0.917	0.820**	0.802**	0.824**	0.771**	0.820**	0.775	0.009***	0.258	0.277	0.227	0.265	0.237	0.003
	(0.601)	(0.254)	(0.254)	(0.253)	(0.255)	(0.254)	0.255	0.003	0.303	0.302	0.303	0.303	0.304	0.003
Asset growth	-0.18	-0.042	-0.042	-0.041	-0.042	-0.042	37.425***	-0.001	43.992***	44.204***	44.095***	44.043***	44.245***	43.22*
	(0.098)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	2.192	0.064	0.356	0.352	0.354	0.357	0.353	0.346
Freedom	-0.004	-0.005	-0.005	-0.006	-0.006	-0.005	-77.731***	0.002	-82.519***	-82.553***	-82.566***	-82.542***	-82.588***	81.01**
	(0.015)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	0.907	0.058	0.744	0.743	0.743	0.744	0.743	0．744
GDP per capita	-0.047	-0.035**	-0.035**	-0.035**	-0.035**	-0.035**	-0.041	-0.000***	-0.012	-0.012	-0.012	-0.012	-0.012	-0.009*
	(0.03)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	0.041	0.003	0.035	0.035	0.035	0.035	0.035	0.006
Noninterest		36.834***	36.890***	37.357***	36.922***	36.841***	-0.007	0.383***	-0.014	-0.015	-0.015	-0.014	-0.015	0.446***
		(0.192)	(0.189)	(2.188)	(0.189)	(0.196)	0.006	0.022	0.009	0.009	0.009	0.009	0.009	0.023
ROA		-77.594***	-77.637***	-77.684***	-77.652***	-77.594***	-0.035**	-0.782***	-0.027*	-0.028*	-0.027*	-0.027*	-0.028*	-0.827***
		(0.91)	(0.909)	(0.907)	(0.909)	(0.911)	0.013	0.009	0.012	0.012	0.012	0.012	0.012	0.007
Islamic_REG								0.005***						0.005**
								0.001						0.002
IB*Islamic_REG								0.008*						0.007
								0.004						0.005
Constant	4.346*	-0.485	-0.359	-0.762	-0.418	-0.486	-0.593	-0.014	-0.414	-0.728	-0.368	-0.481	-0.494	-0.01
	(0.763)	(0.746)	(0.747)	(0.747)	(0.746)	(0.746)	0.752	0.008	1.04	1.036	1.036	1.036	1.046	0.011
R-squared	0.021	0.826	0.827	0.827	0.827	0.826	0.828	0.831	0.8243	0.8253	0.8246	0.8236	0.8257	0.8287
N	1586	1586	1586	1586	1586	1586	1586	1586	1586	1586	1586	1586	1586	1576

Table 5. 11 Credit risk, bank regulation and economic freedom

This table reports the results from model 5.2. IB refers to Islamic banks and CB refers to conventional banks. Freedom stands for economic freedom index. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
Capital	-0.281				-0.600***			
	(0.369)				(0.132)			
Capital*Freedom	0.005				0.010***			
	(0.006)				(0.002)			
Private		-0.16***				-0.649***		
		(0.506)				(0.158)		
Private*Freedom		0.003				0.010***		
		(0.008)				(0.003)		
Restrictions			0.316				-0.063	
			(0.369)				(0.054)	
Restrictions*Freedom			-0.005				0.002*	
			(0.006)				(0.001)	
Power				-0.196				0.264**
				(0.598)				(0.081)
Power*Freedom				0.006				-0.004**
				(0.009)				(0.001)
Size	0.085	-0.101	-0.081	-0.031	0.052**	0.048**	0.057***	0.085***

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
	(0.060)	(0.077)	(0.098)	(0.105)	(0.017)	(0.015)	(0.016)	(0.018)
Loans	1.538***	0.269	-0.024	-0.256	2.034***	1.885***	1.940***	1.869***
	(0.345)	(0.483)	(0.653)	(0.669)	(0.199)	(0.168)	(0.176)	(0.199)
Liquid assets	1.256*	0.413	0.331	0.581	0.836***	0.575**	0.606**	0.377
	(0.607)	(0.804)	(0.015)	(0.07)	(0.209)	(0.181)	(0.194)	(0.220)
Asset growth	-0.313	0.053	-0.071	-0.058	-0.043	-0.005	-0.003	-0.002
	(0.189)	(0.177)	(0.246)	(0.265)	(0.034)	(0.012)	(0.012)	(0.012)
Freedom	-0.053	-0.006	0.07	-0.045	-0.095***	-0.098***	-0.025**	0.032*
	(0.045)	(0.066)	(0.061)	(0.111)	(0.015)	(0.020)	(0.008)	(0.015)
GDP per capita	0.010	-0.011	0.017	0.001	-0.040***	-0.030***	-0.026**	-0.018*
	(0.024)	(0.020)	(0.031)	(0.036)	(0.012)	(0.007)	(0.008)	(0.009)
Noninterest	-6.372	-20.759***	-23.799***	-23.164***	42.539***	43.281***	44.457***	45.279***
	(0.217)	(0.150)	(0.732)	(0.766)	(0.928)	(0.569)	(0.815)	(0.038)
ROA	-32.535***	-15.863***	-17.070***	-16.754***	-78.156***	-70.710***	-74.280***	-76.229***
	(0.926)	(0.981)	(0.340)	(0.339)	(0.832)	(0.803)	(0.814)	(0.839)
Constant	1.364	2.941	-2.184	2.76	4.819***	5.211***	0.080	-3.859***
	(0.154)	(0.597)	(0.674)	(0.898)	(0.083)	(0.170)	(0.610)	(0.015)
R-squared	0.329	0.183	0.212	0.22	0.825	0.74	0.782	0.816
N	221	436	320	319	1929	2803	2395	1932

