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# THE IMPACT OF CAPITAL REGULATIONS ON BANK MARGINS OF ASEAN BANKING SECTOR

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## ABSTRACT

*Basel Committee on Banking supervision (BCBS) has issued Basel which requires the banks to comply with the minimum capital requirement after the crisis. Nevertheless, whether the requirement imposes impact the banking sector which comprises a dual banking system, in a positive manner is still questionable. Given the higher capital costs from the strict capital requirements, banks are being forced to raise bank margins. This study investigates the effect of capital regulations on conventional and Islamic banks' margins covering the ASEAN banking system from 2009 to 2017. The empirical analysis uses dynamic panel data frameworks to reveal several factors affecting bank margins. Overall, the results suggest that the total regulatory capital ratio helps reduce the margins of conventional banks but does not influence the margins of Islamic banks. As for the Tier-1 capital ratio, the variable increases the Islamic bank margins but does not significantly affect conventional bank margins. Based on the analysis results, regulators of conventional banks need to impose capital requirements as suggested by Basel III to reduce bank margins. Meanwhile, as for Islamic banks, the bank margins can be reduced if regulators can introduce a separate set of requirements tailored explicitly for Islamic banks.*

**Keywords:** *Bank margins, Capital regulations, ASEAN countries, Conventional and Islamic banks*

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## INTRODUCTION

The global financial crisis severely affected the banking system from 2007 to 2009. In the wake of the crisis, strengthening bank capital has become a significant focus of banking regulations (Berger & Bouwman, 2013; De Bandt et al., 2016). Korbi and Bougatef (2017) stated that a bank's capital may be used to finance assets, cover unexpected losses, and assess the safety and soundness of banking systems. Therefore, a specified set of regulations by the Basel Committee on Banking Supervision (BCBS), known as Basel III, contains a central piece of reform that strengthens capital requirements. Basel III requires the banking system to maintain a higher proportion of capital and liquid assets, which protects a bank run (Abbas et al., 2019). Ensuring that banks maintain the minimum capital requirement is important for the stability and efficiency of a banking system. Accordingly, the BCBS has established capital requirements for banks to maintain. Bitar et al. (2017) demonstrated that Basel III consists of the capital adequacy ratio, which mandates a minimum ratio of 8% of capital to risk-weighted assets, and the Tier-1 capital ratio, which necessitates a minimum ratio of 6% of Tier-1 capital to risk-weighted assets. The measurement of capital regulations, as proposed by Basel III, specifically the capital adequacy ratio and Tier-1 capital ratio, has garnered significant attention from researchers. However, only a few researchers have explored the relationship between capital regulations and interest margin (Bitar et al., 2017; Zheng et al., 2017). The proxy for the capital adequacy ratio is the regulatory capital to total risk-weighted assets ratio. Meanwhile, the Tier-1 ratio assesses the core capital of a bank relative to its overall risk-weighted assets, which include all the assets the bank holds that are systematically weighted for credit risk. Tier-1 capital consists of shareholders' funds and perpetual, non-cumulative preferred shares (Bitar et al., 2017).

Figure 1 portrays the average value of capital requirements for each of capital measurements (capital adequacy ratio and Tier-1 capital). Accordingly, the requirements of capital hold by each of the countries are higher than the requirements proposed. Interestingly, Mia (2022) found that the implementation of higher regulatory capital led to higher cost of intermediation in Bangladesh banking sector. Thus, this plugs an interesting question on whether the implementations of high capital on bank margins in ASEAN countries could have reduced the cost of intermediation.

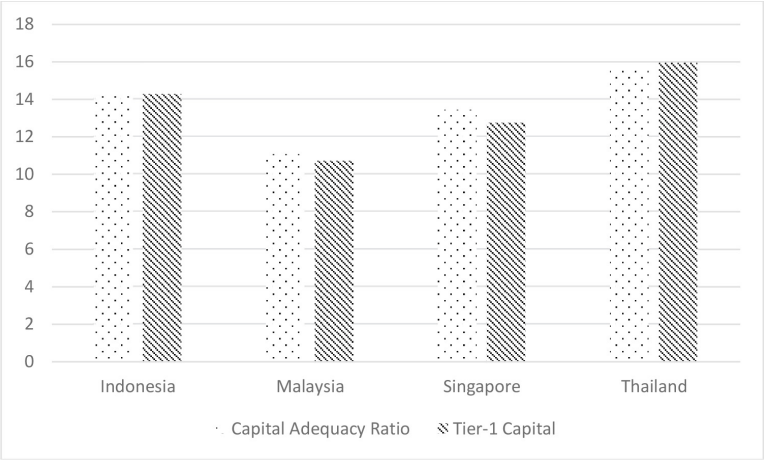


*Figure 1*. The average of capital requirements measurement in ASEAN countries
*Source*: FitchConnect Database, Fitch Solution

Angelini et al. (2015) argued that capital requirements may have positive consequences in the higher cost of financial intermediation. The impact of capital regulation on ASEAN bank margins has been a topic of significant interest and discussion among industry experts. While higher capital requirements have certainly increased the cost of funding for banks, they have also strengthened the resilience of the banking system and provided greater protection for depositors. Moreover, the impact of capital regulation on bank margins in ASEAN has varied widely across countries and banks depending on their business models, risk appetite, and funding sources. For instance, banks with a higher proportion of low-cost deposits have been able to mitigate the impact of higher capital requirements on their margins, while those that rely more heavily on wholesale funding have faced greater challenges. Overall, the impact of capital regulation on bank margins in ASEAN has been a mixed bag, and it is important for banks and regulators alike to continue monitoring and assessing its effects on financial stability, profitability and competition in the region's banking sector.

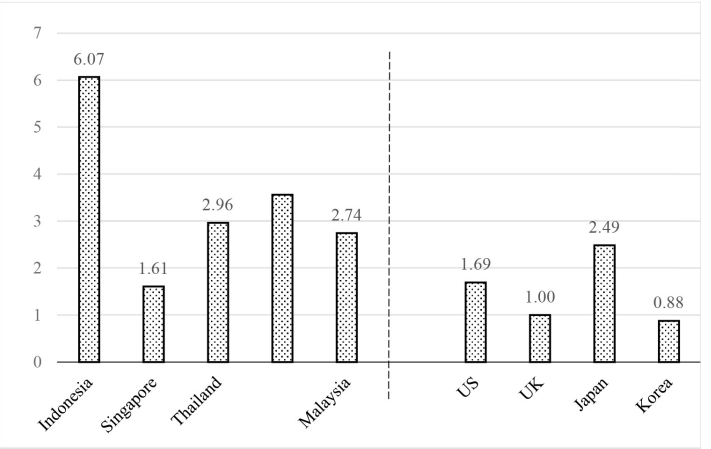


*Figure 2*. The average of bank margins in ASEAN countries vs. other developed countries

*Source*: FitchConnect Database

Figure 2 depicts the percentage average bank margins in ASEAN countries against several developed countries from 2009 to 2017. The graph shows that the bank margins in ASEAN countries are higher compared to other developed countries. The graph depicts that Indonesia portrays the highest level of bank margins in the ASEAN countries (6.07%), followed by other ASEAN countries such as the Philippines (3.56%) and Thailand (2.96%). Meanwhile, the highest bank margins recorded in developed countries, only 2.49% in Japan. Although the bank margins decreased in some countries and increased in the ASEAN region throughout the study, it remains high according to international standards.

