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**The Relationship between Corporate Governance and Systemic
Risk of the Banking Sector in Indonesia**

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PREFACE AND ACKNOWLEDGEMENTS

This thesis is part of my master's study at the Erasmus School of Economics, Erasmus University Rotterdam. It represents my passion in finance, especially in the fields of corporate governance and systemic risk. This thesis has been challenging and time-consuming. However, due to my interest and passion in this field, it turned into an unexpected experience during my study. The topic of this thesis, corporate governance and systemic risk, is inspired by the material from my courses at the Erasmus School of Economics. First, I would like to thank God for His blessings. Foremost, I would like to express my special appreciation to my supervisor, Dr. J.J.G. Lemmen, for his encouragement, patience, insightful comments, advice, and constant help to this thesis. My deepest gratitude also goes to my parents, my two sisters, and Raffy Priyatama for their unconditional love, endless prayers, and support throughout my master's study. I am also grateful to all my friends in Rotterdam and Indonesia for supporting and inspiring me while I wrote this thesis. Last but not least, I would like to thank everyone who has contributed in the completion of this thesis, including the Central Bank of Indonesia (BI) and Indonesia Financial Services Authority (OJK) who have helped me with data collection and experts' discussions.

Rotterdam, October 2017

Andrea Erwina Putri

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ABSTRACT

This thesis investigates the relationship between the corporate governance mechanisms and the systemic risk of the banking sector in Indonesia during the period of 2011–2016, using 26 banks (large and small banks) that are publicly listed. This thesis finds important evidence that the banks in Indonesia having well-implemented corporate governance mechanisms may actually incorporate the highest systemic risk levels, because strong corporate governance could lead to banks taking more risks in order to maximize shareholder value. Moreover, the findings show the higher levels of systemic risk are associated for all banks and small banks sample with stronger corporate governance mechanism. However, this relationship does not exist for samples of large banks. Hence, the results suggest that a strong corporate governance may lead to exaggerated risk-taking behavior to maximize shareholder value. Furthermore, a variable of total assets as the proxy for bank size shows a significant result in every regression and implies that larger banks are associated with higher systemic risk in Indonesia. The bank size is the primary indicator when it came to systemic risk in Indonesia. This result supported the findings of Laeven et al. (2014) that larger banks produced a higher systemic risk compared to smaller banks and that the high risk arose when they had unstable funding, more market-based activities, or a more complex organization. Finally, the results imply the importance of having a robust framework for corporate governance rules for different sizes of banks in Indonesia.

Keywords: corporate governance, systemic risk, risk-taking, Marginal Expected Shortfall

JEL Classification: G21, G32, G34

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Chapter 1: Introduction

1.1 Background

Corporate governance and systemic risk are popular topics nowadays. The two topics are in fact closely associated. Unfortunately, there are only a few studies observing the linkage between corporate governance and systemic risk in Indonesia. Thus, the aim of this research is to fill the gap and to focus on the implementation of the Basel III second pillar. The second pillar is fortified with additional requirements that focus on governance throughout institutions and risk management (Basel Committee on Banking Supervision, 2011).

The corporate governance mechanism is related to the market corporate control that will lead the bank manager or management to act in favor of the shareholder. Whilst, systemic risk is a sophisticated concept that many researchers have tried to specify. Many factors can cause systemic risk, wherein two factors can be seen as the most acclaimed ones. First, the interconnectedness among financial institutions nowadays may easily infect and spill over other financial institutions. Second, since financial institutions are heavily regulated, they tend to undertake similar activities (e.g. risk management system), which may increase the impact of shock. A credit shortage may occur in firms as banks could provide loans to firms only for an uncertain time, and since firms cannot obtain other sources of financing. Thus, firms cannot finance their business operation leading to the slowdown of overall growth. The loss of market confidence in the entire financial system could, in the end, endanger the whole economy.

The subprime mortgage crisis during 2007–2008 has been one of the most severe crises that had led to tremendous insolvency risks in major financial institutions (Yeoh, 2010). The interconnection among banks' exposures to subprime mortgages and their interbank activities are risky. Additionally, subprime mortgages are usually correlated to high leverage. Banks finance themselves by issuing short-term debt while short-term financing is very sensitive to their performance during the crisis. As the housing market worsened during the crisis, banks were forced to sell unfinanced assets due to their lower value when compared to the fundamental one. These valuation losses depleted the equity capital buffers and raised the funding costs as it could affect default risk more. Therefore, it became even harder to acquire short-term financing. In addition, due to the falling capital buffers, banks were required to

raise a new equity capital and increase the total shares outstanding, which had a dilutive effect on the ownership percentage of the existing shareholders (Kashyap et al., 2008). The consequence was a value transfer from the existing shareholders to debt holders, which led to under-investment and future depletion of share value for existing shareholders (Philippon, 2009).

Prior to the subprime crisis, corporate governance issues had not received as much attention as it was supposed to, and even corporate governance had failed to attract public attention in many cases (Basel Committee on Banking Supervision, 2010). Hence, many researchers argued that corporate governance is one of the main causes behind the global financial crisis. Furthermore, there is a substantial prolonged discussion regarding the banks risk exposures which contributed by government failures. There are debates regarding inadequate bank boards on monitoring and controlling bank risk, or the excessively structured pay that encourage executive to boost their risk-taking behavior, and the banks' risk management systems itself (Bebchuck and Spamann, 2009). The complexity of a bank's corporate governance mechanism, among the board of directors/commissioners, the shareholders, and the regulator(s) encourages the banking industry to have a particular corporate governance mechanism. This is because both agency problems and moral hazard problems within banks are more severe than in non-financial firms. Furthermore, banks' capital structure with high leverage positions may also severely invite moral hazard problems within banks. Banks are also known for their conversion of short-term deposits into long-term assets, which could potentially lead to a maturity mismatch risk. Since a long-term loan is riskier than a short term one, banks increases the long-term interest to gain interest rate spread. Hence, borrowing short and lending long makes traditional banking a risky business and quite different from the input-output transformation of manufacturing firms.

Banks find equity to be a costly form of financing and try to reduce it as much as possible (Kashyap et al., 2008). Because commercial banks want to gain profits by extending as many loans as possible, it is indeed a primary challenge for the regulator to regulate capital requirement and enforce banks to hold more equity. One reason behind it is that equity-rich balance sheet allow cost-of-equity premium to be the high level discretion. According to Kashyap et al. (2008), bank investors must realize that poor decision made by the management will diminish their shareholding value. On the contrary, it has no impact on short-term creditors. Hence, it is an optimal response to governance problem for bank to

finance itself through short-term debt (Kashyap et al., 2008). This is because bank loss could expose the stakeholders as well as the economy, in general. Hence, governments attempt to form a corporate governance mechanism for banking through laws and regulations. Although bank risk-taking is strongly regulated, the board still holds an important position in decision-making and risk adjustment (Mehran et al., 2011). Therefore, an efficient and functional corporate governance mechanism is necessary for banks and for the economy as a whole. Corporate governance flaw at banks, especially which hold an important role in the financial system may educe in a transmission of problems across the banking sector (Basel Committee on Banking Supervision, 2015).

Review on risk assessment procedures and regulations within the financial system post-crisis are needed. Raising awareness on systemic fragility and macro-prudential regulation depends upon the emphasis in the risk and contribution of individual banks towards the risk of the financial system as a whole (Anginer et al., 2014). Nowadays, there are many discussions regarding the urgency for a re-assessment of traditional regulatory practices.

The macroprudential approach sees the financial system as a whole and acknowledges the threat that may appear from financial institutions' risk exposure. The key point of the macroprudential view is that a shock can affect financial institutions simultaneously, hence, they can fail at the same time. The failure of one financial institution can spill to other and to the entire system, which can quickly accelerate the degree of impairment. These findings may have important implications on the existing regulatory framework. The main problem is that these components of systemic risk cannot be controlled using the traditional regulatory practices. Nonetheless, the "too-big-to-fail" phenomenon, deposit insurance systems, and shareholder-focused governance mechanism push bank managers to adopt riskier business strategies and operations, which consecutively may lead to increased systemic risk. (Iqbal et al., 2015).

According to Tchikanda (2017), bank complexity hinders market discipline through regulatory, while their interrelation over trading increases systemic risk. Over the last decades, bank involvement over market activities have affected the banking and financial industry through the growing and complex interaction among participants. Consequently, many large banks shifted redundant resources to trading books.

A major challenge is the measurement of systemic risk. Since the recent financial crisis, many risk measurements have been constructed to measure the risk contribution of a financial institution toward the financial system. Prominent systemic risk measurements that are widely used include Marginal Expected Shortfall (MES) (Acharya, Pedersen, Philippon, & Richardson, 2010), Systemic Expected Shortfall (SES) (Acharya, Pedersen, Philippon, & Richardson, 2010), Conditional Value-at-Risk (CoVaR) (Adrian & Brunnermeier, 2010), Systemic Risk as the expected capital shortfall of a financial entity conditional on a prolonged market decline (SRISK) (Brownlees & Engle, 2016), and Turbulence (Kritzman & Li, 2010). Many of these measures are essentially co-variances between a bank's stock price and banking sector index, conditional on a tail realization of the system. The conditional tail expectation measures the expected value of the loss that can take place above a given probability level.

Indonesia is one of the emerging countries that was also impacted by the US subprime mortgage crisis from the decline of both the stock exchange performance and the Rupiah exchange rate. The condition has motivated the Indonesian government to increase awareness about the prevention of the potential threats that can lead to crisis in the whole Indonesian economy. However, Indonesia was fortunately able to maintain a positive growth during the crisis period despite its impact on the balance-sheet accounts through import and export transactions.

For example, in 2008, the Rupiah lost 16.9% of its value against the US dollar and up to March 2009, it had already depreciated by almost 10% from its value. Nevertheless, Indonesia has made a lot of efforts and taken steps to improve corporate governance standards since the Asian crisis, which brought the Rupiah down by almost 80% during 1997–1998. Likewise, the main reason for the 1997–1998 crisis was institutional weaknesses, such as a lack of enforcement from the central bank's regulation, along with irregular banking practices (Hartono, 2001).

According to the International Monetary Fund (2017), Indonesian authorities have been pushing a plan to strengthen financial oversight and crisis management, nevertheless, a weak governance further complicates the duty of the authorities. The independence of the control function undermined the board of commissioners' ability to evaluate management performance and create a problem to implement good corporate governance in Indonesia

(International Monetary Fund, 2017). Moreover, there are vague borders in the legal framework, such as blurred roles of the board of directors, board of commissioners, and shareholders. The company law strictly forbids the board of commissioners to appoint the board of directors.

Likewise, the law also stated that the board of commissioners should approve and monitor the decisions that have been made by the board of directors. The board of directors should be appointed by shareholders at the general meeting. However, even though the law portrays the responsibilities of the board of directors and the board of commissioners, reality does not correspond with the international best practice, specifically, in terms of the board of directors' nomination. It occurs because of the lack of independence in some banks, due to nepotism. Some banks in Indonesia may have related families in their board structure which may give them adequate power to influence any bank's decision for their own personal benefit and could later affect the bank's performance as a whole.

1.2 Aim and Research Question

This study aims to combine both the streams of corporate governance and systemic risk literature to provide empirical evidence. In detail, it aims to provide an insight into the Indonesian Central Bank, Bank Indonesia (BI hereafter) and the bank supervisor, Otoritas Jasa Keuangan (OJK hereafter), and also the government, regarding whether the systemic risk of the banking sector is affected by the strength of corporate governance mechanisms, because until recently there has been no research in this particular area. Therefore, the research question that underlies this thesis is:

Does the strength of the corporate governance mechanism determine Indonesia's banking systemic risk?

