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Impact of bank regulation on risk of Islamic and conventional banks

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Abstract

We analyse the impact of bank regulation on the risks of Islamic banks (IBs) and conventional banks (CBs) between 2004 and 2015 by employing 455 CBs and 95 IBs from 22 countries where IBs and CBs coexist. Since the objective of Basel regulations is to achieve a stable banking sector by mitigating risks, we examine the impact of bank regulations on various risks of IBs and CBs by using a regression framework. We examine solvency risk, credit risk, idiosyncratic risk and systemic risk by using capital oversight, restriction on activities, private monitoring and supervisory power bank regulation data provided by the World Bank. The findings show that though the Basel regulations were originally developed for CBs, our results imply that they are effective for IBs as well as CBs. However, our study also shows that regulations affect IBs and CBs differently as their business models are different. More targeted regulations towards IBs would be necessary to support IBs. Additionally, in regions with higher economic freedom indexes, banking regulations can mitigate the risk of IBs and CBs to a greater extent. Our results imply that the combination of free economic policies and banking supervision addresses risks in banking effectively. Finally, the bank regulations did not appear to be able to control the risk of the sample banks during the 2007–2009 crisis. Hence, the Basel committee needs to rethink about regulations during crisis times.

KEYWORDS
bank regulation, financial crisis, insolvency risk, Islamic banking, systemic risk

1 | INTRODUCTION

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, Demirgüç-Kunt, & Levine, 2006; Chortareas, Girardone, & Ventouri, 2012; Cihak, Demirgüç-Kunt, Martinez Peria, & Mohseni-Cheraghlou, 2013; Pelster, Irresberger, & Weiß, 2018). Beltratti and Stulz (2012) suggest that bank regulations

that are stressed by the 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 conventional banks (CBs), and when these regulations are implemented uniformly, Islamic banks (IBs) are also bound by these regulatory practices (El-Gamal, 2006). Though total assets of IBs have continued to increase in recent years, little research has been conducted on the influence of these regulatory

practices on the risk of IBs. The objective of this study is to examine the impact of regulations on the risks of IBs and CBs. The purpose of this study is to examine whether the impact of bank regulation is different on IBs and CBs where these two types of banks coexist in many countries. Moreover, it attempts to investigate whether macroeconomic factors such as countries' economic environment could affect the impact of regulation on bank risk. As our sample period includes the 2007–2009 financial crisis, we also examine the impact of regulations on the risk-taking of banks during the financial crisis.

We use several measures for risk. First, the solvency of the business is the single most important consideration for banks. Therefore, we use a measure for insolvency risk to gauge how solvent are the banks. 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. We employ Z-score value as a measure of insolvency risk for IBs and CBs. Higher values of Z-score indicate higher financial stability of banks. Second, we employ a measure of credit risk – loan loss provisions (LLPs) – the possibility that the borrowers do not repay the loan on time or at all. A higher value of LLP indicates that the bank bears more credit risk, as adopted by Abedifar, Molyneux, and Tarazi (2013). Third, we use idiosyncratic risk which is the inherent risk related to an individual bank's business models and not affected by the market-wide movements. For any bank, idiosyncratic risk is important as it is related to the business model. Finally, we use a measure of systemic risk of banks by using the popular indicator of a financial institution's exposure to systemic uncertainty, the marginal expected shortfall (MES). The bank's MES appears to be a measure that effectively predicts the risk of the extreme market crash in the short term and hence very important during a time of crisis.

IBs, 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 the above risks similar to those encountered by CBs because both of them deal with money and credit. 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 face lower credit risk and insolvency risk than traditional banks, but their research does not involve regulatory factors. Distinguished from the focus of previous empirical analysis, this study examines the 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. 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 effects on IBs and CBs' financial stability, and the implementation of these regulations are expected to reduce the risk of CBs because these factors are designed for the business of CBs and not involve the treatment of Islamic financial services and products. However, the results show that regulatory factors are more effective in reducing the insolvency risk of IBs. Besides, 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. Moreover, during the 2007–2009 global financial crisis, the impact of regulations has been highly heterogeneous among IBs and CBs as these regulatory factors are associated with the stability of CBs and are irrelevant to the risk of IBs. It seems that the crisis management of IBs has not received much attention.

Second, this study finds that IBs have higher idiosyncratic volatility compared to CBs, reflecting their differences in the 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 the 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 IBs' information disclosure. IBs' business model, including Islamic financial transactions, leads them to face greater risk management pressures and more operational uncertainties. Furthermore, a liberalis ed business environment and flexible economic system enable regulatory policies to effectively control the business risk in the CBs, while the impact of regulation on IBs does not rely on the external environment. However, these bank regulations are not adequate to protect IBs and CBs from fluctuations in their inherent business risks during the crisis.

Finally, only capital requirements can explain systemic risk of IBs and CBs that proxied by MES, and more stringent capital regulation results in more systemic risk in IBs compared to CBs. The regulatory indexes and systemic risks are almost unrelated to IBs and CBs during the financial crisis. The regulatory indicators stressed by the Basel Committee are limited in curbing the systemic risk of financial institutions in countries that have IBs, which make it necessary to establish potential schemes for reducing IBs' systemic risk such as investment depositors protection programmes (Weiß, Bostandzic, & Neumann, 2014). We find that the regulatory capacity during the crisis is limited in addressing each risk that we examine.

We also use whether a country has specific rules to regulate Islamic banking. We define Islamic regulation (Islamic_REG) as 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. We find that most of the risk that we examine in this article is negatively related to the Islamic regulation dummy, which implies that Islamic regulation is effective in controlling the risk.

The findings of this study show that the regulatory factors highlighted by Basel rules can help IBs achieve stablilty and reduce risks. The results of the paper have several policy implications. First, regulatory practices designed for CBs can promote the stability of IBs. This means that national regulators need to think more about the implementation of international regulatory reforms among IBs and CBs separately, 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. Thus, improving the regulatory system is an ongoing process that requires regular fine-tuning of existing economic conditions in response to the changing regulatory framework. Moreover, due to the limitations of the current regulatory standards during the financial crisis, countries with systematic importance of banks need to introduce crisis management mechanisms to improve the risk management of IBs and CBs based on their respective characteristics.

The research structure of this article is arranged as follows. Section 2 describes the Theoretical Background of the paper. Section 3 presents the literature review and hypotheses development. Section 4 and Section 5 introduce the data collection method and methodology. Section 6 demonstrates the empirical findings. Section 7 presents an additional analysis related to the financial crisis. The discussion and conclusion are provided in Section 8.

2 | THEORETICAL BACKGROUND

The banking industry is subject to more regulation than other industries. The original intention of regulation is to discipline the behaviour 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 demonstrates that bank regulations bring positive effects to the development of banks (Angkinand, 2009; Cihak et al., 2013; Klomp & de Haan, 2015). On the other hand, Barth, Caprio, and Levine (2004) raise a cautionary flag against the regulations that rely too much on government supervision and regulation of bank activities.

If banks are allowed to participate in a wider range of activities, they are likely to engage in higher-risk activities. Demirgüç-Kunt and Huizinga (2010) conclude a 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 pursue profits within a limited business scope. In contrast, encouraging banks to participate in 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, Delis, and Pasiouras (2011) find more stringent restrictions on banking activities in Central and Eastern European countries can effectively reduce the bankruptcy risk of banks.

