



An Examination of the Relationship between Board Characteristics
and Firm Risks in the Thai Service Industry

Ms. Chomkwan Smansotivong

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Business Administration in Finance
Graduate School of Business

Assumption University

Academic Year 2016

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The Graduate School of Business, Assumption University, has approved this thesis as a partial fulfillment of the requirements for the Degree of Master of Business Administration in Finance.



Dean of the Graduate
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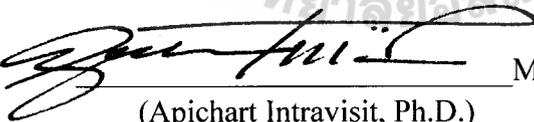
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Abstract

The purpose of this paper is to identify the relationship between board characteristics and firm risk. The data were collected on a sample of 65 Thai service firms listed in SET during the period 2010 to 2014 from SETSMART database and form 56-1. There are ten independent variables (board size, board composition, board leadership structure, board age, board gender diversity, board ownership, board compensation, board meeting, remuneration committee, and CEO compensation) and four dependent variables which are measurements of firm risks that are classified as capital adequacy risk, business risk, financial risk, and investment risk that will determined the relationship to the firm risks in the study. This research uses the Panel Least Squares Method to examine these factors. In this research, the fixed effect panel data regression model is applied to examine the effect of independent variables toward firm risks.

The results present that board composition, a remuneration committee, and CEO compensation are positively related with firm risk while board age, board gender diversity, board compensation, and board meeting are negatively related. The sample contains only Thai listed firms in the service industry, and may not be representative of the entire service industry in Thailand and other countries. The results could be useful to company owners regarding board construction based on the firm's desired risk levels. In addition, the results will also assist investors and creditors in considering the risk levels of a given company based on board characteristics. This research may also assist those who study corporate governance in Thailand.

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Finally, I must express my profound gratitude to my parents and friends for providing me with unfailing support and continuous encouragement throughout my years of study, the research process, and writing this thesis. This accomplishment would not have been possible without them. Thank you.

Chomkwan Smansotivong

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Chapter 1: Generalities of the Study

This chapter comprises seven parts. The first is an introduction to the study, involving firm risk and board characteristics of the service sector in Thailand. The second part sets out the statement of the problem and research objectives. This is then followed by the scope of the research, limitations of the study and its significance. The final part provides a definition of the terms.

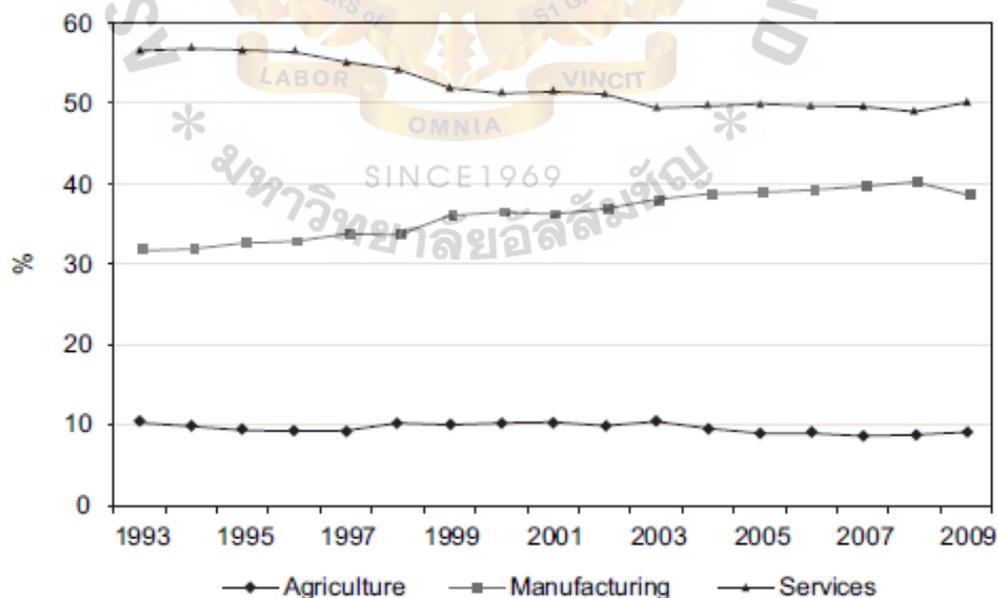
1.1 Introduction

In business operations, every firm faces a certain amount of risk in order to generate returns (Thai Institute of Directors Association, 2014). Tennent (2008) stated that as long as businesses are still in operation they will risk all for returns. Corporate risk management is a major issue for managers to consider when making investment decisions (Li & Wu, 2009). The importance of risk management, enabling companies to take risks in order to develop, is magnified by rapid changes in environment, market uncertainty, and a variety of financial crises (Cheikh, 2014).

Thailand is an upper-middle income country, and its economy comprises three main industries: agriculture, manufacturing, and service. In 2012, these industries contributed around 13.3%, 34%, and 52.7%, respectively to the country's GDP (Central Intelligence Agency [CIA], 2012). Thailand's service industry gained a significant share of its GDP in the period from 1993 to 2009, with a contribution of over 50% to real GDP and an increase in growth from 0.6 to 3.4% (Koonathamdee, 2013). Over the past few decades, the significance of service and manufacturing industries in terms of real GDP has increased steadily, while the share of real GDP derived from the agriculture sector has become less important and has stabilized,

contributing less than 0.5% to GDP growth in the same period (Koonnathamdee, 2013). The service sector therefore provides important benefit to the Thai economy. For instance, employment in the industry has been dominant since 2003, and in 2010 provided work for about 18 million people (Koonnathamdee, 2013). This implies that growth in the Thai economy relies heavily on the service industry since it provides the largest contribution to GDP and generates the most employment. As the service industry remains the sector with the highest demonstrated potential, the Thai government sees its development as a priority and allocated most of the BOI-approved investment capital during January to September 2009, providing 66,800 million baht to services and public utilities (The Board of Investment of Thailand [BOI], 2010). Figure 1-1 presents the share of agriculture, manufacturing, and service sectors during the years 1993 to 2009.

Figure 1-1: Sector Share of GDP



Source: Koonnathamdee, P. (2013). *A turning point for the service sector in Thailand* (ADB Economics Working Paper No. 353). Mandaluyong City, Philippines: Asian Development Bank, p. 3.

However, there are reports of poor performance in the Thai service sector. According to Figure 1, the Thai service sector share of GDP keeps decreasing which implies a problem in service sector performance. Koonathamdee (2013) suggested that the service sector should receive promotion from the government by an unambiguous policy which is suitable for each region and province. A similar view was also expressed by the Asian Development Bank (ADB) (2015) which stated that the Thai service sector is inferior compared to high-income economies in Asia and the Pacific where the share of GDP accounted for 72%, while in Thailand it is around 52%. The author expressed that although there is high competition in some service sectors in Thailand, overall they tend to fall behind other industries, and productivity has been stagnant. Poor performance could result in some service firms ceasing operations (Nkundabanyanga, Ahiauzu, Sejaaka, & Ntayi, 2013). Several literature studies state that one of the main causes of business failure is management deficiency (Arasti, Z., 2011; Kambwale, Chisoro, & Karodia, 2015) and the subsequent indictment that boards were ineffective (Nkundabanyanga *et al.*, 2013).