This thesis uses 26 banks that are publicly listed on the Indonesian Stock Exchange during the period of 2011 until 2016, by implementing a panel data regression. To provide better perspective, the sample is divided into two based on their size; large and small banks. This thesis finds evidence that banks in Indonesia with stronger corporate governance mechanisms actually incorporate the highest systemic risk levels, because strong corporate governance may actually lead to more risk taking to maximize shareholder value by these banks. Moreover, the findings show that all banks and small banks samples with stronger corporate

governance mechanisms are associated with higher levels of systemic risk. However, this relationship does not hold for large banks' samples.

1.3 Structure of the Thesis

The remainder of the thesis is organized as follows: Chapter 2 describes the related research and hypothesis development; Chapter 3 contains the data and methodology, including the model, data sample and selection of explanatory variables, and the research design; Chapter 4 presents the descriptive statistics; then, the performed tests are analyzed, it will include some robustness checks; and finally, Chapter 5 concludes with an answer to the research question, the implications and limitations of the research, and suggestions for future research.

Chapter 2: Related Research and Hypothesis Development

2.1 *Corporate Governance in the Banking Sector*

Good corporate governance can contribute to proper incentives for the board of directors and the management to keep up with the objectives that are in the interest of the company and shareholders. By definition, corporate governance is a system of relationships that may include parties with different interests. A moral hazard problem arises with the different interests of shareholders and the management of the bank and the fragility of banks. A bank, as the liquidity provider, converts short-term debt into long-term assets, causing maturity mismatch.

Furthermore, banks are prone to an adverse selection problem that occurs due to an information asymmetry between the bank and its customers, which makes it difficult for banks to differentiate between good and bad credit. As a result, banks tend to have higher leverage in their capital structure as they usually take on more risks as the shareholders will bear the costs. In particular, excessive risk-taking behavior is one of the causes of the recent crisis.

Caprio et al. (2007) argued that the ownership structure is an important tool for governing banks. According to Jensen and Meckling (1976), the ownership structure also affects the managerial incentive for risk-taking. CEOs are more likely to align company strategy with their own benefits rather than with shareholder interest. A study by Jeon et al. (2016) investigated the effect of foreign ownership in emerging countries, using bank-level panel data in 32 countries and found that foreign owned banks take on more risk. However, Lassoed et al. (2015) found that state ownership took more risks compared to foreign ownership.

Moreover, Laeven and Levine (2009) stated that the agency conflict between the CEO and shareholders highly depended on corporate governance structure as well as the shareholder's power. Therefore, a shareholder who owned a large proportion of shares tends to encourage the bank's manager to take more risk in order to receive a higher return. Furthermore, Pathan (2009) emphasized that there is a positive correlation between bank's strength and its risk-taking behavior. A strong bank board is measured by its board size, meaning the size of the board reflect the board's strength itself; however, this condition applied only up to a certain

board size, because if the board is too large relative to the business, then the board size is not optimal. A strong bank board is also measured by its independence and is non-staggered, and there is a lack of poison pill. The board should discipline the CEO/managers to avoid taking excessive risks. In summary, a strong bank board is a board that represents the shareholders' interest more suitably.

Furthermore, Pathan (2009) also investigated the CEO's power. A powerful CEO meant the CEO has a power to affect the board's monitoring and decisions. CEO duality or an internally-hired CEO are used as proxies for CEO power and it was found that it negatively affected the bank's risk-taking behavior as they preferred lower risk due to their un-diversifiable wealth, such as a portfolio of tangible and financial assets. Since a CEO's wealth is generally concentrated in their own firm, going to the extent of a fixed-wage compensation may turn the CEO's behavior into risk-averse behavior. It is because if he makes a mistake, his share wealth could decline to zero.

Another study by Onali et al. (2016) found that the CEO power has a negative effect on performance. It suggested that it is ineffective for entrenched CEOs to increase pay-out ratio (performance) in order to discourage monitoring from outside shareholder. The result is contrary in non-financial sector, considering dividend dampens monitoring from minority stakeholders. Thus, dividend pay-out ratios have positive interaction with CEO power. Pearce and Zahra (1991) found that several board characteristics that are proven to minimize the managerial power of the CEO also contributed to a strong board of directors and that the CEO's power over the board is a threat. Because the decision will reflect the CEO's opinion rather than the decision made by the board of directors. However, when a CEO is also the chairman of the board, it automatically increases the managerial power (Bebchuk, Fried, & Walker, 2002).

Moreover, a study by Carter et al. (2003) discovered that the CEO duality or a CEO who is also the chairman of the board is significantly negative to firm value. This still applies even if the CEO is the only insider in the board. However, when there are more insiders on the board, the managerial power is decreased because the CEO has less power over the board, so this increases the board power. CEO's managerial power also can be increased if some board of director members are either too old or too busy to be a present at board meetings (Adams, Almeida, & Ferreira, 2005). This is because they become less efficient and lose focus as they

become older and work for too many boards (Core, Holthausen, & Larcker, 1999). Furthermore, the board of directors should consist of diverse members. This board characteristic is found to have a significant result with firm performance. Carter et al. (2003) defined board diversity as the percentage of minority ethnics, such as African Americans, Asians, Hispanics, and number of women in the board of directors. However, diversity may lead to conflicts when there are many varieties of perspectives. In terms of consequences, decision makers could conduct a better analysis and alternatives. Hence, board diversity could be better for the company because it creates more effective problem-solving and attractive innovation.

Hereinafter, if a CEO owned shares or share options in its own bank, it could induce certain incentives for their own interest. Nevertheless, aligning the interests of CEO and shareholder can create another problem for the debt holder's interest (Jensen & Meckling, 1976). Hence, executive compensation is a way to reduce agency problems within banks. In most cases, the company would have equity in its CEO compensation package. The use of stocks may reduce agency problems if CEOs only held a limited proportion of equity, as they tend to take less risks. Since a stock option is a call option, it has a floor. If the share price falls below the exercise price of a call option, and the option is not exercised due to the floor, the CEO will seek risk and will try to drive the share price above the exercise price; in such a case, he can gain profits from the shares by exercising it at cheap prices, and sell those shares at a high market price. Thus, the CEO has every intention to boost up the stock price and maximize the shareholders' value.

Likewise, most of their compensation being given as stock option might boost their risk-taking behavior because any possible losses on the shares held are capped due to the floor in a call option. Supported by Fortin et al. (2010), bank holding companies that pay their CEOs with high base salary take less risk, while banks that grant their CEOs more in stock options take more risk. They also found that banks with better managerial control and corporate governance mechanism take less risk. To extend this study, Chen et al. (2006) examined the relationship between stock options and bank risk taking, and suggested that shareholder interests are aligned with the CEO's interests when the CEO chooses to increase the bank's risk level to receive higher returns in their compensation.

The board of directors decide the level and structure of the compensation package. Therefore, the literature examines the role of corporate governance mechanism and the board of directors' characteristics in the banking industry. According to Andres & Vallelado (2008), board composition and board size have contribution to their ability to monitor and to advise the management. In that regard, the larger and sensible independent boards may lead to be more effective in term of monitoring and creating value. In their study, Yeh et al. (2011) investigated that financial institution performance has positive correlation with the number of independent directors on auditing and risk committees. Adams & Mehran (2012) measured the relationship between board size and bank performance and found that they are positively related due to the bank complexity. Nevertheless, the relationship has an inverse U shape. When the board size is bigger than seven or nine members, the value is destroyed. In addition, Erkens et al. (2012) stated during the crisis, the bigger independent boards and greater institutional ownership experience worsen stock returns for financial institution.

The study by Sukasih and Susilawati (2011) in Indonesia examined the corporate governance and the financial performance of companies listed in Indonesia. They found that an implementation of good corporate governance will reduce the cost of capital resulting in low cost production, thus ultimately increasing the investment. In relation to the company's stock price, it is conveyed that good corporate governance will also increase the Tobin's Q of the companies. Tobin's Q is calculated as the total market value of the firm divided by the total book value. Hence, the market value will be increased above the book value. Another study by Tjondro and Wilopo (2011) investigated the relationship between corporate governance and their profitability using 26 banks that were publicly listed on Indonesia's stock exchange in 2008 and showed that good corporate governance is significantly positively correlated to profitability in Indonesia.

2.2 Systemic Risk

The "too-big-to-fail" phenomenon, the deposit insurance system, and the shareholders-focused governance mechanism may lead banks to take excessive risk and generate significant negative externalities and systemic risk. Thus, banks are more heavily regulated when compared to non-financial institutions and other financial institutions. Under a lot of circumstances, the implication of high leverage creates a higher probability of failure and threatens the financial system (de Haan & Vlahu, 2016).

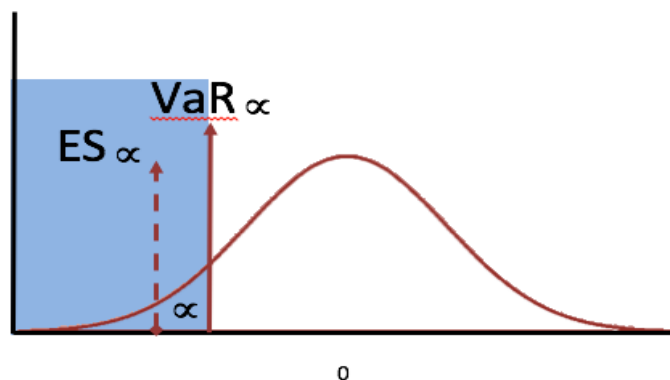
Systemic risk should be described as the bank's overall contribution to system wide failure, not in terms of the bank's failure per se (Acharya, Pedersen, Philippon, & Richardson, 2010). Good risk measures should present many aspects that define the importance of banking in the system. Systemic risk measurement should consider size, leverage, liquidity, interconnectedness, complexity, and substitutability (Benoit, Colletaz, Hurlin, & Perignon, 2013). There are two approaches to measure the risk contribution of banks to the system. The first approach uses information on position and risk exposures. That information can be gathered from bank balance sheet. It is confidential information and banks are obligatory to provide it to bank regulator. The second approach is to use public market data; such as stock return, option prices, or credit default swap spreads. Contrasting from balance sheet, this information is available for public (Benoit, Colletaz, Hurlin, & Perignon, 2013). According to Iqbal et al. (2015), the distinct between the measurement based on balance sheet numbers and market numbers are the time. Meaning, the first approach is a conservative and backward-looking framework, while the second approach provides more timely and modern assessment of systemic risk. As previously mentioned, researchers' attempts to create system risk measurements have been increasing in recent years.

One of the most celebrated risk measures, the Marginal Expected Shortfall (MES), proposed by Acharya et al. (2010) estimates losses in the tail of the system's total loss distribution, examining the 5% worst return days for the market. Moreover, the MES is able to predict the risk contribution of the bank to the system. On the other hand, other measurements of firm-level risk, such as VaR, expected loss, or volatility, have no explanatory power (Acharya, Pedersen, Philippon, & Richardson, 2010). A study by Derbali & Hallara (2016) investigated the systemic risk of European banks using the MES to rank banks based on their risk contribution level to the system and suggested that the systemic risk in European banks is very high.