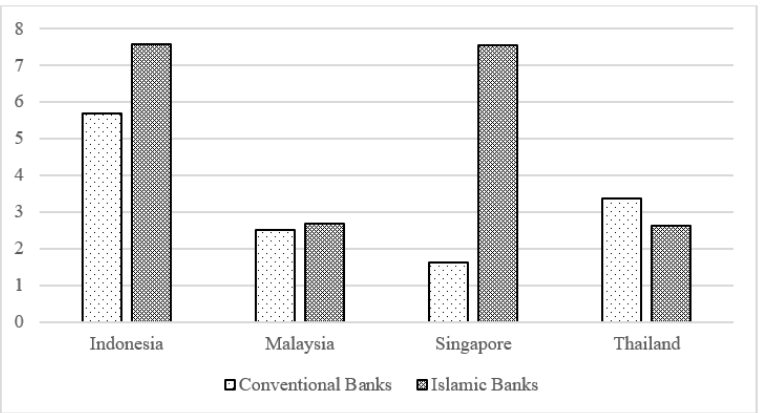


*Figure 3*. The average of bank margins in ASEAN countries of conventional and Islamic banks

*Source*: FitchConnect Database

Interestingly, Islamic banks ASEAN countries portrayed the highest level of bank margins compared to conventional banks in Indonesia, Malaysia and Singapore as depicted in Figure 3. The high level of interest margin could cause a major concern as it discourages depositors and borrowers (Dabla-Norris & Floerkemeier, 2007). The high margins imply low deposit rates, discouraging depositors because low returns on deposits and high lending rates increase financing costs to borrowers. In addition, Barajas et al. (1999) stated that high-interest margins in developing countries are closely associated with the inefficiency of the banking system. This is due to the costs incurred due to inefficiency, which are transferred to bank customers by charging high-interest rates. The differences in bank margins of conventional and Islamic banks could potentially due to the differences in both banking systems' operations. For example, conventional banks set the rates on deposits and loans independently. In contrast, Islamic banks' returns on investment paid and received are interdependent (Bougatef & Korbi, 2018). Furthermore, Islamic banks will respond differently following the *shariah* standards. In accordance with *shariah* rules, Islamic banks prohibit interest. The bank margins of Islamic banks will be calculated at the end of the period. Islamic banks generate profits via equity financing or debt-based financing. The debt-based products of Islamic banks follow *murabahah* and *tawarruq* contracts, while equity-based products follow *mudarabah* and *musyarakah* contracts. Hutapea and Kasri (2010) classified the deposit and financing rates into ex-ante and ex-post, where ex-ante is debt-based and ex-post is equity-based. However, Islamic banks are not allowed to have predetermined rates to pay the return or profit to depositors (Fianto et al., 2018). Since Islamic banks are not allowed a predetermined interest rate, Islamic banks will invest deposits according to Islamic contracts. Meanwhile, the margins of conventional banks are known as ex-ante as the banks are allowed to predetermine their interest rates such as the deposit and credit rates.

Furthermore, several authors argue that the conventional banking system was more severely affected than the Islamic banking system during the crisis (Hasan & Dridi, 2010; Olson & Zoubi, 2017). Islamic banks are more resilient than their conventional counterparts, with higher capitalisation levels portrayed in Islamic banks (Beck et al., 2013). Furthermore, the Islamic financial products that prohibit the payments of debts at higher interest rates played an important role during the crisis (Boukhatem & Moussa, 2018). For example, in *mudarabah*, the return on he invested capital and profits investment are not fixed, unlike conventional banking, where the capital is guaranteed. Moreover, Karim et al. (2014) stated that the contract utilised by Islamic banks helps reduce the risk investment faced by banks. Therefore, the minimum capital requirement imposed by BCBS could be irrelevant. However, from another point of view, the minimum capital requirements are important for Islamic banks due to the specific risk of Islamic

bank products as well as the nature of Islamic banks as intermediaries (Hassan & Dicle, 2005). Therefore, this has plugged interest on whether the importance holds for the minimum capital requirement for Islamic banks' efficiency as it is for conventional banks under debate, which deserves further studies.

This study enriches the existing literature on the efficiency of a banking system. Firstly, this study investigates the impact of capital regulation on bank margins in the ASEAN region. The ASEAN countries are also susceptible to the crisis, thereby undergoing several regulatory reforms (Lee & Park, 2009). Moreover, over the nine-year sample period focusing on after the crisis period, the implementation of capital regulation according to Basel standards could highlight its impact on bank margins. Secondly, this study uses new measures inspired by the Basel III regulatory framework beyond the determinants considered in the existing literature: the survey compiled by World Bank Surveys on Bank Regulation and Supervision. Lastly, this study compares the differences between Islamic and conventional banks on the role of capital regulations and their impact on bank margins. In the context of conventional banks, several studies demonstrate the effect of the minimum capital requirements on the stability and efficiency of the banking system. In contrast, studies covering Islamic banks are still scarce.

## LITERATURE REVIEW

Theoretically, the modelling framework for understanding the determinants of bank margins was introduced by Ho and Saunders (1981). The model proposed by Ho and Saunders (1981) initially constitutes four variables (banks' size, the degree of risk aversion, the uncertainty rate, and the market structure). The model suggests that the high level of bank margins is related to large banks' size, an increase in the degree of risk aversion, a higher interest rate, and a greater market structure. The model then has been extended and modified by several researchers, including Allen (1988), Angbazo (1997), Maudos and Fernández De Guevara (2004), Carbó Valverde and Rodríguez Fernández (2007), Entrop et al. (2015) as well as Birchwood et al. (2017). For example, Allen (1988) included the heterogeneity of the loan, and Angbazo (1997) extended the model by introducing credit risk. Then, Maudos and Fernández De Guevara (2004) included operating cost while Carbó Valverde and Rodríguez Fernández (2007) included bank specialisation to gauge the relationship between market power and bank margins. Next, Entrop et al. (2015) incorporated the maturity transformation, and Birchwood et al. (2017) extended the model by including the regulation variables.

As for capital regulations and bank margins, no specific theory discusses the relationship between capital regulation and bank margins. This study followed the perspectives proposed by past researchers which led to different inferences. This study followed the framework proposed by Modigliani and Miller (1958). The first perspective stated the level of capital relative to assets has no effect on banks' profitability. Secondly, too much capital decreases banks' profitability. The last perspective claimed that higher capital increases banks' profitability. Nevertheless, these perspectives focus on the profitability of the banking system instead of cost of intermediation. Hence, this study opt the model framework as suggested by Birchwood et al. (2017) who extended the model by including the regulation variables.

Capital regulation has been under several debates on its importance to the banking system (Karim et al., 2014). Capital is important because it provides a buffer against insolvency to prevent banks from experiencing losses (Nguyen et al., 2019). Capital is a source of funds from shareholders and shareholders' equity which is not directly dependent on the performance of a banking system. However, capital regulation is the requirement imposed by regulatory boards on how much capital must be held to protect depositors from operating losses while meeting liabilities demanded by regulations. In order to improve financial stability and efficiency, Basel regulations have been established by the BCBS as a benchmark for banking regulations. There are three Basel that has been introduced. The Basel I standards were established in 1988 to introduce minimum capital requirements for banks. Then, the Basel II regulatory framework was introduced in 2004 as an extension of the regulations of minimal capital requirements in Basel I and began implementation in 2006. Basel II was introduced to strengthen the regulatory framework focused on three pillars: capital requirements, supervisory review, and market discipline. Pillar 1 requires the banks to have a minimum capital to cover credit risk and trading book issues, including market and operational risk. Meanwhile, pillar 2 aims to reinforce regulatory authorities' power to ensure each bank can assess its capital adequacy based on a thorough evaluation of its risks. Pillar 3 of Basel III was enforced to ensure that disclosing relevant information about banks' financial profiles is compulsory to ensure transparency so that market discipline can operate most effectively. Meanwhile, the Basel III regulatory framework was introduced to reduce damage suffered by banks that take on excess risk. Therefore, the BCBS issued Basel III, focussing on capital management requirements to ensure that a bank has sufficient capital for the risks it is exposed to through its lending and investment practices (King, 2013).

Barth et al. (2004; 2008; 2013) are among the first studies that incorporated the capital requirement as a determinant of the bank's development, efficiency, and fragility. Barth et al. (2013) applied the capital regulation indexes to measure the amount of capital banks must hold and the stringency of regulations on the nature and source of regulatory capital. The capital requirement accounts for both initial and overall capital stringency. The initial capital allocates sources of funds counted as regulatory capital including assets other than cash or government securities and borrowed funds that the regulatory or supervisory authorities will verify. The latter indicates that the calculation of regulatory capital considered the risk elements and value losses. Barth et al. (2004) showed empirical evidence of the impact of specific regulatory and supervisory practices on bank performance covering 107 countries from 1999 data to 2004. They found an insignificant effect between capital requirements and bank performance. Meanwhile, Barth et al. (2013) produced a new set of banking regulations and supervision surveys covering 1999 to 2011 to provide useful measurements regarding the regulation indicators.

