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## Article

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## BANKING & FINANCE | RESEARCH ARTICLE

# Shariah supervisory board attributes and corporate risk-taking in Islamic banks

Hasan Mukhibad<sup>1\*</sup> and Doddy Setiawan<sup>2,3</sup>

**Abstract:** Previous studies use mainly insolvency, credit, liquidity, market, and operational risk to measure risk-taking in Islamic banks. We are expanding the risk indicators: credit risk, market risk, liquidity risk, operational risk, legal risk, reputation risk, strategic risk, shariah compliance risk, rate of return risk, equity investment risk, and insolvency risk. We summarize these risks in a risk index. Additionally, we expanded the Shariah Supervisory Board (SSB) attribute indicator and developed the SSB busyness attribute unused by previous researchers. The study sample included 14 Islamic commercial banks in Indonesia, observed from 2010 to 2020. Fixed effect and random effect data analysis models were used. Model determination is based on Hausman test results. Based on the test results for each type of risk, we find that busyness, educational background (economics/finance and Islamic law), and SSB experience has a negative effect on the risk. However, SSB's level of education encourages directors to take risks. This result is also consistent when using a risk index where SSB education can increase the risk. Our findings strengthen the resources-dependent theory that experience, busyness, and educational background as access to resources have an impact on increasing the knowledge and skills of SSB in controlling risk. The findings are robust to the potential issues of endogeneity and sensitivity analyses.

## ABOUT THE AUTHORS

Hasan Mukhibad is a lecturer and researcher at the Department of Accounting, Faculty of Economics, Universitas Negeri Semarang, Indonesia. His current research interests include Islamic Accounting, Islamic Finance, and corporate governance. Currently, he also as is a Doctoral Student in Economics and Business Faculty, Universitas Sebelas Maret, Indonesia. Doddy Setiawan is a Professor in Financial Accounting at the Faculty of Economics and Business, Universitas Sebelas Maret, Indonesia. He received his Ph.D. in Accounting from Universiti Sains Malaysia in 2015. His current research is concerned with Financial Accounting and Corporate Governance. He is also a reviewer in many international journals.

## PUBLIC INTEREST STATEMENT

Islamic banks comply with Shariah principles and rules, which lead Islamic banks to have operational complexity, and imply higher risks than conventional banks. Islamic bank regulators are concerned with the types of risks: financial, market, liquidity, operational, legal, reputation, strategic, shariah compliance, return rate, and equity-based financing risk. However, studies on Islamic bank risk used partial risk ignoring various risks determined by the bank's regulator. This study expands the study of bank risk regarding the market, operational, legal, reputation, strategic, shariah compliance, return rate, and equity-based financing risk. In addition, our study focuses on the role of the shariah supervisory board (SSB) attributes regarding busyness, educational background in economics/finance, education on Islamic law, tenure, experience, and educational level in explaining Islamic bank risk. Our study contributes to the expansion of the literature on risk in Islamic banks and the implications of resource dependence theory on enhancing the capability of SSBs in controlling risk.

**Subjects:** Corporate Finance; Banking; Risk Management; Corporate Governance

**Keywords:** risk taking; busyness; shariah compliance risk; tenure; experience; education

## 1. Introduction

Islamic banks have more complex transaction products and mechanisms than conventional banks (Mollah et al., 2017; Trinh, Aljughaiman et al., 2020). The complexity of Islamic banks' operations is caused by Islamic banks performing general bank duties while complying with Islamic law. Additionally, the existing regulatory infrastructure suits conventional banks, so Islamic banks must adjust to comply with Islamic banks' requirements to conduct law-abiding Islamic transactions (Safiullah & Shamsuddin, 2018). Siddiqui (2004) assesses the risk of Islamic banks as high because of limited investment options such as derivatives, options, and bonds to manage liquidity and risk. The operational complexity of Islamic banking implies higher risks than conventional banks (Beck et al., 2013; Čihák & Hesse, 2010; Kabir et al., 2015; Safiullah & Shamsuddin, 2018). Trinh, Elnahass et al. (2020) maintain that the higher risk of Islamic banks requires more effective risk monitoring.

Policies on risk-taking or risk avoidance are inseparable from corporate governance structures, in line with expert opinion that corporate governance affects entity risk-taking (see, Abou-el-sood, 2019; Elamer et al., 2018; Koerniadi et al., 2014; Su & Lee, 2013). Corporate governance (CG) needs to protect all stakeholders, including investors, against excessive risk-taking. Entity policies are collective policies of all management, so the management and CG structure characteristics influence bank policies. On the other hand, in the agency conflict approach, the conflict of interest between owners and management affects the company's risk-taking (Su & Lee, 2013).

Abou-el-sood (2019), Ghosh (2018), and Mollah et al. (2017) use CG to explain risk-taking in Islamic banks and use more CG-specific indicators in Islamic banks. Their studies do not accurately explain the phenomenon because the product's characteristics require additional risk management and supervision (Mollah & Zaman, 2015). Abou-el-sood (2019), Ghosh (2018), and Mollah et al. (2017) did not use the SSB factor in explaining the risk-taking of Islamic banks. Islamic banks and conventional banks have different products and CG structures, so SSB also influences Islamic bank risk-taking. SSB is an independent control mechanism that aligns all bank activities with Islamic law (Alabbad et al., 2019). Alabbad et al. (2019) and Najwa et al. (2019) found that large SSBs and busy SSBs reduce monitoring of director policies; consequently, directors will adopt risky policies according to preference.

The previous studies on risk-taking in Islamic and conventional banks conducted cross-border studies. Such studies require care because each country has different characteristics (Lassoued, 2018a), and country regulators may place limitations on bank operations, as in the corporate governance of Islamic banks in different Gulf countries (Alabbad et al., 2019). Hence, our study uses only Islamic banks in Indonesia. We use Islamic banks in Indonesia as the object of study because in Indonesia is intense competition between Islamic banks and conventional banks. While Islamic banks in Indonesia have been established for around 38 years, they only have an approximate market share of 5.3% (Mukhibad et al., 2020). Louhichi et al. (2020) stated that market strength and competition are factors in bank risk-taking. Further, Indonesia has the largest Muslim population worldwide but a low market share and the Muslim population is a major factor in the growth of Islamic law.

Furthermore, previous studies used general, less specific risk measurements using in Islamic banks, such as (1) insolvency (Alabbad et al., 2019; Harkati et al., 2019; Louhichi et al., 2019; Mokni et al., 2016; Najwa et al., 2019; 2) a combination of capital, credit, and liquidity risks (Mahdi & Abbes, 2018); (3) risk market (Kutubi et al., 2018); (4) Islamic law compliance risks (Basiruddin & Ahmed, 2019); (5) combined credit, market, liquidity, insolvency, and operational risks (Aljughaiman & Salama, 2019). Previous studies of Islamic bank risk in Indonesia have also

emphasized credit risk (Anggraeni & Setiawan, 2020; Nugraheni & Muhammad, 2019; Syamlan & Jannah, 2019), insolvency (Budiandru, 2021; Effendi, 2017), and shariah compliance risk (Mukhibad, Nurkhin et al., 2022).