Another research conducted by Raz et al. (2016) showed that in Indonesia, the MES is more applicable for systemic risk monitoring when compared to the CoVaR because the MES relatively predicted better *ex-post* losses. Additionally, the MES is coherent with the characteristics seen as bank fragility, such as a high dependency on wholesale funding, high investment in corporate loans, low profitability, and low quality of assets (Idier, Lame, & Mesonnier, 2014). In addition, the VaR and the MES are official academic quantitative risk measures of the Basel Committee on Banking Supervision (BCBS) (Chang, 2015).

Furthermore, the MES represents the extension of the VaR. Considering, the VaR gives no information on the potential loss once the confidence interval is exceeded, it become the main drawback of this measure. This problem can be solved by the MES as can be seen in Figure 1. In 2013, the BCBS replaced the VaR requirements by the MES requirements. The MES can handle the main flaw of this measure. Another disadvantage of the VaR is that it implicitly assumes that the distributions are approximately symmetric around the mean. Lastly, the MES is shown to be sub-additive, whereas the VaR is not¹. Nonetheless, it must be considered that first the VaR has to be calculated before the MES can be estimated.

Figure 1 VaR and MES



As seen in Figure 1, the VaR is the loss level that will not be more than a specified probability (α) and the MES is the expected loss, given that the loss is greater than the VaR level. In contrast, VaR tells how bad things can go, while MES explains the expected loss if things go bad.

In 2016, the framework of Indonesia's crisis management and resolution was renewed under the new Prevention and Resolution of Financial System Crisis Law (Undang – Undang Pencegahan dan Penanganan Krisis; PPKSK law). There are four members in the Financial System Stability Committee (Komite Stabilisasi Sistem Keuangan; KSSK); The Ministry of Finance (Kemenkeu), Central Bank of Indonesia (BI), Financial Services Authorities (OJK), and Indonesia Deposit Insurance Corporation (Lembaga Penjamin Simpanan; LPS).

They are in charge of performing a regular monitoring of the financial system, purchasing government bonds and bailing out insolvent banks. KSSK determines which banks are to be categorized as domestic systemically important banks (D-SIBs). The framework focuses on

¹ Artzner et al. (1997) provided an explanation for the lack of sub-additivity of the VaR.

the impact that bank insolvency will lead to externalities due to spill overs posed by an individual bank on other banks. To minimize the moral hazard, a law was made to state that only the big banks classified by the KSSK as D-SIBs can be bailed out by the government. According to the Basel Committee on Banking Supervision (2012), in principle D-SIBs should be addressed taking into consideration four aspects, namely size, interconnectedness, substitutability, and complexity.

First, The Bank of International Settlement (BIS) defines size as the total exposure or total assets of the banks. As large banks grow larger, they tend to be prone to more risk and participate more in market-based activities. They also create more systemic risk, because large banks more likely hold lower capital and less-stable funding (Laeven et al., 2014). Second is the interconnectedness of banks. As a bank is interconnected with other banks through their interbank activities, it is more likely to have a spill-over effect on other banks (BIS, 2011). Furthermore, Allen and Gale (2000) found that the contagion occurred because the low returns on loans commenced by one institution may hurt the returns on portfolios of connected institutions and increase the default probability of these financial institutions. Third is the bank's substitutability. Several banks hold such a position that they cannot be replaced by other banks. They are systemically important because other financial market participants and customers depend on them for the continued key services. The bigger a bank's role in specific business, the bigger the disruption anticipated in its failure. Last is the complexity of banks. Large and interconnected banks are more likely to contribute to a higher systemic concern when they get more complex. Moreover, complexity is usually related to the lack of transparency and difficulties in understanding the exposures of the bank. The more complex the business model of the bank, the larger the cost and time needed to settle the bank failure (APRA, 2013).

2.3 Corporate Governance and Systemic Risk

Before the crisis, academic papers regarding the corporate governance of banks was found to be rare. Supported by Adams and Mehran (2012), a lot of researches regarding board effectiveness excluded financial firms, which lead to limited information concerning the effectiveness of banking firm governance. Financial firm's risk management before the crisis and capital raising activities during the crisis were the outcome of boards and the shareholder's cost-benefit trade-off (Kashyap, Rajan, & Stein, 2008).

Banks can maximize their valuations by increasing leverage and risk, which may lead to dangerous problems if it is followed by an increasing probability of failure that raises systemic risk (Laeven, 2013). A study by Aebi et al. (2012) investigated whether risk management is related to corporate governance using corporate governance variables and risk governance variables. They stated that the existence of a risk-management governance mechanism, such as the Chief Risk Officer (CRO)'s presence and the CRO reporting procedure, is important. Hence, they showed that the reporting process of the CRO is important as the CEO and CRO may have contradicting interests. Additionally, they mentioned that the boards pushed banks to maximize their shareholder's wealth before the crisis, which turned out poorly. Another strand of literature studied the relation between bank risk-taking and bank size. It showed that large banks within Tier 1 categories with high capital level, high deposit level, and less unsafe funding (more retail funding than wholesale funding) performed better during the recent crisis (Beltratti & Stulz, 2010). Moreover, Anginer et al. (2014) found that competition encouraged banks to hold more diversified risk. Thus, banks are more resilient to a shock.

Another study by Andries & Mutu (2016) suggested that a stronger corporate governance mechanism and a shareholder-friendly supervisory board are positively correlated to provide higher contributions to systemic risk. As a traditional shareholder value maximization, the CEO of the bank could boost their profit margin by increasing their risk-taking behavior rather than reducing it. This is in line with the study by Chen et al. (2006), which found that the shareholders' interests are aligned with the CEO's interests when the CEO chooses to increase the bank's risk level to receive higher returns for his/her compensation. Hence, the contribution to the risk increases. Furthermore, Iqbal et al. (2015) investigated whether the systemic risk of financial institutions is affected by the corporate governance mechanism. They used the Marginal Expected Shortfall as the dependent variable for systemic risk measurement, and corporate governance index as the independent one.

This thesis differs from the previous studies by Iqbal et al. (2015), Andries and Mutu (2016) and Battaglia et al. (2014) in two aspects. First, the sample is divided into large and small banks' samples based on their total assets to obtain a better perspective of Indonesia's banking system. Second, the impact of ownership structure on systemic risk is also analyzed. This is in line with previous studies by Iqbal et al. (2015) and Andries and Mutu (2016), in which they also stated that stronger corporate governance and shareholder-friendly boards are

associated with higher levels of systemic risk. Excessive risk-taking behavior may prevail due to the nature of shareholder-value maximization.

In summary, these studies showed that shareholder-friendly corporate governance mechanism and shareholder value maximization may lead to excessive risk-taking. Therefore, this research can be done by empirically re-examining the previous study by Iqbal et al. (2015) on how strong corporate governance determined the level of systemic risk contribution in Indonesia. Thus, the hypothesis for this thesis is:

H1: Banks with stronger corporate governance mechanism are associated with higher level of systemic risk.

2.4 Literature Matrix

The following table 1 discusses literatures that are incorporated in this thesis.

Table 1 Literature matrix

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
Pearce & Zahra (1991)	To examine the relation between the CEOs power and board of directors with corporate performance	<ul style="list-style-type: none"> • 69 manufacturing firms and 70 service firms 	Multivariate analysis of variance	<ul style="list-style-type: none"> • Corporate performance: earning per share 	<ul style="list-style-type: none"> • CEO-board power • Board characteristics • Board process & style • Board decision style 	<ul style="list-style-type: none"> • The difference between each company's performance and its industry average divided by the industry average 	<ul style="list-style-type: none"> • Powerful boards were associated with great corporate financial performance.
Core, Holthausen, & Larcker (1999).	To investigate whether the compensation component rising from the board and ownership structure is associated with stock market performance	<ul style="list-style-type: none"> • Three-year period • 205 publicly traded US firms 	OLS regression	CEO compensation variables: total compensation, cash compensation, and salary	<ul style="list-style-type: none"> • Economic determinants; sales, return on assets, stock return • Board structure Ownership structure 		<ul style="list-style-type: none"> • CEOs got greater compensation when the governance structure were less effective • Firms with weaker governance structure had greater agency problems.
Bebchuk, Fried, & Walker (2002)	To study the role and significance of managerial power in executive compensation		Literature study				<ul style="list-style-type: none"> • The managerial power played a significant role in the design of executive compensation.
Carter <i>et al.</i> (2003)	To investigate the relationship between board diversity and firm	<ul style="list-style-type: none"> • 1997 • 797 firms 	2SLS regression	Firm value: Tobin's Q	<ul style="list-style-type: none"> • Board diversity is defined as the percentage of women, African 	<ul style="list-style-type: none"> • Board size • Number of meetings annually • CEO duality 	<ul style="list-style-type: none"> • There was a significant positive relationship between the fraction of women or minorities on

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
	value				<ul style="list-style-type: none"> American, Asians and Hispanics on the board of directors Presence of women or minorities 	<ul style="list-style-type: none"> Dummy indicating whether the directors receive stock compensation Insider ownership Firm size Return on assets Industry 	<p>the board with firm value</p> <ul style="list-style-type: none"> As the proportion of women and minorities increased, it increased proportionally to firm size and board size.
Adam, Almeida, & Ferreira (2005)	To study that the firms whose CEOs have more decision-making power should experience more performance variability	<ul style="list-style-type: none"> 1992–1999 336 firms 	Cross-sectional regression	Performance: standard deviation of stock returns, standard deviation of return on assets, and standard deviation of Tobin's Q	<ul style="list-style-type: none"> CEO as the founder CEO only insider CEO's concentration CEO ownership CEO tenure 	<ul style="list-style-type: none"> Firm size Firm age Number of segments Capital expenditure divided by sales 	<ul style="list-style-type: none"> Stock returns were more favorable for firms run by powerful CEOs.
Chen <i>et al.</i> (2006)	To investigate the relation between option-based executive compensation and market measures of risk	<ul style="list-style-type: none"> 1992–2000 68 banks 	OLS regression	<ul style="list-style-type: none"> Risk 	<ul style="list-style-type: none"> Accumulated option Option Ratio 	<ul style="list-style-type: none"> Total asset Capital ratio Non-interest income Growth rate Dividend yield Stock price Changes in shareholder wealth 	<ul style="list-style-type: none"> The structure of executive compensation induced risk-taking, and the stock of option-based wealth also induced risk-taking.
Caprio <i>et al.</i> (2007)	To examine the ownership structure of banks and shareholder protection laws on bank valuations	<ul style="list-style-type: none"> 2001 244 banks across 44 countries 	OLS regression	<ul style="list-style-type: none"> Market-to-book value of the equity Tobin's Q 	<ul style="list-style-type: none"> The cash flow Control rights of controlling shareholders Bank-specific trait 	<ul style="list-style-type: none"> Country-special characteristics: level of economic and institutional development, differences in legal system design, the 	<ul style="list-style-type: none"> The ownership structure was an important tool for governing banks. Larger cash-flow rights by the controlling owner boosted

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
						<p>level of corruption, and differences in deposit insurance policies</p> <ul style="list-style-type: none"> • Loan growth, the degree of state ownership of banks 	<p>valuation, weak shareholder protection laws, and lower bank valuations, and greater cash-flow rights mitigated the adverse effects of weak shareholder protection laws on banks valuations</p>
Andres & Vallelado (2008)	To examine the effectiveness of the board of directors in monitoring managers	<ul style="list-style-type: none"> • 1995–2005 • 69 large commercial banks from six developed countries 	OLS regression	Bank performance: market-to-book value ratio (Q)	<ul style="list-style-type: none"> • Board size • Outsiders • The number of meetings held each year 	<ul style="list-style-type: none"> • Differences in bank business structure: bank size (total asset) & ratio of loans to total assets at book value • Differences among countries in terms of regulation and regulator power: bank activity and ownership restrictiveness, official supervisory power, prompt corrective action and deposit insurance design • The size and concentration • Ownership • Level of protection of investors rights according to La Porta et al. (1998) 	The board composition and size were associated to the directors' ability to monitor management, and that larger and not excessively independent boards proved more efficient in monitoring and advising, and creating more value.