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) find capital stringency can directly promote bank stability. While capital regulations do have an impact on the risk behaviour of banks, the impact is dependent on banks' shareholder structure. Their findings display that when most banks' shares are held by one shareholder, the stricter capital regulation will increase bank risk. The results of Anginer, Demirguc-Kunt, and Zhu (2014) show higher capital stringency could minimize the spread of crises and systemic risk in US banks. Consistently, Hoque, Andriosopoulos, Andriosopoulos, and Douady (2014) suggest that stricter capital supervision plays a positive role in the financial crisis since strengthening the 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 allows 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. 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.

The importance of bank regulation and risk is self-evident, and there is a lot of literature on regulation and risk, but the relationship between the two has not yet been examined for IBs. On one hand, there are fundamental differences between IBs and CBs. For example, the asset and liability side of the balance sheet is different for IBs and CBs. IBs use a profit-loss sharing (PLS)[1] contract on the asset and liability side of their balance sheet, which makes their business model different compared to CBs. On the other hand, both types of banks deal with money and credit, which makes them resemble each other. As there are differences and similarities between IBs and CBs, therefore, it is important to empirically examine the effect of regulations on different types of risk of IBs and CBs where both types of banks coexist in many economies.

3 | LITERATURE REVIEW AND HYPOTHESES

IBs face many risks similar to those encountered by CBs as they accept deposits and provide funds to the customers. This research discusses some of the risks faced by IBs and CBs, including bankruptcy risk, credit risk, idiosyncratic risk, and systemic risk (Al-Wesabi & Ahmad, 2013; Bitar, Naceur, Ayadi, & Walker, 2017; Elnahass, Izzeldin, & Abdelsalam, 2014; Hoque et al., 2014; Rosly & Zaini, 2008; Zins & 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 (a) capital oversight; (b) restrictions on bank activities; (c) private monitoring and (d) supervisory power, which are key elements highlighted by the core principles of Basel Committee supervision (Laeven & Levine, 2009). The study below describes why bank regulations are expected to have different effects on the risk of IBs and CBs.

3.1 | Capital oversight

Regulators usually require financial institutions to hold a certain amount of equity capital as a 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 & Levine, 2009). There have been theoretical papers focussing on the topic of bank capital regulation (Calem & LaCour-Little, 2004; Drumond, 2009; Hellwig, 2010; Karim, Hassan, Hassan, &

Mohamad, 2014). Gauthier, Lehar, and Souissi (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 is linked with bank risk (Agoraki et al., 2011; Baker & Wurgler, 2015; Beltratti & Stulz, 2012; Hoque et al., 2014; Laeven & Levine, 2009; Weiß et al., 2014). 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 & Santomero, 1988). Therefore, 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, Calomiris, Hooley, Korniyenko, and Wieladek (2014) illustrate that more regulations on capital levels drive banks to seek out high-risk activities.

Many countries have established a risk management framework for IBs, 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, IBs need sufficient capital to maintain the depositor's confidence in the bank and provide psychological assurance. However, both PLS and non-PLS modes 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 do not require collateral, the risk of these businesses is considered greater than the non-PLS modes assets (Errico & Farahbaksh, 1998).

Although the capital requirements of the Basel rules do not specifically highlight Islamic financial products, they provide a modern basic capital regulatory foundation for IBs. Zins and Weill (2017) find that Basel II, at the expense of IBs, widened the bankruptcy risk gap between traditional banks and IBs. 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 & Aliyu, 2018). First of all, in terms of assets, IBs' PLS financing modes which normally do not get involved with collaterals are probably riskier, requiring more capital to absorb losses. Second, because of the risk-sharing feature, investment accounts on the side of IBs'

liability could make the calculation of risk-weighted assets and capital adequacy ratio more complex. 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.

The index of bank capital regulations includes information on (a) the extent of regulatory requirements regarding the amount of capital banks must hold and (b) the stringency of regulations on the source of funds that count as regulatory capital can include assets other than cash or government securities, borrowed funds, and whether the regulatory/supervisory authorities verify the sources of capital. Since capital regulations should make the banks less risky, it is an important empirical question whether capital regulations affect IBs and CBs differently in terms of insolvency, credit, idiosyncratic and systemic risk. Thus, we propose the following hypothesis:

Hypothesis 1. *The impact of capital requirements is different on different types of the risk of IBs and CBs.*

3.2 | Restriction on activities

Traditionally, 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 an unacceptable risk (Mishkin & 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 has been studied in the literature. Demirgüç-Kunt and Huizinga (2010) suggest the diversified activities could lead to riskier behaviour by banks. The empirical evidence produced by Jiménez, Lopez, and Saurina (2013) and Agoraki et al. (2011) shows 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.

IBs 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 are theoretically prohibited. But, the modern interpretation of Islamic laws suggests 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 regulations. Three institutions – international organizations, local authorities and Islamic advisory committees – make regulations in accordance with Sharia law to regulate and limit Islamic financial operations.

There are differences between IBs′ financial products and traditional banks′ financial products. The operation of these IBs′ products is not covered by the scope of Basel rules, which are international guidelines designed for traditional banks. Perhaps these restrictions on regulation will control the overall risk of IBs by limiting the diversification of IBs′ non-Islamic operations. However, Islamic-compliant securities and derivatives transactions are not affected by these restrictions. That is to say, these regulations can cover almost all of the non-lending businesses of CBs but cannot reach certain services provided by IBs, which probably makes these regulations less effective for IBs than CBs. Thus, regulation of restrictions on bank activities can effectively reduce the more risk of CBs. In sum, the influence of the restrictions on banks might affect IBs and CBs differently in terms of insolvency risk, credit risk, idiosyncratic risk and systemic risk. It is ultimately an empirical question of how the restriction on bank activities affects various types of risk that we examine in this article. Based on the previous discussion, we propose the following hypothesis:

Hypothesis 2. *The impact of the restriction on bank activities is not the same on the risk of IBs and CBs.*

3.3 | Private monitoring

Banks collect funds from depositors and then invest these in various risky assets such as loans and securities. The information asymmetry between banks and fund suppliers could result in the moral hazard behaviour 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 a 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, Lin, Ma, Seade, & Song, 2013). As a result, private agents can make decisions based on disclosed information about asset quality and exposure to the risk of banks.

There are different views based on the effect of private monitoring practice. Lower information asymmetry is positively associated with systemic risk of banks, and increased disclosure of information can protect investors (Agoraki et al., 2011). However, in markets where banks are not highly competitive, the depth of information disclosure has less impact on reducing the systemic risk of banks (Anginer et al., 2014). Another example is that in countries that require more information disclosure, banks take on more idiosyncratic risks (Beltratti & Stulz, 2012).

Due to the risk-sharing characteristics of IBs (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, Aljabrin, Awad, Norat, and Song (2014) state that the protection provided by IBs 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 & 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 the Islamic bank's operating strategies for PLS funds. Song and Oosthuizen (2014) argue that the 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 certain 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 IBs. Since the modern risk management foundation of IBs might be limited compared to CBs, frequent transparency of its operating conditions may allow shareholders or stakeholders to limit the high-risk behaviour of IBs, thus reducing more risk of IBs in a short period compared to CBs. However, the disclosure framework and details of the Basel rules were not developed for IBs. 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 IBs.