Previous studies (which used a sample of Islamic banks in Indonesia and other countries) used partial risk ignoring various risks determined by the bank's regulator. Regulation of the Financial Services Authority (OJK) (as the banking regulator in Indonesia) Number 65/POJK.03/2016; Implementation of Risk Management for Islamic Commercial Banks. This regulation concerns the types of risks: financial, market, liquidity, operational, legal, reputation, strategic, shariah compliance, return rate, and equity-based financing risk. Of these ten types of risk, shariah compliance, return rate, and equity-based financing rate are additional risks that do not exist in conventional banks. Islamic Financial Services Board and State Bank of Pakistan also added the return rate and equity-based financing risk as unique risks for Islamic banks (IFSB, 2005; Said et al., 2012). Therefore, this study extends previous studies by expanding the types of risks that are not limited to credit, insolvency, liquidity, and operational risks. Our study expands the study of bank risk regarding the market, operational, legal, reputation, strategic, shariah compliance, return rate, and equity-based financing risk.

Second, we broaden our study of the role of SSB in controlling risk. Previous studies have proven the role of SSB in controlling risk. However, in explaining SSB, they use the attribute of the number of members (see, Alman, 2012; Aslam & Haron, 2021; Hamza, 2016; Lassoued, 2018b; Safiullah & Shamsuddin, 2018), and education level (see, Safiullah & Shamsuddin, 2018), expertise in finance/banking (see, Isa & Lee, 2020; Jabari & Muhamad, 2021; Nguyen, 2021), and experience (see, Isa & Lee, 2020; Najwa et al., 2019). This study expands the attributes of SSB, including busyness and tenure, to complement the attributes of education level, experience, expertise in finance/banking, and educational background in Islamic law/shariah.

The remainder of this paper is organized as follows. The first part describes the background of the study. The second part is the theory and hypotheses development, where we formulate a measurement of each risk in the regulation. This step is needed because the regulation provides no specific operation to measure each risk. We provide the sample, variable measurements, and analytical tools in the third part. In the next section, we present the test results to answer the hypotheses and discuss the research results from previous researchers. The final section conveys conclusions and suggestions to regulators, researchers, and other interested parties.

## **2. Theoretical framework and hypotheses development**

### **2.1. Agency theory and resource dependence theory**

Agency theory emphasizes the relationship between the agent and the principal. Agency theory emphasizes the main problem of self-interested agents rather than the principal's interests (Jensen & Meckling, 1976). This approach is straightforward because the company is not only the result of the interaction between the principal and the agent. Self-interested behavior can also occur from the principal side (Panda & Leepsa, 2017). Conflicts of interest can occur between majority and minority shareholders (type 2) and shareholders and creditors (type 3; Mukhibad, Nurkhin et al., 2022).

One of the unique characteristics of Islamic banks is profit-and-loss-sharing (PLS). Islamic banks implemented PLS contracts on deposit and financing products. PLS contracts on Islamic bank deposit products cause the customer to be subject to the risk of losing the total customers invested unless the loss is caused by negligence or proven error on the part of the bank. This schema leads to the possibility of conflict of interest faced by the managers in dealing with the interests of shareholders and customers (Zainulidin et al., 2018). Based on these arguments, Islamic banks have complex operations (Trinh, Elnahass et al., 2020). SSB is an additional board to reduce agency conflicts in Islamic banks (Anisykurlillah et al., 2020).

Resource dependence theory (RDT) studies how an organization's external resources affect organizational behavior. Researchers use RDT to explain the ability of BOD to improve bank performance. BOD has the task of overseeing manager policies to improve manager performance, providing advice, and providing access to resources (Pugliese et al., 2014). RDT considers that BOD is a provider of resources and capital that can support the performance of directors and organizations. Current research trends expand the agency theory approach by integrating agency theory with RDT. The reason is that the board has supervisory duties (agency approach) and provides advice (RDT; Pugliese et al., 2014).

RDT considers that company managers bring information and expertise to the company, create communication networks with external parties, get commitments for support from outsiders, and work to create legitimacy for companies in the external environment (Zhou et al., 2018). In addition, RDT views boards as providing access to unique resources (Salancik & Pfeffer, 1978); as advisers and councilors (Attah-Boakye et al., 2020; Hillman & Dalziel, 2003), and as corporate assets that contribute to sustainable value (Hillman & Dalziel, 2003; Hillman et al., 2009). The advisory or resource provisioning duties the board carries include advice on strategic initiatives, active involvement in decision-making, and follow-up on the company's strategic choices (Pugliese et al., 2014).

Attah-Boakye et al. (2020) provide evidence that having large non-executive directors will enable companies to gain specialized knowledge, relevant experience, and expertise that can sharpen managers' strategic decisions (Attah-Boakye et al., 2020). So that the number of boards has a positive influence on performance (Ali, 2018; Bhatt & Bhattacharya, 2015; Jahan et al., 2020; Kalsie & Shrivastav, 2016) and enhances the company's reputation (Orozco et al., 2018).

SSB, as a multi-layer in Islamic banks places SSB as a board that serves as a consultant and supervisor for managers (Trinh, Aljughaiman et al., 2020). This SSB task is like BOD. SSB and BOD as supervisors and consultants for directors to manage bank assets. However, the scope of SSB supervision is more specific on the compliance of bank operations with shariah principles. Based on RDT, SSB provides access to unique resources and contributes to the sustainable of Islamic banks. Safiullah and Shamsuddin (2018) prove that the operational risk and bankruptcy in Islamic banks decrease with an increase in the SSB size and the academic qualifications of SSB members. The number of SSB members has a positive influence on risk (Q. K. Alman, 2012; Aslam & Haron, 2021; Nguyen, 2021). SSB's expertise in finance and accounting has a positive effect on insolvency and a negative effect on risk (Q. K. Basiruddin & Ahmed, 2019; Nguyen, 2021).

## **2.2. Islamic bank risk and corporate governance**

Islamic banks avoid the use of interest (*riba*), uncertainty (*gharar*), and gambling (*maysir*) transactions. They avoid the interest system using the profit-sharing system (PLS) and the non-PLS system. PLS system has become the main character of an Islamic bank. The PLS system is where both parties (business actors and capital owners) divide the income (stipulated in the contractual agreement) based on business performance. If the business loses, then the loss is the capital owners. This PLS contract can be used in lending to entrepreneurs and raising funds from customers, also called investment account holders (IAH).

Excessive risk-taking by distributing IAH funds as high-risk loans allow Islamic banks to obtain high returns and better bank growth. Additionally, high returns provide high profits to the IAH fund owners. However, high risk-taking also means possible high failure, so the interest of IAH fund owners is uncertain. Owing to this PLS concept, the owner of the IAH accepts the losses incurred by the bank unless they are due to bank negligence (Alabbad et al., 2019).

The requirement that Islamic banks comply with Islamic law makes them unable to manage liquidity as conventional banks do. Tiby (2011) argued that liquidity risk is a critical risk faced by Islamic banks due to: (1) the limited availability of Islamic instruments, unlike conventional



instruments; (2) Islamic law (*shariah*) imposes restrictions on trading financial claims unless the claims relate to real assets; (3) the central bank discount window because the lender of last resort option available to conventional banks is not available for Islamic banks; (4) Certain characteristics of the Islamic instruments available for Islamic banks pose a liquidity risk (example the cancellation risk in *murabaha* (cost-plus sale).