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
Laeven & Levine (2009)	To examine the risk taking behavior of banks, their ownership structures, and national bank regulations.	<ul style="list-style-type: none"> • 1996–2001 • 270 banks across 48 countries 	Multivariate OLS	For bank risk: using the z-score of each bank.	Ownership structure	<ul style="list-style-type: none"> • Country level: GDP, Capital regulations, activity restrictions, deposit insurance, shareholder protection rights, and the degree to law enforcement • Bank level: concentration, M&A activity, managerial ownership, large ownership on management board, revenue growth, size, loan loss provisions, and the liquidity ratio 	<ul style="list-style-type: none"> • Banks with powerful owner favor took a greater risk • The effect of bank regulations on bank risk relied upon their ownership structure
Pathan (2009)	To investigate the relevance of bank board structure on risk-taking	<ul style="list-style-type: none"> • 1997–2005 • 212 large US bank holding companies 	Generalized least square	<ul style="list-style-type: none"> • Bank risk: standard deviation of its daily stock return (total risk) and two index market models (idiosyncratic risk & systemic risk) 	<ul style="list-style-type: none"> • Board size • Percentage of total independent directors • A shareholders' restrictive rights index: staggered boards and poison pills • CEO power to capture CEO influence over bank board decisions (1 if CEO is also the board chair and if 	<ul style="list-style-type: none"> • Total asset • The present value of a bank's future economic profits when considered as a going concern • Leverage • Frequency of trading • Any previous M&A activity 	<ul style="list-style-type: none"> • Strong bank boards (boards reflecting more of bank shareholders interest) particularly small and less restrictive boards positively affected bank risk-taking • CEO power negatively affected bank risk-taking

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
Beltratti & Stulz (2010)	To investigate whether bank performance is related to bank-level governance	<ul style="list-style-type: none"> July 2007–December 2008 98 institutions 	Multivariate OLS regression	<ul style="list-style-type: none"> Buy-and-hold dollar returns 	<ul style="list-style-type: none"> internally-hired) Bank balance sheet and income characteristics Bank-level governance Country-level governance Country-level regulation 		<ul style="list-style-type: none"> Banks with more Tier 1 capital, more deposit, and more loans performed better. Banks with stronger capital supervision also performed better.
Rich Fortin <i>et al.</i> (2010)	To examine bank governance, share ownership, CEO compensation, and bank risk taking in the period leading to the current banking crisis	<ul style="list-style-type: none"> All variables are measured using data from 2005 except Risk_{t+1}, which is measured using data from 2006. 83 banks 	Multivariate OLS regression	<ul style="list-style-type: none"> Risk $t+1$: the standard deviation from a daily share returns (a measure of bank risk taking) for firm i at time $t+1$ 	<ul style="list-style-type: none"> Bank governance index Managerial ownership is the percentage of common shares owned by inside directors CEO compensation: salary, option and bonus 	<ul style="list-style-type: none"> Total assets Market-to-book ratio Equity-asset ratio 	<ul style="list-style-type: none"> Bank holding companies that paid CEOs high base salaries took less risk, while bank holding companies that granted CEOs more in stock options or that paid CEOs higher bonuses took more risk Bank holding companies with better managerial control, achieved through various corporate governance mechanism, took less risk.
Yeh <i>et al.</i> (2011)	To examine whether the performance is higher for	<ul style="list-style-type: none"> 2005–2008 20 largest financial institutions 	OLS regression	<ul style="list-style-type: none"> Financial institutions performance: Stock returns, 	<ul style="list-style-type: none"> Auditing independence Civil law Earning sources 	<ul style="list-style-type: none"> Total asset Equity ratio Current ratio Subsidiaries 	<ul style="list-style-type: none"> The performance of financial institutions with more independent directors on auditing

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
	financial institutions with more directors in different committees	from each of G8 countries		ROA, ROE	<ul style="list-style-type: none"> • Loan loss reserve 	<ul style="list-style-type: none"> • Ratio of the difference between interest income and interest paid to total assets • The level of ownership diversity index 	<p>and risk committees was higher</p> <ul style="list-style-type: none"> • The influence of committee independence on the performance was particularly stronger for civil law countries
Adams & Mehran (2012)	To investigate the relationship between board composition, size and bank performance—whether governance mechanism is ineffective	<ul style="list-style-type: none"> • 1986–1999 • 35 publicly bank holding companies 	OLS regression	Tobin's Q	<ul style="list-style-type: none"> • Board size • Fraction of outside directors • Fraction of non-insiders • Number committees • Percentage outside chair • Number board meetings • Meeting fee • Average other directorship for outsiders • Average other directorship for insiders • Interlock board • Percentage CEO ownership • Deferred compensation • Deferred stock 	<ul style="list-style-type: none"> • Firm size: total asset • Capital ratio • Volatility • Return on assets 	<ul style="list-style-type: none"> • Board independence was not related to performance • However, board size was positively related to performance
Aebi <i>et al.</i> (2012)	To examine whether risk	• July 1, 2007–	Multivariate	Bank performance	Corporate governance variables	• 18-month buy-	• Risk governance in

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
	management is related to corporate governance mechanism	December 31, 2009 <ul style="list-style-type: none"> • 372 banks 	OLS regression	<ul style="list-style-type: none"> • Buy-and-hold returns • Return on equity 	<ul style="list-style-type: none"> • CRO in executive • Risk committee • Board size • Board independence • Percentage of director with experience as an executive officer in a bank or insurance company Risk governance variables <ul style="list-style-type: none"> • Number of meetings of risk committee • Number of directors in risk committee • The percentage of independent directors in the risk committee • CRO reports to board • CRO reports to CEO 	<ul style="list-style-type: none"> • and-hold returns over the time period of July 1, 2005 to December 31, 2006 (lagged) • Market-to-book ratio • Total asset • Tier 1 capital to total risk-weighted assets • Ratio of deposits to total assets • Loans to total assets • Income diversity 	<ul style="list-style-type: none"> • general and the reporting line of the CRO in particular were important to the banks' crisis performance as the CEO and CRO may have conflicting interests • Banks were pushed by their boards to maximize shareholder wealth before the crisis and took risks that were understood to create wealth but later turned out poorly in the credit crisis
Erkens <i>et al.</i> (2012)	To examine how corporate governance affected the bank performance during crisis	<ul style="list-style-type: none"> • 296 financial firms from 30 countries 	OLS regression	Firm performance (buy-and-hold stock returns measured from the first quarter of 2007–the third quarter of 2008)	<ul style="list-style-type: none"> • Board independence • Institutional ownership • Large shareholders 	<ul style="list-style-type: none"> • Firm size: logarithm of total assets • Leverage • ADR (indicating whether a firm is cross-listed on U.S) 	<ul style="list-style-type: none"> • Financial institutions with bigger independent boards and greater institutional ownership experienced worse stock returns during the crisis period

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
	period					<ul style="list-style-type: none"> stock exchanges) • Buy-and-hold stock returns from January 2006–December 2006 • Firm’s industry membership • Firm’s country of incorporation 	
Anginer <i>et al.</i> (2013)	<ul style="list-style-type: none"> • To analyze the relationship between competition and systemic risk as well as the correlation in the risk-taking behavior of banks. 	<ul style="list-style-type: none"> • 1997–2009 • 1872 publicly banks in 63 countries 	Fixed-effects panel regression	Systemic risk measure (Merton)	Competition measures (Lerner index)	<ul style="list-style-type: none"> • Total asset • Non-deposit funding • Return on assets • Market-to-book ratio • Non-interest income share • GDP per capita • Provisions • Trade • Private credit • Number of banks 	<ul style="list-style-type: none"> • Competition boosted banks to hold more diversified risks, hence the banks were more resilient to shocks. • Banking systems were less resilient in countries with weak supervision and private monitoring, bigger government ownership of banks, and with policies that restrained competition.
Iqbal <i>et al.</i> (2015)	To test whether the systemic risk of financial institutions is affected by the strength of corporate governance mechanism.	<ul style="list-style-type: none"> • 2005–2010 • 71 large publicly traded U.S financial institutions 	Fixed-effects panel regression	Systemic risk: MES & SRISK	Corporate governance quotient index (audit committees, board of director, bylaws, education, compensation, ownership, progressive practices, and state of incorporation)	<ul style="list-style-type: none"> • Firm size • Capital ratio • Return on assets • Loans-to-assets • Loan growth • Deposit-to-assets • Non-interest income 	<ul style="list-style-type: none"> • A stronger corporate governance mechanism and more shareholder-friendly boards were correlated with higher levels of systemic risk. • Good corporate governance may lead to an excessive risk-taking in the financial sector.
Andries &	To test the effect	<ul style="list-style-type: none"> • 2005Q1– 	Pooled OLS	<ul style="list-style-type: none"> • Each bank’s 	<ul style="list-style-type: none"> • Banks’ governance 	<ul style="list-style-type: none"> • Bank level control: 	<ul style="list-style-type: none"> • A stronger corporate

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
Mutu (2016)	of governance on systemic risk.	2012Q4 <ul style="list-style-type: none"> • 27 banks in 10 CEE countries 	regression	contribution to systemic risk	policies: <ul style="list-style-type: none"> • Risk Management Index (CRO present, CRO executive, risk committee, and risk committee reports to board) • Supervisory Board Index (board size, board expertise, board independence and board foreign) • Corporate governance index by taking the first principal component of the eight supervisory boards and risk management variables 	<ul style="list-style-type: none"> • Bank size • Capital structure • Liquidity ratio • Foreign ownership 	<p>governance mechanism and shareholder-friendly supervisory boards were positively correlated to bigger contributions to systemic risk.</p> <ul style="list-style-type: none"> • A solid risk management structure had an evident effect in decreasing systemic risk for banks operating in countries with rigid a strict capital regulation. • A solid supervisory board structure had a limited positive impact to reduce banks' systemic contribution for banks whose countries represented a high supervisory level.
Derbali & Hallara (2016)	To measure the systemic risk of European banks using the MES and rank based on their contribution	<ul style="list-style-type: none"> • Jan 2006– Dec 2012 • 281 European financial 	DECO-GARCH to estimate the correlation between the return of each bank and the return of their financial				<ul style="list-style-type: none"> • Systemic risk supported by European banks was very high • The risk contribution of banking system was very important as a result of the strong correlation between institutions' returns and

Author (publication)	Research Question(s)	Sample Period	Methodology	Dependent variable	Independent variable	Control variable	Result
			system				market returns.
Onali <i>et al.</i> (2016)	To examine the role of CEO power and government monitoring on bank dividend policy	<ul style="list-style-type: none"> • 2005–2013 • 109 European listed banks 	2SLS regression	Payout ratio	<ul style="list-style-type: none"> • Performance: market-to-book ratio and Tobin's Q • CEO power: CEO ownership, CEO turnover and unforced turnover of CEO • Larger ownership stakes • Government ownership 	<ul style="list-style-type: none"> • Board size • Standard deviation of monthly stock returns • Size 	<ul style="list-style-type: none"> • CEO power had negative relationship with dividend payout ratio • Stronger internal monitoring increases performance • Government ownership also decreased payout ratio
Raz <i>et al.</i> (2016)	To test the implementation of systemic risk measurements	<ul style="list-style-type: none"> • 2008– 2015 • 15 Indonesian banks 	OLS regression	Systemic risk measurement: MES and CoVaR	<ul style="list-style-type: none"> • Market risk variables: VaR & Beta Risk -> estimated using the CAPM • Bank balance-sheet variables: leverage, maturity mismatch, NPL ratio, and capital position. • Macroeconomics risk: GDP, inflation rate, and IDR depreciation (to USD) 		<ul style="list-style-type: none"> • MES was more applicable for systemic risk monitoring compared to CoVaR, due to its relatively better <i>ex-post</i> losses' predictability power.