The private monitoring index measures the degree to which regulations empower, facilitate and encourage the private sector to monitor banks. Because IBs and CBs have a shareholder base and depositors are quite keen to monitor the banks, however, the different business models for IBs are compared to CBs that makes it difficult for the private sector to monitor IBs compared to CBs. Hence, we empirically examine the different types of risk is related to the private monitoring regulation for IBs and CBs. Given the above discussions, the hypothesis is as follows:

Hypothesis 3. *The impact of private monitoring is different on the risk of IBs and CBs.*

3.4 | 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) argues 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 & Farahbaksh, 1998; Farooq & 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 behaviour (Barth et al., 2013; Čihák & 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.

Adopting the international bank regulation guidelines, supervisors are able to set out the steps to adequately monitor and apply the standards to transactions conducted by IBs (Mejia et al., 2014). However, Alam (2014) finds official supervision might do 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 ambiguous (Song & Oosthuizen, 2014).

The official supervisory index measures the degree to which the country's commercial bank supervisory agency has the authority to take specific actions. As the official supervisory index measures, a number of actions that the supervisory agency can take should be related to the risk factors that we consider in this article. The supervisory index encompasses different activities including change of management, directors and organization structure which could be very different for IBs compared to CBs. Hence, it is an empirical question of how the official supervisory index is related to the risks of IBs and CBs. The final hypothesis we propose:

Hypothesis 4. *The impact of official supervision is different on the risk of IBs and CBs.*

4 | DATA AND VARIABLES

4.1 | Sample selection

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.[2] 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 the Datastream database. The regulatory indexes used in this study are from the World Bank's surveys for banks across countries. The 2005 survey data are used for the years 2005–2007, the survey data of 2008 are used for the years 2008–2011 and survey data of 2012 are used for the years 2012–2015 (Anginer et al., 2014; Barth et al., 2004).

The variables included are presented in Table 1, and the following subsections contain definitions and discussions of dependent and independent variables used in this empirical research.

4.2 | 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 based on data in financial statements.

4.2.1 | Insolvency risk

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

$$Z_{i,t} = \frac{\text{Return\_on\_assets}_{i,t} + \text{Capital}_{i,t}}{\sigma(\text{return\_on\_assets}_{i,t})} \quad (1)$$

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, De Jonghe, & Schepens, 2013). 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 indicate higher financial stability of banks. For simplicity, the 'Z-score' is used to refer to the logged Z-score in this article.

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 account may also increase the uncertainty of Islamic bank returns, banks' capital and return on an asset will still be affected when the cushion exhausts, and then instability will be reflected in the value of the Z-score (Čihák & Hesse, 2010).

4.2.2 | Credit risk

The ratio of LLP to total assets can be used to represent the credit risk, that is, the possibility that the borrowers do not repay the loan on time or at all. Credit risk management aims to maximize banks' return by limiting the exposure of expected loan losses within an acceptable range. The 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 LLP 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

TABLE 1 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, Engle, and Richardson (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 B; World bank; Barth et al. (2004)
Private	An index measure reflecting accurate information disclosures give private agents the right to monitor banks	Appendix B; World bank; Barth et al. (2004)
Restrictions	An index of regulatory restrictions on the non-traditional activities of banks	Appendix B; World bank; Barth et al. (2004)
Power	An index of the power of the bank supervisory agency	Appendix B; World bank; Barth et al. (2004)
Size	The natural logarithm of bank assets	Bankscope
Loans	Ratio of total loans to total assets	Bankscope
Non-interest 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
Economic freedom index	Is a composite of 10 indicators in the fields of property rights, government integrity, judicial effectiveness, tax, government spending, fiscal health, business freedom, labour, 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

the business transactions of Islamic finance, but IBs carry out transactions such as lending, trade financing and other financial services just like their conventional counterparts while maintaining their unique financial products (Al-Wesabi & Ahmad, 2013). Farook, Hassan, and Clinch (2014) find that the LLPs of IBs are lower than that of CBs, resulting from the fact that IBs 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 research tends to pay attention to whether financial regulation has widened the credit risk gap between IBs and CBs.

4.2.3 | Idiosyncratic risk

Idiosyncratic risk is considered 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 & Varela, 2017). Following Beltratti and Stulz (2012), this study calculates the idiosyncratic volatility as:

$$r_{id} = \alpha + \beta r_m + e_{id} \qquad (2)$$

where r_m is the MSCI world bank index[3] excess return, and r_{id} refers to the daily returns. The estimated 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 1 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, Lettau, Malkiel, & Xu, 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 IBs must be invested in real economic enterprises, and trade and equity investment are the most important forms of transactions. Because of these restrictions, IBs use different contracts from CBs in terms of the sources and use of funds (Aggarwal & Yousef, 2000). The study, therefore, predicts different idiosyncratic risks between IBs and CBs.

4.2.4 | 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 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 the systemic volatility of IBs because banks in counties other than the US and EU areas probably have not experienced that extreme capital shortage (Brownlees & Engle, 2016). This research explores the systemic risk of IBs 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 an extreme market crash in the short term (Bierth, Irresberger, & Weiß, 2015; Weiß et al., 2014). Following the research of Acharya, Pedersen, Philippon, and Richardson (2017), this study calculates

the average of bank returns in the worst 5% days of market returns in a given year:

$$MES_{it} = E(R_{it}|R_{mt} < 5\%) \qquad (3)$$

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 a daily frequency. The daily bank share price and the market index were 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 the 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.'s (2014) 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 capital regulation, banks inject capital promptly. Berger, Roman, and Sedunov (2019) analyse the impact of government aid on the contribution of banks to systemic risks in the United States. Their findings demonstrate that the troubled asset relief program (TARP)[4] can help banks reduce systemic risk in the short term, but it will make them more unstable in the long run. However, there is no clear literature support whether the bank regulation environment prevents IBs from systemic risk or increases their instability. Then, this article provides empirical evidence to help clarify whether the impact of banking regulation on the systematic risks is different for IBs and CBs.

4.3 | Explanatory variables

4.3.1 | Regulation variables

Beck et al. (2006), Caprio, Laeven, and Levine (2007) and Barth et al. (2004) conduct empirical studies on various regulatory indicators. This article 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 B.

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 article, 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 mean more restrictions. In this study, the activities restrictions index ranged from 4.58 (e.g., United Kingdom) to 16 (e.g., Bangladesh).

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. A higher value of this index means more incentives and tools are provided for the 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 the 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, and so on. A higher supervisory power value indicates higher supervisory power (Delis & Kouretas, 2011). In this study, the index of supervisory power takes values between 8 (e.g., Cayman Islands) and 14.5 (e.g., Indonesia).

4.3.2 | Other independent variables

Some control variables are used in this article. 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 bank size, loans, non-interest 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 & Papanikolaou, 2012). The loan is measured by the ratio of the loan amount to assets (Hoque et al., 2014). Non-interest activities are constructed as the ratio of non-interest expense to assets to explore whether concentration in non-interest 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 & Staikouras, 2011). The return on assets indicator is used to represent 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 of 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 (from the website of the Heritage Foundation) is a synthesis of 10 indicators in the areas of government integrity, judicial effectiveness, property rights, taxation, fiscal health, commercial freedom, government spending, labour, 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.

