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Audit committee effectiveness, bank efficiency and risk-taking: Evidence in ASEAN countries

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Abstract: This study investigates the inter-relationship between audit committee effectiveness, bank efficiency and risk-taking in seven ASEAN countries for the period 2010–2019. By using three-stage least squares (3SLS) method, we contribute to literature the relationship between audit committee effectiveness and bank risk-taking by examining the mechanism behind this relation. Our results show that audit committee effectiveness reduces bank risk-taking through increasing bank efficiency. This study also finds that the association between audit committee effectiveness and bank risk-taking is bi-directional, i.e the higher audit committee effectiveness induces lower risk and vice versa.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: Audit committee effectiveness; bank efficiency; bank risk-taking
JEL Codes: G10; G30; G32; G33

1. Introduction

Risk of the banking sector is a major concern of researchers because it causes potential contagion across the financial sector and the possible effect on the whole economy. The literature in this field agrees that corporate governance of banks has a key role in controlling risk-taking. Especially, some studies agree that the Board of director is the "apex body" of an organization's internal governance system (Fama and Jensen, 1983). After the 2007–2008 financial crisis, Basel Committee required Board of director of banks as well as its committee to enhance their role in controlling bank risk. Pathan (2009) find that a strong board increase risk-taking in US banks, However, Minton et al. (2011) report the negative association between Board effectiveness and risk-taking. These findings indicate that Board has an important role in oversight risk-taking. Sun and Liu (2014) argue that Boards do this role through their audit committee. They find that the audit committee effectiveness can constrain risk-taking activity and increase the effectiveness of risk management.

ABOUT THE AUTHOR

Quang Khai Nguyen is a researcher at School of Banking, University of Economics Ho Chi Minh City (UEH). His research covers a variety of topics related to financial institutions and empirical corporate finance and banking, including capital structure, corporate governance, risk-taking behaviors, earnings management and bank stability.

PUBLIC INTEREST STATEMENT

How to build an appropriate governance mechanism to improve the bank's operational efficiency and control risks is always a matter of concern to bank shareholders as well as regulators. This paper comprehensively evaluates the role of an audit committee in bank performance as well as monitoring bank risk-taking. Research results highlight the role of audit committee, thereby implying that banks need to pay more attention to the role of audit committee in the trend that more and more banks focus on risk committees.

In the ASEAN region, the financial market is quite different and the countries in this region apply international guidelines such as FSB (2013), BCBS (2015) in different ways (Nguyen, 2022). Therefore, the corporate governance structure in general and the audit committee structure in particular are very different between countries. Furthermore, with the strong development of financial markets in the ASEAN region, it has become more important to study bank risks and their efficiency in this region (Nguyen, 2021a; Dang & Nguyen, 2021; Nguyen & Dang 2022). By focusing on commercial banks in ASEAN countries, our study contributes to the literature in some ways.

First, we extend the research of Sun and Liu (2014) by investigating the mechanism that audit committee effectiveness affects bank risk-taking. Moreover, this study does not use specific characteristic of audit committee but use an overall index to measure audit committee effectiveness. Applying some unique characteristics as literature may not reflect audit committee effectiveness exactly.

Second, as best knowledge, this is the first study that investigates the inter-relation of audit committee effectiveness, efficiency and bank risk-taking. Our results will give practically strong implications for banks to have appropriate strategies in enhancing audit committee effectiveness, bank efficiency as well as constraining bank risk-taking.

The remainder of this paper is organized as follows. Section 2 provides the literature review related to firm risk, firm efficiency and audit committee effectiveness and then proposes the related hypotheses. Section 3 introduces the research methodology including describing the data, the empirical testing methodology, and the model variable specification. In Section 4, we report the empirical evidence and analyze the testing results. Finally, Section 6 presents the conclusion.

2. Literature review and hypotheses development

2.1. Audit committee effectiveness and bank efficiency

Prior studies find that Bank shareholders tend to want managers to take more risk (Q. K. Nguyen , 2020; Pathan, 2009) and increase efficiency (Lin & Zhang, 2009; Margaritis & Psillaki, 2010). However, the bank managers may not have actions as shareholders' requirements because of the agency problems. Agency theory states that the delegation of managerial responsibilities by shareholders managers requires the presence of mechanisms that firms should have the monitor mechanism to oversight the performance of managers and ensure that they use their delegated powers in the best interests of the shareholders.