Chapter 3: Data and Methodology

This chapter presents the sample selection, data construction, as well as variable definition and measurement. Section 3.1 discusses the data used and elaborates steps on gathering and merging the data. In section 3.2, the methodology is discussed. Lastly, in section 3.3, the description and measurement of all dependent, independent, and control variables are provided.

3.1 Data

After the Asian crisis, the Central Bank of Indonesia realized the importance of soundness, and thus, Indonesia's banking system implemented the measurement for bank health based on their capital, asset, management, earnings, liquidity, and sensitivity to market risk. Further, BI revised the measurement of risk-based bank rating in 2011. This study focuses on the period after the implementation of the new risk-based rating measurement. This methodology is based on a risk-based approach, which includes risk profile assessment, good corporate governance assessment, earnings assessment, and capital assessment to ensure the soundness of Indonesia's banking system (Bank Indonesia, 2011).

This thesis solely focuses on one factor from the risk-based bank rating, which is good corporate governance. Consequently, this study's time period runs from 2011 to 2016. To study the relationship between corporate governance and systemic risk, a daily stock return from Bloomberg for systemic risk measurement is needed. First, it was started by the collection of all the banks that was listed on the Indonesia Stock Exchange; however, several banks stocks were inactive stock. To calculate the MES, inactive stock was excluded because it did not represent the financial condition of the bank. Finally, it was found that there are 26 banks that are actively listed on the Indonesia Stock Exchange. Indonesia's banking system may not be highly concentrated, but it includes large state-owned commercial banks.

In Indonesia, it takes a few more than 20 banks to account for 80 percent of Indonesia's financial market share (International Monetary Fund, 2017). For other data, the corporate governance index data (GCG index) from Indonesia's Financial Services Authority (OJK) and the balance-sheet numbers from the Central Bank of Indonesia were collected. In addition, board characteristics' data from each bank's annual report were also hand-collected for in-depth analysis on board characteristics in terms of corporate governance mechanism.

All those data, except for daily stock returns and board characteristics, are confidential data from the Central Bank of Indonesia. In conclusion, the final sample of 26 listed banks and balanced panel dataset consists of 156 observations.

3.2 Methodology

This section discusses the methodology and regression models in this thesis. In accordance with the purpose of this thesis, 26 banks were gathered for the cross-section data and to examine the relationship of systemic risk and corporate governance mechanisms periodically, for which a time series data is needed ranging from 2011 to 2016. Panel data is more likely to create more informative data, more degrees of freedom, and hence, it improves the efficiency of the estimations, and reduces collinearity (Gujarati, 2004). Therefore, panel data regression is necessary to test the hypothesis empirically.

Furthermore, to give better perspectives, the bank sample was separated based on their total asset as stated on the BCBS principles (Basel Committee on Banking Supervision, 2012), where assets is one of the principles for Domestic Systemically Important Banks (D-SIBs), although there are some variations across these jurisdictions in the additional requirements and policy measures applied to categorized D-SIBs.

An endogeneity problem arises when a corporate finance is examined empirically to observe the causes and the effects of a decision. Roberts and Whited (2011) stated that “endogeneity may lead to biased and inconsistent parameter estimates that make reliable inference virtually impossible.” Moreover, Larcker and Rusticus (2010) argued that corporate governance studies face endogeneity problems. It is hard to specify which of the parameter significantly estimates the influence on the dependent variable because, often, there is uncertainty whether the causation is actually reversed or if corporate governance is one of the underlying unobservable factors (Wintoki, Linck, & Netter, 2012).

Therefore, the estimates from the bank-level regressions are preferred since the initial regressions’ estimates are jointly determined with governance, which can cause potentially biased estimates. This method could minimize the endogeneity concern that both bank characteristics and systemic risk can be driven by omitting bank-level variables (Iqbal et al., 2015). Though, to fully remove any endogeneity concern, one would ideally need to conduct Instrumental Variables (IV) estimation. However, IV estimation would need proper instruments, which are not always available in the Indonesian banking sector.

The association between corporate governance and systemic risk was investigated by estimating a fixed effects panel regression. The initial regression model for testing the hypothesis is as follows:

$$\text{Systemic Risk} = \alpha + \beta_1 \text{Governance_index}_{it} + \beta_2 \text{Foreign ownership}_{it} + \beta_3 \text{Government ownership}_{it} + \beta_4 \text{Size}_{it} + \beta_5 \text{Profitability}_{it} + \text{IndustryFE} + \varepsilon$$

where	<i>Systemic Risk</i>	= measured by Marginal Expected Shortfall,
	α	= intercept,
	$\beta_1 \text{Governance_index}_{it}$	= GCG index measured by OJK,
	$\beta_2 \text{Foreign ownership}_{it}$	= the total percentage of foreign ownership,
	$\beta_3 \text{Government ownership}_{it}$	= the total percentage of government ownership,
	$\beta_4 \text{Size}_{it}$	= log natural of total assets,
	$\beta_5 \text{Profitability}_{it}$	= return on assets,
	<i>IndustryFE</i>	= bank fixed-effects,
	ε	= error-terms.

Although several measurements for corporate governance mechanism such as board characteristics have been used, this thesis also investigates board characteristics as corporate governance mechanisms in Indonesia. Thus, board size and board independence are proxies for the board characteristics that are used in this thesis. An in-depth analysis of the board characteristics in terms of corporate governance mechanism is needed to examine whether the board characteristics determine systemic risk. The regression model is as follows:

$$\text{Systemic Risk} = \alpha + \beta_1 \text{Board Size}_{it} + \beta_2 \text{Board Independence}_{it} + \beta_3 \text{Foreign ownership}_{it} + \beta_4 \text{Government ownership}_{it} + \beta_5 \text{Size}_{it} + \beta_6 \text{Profitability}_{it} + \text{IndustryFE} + \varepsilon$$

where	<i>Systemic Risk</i>	= measured by Marginal Expected Shortfall,
	α	= intercept,
	$\beta_1 \text{Board Size}_{it}$	= the total number of board members,
	$\beta_2 \text{Board Independence}_{it}$	= the total number of independent board members,
	$\beta_3 \text{Foreign ownership}_{it}$	= the total percentage of foreign ownership,
	$\beta_4 \text{Government ownership}_{it}$	= the total percentage of government ownership,
	$\beta_5 \text{Size}_{it}$	= log natural of total assets,
	$\beta_6 \text{Profitability}_{it}$	= return on assets,
	<i>IndustryFE</i>	= bank fixed-effects,
	ε	= error-terms.

3.3 Variables description and measurement

The following sections discuss the definition and measurement of all variables used in this study. The dependent variables are explained first, followed by the independent and control variables.

3.3.1 Dependent variable

The dependent variable in this study is the Marginal Expected Shortfall (MES). The systemic risk indicator was developed by Acharya et al. (2010) to measure the contribution of systemic risk from each bank to the overall banking sector. Based on Acharya et al. (2010), the Value-at-Risk (VaR) and the Expected Shortfall (ES) were applied as a proxy measurement for the expected loss in crisis.

Expected Shortfall (ES) is the estimated loss when the system performs at or below the VaR level, which is notated as:

$$ES_{\alpha} = -E[R|R \leq -VaR_{\alpha}] \quad (1)$$

Where, $\alpha = 5\%$

As noted from equation 1, the expected shortfall is the average returns on days when the market losses exceed its VaR limit. Starting with the Expected Shortfall measurement and by considering all the banking system, Acharya et al. (2010) computed the Marginal Expected Shortfall. To elaborate the group's return, R , to the total of each group's return, r_i , which is, $R = \sum y_i r_i$, where y_i , is the weight of group i in terms of total market capitalization.

$$ES_{\alpha} = -\sum y_i E[r_i | R \leq -VaR_{\alpha}] \quad (2)$$

From equation 2, we can differentiate the overall risk to y_i , to each group i , thus:

$$\frac{\partial ES_{\alpha}}{\partial y_i r_i} = -E[r_i | R \leq -VaR_{\alpha}] \equiv MES_{\alpha}^i \quad (3)$$

Where, r_i is the return of the group i , $\alpha = 5\%$ and MES_{α}^i is group i 's Marginal Expected Shortfall to measure how group i 's risk-taking adds to the overall risk. In other words, the MES can be measured by estimating group i 's losses when the market is doing poorly.

The Marginal Expected Shortfall (MES) is calculated for every sample of banks with daily frequency from January 4, 2011 to December 30, 2016. It is defined as the losses in the 5% left tail of the aggregate shock of the market portfolio. Hence, by forming a portfolio of 26 selected banks, the equal-weighted return is estimated based on the daily log return for the

portfolio, and then, it concluded the worst 5% days. As a proxy of the market portfolio, LQ45 is considered, since it suitably represents the overall Indonesia market. Thus, the MES of stock return for each bank could be calculated as follows:

$$MES_{5\%}^{bank\ i} = \frac{1}{\#\ days} \sum_{t:bank\ system\ in\ its\ 5\% \ tail} R_t^i \quad (4)$$

Where, R_t^i is the log return of firm i at time t.

3.3.2 Independent Variables

The independent variables used in this thesis are corporate governance index, foreign ownership, and government ownership. First, the corporate governance index is issued by Indonesia Financial Services Authorities (OJK) as the supervisory agency for Indonesia's Financial Services. Indonesia's Financial Services Authority understands that after the global financial crisis, it is critical to appreciate the soundness of banks. They have an annual assessment that includes assessment of the risk profile, the implementation of the good corporate governance (GCG), profitability, and capital. The GCG index is an assessment of bank management on the implementation of the GCG principles with reference to prevailing OJK regulation concerning the GCG Implementation for Commercial Banks. The assessment should be comprehensive, structured, and integrated into three main aspects of governance: governance structure, governance process, and governance outcome as a continuous process. The assessment refers to 11 factors on the role of the board of directors, the role of the board of commissioners, the completion and implementation of board committee, management conflict of interest, compliance implementation, external audit, internal audit, the implementation of risk management including the internal control system, financial transparency, bank's strategic plan, and provision of funds to related parties and large exposures (Bank Indonesia, 2013). To define the GCG index, OJK, as the supervisor, analyses the implementation of the GCG principles based on bank self-assessment that banks report to OJK every year. Then, OJK evaluates whether the principles are integrated with the three aspects of governance, namely, governance structure, process, and outcome. Furthermore, the GCG should correspond to the OJK law number 55/POJK.03/2016 regarding the implementation of good corporate governance for conventional bank. This thesis gathered the GCG index for 26 banks for every individual year from 2011 until 2016. However, the individual bank self-assessment report could not be compiled due to confidentiality terms of OJK. Consequently, the GCG index data used in this thesis, only the final score index has been issued by OJK as the financial authority.