Table 5. 12 Credit risk, bank regulation and crisis

This table reports the results from model 5.3. Crisis is a dummy variable and it stands for 2007-2009 financial crisis. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Capital		0.081*					0.061***			
		(0.032)					(0.015)			
Capital*Crisis		0.077**					0.032**			
		(0.029)					(0.010)			
Private			-0.038					-0.036*		
			(0.047)					(0.017)		
Private*Crisis			0.122***					0.031***		
			(0.031)					(0.008)		
Restrictions				-0.023					0.038***	
				(0.051)					(0.010)	
Restrictions*Crisis				0.081**					0.013*	
				(0.026)					(0.006)	
Power					0.116					0.009
					(0.078)					(0.015)
Power*Crisis					0.076**					0.013*
					(0.026)					(0.006)
Crisis	0.915***					0.229***				
	0.224					0.059				
Size	-0.072	0.153*	-0.088	-0.069	0.011	0.042**	0.058***	0.041**	0.060***	0.081***
	0.07	(0.064)	(0.070)	(0.093)	(0.103)	0.015	(0.017)	(0.015)	(0.016)	(0.018)

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Loans	0.048	1.256***	0.077	-0.093	-0.555	1.824***	1.923***	1.828***	1.900***	2.043***
	0.475	(0.349)	(0.475)	(0.642)	(0.639)	0.168	(0.198)	(0.168)	(0.176)	(0.192)
Liquid assets	0.014	0.841	0.068	0.133	0.115	0.464*	0.770***	0.461*	0.512**	0.535*
	0.785	(0.621)	(0.794)	(0.997)	(0.034)	0.18	(0.210)	(0.180)	(0.192)	(0.212)
Asset growth	0.081	-0.304	0.088	-0.051	-0.06	-0.007	-0.037	-0.006	-0.003	-0.003
	0.173	(0.186)	(0.174)	(0.242)	(0.261)	0.012	(0.035)	(0.012)	(0.012)	(0.012)
Freedom	0.015	-0.005	0.015	0.021	0.026	-0.022***	-0.020***	-0.021***	-0.011**	-0.013***
	0.012	(0.009)	(0.013)	(0.016)	(0.017)	0.003	(0.004)	(0.003)	(0.004)	(0.004)
GDP per capita	0.025	0.020	0.024	0.043	0.043	-0.027***	-0.037**	-0.027***	-0.027***	-0.017
	0.021	(0.024)	(0.021)	(0.032)	(0.038)	0.007	(0.012)	(0.007)	(0.008)	(0.009)
Noninterest	-22.513***	-6.174	-22.437***	-25.377***	-24.910***	43.764***	43.110***	43.628***	44.512***	45.287***
	3.114	(0.146)	(0.122)	(0.707)	(0.739)	1.563	(0.934)	(0.566)	(0.815)	(0.041)
ROA	-16.255***	-32.092***	-16.218***	-17.557***	-17.376***	-70.491***	-77.947***	-70.491***	-74.014***	-76.256***
	1.94	(0.854)	(0.944)	(0.305)	(0.32)	0.803	(0.837)	(0.803)	(0.813)	(0.841)
Constant	1.175	-2.761*	1.641	1.148	-1.804	0.506	-0.411	0.732*	-0.851*	-0.878*
	1.249	(0.144)	(0.247)	(0.841)	(0.437)	0.271	(0.397)	(0.288)	(0.369)	(0.402)
R-squared	0.213	0.348	0.211	0.234	0.239	0.74	0.824	0.74	0.782	0.815
N	436	221	436	320	319	2803	1929	2803	2395	1932

5.5.4 Systemic risk

Networks of internationally active banks can transmit shocks and amply economic downturns to adversely influence other financial institutions, so linkages between financial institutions matters to both scholars and policymakers. The extreme events in the global financial markets could affect the performance of financial institutions across the world. This section attempts to explore whether the macro-level factors related to the reform proposals supported by the Bank of International Settlements could efficiently control systemic exposure of IBs and CBs across countries. Several specifications related to OLS estimations (Column 1-8) and random effects estimations (column 9-14) are illustrated in Table 5.13 where marginal expected shortfall (MES) is the dependent variable. The results of Weiß et al (2014) show that bank's MES appears to be an index that effectively predicts the risk of extreme market crash in the short term. The higher the value of the MES, the lower the system risk experienced by banks. The findings in regressions show that the systemic risk of IBs do not differ significantly from that of CBs, implying when the global banking industry experiences adverse shocks, performance of IBs in the market may not be better than CBs.