The literature on corporate governance increasingly recognizes that boards of directors have a central role in reducing agency problems and enhancing firm performance (Zahra & Pearce, 1989). Because board of directors usually does their roles through board committees. Some empirical studies, therefore, try to examine whether audit committee effectiveness can enhance firm efficiency. Huang et al. (2011) find that financial or accounting expertise on the audit committee is positively associated with firm efficiency. Menon and Williams (1994) considered two audit committee traits (meeting frequency and independence) to ascertain if the board directly relied on audit committee as a tool to control managers and found that these two characteristics improved the monitoring of the firm, and could thereby improve its performance. Rahman et al. (2006) and Saleh et al. (2007) provided evidence that a lesser number of audit committee meetings improved financial performance of the firm as it reduced the additional cost that was incurred with every meeting. These results indicate that audit committee effectiveness can enhance firm efficiency and thus we propose the hypothesis as follows:

H1: audit committee effectiveness can improve bank efficiency

2.2. Audit committee effectiveness and bank risk-taking

Some prior study investigates the role of Board of director in controlling bank risk-taking. Pathan (2009) finds that a strong board (Board reflects more shareholder interest) increases risk-taking in US banks. Minton et al. (2011) report the positive relationship between financial expertise, independent directors and bank risk. These findings indicate that high board of director effectiveness may increase risk-taking. Because board of directors do not oversee bank risk-taking activities directly, but through audit committee (Sun & Liu, 2014), audit committee effectiveness can constraint risk-taking in banking sectors. In addition, higher effectiveness of audit committee may be a key factor to reduce managers taking excessive risk to make profits in the short run for personal gain although these actions are not truly value-maximizing for shareholders (Cheng et al., 2010). Q. Nguyen and Dang (2020) find some characteristics of audit committee significantly associated with bank risk and bank stability. Based on some findings of the literature, we expected audit committee effectiveness can constraint risk-taking and propose hypothesis as follows:

H2: audit committee effectiveness can reduce risk-taking behavior

2.3. Bank efficiency and bank risk-taking

Berger and Humphrey (1997) introduce some hypotheses to explain the relationship between equity capital, bank risk-taking behavior, and bank efficiency. The authors defined a "bad management hypothesis" that ineffective management in banks causes higher operative costs and may make banks difficult in evaluating credit risk. As a result, banks with lower efficiency may cause an increase in the non-performing loan ratio, i.e increasing bank risk. On the contrary, the "bad luck hypothesis" argues that banks need to expend more resources to recover bad loans because of adverse economic conditions. Thus, an increase in risky loans leads banks to employ more resources than usual for monitoring loans as well as limiting bad loans. It causes lower their cost-efficiency. These indicate that the relationship between bank efficiency and risk-taking is bi-directional.

Recent studies provide evidence that the consequences of ineffective management or risk-taking excessively, by skimping or moral hazard incentives, could lead to both inefficiency and higher non-performing loans because banks can choose their level of operating, monitoring costs as well as capitalization to manage their level of risk exposure (Altunbas et al., 2007; Tabak et al., 2011). Lepetit et al. (2008) find a negative relationship between non-performing loan ratio and cost-efficiency. Using a sample of commercial banks in the United Arab Emirates (UAE), Rao (2005) provides evidence that the relationship between liquidity risk and cost efficiency is negative. However, Rao (2005) fails to find any relationship between credit risk and cost efficiency levels in the banking sector; this result does not consistent with the evidence reported in prior studies (e.g. Fiordelisi et al., 2011; Kwan & Eisenbeis, 1997) of a negative association between efficiency and both credit risk and loan quality. More recently, Papanikolaoul (2004) has examined the "product mix" and risk-taking behavior of commercial banks in the 27 countries of the European Union for the 2000–2007 period. Their results reveal that cost and profit efficiencies are negatively associated with credit risk, liquidity risk, interest rate risk and insolvency risk, thereby supporting the Middle East- and USA-based findings reported by Rao (2005). Overall, the literature gives strong evidence about the significant association between bank efficiency and risk-taking. In another word, there may be a negative relationship between bank risk and bank efficiency. We can *propose the hypothesis as follows*:

H3: bank efficiency is negatively associated with bank risk-taking behavior

Overall, based on the review of prior studies about the relationship between audit committee effectiveness, efficiency and bank risk-taking, we argue that it is necessary for a comprehensive study on the overall relationship between them.