The GCG index is divided to 5 (five) scales namely 1, 2, 3, 4, and 5. The smaller GCG index order reflects the better implementation of the GCG in the bank. Thus, 1 indicates the best GCG and 5 is the worst GCG.

Table 2. GCG Index

Criteria	Rating Scale
1	Excellent
2	Good
3	Fair
4	Bad
5	Poor

Source: OJK law number 55/POJK.03/2016

Ownership is one of the important aspects of corporate governance mechanism. Hence, this thesis implements foreign ownership percentage and government ownership percentage to measure the effect of ownership on systemic risk. This foreign ownership percentage is obtained from the bank's annual report. It is the total percentage of shares held by foreign investors (private or institutions) over the total shares. Thus, it reflects the degree of control owned by foreign parties. In addition, government ownership is also gathered from individual bank reports. It is the total percentage of shares held by the government over the total shares.

In order to produce an in-depth analysis, the board characteristics are used as independent variables. The proxies for board characteristics are the board size and the board independence. The board size is measured as the total number of directors serving in the board at the end of the year. The board independence is the number of independent directors on the bank's board. It is measured as the number of total independent directors serving in the board at the end of the year. This measurement has been implemented in the former studies by Pearce and Zahra (1991), Adams and Mehran (2012) and Aebi et al. (2012).

3.3.3 Control Variables

This study involves several control variables. Brunnermeier et al. (2012) studied bank risk-taking behavior literature, which found that larger banks are associated with higher systemic risk, thus, the size is calculated by the natural logarithm of total assets. Furthermore, to

measure the bank performance, return on asset is used as the ratio of net income to total asset as the proxy for profitability (Adams and Mehran, 2012).

Chapter 4: Results

This chapter discusses the empirical results from the panel data regression. First, in section 4.1, the descriptive statistics of the Marginal Expected Shortfall (MES) as the dependent variable, independent variables, and control variables are provided. Second, the section 4.2 presents the correlation analysis of all independent and control variables. Last, section 4.3 displays the analysis of regression results from testing the formulated hypothesis.

4.1 Descriptive Statistics

The descriptive statistics of 26 publicly listed banks in 2011–2016 for variables used in the empirical results is presented in table 3. As noted in the table, the sample varies in terms of systemic risk across banks. It shows that the MES ranges from the minimum value of -0.0624 to the maximum of 0.0244 with the mean value of -0.017. It indicates that in Indonesia, systemic risk measured by the MES is relatively low. This supports the finding from the International Monetary Fund (2017) that in Indonesia, systemic risk is low, and the banking system is resilient to a severe shock. If a bank has a high MES, its equity capital will become worse during the crisis, and therefore, the banks will be in danger of default.

Table 3. Descriptive statistic for all banks

Variable	Mean	Median	Min.	Max.	No. Obs.	St. Dev.
Dependent variable						
Marginal Expected Shortfall	-0.0185	-0.0170	-0.0624	0.0244	156	0.017
Independent Variables						
GCG Index	2.284	2	1	4	156	0.588
Foreign ownership (%)	33.97	26.04	0	97.29	156	31.29
Government ownership (%)	16.92	0	0	100	156	30.64
Board size	5.481	5	2	10	156	1.954
Independent board	3.038	3	2	5	156	0.915
Control Variables						
Size	31.62	31.84	28.72	34.51	156	1.543
Profitability	1.717	1.791	-9.857	5.166	156	1.824

The table reports the descriptive statistics for the total sample. The sample consists of 26 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock, given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

In addition to the corporate governance measures, the sample is homogeneous as the GCG index ranges only between 1 and 5, which represents the score of their governance mechanism. As seen in table 3, the mean value of the GCG index is 2.284 with the maximum value of 4. Hence, there is no bank in Indonesia having the worst GCG score, which is 5.

For small banks and large banks samples, the descriptive statistics are presented in tables 4 and 5, respectively. It was discovered that board sizes in small banks are relatively smaller than large banks (see table 5) with the average of 4 members for small banks and 6 members for large banks. However, the maximum number of independent directors in small banks and large banks are the same as the maximum of 5 independent director members. In Indonesia, there is a law stated that every bank should have at least 50 percent of independent directors from the total members of the board of directors².

Based on tables 4 and 5, the MES for large banks are slightly higher than small banks, with the mean value of -0.024. It corresponds to the previous literature that a larger bank is associated to higher systemic risk (Laeven et al., 2014). The other corporate governance mechanism incorporated in this thesis are foreign ownership and government ownership. As noted in table 5, the percentage of foreign ownership in large banks are relatively high with the mean of 43.15% with the maximum value of 97.29%. However, the government ownership in small banks is slightly higher with the maximum value of 100% (see table 4). It shows that there is a bank (in the sample) that is fully controlled by the government. Moreover, the bank size was normalized through the calculation of the natural logarithm of the total assets. The variation of size with the amount of total assets varies from 28.717 to 31.841 with an average of 31.621. The return on assets (ROA) as the proxy of profitability has a mean value of 1.7176, with a minimum and maximum nearly -10 and 5, respectively. It can be further noted that since Indonesian banks are heavily regulated, it makes the sample homogeneous.

² OJK law number 55/POJK.03/2016 regarding the implementation of good corporate governance for conventional bank.

Table 4. Descriptive statistic for small banks

Variable	Mean	Median	Min.	Max.	No. Obs.	St. Dev.
Dependent variable						
Marginal Expected Shortfall	-0.013	-0.0121	-0.0624	0.0245	84	0.016
Independent Variables						
GCG Index	2.482	2	2	4	84	0.570
Foreign ownership (%)	26.09	15.13	0	82.59	84	28.50
Government ownership (%)	14.34	0	0	100	84	32.37
Board size	4.417	4	2	9	84	1.416
Independent board	2.631	2	2	5	84	0.757
Control Variables						
Size	30.46	30.46	28.71	32.23	84	0.980
Profitability	1.217	1.5	-9.857	4.711	84	1.986

The table reports the descriptive statistics for the small bank sample. The sample consists of 14 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

Table 5. Descriptive statistics for large banks

Variable	Mean	Median	Min	Max	No. Obs	St. Dev
Dependent variable						
Marginal Expected Shortfall	-0.024	-0.025	-0.059	0.012	72	0.016
Independent Variables						
GCG Index	2.055	2	1	4	72	0.527
Foreign ownership (%)	43.15	32.73	0	97.29	72	32.08
Government ownership (%)	19.92	0	0	71.91	72	28.42
Board size	6.723	7	3	10	72	1.754
Independent board	3.513	4	2	5	72	0.855
Control Variables						
Size	32.98	32.73	31.73	34.50	72	0.774
Profitability	2.301	1.954	-4.886	5.166	72	1.418

The table reports the descriptive statistics for the large bank sample. The sample consists of 12 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock, given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

4.2 Correlations Analysis

This section discusses the relations between all independent and control variables used in the regression models. Table 6 presents the correlation matrix between independent and control variables for all bank samples, comprising the Pearson correlation coefficients as measured by Stata.

Table 6. Correlations of all banks

	GCG Index	Foreign ownership	Government ownership	Size	Profitability
GCG Index	1.000				
Foreign ownership	-0.181*	1.000			
Government ownership	0.051	-0.351*	1.000		
Size	-0.496*	0.215*	0.248*	1.000	
Profitability	-0.418*	-0.021	0.193*	0.478*	1.000

The table reports the Pearson correlation for the total sample. The sample consists of 26 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock, given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets. * Significant at 5% significance level.

Table 7. Correlations of small banks

	GCG Index	Foreign ownership	Government ownership	Size	Profitability
GCG Index	1.000				
Foreign ownership	0.027	1.000			
Government ownership	-0.004	-0.410*	1.000		
Size	-0.331*	0.054	0.148	1.000	
Profitability	-0.424*	-0.009	0.057	0.362*	1.000

The table reports the Pearson correlation for the small bank sample. The sample consists of 14 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets. * Significant at 5% significance level.

The significance of the coefficient of correlation are provided in the table 6, 7 and 8. The superscript (*) indicates that the correlation is significant at 5% significance level. As indicated in tables 7 and 8, the correlation of variables between the large banks' sample are higher compared to the small banks' sample. It shows that large banks gained benefit from economies of scale and it effects their business models. Moreover, the sample group based on

specific criteria, namely assets, suggests that the variation in their independent variables is smaller. Hence, the correlations for large banks is higher than the correlations of small banks.

Table 8. Correlations of large banks

	GCG Index	Foreign ownership	Government ownership	Size	Profitability
GCG Index	1.000				
Foreign ownership	-0.215	1.000			
Government ownership	0.221	-0.377*	1.000		
Size	-0.442*	0.103	0.566*	1.000	
Profitability	-0.224	-0.265*	0.394*	0.562*	1.000

The table shows the Pearson correlation for the large bank sample. The sample consists of 12 banks that are publicly listed on the Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets. * Significant at 5% significance level.

For most variables, the correlation coefficients do not exceed 0.50. The highest correlation is found between size and government ownership for large bank sample, which amounts to 0.566 in table 8. Hence, there is no perfect collinearity among the variables used in the regression since the correlation coefficients are relatively low.

4.3 Results Analysis

This section presents the analysis of the main regression results in testing the formulated hypothesis. Several regression models are constructed to provide better perspectives regarding systemic risk and corporate governance in Indonesia, which carry the three groups of the sample: large banks, small banks and all banks. The regression result tables for performing regressions using Stata are also provided in this section.

4.3.1 GCG Index and MES for all banks

Table 9 reports the regression result of the relationship between corporate governance and systemic risk. The dependent variable is the systemic risk measured by the MES. Homoscedasticity is one of the critical assumptions to be controlled during analysis; according to Wooldridge (2012), the assumption is valid when the error in the model has the same variance. Hence, the robust option is performed to control heteroscedasticity by adjusting the standard errors to several clusters on the panel data (Torres-Reyna, 2014). As seen in table 9, the coefficient of the GCG index in models 1, 2 and 3 are negatively and statistically significant at 5% significance level. Additionally, the government ownership is

also positively and statistically significant at 10% significance level. It indicates that banks with large government ownership are associated with higher systemic risk. This supports the findings by Dong et al. (2014), who analyzed the association between type of ownership in Chinese bank and found that banks controlled by state-owned or government have the tendency to take more risks compared to private banks. Furthermore, the R-squared for models 1, 2, and 3 are 3.3%, 3.4% and 4.4%, respectively. Meanwhile, the adjusted R-squared are 2.6%, 2.1%, and 3.2%, respectively. It suggests that the explanation of model variabilities are relatively low.

In models 4, 5, and 6 the coefficients of the GCG index are positive, but statistically insignificant at any level in every model. Thus, adding control variables such as size and profitability changed the coefficients sign of the GCG index and increases the R-squared and the adjusted R-squared. It indicates that in Indonesia, size and profitability are better factors to determine systemic risk than the GCG index in these models. In addition, the foreign ownership is statistically insignificant at any level in every model. Nevertheless, the positive sign of the coefficient of foreign ownership, as expected, suggested that banks with large foreign ownership may contribute to higher systemic risk. It implies that higher riskiness of foreign ownership may be caused by the information disadvantage faced by foreign banks as well as agency problems among conglomerates (Jeon et al., 2016). However, the result not statistically significant. Hence, no clear conclusion can be made.