In the same year, a study focused on Asian banks from 1994 to 2008 provided contrasting results from Barth et al. (2004). A positive relationship between capital requirements and bank margins is observed in the Asian banking system. Furthermore, Xu et al. (2015) showed that capital regulation would improve the financial system's stability. This has led to extensive empirical research conducted on capital regulations. Lee and Lu (2015) conducted research on 43 countries over the period 1999–2011 to examine the impact of regulations on bank margins. They indicated that less stringent capital regulations are associated with low levels of interest margin. Cruz-garcía and Fernández De Guevara (2019) also suggested that banks must charge high bank margins to maintain high capital levels. Zheng et al. (2017) used the regulatory capital to total risk-weighted assets ratio as an indicator to measure the capital adequacy ratio. This is consistent with Soedarmono and Tarazi (2016), who stated that bank capital ratios affect lending behaviour, which may lead to "capital crunch" problems. Rahman et al. (2023) found evidence regarding the effect of capital on cost of intermediation on banks in the Emerging Economies. The authors' finding suggests that well-capitalized banks with lower bankruptcy costs and anticipated lower returns on equity may reduce their margins thereby, establishing trustworthy relationships with the public. Moreover, banks attempt to accommodate the capital requirement by decreasing risk-weighted assets (Naceur & Kandil, 2009). Requirements of the Basel Accord give a proper guideline for maintaining optimum capital adequacy, where excess ratio may deal with liquidity shortage is a signal for excessive risk-weighted assets in the operational process. Higher capital adequacy will increase the higher cost of intermediation and profitability (Naceur & Kandil, 2009).

Zheng et al. (2017) portrayed an increase in the cost of intermediation of banking systems due to a higher capital adequacy ratio. This leads to a positive result because capital adequacy increases the capital of a banking system leading to an increase in risk-taking behaviour, thereby increasing the bank margins. Bitar et al. (2017) found a positive effect of Tier-1 capital on net interest margins implying that capitalised banks have better management quality and thus higher income and lower costs. Meanwhile, Lin and Chen (2018) investigated the effect of capital regulation on bank margins in the multiple shadow banking activities environment. The authors found that tightening capital requirements may encourage flow in multiple shadow banking activities resulting in a decline in bank margins. Furthermore, Huang et al. (2018) proposed a barrier cap option framework for bank interest margin management under capital regulation. The barrier cap option model introduced by the authors can explain the bank spread behaviour of intermediation efficiency when the bank as a liquidity provider is considered. The estimation results suggested that the high level of the barrier cap leads to a low level of bank margins due to a decrease in demand deposits. Cruz-garcía and Fernández De Guevara (2019) concluded that the capital requirement and the deposit insurance positively impacted bank margins in OECD countries between 2000 and 2014. A capital increase reflects high margins due to banks' higher costs to withstand shocks better. Therefore, banks will lower the rates on depositors, thereby enhancing bank margins. Interestingly, using bank data from Indonesian banking industry, Sirait and Rokhim (2019) found that regulatory capital requirement reduces the cost of financial intermediation of banks. The latest study on the impact of capital regulations on bank margins is conducted by Mia (2023). The author examined the impact of capital regulation on the cost of financial intermediation of banks in the Bangladesh banking industry and found a positive relationship between capital regulations and bank margins, implying that an increase in regulatory capital increases bank margins.

Relatively, there are also empirical studies that reflect the role of financial regulations on bank margins (Demirguc-Kunt et al., 2004; Poghosyan, 2013; Chortareas et al., 2012; Birchwood et al., 2017; Alam et al., 2018). For instance, Demirguc-Kunt et al. (2004) investigated the impact of bank regulations, market structure, and national institutions on the cost of financial intermediation for 1,400 banks operating in 72 countries from 1995 to 1999. The study showed that tighter regulations on the bank activities will increase the costs of financial intermediation. However, Poghosyan (2013) found a contradicting result regarding the restriction on bank activities. The activity restrictions on banks' activity, such as securities underwriting, insurance, real estate, and ownership in non-financial firms, do not impact on bank interest margins in low-income countries. Then, Birchwood et al. (2017) included bank entry requirements and financial transparency as

regulation variables to examine their impact on bank margins. Countries with more stringent bank entry requirements and low foreign bank presence will have higher margins. As for financial statements, transparency is associated with lower bank margins in the Caribbean and Central American markets. The result suggested that an increase in bank transparency decreases bank margins. Rahman et al. (2023) have found a positive relationship between activity restrictions and bank margins, thus suggesting that tighter restrictions imposed on bank activities will increase high margins. On the other hand, supervisory power help reduce bank margins. The authors also find that management efficiency to have negative association with cost of intermediation. Regarding Islamic banks, Alam et al. (2018) investigated the impact of Islamic regulations on Islamic banks' performance in Asia, and Gulf Cooperation Council (GCC) covered 2006 to 2015. Findings suggest that Islamic regulatory variables are positively significant to the performance of Islamic banks in the Asian region but not in the GCC region on bank's performance.

The literature comparing the determinants of bank margins between conventional and Islamic banks is scarce (Lee & Isa, 2017; Bougatef & Korbi, 2018; Ibrahim & Law, 2019). For example, Lee and Isa (2017) find a significant similarity between the resilience of these two conventional and Islamic banks. The authors argue these same significant findings of operational costs, operational efficiency and credit risk management, and implicit interest payments on bank margins in Malaysia's banking system. Bougatef and Korbi (2018) revealed that only two indicators have a similarly significant effect on both banks' margins: the degree of diversification and risk aversion. The differences in the impact of determinants on bank margins between conventional and Islamic banks can be explained mainly through other variables. For example, the net profit of Islamic banks influences inefficiency and economic conditions. Regarding conventional banks, the margins positively depend on the market concentration while negatively on liquidity. Meanwhile, Ibrahim and Law (2019) investigated the presence of Islamic banking on bank margins by comparing the margins of Islamic and conventional banks. The finding suggested that Islamic banks have higher margins than conventional banks due to higher cost inefficiency and lower diversification experience by Islamic banks.

Although there are extensive studies of capital regulation on bank margins (Bitar et al., 2017; Cruz-garcía & Fernández De Guevara, 2019; Huang et al., 2018; Zheng et al., 2017; Sirait & Rokhim, 2019; Mia, 2023), there exists little evidence of the impact of capital regulations on banks margins in ASEAN countries. A relatively small number of researchers compared the impact of capital regulation variables on bank margins between conventional and Islamic banks (Korbi & Bougatef, 2017). Although Islamic banks have improved over the last decade, there

are a few challenges faced by Islamic banks, such as the inability to compete with conventional banks due to capital limitations. Economists believe Islamic banks need to increase capital holdings to compete with conventional banks and solve liquidity risks (Korbi & Bougatef, 2017). Despite the importance of this concept, there are only few empirical studies, which estimate the effect of regulation bank margins of conventional and Islamic banks. For example, Mateev and Bachvarov (2021) conducted a study of the impact of regulations on banks' performance focussing in Middle East and North Africa (MENA) region. Furthermore, Sirait and Rokhim (2019) investigated the impact of capital adequacy on the cost of intermediation in Indonesian banking system. Relatively, there are limited studies conducted on the impact of capital regulation on bank margins of conventional and Islamic banks. To address this issue, this study would like to highlight the impact of the capital adequacy requirements on a sample of Islamic and conventional banks operating in four countries from the ASEAN region surveyed between 2009 and 2017.

## DATA AND RESEARCH METHODOLOGY

### Data

The source of the banking data is the FitchConnect database from Fitch Solutions, which reports published financial statements from banks across the globe. The data has been standardised into a standard format to facilitate comparison across countries and is suitable for a cross-country study. However, most variables are in ratios, except for total assets, where large values are calculated in logarithms. Next, the capital regulations variables also were taken from the FitchConnect database. Meanwhile, the macroeconomic data, the annual percentage growth rate of domestic growth products (GDP), and the inflation rate are from the World Development Indicators (World Bank, 2019). The sample comprises 155 commercial banks covering both conventional and Islamic banks with 129 conventional banks and 26 of Islamic banks. Nevertheless, this study exclude Philippines banking system due to the unavailability of capital regulation data for Islamic banks in the Philippines within the FitchConnect database. The data used in this study covers yearly bank-level data for the 2009 to 2017 period. This study focuses on the period after the crisis to investigate the impact of implementing the regulation on bank margins. The suggestion to overcome bank failures due to default risk during the crisis is to impose tighter regulations on the banking system. Furthermore, most ASEAN[1] countries began implementing the regulations according to Basel after the crisis in 2007. Furthermore, the period is chosen due to the minimum capital requirement required for the banks to follow as proposed by the Basel Accords. Therefore, the

analysis of regulations on bank margins after the crisis period enables to highlight the impact of regulation on bank margins in ASEAN region.