The coefficients of capital regulation and the interaction term between IB dummy and capital oversight index are significantly negative across regressions. It seems that the characteristics of the bank's capital regulatory environment can help explain the changes in extreme systemic risk of IBs and CBs, and more stringent capital regulation actually increases more systemic risk in IBs compared to CBs. The results show that the regulatory indicators that stressed by the Basel Committee are probably not effective in curbing the systemic risk of financial institutions in countries that have Islamic banks, reflecting the limitations of bank regulations. The findings brings challenges for supervisors to design effective regulatory tools to control the systemic risk of banks in countries where Islamic banks play important roles (Mejia et al, 2014).

The results in Table 5.14 report whether the free economic environment would affect the relationship between regulations and systemic risk in IBs (ie, columns 1-4) and CBs (columns 5-8). It appears that the impact of banking regulations on systemic risk is not affected by economic freedom in IBs and CBs (except restrictions). A more stable and free trading environment has not driven these regulations to reduce the systemic risk exposure of banks.

Although the United States is the first place where the crisis began, many banks outside the United States also bought US financial products and then the crisis gradually spread throughout the world. The coefficients of key interaction terms are insignificant in Table 5.15, which is similar to the findings in Table 5.13, and it demonstrates for IBs and CBs, regulatory and systemic risks are almost unrelated during financial crisis. Since the financial crisis has brought huge losses to financial institutions around the globe, how to reduce systemic risk has become a topic of concern for global policymakers. During the financial crisis, the US government rescue financial institutions by implementing Troubled Asset Relief Program. Berger et al (2019) find that the Troubled Asset Relief Program that promote pure capital restructuring can reduce systemic risk. Therefore, in countries where Islamic financial institutions are systemically important, developing targeted policy tools for capital restructuring to reduce the negative impact of systemic risk may be a viable choice for regulators.

Table 5. 13 Systemic risk and bank regulation

This table presents the impact of regulation variables on bank's systemic risk by including interactions between Islamic bank dummy and regulation variables. The whole bank sample consists of 551 banks from 22 countries in which 95 are IBs and 455 are CBs. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE
IB	-0.002	-0.001	-0.055	-0.138	-0.032	-0.049	-0.09	-0.263	-0.244	-0.295	-0.029	-0.022	-0.323	-0.24
	(0.013)	（0.013）	(0.127)	(0.157)	(0.044)	0.085	0.111	0.249	0.252	0.175	0.053	0.104	0.299	0.3
Capital	-0.014**	-0.014**	-0.015**	-0.014**	-0.015**	-0.014**	-0.003**	-0.015**	-0.013*	-0.001**	-0.002**	-0.015**	-0.004**	0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	0.005	0.006	0.005	0.006	0.006	0.006	0.006	0.006	0.007
Private	0.053	0.052	0.052	0.049	0.051	0.052	-0.003	0.050	0.048***	-0.008	-0.003	-0.003	-0.011	-0.014
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	0.008	0.01	0.009	0.009	0.011	0.01	0.01	0.011	0.011
Restrictions	0.012***	0.011***	0.011***	0.012***	0.012***	0.011***	-0.001	0.013***	0.014***	-0.001	-0.001	-0.001	-0.003	-0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004
Power	0.001	0.001	0.001	0.001	0.001	0.013	0.009*	-0.001	-0.001	0.010*	0.01	0.010*	0.012*	0.013*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	0.003	0.005	0.004	0.004	0.005	0.005	0.005	0.005	0.005
IB*capital			-0.006***				-0.007***	0.014	0.012				-0.005***	-0.007*
			(0.014)				0.012	0.016	0.016				0.015	0.016
IB*private				0.018				0.014	0.018	0.035			0.045	0.04
				(0.021)				0.024	0.028	0.023			0.029	0.032
IB*restrict					-0.003			-0.007	-0.009		0		0.005	0.006
					(0.004)			0.005	0.008		0.005		0.007	0.008
IB*power						0.004		0.008	0.008			-0.004	-0.004	-0.007
						0.007		0.01	0.01			0.009	0.015	0.015
Size	0.082***	0.083***	0.083***	0.083***	0.083***	0.083***	0.042***	0.083***	0.083***	0.042***	0.042***	0.042***	0.042***	0.043***