When distributing IAH funds to entrepreneurs' banks must pay attention to whether the types of businesses are categorized as involving usury, haram, *maysir*, and *gharar*. These transactions must be avoided because Islam prohibits them. Islamic banks not only consider creditworthiness and the potential income from IAH funds channeled but must consider the type of business. With such business characteristic requirements in mind, we support the arguments of Safiullah and Shamsuddin (2018), Kabir et al. (2015), and Beck et al. (2013) that the uniqueness and complexity of the operations put Islamic banks at greater risk than conventional bank counterparts. This also encourages more effective Islamic bank risk monitoring (Trinh, Elnahass et al., 2020).

The corporate governance structure at Islamic banks in Indonesia uses a two-tier system that separates the supervisory functions (board of commissioners) and implementers (directors). Because Islamic banks must provide services and products in accordance with shariah, there is a need for additional supervisors. SSB is a multi-layer in the CG structure of Islamic banks (Trinh, Aljughaiman et al., 2020). SSB as a supervisor, consultant to other boards, and a guarantor of shariah bank operations following shariah. SSB is involved in product innovation to ensure products comply with shariah. Following (Alman, 2012), bank risk is inherent in the products. Therefore, we argue that SSB has a role in risk-taking, and that is why scholars use SSB as a variable that can affect bank risk-taking.

SSB is an independent board that cooperates with other boards by providing consulting and supervision services for bank operations in line with Islamic law. The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) states that the SSB is "entrusted with the duty of directing, reviewing, and supervising the activities of the Islamic financial institution." The SSB supervises and advises the director in many countries so that bank operations accord with Islamic law. However, the SSB's differences in countries lie in the appointment, composition of members, the legal status of power, and internal controls. For example, the State Bank of Pakistan (SBP) requires Islamic banks to have an SSB of at least three members (Abdullah et al., 2013). Islamic banks in Bahrain and Malaysia have a minimum of three SSB members, while Indonesia requires a minimum of two members. Alabbad et al. (2019) found that SSBs reduce the oversight of managers when taking excessive risks. Islamic banks operate under Islamic law ethics, which limit risk-taking (Safiullah & Shamsuddin, 2018). Mollah and Zaman (2015) stated that the SSB might exert pressure on other directors and management to limit aggressive and risky projects.

Alabbad et al. (2019) found that the number of SSB members and SSB busyness were associated with increased risk. Additionally, risk can reduce with a greater SSB ratio of external parties (foreign SSB). Foreign SSB is more concerned with their reputation for controlling managers from excessive risk-taking (Alabbad et al., 2019). Meanwhile, Mollah et al. (2017) used a sample of 52 Islamic banks and 104 conventional banks in 14 countries from 2005–2013. They found that the corporate governance structure of Islamic banks increases managers' risk-taking and achieves better performance.

Alman (2012) found that Islamic bank risk portfolio loans were associated with increased SSB members. Additionally, the SSB's reputation and the policy of replacing members of the SSB helped banks take risks. Thus, the SSB composition influences the composition of bank loans. Trinh, Elnahass et al. (2020) found that the busyness of SSB is associated with a decrease in bank performance and stability. Board busyness increases stability in conventional banks, but a busy Islamic bank board worsens bank performance and stability.

### 2.3. Hypotheses development

Researchers view board busyness as a proxy to measure the quality of supervision. However, not many use it as a proxy for SSB effectiveness at monitoring, except for Alabbad et al. (2019). Our reason for focusing on busyness is that SSB is an independent board believed to be able to reduce agency conflicts at Islamic banks with the duty to monitor and provide advice on manager policies, so that bank operations align with Islamic law.

Trinh, Elnahass et al. (2020) found that Islamic banks with busy board attribute low performance and high risk-taking (bankruptcy, credit, liquidity, assets, and operations). Kutubi et al. (2018) found that board busyness influences performance, not risk-taking. Elyasiani and Zhang (2015) found an inverse relationship between board busyness and risk (total, market, idiosyncratic, credit, and default risks). Ferris et al. (2018) found that board busyness is associated with decreased performance.

Kutubi et al. (2018) proposed two effects of board busyness: the effect of reputation and the effect of over-boarding. The effect of reputation emanates from the resources-dependency theory (RDT). Busyness is associated with an increase between busyness and performance. The opposite, the over-boarding effect, derived from agency theory, demonstrates a busyness is associated with a decrease in performance because busyness induces neglect and reduces performance by encouraging management opportunism (Kutubi et al., 2018).

Based on RDT, we consider SSB busyness is more inclined to increase supervision because SSB busyness will increase its competence. SSB members have positions in many Islamic law entities to increase their knowledge and experience, and SSB can even apply experience gained from other entities. A busy SSB can utilize knowledge gained from other companies because decisions on one board can inform decisions on other boards (El-Halaby & Hussainey, 2016). A busy SSB will likely give the best advice from practice with other entities.

H1: SSB Busyness is associated with a decrease in Islamic bank risk.

Education is a good proxy for measuring human capital, knowledge base, or intellectual competence (Hambrick & Mason, 1984). Education tends to be a unique measure for determining the level of professionalism of the board (Grace et al., 1995) and as a proxy for measuring knowledge, intelligence, and readiness to respond to change and innovate (D'Amato & Gallo, 2019). This informs previous studies such as Rahmana and Haron (2019), who use the educational background as an attribute to predict its effectiveness. Since the SSBs function as supervisors and a consultant board for business, Grassa (2016) and Nomran et al. (2018) agreed that the SSB's ability in the economic/finance sector supports its work. Bukair and Abdul-Rahman (2013) contend that SSB members with financial knowledge and experience can be more responsible and effective than SSB members without financial expertise.

SSB decisions influence the acceptance of one product over another. Thus, certification of SSB approval can affect the volume of banking business, especially when management has no right to engage in SSB decisions (Mohammed & Muhammed, 2017). SSB is to ensure that products align with Islamic law and reduce risky policies. Therefore, SSB expertise is associated with a decrease in excessive risk-taking, as proven by Nomran and Haron (2020). SSB decisions influence product acceptance, resulting in low-risk, Islamic law-compliant products. We measure SSB expertise with expertise in economics/finance, where the assumption is that economics/finance expertise can identify the risks faced by banks (Minton et al., 2014). Therefore, we develop the following propositions:

H2: SSB expertise in economics and finance is associated with a decrease in Islamic bank risk.



Islamic banks operate under Islamic law, which comprises moral prohibitions of excessive risk-taking, interest operations, and operational transactions whose main business is *haram* (Safiullah & Shamsuddin, 2018). The unique characteristics of Islamic banks also prohibit uncertainty (*gharar*) and speculation, limit involvement with aggressive loans, and avoid excessive risk-taking activities, embargoing activities that are considered hazardous to society (*gambling*, alcohol, tobacco, and adult entertainment). Instead, they generate profits by sharing risks and distributing equitable benefits and investment risks (Aljughaiman & Salama, 2019).

Almutairi and Quttainah (2017) and Nomran et al. (2018) use educational background as an SSB attribute and find that education level is associated with an increase in Islamic bank risk. Education level and background can improve expertise. Highly educated directors tend to offer a richer source of innovative ideas and policy development because of their intellectual abilities, experience, good judgment, and integrity. However, we replaced this proxy with SSB, which had Islamic law education. Our reason is that education provides the benefits of cognitive and social improvement. Therefore, SSB with Islamic law backgrounds certainly have more control over Islamic law and is the necessary ability to provide capital in consultation with other boards when formulating strategies or developing new Islamic law-compliant products. Presented by experts, Islamic law encourages managers to avoid excessive risk.