**Model Specification**

There is a variety of methods that can be applied in the determination of factors influencing bank margins. The Panel Generalised Method of Moments (GMM) is the most widely used method. This method has been applied widely in previous literature (Chortareas et al., 2012; Nguyen et al., 2019; Poghosyan, 2013; Lee & Isa, 2017; Bougatef & Korbi, 2018; Yanikkaya et al., 2018). There are many advantages to using the GMM method. The first advantage is relatively allowed panels characterised by a relatively small number of time series and a large number of cross-sections per year. The second benefit is that GMM addresses the potential of endogeneity, heteroscedasticity, and autocorrelation issues in the data. The third advantage is the possibility to use instrumental variables, reducing bias in the model. The GMM model is estimated using this equation:

$$y_{it} = \alpha y_{it-1} + \beta_1 x_{it} + (\eta_i + \varepsilon_{it}); |\alpha| < 1, i = 1,2,\ldots,N, t = 2,3,\ldots,T \quad (1)$$

Where represents the observations for individual *i* at time *t*, $\varepsilon_{it}$ is the disturbances term and is the unobserved individual-specific in the model and time-invariant which allows for unobserved heterogeneity. The heterogeneity is overcome by first differencing known as first-differenced GMM is suggested by Anderson and Hsiao (1981). The first-differenced GMM proposed estimator that used instrument variables from the lagged level of the regressors. Nevertheless, first differenced GMM creates correlations between error terms and the instrument variables which raise the endogeneity issue causing the model to be consistent but not efficient (Arellano & Bond, 1991). Then, Arellano and Bond (1991) introduced system GMM is used to overcome endogeneity by suggesting the creation of instruments whose validity is based on no correlations between lagged values of the dependent variable and the errors to produce more efficient estimator. Hence, this study applied GMM dynamic panel data approach as proposed by Arellano and Bond (1991) also known as Arellano-Bond estimator. The empirical model of the factors influencing bank margins is based on the extended theoretical framework of the dealership model of Ho and Saunders (1981). The extended versions introduced regulatory variables is proposed by Birchwood et al. (2017). In order to compare the role of regulations on bank margins between Islamic and conventional banks, the Islamic bank dummy variable is introduced. The interaction terms of each regulation variable with dummy variable (IB) will represent the effect of regulations on Islamic banks. This study follows the analysis of the interaction variables in the baseline model proposed by Brambor et al. (2006). According to

Brambor et al. (2006), the regression model that includes the interactive variable should focus on the interaction model by computing the marginal effects of the interaction term with partial differentiation. Therefore, the baseline model for the impact of the banking regulations (total regulatory capital ratio and Tier-1 capital ratio) on bank margins for Islamic banks is given by:

$$BM_{ijt} = \alpha + \beta_1 l.BM_{ijt} + \beta_2 BS_{ijt} + \beta_3 MS_{ijt} \\ \beta_4 MV_{jt} + \beta_5 CR_{jt} + \beta_6 IB_{jt} + \beta_7 (CR_{jt} \times IB) + \varepsilon_{ijt} \quad (2)$$

Where the $BM_{ijt}$ represents the bank margins for conventional banks and Islamic banks. For explanatory variables, the first estimated is lagged dependent variable to some extent should capture the persistence of bank's margin. Then, $CR_{jt}$ takes two different definitions of variables that is the ratio of total regulatory over risk-weighted asset and Tier-1 over risk-weighted asset. Followed by $BS_{ijt}$ is a measure of bank-specific characteristics for bank *j* in country *i* at time *t.* The bank-specific variables are bank size, risk aversion, credit risk, liquidity and the management efficiency of a banking system. Next, $MS_{jt}$ noted the industry-specific variable which uses Lerner index to measure banks' competition in the country *j* at time *t* and $MV_{jt}$ represent macroeconomic variables covered the GDP growth, the inflation rate and interest rate risk are included to take account of broad banking system differences across the countries in the sample. Then, Lastly, $\varepsilon_{ij}$ is an error term.

Take note, that in the specification of the Equation (2), the interaction terms of $(CR_{jt} \times IB)$ enable the differences between the slope coefficients of the two conventional and Islamic banks to be analyse. For example, the effect of the regulation variables on bank margins in Islamic banks $(\beta_5 + \beta_7)$. The $(\beta_5 + \beta_7)$ explains the impact of regulation variables on bank margins when Islamic bank exist meaning that the dummy variable, IB takes the value of one. For conventional banks, the effect is measured as $\beta_5$. $\beta_5$ illustrates the effect of regulation variables on bank margins when Islamic banks, IB = 0. Since, the key parameters of the model are $\beta_5$ and $\beta_7$ Table 1 summarises the specification of (2) conditional on whether the bank is Islamic or conventional.

Table 1
*The calculation of marginal effects of regulations on bank margins*

| Case | Marginal effect | Variances |
|---|---|---|
| Total regulatory capital ratio | $\frac{\partial BM}{\partial} = \beta_5 + \beta_7 IB$ | $\sigma^2_{\frac{\partial BM}{\partial AR}} = var(\beta_5) + IB^2 var(\beta_7) + 2Cov(\beta_5 \beta_7)$ |
| Tier-1 capital ratio | $\frac{\partial BM}{\partial} = \beta_5 + \beta_7 IB$ | $\sigma^2_{\frac{\partial BM}{\partial SP}} = var(\beta_5) + IB^2 var(\beta_7) + 2Cov(\beta_5 \beta_7)$ |

**Description of Variables**

Table 2 displays the summary of variables included in the study. The variable representing the dependent variable is the bank margins. The bank margins are measured by net interest margins for conventional banks' and net financing margins for Islamic banks. The net interest margin is represented as net interest income over average earning assets (Saunders & Schumacher, 2000). On the other hand, the net financing margins are measured by net financing income over average earning assets (Hutapea & Kasri, 2010). The bank margin is widely used in the literature. The bank margin reflects the costs of intermediation services on society.

The key explanatory variable is the capital regulation variable. The capital regulation variables used in this study comprises of two sets of the indicator. Regulatory capital is based on risk, which is maintained under the rules determined by the supervisor in a country (Rahman et al., 2015). This capital is known as the risk-based capital adequacy ratio. The capital uses the risk-weighted asset in its definitions according to Basel. This study employs two measurements of capital regulations: total regulatory capital ratio and Tier-1 ratio. The total regulatory capital ratio is measured as total regulatory capital divided by the risk-weighted asset (Bitar et al., 2017).

Few explanatory factors include examining its impact on bank margins. For example, bank-specific factors and macroeconomic variables are considered in studies evaluating the level margins of a banking system. Firstly, the bank size is included in this study. The size of a baking system has beneficial effects on margins in terms of economies of scale and reduced costs or economies of scope (Iloska, 2014). In addition, this study also includes bank capital and liquidity as it reflects the ability of banks to absorb shocks. The bank capital used in this study is the equity-to-total assets ratio (Ho & Saunders, 1981). Liquidity measurement incorporated in this study is defined as the ratio of total liquid assets to total assets following Qi and Yang (2016). Besides that, this study also includes credit risk. Credit risk is a major factor in determining the interest rate on loans. For example, the longer the loan term, usually the higher the interest rate. It is also known as credit exposure.