The board of directors plays an important role in service firms as they are monitors and decision-makers of the firms as well as resource providers. In service firms, directors act as resources in the form of advising, guiding, and supporting managerial activities (Kim, Cha, Cichy, Kim, & Tkach, 2012). For example, the boards of hospitality firms will provide feedback, advice, and direction to the general managers and chief operating officers. The advice and direction that the board gives will become the basis of a firm's business strategies (Kim *et al.*, 2012). Another example is a hospital board which is responsible and accountable for the overall operation of the firm (Bohen, 1995). All hospitals inevitably face expectations related

to health care quality, proficiency, access availability, responsive service, fairness, and service providers' morale because health service activities relate to the social and economic development of a country (Abor, Abekah-Nkrumah, & Abor, 2008). In order to meet these expectations, service providers of hospitals as well as their boards face momentous challenges to have competent governance structures, policies and processes, and well-informed accountability (Quigley & Scott, 2004). These statements imply that if such expectations cannot be met, firms are unable to perform well. Therefore, board effectiveness is crucial for service firms because it involves important decision-making which could lead to success or failure in relation to firm risk.

One critical originating factor of a financial crisis is weakness in corporate governance, and there is a significant relationship between risk-taking behavior and good corporate governance practice (Ferrero-Ferrero, Fernández-Izquierdo, & Muñoz-Torres, 2012). During the recent failure of prominent companies in the USA and UK and the Asian financial crisis in late 1990s, the boards of firms were criticized because in most cases, they were found to be ineffective as they abandoned their responsibilities (Nkundabanyanga *et al.*, 2013). For publicly traded US companies and non-US companies requiring a listing in the United States, tighter internal controls have been introduced in order to prevent unreasonable risks being taken by directors and managers within those companies (Tennent, 2008). As the responsibility of the board of directors, corporate governance is regarded by institutional investors to be as important as financial performance, and they are willing to pay a premium for it (Thai Institute of Directors Association, 2014). Therefore, the effectiveness of the board of directors is an important influential factor in firm risk-taking.

There is a significant body of literature which remarks that board characteristics (size, composition, and ownership structure) provide a fundamental internal control mechanism, reflecting the effectiveness of directors (Bhagat & Bolton, 2008; Jensen, 1993). Adams and Ferreira (2009) found that companies with a higher number of female directors were likely to make more effort to monitor, resulting in lower shareholder value and risk. MacCrimmon and Wehrung (1990) found that older boards are more risk-averse and the most successful are big risk-takers. From the study by Adams (2003), board compensation is shown to be related to the effectiveness of the board, especially in the difficult task of monitoring the firm. Pathan (2009) stated that CEO duality or the board leadership structure is negatively related to bank risk-taking. Belkhir and Chazi (2010) found that there is a positive relationship between CEO compensation and the risk-taking behavior of the firm. The governance quality of the remuneration committee significantly affects the CEO's compensation, which may affect risk-taking (Ayadi & Boujèlbène, 2012). The frequency of board meetings could affect the way the board members do their job since meetings allow directors to discuss and exchange ideas on management strategy as well as finding ways to monitor managers (Vafeas, 1999).

Thai board features are mainly a result of the Public Limited Companies Act of 1992, and the Principle of Good Corporate Governance, 2012 issued by the Stock Exchange of Thailand (SET). As for private limited companies, there is the Civil and Commercial Code Book III Specific Contracts Title XXII Partnerships and Companies Chapter IV, which requires companies to have directors without mentioning any specific qualification requirements. Therefore, Thai corporate governance tends to mostly concerns public limited companies listed on the SET. The

Securities Exchange of Thailand was established in Bangkok and started trading in 1975. During 1991 its name was formally changed to the Stock Exchange of Thailand (SET). The SET operates under a legal framework laid down in the Securities and Exchange Act of 1992 (SEA). The SEA requires the Securities and Exchange Commission (SEC), a single unified supervisory agency and the regulator of the Thai Capital Market and the Bank of Thailand (BOT), to be responsible for the country's money market (the SET, n.d.). The trading currency of the SET is the Thai baht and its market capitalization and MAI (Market for Alternative Investment) at the end of 2010 was 8.33 trillion baht, or approximately USD276.44 billion (the SET, 2010a). The target population of this study includes 83 listed service companies on the SET. Since the data are not complete for some listed service companies in Form 56-1, the researcher obtained complete data from 65 companies and rearranged it. At the end of 2010, the listed service companies' total assets accounted for around 1.1 trillion baht, with total sales of 806,857 million baht, and a net income of 55,053 million baht (the SET, 2010b).

The Public Limited Companies Act of 1992 mentions board characteristics in Chapter VI which is entitled Board of Directors. The Act includes the minimum number of directors, their appointment and removal, minimum age requirements, directors' duties, and assignment of duties by directors. In order for a public limited company to be registered, the Act requires that it have a minimum of five directors with at least half of the board being Thai citizens. The Act does not provide term limits for directors but prescribes the director's minimum age requirement at 20 years which is only applicable to public companies. While, the Principles of Good Corporate Governance, 2012 states that boards should have at least five directors and

should not exceed 12. The Act does not mention how board performance and its required duties can be ensured. Moreover, there is no law prescribing the appointment of executive and non-executive company directors. On the other hand, the Principles of Good Corporate Governance, 2012 recommend that boards should comprise an appropriate balance and diversity of skills, experience, gender and at least one non-executive director having prior work experience of the major industry in which the company is operating (SET, 2012). The Securities and Exchange Commission requires that boards should have independent directors at least one-third of all board members (Thai Institute of Directors Association, 2014). In addition, the Principles of Good Corporate Governance, 2012 mentions that at least half the board must consist of independent directors if the board chairman also assumes the role of CEO; the chairman of the board and the CEO are immediate family members; the board chair is part of the management team; or in a case where the board chair is not an independent director. The board is recommended to assign power to remuneration and nomination committees as may be required in relation to executives' compensation and the appointment of board members and top executives (SET, 2012). The frequency of board meetings should be compatible with the duties and responsibilities of the board and nature of the company. Nevertheless, companies should hold board meetings at least six times per year (SET, 2012).

1.2 Statement of the Problem

Even though risk is an essential topic for management to consider when they make investment decisions (Li & Wu, 2009), and corporate governance plays a major role in firm risk-taking (Ferrero-Ferrero *et al.*, 2012), a large amount of related research has focused on the relationship between board characteristics and firm

performance, while research related to board characteristics and firm risk-taking is very limited (Merle, 2013). A number of researchers have studied the relationship between board characteristics and firm risk-taking (Ayadi & Boujèlbène, 2012; Cheikh, 2014; Ferrero-Ferrero *et al.*, 2012; Kim, 2014; Lenard, Yu, York, & Wu, 2014; Merle, 2013; Rachdi & Ameer, 2011; Wang, 2012), but their findings contain a certain degree of variation. Due to these varying results, the researcher cannot confirm whether the results are applicable to the Thai stock market. Due to the absence of clarity regarding the effect of corporate governance on firm risk in Thailand, this research aims to study how board characteristics and CEO compensation determined the risk to listed service firms in Thailand during the years from 2010 to 2014. The research focuses on finding answers to the questions mentioned below.

- 1) Is there a significant relationship between board characteristics and CEO compensation and capital adequacy risk during the years 2010 to 2014?
- 2) Is there a significant relationship between board characteristics and CEO compensation and business risk during the years 2010 to 2014?
- 3) Is there a significant relationship between board characteristics and CEO compensation and financial risk during the years 2010 to 2014?
- 4) Is there a significant relationship between board characteristics and CEO compensation and investment risk during the years 2010 to 2014?