The proposed hypothesis in this thesis is that banks with stronger corporate governance mechanism are associated with higher levels of systemic risk. To the extent, a decrease of the GCG index means that stronger corporate governance mechanism leads to higher systemic risk. Hence, this result accepts the proposed hypothesis in models 1, 2, and 3 (see table 9). A strong corporate governance may lead to exaggerated risk-taking behavior in the nature of maximisation of shareholder value in order to increase shareholders' wealth. In addition, the negative signs for the GCG index and the MES suggests that the implementation of corporate governance mechanism in Indonesia has not been ideal yet. Moreover, size is statistically significant at 1% significance level in every model. It suggests that the larger bank is more associated with higher systemic risk (Brunnermeier, Dong, & Palia, 2012). Additionally, this indicates that in Indonesia, bank size seems to highly determine a systemic risk. Nevertheless, Indonesia's systemic risk is not only caused by the corporate governance mechanism and bank size, but also by other factors such as macro (e.g. GDP growth of

Indonesia) and micro conditions (e.g. costs at banks, interest and fee income of banks, competition between banks) and global impact (e.g. Rupiah US dollar exchange rate). Furthermore, the profitability is positive, but not statistically significant at any significance level. Profitable banks may have higher risk-taking incentives because these banks have more advantages to borrow and therefore, accumulate more risks. Hereinafter, this thesis divides the sample into large and small banks based on their assets under management to provide a better perspective of corporate governance in Indonesia's banking system.

Table 9. GCG Index and MES for all banks

VARIABLES	Dependent Variable: MES					
	(1)	(2)	(3)	(4)	(5)	(6)
GCGINDEX	-0.0055**	-0.0053**	-0.006**	0.0008	0.0005	0.0006
	(0.0024)	(0.0024)	(0.0027)	(0.0028)	(0.0028)	(0.0028)
Foreign Ownership		5.05E-05		7.49E-05		0.00006
		(0.0001)		(0.0001)		(0.00007)
Government Ownership			0.0003*		0.0004	0.0004
			(0.0018)		(0.0002)	(0.0002)
Size				0.0193***	0.0197***	0.0196***
				(0.0053)	(0.0054)	(0.0054)
Profitability				0.00007	0.0008	0.0009
				(0.0008)	(0.0011)	(0.0011)
Constant	-0.0060	-0.0080	-0.010**	-0.632***	-0.652***	-0.652***
	(0.0055)	(0.0070)	(0.0049)	(0.172)	(0.174)	(0.174)
Observations	155	155	155	155	155	155
R-squared	0.033	0.034	0.044	0.210	0.222	0.223
Adj R-squared	0.026	0.021	0.032	0.189	0.201	0.196
Bank FE	YES	YES	YES	YES	YES	YES
Number of bankid	26	26	26	26	26	26

Note: Robust standard errors are in parentheses. *** p<0.01; ** p<0.05; *p<0.1

The sample consists of 26 banks that publicly listed in Indonesia Stock Exchange. Systemic risk measured with the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

4.3.2 GCG Index and MES for small banks

Table 10 reports the regression results for 14 small banks. In models 1, 2, and 3, the GCG index is negative and statistically significant at 5% significance level. These imply that banks

with stronger corporate governance mechanism are associated with higher levels of systemic risk. The coefficient of 0.0073 in model 2 indicates that, on average, one point decrease in the GCG index means stronger corporate governance mechanisms, which will lead to a 0.0073 percent increase in the bank's MES or higher systemic risk. This result supports the findings of Andries and Mutu (2016), and Iqbal et al. (2015), who discovered a negative correlation between a better corporate governance mechanism and systemic risk.

However, the R-squared of this model is 0.067, indicating that this model could only explain 6.7% of the variability of the data. Meanwhile, the adjusted R-squared is 2.6%. As shown in models 4, 5, and 6 in Indonesia, the GCG index is not statistically significant at any significance level. Thus, this result accepts the proposed hypothesis. A stronger corporate governance tends to increase the risk-taking behavior to maximise the shareholder value to increase the shareholder's wealth. The main objective of corporate governance mechanism is to minimize the chance of moral hazard to protect the shareholder's interest. However, in terms of the banking industry, the results indicate that the corporate governance mechanism cannot hold the excessive risk-taking behavior.

Afterwards, the coefficient of foreign ownership is positive, but statistically insignificant at any level in all models. Jeon et al. (2016), who investigated the effect of foreign ownership on risk taking in emerging countries, discovered that foreign-owned banks are positively associated with risk-taking. They suggested that the disadvantages of large foreign ownership attribute to higher risk through the disparity between home and host market, such as economic growth, market competition, and regulation differences. Yet, no definite conclusion can be deduced from the regression result. As reported in models 3, 5 and 6 (see table 10), government ownership is positive and statistically significant in 1%, 10% and 10% significance level. The coefficient of 0.0005 in model 3 indicates that, on average, one percent increase in the government ownership will lead to 0.0005 percent higher systemic risk. This result supports Srairi (2013), who investigated the relationship between ownership structure and risk-taking behavior in MENA countries and found that state-owned banks have higher volume of non-performing loans, thus, higher credit risk. Additionally, Berger et al. (2005) and Ionnotta et al. (2007) reported that the association between government ownership and risk is positively significant. These studies stated that state-owned banks have a poorer quality of loan than private banks. Thus, it increases their risk.

Table 10. GCG Index and MES for small banks

VARIABLES	Dependent Variable: MES					
	(1)	(2)	(3)	(4)	(5)	(6)
GCGINDEX	-0.0075**	-0.0073**	-0.0088**	-0.0029	-0.003	-0.0028
	(0.0033)	(0.0024)	(0.0035)	(0.0042)	(0.0042)	(0.0043)
Foreign Ownership		4.03E-05		0.000008		0.00005
		(0.0001)		(0.00007)		(0.00006)
Government Ownership			0.0005***		0.0004*	0.0004*
			(0.0001)		(0.0002)	(0.0025)
Size				0.0144**	0.0147**	0.0146**
				(0.0058)	(0.0058)	(0.0058)
Profitability				-0.0012	0.00008	0.0002
				(0.0009)	(0.0018)	(0.0018)
Constant	0.0054	0.004	0.001	-0.442**	-0.461**	-0.461**
	(0.008)	(0.008)	(0.008)	(0.182)	(0.181)	(0.181)
Observations	83	83	83	83	83	83
R-squared	0.067	0.068	0.104	0.202	0.219	0.221
Adj R-squared	0.055	0.044	0.081	0.162	0.179	0.170
Bank FE	YES	YES	YES	YES	YES	YES
Number of bankid	14	14	14	14	14	14

Note: Robust standard errors are in parentheses. *** p<0.01; ** p<0.05; *p<0.1

The sample consists of 14 small banks that publicly listed in Indonesia Stock Exchange. Systemic risk is measured with the Marginal Expected Shortfall (MES) defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

Based on Erkens et al. (2012), firms with more independent boards as one of corporate governance mechanisms resulted in worse stock returns during crisis. It suggested that independent directors have encouraged the manager risk-taking behavior to increase shareholder's returns. The tendency of bank owner's intervention on bank management indicates that the independent directors are not entirely independent. The supervisory should evaluate their appointment of independent directors.

Moreover, similar to table 9, size is constantly positive and statistically significant at 5% significance level in all models. In model 6, the coefficient implies that, on average, an increase in size by one percent is associated with an increase of 0.014 percent of the bank's MES. Furthermore, the profitability is negative and not statistically significant at any

significance level. The negative sign of coefficient suggests that higher profitability leads to lower systemic risk. This finding is in line with the prior study by Iqbal et al. (2015).

In spite of the limited role of corporate governance mechanisms in small banks, the risk in small banks is more concentrated in operational risk rather than in systemic risk. Nonetheless, small banks that are often exposed by political risk, such as the appointment of independent directors, or day-to-day monitoring that have been compromised because of nepotism and it seems that corporate governance mechanism cannot mitigate the bank risk-taking behavior. Hence, there are other factors to determine a bank as systemic other than the GCG.

4.3.3 GCG Index and MES for large banks

Table 11 shows the regression result of the GCG index and the systemic risk measure using the MES in 12 large banks based on their total assets. In this regression, the bank-fixed effects are also included to control the time-invariant bank characteristics (Anginer et al., 2013). As seen in model 1, the coefficient of the GCG index is insignificant at any significance level. If the foreign ownership is included in model 2, the coefficient of the GCG index is negative and statistically significant at 5% significance level. Thus, the model 2 accepts the proposed hypothesis. It suggests that a decline in the GCG index means that better corporate governance mechanism leads to more risk-taking. However, the R-squared and adjusted R-squared in model 2 is comparatively low. It implies that no predictive value can be taken from this model.

In contrary, if the other control variables are included in models 3, 4, 5, and 6, the coefficient of the GCG index becomes positive and statistically significant at 5% significance level. Furthermore, the R-squared increases proportionally within the model when more control variables are added such as bank size, and profitability in the regression to 37.2%.

Moreover, model 5 has the highest adjusted R-squared of 33.1%. It implies that model 5 in table 11 could explain more variability of the data compared to other models. The coefficient of 0.0047 in model 5 indicates that, on average, one point decrease in the GCG index means that stronger corporate governance mechanisms will lead to 0.0045 percent decrease of the bank's MES or lower systemic risk. This supports the findings of Battaglia et al. (2014), who found a negative relation between the number of board meetings and the bank risk-taking. It suggested that bank board meetings, as one of corporate governance mechanisms, played an important role to prevent excessive risk-taking during the crisis. However, in Indonesia,

corporate governance mechanisms may not be the major concern, since large banks are systemic risk-based on their nature of size, interconnectedness, substitutability, and complexity.³

Table 11. GCG Index and MES for large banks

VARIABLES	Dependent Variable: MES					
	(1)	(2)	(3)	(4)	(5)	(6)
GCGINDEX	-0.0005 (0.0019)	-0.0005** (0.0024)	0.0006 (0.0041)	0.0045** (0.0016)	0.0047** (0.0015)	0.0048*** (0.0014)
Foreign Ownership		-2.36E-05 (0.0008)		-2.49E-05 (0.0003)		-0.00025 (0.0003)
Government Ownership			-0.0025*** (0.001)		-0.0013*** (0.002)	-0.0014*** (0.003)
Size				0.0336*** (0.0048)	0.0331*** (0.005)	0.0308*** (0.005)
Profitability				0.0026** (0.001)	0.0025* (0.001)	0.0025* (0.001)
Constant	-0.023*** (0.004)	-0.022 (0.034)	0.025*** (0.021)	-1.146*** (0.159)	-1.041*** (0.168)	-1.017*** (0.171)
Observations	72	72	72	72	72	72
R-squared	0.000	0.000	0.092	0.348	0.369	0.372
Adj R-squared	-0.013	-0.028	0.065	0.308	0.331	0.324
Bank FE	YES	YES	YES	YES	YES	YES
Number of bankid	12	12	12	12	12	12

Note: Robust standard errors are in parentheses. *** p<0.01; ** p<0.05; *p<0.1

The sample consists of 12 large banks that publicly listed in Indonesia Stock Exchange. Systemic risk measured by the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Services Authority (OJK), the foreign ownership is the percentage of foreign ownership, and the government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets and profitability is the return on assets, which is the ratio of net income to total assets.