Table 2
*Descriptions of variables*

| Variables | Proxy | Source | Expected sign |
|---|---|---|---|
| Dependent variables | | | |
| Net interest margins | Net interest income over average earning assets (Saunders & Schumacher, 2000) | FitchConnect | |
| Net financing margins | Net financing income over average earning assets (Hutapea & Kasri, 2010) | FitchConnect | |
| Independent variables | | | |
| I. Capital regulations | | | |
| Total capital ratio | Total regulatory capital over risk-weighted asset (Bitar et al., 2017). | FitchConnect | + |
| Tier-1 ratio | Tier-1 capital over risk-weighted asset (Bitar et al., 2017) | FitchConnect | + |
| II. Bank-specific variables | | | |
| Bank size | Natural logarithm of total assets (Trinugroho et al., 2018) | FitchConnect | +/– |
| Risk aversion | Ratio of equity over total asset (Poghosyan, 2013) | FitchConnect | + |
| Credit risk | Ratio of loan loss reserves to gross loans (Kosmidou et al. 2008) | FitchConnect | + |
| Liquidity | Ratio of total liquid assets to total assets (Qi & Yang, 2016) | FitchConnect | + |
| Quality of management (efficiency) | Cost to income ratio (Rahman et al. 2023) | FitchConnect | – |
| III. Industry-specific variables | | | |
| Lerner Index | Ratio of the mark-up pricing of banking products over marginal cost (Meslier et al., 2017) | FitchConnect | + |
| IV. Macroeconomic variables | | | |
| GDP growth | Annual percentage growth rate of GDP (Mia, 2023) | Worldbank | – |
| Inflation | Rate of change in the consumer price index (López-Espinosa et al., 2011; Rahman et al., 2023) | Worldbank | + |
| Interest rate risk | The proxy used is standard deviation of monthly lending rate (Birchwood et al., 2017) | Worldbank and own calculation | + |

This study employs the cost-to-income ratio as the quality of management (Rahman et al., 2023). The cost-to-income ratio is a measurement of the banks' efficiency. Accordingly, a negative and significant impact of cost to income ratio on banks margins was obtained by Rahman et al. (2023). Next, interest rate risk was included in a few research studies as the determinant of banks' margins. Wong (1997) extended the model made by Zarruk (1989), who was the first to include interest rate risk in research. Turning to the industry-specific variable, the Lerner index is incorporated in this study. Lerner index is commonly used in the banks' competition literature. The Lerner Index calculation is detailed in the Appendix. Few macroeconomic variables are usually used, which are GDP and inflation rate. Real per capita gross domestic product (GDP) growth is a proxy for the existence of opportunities since banks may respond to the business cycle by contracting loans during periods of recession and facilitating loans during periods of expansion.

## RESULTS

### Descriptive Statistics

Table 3 reports descriptive statistics of the variables incorporated in this study for conventional and Islamic bank samples. The number of observations for conventional banks denotes 676 total banks, while the number of Islamic banks is 127. Columns 3 to 6 represent conventional banks' mean, standard deviation, minimum and maximum. Meanwhile, columns 8 to 11 indicate Islamic banks' mean, standard deviation, minimum, and maximum values.

The descriptive statistics indicate that the average mean of the main variable total regulatory capital ratio of ASEAN countries for conventional banks (Mean = 24.83, S. D. = 27.12) is significantly different than those of Islamic banks (Mean = 17.36, S. D. = 14.98). Then, tier-1 capital ratio also indicates different results of conventional (Mean = 22.74, S. D. = 27.43) and Islamic banks (Mean = 15.24, S. D. = 15.06). The average values of the capital regulatory variables suggest that conventional banks are more capitalised than Islamic banks in ASEAN countries. The average value contradicts previous literature, which claims that Islamic banks are more capitalised than conventional banks (Beck et al., 2013). Moreover, on average, conventional banks have more equity capital as a percentage of total assets (14.93) than Islamic banks (10.4). The dependent variable, bank margins of conventional banks, have higher values (4.43) than Islamic banks (3.66). This result is unexpected since conventional banks should have a smaller spread given the relatively large size of operations compared to Islamic banks (Lee & Isa, 2017).

Nevertheless, Islamic banks are more efficient than conventional banks. This is shown by the lower efficiency ratio of conventional banks (62.23) compared to Islamic banks (65.04). The results suggest that Islamic banks are less efficient than conventional banks (Beck et al., 2013). Besides that, the ratio measured for credit risk implies that conventional banks have a lower ratio than Islamic banks, but the liquidity ratio is higher than Islamic banks. The high average value for the credit risk ratio in Islamic banks suggests that Islamic banks keep more reserves against bad loans (Khasawneh, 2016). Turning to industry-specific variables, the average Lerner index of Islamic banks is 0.65, slightly higher than its conventional counterparts with 0.63. The macroeconomic variables, GDP, and the inflation rate of conventional banks both depict high average values (4.85 for GDP, 3.91 for inflation) than Islamic banks (5 for GDP, 3.49 for inflation).

Table 3
*Descriptive statistics*

| Variable | Conventional banks | | | | | Islamic banks | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Obs. | Mean | S. D. | Min | Max | Obs. | Mean | S. D. | Min | Max |
| Bank margins | 676 | 4.43 | 2.36 | 0.33 | 16.73 | 127 | 3.66 | 1.97 | –2.44 | 9.10 |
| Size | 676 | 7.94 | 2.07 | 2.92 | 12.87 | 127 | 7.72 | 1.48 | 4.26 | 10.61 |
| Risk aversion | 676 | 14.93 | 10.13 | –3.28 | 92.80 | 127 | 10.40 | 12.17 | –27.91 | 73.17 |
| Efficiency | 676 | 60.23 | 28.50 | 17.09 | 345.34 | 127 | 65.05 | 22.48 | 29.59 | 140.40 |
| Liquidity | 676 | 20.66 | 14.48 | 1.74 | 92.41 | 127 | 14.33 | 9.98 | 0.34 | 54.21 |
| Credit risk | 676 | 2.34 | 3.64 | 0.00 | 68.09 | 127 | 4.01 | 6.78 | 0.47 | 41.19 |
| Lerner index | 676 | 0.63 | 0.28 | 0.01 | 0.99 | 127 | 0.65 | 0.25 | 0.01 | 0.99 |
| GDP | 676 | 4.85 | 1.69 | –1.50 | 15.20 | 127 | 5.00 | 1.75 | –1.50 | 15.20 |
| Inflation | 676 | 3.91 | 2.04 | –0.90 | 6.40 | 127 | 3.49 | 1.79 | –0.90 | 6.40 |
| Interest rate risk | 676 | 0.30 | 0.27 | 0.00 | 0.88 | 127 | 0.22 | 0.25 | 0.00 | 0.88 |
| Total regulatory capital ratio | 676 | 24.83 | 27.11 | 8.02 | 501.51 | 127 | 17.36 | 14.98 | –52.83 | 79.20 |
| Tier-1 ratio | 676 | 22.74 | 27.43 | 0.14 | 501.51 | 127 | 15.24 | 15.06 | –52.57 | 78.60 |

## Regression Result

This study has five separate specifications of Equation (1). The first specification only includes bank-specific factors, followed by market-specific factors. Then in the third specification, macroeconomic factors are included, and lastly, the capital regulations indicators are included as this study's main research objective. Capital regulation variables are included to explore the impact of capital measurement according to Basel Accords standards between conventional and Islamic banks.

This study incorporates two measurements of the capital requirement: the total regulatory capital and the tier-1 capital ratio as a measurement of capital regulation followed the international standards for the regulation of banks set by the Bank for International Settlements (Basel Accords). Firstly, the total regulatory capital proxy as total capital to risk-weighted asset reflects the amount of a bank's capital concerning the risk banks take. The total regulatory capital ratio is defined as Tier-1 and Tier-2 capital to risk-weighted assets. According to Basel III criteria, the minimum level banks had to maintain between capital and their weighted risk asset is 8% (Basel Committee on Banking Supervision, 2011). The reason for using two different measurements of the capital requirements is to investigate whether the percentage of the minimum capital requirements introduced by regulators varied differently in its impact on conventional and Islamic bank margins. For instance, regulators set the minimum requirement at 8% for the ratio of total regulatory capital to total risk-weighted assets, while the ratio of Tier-1 capital to total risk-weighted assets is at 4% in all countries before 2013, 4.5% in 2013, 5.5% in 2014 and 6% in 2015 following Basel III phase-in arrangements (Bank of International Settlements, 2013).

The results from Table 4 show that almost all of the coefficients are generally in agreement with the predicted signs. According to Table 4, the lagged dependent variable is consistently and highly significant at 1% throughout all the models and suggests that the specification of this model is dynamic. However, the null hypothesis number of valid instruments is rejected, and the autocorrelation test of regressions of no-second order serial correlation is not rejected. Therefore, as an alternative, this study runs the sample of conventional and Islamic banks together by introducing a dummy variable (IB) to separate Islamic banks from conventional banks. The value 1 of the IB denotes the presence of Islamic banks and 0 otherwise. Then, the interaction term of capital regulation with IB reflects the effect of capital regulation on bank margins with the presence of Islamic banks.