1.3 Research Objectives

The purpose of this research is to test the relationship between board characteristics and CEO compensation, and capital adequacy, business risk, finance risk, and investment risk in service industry companies listed on the SET. This

research uses the Panel Least Squares Method to examine these factors for the years 2010 to 2014.

- 1) To identify whether board characteristics and CEO compensation has a significant relationship with firm risk in terms of capital adequacy during the years from 2010 to 2014.
- 2) To identify whether board characteristics and CEO compensation has a significant relationship with business risk during the years 2010 to 2014.
- 3) To identify whether board characteristics and CEO compensation has a significant relationship with financial risk during the years 2010 to 2014.
- 4) To identify whether board characteristics and CEO compensation has a significant relationship with investment risk during the years 2010 to 2014.

1.4 Scope of the Research

This research focuses on the relationship between board characteristics which including board size, board composition, board leadership structure, board age, board gender diversity, board ownership, board compensation, board meeting as well as remuneration committee and CEO compensation for service industry companies listed on the SET, and capital adequacy, business, finance, and investment risk for the years 2010 to 2014. The study uses data of 65 service firms listed in SET during 2010 which was collected during January and February 2016. All data were analyzed using the Panel Least Squares Method. The data were obtained from secondary sources mainly from the SET Market Analysis and Reporting Tool (SETSMART) database, Bloomberg database, and the Securities and Exchange Commission website. Some data are not directly available from the sources, thus these data are calculated and

organized by the researcher in order to make them fit for use in the data analysis. Firm risk and financial data were obtained from the SETSMART and Bloomberg databases.

1.5 Limitations of the Study

The sample contains only listed firms in the service sector on the SET, and may not be representative of all service industries in Thailand and other countries. Due to insufficient data being available for some listed service companies in Form 56-1, it was not possible to obtain complete data for the 83 companies listed in the service sector during 2010. Therefore, the researcher used the completed data from 65 listed service companies for data analysis. This study does not intend to investigate board characteristics involving culture, attitude, and attributes.

Time constraint is another limitation of the study. Annual data were collected for firm risk, board characteristics, and CEO compensation to test the relationship between these factors. The research data were collected during January to February 2016 and the results can be applied to the specific time period of 2010 to 2014. The results may not apply to any other time period.

1.6 Significance of the Study

This study hopes to provide an understanding of the effect of board characteristics on firm risk. If a significant relationship between board characteristics and firm risk is found, the research should lead to an awareness of the risk tendency for a given board of directors based on their characteristics. Such knowledge would give rise to board construction being based on the firm's desired risk levels since shareholders or owners could select board members with certain characteristics, thus influencing risk-taking. This knowledge should benefit both insiders and outsiders, as a significant relationship between board characteristics and firm risk could help

investors to evaluate the potential risk of a given stock. Such knowledge could also assist creditors in evaluating the risk level of a company based on board characteristics. This study could benefit those who are interested in studying corporate governance and firm risk-taking in Thailand.

1.7 Definition of Terms

Board Age

Merle (2013) referred to board age as the average age of board members. From studies by MacCrimmon and Wehrung (1990) as well as Hambrick and Fukutomi (1991), older board members are the most risk-averse, and big risk-takers are the most successful.

Board Compensation

Board compensation is defined as annual fees for directors' services plus meeting fees to attend board meetings (Adams, 2003; Ferrero-Ferrero *et al.*, 2012).

Board Composition

Board composition refers to the degree to which non-executive or independent directors have no relationship with the organization. Precisely, directors not employed by the firm and business professionals whose main responsibilities involve the monitoring of management (Dalton & Dalton, 2011; Davidson, Good-Stewart, & Kent, 2005; Pathan, 2009).

Board Gender Diversity

Board gender diversity refers to the presence of female directors on the board (Lenard *et al.*, 2014).

Board Leadership Structure

Board leadership structure refers to the structure of a board of directors, whether the company has a board chairman assuming the role of CEO (i.e., CEO duality), or if it assigns these positions to different individuals (i.e., CEO non-duality) (Abdullah, 2004; Elsayed & Wahba, 2013).

Board Meeting

Ayadi and Boujèlbène (2012) define a board meeting as a tool for strengthening the control and activities of the board of directors to solidify the advisory role, and measured board meetings by their frequency in each financial year.

Board Ownership

Board ownership refers to company stock owned by the board of directors (Merle, 2013).

Board Size

Board size refers to the number of board members at the annual board meeting (Merle, 2013).

Business Risk

Business risk is defined as that relating to the opposing effects of environmental inconstancy in earnings as a result of corporate business activities (Ward, 1993). Business risk can also refer to the respective variability in the firm's expected earnings before interest and taxes (Gallagher & Andrew, 2007).

Capital Adequacy Risk

Capital adequacy risk means the extent to which unexpected loss has to be covered by another form of capital (Krause, 2006). Several studies have found that the capital structure of a firm could affect operational risk and profitability (Chen, Chen, Liao, & Chen, 2009).

Cash Flow

Weygandt, Kieso, & Kimmel, (2006) defined cash flow as flow of a firm's cash receipts and payment.

CEO Compensation

CEO compensation is the annual salary of the CEO plus bonus (Barro & Barro, 1990). The CEO's remuneration is a tool designed to reduce the problem of moral hazard by rewarding performance.

Charter Value

Charter value was proposed by (Keeley, 1990) as proxy of competitive structure as banks with higher charter values will have higher risk because they either use of leverage or asset substitution thus reduced incentives.

Financial Risk

Financial risk is related to the obligations of increasing debt finance usage (Ward, 1993). The presence of debt in the financial structure increases the probability of bankruptcy or financial risk (Kale, Thomas, & Ramirez, 1991).

Firm Performance

Firm performance refers to a subset of organizational effectiveness that covers operational and financial outcomes (SantosI & BritoI, 2012).

Firm Size

Cheikh (2014) defined firm size as size of the firm. Cheikh (2014) used firm size as a risk measurement and stated that the large firms often doing better at diversify risk than small firms.

Investment Risk

Investment risk is defined as the variability which encompasses the return generated by a certain investment (Gitman, Joehnk, & Smart, 2011). The investment period is an indicator of asset risk; the longer the investment term, the bigger the risk.

Remuneration Committee

The remuneration committee is a type of board committee. According to the Thai Institute of Directors Association (2014), a remuneration committee is established in order to ease the burden on directors responsible for advising the board or taking decisions regarding the consideration and design of compensation rules for the board and its executives.

Service Industry

This consists of companies involved in commerce, health care services, media and publishing, professional services, tourism and leisure, and transportation and logistics; excluding financial services and information or technology services, or other specialized services already classified (the SET, 2015).

Chapter 2: Review of Related Literature and Studies

This chapter consists of three sections which define the study's concept and theories. The first section presents a definition of dependent variables in firm risk, described as capital adequacy, business, financial, and investment risk. The second section contains the definition of independent variables: board size, percentage of outside directors, duality, age, proportion of stock held by board members, board fees, board meetings, board gender diversity, board education, remuneration committee, compensation of the CEO, and their relationship with firm risk. The third section summarizes the results of previous studies related to the topic.