H3: SSB-specific education on Islamic law is associated with a decrease in Islamic bank risk.

Based on RDT, SSB tenure makes a major contribution to increasing SSB's expertise. To the best of the author's knowledge, this is the first paper to employ SSB tenure as a proxy that affects SSB quality. Many general studies use indicators similar to this, that is, the board's tenure. Chen et al. (2006) found that boards with shorter experience are less able to prevent fraud, and boards with long tenure gain expertise and can prevent fraud better. Reguera-Alvarado and Bravo (2017) found that board tenure is associated with increased board knowledge, and greater board business knowledge improves corporate performance. We deduced from previous studies that the board's tenure of commissioners equates with the tenure of the SSB. The reason is that SSBs carry out tasks like the board of commissioners. Therefore, we develop the following hypothesis:

H4: SSB tenure is associated with a decrease in Islamic bank risk.

We predict that one's length of office to become an SSB member in a bank and the time a person takes to become a member of the SSB in another entity are factors that enhance the experience and subsequently impact the SSB's ability to carry out their duties. Najwa et al. (2019) found that the SSB experience in the Islamic law field reinforces the negative influence of the number of boards one belongs to on bank risk. Additionally, risk monitoring by a credit risk officer who is a member of the executive board, and an SSB with great experience, will reduce the risk of bankruptcy (Najwa et al., 2019).

H5: SSB experience is associated with a decrease in Islamic bank risk.

Their educational background and education level influence the effectiveness of the SSB. The presence of required competencies positively impacts the quality of their services. Unlike the number of meetings, the educational background and level of SSB education have been widely explored in previous studies such as Nurkhin et al. (2018). They found the SSB's educational background is associated with an increase in performance. Nomran et al. (2017) found that the SSB's education qualifications significantly affected profitability. Meanwhile, Safiullah and

Shamsuddin (2018) found that the risks of bank operations and bankruptcy decrease with an increase in the educational qualifications of the SSB. Thus, we develop the following hypothesis:

H6: The SSB Education Level is associated with a decrease in Islamic bank risk.

### 3. Research model

The study aimed to explore the role of the SSB in controlling risk-taking in Islamic banks. This study used all Islamic commercial banks (14 banks) in Indonesia from 2009 to 2020. The sample consists of Islamic banks which provide an annual report. Based on the results of searching the data shows that in 2009, 9 banks did not publish annual reports, 4 banks did not publish reports in 2010, 3 banks did not publish reports in 2011, 2012, and 2013; 2 banks did not publish annual reports in 2014 and 2015; 1 bank did not publish annual reports in 2017. Starting in 2018, 14 banks have published complete annual reports. Therefore, this research uses unbalanced panel data with 149 bank-year observations.

In line with Abou-el-sood (2019), the risk measurement faced by a bank cannot use one measure. We used 11 risk indicators determined and summarized 11 indicators to become a risk index, and the risk is (The operational definitions of the variables are shown in Table 5 - Appendix):

- (1) Credit risk (CREDITRISK) is measured by non-performing financing to gross financing (Alandejani & Asutay, 2017; Najwa et al., 2019; Warninda et al., 2019).
- (2) Market risk (MARKETRISK) is the risk on the balance sheet and off-balance sheet due to changes in market prices, including, among others, the risk of changes in the value of assets that can be traded or leased. We measure the market ratio from the net value of financing because the main asset of Islamic banks is financing. Similar to Zarrouk et al. (2016) and Beck et al. (2013), we use financing ratio-loss-reserves-to-gross-financing to measure market risk.
- (3) Liquidity risk (LIQRISK) is the risk due to the inability of the bank to pay its debts. We use the ratio of net financing to total assets to measure liquidity risk (Abdul et al., 2018; Mukhibad & Nurkhin, 2019).
- (4) Operational risk (OPERISK) is the risk of loss resulting from the failure of internal processes, human error, system failure, or external events that affect bank operations. We use the ratio of operating costs to operating income to measure operational risk (Abou-el-sood, 2019).
- (5) Legal risk (LAWRISK) is due to legal claims and/or weaknesses in juridical aspects. Due to limited information on lawsuits, we use category 1 if the bank has lawsuits and 0 if otherwise.
- (6) Reputation risk (REPURISK) is the risk due to a decrease in the level of trust of stakeholders, which results from negative perceptions of the bank. Islamic banks have products that require customer trust, namely, investment account holders (IAH). In this IAH fund, the bank allows the transfer of the risk of bank business losses to the IAH fund owner, so the IAH fund owner's trust is indispensable for bank operations. We use the standard deviation of the ratio of IAH funds to assets calculated with an all-year rolling window for each bank as an indicator of reputation risk or customer trust in the bank (Mukhibad et al., 2019).
- (7) Strategic risk (STRATRISK) is the risk due to inaccuracy in making and or implementing a strategic decision and failure to anticipate changes in the business environment. We use the Standard deviation of ROA calculated with an all-year rolling window for each bank to measure strategic risk (Abou-el-sood, 2019).
- (8) Shariah compliance risk is the risk that arises because a bank does not comply with and or does not implement the prevailing laws and regulations with *shariah* principles. We use two indicators to measure Islamic compliance risk: (a) the ratio of PLS financing (SHARISK-PLS)

and (b) shariah non-compliant income (SHARISK-SNCI). We use the PLS financing ratio as the shariah compliance risk indicator based on the argument that PLS financing is financing that promotes Islamic values (Rahman et al., 2014; Salman & Nawaz, 2018). PLS financing differentiates between Islamic bank and conventional banks (Chong & Liu, 2009; Salman & Nawaz, 2018) and promotes the value of spirituality (Hidayah et al., 2019). We use SNCI as shariah compliance risk indicator based on the argument that shariah non-compliance can be caused by various business activities, such as selling products that violate shariah in products and processes (Basiruddin & Ahmed, 2019).

- (9) The rate of return risk (RATERISK) is a risk caused by changes in the rate of return paid by the bank to depositors due to changes in the revenue share received by the bank and potentially affects depositor behavior. We measure RATERISK with the standard deviation of the ratio of profit-sharing costs for IAH funds divided by IAH funds calculated with an all-year rolling window for each bank.
- (10) Equity investment risk (INVRISK). This risk arises because the bank bears the business losses experienced by the customer because the bank provides equity financing to the customer. The characteristics of equity financing are the sharing of benefits and risks between the bank and the customer. Equity investment risk is measured by the standard deviation of the ratio of PLS financing income to PLS profit-sharing financing calculated with an all-year rolling window for each bank.
- (11) Insolvency risk is measured by the z-score (ROA and capital adequacy ratio (CAR), divided by the standard deviation of ROA (Halteh et al., 2018; Safiullah & Shamsuddin, 2019).
- (12) Risk index. All risk indicators will be given a score of 1 if the bank has above the average risk for an all-bank-a-year observation and 0 if otherwise. The index value is the number of scores divided by the maximum score. We adopted this method from Mollah et al. (2017).