Table 4
*Estimation results: The impact of capital regulation on conventional and Islamic bank margins*

| | (1)<br>BM | (2)<br>BM | (3)<br>BM | (4)<br>BM | (5)<br>BM |
|---|---|---|---|---|---|
| L.BM | 0.6506*** | 0.6462*** | 0.8355*** | 0.7757*** | 0.7800*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| *Bank-specific factors* | | | | | |
| Size | –0.1537*** | –0.2155*** | –0.1023*** | –0.1144*** | –0.1249*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |

(*Continued on next page*)

Table 4 (*Continued*)

| | (1)<br>BM | (2)<br>BM | (3)<br>BM | (4)<br>BM | (5)<br>BM |
|---|---|---|---|---|---|
| Risk aversion | 0.0098* | 0.0085 | 0.0046 | 0.0210** | 0.0118 |
| | (0.0570) | (0.1120) | (0.2000) | (0.0230) | (0.2780) |
| Quality of management | –0.0062*** | –0.0070*** | –0.0049*** | –0.0052*** | –0.0056*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Liquidity | –0.0138*** | –0.0101*** | –0.0035* | –0.0049*** | –0.0049*** |
| | (0.0000) | (0.0000) | (0.0540) | (0.0020) | (0.0070) |
| Credit risk | 0.0169** | 0.0163** | 0.0018 | 0.0150*** | 0.0177*** |
| | (0.0330) | (0.0420) | (0.7560) | (0.0000) | (0.0000) |
| *Market-specific factors* | | | | | |
| Lerner index | – | –0.4757* | –0.2910** | –0.3182** | –0.2926** |
| | | (0.0610) | (0.0450) | (0.0280) | (0.0490 |
| Macroeconomic factors | | | | | |
| GDP | – | – | –0.0342*** | –0.0224** | –0.0213** |
| | | | (0.000) | (0.019) | (0.039) |
| Inflation | | | 0.0111 | 0.0163 | 0.0154 |
| | | | (0.3790) | (0.1040) | (0.1500) |
| Interest rate risk | – | – | 0.3563*** | 0.3868*** | 0.3752*** |
| | | | (0.0000) | (0.0000) | (0.0000) |
| IB | – | – | – | –0.2161 | –0.3670 |
| Regulations factors | | | | | |
| Total regulatory capital | – | – | – | –0.0088** | – |
| | | | | (0.0140) | |
| Total regulatory capital × IB | – | – | – | 0.0114* | – |
| | | | | (0.0510) | |
| Tier-1 capital | – | – | – | – | –0.0046 |
| | | | | | (0.2620) |
| Tier-1 capital × IB | | | | | 0.0159** |
| | | | | | (0.0400) |
| _cons | 3.0359*** | 3.8344*** | 1.9029*** | 2.1350*** | 2.2499*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| N | 640 | 640 | 640 | 640 | 640 |
| No. of groups | 155 | 155 | 155 | 155 | 155 |
| Hansen test (*p*-value) | 34.8708 | 33.5569 | 42.3763 | 58.7305 | 61.5258 |
| | (0.4264) | (0.4892) | (0.1534) | (0.4485) | (0.3510) |
| AR(1) (*p*-value) | –2.5366 | –2.4883 | –3.1141 | –3.0326 | –3.0314 |
| | (0.0112) | (0.0128) | (0.0018) | (0.0024) | (0.0024) |

(*Continued on next page*)

Table 4 (*Continued*)

| | (1) BM | (2) BM | (3) BM | (4) BM | (5) BM |
|---|---|---|---|---|---|
| AR(2) (*p*-value) | –1.1811 (0.2376) | –1.1895 (0.2342) | –1.1796 (0.2382) | –1.1748 (0.2401) | –1.1630 (0.2448) |
| No. of instrument | 41 | 42 | 45 | 72 | 72 |

*Notes*: The sample period goes from 2009 to 2017. The number of banks is 156 and the number of observations is 640. All estimations are based on the Arellano and Bover (1995) system GMM estimator. Robust standard errors are reported in brackets. The null hypothesis of the AR(2) test is that errors in the first-difference regression exhibit no second-order serial correlation. The null hypothesis of the Hansen test is that the instruments are valid. ***, **, * indicate significance at the 1%, 5% and 10% level, respectively. The dependent variable is net interest margin measured as difference between interest income and interest expenses divided by interest-earning assets. The *p*-values in parentheses. $^{*}$ $p < 0.1$; $^{**}$ $p < 0.05$; $^{***}$ $p < 0.001$; L.BM = Lagged bank margin; BM = bank margin.

As for the controlled variables, the bank-specific, industry-specific, and macroeconomic variables also impact bank margins in ASEAN countries. All of the bank's specific factors indicators (risk aversion, quality of management and credit risk), market-specific factors (Lerner index) as well as macroeconomic variables (GDP and interest rate risk) have an impact on bank margins. Following previous literature, a positive and significant effect was found from the association between risk aversion and conventional bank margins, suggesting that well-capitalised banks lead to higher operations costs, thereby enhancing bank margins. The result is in line with Bougatef and Korbi (2018) findings in 14 MENA countries. Similarly, credit risk also was found to have a positive and significant impact on bank margins. The previous findings suggest that banks are likely to increase the bank margins to compensate for high expected losses in credit portfolios.

As for the quality of management, the variable exhibit a downward trend suggesting that efficiency has contributed to the declining pattern of the interest margins in ASEAN consistent with Maudos and Solís (2009), Hawtrey and Liang (2008), Trinugroho et al. (2014) and Bougatef and Korbi (2018). The quality of management (efficiency) indicator indicates that banks do not charge higher interest rates to cover the rise in cost. Bank size also portray a significantly negative on bank margins implying that larger banks would reduce the bank margins, in contrast to small banks. The plausible explanation would be that big banks would have a smaller operating cost due to economies of scale and charge less cost to borrowers and pay more to depositors. The same explanation for small-sized banks, as they would incur high costs, prompts banks to charge borrowers higher margins to offset the high banks' fees. The results align with Poghosyan (2013) as well as Lee and Isa (2017). Contrary to the anticipated outcome, liquidity had a significant negative impact on bank margins in ASEAN countries. The

observed negative outcomes may imply that banks operating within the ASEAN region, which possess a substantial proportion of their assets in the form of cash or reserves, are capable of managing deposit withdrawals without necessitating the imposition of elevated interest rates on borrowers.

Turning to market-specific factors, the Lerner index provides evidence of a negative and significant relationship between the Lerner index and bank margins. The negatively significant result possibly explains that conventional banks in ASEAN countries do not require a high level of competition in the financial market adopt risk-taking strategies to increase returns to cover the reduced franchised values (Gee et al., 2017). With regards to macroeconomic variables, GDP and interest rate risk have impact on bank margins. Relatively, the interest rate risk portrays a positive and significant impact on bank margins which are in line with the findings of Birchwood et al. (2017), and Ibrahim and Law (2019). The previous findings suggest the banks need to adjust the rate price to cover the rise in the uncertainty of the interest rate environment by increasing bank margins to cover higher levels of market interest rate volatility.

On the other hand, a negative and significant result of GDP on bank margins reflects the estimation result reveals that bank margins also depend on the macroeconomic variable (GDP). The GDP shows a negative and significant impact on bank margins, which correlates with Birchwood et al. (2017). The regression results show that a decrease in the bank margins would encourage lending by the banks, thereby inducing economic growth. Thus, ASEAN countries should have an appropriate macroeconomic environment to reduce the bank margins and encourage investment opportunities. In contrast, the inflation rate has no significant impact on bank margins. The insignificant results could imply that increasing inflation in a country due to high interest rates set by government monetary policy plays no role in banks' margins. The insignificant results align with Birchwood et al. (2017).

The interaction terms are incorporated to test whether capital regulations' impact on bank margins is similar for conventional and Islamic banks. Based on specifications (4) and (5), the total regulatory capital ratio is significant, suggesting that this variable is important in explaining the bank margins. The coefficients of both of the interactive terms are positive, implying that the marginal effect of the variables on bank margins is higher for Islamic banks than conventional banks. The coefficients of the interactive terms, Total regulatory capital ratio × IB and Tier-1 capital ratio × IB, are significant. Then, Table 5 was constructed to report the marginal effect of the total regulatory capital ratio and Tier-1 capital ratio for conventional and Islamic banks.