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	RE	RE	RE	RE	RE
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	0.004	0.005	0.004	0.004	0.005	0.005	0.005	0.006	0.005
Loans	-0.369***	-0.367***	-0.368***	-0.365***	-0.364***	-0.367***	-0.114**	-0.361***	-0.351***	-0.113**	-0.115**	-0.114**	-0.117**	-0.107**
	(0.030)	(0.032)	(0.032)	(0.032)	(0.032)	0.032	0.036	0.032	0.033	0.036	0.036	0.036	0.036	0.037
Liquid assets	-0.02	-0.031	-0.028	-0.029	-0.035	-0.028	0.004	-0.023	-0.032	0.003	0.005	0.003	0.004	0.003
	(0.044)	(0.045)	(0.046)	(0.045)	(0.046)	0.046	0.034	0.046	0.048	0.034	0.034	0.034	0.034	0.035
Asset growth	0.026	0.03	0.031	0.030	0.029	0.03	0.004	0.085	0.033	0.004	0.003	0.003	0.003	0.004
	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	0.019	0.008	0.228	0.019	0.008	0.008	0.008	0.008	0.008
Freedom	-0.002**	-0.002**	-0.002**	-0.002*	-0.002**	-0.002**	0.031	-0.581	-0.002*	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	0.001	0.001	0.425	0.001	0.001	0.001	0.001	0.001	0.001
GDP per capita	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.003***	0.032	-0.011***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	0.002	0.001	0.019	0.002	0.001	0.001	0.001	0.001	0.001
Noninterest		0.063	0.084	0.05	0.069	0.047	0.052	-0.002*	0.102	0.01	0.014	0	-0.002	0.028
		(0.219)	(0.224)	(0.219)	(0.219)	0.22	0.134	0.001	0.249	0.117	0.12	0.12	0.154	0.16
ROA		-0.516	-0.55	-0.554	-0.462	-0.551	0.016	-0.011***	-0.641	0.016	0.018	0.024	0.01	-0.016
		(0.407)	(0.415)	(0.410)	(0.413)	0.412	0.223	0.002	0.443	0.223	0.224	0.223	0.223	0.224
Islamic_REG									0.024					0.078*
									0.019					0.032
IB*Islamic_REG									-0.031					-0.043
									0.052					0.069
Constant	-1.203***	-1.211***	-1.210***	-1.207***	-1.217***	-1.209***	-0.546***	-1.214***	-1.258***	-0.526***	-0.554***	-0.555***	-0.506***	-0.576***
	(0.110)	(0.115)	(0.115)	(0.116)	(0.116)	0.116	0.137	0.116	0.122	0.137	0.137	0.136	0.14	0.141
R-squared	0.55	0.554	0.554	0.555	0.555	0.555	0.4576	0.557	0.558	0.4531	0.4575	0.4551	0.4418	0.4277
N	586	581	581	581	581	581	581	581	581	581	581	581	581	581

Table 5. 14 Systemic risk, bank regulation and economic freedom

This table reports the results from model 5.2. IB refers to Islamic banks and CB refers to conventional banks. Freedom stands for economic freedom index. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
Capital	-0.300*				-0.148*			
	(0.143)				(0.070)			
Capital*Freedom	0.005				0.002			
	(0.002)				(0.001)			
Private		-0.227				-0.106		
		(0.173)				(0.074)		
Private*Freedom		0.004				0.002		
		(0.003)				(0.001)		
Restrictions			-0.137**				-0.019	
			(0.051)				(0.022)	
Restrictions*Freedom			0.002*				0.001	
			(0.001)				(0.004)	
Power				-0.102				0.021
				(0.089)				(0.037)
Power*Freedom				0.001				0.010
				(0.001)				(0.001)
Size	-0.03	-0.007	-0.022	-0.002	0.002	-0.005	0.001	0.0012
	(0.014)	(0.012)	(0.012)	(0.010)	(0.008)	(0.006)	(0.006)	(0.008)
Loans	-0.023	0.086	0.209**	0.059	0.032	-0.01	0.01	-0.024

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)
	IB	IB	IB	IB	CB	CB	CB	CB
	(0.087)	(0.068)	(0.071)	(0.062)	(0.102)	(0.065)	(0.073)	(0.087)
Liquid assets	-0.09	0.154	0.133	0.073	0.007	0.111	0.126	0.100
	(0.133)	(0.106)	(0.103)	(0.090)	(0.133)	(0.085)	(0.094)	(0.124)
Asset growth	-0.052	-0.129***	-0.081**	-0.120***	0.012	0.003	0.003	0.002
	(0.042)	(0.023)	(0.028)	(0.024)	(0.020)	(0.003)	(0.003)	(0.003)
Freedom	-0.039	-0.029	-0.022**	-0.015	-0.020*	-0.013	-0.005	0.003
	(0.020)	(0.021)	(0.008)	(0.015)	(0.009)	(0.009)	(0.004)	(0.008)
GDP per capita	-0.007	0.001	0	0.005	-0.008	-0.001	-0.003	-0.003
	(0.005)	(0.003)	(0.004)	(0.003)	(0.005)	(0.002)	(0.003)	(0.004)
Noninterest	0.101	0.071	0.088	0.291	0.174	0.337	1.065	0.685
	(0.267)	(0.243)	(0.224)	(0.202)	(0.375)	(0.772)	(0.866)	(0.090)
ROA	0.494	1.358***	1.049***	1.185***	0.186	0.236	0.179	0.181
	(0.619)	(0.252)	(0.240)	(0.208)	(0.268)	(0.211)	(0.223)	(0.247)
Constant	2.569*	1.751	1.746**	1.021	1.331*	0.856	0.175	-0.267
	(0.219)	(0.361)	(0.620)	(0.072)	(0.571)	(0.565)	(0.252)	(0.460)
R-squared	0.166	0.165	0.181	0.236	0.014	0.008	0.008	0.005
N	234	285	233	209	899	1441	1240	1011

Table 5. 15 Systemic risk, bank regulation and crisis

This table reports the results from model 5.3. Crisis is a dummy variables and it stands for 2007-2009 financial crisis. Standard errors are in the parentheses. * Statistical significance at 10% level. ** Statistical significance at 5% level. *** Statistical significance at 1% level.