The following attributes measure SSB:

- (1) SSB busyness (SSBBusy) is calculated as the number of firms served by all SSB members divided by the number of SSB on the board. (Alabbad et al., 2019; Trinh, Aljughaiman et al., 2020). In Indonesia, SSB members can serve in other firms (outside) as SSB members, commissioners, and in other similar positions.
- (2) SSB's educational background in economics/finance (SSBFin) is measured by the ratio of SSB has a graduate or undergraduate degree in economics/finance (Bukair & Abdul-Rahman, 2013; Najwa et al., 2019; Rahmana & Haron, 2019).
- (3) SSB-specific education on Islamic law (SSBSya) is measured by the ratio of SSB has a graduate or undergraduate degree in Islamic law (Bukair & Abdul-Rahman, 2013; Trinh, Aljughaiman et al., 2020).
- (4) SSB Tenure (SSBTen) is measured by the average number of SSB members serving as SSB in a bank (Bhat et al., 2020; Reguera-Alvarado & Bravo, 2017).
- (5) SSB Experience (SSBExp) is measured by the experience of SSB members in managing the company before they are appointed as SSB members (we developed from Tejerina-Gaite & Fernández-Temprano, 2021).
- (6) SSB Educational Level (SSBEdu) is measured from the average score of SSB members' last education. Score 3 for SSB with a Ph.D./Doctorate education; score 2 for a master's degree; and score 1 for a bachelor's degree (Almutairi & Quttainah, 2017; Nomran et al., 2017; Rahmana & Haron, 2019).
- (7) The control variable is:
  - a. The Board of Directors index (BODIndex) is constructive based on 8 BOD attributes. The attributes are (1) BOD size, (2) BOD independent ratio, (3) BOD female ratio, (4) BOD educational level, (5) BOD experience, (6) Tenure BOD, (7) BOD's education background in the field of economics/finance, (8) BOD busyness. We give a score of 1 if it has a ratio

above the average value of all BOD attributes and otherwise zero. We adopt from Mollah et al. (2017), and Kabir et al. (2015).

- b. The bank's size is measured by the natural logarithm of total assets (LNASSET). Different bank assets lead to different risk-taking (Hamid et al., 2020).
- c. Crisis dummy. 1 in the pandemic covid-19 (2020) and otherwise zero. We added crisis as a control variable because the COVID-19 pandemic caused a recession in Islamic banks. We adopt from (Mukhibad, Yudo Jayanto et al., 2022).

### 3.1. Model specification and data analysis

Research data will be processed by panel data regression (unbalanced data) using the Fixed-Effect Model (FEM) or Random Effect Model (REM) approach. The choice of the model used in answering the hypotheses is based on the results of the Hausman test, where if the probability result is  $> 0.05$ , then the model is used in FEM. In contrast, if the probability is  $< 0.05$ , then the model used is REM. Before testing the model, we also conducted multicollinearity, autocorrelation, and heteroskedasticity tests. To test this hypothesis, we use the following regression model:

$$\text{Risk}_{it} = \beta_0 + \beta_1 \text{SSBBusy}_{it} + \beta_2 \text{SSBFin}_{it} + \beta_3 \text{SSBSya}_{it} + \beta_4 \text{SSBTen}_{it} + \beta_5 \text{SSBExp}_{it} + \beta_6 \text{SSBEdu}_{it} + \beta_7 \text{CONTROL}_{it} + \varepsilon_{it}$$

## 4. Results

### 4.1. Descriptive statistic

The description of the data in this study presented in Table 1 shows that Islamic banks have a low-risk score, which is an average of 0.364. However, some banks have a high risk of 0.643, and other

**Table 1. Descriptive variables**

Variables	Mean	Std. Dev.	Min.	Max.
RISKINDEX	0.364	0.118	0.143	0.643
CREDRISK	5.267	13.794	0.000	74.351
MARRISK	16.365	119.571	0.000	192.889
LIQRISK	65.298	15.583	40.320	89.038
OPERISK	70.967	32.422	23.972	98.449
LAWRISK	0.659	0.476	0.000	1.000
REPURISK	-0.147	1.357	-6.753	2.910
STRATRISK	-0.010	0.948	-2.957	2.183
SHARISK-PLS	0.329	1.516	0.000	17.469
SHARISK-SNCI	31.934	26.527	0.000	99.991
RATERISK	-0.186	1.572	-8.667	3.057
INVRISK	0.082	0.198	0.000	1.879
Z-SCORE	50.854	52.804	0.000	265.202
SSBBusy	2.729	1.405	0.667	7.500
SSBFin	0.339	0.373	0.000	1.000
SSBSya	0.676	0.255	0.333	1.000
SSBTen	4.811	1.401	0.693	7.256
SSBExp	5.311	1.912	1.000	11.667
SSBEdu	2.145	0.442	1.000	3.000
LNASSET	29.814	1.290	26.852	32.474
BODINDEX	0.479	0.155	0.111	0.889

banks have a risk level of 0.118. Our sample has a slightly heterogeneous level of risk because it has a standard deviation of 0.118.

When observed from various types of risks, our sample has a high credit risk (NPF), which is on average, 5.267%. This value is slightly higher than the maximum limit set by Bank Indonesia, which is 5%. However, some banks have zero credit risk. This provides evidence that our sample has a standard deviation of credit risk. Market risk shows an average value of 16.365. This means that 16.365% of bank financing is recognized as costs due to the high NPF owned by banks. The high costs incurred by banks due to the low quality of financing increased in line with the low ratio of financing owned by banks, which averages 65.298%. Our sample converts 16.365% financing as a cost due to the high NPF.

Operational risk shows an average score of 70.967%. This value shows that 70.967% of the income obtained by the bank can be used for bank operations. However, the maximum value of this ratio is 98.449%. This shows that there are Islamic banks that have low profitability performance due to low income earned by banks due to high NPF and high debt with fixed costs. The high risk faced by banks was also strengthened by an average of 65.9% of banks currently undergoing lawsuits. Our observation shows that most legal problems faced by banks are related to the problem of solving bad loans.

Reputational risk, as measured by the standard deviation of the IAH fund, shows an average value of  $-0.147$ . The average value of an increase or decrease in IAH funds is categorized as low. These results indicate that Islamic banks have a low reputation risk because they have low IAH fund fluctuations. The strategic risk showed a low average of  $-0.010$ . However, this risk also has a high standard deviation. Our indications are the same as before that there are banks that have poor performance and have an impact on decreasing ROA.

To identify the risk of shariah compliance, we use two indicators: PLS financing ratio and SNCI. Our results show that Islamic banks have a low average of 32.9%. This value indicates that our sample is more likely to provide financing that generates fixed income (sale and purchase agreements) because this type of financing has a lower risk than PLS financing. The average SNCI score of 0.319%, the lowest score of 0, and the highest score of 0.999%. These results indicate that our sample has a low SNCI score and a low risk of shariah compliance.

The risk rate shows a low average value of  $-0.189$  and an average value of investment risk of 0.082. These two indicators show that the profit-sharing amount given to IAH fund holders tends to be stagnant (not fluctuating). This condition may be due to the unstable ratio of PLS financing income. Even though banks have low PLS financing ratios have a higher income than non-PLS financing (Ernawati, 2016).