3. Research methodology

3.1. Research data

The research uses the data from Bankscope (Orbis Bank Focus) for the period 2010–2019 of banks in 7 countries in ASEAN countries, including Vietnam, Thailand, Malaysia, Indonesia, Philippines, Singapore, Cambodia. Corporate governance variables are hand-collected from Bank annual reports. Our data is not included Islamic banks because they have different corporate governance (Mollah & Zaman, 2015). Any missing data will be collected from other sources such as bank websites, financial statements, stock exchange websites. Our data include 71 banks. After excluding some outliers and missing data, our dataset includes 528 bank-year observations.

3.2. Variable measures

- Bank risk-taking

In this study, we use the inverse of *Z*-score (i.e 1/*Z*) as the proxy for the bank risk-taking variable. The *Z*-score is used to measure bank risk-taking in large literature (Q. K. Nguyen , 2020; Pathan, 2009). *Z*-score is calculated as follows:

$$Z\text{score} = \frac{\text{ROA} + E/A}{\text{StdROA}} \tag{1}$$

Where ROA is the return on asset ratio, StdROA is the standard deviation of ROA. *E*/*A* is the equity on assets ratio. Thus, *Z*-score is the number of standard deviations by which a bank's return on assets has to fall for the bank to become insolvent. A higher inverse of *Z*-score (i.e 1/*Z*) implies high risk-taking.

- Bank efficiency

To measure bank efficiency, we use the slack-based measure of data envelopment analysis (DEA) to estimate banks' efficiency scores proposed by Tone (2001). The DMU (decision-making unit) in this case is banks. We illustrate the models which use to estimate cost and profit efficiencies as follows:

$$\begin{aligned}
&\theta^* = \min \theta \\
&\text{s.t.} \sum_{j=1}^{n} \gamma_j x_{ij} \le \theta x_{i0} \quad i = 1, 2, \ldots, m, \\
&\sum_{j=1}^{n} \gamma_j y_{rj} \le y_{i0} \qquad \text{r} = 1, 2, \ldots, s, \\
&\sum_{j=1}^{n} \gamma_j = 1 \qquad i = 1, 2, \ldots, m, \\
&\gamma_j \ge 0 \qquad j = 1, 2, \ldots, n
\end{aligned} \tag{2}$$

where x_{io} is the *i*th input and y_{ro} and *r*th is output for DMU_0, while DMU_0 is one of the *n* DMUs; is the unknown weights and *j* is the number of DMUs.

The value of θ^* is the distance from the sector to the efficient frontier. The value of θ^* is from 0 to 1. The banks have θ^* get 1 is the most efficient bank, any bank that has $\theta^* < 1$ is inefficient.

The slack-based model is following:

$$\begin{aligned}
&\max \sum_{i=1}^{m} w_i^- s_i^- + \sum_{r=1}^{s} w_r^+ s_r^+ \\
&\text{s.t.} \sum_{j=1}^{n} \gamma_j x_{ij} + s_i^- = x_{i0} \qquad i = 1, 2, \ldots, m, \\
&\sum_{j=1}^{n} \gamma_j y_{rj} - s_i^+ = y_{i0} \qquad r = 1, 2, \ldots, s, \\
&\sum_{j=1}^{n} \gamma_j = 1 \qquad i = 1, 2, \ldots, m, \\
&\gamma_j, s_i^-, s_i^+ \geq 0 \qquad j = 1, 2, \ldots, n
\end{aligned} \tag{3}$$

where w_i^- and w_r^+ are the user-specified weights; s_i^- is the *i*th input slack and s_i^+ is the *r*th output slack.