Table 5
*Marginal effects of capital regulation on bank margins*

| Bank | Total regulatory capital ratio | Tier-1 capital ratio |
|---|---|---|
| Conventional banks | –0.0043 (0.1350) | –0.0020 (0.5250) |
| Islamic banks | 0.0104 (0.1130) | 0.0148** (0.0400) |

*Notes:* The *p*-values in parentheses. * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Table 5 reports that total regulatory capital ratio has no effect on both Islamic bank margins and conventional bank margins. The negative results contradict the previous literature (Abdel Reda et al., 2016; Rahman et al., 2018) who conclude a negative association between total regulatory capital to bank margins. Rahman et al. (2018) indicates that well-capitalised banks can benefit from lower funding costs due to having lower default risk resulting in lower intermediation costs.

On the other hand, the Tier-1 capital has no effect on bank margins for conventional banks but positively influenced bank margins of Islamic banks. For Islamic banks, the estimated marginal effect (0.0148) indicates that an increase in Tier-1 capital ratio by 1 point is associated with the increase in margins by roughly 0.01 points. Interestingly, the BCBS introduced Basel III, which required the financial institutions to have more Tier-1 capital which is not favourable to Islamic banks. One of the plausible reasons would be on the sources of funds of Islamic banks. Mejia et al. (2014) clarify that adjustments are made in the sources of funds and risk-weighted assets for Islamic banks because the losses are held responsible by investment account holders which are different from conventional banks. The *shariah* rules require the Islamic banks to practice equity-based financing contracts, i.e., *musharakah* and *mudarabah*. Customers were required to handle capital properly to create profit while avoiding losses under the contracts (Maikabara, 2019). Furthermore, the *mudarabah* contract requires the account holder to carry the loss. The losses of the deposits suffered by the capital provider cause the Islamic banks to bear excessive risk by allocating deposits constituting a large part of their assets (Hamza, 2016). In other words, the requirement of Islamic banks to maintain the minimum Tier-1 capital ratio of at least 6% could increase the risk faced by the banks. The higher the risk faced by the banks, the higher the cost charged to the borrowers. Thereby, the impact of Tier-1 capital on the margins is higher for Islamic banks because of the risk faced by Islamic banks. The finding for Islamic banks is in line with Miles et al. (2013). Miles et al. (2013) find that the cost of funding bank-lending will increase due to the replacement of debt leading the banks to charge higher interest to borrowers.

## ROBUSTNESS

To support the analysis of the baseline regressions, some additional tests were performed as robustness tests. Firstly, this study includes a different indicator of capital regulations that were used by Barth et al. (2013). The capital regulation indicator is an index constructed based on several sets of questions (refer Barth et al., 2013) from the survey conducted by Barth et al. (2001; 2004; 2013) and obtained from the Banking and Supervision Database.

Table 6
*Determinants of bank margins in ASEAN countries (using alternative indicator)*

| | (1)<br>BM | (2)<br>BM | (3)<br>BM | (4)<br>BM |
|---|---|---|---|---|
| L.BM | 0.6506*** | 0.6462*** | 0.8355*** | 0.8154*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Bank-specific factors | | | | |
| Size | –0.1537*** | –0.2155*** | –0.1023*** | –0.1158*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Risk aversion | 0.0098* | 0.0085 | 0.0046 | 0.0027 |
| | (0.0570) | (0.1120) | (0.2000) | (0.4960) |
| Quality of management | –0.0062*** | –0.0070*** | –0.0049*** | –0.0053*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Liquidity | –0.0138*** | –0.0101*** | –0.0035* | –0.0038* |
| | (0.000) | (0.000) | (0.0540) | (0.0510) |
| Credit risk | 0.0169** (0.0330) | 0.0163** | 0.0018 | 0.0034 |
| | | (0.0420) | (0.7560) | (0.5670) |
| Market-specific factor | | | | |
| Lerner Index | – | –0.4757* | –0.2910** | –0.3038** |
| | | (0.0610) | (0.0450) | (0.0420) |
| Macroeconomic variables | | | | |
| GDP | – | – | –0.0342*** | –0.0308*** |
| | | | (0.0000) | (0.0020) |
| Inflation | – | – | 0.0111 | 0.0092 |
| | | | (0.3790) | (0.5020) |
| Interest rate risk | – | – | 0.3563*** | 0.3674*** |
| | | | (0.0000) | (0.0000) |
| IB | – | – | – | –1.1740*** |
| | | | | (0.0010) |
| Regulation factor | | | | |
| Capital requirement | – | – | – | –0.0066 |
| | | | | (0.8020) |
| Capital requirement × IB | – | – | – | 0.1482*** |
| | | | | (0.0010) |

(*Continued on next page*)

Table 6 (*Continued*)

| | (1)<br>BM | (2)<br>BM | (3)<br>BM | (4)<br>BM |
|---|---|---|---|---|
| _cons | 3.0359*** (0.0000) | 3.8344*** (0.0000) | 1.9029*** (0.0000) | 2.2031*** (0.0000) |
| N | 640 | 640 | 640 | 640 |
| No. of groups | 155 | 155 | 155 | 155 |
| Hansen test (p-value) | 34.8708 (0.4264) | 33.5569 (0.4892) | 42.3763 (0.1534) | 41.0733 (0.1883) |
| AR(1) (p-value) | –2.5366 (0.0112) | –2.4883 (0.0128) | –3.1141 (0.0018) | –3.1051 (0.0019) |
| AR(2) (p-value) | –1.1811 (0.2376) | –1.1895 (0.2342) | –1.1796 (0.2382) | –1.1886 (0.2346) |
| No. of instrument | 41 | 42 | 45 | 48 |

*Notes:* The sample period goes from 2009 to 2017. The number of banks is 155 and the number of observations is 640. All the estimations are performed using GMM method. The standard errors are reported in the brackets. The *p*-values in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; L.BM = lagged bank margin; BM = bank margin.

Table 6 portrays the results of the capital requirements on the conventional bank and Islamic banks. The result is compatible with the baseline regression of the Tier-1 capital ratio. The capital requirements index is significant, suggesting that this variable is important in explaining the margins of conventional banks. The coefficient of the interactive term is positive, suggesting that the marginal effect of the variable is higher for Islamic banks than conventional banks. The results are consistent with baseline regression.

Table 7
*Marginal effect of capital requirement on bank margins*

| Bank | Capital requirements |
|---|---|
| Conventional bank | –0.0066 (0.8020) |
| Islamic bank | 0.1416** (0.0071) |

*Note:* The *p*-values in parentheses. * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

The marginal effect of the interaction term is given in Table 7. The marginal effect of capital requirement on bank margins when conditioning Islamic banks is 0.1416. This implies that an increase in 1% in minimum capital requirements will lead to a 0.1416% increase in Islamic bank margins. The result obtained on the capital requirement measurement suggested by Barth et al. (2013) is consistent with the baseline regression and marginal effect results for the primary result.

Secondly, this study employs different definitions of the dependent variable following Birchwood et al. (2017), the difference between the implicit lending rate and implicit deposit rate. Then, as an alternative indicator to capital regulation, as a robustness test, this study includes the measurement proposed by Barth et al. (2004; 2013) in the surveys. The index varies from 0 to 10, and higher values indicate greater capital stringency. Hence, Table 8 displays the results for the robustness test of both the alternative dependent variable. Using the difference of implicit lending rate and implicit deposit rate, the total regulatory capital ratio and Tier-1 show an insignificant impact on conventional bank margins. The insignificant result could suggest that increase in the capital ratios does not reduce the lending rate or increase the deposit rates of conventional banks in the ASEAN region.