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
Capital		-0.037**					-0.017*			
		(0.011)					(0.008)			
Capital*Crisis		-0.012					-0.005			
		(0.006)					(0.004)			
Private			0.008					-0.004		
			(0.008)					(0.005)		
Private*Crisis			-0.021***					-0.006*		
			(0.004)					(0.003)		
Restrictions				-0.004					0.005	
				(0.006)					(0.004)	
Restrictions*Crisis				-0.013***					-0.002	
				(0.003)					(0.002)	
Power					0.003					0.007
					(0.008)					(0.006)
Power*Crisis					-0.010***					-0.002
					(0.003)					(0.002)
Crisis	-0.162***					-0.042*				
	(0.030)					(0.019)				
Size	-0.013	0.001	-0.010	-0.012	0.001	-0.005	-0.002	-0.006	0.003	0.001

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
	IB	IB	IB	IB	IB	CB	CB	CB	CB	CB
	(0.010)	(0.014)	(0.011)	(0.011)	(0.010)	(0.005)	(0.008)	(0.005)	(0.006)	(0.008)
Loans	0.107	0.017	0.099	0.178*	0.051	-0.002	0.004	-0.007	0.006	-0.011
	(0.064)	(0.083)	(0.065)	(0.069)	(0.060)	(0.065)	(0.101)	(0.065)	(0.072)	(0.085)
Liquid assets	0.220*	-0.159	0.217*	0.133	0.088	0.136	0.048	0.142	0.137	0.122
	(0.101)	(0.122)	(0.101)	(0.098)	(0.086)	(0.086)	(0.132)	(0.086)	(0.096)	(0.123)
Asset growth	-0.134***	-0.072	-0.135***	-0.087**	-0.120***	0.003	0.014	0.003	0.002	0.002
	(0.022)	(0.043)	(0.022)	(0.027)	(0.024)	(0.003)	(0.020)	(0.003)	(0.003)	(0.003)
Freedom	-0.001	-0.002	-0.001	-0.003	0.002	-0.001	-0.003	-0.0005	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
GDP per capita	-0.007*	-0.008	-0.006*	-0.007	0.0005	-0.002	-0.007	-0.002	-0.003	-0.003
	(0.003)	(0.005)	(0.003)	(0.004)	(0.003)	(0.002)	(0.005)	(0.002)	(0.003)	(0.004)
Noninterest	0.130	0.115	0.138	0.193	0.316	0.500	0.429	0.452	1.032	0.632
	(0.231)	(0.266)	(0.232)	(0.218)	(0.190)	(0.767)	(0.368)	(0.767)	(0.866)	(0.086)
ROA	1.383***	0.656	1.389***	1.167***	1.186***	0.193	0.156	0.191	0.180	0.148
	(0.240)	(0.611)	(0.240)	(0.231)	(0.199)	(0.211)	(0.270)	(0.211)	(0.224)	(0.248)
Constant	0.162	0.458	0.081	0.275	-0.234	0.063	0.338	0.100	-0.052	-0.096
	(0.184)	(0.233)	(0.203)	(0.201)	(0.217)	(0.103)	(0.183)	(0.111)	(0.135)	(0.166)
R-squared	0.239	0.167	0.238	0.222	0.286	0.009	0.012	0.01	0.008	0.005
N	285	134	285	233	209	1441	899	1441	1240	1011

5.6 Conclusion

This chapter examines whether the regulatory elements highlighted by the Basel Committee (including restrictions on bank business transactions, capital oversight, empower private agents to monitor banks, and official supervisory powers) have different effects on the various risks of IBs and CBs. In addition, the study seeks to link the impact of regulatory factors on risk of IBs and CBs with the external business environment. Four bank risk measures (i.e. insolvency risk, idisoyncratic risk, credit risk, and systemic risk) have been used.

The sample of 550 banks contains 455 CBs and 95 IBs from 22 countries spanning an 11 year period from 2004 to 2015. This chapter contribute to the existing literature by highlighting that bank regulation factors emphasized by international regulators have different effects on reducing risk exposure of IBs and CBs. The bank regulations' influence on reducing risk also relies on the degree of economic freedom, and it is likely that flexible business environment and economy that allows firms have more freedom to operation could increase the effectivess of regulations on reducing bank risk.

This research extends the prior empirical studies of banking and regulation in several aspects. First, this study finds that the financial stability of IBs is lower than that of CBs, consistent with the evidence in the research of Čihák and Hesse (2010). The regulatory practices designed for CBs appear to have a greater effect on risk reduction of IBs. The stricter restrictions bank activities, and powerful supervisors could lead to higher reduction in IBs' insolvency risk compared to CBs. It also appears that the positive impact of official supervision on bank risk reduction increase when IBs and CBs are in countries with higher economic degrees of freedom.