The description of the independent variables of this study—the attributes of the SSB—include busyness, experience, education, economic education/finance background, Islamic law education background, tenure, and education. These tables show that SSB members serve on other firms (outside) in an average of 2.729 of the firm. Observed from an educational background, we found that it averaged 2.145 and indicated the SSB had master's degree education and many also had doctoral/Ph.D. degrees. SSB has experience as a member of SSB in various types of Islamic entities, with an average of 4.811 years. As many as 33.9% of SSB have studied finance/economics, and 67.6% have studied Islamic Jurisprudence/Islamic law. Both competencies are needed for an SSB (Safiullah & Shamsuddin, 2018). From our observation, some SSBs have education outside these fields, such as Islamic Studies, Islamic Philosophy, and Islamic Education.

#### 4.2. Empirical findings

Table 2 presents the results of correlation tests between independent variables, and no variable correlates with 0.7. The result of the correlation test between independent variables shows that

**Table 2. Correlation between independent variables**

	<b>Risk Index</b>	<b>SSBBusy</b>	<b>SSBFin</b>	<b>SSBSya</b>	<b>SSBTen</b>	<b>SSBExp</b>	<b>SSBEdu</b>	<b>LNASSET</b>	<b>BODINDEX</b>
Risk Index	1.000								
SSBBusy	-0.266	1.000							
SSBFin	0.290	-0.146	1.000						
SSBSya	0.128	-0.425	-0.069	1.000					
SSBTen	0.163	-0.407	-0.077	0.415	1.000				
SSBExp	-0.139	0.261	-0.045	0.066	-0.268	1.000			
SSBEdu	-0.162	0.334	-0.061	-0.104	-0.589	0.133	1.000		
LNASSET	0.132	0.221	0.313	-0.252	-0.078	-0.109	-0.056	1.000	
BODINDEX	-0.044	-0.073	-0.118	0.030	0.208	0.043	-0.140	-0.284	1.000



the highest correlation is the correlation between experience and tenure (correlation score is 0.661). This indicates the absence of multicollinearity between the independent variables.

The Breusch and Pagan ML Test was used to select the pooled OLS or random effect model. The test results on all of models are presented in Table 3. Table 3 shows that all models, except the 5th model, produce a P-value greater than 0.05. These results recommend using pooled OLS to analyze the fifth model and GLS for other models. Next, we did the Hausman test. The p-value of the Hausman test lower than 0.05 recommends using fixed-effect. The Hausman test result for most models, except for models 3, 6, 7, and 13, produced a p-value of the score more than 0.05 and was recommended using a random effect. Thus, models 3, 6, 7, and 13 were analyzed using fixed effects.

VIF test is used to identify the correlation between independent variables. A VIF score of less than 10 indicates no correlation between independent variables. The results of the VIF test in all models (Table 3) resulted in a mean VIF of less than two and identified no multicollinearity in all models.

The test results of the influence of the relationship between the attributes of the SSB on the risk are presented in Table 3. Table 3 presents test results using the FEM and REM. Determination of whether FEM or REM models on the model test results are based on the Hausman test results. The Wooldridge test is used to identify autocorrelation in the model. The p-value of the Wooldridge test more than 0.05 indicates an autocorrelation problem. Table 3 shows that most of the models, except for models 5, 9, and 13, produced a p-value of more than 0.05. This Wooldridge test shows no autocorrelation problem in models 5, 9, and 13.

The modified Wald test is used to identify heteroscedasticity problems. P-value scores less than 0.05 indicates the presence of heteroscedasticity. The modified Wald test on all models resulted in a p-value of 0.000, which shows a problem of heteroscedasticity in all models. To overcome heteroscedasticity and autocorrelation in the model, we use the robust standard error. We add the command “cluster ()” for the model that occurs heteroscedasticity and autocorrelation and adds the command “vce (robust)” for the model that occurs heteroscedasticity (Hoechle, 2007).

#### 4.3. Discussion

Table 3 shows that SSB busyness proved able to control liquidity risk (model 3), strategic risk (model 7), and shariah compliance risk (model 8). The results of our differ from Trinh, Elnahass et al. (2020), Ferris et al. (2018), and Elyasiani and Zhang (2015) that SSB busyness has a negative impact on SSB outcomes. The busyness of the SSB will encourage the directors to increase the allowance for write-offs due to the high NPF. In the RDT approach, SSB with positions in other firms is a beneficial resource because they have access to resources and connections and gain knowledge from other firms (Salancik & Pfeffer, 1978; Zhou et al., 2018). Thus, RDT considers SSB as a resource for banks that can provide resources for banks in addition to supervisors and counselors (Attah-Boakye et al., 2020). This study indicates that SSB busyness has been effectively used as access to resources that can increase the ability of SSB to control liquidity, strategic, and shariah compliance risk. On the other hand, SSB's busyness has not been effectively used to increase SSB's capability to control credit, operational, law, return rate, and equity investment risk. Regulators in Indonesia require that prospective SSB members obtain a recommendation from the National Shariah Board so that their SSB number is limited. This condition causes the transfer of knowledge, experience, and access to information between SSB to be limited.

Other indicators in measuring the effectiveness of SSB in carrying out their duties are the educational background in economics/finance and education background in Islamic law. Table 3 shows that SSB's educational background in economics/finance has negative effect on law risk (model 5) and shariah compliance risk (model 8). Table 3 also shows that SSB's educational background in Islamic law has a negative effect on operational risk and shariah compliance risk

**Table 3. Regression analysis**

	CREDRISK	MARRISK	LIQRISK	OPERISK	LAWRISK	REPURISK	STRATRISK	SHARISK-PLS	SHARISK-SNCI	RATERISK	INVRISK	Z-SCORE	RISKINDEX
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
SSBBusy	0.026	0.568***	-2.034*	0.002	0.005	-0.018	-0.372***	-0.309**	0.885	-0.077	0.011	1.597	-0.003
SSBEdu	0.098	0.186	1.091	0.057	0.040	0.100	0.114	0.146	1.628	0.128	0.016	2.378	0.012
	-0.231	-0.390	-9.199	0.708	0.170	1.105**	0.602	1.001**	12.428	0.051	0.122**	8.609	0.118**
SSBExp	0.267	0.679	6.497	0.427	0.128	0.498	0.435	0.418	8.145	0.434	0.056	8.577	0.051
	0.038	-0.125	-0.041	0.081	-0.035	-0.155**	-0.068	0.145*	-0.745	-0.236**	-0.017 **	0.466	0.000
	0.044	0.078	0.898	0.055	0.026	0.058	0.062	0.079	1.425	0.109	0.008	0.966	0.005
SSBFin	0.637	1.384	-20.860	0.063	-0.362 ***	-0.158	0.479	-0.681*	-11.029	-0.611	0.041	12.070	-0.060
	0.402	0.885	15.058	0.195	0.119	0.697	0.427	0.394	7.449	0.572	0.042	11.201	0.043
SSBSya	-0.761	-0.662	4.851	-1.256*	0.221	-1.320	0.795	-0.602*	-1.597**	1.161	0.036	-10.063	-0.020
	0.513	0.541	11.810	0.753	0.218	0.786	0.920	0.327	7.020	1.324	0.079	23.535	0.044
SSBTen	0.117*	0.300	-3.337**	0.112**	-0.026	-0.030	-0.282**	0.370**	1.379	-0.296**	-0.003	3.531*	0.005
	0.061	0.121	1.253	0.056	0.047	0.089	0.129	0.154	2.809	0.120	0.021	2.027	0.015
LNASSET	-0.106	-0.478	10.019	-0.074	0.018	0.830	0.263	0.213*	6.729**	-0.187	0.018	-2.365	0.087*
	0.166	0.341	6.783	0.063	0.037	0.266	0.202	0.123	3.217	0.187	0.014	5.331	0.017
BODINDEX	0.298	0.642	-10.078	-0.093	0.139	1.053	1.233*	-1.642	-3.449	0.304	-0.076	16.971	-0.002
	0.554	0.768	9.300	0.301	0.280	0.963	0.671	1.209	25.747	1.652	0.140	14.916	0.080
_cons	3.901	13.083	-183.096	4.755**	-0.040	-25.601***	-7.722	-8.375*	-206.450 **	6.961	-0.636	74.816	-2.475
	4.702	10.606	185.935	1.856	1.261	8.086	5.709	4.325	99.600	6.442	0.595	154.508	0.541
Crisis Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Breusch and Pagan ML Test (p-Value)	0.000	0.000	0.000	0.000	0.322	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean VIF	1.530	1.540	1.540	1.530	1.540	1.540	1.540	1.540	1.540	1.540	1.540	1.540	1.540
Wooldridge Test (p-Value)	0.040	0.009	0.009	0.004	0.121	0.014	0.001	0.042	0.081	0.000	0.000	0.000	0.160