Table 8
*Determinants of bank margins for conventional and Islamic banks (using alternative indicator)*

| | (1)<br>BM2 | (2)<br>BM2 | (3)<br>BM2 | (4)<br>BM2 | (5)<br>BM2 |
|---|---|---|---|---|---|
| L.BM2 | 0.4877*** | 0.4844*** | 0.5325*** | 0.5284*** | 0.5295*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Bank-specific factors | | | | | |
| Size | –0.1780*** | –0.3484*** | –0.2808*** | –0.3133*** | –0.3179*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Risk aversion | 0.0259*** | 0.0221** | 0.0108 | 0.0134 | 0.0057 |
| | (0.0050) | (0.0130) | (0.1390) | (0.4170) | (0.7390) |
| Quality of management | –0.0090*** | –0.0114*** | –0.0090*** | –0.0078*** | –0.0081*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Liquidity | –0.0330*** | –0.0288*** | –0.0220*** | –0.0231*** | –0.0241*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Credit risk | 0.0455*** | 0.0478*** | 0.0441*** | 0.0476*** | 0.0473*** |
| | (0.0010) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Market-specific factor | | | | | |
| Lerner index | – | –1.3205*** | –1.4380*** | –1.5380*** | –1.5171*** |
| | | (0.0010) | (0.0000) | (0.0000) | (0.0000) |
| Macroeconomic variables | | | | | |
| GDP | – | – | –0.0469** | –0.0395** | –0.0407** |
| | | | (0.0180) | (0.0485) | (0.0376) |
| Inflation | – | – | 0.0792*** | 0.0601** | 0.0585** |
| | | | (0.0017) | (0.0220) | (0.0265) |
| Interest rate risk | – | – | 0.5813*** | 0.5232*** | 0.5272*** |
| | | | (0.0000) | (0.0000) | (0.0000) |

(*Continued on next page*)

Table 8 (*Continued*)

| | (1) BM2 | (2) BM2 | (3) BM2 | (4) BM2 | (5) BM2 |
|---|---|---|---|---|---|
| IB | – | – | – | –0.9977*** (0.0000) | –0.9805*** (0.0000) |
| Regulation factor | | | | | |
| Total regulatory capital | – | – | – | –0.0072 (0.2976) | – |
| Total regulatory capital × IB | – | – | – | 0.0329*** (0.0010) | – |
| Tier- 1 capital | – | – | – | – | –0.0029 (0.7000) |
| Tier-1 capital × IB | – | – | – | – | 0.0356*** (0.0000) |
| _cons | 4.3089*** (0.0000) | 6.5890*** (0.0000) | 5.5728*** (0.0000) | 6.0998*** (0.0000) | 6.1764*** (0.0000) |
| N | 640 | 640 | 640 | 640 | 640 |
| No. of groups | 155.0000 | 155.0000 | 155.0000 | 155.0000 | 155.0000 |
| Hansen test (*p*-value) | 30.5268 0.6386 | 29.4722 0.6892 | 52.9450 0.0202 | 50.6275 0.0332 | 50.0029 0.0377 |
| AR(1) (*p*-value) | –3.2469 0.0012 | –3.2053 0.0013 | –3.3787 0.0007 | –3.3715 0.0007 | –3.3581 0.0008 |
| AR(2) (*p*-value) | –0.9704 0.3318 | –0.8300 0.4066 | –0.3830 0.7017 | –0.4278 0.6688 | –0.3874 0.6985 |
| No. of instrument | 41 | 42 | 45 | 48 | 48 |

*Notes:* The sample period goes from 2009 to 2017. The number of banks is 155 and the number of observations is 640. All the estimations are performed using GMM method. The standard errors are reported in the brackets. The dependent variable is bank margins measures as difference between the implicit lending rate (ratio of interest income on loans divided by total loans) and the implicit deposit rate (ratio of interest expenses on customer deposits divided by total deposits). The *p*-values in parentheses. * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$.

Table 8 portrays the results of the capital regulations on bank margins of conventional and Islamic banks. The result is incompatible with the baseline regression of the total regulatory capital ratio and Tier-1 capital ratio. An insignificant result was obtained, suggesting that these variables have no significant effect on bank margins. To better illustrate, the marginal effect table is constructed. Table 9 shows that both the total regulatory capital ratio and Tier-1 capital ratio have no significant impact on conventional and Islamic banks' margins.

Table 9
*Marginal effect of capital requirement on bank margins*

| Bank | Total regulatory capital ratio | Tier-1 capital ratio |
|---|---|---|
| Conventional banks | –0.0072 (0.2976) | –0.0029 (0.7000) |
| Islamic banks | 0.0257 (0.9154) | 0.0327 (0.8856) |

*Notes:* The *p*-values in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$ and $^{***}$ $p < 0.01$

## CONCLUSION

This study compares the effect of capital requirements on bank margins amongst a sample of Islamic and conventional from four ASEAN countries (Indonesia, Malaysia, Singapore and Thailand). The statistic reveals that, on average, the conventional bank margins are higher than Islamic bank margins during the study period. Hence, this study investigates the impact of capital regulation on bank margins of conventional and Islamic banks. The core variable of this study is the regulatory capital variable, constituting two measurement types: total regulatory capital ratio and Tier-1 capital ratio. On the one hand, the findings show that the total regulatory capital ratio is negatively significant for conventional banks' margins but does not significantly affect Islamic banks' margins.

On the other hand, the Tier-1 capital ratio increases the bank margins of Islamic banks but has no significant impact on conventional banks' margins. In a nutshell, the analysis provides a few policy and research implications. The negative association between total regulatory capital ratio and bank margins induces regulatory authorities to force banks to hold at least the minimum required works for conventional banks. This implies that conventional banks should follow Basel's guidelines for capital regulations as it helps lower bank margins. However, an appropriate set of capital requirements should be introduced for Islamic banks instead of the Basel III minimum capital requirements. Future research could investigate the capital requirements suggested by Islamic Financial Services Board (IFSB) for Islamic banks on the efficiency of a banking system.

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## NOTE

1. The ASEAN countries' average is calculated using the following countries: Indonesia, Malaysia, Thailand and Singapore.

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## APPENDIX

The Lerner index is calculated as the ratio of the mark-up pricing of banking products over marginal cost (Meslier et al., 2017). The index captures the ability of a bank to set the price of output above its marginal cost (Ibrahim et al., 2018). The measurement of Lerner index is as follows:

$$Lerner_{it} = \frac{Price_{it} - MC_{it}}{MC_{it}}$$

where $Price_{it}$ is the price of the bank's output $i$ at time $t$ . The price is measured as the ratio of total revenue over total asset. The total revenue is the sum of total interest income and total of non-interest operating income. Meanwhile, $MC_{it}$ is the marginal cost of the total asset of the bank $i$ at time $t$. The marginal cost is computed using the trans-logarithm of total cost function with one output and three inputs (price of labour, price of capital and price of funds) following the methodology by Meslier et al. (2017). Therefore, to estimate the marginal cost, the trans-logarithm of the total cost is as follows:

$$\ln TC_{it} = \alpha_0 + \alpha_1 \ln(TA)_{it} + \frac{\alpha_2}{2} \ln(TA)^2_{it} + \sum_{j=1}^{3} \delta_i \ln w_{jit}$$
$$\sum_{j=1}^{3} \sum_{k=1}^{3} \delta_{jk} \ln w_{jit} \ln w_{kit} + \sum_{j=1}^{3} \gamma_{jk} \ln(TA)_{it} \ln w_{jit} + \varepsilon_{kit}$$

where $TC_{it}$ is the total cost of banks $i$ at time $t$ measured as sum of total interest expenses and total of non-interest expenses. denotes the total asset of bank $i$ at time $t$. Meanwhile, $TA_{it}$ the three inputs are: price of labour, $w_1$, price of capital, $w_2$ and price of fund, $w_3$. The price of labour is calculated by dividing personnel expenses to total assets. The price of capital is measured by calculating the ratio of other operating expenses to total assets. The price of funding is computed using the ratio of interest expenses to total customer deposits. Then, the marginal cost is computed using the following equation:

$$MC_{it} = \frac{TC_{it}}{TA_{it}} \left( \pm_1 + \pm_2 \ln(TA)_{it} + \sum_{j=1}^{3} \gamma_j \ln w_{jit} \right)$$

The Lerner index value ranges between 0 and 1 (Maudos & Fernández De Guevara, 2004). If the Lerner index = 0, it indicates a perfectly competitive behaviour and the firm has no market power. Meanwhile, if the Lerner index is close to 1, the index indicates the weakness of the competition at the price level and that the firm exercises a market power thanks to a higher mark-up. Maudos and Solis (2009) suggest a positive relationship between the Lerner index and bank margins because banks with greater market power will increase bank margins to exercise market conditions.