Second, this research finds that the idiosyncratic volatility of IBs is higher than that of CBs, which might be due to the uncertain outcome of the profit-sharing transactions in Islamic banks' business model. The results show that stricter restrictions on non-loan

activities and more information disclosure could reduce more idiosyncratic risk of IBs compared to CBs. Moreover, liberalized business environment and flexible economic system make regulatory policies more effective in controlling idiosyncratic risk in CBs, while the impact of regulations on IBs' risk is not affected by the external environment.

Then, increased financial information disclosure to public and private agents is more effective to reduce the credit risk of IBs compared to CBs. While bank regulation have direct impact on enhancing loan quality for IBs, bank regulations in combination with economic freedom policies are able to effectively reduce the credit risk of CBs.

Finally, characteristics of the bank's capital regulatory environment can help explain the changes in extreme systemic risk of IBs and CBs, and more stringent capital regulation actually results in more systemic risk in IBs compared to CBs. The findings demonstrate that the regulatory indicators that stressed by the Basel Committee are not effective in curbing the systemic risk of financial institutions in countries that have Islamic banks, reflecting the need to update regulatory policies to reduce systemic risk (Weiß et al, 2014).

Furthermore, it demonstrates these regulatory policies' impact on various risks in the financial crisis. The findings show that these regulatory factors are probably not adequate as effective tools to control risk, and crisis management approaches for different risks need to be developed and designed.

This study suggest that the regulatory factors highlighted by Basel rules can actually help Islamic banks achieve stable goals and reduce risks. Regulators need to consider the differences in the impact of international regulatory factors on IBs and CBs, and design effective regulatory guidelines following the recommendation of international regulatory organizations to reduce the excessive risk-taking behavior of IBs and CBs. It also appears necessary to develop a greater degree of free economic environment, as the free business environment increases the effectiveness of regulation to reduce bank risk exposure.

Chapter 6 Conclusions

The Islamic banking embraces not only Muslim-majority countries but also works to integrate into the global financial market with its unique services. While IBs play roles similar to CBs to facilitate the funds from surplus units to deficit units, fundamental differences exist between the two bank types. Firstly, Islamic finance operates in compliance with the rules of Shariah, the legal code of Islam which does not allow investment in derivatives. It implies the transactions featuring extreme uncertainty, gambling and risk are not supported in the Islamic financial system. Then, the prohibition of interest (Riba) and permission of profit-loss sharing arrangements constitute the unique nature of Islamic financial services and products (Iqbal, 2007).

By using advanced panel data techniques, this research provides novel evidence which are meaningful for policymakers and regulators to understand the performance of Islamic banking industry, and help regulators to create more effective regulatory practices enhancing stability of Islamic financial institutions. The links between three chapters constitute a complete thesis. Specifically, the end of Chapter 3 focuses on the ability of banks' regulatory capital to asset risk, while Chapter 4 investigate the association between asset risk and regulatory risk to observe the risk management condition of IBs. Then, the last part of the Chapter 4 explore the impact of international regulatory policies on the IBs risk management system, while Chapter 5 centers on the effect of international regulatory policies on the risk of IBs and CBs.

This research in Chapter 3 contributes to bank capital structure literature by comparing IBs and CBs and provides novel insights as follows. The findings first show that IBs have lower book leverage than CBs, which could be due to Islamic banks' own features to have less diversified external financing sources. In addition, book leverage of IBs and CBs respond significantly different to the increase in collateral, profits and financial stability. Especially, when holding more tangible assets on hand, CBs take advantage of reduced information costs and have more intention to borrow compared

to IBs. Compared with CBs, the Islamic banking system seems to face higher financing costs and transaction costs because of the greater degree of information asymmetry and the opacity of the pledge's credit rating information. It is therefore necessary to promote the information infrastructure of IBs to provide reliable information on collateral and asset valuation.

Secondly, IBs and CBs actively move towards the desired capital structure. The results show that adjustment speed of IBs is lower compared to CBs, implying Islamic banks may face higher external financing costs and adjustment costs when they need to raise funds.

Third, it seems that both IBs and CBs choose to significantly increase debt when they intend to capture potential investment opportunities. Conventional banks are more incentivized to rely on debt financing as the funding source because they have more active interbank markets and various debt instruments compared to Islamic banks. It is necessary to create a wide range of innovative Islamic financial instruments. Diversified financing products will not only make Islamic banks more flexible to mobilize funds to support the development of their own assets, but could also reduce information asymmetry by conveying the message to the market.

Finally, IBs have higher regulatory capital ratios than CBs and the regulatory capital, on average, exceeds the minimum required capital ratio in both IBs and CBs. The regulatory capital of CBs is more active and timely in responding to the asset risk exposure and deteriorated loan quality than IBs, reflecting the weakness of the Islamic banking regulatory framework to deal with asset uncertainty.