Equations (2) and (3) follow the variable returns to scale (VRS) model, which assumes that production takes place with a disproportionate change in inputs and outputs. The scalar, ρ, which captures the VRS-based slack variables, is as follows:

$$\rho = \left(\frac{1}{a} \sum_{m=1}^{M} \frac{X_{jm}^0 - S_{jm}^-}{X_{jm}^0}\right)\left(\frac{1}{b} \sum_{n=1}^{N} \frac{Y_{jn}^0 - S_{jn}^-}{Y_{jn}^0}\right) \tag{4}$$

The traditional DEA model holds the input or output at a given level that may not provide a good representation of banking operations. In fact, banks are controlled to a certain extent on both the input and output sides. We apply the slack-based model to deal with input excesses and output shortfalls simultaneously, because it is preferred to parametric estimation.

First, we select inputs and outputs for cost efficiency based on Sealey and Lindley (1977). This approach is appropriate for financial institutions which were found in the literature (Berger & Humphrey, 1997; Casu & Molyneux, 2003). This study defines cost efficiency as minimizing the cost of producing financial outputs. The cost inputs include personnel, depreciation and interest expenses, while the financial outputs are investments and loans.

Second, profit efficiency in this study focuses on maximum profit, taking into account cost minimization and revenue maximization. Following Avkiran (2009), to measure profit efficiency, we use interest expenses and non-interest expenses as inputs as well as interest income and non-interest income are outputs.

- Audit committee effectiveness

In this study, we use the audit committee index (ACID) which was established by Al-ahdal et al. (2020) as a measure of audit committee effectiveness.[1] Our index is comprised of 9 audit committee characteristics dummy variable including "(1) audit committee meets two or more times per year; (2) audit committee has a written charter or terms of reference (3) all members of audit committee attended at least 75% of board meetings; (4) audit committee size is at least three members; (5) one member at least of the audit committee has accounting expertise or experience in the field of finance; (6) chairman of an audit committee is an independent director; (7) at least two-thirds of members in audit committee are independent directors; (8) audit committee consists solely of non-executive directors; and (9) the firm has formed an audit committee". For each characteristic that meets the criteria, it gets 1 and 0 otherwise. Therefore, the value of ACID is from 0 to 9.

- Control variables

First, we control Board size (BOSIZE) and Board independence (BOINDI) as other internal corporate governance. BOSIZE is measured by the number of directors on Board, and BOINDI is the proportion of independent directors on the total members of the Board. Previous studies agree that board of director is an apex of internal corporate governance and play an important role in oversight firm operation and management (Dang & Nguyen, 2021; Nguyen, 2021a; Pathan, 2009). Second, to consider too big to fail policies, we control bank size (BASIZE) which is measured by the natural logarithm of total assets. Third, we control ownership structure, including state ownership and foreign ownership, we use a proportion of state of equity (STAOWN) and foreign equity (FOROWN) to total equity, respectively. The previous studies also provided evidence that firm risk and performance are affected by ownership structure (Barry et al., 2011; Q. K. Nguyen 2020) Forth, we control firm leverage (LEV) measured by the ratio of long-term loans to total equity. Finally, risk governance effectiveness was found to be different between the countries (Nguyen, 2022). This study, therefore, also controls the differences in economic development across countries by using the natural logarithm of GDP per capita (GDPC).

3.3. Empirical model and estimation method

First, to investigate the inter-relationship between audit committee effectiveness, bank efficiency and risk-taking, we use the 3SLS method to estimate the simultaneous equation model as follows:

$$1/Z_{it} = \alpha_0 + \alpha_1 \mathrm{EFF}_{it} + \alpha_2 \mathrm{BOSIZE}_{it} + \alpha_3 BOINDI_{it} + \alpha_4 BASIZE_{it} + \alpha_5 STAOWN_{it} + \alpha_6 FOROWN_{it} + \alpha_7 GDPC_t + \varepsilon_{it} \quad (5.1)$$

$$\mathrm{EFF} = \beta_0 + \beta_1 ACID_{it} + \beta_2 BASIZE_{it} + \beta_3 STAOWN_{it} + \beta_4 FOROWN_{it} + \beta_5 LEV_{it} + \varepsilon_{it} \quad (5.2)$$