2.1 Explanation of Dependent Variables: Firm Risk

Several researchers have defined risk as a composition of potential losses (Baird & Thomas, 1985; Mao, 1970; March & Shapira, 1987). Risk means the variability of financial loss, the disparity between actual and expected results, and the likelihood that a loss has occurred or will occur (Broder, 2006). Investment risk is interpreted by Gitman *et al.* (2011) as the uncertainty encompassing the return that a particular investment generates. Tennent (2008) stated that risk is the possibility of losing money and specifically destroying investor capital; as long as businesses still operate, they will take risks for return. Brigham and Ehrhardt (2002) also proposed the definition of risk as the chance that some disadvantageous events may occur, and business risk can be defined as the chance that future profits and cash flow will be materially lower than expected. Firm risk is a term encompassing all major risks faced by businesses (Rejda & McNamara, 2014). Ward (1993) proposed that firm risk can

be analyzed in terms of business risk and financial risk. Increased business and financial risk may have more chance of causing bankruptcy, but for any given level of business risk, the chance of bankruptcy will be positively related to the company's financial risk (Peirson, Bird, Brown, & Howard, 1990). Firm risks proposed in literature are capital adequacy risk (Merle, 2013), business risk (Lenard *et al.*, 2014), financial risk, and investment risk (Wang, 2012).

Diverse measurements and models were used in approaching this risk-related research. Lenard *et al.* (2014) suggests that company values, cash flow volatility, and the volatility of stock returns are capable of measuring firm risk-taking. In the United States, a variety of capital ratios have been used in banking regulations to measure risk for institutions: setting limits for prompt corrective action (PCA) (Merle, 2013). The Tier 1 capital leverage ratio is used to measure capital adequacy risk (Merle, 2013). Companies managing their hedging activity and reducing the insecurity of their financial performance are valued more than those incapable of doing so (Allayannis & Weston, 2003). Earnings volatility was used by Allayannis and Weston (2003) to study its relationship with firm value. A remarkable amount of literature uses the standard deviation of stock returns for measuring firm risk (Anderson & Fraser, 2000; Cheng, 2008; Lenard *et al.*, 2014; Pathan, 2009; Wang, 2012). Earnings volatility and stock return volatility were used alternatively as measurements of firm risk (Wang, 2012). Wang (2012) noted that literature suggests firm choice, including investment and debt policies as measurements of firm risk, with investment policy representing investment risk and debt policy representing financial risk.

2.1.1 Capital Adequacy Risk

Mireku, Mensah, and Ogoe (2014) referred to capital structure as a company's financing structure or a combination of equity and debt, strongly linked to the capability of a company to fulfill the expectations of its stakeholders. Chen *et al.* (2009) stated that a number of studies have found a close relationship between capital structure, operational risk, and profitability. Capital is defined as a synonym of equity and acts as a provision against losses which may occur as a result of risk (Krause, 2006). Merle (2013) noted that according to the 1988 Basel Accord, banks are required to maintain equity accounts equal to a risk-weighted proportion of their asset base in order to allow more flexibility in determining the minimum required capital level. The relationship between the capital level and ensuing loss is clear in the case of a bank which has losses exceeding the capital held, and will either be a failure or in imminent danger of falling into that category (Merle, 2013). From the observation by Krause (2006), the capital requirement is implemented to prevent financial service companies from insolvency. Capital requirements and solvency are important aspects of financial services and all other industries. Krause (2006) stated that loss is closely related to risk for firms; it is clear that capital and risk are closely linked. Capital adequacy risk means the extent to which unexpected loss has to be covered by another form of capital (Krause, 2006).

Estrella, Park, and Peristiani (2000), who studied capital ratios as predictors of bank risk, proposed that they are a valuable tool for assessing the safety and soundness of a bank. Their research also found that in predicting bank failure, the risk-weighted ratio did not always surpass the leverage or gross revenue capital ratios over less than two periods. Ediz, Michael, and Perraudin (1998) also found that the

risk-weighted ratio is not a better predictor of bank failure when compared to simpler ratios. The literature provides a strong rationale for using the capital leverage ratio as a measure of risk in this study. The capital leverage ratio is generally expressed as Tier 1 capital, which includes common stock, common stock surplus, retained earnings, and certain perpetual preferred stock as a proportion of total adjusted assets (Estrella, 2000). Merle (2013) stated that higher capital ratios represent a lower risk of failure.

2.1.2 Business Risk

Ward (1993) defined business risk as that related to the opposing effects of environmental inconstancy in earnings as a result of corporate business activities. Business risk refers to the respective variability in the firm's expected earnings before interest and taxes (EBIT) (Gallagher & Andrew, 2007). Chakraborty, Sheikh, and Subramanian (2007) researched managerial risk and suggested that it is closely related to a firm's overall risk. If firms do not use debt for financing, business risk can be defined as the unpredictability inherent in the projection of future returns on assets or equity (Weston & Brigham, 1993). Brigham and Ehrhardt (2002) defined business risk as the chance that future profits and free cash flow will be materially lower than expected. Better performance implies higher risk (Ayadi & Boujèlbène, 2012). A firm's risk-taking increases as its performance falls below the industry average (Merle, 2013).

Allayannis and Weston (2003) used earnings volatility to study its relationship with firm value. Chakraborty *et al.* (2007) stated that business risk can be measured by using volatility in returns. Volatility in earnings and stock returns was used as an alternative measurement of firm risk (Wang, 2012). Wang (2012) used earnings

volatility to measure income before the deduction of extraordinary items, depreciation and dividends, divided by the total assets over a three-year period. Lenard *et al.* (2014) used volatility in the monthly stock returns to measure firm risk.

2.1.3 Financial Risk

Brigham and Ehrhardt (2002) stated that financial risks result from financial transactions. Financial risk is related to obligations arising from increased debt finance usage (Ward, 1993). The issue of risk and its effect on the financing policy of firms is critical when considering the cost of capital, and hence the value of a firm depends upon its debt-equity mix (Boyd and Smith, 1998; Hovakimian, Opler, & Titman, 2001). Abor *et al.* (2009) reported that firms with a higher chance of survival are more likely to take financial risk by debt financing. Modigliani and Miller (1963) noted that under an imperfect capital market, where interest expenses are tax deductible, firm value will increase with higher financial leverage and the optimal capital structure is determined by a trade-off between increased bankruptcy risk from gaining a larger portion of debt, and the related tax advantages. Abor *et al.* (2009) suggest that if companies increase their debt proportion for tax benefits, their ability to meet fixed interest payment obligations is weakened, leading to increased financing cost and bankruptcy risk. According to Kale *et al.* (1991), the presence of debt in the financial structure increases the probability of bankruptcy, and firms with more variable cash flows imply a greater business risk and have a higher probability of bankruptcy for a given level of debt.

To measure financial risk, Wang (2012) proposed the use of the leverage ratio. The debt ratio, also known as the debt to assets ratio, calculates the total debt scale by the total assets. The debt ratio indicates how much firms use debt to finance their

assets (Petty *et al.*, 2011). Weygandt, Kieso, and Kimmel (2006) stated that the higher the debt ratio, the higher the percentage of debt, and the greater the risk that the company may be unable to meet the obligations associated with it. Literature suggests a positive relationship between financial risk and debt ratio (Jordan, Lowe, & Taylor, 1998; Michaelas, Chittenden, & Poutziouris, 1999).