Afterwards, the coefficient of foreign ownership is negative, but statistically insignificant at any level in all models. Hence, no clear conclusion can be deduced from the regression result. The result is in line with the prior study by Chou & Lin (2011), who found that foreign ownership is inversely associated to bank risk-taking in emerging economies. It indicates that larger foreign ownership could lessen their risk-taking behavior. In addition, the coefficient of government ownership is negative and statistically significant at 1% significance level in

³ chapter 2 section 2: systemic risk.

all models. The coefficient in model 5 in table 11 implies that, on average, an increase in government ownership by one percent is associated with a decrease of 0.013 percent of the bank's MES or lower systemic risk. This suggests that in Indonesia large banks sample, government ownership succeeds to hold their risk-taking behavior. Razak et al. (2008) investigated government ownership and the performance of listed companies in Malaysia. They found that government ownership was beneficial to serve as a monitoring device that leads to better bank performance.

Furthermore, the profitability is positive and statistically significant at 5% significance level. This result is in line with prior research by Martynova et al. (2015), which stated that profitable banks might have higher risk-taking incentives because these banks had more advantages to borrow and therefore, it could accumulate more risks. Nevertheless, the coefficient of size is constantly positive and statistically significant at 1% significance level in all regressions. In model 5, the coefficient implies that, on average, an increase in size by one percent is associated with an increase of 0.033 percent of the bank's MES. Therefore, the results of model 5 in table 11 reject the proposed hypothesis that banks with stronger corporate governance mechanisms are associated with higher systemic risk. Hence, the effect of good corporate governance seems to depend on the size of the banks since there is a different result between small and large banks samples.

4.3.3 Board characteristics and MES

For more in-depth analysis, this thesis performs an additional test to examine one of the factors in the GCG index, which is the board characteristics. As seen in table 12, the coefficient of the board size generates a negative yet insignificant result at any significance level. This supports the finding by Wang and Hsu (2013) that discovered a negative relationship between the board size and risk. Moreover, the coefficient of independent board in all banks and small banks sample are positive yet insignificant. However, in large banks sample the coefficient turns to be negative although it is still statistically insignificant at any level. It suggests that in Indonesia, large banks, and independent board act more conservatively towards risk.

Furthermore, the coefficient of foreign ownership are negative, but not significant at any significance level. However, the negative sign indicates that higher foreign ownership could enact their risk-taking behavior more cautiously. Nevertheless, since the board size, independent board and foreign ownership are not significant at any level, no clear conclusion

can be drawn from these results. On the other hand, the coefficient of government ownership in large banks sample is negatively and statistically significant at 1% significance level. This results in line with the findings from table 11 in large banks sample, the negative sign of coefficient represents that higher government ownership is able to withstand their risk-taking behavior. In all regression models, size is the only variable that is constantly positive and statistically significant at 1% significance level.

Table 12. Board characteristics and MES

VARIABLES	Dependent Variable: MES		
	All Banks	Small Banks	Large Banks
Board size	-0.0002	-0.0023	-0.0012
	(0.003)	(0.005)	(0.003)
Independent board	0.0048	0.0092	-0.0009
	(0.003)	(0.005)	(0.003)
Foreign ownership	-0.00004	-0.00008	-0.0002
	(0.00006)	(0.00006)	(0.0002)
Government ownership	0.0003	0.0003	-0.0015***
	(0.0002)	(0.0002)	(0.0004)
Size	0.0196***	0.0182***	0.0296***
	(0.005)	(0.006)	(0.004)
Profitability	0.0005	-0.00009	0.0028***
	(0.0011)	(0.002)	(0.0009)
Constant	-0.657***	-0.580***	-0.955***
	(0.153)	(0.177)	(0.067)
Observations	156	84	72
R-squared	0.253	0.288	0.360
Adj. R-squared	0.222	0.232	0.301
Bank FE	Yes	Yes	Yes
Number of bankid	26	14	12

Note: Robust standard errors are in parentheses. *** p<0.01; ** p<0.05; *p<0.1

The dependent variable is systemic risk measured with the Marginal Expected Shortfall (MES) is defined as the expected shortfall of a stock given the market return is below its 5th percentile.). Board size is the total member of directors serve in the board and independent board is the number of independent director in bank's board. Foreign ownership is the percentage of foreign ownership, and government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets, and profitability is the return on assets, which is the ratio of net income to total assets.

4.4 Robustness test

For the robustness check, a comparison was made between the initial model regression using the MES as the dependent variable and other model using Tier 1 leverage ratio as the dependent variable; each dependent variable represents a systemic risk of the banking

industry in Indonesia. The Tier 1 leverage ratio is measurement used by regulatory of capital ratios under Basel III to force the bank to hold buffer against unexpected losses. The agreement is that an increased amount of capital implies an increased chance of survival in a crisis. It defines the sensitivity of the equity value of banks with reference to the underlying value of the bank. Thus, the higher Tier 1 leverage ratio represents a higher systemic risk. This thesis compares the measurement made by academic, which is MES (Acharya et al., 2010) and Basel III regulatory measurement, which is Tier 1 leverage (Smith et al., 2017). Furthermore, Tier 1 leverage is the ratio of Tier 1 capital to total assets.

Table 13. Robustness test

VARIABLES	Dependent Variable: Tier 1 leverage		
	All Banks	Small Banks	Large Banks
GCGINDEX	-0.0033	-0.006**	0.001
	(0.002)	(0.002)	(0.0017)
Foreign ownership	-0.0002	-0.0001	-0.0003
	(0.0001)	(0.0001)	(0.0002)
Government ownership	0.0001	0.0002	0.0004
	(0.0001)	(0.0002)	(0.0004)
Size	0.0186***	0.0149***	0.0290***
	(0.005)	(0.006)	(0.003)
Profitability	-0.0005	-0.0008	-0.0004
	(0.0006)	(0.002)	(0.0006)
Constant	-0.087	0.033	-0.441***
	(0.169)	(0.184)	(0.103)
Observations	155	83	72
R-squared	0.520	0.508	0.686
Adj. R-squared	0.504	0.476	0.560
Bank FE	Yes	Yes	Yes
Number of bankid	26	14	12

Note: Robust standard errors are in parentheses. *** p<0.01; ** p<0.05; *p<0.1

The dependent variable is Tier 1 Leverage is the ratio of Tier 1 capital to total assets. The corporate governance index is defined to measure the corporate governance strength that is issued by Indonesia's Financial Service Authority. Foreign ownership is the percentage of foreign ownership, and government ownership is the percentage of government ownership. The control variables are defined as follows: Size is measured as the natural logarithm of total assets, and profitability is the return on assets, which is the ratio of net income to total assets.

As seen in table 13, the model decided to include size and profitability to show the association to the GCG index, foreign ownership and government ownership as the corporate governance mechanism on systemic risk. The coefficient of the GCG index in small bank sample is negative and statistically significant at 5% significance level. Therefore, the result

corresponds to the hypothesis of this thesis in terms of the GCG index. Stronger corporate governance or a decline in the GCG index is associated with higher systemic risk in the nature of the maximization of shareholders' value.

In addition, the coefficient of foreign ownership is negative and not statistically significant at any level. The coefficient sign shows that in Indonesia, banks with higher foreign ownership are associated with lower systemic risk or Tier 1 leverage. This finding is in line with the prior study by Haque & Shahid (2016), who investigated the relationship between ownership, risk-taking and performance of banks in India. They found that foreign banks were benefited by more advanced technologies, highly skilled human resources, and better transparency. However, no clear conclusion can be deduced from the regression result. Additionally, the coefficient of government ownership in large bank sample differs from table 11 model 5. The coefficient sign changes as the dependent variable changes, but since the coefficient is not statistically significant at any level, no definite conclusion can be conceived from this result.

Further, similar to the other results, size is the only variable that is constantly positive and statistically significant in all models. As seen in table 13, the R-squared and adjusted R-squared are slightly higher compared to the previous initial model regression with MES as the dependent variable. It implies that Tier 1 leverage is a better proxy to determine systemic risk rather than MES in Indonesia case since Indonesia's financial market may not be as representative for risk in the banking industry.

Chapter 5: Conclusion

The Indonesian banking has a less proper corporate governance mechanism that is easily impacted by the Asian crisis and faces systemic risk. Therefore, this research studies the relationship between corporate governance mechanism and systemic risk. Corporate governance may lead to excessive risk in order to maximize the shareholder value. Hence, banks with stronger corporate governance mechanisms are associated with higher levels of systemic risk.

This thesis uses 26 banks that are publicly listed on the Indonesia Stock Exchange over the period of 2011 until 2016 by implementing a panel data regression in this study. To provide a better perspective, the sample is divided into two samples based on their asset size: large and small banks. In small banks sample, the result shows that stronger corporate governance mechanism is associated with higher level of systemic risk in terms of the GCG index. Moreover, foreign ownership is positively associated with systemic risk. It suggests that in small banks sample, government ownership cannot hold their risk-taking behavior since greater government ownership is supposed to increase the government monitoring.

On the contrary, as for large banks, the foreign ownership is negatively associated with systemic risk. This indicates that government ownership in large banks sample is beneficial to serve as a monitoring device. Additionally, the GCG index is positively associated with systemic risk. It suggests that a decline in the GCG index means stronger corporate governance mechanisms and hence, it is associated with lower systemic risk. However, in Indonesia, corporate governance mechanisms may not be the major concern since large banks are systemic risk-based on their nature of size, interconnectedness, substitutability, and complexity⁴.

To conclude, the findings show that all banks and small banks with stronger corporate governance mechanism are associated with higher levels of systemic risk. However, the relationship does not occur for the large banks sample. Thus, the results suggest that good governance may lead to excessive risk-taking rather than to withstand their risk behavior. It shows that corporate governance mechanism in the banking sector may not be enough to reduce risk-taking behavior and to avoid crises in the future. It is in line with the study by Andries and Mutu (2016), which resulted that stronger corporate governance mechanism and

⁴ chapter 2 section 2: systemic risk.

shareholder-friendly supervisory board were correlated with higher contributions to systemic risk. In addition, the results imply that it is important to make a framework of corporate governance rules for different sizes of banks in Indonesia. Hence, the size of assets under management matters in terms of which corporate governance regime should apply.

Furthermore, total assets as a proxy for size show a significant result in every regression. It indicates that the Indonesian larger banks are associated with higher systemic risk. In terms of systemic risk, size is the primary indicator to indicate systemic risk in Indonesia. This result supports the findings of Laeven et al. (2014), which stated that larger banks produce a higher systemic risk compared to smaller banks and that the high risk arises when they have unstable funding, more market-based activities, or more complex organisation.

The findings of this research extend to the previous academic literature related to the association between corporate governance and systemic risk. Additionally, it is beneficial for regulators since this research provides insights to enhance the effectiveness of supervisory for Indonesia's authorities. In conclusion, the results show that the Indonesian banking and financial system authorities should consider the externalities from corporate governance mechanism in the banking industry. The authorities should ensure that the design of a corporate governance mechanism is properly in line with the interest of depositors, debt holders, authorities, government, and the society in an attempt to control their potential for 'excessive risk-taking'.

There are several limitations in this thesis that needs further improvement. First, in terms of the data observed and the number of the observations. The sample is relatively small and limited to 26 banks that are listed on the Indonesia Stock Exchange and a six-year period from 2011–2016. Second, this thesis uses the MES as the systemic risk measurement and also the Tier 1 leverage in the robustness check section. However, there are other systemic risk measurements such as the systemic risk indicator stipulated by the Indonesian authorities and the MES used market-based data, which limits the sample to banks that are publicly listed. Thus, different results might potentially arise with different measurements and with private banks and Islamic banks. Third, this thesis does not take into account the bank competition in the model. Bank competition may affect bank risk-taking behavior by the risk diversification. For future research, it may be beneficial to include bank competition into account to get an insight of the competition on systemic risk, similar to the prior research by Anginer et al. (2014).

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