4.4 | Descriptive statistics

Table 2 shows the descriptive statistics for IBs and CBs. The results show that the idiosyncratic risk and credit risk are higher for IBs, while the systemic risk and insolvency risk are lower for IBs. The mean difference test results show that all the risk variables are statistically different for IBs and CBs. The other variables show that the size and liquid assets are lower for IBs, but the asset growth is higher for IBs.

Figure 1 indicates that the risks of CBs and IBs vary in different time intervals. In particular, the Islamic bank's LLP is higher than that of CBs from 2008 to 2011. It shows that during this period, the asset quality of IBs is worse than that of CBs, or that IBs are more aggressive in adjusting their LLPs and planning for the expected future losses of their loan portfolios.

Figure 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 IBs also experience market instability during the global financial crisis, which is similar to the results obtained by Archer and Karim (2007a) and Archer and Karim (2007b) who suggest IBs significantly contribute to systemic risk mainly during unstable periods. At the height of the crisis, the MES values of IBs are lower than those of CBs, indicating that the systemic risk of IBs is greater. In general, IBs' assets are less liquid than CBs. It is because the current IBs' asset portfolio

consists mainly of low-liquid trade finance and assets that generate rents, which are not easy to be sold quickly to increase liquidity, thus exacerbating IBs' systemic risks (Khan & Ahmed, 2001). In contrast, in times of crisis, CBs are often able to escape financial distress by selling liquid assets and send positive signals to the capital markets. Following the crisis, the average MES of both IBs and CBs increased once again, implying the systemic risk reduces afterwards.

The overall sample data present a considerable change of the insolvency risk among IBs and CBs over time, as shown in Figure 3. Overall, the stability of IBs is significantly lower than the 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 in other 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 4 shows the case of idiosyncratic risk for the entire sample. 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 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
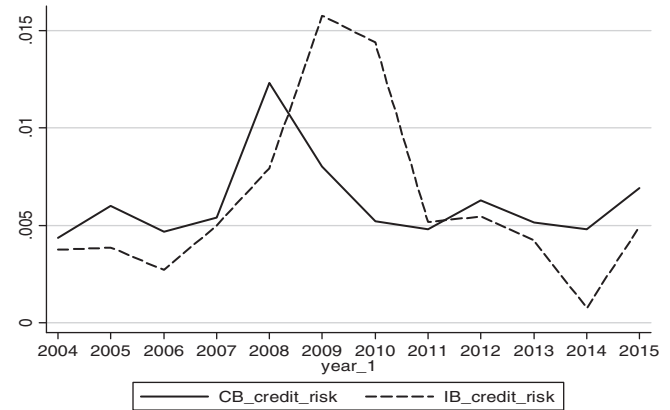
FIGURE 1 Credit risk of banks. The left vertical axis measures the linear average credit risk (i.e., loan loss provisions) for conventional banks (CBs) and Islamic banks (IBs) in each year for the period 2004–2015.
Note: CB_credit_risk refers to the credit risk of CBs, and IB_credit_risk refers to the credit risk of Islamic banks

TABLE 2 Summary statistics for IBs and CBs

	N	Mean	Std.dev	Min	Max	Islamic banks	Conventional banks
Panel A: Bank risk measures							
Idiosyncratic risk (%)	2,809	38.06	0.35	0.23	97.49	38.95	37.87[**]
Systemic risk (MES)	2,785	−0.02	0.003	−9.90	6.93	−0.035	−0.01[***]
LogZ	2,941	1.33	0.45	−1.35	4.53	1.21	1.35[***]
Credit risk (%)	3,920	0.62	0.03	−5	17.43	0.65	0.63[***]
Panel B: The explanatory variables							
Size	4,539	14.78	1.97	3.65	22.06	14.25	14.88[***]
Loans	4,399	0.48	0.22	0	1.49	0.49	0.48[**]
Non-interest expenses	4,409	0.02	0.05	−1.72	1.25	0.039	0.015[***]
Liquid assets	4,497	0.28	0.21	0	1	0.22	0.292[***]
ROA	4,522	0.009	0.19	−11.93	2.099	0.0097	0.009
Asset growth	3,942	0.168	1.72	−1	98.92	0.187	0.164[***]
Index of economic freedom	6,236	63.15	9.69	40.6	89.4	63.97	62.99[***]
GDP per capita growth	6,419	2.07	3.94	−29.89	15.55	1.39	2.22[**]
Capital regulation index	4,138	8	2.3	3	10	8	8
Private monitoring	6,587	7	1.83	0	9	8	7
Restrictions on bank activities	5,447	11	3.37	4	16	11	11
Supervisory power index	4,298	12	2.3	8	16	12	12

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

FIGURE 2 Systemic risk of banks. The left vertical axis measures the linear average systemic risk for conventional banks (CBs) and Islamic banks (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

FIGURE 3 Insolvency risk. The left vertical axis measures the linear average insolvency risk for conventional banks (CBs) and Islamic banks (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

deposit contracts and long-term uncertain loan contracts can be mitigated by risk sharing.

Some scholars believe that the diversified risk characteristics of IBs will make them 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 of IBs is higher than CBs, especially in a crisis (Farooq & 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 analysed data. Table 3 reports descriptive statistics. It shows that IBs have higher idiosyncratic risk, systemic risk, insolvency risk and credit risk compared with CBs, indicating that IBs need to establish a sound operating foundation for risk management.

5 | METHODOLOGY

This empirical study analyses 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:

$$Risk_{i,j,t} = \beta_0 + \beta_1 IB_i + \beta_2 IB_i * X_{it} + \beta_3 * X_{it} + \varphi Controls_{it} + \varepsilon_{it} \tag{4}$$

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 IBs and zero otherwise. X_{it} is a set of regulatory indexes, including $Capital_{i,j,t-1}$, $Private_{i,j,t-1}$, $Restrictions_{i,j,t-1}$, and $Power_{i,j,t-1}$, 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., $IB_i * X_{it}$) 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 & Staikouras, 2011). To capture the bank-specific differences, bank-level variables incorporate size, loans, non-interest expenses, liquid assets, profitability and asset growth. The country-level variables include GDP growth per capita and the economic freedom index. The variable ε is the error term or disturbance which contains the unobservable elements that affect bank risk. To reduce the possibility of a reverse causal relationship between bank risk and independent variables, all explanatory variables are lagged by 1 year.