(Continued)

**Table 3. (Continued)**

	CREDRISK	MARRISK	LIQRISK	OPERISK	LAWRISK	REPURISK	STRATRISK	SHARISK-PLS	SHARISK-SNCI	RATERISK	INVRISK	Z-SCORE	RISKINDEX
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Modified Wald (P-Value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hausman (P-Value)	0.998	0.262	0.000	0.612	0.081	0.001	0.032	0.167	0.867	0.824	0.528	0.100	0.000
R-Square	0.108	0.217	0.219	0.240	0.134	0.344	0.208	0.006	0.143	0.203	0.176	0.098	0.276

We present scores of coefficients and robust standard error. \*\*\*, \*\*, \* denote 1%, 5% and 10% significance levels, respectively

(model 8 and 9). The results shows that these two indicators indicate that SSB's educational background in economics/finance and Islamic law improve SSB's ability as a consultant and supervisor of risky director policies. This finding confirm human resources management that education can increase professionalism, knowledge, and ability to process complex information and increase the ability to innovate (Hambrick & Mason, 1984; Grace et al., 1995; D'Amato & Gallo, 2019). In line with Minton et al. (2014), finance education causes the board to better recognize the proven risks.

SSB's level of education encourages directors to take greater risks. The results of testing models 6, 8, 11, and 13 show that SSB education positively impacts reputation, shariah compliance, investment equity, and index risk. In line with (D'Amato & Gallo, 2019), higher education is a proxy for measuring knowledge and intelligence. However, this knowledge and intelligence are not specific to bank risk management. Higher education tends to increase to take policies that can increase income even though it has the effect of high risk. This assumption is reinforced by the findings of Cheng et al. (2010) and Darmadi (2013), which show that the education level of the board positively influences performance. It is possible that SSB education has not been effectively used to improve their supervision of bank risk-taking.

SSB tenure can also increase knowledge, skills, expertise whereas long tenure indicates having better knowledge. The main difference between the SSB experience and SSB tenure variables is SSB can obtain that experience from other firms. In contrast, tenure can provide experience to SSB related to certain bank business operations where different banks may have different environments. Table 3 shows that SSB tenure has negative impact on liquidity risk (model 3), strategic risk (model 7), and return rate risk (model 10). This means that longer tenures at the SSB encourage bank directors to take greater liquidity, strategic, and return rate risks. This finding is similar to Ji et al. (2021), Bhat et al. (2020), and Gafrej and Boujelbéne (2021), which found that board tenure can control risk-taking.

RDT believes that SSBs with experience in managing organizations tend to have general skills and knowledge in managing companies. Table 3 shows that SSB experience has a positive influence on reputation risk (model 6), shariah compliance risk (model 8), investment equity risk (model 11), and risk index (table 13). A long-serving SSB member in Islamic and non-Islamic bank entities takes a risky policy. SSB's experience encourages directors to increase the distribution of PLS financing to increase bank profitability. This policy was taken because PLS financing has a higher income for banks than non-PLS financing (Ernawati, 2016). However, the characteristics of PLS financing that generate fluctuating income causes fluctuations in the profit sharing that the bank provides to the depositor (IAH). Thus, the increase in PLS financing will positively impact equity financing risk.

In general, the results of this study provide evidence of the effect of the SSB on Islamic bank risk. The attribute that impacts Islamic bank risk control is the busyness, tenure, and educational background in economics/finance and Islamic law, which proved to have a positive influence on risk-taking. However, by summarizing all types of risk in the form of a risk index, our results show that only SSB experience is associated with an increase in the risk-taking of Islamic banks. Other SSB attributes such as busyness, tenure, level of education, education background in economics/finance, and education background in Islamic law have not been proven to influence the risk index. This means SSB's experience is ineffective in getting directors to take greater risks. High experience will have at least: (1) SSB better understanding bank's operations, (2) increasing SSB skill, and (3) an understanding of the level of risk faced by banks.

#### **4.4. Robustness checks**

We tested the risk index by adding the income diversity variable as a robustness test. We use this approach because risky banks will use income diversification for risk reduction (Pennathur et al., 2012). Based on Safiullah (2021), we use the ratio of other operational income (non-financing

income) to total operating income as a measurement of income diversification. An increase in non-financing income can lead to a reduction in the traditional intermediation function of banks by reducing the financing disbursed. So that income diversity will reduce risk (Pennathur et al., 2012). Banks with large income diversity will increase stability and keep banks away from insolvency risk (Safiullah, 2021).

Using the same steps in the primary model test, we present the results of the robustness check test in 4. After adding the income diversity factor, our results are consistent with the results of Table 3 test that SSB education positively influences the risk index. In addition, we also find that income diversity positively affects the risk index.

Endogeneity problems occur in corporate finance research (Roberts & Whited, 2013). Endogeneity occurs because a regression model has a correlation between the independent variables and the error term. Endogeneity problems lead to biased and inconsistent results. We followed Ullah et al. (2018) to use GMM to solve the endogeneity problem. Our reasons are (1) GMM is commonly used for panel data, and (2) GMM gives consistent results by solving the source of endogeneity: unobserved heterogeneity, simultaneity, and dynamic endogeneity (Ullah et al., 2018; Wintoki et al., 2012).