2.1.4 Investment Risk

Investment risk is defined as the variability which encompasses the returns generated by certain investments (Gitman *et al.*, 2011). Brigham and Ehrhardt (2002) proposed that investment risk is associated with the likelihood that actual returns will be low or negative. They also noted that an increased likelihood of low and negative returns represents higher investment risk. Investors are faced with a continuum of investments, ranging from low risk or low variations in returns, to high-risk or high variations in returns (Gitman *et al.*, 2011). Investment risk has a positive relationship with risky assets or those earning more or less than originally expected (Brigham & Ehrhardt, 2002). Since the future is uncertain, investors must determine an acceptable risk level, as higher returns mean more risk (Kabra, Mishra, Dash, & Manoj, 2010). The investment period also indicates a risk to assets; the longer money is investment, the bigger the risk (Gitman *et al.*, 2011). Bhagat and Welch (1995) suggested that research and development spending has a higher investment risk level compared to capital spending on tangible assets. Wang (2012) used capital expenditure as a measurement of low investment risk, and research and development (R&D) expenditure for high investment risk.

2.2 Explanation of Independent Variables

2.2.1 Board Characteristics

While several theories have been used in corporate governance literature to explain the main role of the board, agency theory (Jensen & Meckling, 1976) and stewardship theory (Donaldson & Davis, 1991) are considered to be the most distinguished prospects (Wahba, 2015). This research follows that of Wijethilake, Ekanayake, and Perera (2015) by employing agency, stewardship, and resource dependence theories in order to understand the complex relationship of board characteristics and firm risks.

According to Jensen and Meckling (1976), agency theory explains the relationship between principal and agent as a contract between one or more persons (the principal) who own economic resources, engaging another person (the agent), to perform certain services by using and controlling economic resources on their behalf. This involves entrusting the authority for some decision-making to the agent. Since authority for decision-making is entrusted to the agents or managers, there is a high possibility that they may not always act according to the interests of the principal or owner, and this can lead to agency problems (Maneroj, 2006). Shareholders therefore appoint a board of directors to act as the link between managers and owners (Mallin, 2004) in order to monitor managerial performance and serve shareholders' interests (Imhoff, 2003).

Contrary to agency theory, the stewardship theory proposes that managers are sufficiently trustworthy and good stewards of the capital entrusted to them, making overseeing unnecessary (Donaldson & Davis, 1991). Elsayed (2010) also claimed that

executives with non-duality spent more time responding to external events, provided clearer direction and unity of command, faster and more effective decision-making, and were more resourceful in day-to-day operations.

Resource dependence theory describes firms as open systems reliant on external resources (Wijethilake *et al.*, 2015). The resource dependence theory concerns sociological and management disciplines; there is no generally accepted description of an important resource (Nicholson & Kiel, 2007). In order to reduce dependence toward external resources, Pfeffer and Salancik (1978) propose five alternatives for firms, of which a board of directors is one.

Generally, a board of directors is expected to be comprised of a group of persons who possess the appropriate ability and/or authority for the organization's activities, and as such, would help to decrease environmental dependences and maximize firm performance (Wijethilake *et al.*, 2015). Hillman, Cannella, and Paetzold (2000), who employed the resource dependence theory in their research, presented that the board is a crucial resource for magnifying firm performance. Nicholson and Kiel (2007) indicated that a board with a high level of linkage to the external environment provides a company with a correspondingly high level of access to various resources, and consequently, a high corporate performance. An active board should be of considerable benefit to firm performance because it could use its ability and knowledge to monitor managers, as well as give guidance and support to CEOs (Daily, Dalton, & Cannella, 2003).

According to the Thai Institute of Directors Association (2014), business governance was previously under the control of the owner for the purposes of achieving its goal, but at the present time, shareholders or owners appoint a board of

directors and assign them two main responsibilities: complying with laws and regulations, and creating good operating performance conditions by focusing on setting the direction of business strategy. The board of directors is fundamentally an internal control system, since they have the final responsibility for the firm's function (Bhagat & Bolton, 2008; Jensen, 1993; John & Senbet, 1998). According to Pfeffer and Salancik (1978), firms gain four advantages from having a board of directors: information in the form of guidance and support, access to information channels between the firm and environmental opportunities, superior access to resources, and lawfulness.

Jensen (1993) proposed that board characteristics in terms of size, composition, and ownership structure reflect its activity efficacy in management control. Literature on the subject mentions that board characteristics can influence firm risk. Empirical research demonstrates the responsibility of the board of directors in risk abatement and organizational value (Lenard *et al.*, 2014). Firms that proficiently manage their hedging activity and reduce the insecurity of their financial performance are valued by investors more than those incapable of doing so (Allayannis & Weston, 2003). Boards taking a lower risk strategy ensure that the company is operating for the highest benefit to the owners because they have decision-making authority from the shareholders (Wang, 2012). Ferrero-Ferrero *et al.* (2012) affirmed that monitoring and direction from the board of directors may influence the performance and risk-taking of a firm. In their research, they concluded that an effective board could reduce firm risk-taking during a financial crisis.

In empirical studies on corporate governance, the ability of the board of directors to fulfill duties is related to certain characteristics, mainly consisting of the

composition and leadership structure (Wahba, 2015). Wang (2012) employed board composition and size as two common characteristics to study its impact on corporate action and performance. Ayadi and Boujèlbène (2012) stated that board and CEO compensation, frequency of meetings, and the remuneration committee possibly influence firm risk-taking. Board gender diversity was used by Lenard *et al.* (2014) to predict firm risk. Bhagat and Bolton (2013) found that the ownership of the board of directors can affect firm performance. This study indicates that board of director ownership may have an impact on firm risk. Merle (2010), who researched bank risk-taking, used board age as one of the characteristics of firm risk. The research carried out in this study indicates that board education level is likely to affect risk.

2.2.1.1 Board Size

Board of director size is an instrument for limiting managers' moral hazard behavior. Cheng, Evans, and Nagarajan (2008) recognized board size as an important aspect in the corporate governance process. Although various researchers have examined the relationship between board size and firm risk-taking, the results showed a lack of consent. Conforming to agency theory, a large board can dominate managers, leading to conflict of interest (Jensen, 1993). Lipton and Lorsch (1992) and Yermack (1996) show that there is a negative relationship between firm value and board size. Certain authors obtained identical results indicating that shareholders may benefit from a smaller board (Cheng *et al.*, 2008; Eisenberg, Sundgren, & Wells, 1998; Lee & Lee, 2009). In 2006, the Thai Institute of Directors Association explored the corporate governance of 402 companies listed on the SET and issued the Corporate Governance Report of Thai Listed Companies 2006, which suggested a suitable board size of between five and ten directors (Thai Institute of Directors

Association, 2014). Lipton and Lorsch (1992) noted that a smaller board can efficiently protect the interests of shareholders by control, aligning decisions between the board and managers, and reducing agency costs. This implies a larger board has greater difficulty in organizing meetings, reaching conclusions, and reacting effectively to important matters due to the costs of communication and coordination. The findings by Cheng (2008) and Pathan (2009) show that there is a statistically significant negative correlation between the coefficient of board size and banking risk related to measures taken by a strong board. These studies suggest that once the instruments of governance and certain bank characteristics are considered, a smaller board is linked with larger risk-taking. Research by Andres and Vallelado (2008) considered the relationship between board size and firm risk using a sample of 69 large banks in Canada, the USA, Spain, Great Britain, France, and Italy during the period from 1995 to 2005 and presented that banks with smaller boards were more accomplished. This result is also consistent with Wang (2012) who studied the relationship between board size and company risk policy options. The research found that compact boards have a higher tendency to select riskier policy options aligned with shareholder interests than larger boards.