$$\mathrm{ACID}_{it} = \gamma_0 + \gamma_1 \mathrm{RISK}_{it} + \gamma_2 \mathrm{BOSIZE}_{it} + \gamma_3 BOINDI_{it} + \gamma_4 BASIZE_{it} + \varepsilon_{it} \quad (5.3)$$

where: 1/*Z* is bank risk-taking of bank i at time *t*, ACID is the firm-level Audit committee effectiveness variables of bank i at time *t*, EFF is firm efficiency (include cost efficiency and profit efficiency). Other control variables were defined in Section 3.2. ε_{it} is the error term, and α, β, γ are coefficient estimates. Equation (5.1) is built to test the effect of firm efficiency on risk-taking. Based on the literature, we control board structure, ownership structure, bank size and the country's economic development (Q. K. Nguyen , 2020; Pathan, 2009). Equation (5.2) is built to test the effect of audit committee effectiveness on bank efficiency. Because the oversight role of board of director is performed through audit committee (Nguyen, 2021a, 2021b; Sun & Liu, 2014), therefore, we do not control board structure in this model. In addition, risk-taking may not affect bank efficiency directly. Board of director or audit committee has the role in oversight risk but it is not mean that they ensure such role make bank operate more efficiently (Aljughaiman & Salama, 2019; Sun & Liu, 2014, Dang & Nguyen 2022), we, therefore, exclude risk-taking variable (1/*Z*) in this model. However, the firm leverage was found to have an association with firm efficiency in large literature (Guo et al., 2021; Margaritis & Psillaki, 2007). We, therefore, include LEV into Equation (5.2). In Equation (5.3), we test the relationship between risk-taking on audit committee effectiveness. Based on the "scope of operation" theory, corporate governance structure depends on the complexity of firm operation (Boone et al., 2007; Linck et al., 2008; Nguyen, 2022). Furthermore, audit committee structure is built based on board of director requirements. We, therefore, include board structure (BOSIZE and BOINDI), and bank size (BASIZE) in Equation (5.3).

In this study, 3SLS estimation method is used because the joint dependency between risk-taking, efficiency and corporate governance means that traditional methods such as ordinary least squares, fixed effect, random effect estimation is inefficient. Further, 3SLS is a full-information estimation technique that estimates all parameters simultaneously and is preferred to two-stage least squares (2SLS) for this reason. It means that 3SLS incorporates the cross-equation correlations (equation 5.1–5.3), thus it makes the parameter estimates asymptotically more efficient than

2SLS). Another advantage of the 3SLS estimation method is that it eliminates problems associated with serial correlation in the error terms. The reason is 3SLS method can be interpreted as an extension of the generalized least squares (GLS) method to a simultaneous equation system. This study also applies Hausman test to test whether 3SLS is better than 2SLS for our panel data. Chosen instruments should be correlated with risk-taking (1/*Z*) but have zero or low correlation with the disturbance in the structural model for the firm's efficiency (Equation (5.2)). We follow Chen and Ma (2011 and use the firm's characteristics as instrument variables including firm leverage, firm size and ownership structure when studying risk-taking in general.

4. Empirical results

4.1. Descriptive statistic and correlation matrix

The descriptive statistics for the key variables are reported in Table 1. The mean and standard deviation of bank risk (1/*Z*) are 10.231and 8.413, respectively. The value of 1/*Z* is from 0.234 to 23.670 imply that the risk-taking of banks in ASEAN countries is much different. The mean of cost efficiency and profit efficiency are 0.768 and 0.721, respectively. They are nearly similar to other samples in prior studies, such as East Asian countries (Chan et al., 2014) and China (Dong et al., 2017).

Table 2 presents Spearman rank correlation coefficients for all our in this study. The main finding is that most correlation coefficients between audit committee effectiveness and bank efficiency are positive but between audit committee effectiveness and bank risk-taking are negative. The maximum value is 0.780 (the coefficient on PEFF and 1/*Z*) implys that multicollinearity among the regressors is not a concern in this study.