This research has practical implication for regulators, policymakers and bankers who needs to understand the different capital structure behaviors of banks. The limited financing channels and relatively high capital costs make Islamic financial institutions need the support of regulators to expand the financing sources of Islamic financial institutions, design more debt instruments in line with Islamic rules, and reduce the financing costs of Islamic banks. In addition to implementing a unified regulatory

framework and standards for all banks in countries where dual banking systems exist, it is necessary to implement specific guidelines to address the inherent asset risk issues of IBs.

The research of chapter 4 makes contribution by linking required regulatory capital to portfolio volatility in Islamic banks across countries, from 2004 to 2015. The results start by showing that the increases in risk-weighted assets are not closely linked to increases portfolio risk that obtained from application of option pricing model in valuation (Flannery and Giacomini, 2015; Merton, 1974). This weak relationship leads to Islamic banks holding a less than required level of capital when taking on more risk, implying Islamic banks are likely to conduct regulatory capital arbitrage.

Then, this research links the regulatory arbitrage of Islamic banks with their unique nature such as profit-loss sharing investment account (PSIA) and implementation of IFSB standards. PSIA has the feature of absorbing losses and bearing risk, and IFSB standards (i.e. Islamic Financial Reporting Standards) are guidelines to enhance the stability of financial institutions offering Islamic financial products and services. The findings show that Islamic banks, on average, do not increase sufficient required capital in response to higher portfolio risk when investment deposits increase and IFSB standards adopted. Therefore, the inconsistency between variation in minimum required capital and portfolio risk is not necessarily the result of their participation in regulatory capital arbitrage, but is related to the profit-sharing characteristics of Islamic financial transactions.

Finally, the capital requirements of Islamic banks are more risk-sensitive in countries where there are less information barriers for private agents to monitor banks and supervisors have power to take prompt corrective actions to deal with deficiencies in weak banks following pre-agreed standards.

The risk-sharing transactions of Islamic banks has significant impact on bank capital requirements' ability to capture asset risks, but the disclosures and regulations of these businesses are not very specific. It is necessary to unify the risk-weighted assets

methodology of Islamic banks across countries, and enhance the quality and transparency of their capital base to develop the strong connection between capital requirements and market-based asset risk of Islamic banks (Archer et al, 2010;Mejia et al, 2014). This chapter also provides implications for policymakers and regulators to strengthen the risk-sensitivity capital framework by establishing effective supervisory practices.

The study in Chapter 5 sheds light on how bank regulation elements stressed by Basel Committee (including restrictions on bank business transactions, capital oversight, empower private agents to monitor banks, and official supervisory powers) reduce the risk-taking of IBs relative to CBs. Bank regulation has always been of social concern because banks play a crucial role to channel funds to companies in the society and the bank failure that causes restricted lending to other business sectors will significantly impact the wider economy. The impact of the banking regulation is not certain because a more liberal regulatory regime may make the banking system less stable or more stable. For instance, Barth et al. (2004) claim that regulatory practices reducing informational barriers are the most helpful in reducing the financial fragility of banks in countries. On the other hand, Beltratti and Stulz (2012) argue that more information disclosure increases banks' bankruptcy risk before the recent global financial crisis.

Chapter 5 contributes to the existing empirical research by providing evidence and explanations as follows. First, this study finds that the financial stability of IBs is lower than that of CBs, consistent with the evidence in the research of Čihák and Hesse (2010). The stricter restrictions bank activities, and powerful supervisors could lead to higher reduction in IBs' insolvency risk compared to CBs. While more stringent official supervision and business activities improve the financial stability of CBs and IBs. It also appears that the positive impact of official supervision on bank risk reduction increase for IBs and CBs that operate in regions with higher level of economic freedom.

Second, this research finds that the idiosyncratic volatility of IBs is higher than that of CBs, which might be due to the uncertain outcome of the profit-sharing transactions

in IBs' business model. The results show that stricter restrictions on non-loan activities and more information disclosure could reduce more idiosyncratic risk of IBs compared to CBs. Moreover, liberalized business environment and flexible economic system make regulatory policies more effective in controlling idiosyncratic risk in CBs, while the impact of regulations on IBs' risk is not affected by the external environment.

Then, increased financial information disclosure to public and private agents is more effective to reduce the credit risk of IBs compared to CBs. While bank regulation directly have impact on enhancing loan quality for IBs, bank regulations in combination with degree of economic freedom affect the credit risk of CBs.

Finally, characteristics of the bank's capital regulatory environment can help explain the changes in systemic risk of IBs and CBs, and more stringent capital regulation actually increases the more systemic risk in IBs compared to CBs. The results demonstrate that the regulatory indicators that stressed by the Basel Committee are not effective in curbing the systemic risk of financial institutions in countries that have Islamic banks, reflecting the limitations of bank regulations (Weiß et al, 2014).

Furthermore, the impact of regulatory practices on various risks in the financial crisis is analyzed. It appears that crisis management policies for different risks need to be developed and designed. The findings of this chapter support that the regulatory factors highlighted by Basel rules can actually help Islamic banks achieve stable goals and reduce risks, mainly because Islamic banks have a relatively weak foundation, so regulation is more effective. To a certain point, the findings are meaningful because it motivates policymakers and regulators to consider the differences in the impact of international regulatory factors on IBs and CBs, and to design effective regulatory guidelines following the recommendation of international regulatory organizations to reduce the excessive risk-taking behavior of IBs and CBs, especially in crisis periods.