The estimation of Equation (4) 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 the fixed effects model might not be the best choice when the 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 IBs still

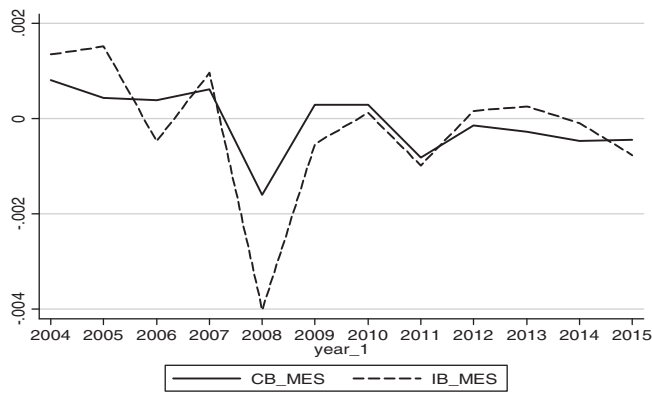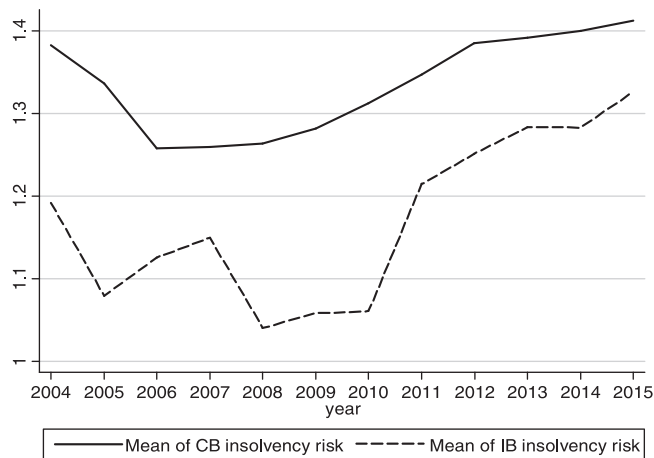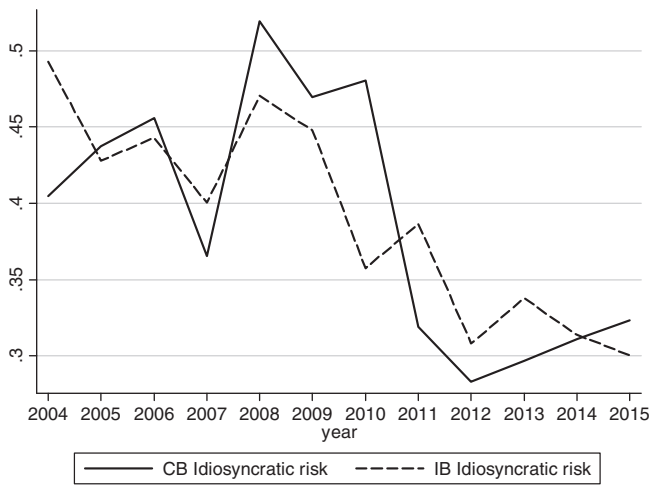**FIGURE 4** Idiosyncratic risk. The left vertical axis measures the linear average idiosyncratic risk for conventional banks (CBs) and Islamic banks (IBs) in each year during 2004–2015.
Note: CB idiosyncratic risk refers to the risk of CBs, and IB idiosyncratic risk refers to Islamic banks' uncertainty

have a significantly different risk from CBs when additional variables are controlled.

The coefficient of regulation indexes (i.e., β_3) informs about the impact of regulation factors on CBs, while the sum value of β_3 and β_2 (i.e., the coefficient on the interaction of IB dummy and regulation) measures the impact of regulation practices on the risk 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 is not identical for IBs and CBs.

The business and economic environment are important to the development of banks. Sufian and Zulkhibri (2015) find greater financial and economic freedom have played a positive role in the profitability of IBs, and Gropper, Jahera, and Park (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, Ritchken, & Thomson, 2005). The following model is used for the analysis:

$$\text{Risk}_{i,j,t} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} * Freedom + \varphi Control_{it} + \varepsilon_{it}, \quad (5)$$

where $Risk_{i,t}$ is the risk measure in Section 3.2. 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 depends on the degree of business

freedom is the reason for adding interaction variables. Estimation of Equation (5) 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 and the economic index is obtained from the Heritage Foundation (Behr, Schmidt, & Xie, 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 & Martínez Pería, 2013; González, 2016; Vazquez & Federico, 2015). For instance, Cihak et al.'s (2013) survey demonstrates that there is room for regulatory improvement in reducing bank risk, especially in the turmoil period. However, there is a lack of up-to-date empirical information about what impact the regulations have on IBs and traditional banks in crisis. The following model is used to analyse how bank supervision affects the risks of these banks during the recent financial crisis:

$$\text{Risk}_{i,j,t} = \beta_0 + \beta_1 X_{it} + \beta_2 X_{it} * Crisis + \varphi Control_{it} + \varepsilon_{it} \quad (6)$$

where all of the dependent variables are the same as the above equations, and the factors related to a crisis are added to the explanatory variables. The 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 behaviours of IBs and CBs throughout the period are considered separately.

6 | RESULTS

6.1 | Insolvency risk

This section examines how regulatory factors influence IBs and CBs' stability. Table 3 summarizes the estimation when the *Z*-score that measures insolvency risk is the dependent variable. When the value of the *Z*-score is lower, a bank has higher stability. Regression 1–8 is estimated using OLS while the rest regressions use the random-effects model. The sign of Islamic bank dummy

TABLE 3 Insolvency risk and bank regulation

Variables	1 OLS	2 OLS	3 OLS	4 OLS	5 OLS	6 OLS	7 OLS	8 OLS	9 RE	10 RE	11 RE	12 RE	13 RE	14 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
	(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***	4.026***	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)	(0.555)	(0.554)	(0.555)	(0.555)	(0.557)	(0.794)	(0.555)	(0.199)	(0.201)	(0.202)	(0.201)	(0.199)	(0.199)

TABLE 3 (Continued)

Variables	1 OLS	2 OLS	3 OLS	4 OLS	5 OLS	6 OLS	7 OLS	8 OLS	9 RE	10 RE	11 RE	12 RE	13 RE	14 RE
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	1,343	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338	1,338

Note: The table presents the effect of regulation variables on bank's insolvency risk (i.e., measured by Z-score), 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.

Abbreviations: IBs, Islamic banks; ROA, return on assets.

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 fewer earnings relative to total assets.

In Column 5, the level of restrictions increases by 1%, and IBs' insolvency risk decreases by 0.062% (i.e., the coefficient sum of restrictions, and the 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, IBs could engage in investment banking and insurance transactions which avoid any linkage with prohibited and unlawful activities. It implies the restrictions on bank engagement in non-interest generating transactions lead to IBs focussing 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 the capital threshold has exerted a significant positive impact on the financial stability of IBs in regressions 3 and 9, suggesting the higher level of required capital may stabilize IBs.

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 is 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 a 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 & Oosthuizen, 2014). It is in line with the findings of Laeven and Levine (2009) and Hoque et al. (2014) for large international banks, and they state that more restrictions on the transaction scope of banking could effectively reduce bankruptcy risk across countries.

It is predicted that bank regulations have different effects on IBs and CBs' financial stability, and the implementation of these regulations is expected to further reduce the risk of CBs because these factors are designed for the business of CBs and not involve the treatment of Islamic financial services and products. However, the results of this section support our Hypotheses 1–4 which

show that regulatory factors are more effective in reducing the insolvency risk of IBs. This is a phenomenon worth explaining. 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 IBs 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 independent variables on bank risk cannot be ignored in Table 3. In more detail, the Z-score increases significantly when the GDP per capita increases 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 moves in the same direction. In the next step, this study examines whether economic freedom could strengthen the effect of bank regulation on reducing the insolvency risk of banks, and the empirical results are presented in Table 4. 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 analyse IBs and CBs separately. The coefficients of Power*Freedom are significantly positive in Columns 4 and 8, implying that the positive impact of official supervision on risk reduction increases when IBs and CBs are located in regions with higher economic degrees of freedom. It appears that a more liberal economic and business environment is also beneficial for the effectiveness of bank regulation. The free economic index contains many aspects such as freedom of investment, freedom of trade, financial health and so on. A more liberalized economy means that the government provides more resources to society through different policies. The fact is, the combination of policies that encourage economic freedom and bank regulations makes bank insolvency risk management move towards a better direction. Perhaps, collaboration between banking regulators and national policymakers can achieve better results in promoting the development of the banking industry.