4.2. Empirical result

Table 3 report the regression results for the relationship between audit committee effectiveness bank risk-taking and efficiency. The Hausman specification test was not significant and the null hypothesis was accepted. Thus, the Hausman specification test supported using 3SLS. Overall, 3SLS estimation method is appropriate for our research data and research objectives. The coefficients on CEFF and PEFF are negative and significant with 1/*Z* in Panels A and B. It implies that both cost efficiency and benefit efficiency are positively associated with bank risk-taking. These results support our hypothesis H3 and his finding consistent with Fiordelisi et al. (2011) which finds that lower bank efficiency causes higher bank risk. These results provide an implication that focusing on enhancing cost and benefit efficiency may be a good way to constrain risk-taking.

Table 1. Descriptive statistics

	Obs	Mean	Std. Dev	Min	Max
1/*Z*	528	10.231	8.413	−0.234	23.670
CEFF	528	0.768	0.891	0.136	1.000
PEFF	528	0.721	1.686	0.214	1.000
ACID	528	4.250	0.158	3.000	9.000
BOSIZE	528	7.860	4.126	3.000	15.000
BOINDI	528	0.318	0.250	0.000	1.000
BASIZE	528	9.854	3.754	6.547	17.234
STAOWN	528	0.215	0.387	0.000	1.000
FOROWN	528	0.124	0.754	0.000	0.548
LEV	528	0.657	1.279	0.357	0.795
GDPC	528	3.630	0.521	2.635	4.658

Table 3 reports descriptive statistics of main variables. See, Section 3.2 for variable definitions.

Table 2. Correlation matrix

	1/Z	CEFF	PEFF	ACID	BOSIZE	BOINDI	BASIZE	STAOWN	FOROWN	LEV	GDPC
1/Z	1.000										
CEFF	0.660*	1.000									
PEFF	0.780	0.678*	1.000								
ACID	−0.688*	0.537*	0.385*	1.000							
BOSIZE	−0.370	−0.190*	−0.357	0.381	1.000						
BOINDI	0.223	0.486*	−0.664*	−0.237	0.719	1.000					
BASIZE	0.606*	−0.376	−0.217	0.520	−0.281*	0.440	1.000				
STAOWN	0.226	−0.179	−0.357	0.544	−0.131	0.246*	0.369	1.000			
FOROWN	0.530*	0.276	0.399*	−0.515	0.386*	0.306	−0.358	0.118	1.000		
LEV	0.680*	0.407*	0.356	0.395	0.442*	0.323*	0.156	0.349*	0.344	1.000	
GDPC	0.372	0.538	0.149*	−0.215	0.385	−0.378	0.414	0.349	−0.281	−0.372	1.000

This table reports the Spearman rank correlation between variables. *$p < 0.10$. See, Section 3.2 for variable definitions.

Table 3. Three-stage least squares (3SLS) regression results of the relationship between audit committee effectiveness, bank efficiency, and risk-taking

	1/Z		EFF		ACID	
Panel A	Co-eff	*t*-stats	Co-eff	*t*-stats	Co-eff	*t*-stats
1/Z					−0.03***	−4.43
CEFF	−0.15**	−2.34				
ACID			0.11***	3.25		
BOSIZE	0.15***	3.15	−0.03*	−1.78	0.14**	2.24
BOINDI	−0.25**	−2.16			0.06	1.63
BASIZE	0.08	1.23			0.03	1.41
STAOWN	0.03*	1.91	0.07	0.69		
FOROWN	−0.18**	−2.23	−0.17**	−2.16		
LEV			−0.19	−1.26		
GDPC	−0.34**	−2.35				
Const	3.62	1.61	1.21	1.22	−0.11***	−3.41
Adjusted R-squared	0.315		0.251		0.139	
χ^2-statistics	223.13***		221.15***		295.24***	
Obs	528		528	8	528	
Panel B	Co-eff	*t*-stats	Co-eff	*t*-stats	Co-eff	*t*-stats
1/Z					−0.12***	−3.67
PEFF	−0.17***	−3.29				
ACID			0.22**	2.83		
BOSIZE	0.07**	2.14	−0.15*	−1.87	0.09*	1.85
BOINDI	−0.15*	−1.78			0.17	0.69
BASIZE	0.06	1.21			0.07*	1.78
STAOWN	0.11	1.48	−0.00	−0.38		
FOROWN	−0.17*	−1.92	−0.24**	−1.95		
LEV			−0.21*	−1.76		
GDPC	0.21**	2.61				
Const	2.31*	1.77	1.05	1.17	−1.25*	−1.86
Adjusted *R*-squared	0.358		0.214		0.103	
χ^2-statistics	165.24***		271.25***		314.23***	
Hausman specification test between 2SLS and 3SLS					χ^2 = 26.3	
Obs	528		528		528	