This section focuses on what aspects of future research can be extended. First, the study in chapter 3 follows the existing literature by modeling banks' target capital structure primarily based on observable bank-specific factors, but it might still leave

much target capital structure variation unexplained. Gungoraydinoglu and Öztekin (2011) suggest that macroeconomic elements have important theoretical implications in determining banks' capital structure and their empirical results support this view. It will be interesting for further research to include both bank characteristics and country attributes in specifying the desired regulatory capital and unregulated capital ratio for both IBs and CBs. The reasons for affecting the adjustment of banks' capital structure have been explored by De Jonghe and Öztekin (2015), and they find that banks in countries with more stringent capital requirements and high inflation rates will adjust faster. Their research has given regulators a lot of inspiration. Future research can also focus on what policy factors could drive the speed of capital adjustment in banks in the countries that have IBs.

Second, the findings in chapter 4 imply that Islamic banks are provided with opportunities to hold insufficient capital under IFSB standards. Potential research can focus on the risk-weighting system for Islamic banks in the current IFSB standard and address the question of whether current modes of risk weighting are accurate in Islamic banks.

Then, for chapter 5, the direction of further research can be to explore more macro conditions such as variables related to national development or microeconomic factors, and to observe their impact of these factors on the ability of bank regulations on reducing bank risk.

Finally, the main methodology used in each chapter is the two-step GMM estimation which assumes that the current realizations of the dependent variable are influenced by past ones, and the endogeneity issues are considered. However, one disadvantage of system GMM is that it could be complicated and produce invalid estimates. Future research can attempt to analyze bank performance with other models that control endogenous problems.

Appendix

Appendix A

Appendix A.1 Description of Islamic banking mode

Type	Description
Profit and loss sharing mode	
Mudaraba	The banks receive funds from depositors or fund holders and then own the capital. They provide clients with funds for projects development, clients are responsible for managing the business, and provide expertise to facilitate the operation of the project. Profits are distributed according to pre-agreed contracts. Losses are entirely absorbed by banks - the fund providers.
Musharaka	Equity participation contract: Under this business transaction, banks and customers conduct business cooperation in accordance with the terms of the agreement, and they all need to fund the project. Banks and customers like partners because they all contribute capital to the project. After the project produces profits, the bank and the customer share the profits at a pre-agreed ratio. The losses incurred are apportioned strictly according to their respective capital contribution ratios. This kind of transaction is often used to fund long-term investment projects.
Non-PLS mode	
Bai' Mua' jjal	The bank purchases the product according to the customer's request and then sells it to the customer for profit through installment payment. The customer can obtain the final ownership of the product by installment or one-time settlement. Only customers and banks participate in the transaction, and the price of the product is determined by the bank and the customer.
Ijara	Ijara's business is similar to financial leasing in traditional finance. The Islamic banks collect the agreed rent from the lessee by leasing the assets, but the ownership of the asset itself is not transferred to customers. The bank remains the owner throughout the lease period and gives up the benefits of using the asset. The ownership of the assets will be transferred to the customer in the future.
Murabaha	In the mulabaha transaction, a bank purchases the assets identified by its customers (borrowers) from third parties and then sells the assets to the borrowers to obtain the original purchase price and profit elements (usually calculated on a baseline basis, such as LIBOR). Customers purchase products at higher prices and pay the full amount in installments.

Appendix B

Appendix B.1 Capital adequacy ratio formula

(a) Standard formula from Islamic financial services board (IFSB)

$$\frac{\text{Eligible capital}}{\text{Total risk-weighted assets (credit+market risks) plus operational risks}}$$

Less

Risk-weighted assets funded by PSIA (credit+ market risks)

Note: PSIA refers to the profit-sharing investment accounts.

Appendix B.2 Bank regulation indexes

Variable	Quantification	Questions sources
Capital regulatory requirements index	Higher values indicate more stringent capital regulation	The section 4 of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS
Private monitoring index	Higher value indicates more information disclosure and private sectors are more able to monitor banks.	The section 7 of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS
Prompt corrective power index	Higher prompt corrective action index implies supervisors are more powerful to take prompt action in dealing with the financial weakness of banks.	The section 5.(a).(1) of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS

Appendix C

Appendix C.1 regulatory indexes

Variable	Quantification	Question sources
Capital regulatory requirements index	Higher values indicate more stringent capital regulation	The section 4 of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS
Bank activities restrictions index	Higher values indicate higher restrictions on securities underwriting and trading, insurance underwriting and trading, real estate project investments and non-financial corporate transactions.	The section 1 of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS

Variable	Quantification	Question sources
Private monitoring index	Higher value indicates more information disclosure and private sectors are more able to monitor banks.	The section 7 of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS
Official supervisory power	A higher supervisory power value indicates higher supervisory power	The section 5.(a) of table 1 in the research of James R. Barth et al (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS

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