6.2 | Idiosyncratic risk

The idiosyncratic risk is used as the dependent variable in this section, which is the inherent risk relative to the bank's business model and is not affected by the market or external environment (Bley & Saad, 2012). The results of Table 5 report whether bank regulation is related to the idiosyncratic risk of IBs and CBs by following Equation (4.1). IBs face higher idiosyncratic risk than CBs in Table 5 because the coefficients of the Islamic bank dummy are significantly positive, reflecting their differences in the business model. IBs often provide financing to valuable companies in the form of non-PLS and PLS in exchange for profits. When IBs participate in PLS projects to provide clients with venture capital, they may not require collateral and cash flow as the basis for funding, so that when losses occur, they face more uncertainty (Aggarwal & Yousef, 2000).

The effect of supervision power (i.e., the sum of coefficients of power and interaction term between IB dummy and power) is significantly negative for IBs in Columns 6–12. This finding implies that more powerful supervisors lead IBs to take less risk as supervisors who could identify and monitor the risk trends can take proactive actions to stabilise IBs, consistent with the view of Laeven and Levine (2009).

Bank regulation and supervision appear to have a 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 are 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 IBs is incompletely reflecting their 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[5] requirements, and most countries' IBs follow the International Financial Reporting Standards (IFRS) to disclose 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 IBs arising from their own business. Compared with CBs, IBs' own business, including Islamic financial transactions, leads them to face greater risk management pressures. Clear regulatory instructions could help IBs clarify the ideas of risk management efficiently, so these regulatory implementations are more

TABLE 4 Insolvency risk, bank regulation and economic freedom

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
	(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)
Non-interest	−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	1,573	2,170	1842	1,583

Note: 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.
Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 5 Idiosyncratic risk and bank regulation

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)	(0.010)
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)		(0.080)			(0.092)	(0.130)
IB*restrict					**−0.014**		**0.004**	−0.017			−0.006		0.004	−0.017
					(0.013)		(0.016)	(0.028)			(0.017)		(0.020)	(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
	(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)	(0.140)	(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)	(0.520)	(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)

TABLE 5 (Continued)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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)
Non-interest		-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_REG								-0.049**						-0.033
								(0.187)						(0.250)
Constant	1.174***	1.153***	1.088***	1.124***	1.094***	1.014**	0.969**	1.433***	1.179**	1.164**	1.170**	1.078**	1.083**	1.472***
	(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

Note: This table presents the relation between bank's idiosyncratic risk and regulation variables, 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

effective in reducing their business uncertainties from a lower level at a faster rate. The results in this section support our hypotheses 1–4.

As for the control variables, the results illustrate that banks with more non-interest transactions and operating in countries with more economic freedom have lower idiosyncratic volatility. In Columns 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 IBs 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 risk.

The results in Table 6 present the influence of economic freedom on the association between regulations and idiosyncratic risk for IBs and CBs separately. In Columns 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. 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. A 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.

6.3 | Credit risk

This section examines whether the regulatory tools discussed in Section 2 affect LLP of IBs during the period 2004–2015 and makes comparisons between IBs and CBs in Table 7. 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 LLPs to represent the bank's credit risk. The negative coefficient 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 CBs, consistent with

findings provided by Barth et al. (2004). Besides, 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 IBs to review and process loans in a more rigorous manner. The results broadly support our Hypotheses 1–4.

With regards to control variables, banks that have a smaller size and engage in fewer loan transactions will have less credit risk. The relationship between GDP per capita and LLPs is found to be insignificant, suggesting that banks in this sample, on average, do not change LLP in reaction to the phases of economic cycles, which is in contrast with Laeven and Majnoni (2003).

The empirical findings in Table 8 provide the influence of economic freedom on the association between regulations and credit risk for IBs (i.e., Columns 1–4) and CBs (i.e., Columns 5–8) separately. The coefficients of interaction terms between regulatory indexes and economic freedom are insignificant in regressions 1–4, implying bank regulations almost have a 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 the degree of economic freedom to affect the credit risk of CBs. The free economic environment could increase the flow of information, which in turn reduces information asymmetry. It is more conducive to regulators and bank managers to obtain information about the borrowers, thus ensuring the quality of the loans.

6.4 | Systemic risk

Networks of internationally active banks can transmit shocks and amplify economic downturns to adversely influence other financial institutions, so linkages between financial institutions matter 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 9 where MES is the

dependent variable. The results of Weiß et al. (2014) show that a bank's MES appears to be an index that effectively predicts the risk of the extreme market crash in the short term. The higher the value of the MES, the lower the systemic risk experienced by banks. The findings in regressions show that the systemic risk of IBs do not differ

TABLE 6 Idiosyncratic risk, bank regulation and economic freedom

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**
	(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)	(0.010)	(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)	(0.240)	(0.240)
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)	(0.590)	(0.270)	(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	1,449	1,250	1,015

Note: 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.
Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 7 Credit risk and bank regulation