The results of the sys-GMM test (Table 4) show that the Lag1 risk index has a coefficient of 0.267 with a probability of less than 0.001. These results indicate a correlation between the

**Table 4. Robustness and endogeneity test**

	Fixed Effect		Sys-GMM	
	Coef.	Robust Std Err.	Coef.	Std Err.
L1.IndexRisk	-	-	0.267***	0.098
SSBBusy	-0.003	0.012	-0.008	0.013
SSBEdu	0.118**	0.050	0.081*	0.047
SSBExp	0.000	0.005	-0.011	0.007
SSBFin	-0.061	0.044	-0.088	0.047
SSBSya	-0.021	0.039	0.018	0.069
SSBTen	0.005	0.015	0.009	0.014
LNASSET	0.087***	0.018	0.068***	0.018
BODINDEX	-0.001	0.084	-0.038	0.081
DIVERINCOM	0.010*	0.082	0.012*	0.011
_cons	-2.471	0.542	-1.838***	0.505
Crisis (dummy)	Yes	Yes	Yes	Yes
Breusch and Pagan ML Test (P-Value)		0.000		-
Mean VIF		1.530		-
Wooldridge Test (P-Value)		0.161		-
Modified Wald (P-Value)		0.000		-
Hausman (P-Value)		0.262		-
R-Square		0.276		-
Sargan Test (P-Value)		-		0.690
AR (1) (P-Value)		-		0.0031
AR (2) (P-Value)		-		0.2238

\*\*\*, \*\*, \* denote 1%, 5% and 10% significance levels, respectively

current year's risk index and the previous year's risk index. The Sargan test is used to test the validity of the instrument. Acceptance of the null hypothesis indicates that the instrument is valid. Sargan test produces a p-value of 0.690, more than 0.05, and indicates that the instrument is valid. The Arellano Bond test (AR 1) produces a p-value of 0.031 and AR 2 of 0.2238. Arellano Bond test is used to evaluate the consistency of the instrument. The Sargan test p-value greater than 0.05 indicates a consistent instrument. Our instruments are consistent with the second difference. The GMM system test is consistent with the fixed effect test that SSB education level positively affects the risk index.

#### **4.5. Research implication**

In general, our findings indicate the role of SSB attributes in controlling Islamic bank risk-taking. Thus, this research implies that the SSB is expected to increase. It is the ability to recognize risks faced by banks and play an active role in overseeing bank risk-taking. Risk control affects the business continuity of banks and customer confidence in Islamic banks. For regulators, rules or schemes are needed so that all boards, especially SSBs, can increase their role in overseeing bank risk. We see the need for SSB restrictions on SSB tenure to maintain SSB independence.

Islamic banks need to consider the SSB attributes in selecting SSB members. At least there are indicators of SSB's busyness, tenure, and expertise in economics, finance, and Islamic law. These attributes will negatively affect the bank's risk-taking, and the risk taken will affect the profitability and sustainability of the bank's business.

#### **5. Conclusion**

This study examined the presence or absence of the role of the SSB in controlling the risk of Islamic banks. The reason for this study is that excessive risk-taking is not recommended by Islamic law, and the SSB—one of the boards in an Islamic bank in the agency approach, the SSB has the task of supervising the director. We used six attributes to explain SSB: busyness, experience, level of education, educational background in economics/finance, and education in Islamic law and tenure. To measure risk, we developed 12 risk indicators: credit, market, liquidity, operational, law, reputation, strategic, shariah compliance, rate of return, equity investment, insolvency, and index risk.

The research results for each type of risk individually show that busyness, experience, educational background in economics/finance, education in Islamic law, and tenure have an impact on controlling risk. The results of this study strengthen the RDT theory that SSB's skills and expertise can be improved by busyness, tenure, experience in managing entities, and education. In addition, in the RDT approach, SSB busyness has experience in managing other banks, has access to resources and connections and acquires knowledge from other companies. This capability will increase SSB's ability to control risk. However, a higher education level SSB encourages directors to take greater risks. There are indications that the academic knowledge SSB has acquired through formal education encourages banks to increase their income and ignore risks. They encourage directors to increase PLS financing, which has a high risk but high-income potential.

Based on the test results based on the risk index, we found that the SSB education level had a positive effect on the risk index, and we did not find any other SSB attributes influencing the risk index. These results also corroborate the results of individual risk tests that the level of education encourages directors to take greater risks by encouraging banks to channel PLS financing.

The indicators used to measure risk are based on the development of Islamic bank regulations that apply to Islamic banks in Indonesia, thus enabling further researchers to use risk measures adjusted to the applicable regulations in the country of study. Other limitations of this study include using a sample of all Islamic banks in Indonesia, which is limited in number. In addition, the focus of this study is to evaluate the role of the SSB, which is part of corporate governance in Islamic banks, so that future researchers can use or complement it with other corporate governance indicators.



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## APPENDIX

**Table 5. Variable definitions**

List of variables	Abbreviation	Measure
Credit risk	CREDITRISK	$\Sigma$ non-performing financing/ $\Sigma$ gross financing
Market risk	MARKETRISK	$\Sigma$ financing ratio-loss-reserves/ $\Sigma$ gross-financing
Liquidity risk	LIQRISK	$\Sigma$ net financing/ $\Sigma$ assets
Operational risk	OPERISK	$\Sigma$ operating costs/ $\Sigma$ operating income
Legal risk	LAWRISK	Dummy, 1 if the bank has lawsuits and 0 if otherwise
Reputation risk	REPURISK	The standard deviation of the ratio of IAH funds to assets is calculated with an all-year rolling window for each bank.
Strategic risk	STRATRISK	The standard deviation of ROA is calculated with an all-year rolling window for each bank.
Shariah compliance risk	SHARISK-PLS	$\Sigma$ PLS financing/ $\Sigma$ gross financing
	SHARISK-SNCI	$\Sigma$ Shariah non-compliant income/ $\Sigma$ financing income
The rate of return risk	RATERISK	The standard deviation of the Return of Deposit Rate (RDR) is calculated with an all-year rolling window for each bank. RDR = $\Sigma$ profit-sharing costs for IAH funds/ $\Sigma$ IAH funds
Equity investment risk	INVRISK	The standard deviation of the PLS financing income ratio (PLSINC) is calculated with an all-year rolling window for each bank. PLSINC = $\Sigma$ PLS financing income/ $\Sigma$ PLS financing
Insolvency risk	Z-SCORE	$(\Sigma$ ROA+ $\Sigma$ CAR)/ Standard deviation of ROA
Risk index	RISKINDEX	Risk score was measured by a dummy. 1 if a bank has above the average risk for all-bank-a-year observation and 0 if otherwise. RISKINDEX = risk score/maximum score
SSB busyness	SSBBusy	The average of SSB busyness in a board
SSB's education background in economics/finance	SSBFin	The percentage of SSB has a graduate or undergraduate degree in economics/finance
SSB-specific education on Islamic law	SSBSya	The percentage of SSB has a graduate or undergraduate degree in Islamic law
SSB tenure	SSBTen	The average of years occupying the position of all SSB members
SSB Experience	SSBExp	The percentage of SSB experience in a board
SSB education level	SSBEdu	The average score of SSB members' education Score of education: 1 = bachelor and below, 2 = master, 3 = PhD

(Continued)

**Table 5. (Continued)**

<b>List of variables</b>	<b>Abbreviation</b>	<b>Measure</b>
Board of directors' index	BODINDEX	The average score of BOD attribute: BOD size, BOD independent ratio, BOD female ratio, BOD educational level, BOD experience, Tenure BOD, BOD's education background in the field of economics/finance, and BOD busyness. Every BOD attribute is measured by a dummy. 1 if a bank has above the average risk for all-bank-a-year observations and 0 if otherwise.
Bank's size	LNASSET	The logarithm of total assets.
Crisis Dummy	CRISIS	Dummy = 1 for the COVID-19 pandemic (2020) and 0 if otherwise





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