On the other hand, Sah and Stiglitz (1986, 1991) contend that larger boards appear to have less risk because group decision-making gives rise to various views, and hence the final decision often reflects the different opinions of group members. Some researchers have stated that larger boards are more capable of providing company resources than smaller boards (Jackling & Johl, 2009; Korac-Kakabadse, Kakabadse, & Kouzmin, 2001; Zahra & Pearce, 1989). In agreement with resource dependence theory, a larger board could amplify the firm's responsiveness toward

uncertain environmental conditions (Hillman, Withers, & Collins, 2009). On average, bank boards have 16 members and this is considered to be very large (Adams & Mehran, 2003, 2005; Booth, Cornett, & Tehranian, 2002). Complying with Blanchard and Dionne (2004), board size has the possibility of influencing management risk-taking behavior since their findings present that larger boards have more sophisticated instruments for reducing risk, and consequently, excessive risk-taking by managers. Adams and Mehran (2003) express that banks with larger boards tend to realize better performance in relation to high-risk, while smaller boards may be easily manipulated and influenced by managers, while Ferrero-Ferrero *et al.* (2012) and Merle (2013) found no evidence to support a relationship between board size and firm risk. Ferrero-Ferrero *et al.* (2012), who investigated the relationship between board size and firm risk-taking before and during the financial crisis, stated that prior to the crisis, board size had a negative relationship with firm performance and risk-taking but this was not maintained during the crisis. The researchers stated that before the crisis, larger boards had less sense of responsibility. Larger boards have a tendency to be conservative, which obstructs managerial opportunism and during the financial crisis they tried to maintain their position and reputation by claiming responsibility (Ferrero-Ferrero *et al.*, 2012).

2.2.1.2 Board Composition

Board composition refers to the degree to which the board is composed of non-executive or independent directors who have no relationship with the organization and whose main responsibilities concern the monitoring of management (Dalton & Dalton, 2011; Davidson *et al.*, 2005). Another definition of board composition given by Pathan (2009) is the presence of independent directors who are not employed by the

firm, and business professionals. The board composition determines the disciplinary function because board members are experts in management decision control, and independent directors can act as mediators in the case of a conflict between shareholders and managers. Outside directors are supported in the supervision of management because they want to protect their reputation as independent and competent decision-makers (Fama & Jensen, 1983). In line with some academicians, a majority of independent directors on the board could improve its effectiveness and therefore increase the value of the firm. The board of directors should be independent from management in order to work more efficiently (Ayadi & Boujèlbène, 2012). In Thai board composition, at least one-third of all board members must be independent directors, and must not consist of less than three persons (Thai Institute of Directors Association, 2014).

After examining various economic and financial literature studies, the researcher concludes that the relationship between outside directors and firm performance leads to conflict. There are several literary works which show results in accordance with agency theory. This theory proposes that outside directors are more capable than those inside in the area of conflict resolution, agency cost reduction, and moral hazard problems. Rachdi and Ameer (2011) found that independent directors support managerial decisions for the purpose of creating shareholder value. Liang and Li (1999) conducted research using a sample of 228 Chinese companies and found that the existence of outside directors helps to reduce agency costs by complying with the interests of both the principal and agent. Dahya, Dimitrov, and McConnell (2008) support this view by research conducted using a sample of 799 firms. The researchers presented that highly independent boards tend to efficiently monitor managers and

increase the firm's market. Lin, Ma, and Su (2009) used a panel of 461 Chinese firms for the period from 1999 to 2002. The researchers concluded that board independence raised firm efficiency by approximately 10% due to good corporate governance practice. Schiehl and Bellavance (2009) and Sarkar and Sarkar (2009) agree that a higher number of independent directors amplifies value creation within the firm as they have better governance than those inside.

In opposition to the agency theory, various academic research points to the fact that independent directors can adversely affect firm performance. Stewardship theory queries board independence and presents that internal managers are more reliable and competent in acting for the interests of the firm. In the research by Morck, Shleifer, and Vishny (1988), robustness tests concluded that independent boards do not definitively improve corporate achievement. Hermalin and Weisbach (1991) and Bhagat and Black (2002) strengthen the idea further in their analysis. These researchers perform a relationship test between value creation and other variables besides board independence. Hermalin and Weisbach (1991) stated that outside directors could be deficient in acting in the interests of shareholders because they may lack understanding of the firm in terms of complex operations and policies; independent directors are faced with enormous difficulties when dealing with management. Pathan (2009) found a negative and statistically significant relationship between the presence of independent directors and bank risk (except insolvency). This result supports a percentage of non-executive directors being replaced by independent. Independent directors are more sensitive to regulatory compliance and more independent of the bank's shareholders if the board of directors becomes unwilling to take risks. This is also true for managers because when there is close, regular

oversight by the regulatory authorities, bank managers and directors tend to act more conservatively to avoid any pursuit in the case of default. Therefore, in the Indian context, Sarkar and Sarkar (2009) confirm that low independent board firms have higher achievement. Kaymak and Bektas (2008) carried out research on 27 Turkish banks during the period from 2001 to 2004. They concluded that those boosting the financial performance in terms of return on assets were insiders, not outsiders. These researchers tried to recognize the connection between board independence and firm accomplishments, but found a fusion between advanced agency theory and that of stewardship. Current financial literature interprets board independence as having no effect on firm performance (Rachdi & Ameer, 2011). Several researchers have found that the relationship between board independence and firm risk-taking is not statistically significant (Merle, 2013; Rachdi & Ameer, 2011). Thus, the relationship between board composition and firm risk-taking is an open question for further investigation.

2.2.1.3 Board Leadership Structure

Board leadership structure refers to whether a company has a chairman of the board, assuming the roles of CEO (i.e., CEO duality), or if it assigns these positions to different individuals (i.e., CEO non-duality) (Abdullah, 2004; Elsayed & Wahba, 2013). Several authors refer to board leadership structure as CEO duality (Ayadi & Boujèlbène, 2012; Cheng, 2008; Merle, 2013; Ujunwa, 2012). Merle (2013) and Pathan (2009) regard CEO duality as representative of CEO power. Research regarding CEO duality shows contradictory opinions. Some authors support the idea that CEO duality can improve firm efficiency as well as firm risk-taking with management unity (Adams, Almeida, & Ferreira, 2005; Sah & Stiglitz, 1986, 1991;

Sridharan & Marsinko, 1997), while others oppose the idea because CEO duality may lead to executive power abuse; when the CEO also assumes the role of board chairman, he may have too much power (Fama & Jensen, 1983; Simpson & Gleason, 1999; Jensen, 1993; Pathan, 2009; Wright & Helms, 2000). Adams *et al.* (2005) found that CEO power could intensify the volatility of firm performance because a CEO holding a high degree of power tends to take high-risk decisions.

The CEO should not assume the role of board chairman because he may be unable to separate his personal interests from that of the shareholders (Jensen, 1993). Ayadi and Boujèlbène (2012) stated that the CEO may use the position of board chair to control information available to the board of directors when making decisions because controlling the responsibility of the board has two dimensions: the approval of proposed projects, and monitoring which consists of setting up punishment and reward. The same researchers also stated that CEO duality allows executives to exert more power concerning the decisions of the board, leading to conflict with independent directors. High CEO power could lead to weak corporate governance (Core, Holthausen, & Larcker, 1999). CEO duality may reduce firm risks because a manager who is also chairman of the board, constantly strives to protect his/her position and tends to make decisions involving less risk, which may mean reduced returns for stockholders (Merle, 2010). Wright and Helms (2000) also stated that when the CEO assumes the role of board chair, insiders have a tendency to consent with the chair's decision. Despite the tendency to act in his or her own interests, duality of the CEO tends to limit excessive risk-taking in order to protect human capital. Financial risk levels of a firm reduce when the CEO is also chair of the board of directors (Simpson & Gleason, 1999). These results are consistent with Pathan

(2009), who found that the power of the CEO is negatively associated with banking risk. Where the CEO chairs the board there is lower risk to the bank which means duality is negatively and statistically significant for all risk measures. However, a few authors have stated that they were unable to find evidence to support a relationship between the board leadership structure and firm risk (Ferrero-Ferrero *et al.*, 2012; Merle, 2013).