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** (0.269)	−1.130*** (0.119)	−3.461*** (0.974)	3.646** (0.329)	−2.066*** (0.403)	−1.089** (0.727)	−1.282** (2.009)	0.006 (0.020)	−2.178 (1.185)	−2.626 (1.857)	−2.304*** (0.534)	−2.106* (1.010)	−0.859* (2.561)	−0.003* (0.026)
Capital	−0.117 (0.082)	0.028 (0.034)	0.007 (0.035)	0.018 (0.034)	0.031 (0.034)	0.028 (0.035)	0.013 (0.036)	0.001 (0.005)	0.005 (0.046)	0.003 (0.045)	0.015 (0.045)	0.017 (0.045)	−0.008 (0.047)	0.013 (0.052)
Private	−0.259*** (0.141)	−0.262*** (0.06)	−0.247*** (0.060)	−0.196** (0.062)	−0.252*** (0.060)	−0.262*** (0.060)	−0.198** (0.062)	−0.003*** (0.001)	−0.230** (0.080)	−0.175* (0.083)	−0.236** (0.080)	−0.236** (0.080)	−0.176* (0.084)	−0.002** (0.001)
Restrictions	−0.025 (0.049)	0.028 (0.021)	0.027 (0.021)	0.024 (0.021)	0.015 (0.021)	0.028 (0.021)	0.012 (0.022)	0.014 (0.055)	0.011 (0.028)	0.011 (0.028)	−0.003 (0.029)	0.013 (0.028)	−0.001 (0.030)	0.032 (0.005)
Power	0.042 (0.062)	0.031 (0.026)	0.035 (0.026)	0.034 (0.026)	0.04 (0.026)	0.031 (0.026)	0.046 (0.028)	0.001* (0.021)	0.036 (0.038)	0.035 (0.038)	0.046 (0.038)	0.03 (0.038)	0.043 (0.041)	0.001 (0.006)
IB*capital			0.264* (0.110)				0.108 (0.120)	0.002 (0.001)	0.11** (0.134)				0.146 (0.146)	
IB*private				−0.630*** (0.175)			−0.480** (0.198)	−0.006*** (0.002)		−0.635*** (0.242)			−0.556* (0.262)	−0.006* (0.003)
IB*restrict					0.090* (0.037)		0.079 (0.053)	0.002** (0.001)			0.106* (0.049)		0.07 (0.072)	0.002* (0.001)
IB*power						−0.003 (0.060)	−0.046 (0.085)	−0.001 (0.001)				0.075 (0.084)	0.015 (0.124)	−0.001 (0.001)
Size	−0.08 (0.05)	0.102*** (0.021)	0.099*** (0.021)	0.097*** (0.021)	0.102*** (0.021)	0.102*** (0.021)	0.097*** (0.021)	0.001*** (0.006)	0.154*** (0.004)	0.152*** (0.034)	0.157*** (0.034)	0.157*** (0.035)	0.151*** (0.035)	0.001*** (0.075)
Loans	1.645** (0.535)	2.209*** (0.226)	2.191*** (0.226)	2.185*** (0.225)	2.114*** (0.229)	2.210*** (0.227)	2.110*** (0.229)	0.024*** (0.002)	1.820*** (0.305)	1.800*** (0.304)	1.720*** (0.308)	1.800*** (0.306)	1.736*** (0.308)	0.019*** (0.003)
Liquid assets	0.917 (0.601)	0.820** (0.254)	0.802*** (0.254)	0.824** (0.253)	0.771** (0.255)	0.820*** (0.254)	0.775 (0.255)	0.009*** (0.003)	0.258 (0.303)	0.277 (0.302)	0.227 (0.303)	0.265 (0.303)	0.237 (0.304)	0.003 (0.003)
Asset growth	−0.18 (0.098)	−0.042 (0.041)	−0.042 (0.041)	−0.041 (0.041)	−0.042 (0.041)	−0.042 (0.041)	−0.042 (0.041)	−0.001 (0.064)	43.992*** (0.356)	44.204*** (0.352)	44.095*** (0.354)	44.043*** (0.357)	44.245*** (0.353)	43.22* (0.346)
Freedom	−0.004 (0.015)	−0.005 (0.006)	−0.005 (0.006)	−0.006 (0.006)	−0.006 (0.006)	−0.005 (0.006)	−0.007 (0.006)	0.002 (0.058)	−82.553*** (0.743)	−82.553*** (0.743)	−82.566*** (0.743)	−82.542*** (0.744)	−82.588*** (0.743)	81.01** (0.744)
GDP per capita	−0.047 (0.03)	−0.035** (0.013)	−0.035** (0.013)	−0.035** (0.013)	−0.035** (0.013)	−0.035** (0.013)	−0.041 (0.041)	−0.000*** (0.003)	−0.012 (0.035)	−0.012 (0.035)	−0.012 (0.035)	−0.012 (0.035)	−0.012 (0.035)	−0.009* (0.006)
Non-interest		36.834*** (0.192)	36.890*** (0.189)	37.357*** (2.188)	36.922*** (0.189)	36.841*** (0.196)	37.425*** (2.192)	0.383*** (0.022)	−0.014 (0.009)	−0.015 (0.009)	−0.015 (0.009)	−0.014 (0.009)	−0.015 (0.009)	0.446*** (0.023)
ROA	−77.594*** (0.91)	−77.637*** (0.909)	−77.637*** (0.909)	−77.684*** (0.907)	−77.652*** (0.909)	−77.594*** (0.911)	−77.731*** (0.907)	−0.782*** (0.009)	−0.027* (0.012)	−0.028* (0.012)	−0.027* (0.012)	−0.027* (0.012)	−0.028* (0.012)	−0.827*** (0.007)

TABLE 7 (Continued)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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)	(1.040)	(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	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,586	1,576

Note: This table presents association between bank's credit risk and regulation variables. 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.

Abbreviations: IBs, Islamic banks; ROA, return on assets.

significantly from that of CBs, implying when the global banking industry experiences adverse shocks, the 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 explain the systemic risk of IBs and CBs, and more stringent capital regulation increases more systemic risk in IBs compared to CBs. The results show that the regulatory indicators stressed by the Basel Committee are probably not effective in curbing the systemic risk of financial institutions in countries that have IBs, reflecting the limitations of bank regulations. The findings bring challenges for supervisors to design effective regulatory tools to control the systemic risk of banks in countries where IBs play important roles (Mejia et al., 2014).

The results in Table 10 report whether the free economic environment would affect the relationship between regulations and systemic risk in IBs (i.e., 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. In sum, the results are supportive of our Hypotheses 1–4.

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Table 11 reflects whether the impact of regulation on IBs (i.e., Columns 1–5) and CBs (i.e., Columns 6–10) is different during the financial crisis. The coefficients of the crisis dummy are 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 Columns 7–10, private monitoring and supervisory power have exerted a significant effect on reducing insolvency risk in the crisis. For instance, the sum of coefficients of supervisory 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 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 has been highly heterogeneous among IBs and CBs as these regulatory factors are not related to the risk of IBs during the crisis in Columns 2–5 where interaction terms' coefficients are insignificant. It appears that these regulatory approaches might not be enough to protect IBs from

TABLE 8 Credit risk, bank regulation and economic freedom

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***
	(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)
Non-interest	−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	2,803	2,395	1932

Note: 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.
Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 9 Systemic risk and bank regulation

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)	(0.300)
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)	(0.010)	(0.009)	(0.009)	(0.011)	(0.010)	(0.010)	(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				0.04
				(0.021)				(0.024)	(0.028)	(0.023)				(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)		(0.010)	(0.010)			(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***
	(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)
Non-interest		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)	(0.220)	(0.134)	(0.001)	(0.249)	(0.117)	(0.120)	(0.120)	(0.154)	(0.160)
ROA	-0.516	-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)	(0.407)	(0.415)	(0.410)	(0.413)	(0.412)	(0.223)	(0.002)	(0.443)	(0.223)	(0.224)	(0.223)	(0.223)	(0.224)

(Continues)

TABLE 9 (Continued)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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)	(0.140)	(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

Note: 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 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.

Abbreviations: IBs, Islamic banks; ROA, return on assets.

financial vulnerability in times of crisis. In addition to following the existing international regulatory framework, regulators of countries with IBs probably need to establish suitable financial policies to respond to crises.

Table 12 shows the performance of the sample banks' risk in a 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, the regulation still shows its presence in traditional banks because the coefficients of the interaction terms are significant. The results offer evidence that CBs suffer greater idiosyncratic volatility in countries with stricter requirements in private monitoring, non-lending bank activities and power of official supervision. Therefore, the regulations 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 unified international banking business. However, in addition to the minimum rules, the design of banking supervision in countries with IBs needs to add additional contingency plans during times of crisis, tailored for the characteristics of the country's banking system.