This table presents the 3SLS estimates of the system of three regression equations, i.e. Equations (5.1)–(5.3). Panel A and Panel B report the results when applying cost efficiency and benefit efficiency, respectively. See, Section 3.2 for variable definitions. *,**,***Significant at 1, 5 and, 10 percent levels, respectively.

As expected, the coefficient on ACID is positive and significant with both CEFF and PEFF in panels A and B. It indicates that audit committee effectiveness can enhance banks' cost and profit efficiency. These results strongly support hypothesis H1. Our findings are consistent with the prior studies (Huang et al., 2011; Menon & Williams, 1994). This study provides evidence that audit committee also has an important role in enhancing bank efficiency besides their traditional roles which were found in the prior studies, such as monitoring the financial reporting process (Abbott et al., 2004; Bédard et al., 2004), oversight risk-taking activity as well as maintain bank stability (Q. Nguyen & Dang, 2020; Sun & Liu, 2014). The audit committee effectiveness can enhance bank efficiency may because it is a key instrument that board of directors enhances

bank management effectiveness. In addition, by applying simultaneous regression, this finding support prior studies (i.e Q. Nguyen & Dang, 2020; Sun & Liu, 2014) about the effect of audit committee on bank risk-taking. We find that audit committee effectiveness constraints risk-taking though enhancing bank efficiency. Our findings support Nguyen (2021a, 2021b) that audit committee effectiveness may not constraint risk-taking behavior directly. However, our findings still support hypothesis H2. This mechanism provides the implication that banks should have appropriate strategies to improve the audit committee effectiveness in order to achieve both the objectives of improving efficiency and controlling bank risk-taking.

Table 3 reports that the coefficient on 1/*Z* is negative and statically significant with ACID. This result implies that bank risk causes harm to audit committee effectiveness. It may be because the bank takes excessive risk make banks unstable, cause complexity in bank operation and then reduce audit committee effectiveness. This finding contributes to the literature that the relationship between audit committee effectiveness and bank risk-taking is bi-directional.

We also provide some interesting findings related to control variables. First, Table 3 report that Board size increase bank risk and reduce bank efficiency, the coefficients on BOSIZE are positive and negative with 1/*Z* and EFF, respectively. This finding support that a strong board may increase moral hazard problem, therefore increasing risk-taking and reducing bank efficiency. Second, we find that foreign ownership has a negative association with both bank risk-taking and bank efficiency (cost efficiency and profit efficiency), these coefficients are significant in both Panel A and B. Finally, board size and bank are positively associated with audit committee effectiveness. It might support to "scope of operation" hypothesis of Boone et al. (2007) and Nguyen (2022), i.e corporate governance structure may be affected by banks' scope of operation.

5. Conclusion

By using 3SLS method, this study investigates the inter-relationship between audit committee effectiveness, bank efficiency, and risk-taking. Our main findings are that audit committee effectiveness can constraint bank risk-taking through enhancing both cost efficiency and profit efficiency. In addition, the relationship between audit committee effectiveness is bi-directional, i.e the higher audit committee effectiveness induces lower risk and vice versa. Our findings provide a depth overview of the roles of the audit committee in constraining risk-taking as well as enhancing efficiency in bank ring sectors. This study provides an important implication is that banks in ASEAN countries should increase audit committee effectiveness in order to oversee bank risk and bank efficiency.

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Note

1. See, Al-ahdal et al. (2020) for detail.

Disclosure statement

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