2.2.1.4 Board Age

MacCrimmon and Wehrung (1990) conducted research on the characteristics of risk-taking management. Factors used in their research fall into three categories: personal attributes (age, dependents, education, and nationality), financial attributes (wealth and income), and professional attributes (position, authority, seniority, firm size, and industry). The individual's personal perspective is an important factor in decision-making regarding risk or risk management, and hence the board of directors' personal perspectives should be considered (Thai Institute of Directors Association, 2014). Harikanth and Pragathi (2012) state that investment decisions also depend on the type of investors, risk tolerance capacity, education, occupation, age, sex, income, marital status, family background, residential area and environment as well as attachment to the financial advisor etc. Lewellen, Lease, and Schlarbaum (1977) found that age, sex, income, and education affect investor preference. The best board structure should have diversity in the risk acceptance level, which could lead to a variety of information being exchanged between board members, resulting in effective decision-making and firm performance (Thai Institute of Directors Association, 2014).

MacCrimmon and Wehrung (1990) developed 13 risk measures which include both personal and business risks of the board of directors. These were formed into

seven consolidated measures using factor analysis. The study concludes by stating that no single measure of risk tendency is adequate to capture the complexity of risk-taking behavior. MacCrimmon and Wehrung (1990) also found that older board members had greater seniority, and fewer dependents. Grouped together into a variable called “maturity”, this type of board is the most risk-averse, and the most successful are big risk-takers. Similar results were found in studies by Hambrick and Fukutomi (1991), Barker and Mueller (2002), and Cheikh (2014). The researchers found that as the age and tenure of CEOs increase, the more risk-averse they become, and the less likely they are to make risky decisions and undertake innovative strategies. On the contrary, Merle (2010, 2013) found no significant relationship between board age and bank capital adequacy risk.

2.2.1.5 Board Gender Diversity

Gender diversity could increase the effectiveness and efficiency of the board of directors (Adams & Ferreira, 2009). Several authors have noted that the number of women serving on corporate boards is low. Joy (2008) studied the proportion of women directors in US companies during the period from 1995 to 2006 and found that in 1995, Fortune 500 companies with female directors accounted for only 9.6% of all board members, increasing to 14.6% by 2006. According to the researcher’s speculation, at such a growth rate, it would take at least 70 years for the number of female directors in Fortune 500 companies to reach uniformity with males. Catalyst (2012) declared that female director portions accounted for 16.6% on boards of Fortune 500 companies, and among these, 10.3% of boards did not have female directors.

Rhode and Packel (2010) presented research on board diversity. Although it was found that the influence of board gender diversity toward corporate performance is ambivalent, and the effects deviate according to the approach used to test it, nevertheless board diversity elevates decision-making. Diverse studies found a complementary association between board gender diversity and firm achievement. According to the research by Robinson and Dechant (1997), Carter, Simkins, and Simpson (2003), a complementary result was found concerning the influence of gender diversity on firm accomplishment. Firstly, board gender diversity improves marketing proficiency. Secondly, gender diversity magnifies creativity, innovativeness, attitude, and belief which vary in accordance with demographic variability. Thirdly, board diversity in terms of gender results in more effective problem-solving, because the board has differing opinions to consider when making decisions.

Board gender diversity positively influenced firm value when measured by Tobin's Q ratio (Carter *et al.*, 2003). Srinidhi, Gul, and Tsui (2011), who explored US board gender by employing two measurements for the ability to report earnings (income), found that firms with female board members were better able to report earnings (income). From the research by Campbell and Minguez-Vera (2008), which studied Spanish firms during the period from 1995 to 2000, it was found that the implementation of board gender variance had a favorable effect on firm value. Francoeur, Labelle, and Sinclair-Desgagné (2008) conducted research on the 500 biggest Canadian companies. The authors discovered that with more female top management, firms could generate beneficially significant abnormal returns.

However, the relationship was not significant when the authors tested the association between director gender diversity and corporate accomplishment.

Various authors found that women tend to be more risk-averse than men. Schubert (2006), who examined differences in risk perspectives between males and females, learned that females were more cautious concerning gains than males. However, from the risk management perspective, females tend to have a comparative advantage in diverseness and communication tasks. The researchers suggested that company success comes from collaboration between men and women in senior management, developing firm risk analysis and risk management. The work of Krishnan and Park (2005) considers male managers to be more proficient in managing firms than women. Cheng, Chan, and Leung (2010) supported the results by presenting that women managers have a high-risk aversion characteristic. In the research by Jianakoplos and Bernasek (1998), unmarried women exhibited higher risk avoidance in financial decision-making than bachelors. From the result, the risk aversion behavior of women managers may lead to inferior firm performance since higher risk-averse investors can expect less gains. Lenard *et al.* (2014) showed that higher board gender diversity could impact firm risk-taking by contributing to lower variability in stock market returns and firm performance.

Several research studies found that female managers tended to be more risk-averse than male. However, there are still some papers which oppose this idea and present that the risk aversion of female managers is not different from that of male managers when making managerial decisions. Maxfield, Shapiro, Gupta, and Hass (2010), who conducted research using the Simmons 2008 Gender and Risk database, found that the risk acceptance levels of female managers were equivalent to male

managers in their organizational decision-making. Atkinson, Baird, and Frye (2003) investigated the performance of male and female managers of fixed-income mutual funds and found that their funds showed no noteworthy difference in performance or risk.

2.2.1.6 Board Ownership

Board of director ownership refers to company stock ownership by the board (Merle, 2013). Cheikh (2014), who studied the effect of CEO power on firm risk-taking, stated that stock ownership is an indicator of CEO power. The more shares the CEO owns, the more power he holds, and therefore if board members own company stock they have more power and can weaken that of the CEO. This can improve the effectiveness of monitoring management. Xiao, Alhabeeb, Hong, and Haynes (2001) present that management as owners and founders prefer to make risky decisions to generate earnings. Wright and Helms (2000) also stated that board stock ownership can encourage board members to make more risky decisions but this only occurs when the chairman is not the CEO. The nature of CEOs' wealth portfolios, financial and non-financial benefits, costs of their positions, as well as the potential for entrenchment impacts on their dispositions concerning company innovativeness and firm risk. When CEOs hold fewer shares the growth and risk-taking of the firm can improve.

On the contrary, when CEOs own a large number of stocks, they may be discouraged toward corporate risk-taking. An increase in the CEO ownership level might hinder risk-taking and corporate innovation in a growth-oriented firm (Wright & Helms, 2000). If incentives permit a significant amount of CEO share ownership,

they have a tendency to focus on their personal wealth and utility management rather than corporate risk-taking and firm performance (Merle, 2013).