In Table 13, the results illustrate how regulation affects the credit risk of IBs and CBs during a 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 end up with increased credit risk (Diamond & 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 improves private agents to get more information to effectively monitor bank behaviours can significantly reduce the credit risk of IBs while changes in the remaining regulatory variables have not contributed to their improvement of credit risk (Hasan & 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.

The coefficients of key interaction terms are insignificant in Table 14, which demonstrates for IBs and CBs, regulatory practices and systemic risks are almost unrelated during the 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.

Traditional banks' balance sheets usually contain more liquid assets, including saleable securities and various liquid investments. In the event of a crisis, these

TABLE 10 Systemic risk, bank regulation and economic freedom

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
	(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)
Non-interest	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	1,441	1,240	1,011

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 11 Insolvency risk, bank regulation and crisis

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)				
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)

TABLE 11 (Continued)

Variables	1 (OLS)S	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
Non-interest	−3.559***	−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	2,170	1,573	2,170	1842	1,583

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 12 Idiosyncratic risk, bank regulation and crisis

Variables	1 (OLS)S	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)	

(Continues)

TABLE 12 (Continued)

Variables	1 (OLS)S)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
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)
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)
Non-interest	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	1,449	909	1,449	1,250	1,015

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

TABLE 13 Credit risk, bank regulation and crisis

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***									
	(0.224)									
Size	−0.072	0.153*	−0.088	−0.069	0.011	0.042**	0.058***	0.041**	0.060***	0.081***
	(0.070)	(0.064)	(0.070)	(0.093)	(0.103)	(0.015)	(0.017)	(0.015)	(0.016)	(0.018)
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)	(0.180)	(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)

(Continues)

TABLE 13 (Continued)

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6(OLS)	7 (OLS)	8 (OLS)	9 (OLS)	10 (OLS)
Non-interest	−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	2,803	1929	2,803	2,395	1932

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

assets will be sold off as soon as possible in exchange for funds to ease the financial pressure. Unlike CBs, IBs often can attract investment deposits, and most of these funds are used to purchase less liquid Islamic-compliant assets such as murabahah and ijara whose volatility, in theory, will be passed to investment depositors (Archer & Karim, 2007a, 2007b). To avoid losses, it is very likely that profit and loss sharing (PISA) account holders withdraw a large amount of funds, causing IBs to fall into financial difficulties. To control the future systemic risks of IBs, it is necessary to establish a protection system which includes deposit insurance for investment depositors, to reduce the probability of a run when a crisis occurs.

Additionally, during the financial crisis, the US government rescues financial institutions by implementing the TARP. Berger et al. (2019) find that the TARP that promotes 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 a systemic risk may be a viable choice for regulators.

8 | DISCUSSION OF RESULTS AND CONCLUSION

Basel II and Basel III set out a set of regulations that require banks to maintain certain levels of capital and proper leverage ratios to mitigate risk within the international banking sector. These regulations were developed for CBs, and CBs follow those guidelines. However, in countries where CBs and IBs coexist, IBs also abide by these regulations. The growth of Islamic banking needs to be accompanied by the development of effective regulation. According to Song and Oosthuizen (2014), 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 IBs respond to the regulatory framework guidelines recommended by the international regulatory body such as the Basel Committee. Mejia et al. (2014) suggest that IBs need the same prudent regulatory framework as CBs Basel's advancement from II to III will benefit most banks. We add to the literature by examining whether the regulatory elements highlighted by the Basel Committee (including restrictions on banks, capital oversight, private monitoring and official supervisory powers) have different effects on the various risks of IBs and CBs. This article contributes to the existing literature by highlighting that bank regulation factors emphasized by international regulators have different effects on the risk exposure of IBs and CBs.

TABLE 14 Systemic risk, bank regulation and crisis

Variables	1 (OLS)	2 (OLS)	3 (OLS)	4 (OLS)	5 (OLS)	6 (OLS)(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
	(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)
Non-interest	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	1,441	899	1,441	1,240	1,011

Note: 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.

Abbreviations: CBs, conventional banks; IBs, Islamic banks; ROA, return on assets.

This research extends the prior empirical studies of banking and regulation in several ways. First, we analyse the insolvency risk of the IBs and CBs as solvency is the most important parameter to measure the financial health of any business. We utilize Z-score, a measure of insolvency risk which compares a bank's buffers (capitalization and returns) with the volatility of those returns. We find that the Basel II and Basel III regulations which are primarily designed for CBs appear to have a greater effect on reducing insolvency risk for IBs. Stricter restrictions on bank activities and powerful supervisors could lead to a higher reduction in IBs' insolvency risk compared to CBs. The positive impact of official supervision on bank risk reduction is more pronounced when IBs and CBs are in countries with higher economic degrees of freedom.

Second, we analyse idiosyncratic risk – the inherent risk in a business because of the particular business model. As the components of IBs balance sheet is different compared to the CBs, because of the profit and loss sharing principles, 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 private monitoring could reduce more idiosyncratic risk of IBs compared to CBs. More economic freedom makes Basel II and III more effective in controlling idiosyncratic risk in CBs, while the impact of regulations on IBs' risk is not affected by the external environment.

Then, we examine credit risk which is the potential that a bank borrower will fail to meet its obligations following agreed terms. Banks will have problems if they fail to manage credit risk within an acceptable limit. Higher private monitoring is more effective to reduce the credit risk of IBs compared to CBs. While bank regulations have a direct impact on enhancing loan quality for IBs, bank regulations in countries with a higher degree of economic freedom affect the credit risk of CBs.

Finally, we examine systemic risk which became much more important after the financial crisis of 2007–2009. More stringent capital regulation actually results in more systemic risk in IBs compared to CBs. The findings demonstrate that Basel II and III are not effective in curbing the systemic risk of financial institutions in countries that have IBs, reflecting the limitations of bank regulations (Weiß et al., 2014). Furthermore, as our sample period covers the financial crisis of 2007–2009, we examine how effective are the regulations during the financial crisis to curb those risks that we examine in this article. The findings show that these regulatory practices are not sufficient to mitigate the risks faced by IBs and CBs during financial turmoil.

This study suggests that the regulatory factors highlighted by Basel rules can actually help IBs achieve stability and reduce risks. However, the positive role of implementing Basel II and III in IBs seems limited because these rules do not contain guidance on the specific characteristics of the Islamic banking system. The risk-sharing characteristics of IBs have brought certain challenges to their supervision. 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 behaviour of IBs and CBs. A free economic environment increases the effectiveness of regulation to reduce bank risk exposure.

ENDNOTES

[1] *Shari'a* compliant financial products may be classified into two main categories – profit-and-loss sharing (equity-based), and non-profit-and-loss sharing (debt-based). The two main products in PLS modes of financing are Musharakah and Mudarabah. Musharakah is an active partnership, while Mudarabah is a silent partnership.

[2] The countries included in our sample are: Bahrain, Bangladesh, Cayman Islands, Egypt, France, Gambia, Indonesia, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, Pakistan, Qatar, Saudi Arabia, Singapore, Sudan, Syrian Arab Republic, Tunisia, Turkey, Unite Arab Emirates, United Kingdom, and Yemen.

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

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

[5] 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.

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APPENDIX A

TABLE A1 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

TABLE B1   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 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 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 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 5a of Table 1 in the research of Barth et al. (2004); world bank database: https://www.worldbank.org/en/research/brief/BRSS