2.2.1.7 Board Compensation

Compensation is one of the factors used to measure board characteristics according to Ferrero-Ferrero *et al.* (2012). They defined board compensation as fees for directors' services plus fees for attending board meetings. Adams (2003) used annual board fees to measure its effectiveness, because this method is capable of capturing the number of board meetings during a year, the skills and effort of the board in discussing and establishing overall strategic management, surveillance of financial and managerial actions, and evaluating the performance of executive management.

Although a board of directors is the main mechanism of corporate governance and current argument exists about the excessive level of executive and director compensation, few studies have examined board compensation (Wan, 2008). Most research has focused on CEO compensation (Core *et al.*, 1999; Hall & Liebman, 1998). Adams (2003) and Brick, Palmon, and Wald (2002) considered board fees to be associated to the difficulties in firm monitoring. Ferrero-Ferrero *et al.* (2012), who studied the impact of director characteristics on firm performance and risk-taking before and during the global financial crisis, found evidence that higher board compensation worsened firm performance, but observed a positive relationship between board fees and firm risk-taking in both economic contexts. The authors explained that high board fees weaken corporate governance, which in turn weakens performance and increases risk. Merle (2013) suggested that if its members are given high compensation, board effectiveness might be seriously obstructed because they

want to maintain their position and are reluctant to take risks, thus causing a reduction in firm risk-taking, especially in the presence of CEO duality.

2.2.1.8 Board Meeting

The frequency of meetings strengthens the controlling activities of the board of directors, and therefore the advisory role is solidified. Agency and resource dependency theories recommend that the board of directors have a fair amount of boardroom communication with appropriate frequency of board meetings in order to minimize information asymmetry and decrease reliance on outside entities (Wijethilake *et al.*, 2015). The board meeting is one of the major proxies for board activities (Jackling & Johl, 2009; Vafeas, 1999). Empirical studies state that board activities always affect bank risk-taking. Any situation relating to the influence of board activity on bank risk-taking is an empirical issue, developing proactive or reactive results (Ayadi & Boujèlbène, 2012). The effectiveness of board ability has a positive impact on performance (proactive board) (Ayadi & Boujèlbène, 2012). Zahra and Pearce (1989) suggest that the frequency of board meetings, and the timeliness and information quality exchanged between executives and boards, affect the board's ability to make decisions as well as its benefaction to firm performance. In addition, Wijethilake *et al.* (2015), who investigated the effect of board involvement toward firm performance, found that board meetings have a positive effect.

The presence of an advisory board has made the banking business complex, and hence highlights the importance of information exchange. Board meeting frequency can also create a response to poor performance (reactive board) (Ayadi & Boujèlbène, 2012). Vafeas (1999) examined whether the frequency of board meetings is a solution to the problem of limited director cooperation. The researcher stated that

meeting frequency may affect the way the board works, since board meetings allow members to meet, discuss, and exchange ideas on bank strategy, and find ways to monitor managers. Vafeas (1999) also presented that board meeting frequency has a positive effect toward firm value. This result is supported by Ayadi and Boujèlbène (2012), who studied the relationship between the board of directors and bank risk-taking, finding that board meeting frequency has a negative relationship with bank risk-taking. Nevertheless, some researchers found that more frequent board meetings were not always beneficial, since as a consequence, busy board members may be unable to effectively perform their roles in firm monitoring, leading to lower performance (Core *et al.*, 1999; Fich & Shivdasani, 2004; Jackling & Johl, 2009; Shivdasani & Yermack, 1999). Jackling and Johl (2009), who examined the effect of board characteristics toward firm performance in the Indian context, found evidence that busy board members have a negative effect toward firm performance. This negative effect might influence firm risk.

2.2.1.9 Remuneration Committee

The remuneration committee is a type of board. According to the Thai Institute of Directors Association (2014), a board committee is established in order to ease the responsibility of directors advising the board or making decisions on specific issues such as nominating new directors. According to SET (2012), for the purposes of improving its efficiency and effectiveness, a committee should be established to study and analyze the work of the board as appropriate. Apart from an audit committee, which is required by the Securities and Exchange Commission, a board should establish both nomination and remuneration committees. The remuneration committee is responsible for considering and designing compensation payment rules and forms

for the board and executive. The board of directors approves executive remuneration, while board remuneration is approved by shareholders. The nomination committee is responsible for considering the rules and process for appointing new directors and management, as well as determining new directors and management for approval by shareholders. Both committees could solve conflict of interest problems between managers and directors by using compensation, and recruiting skilled, knowledgeable and experienced board members together with a management team. Most stock exchanges therefore recommend the existence of nomination and remuneration committees (Issarawornrawanich, 2015).

Remuneration is related to the strength of corporate governance (Sun, Cahan, & Emanuel, 2009). Improvement in corporate governance quality decreases business opportunities (Ahn & Choi, 2009; Carcello & Neal, 2000, 2003; Klein, 2002; Morey, Gottesman, Baker, & Godridge, 2009). The quality of a remuneration committee's corporate governance directly affects executive remuneration, since when associated with incentive alignment the quality of corporate governance is high. Improving governance quality by strengthening the incentive alignment may reduce agency problems and therefore result in improved business performance (Ayadi & Boujèlbène, 2012).

However, the effectiveness of a remuneration committee is also being questioned because certain literature indicates that it does not necessarily improve governance quality. Ali and Teulon (2014), who studied the effect of corporate governance toward CEO compensation in the French stock market, found a positive relationship between CEO compensation and independent remuneration. Similar results were also presented by Guthrie, Sokolowsky, and Wan (2012), who conducted

research using a sample of US listed firms and found no significant relationship between CEO compensation and independent remuneration. Ayadi and Boujèlbène (2012) found that the presence of a remuneration committee did not have a significant effect toward bank risk-taking. Thus, the relationship between remuneration and firm risk-taking is an open question for further investigation.

2.2.2 CEO Compensation

CEOs are strategic partners in firms since they make financing and investment decisions with suggestions for firm practices. Ayadi and Boujèlbène, (2012) suggest that CEO remuneration is a tool designed to reduce the moral hazard problem by rewarding CEOs based on their performance. This could help lessen the agency problem between principal (owner) and agent (manager). When there is a strong linkage between company pay and performance, CEOs tend to align their interests with those of the shareholders. In order to achieve better performance, banks are willing to take higher risks because the market activity of credit institutions establishes a linkage between executive remuneration and risk-taking (Ayadi & Boujèlbène, 2012).

Wright and Helms (2000) presented that the nature of CEO wealth includes portfolios, financial benefits such as remuneration, and non-financial such as costs relating to their position and therefore the potential for entrenchment may affect a CEO's temperament regarding firm innovativeness and risk. When CEOs have a low level of ownership, they have a tendency to improve the growth and risk-taking of the firm. A similar result was also found by Belkhir and Chazi (2010). Belkhir and Chazi (2010), who studied the relationship between CEO incentive compensation and management risk-taking on a sample of 156 banks during the years from 1993 to

2006, found that there is a positive relationship between CEO compensation and bank risk-taking. They suggest that a higher level of CEO incentive leads to higher risk-taking by the bank. However, when the ownership level of CEOs is higher, they may tend to become more conservative in firm risk-taking. An increase in CEO ownership level may hinder a growth-oriented firm in risk-taking and corporate innovations (Wright & Helms, 2000). These results are supported by Merle (2013), who found that CEO compensation has a negative effect on bank risk-taking.

2.3 Previous Studies

Rachdi and Ameer (2011) studied the relationship between board characteristics, firm performance, and bank risk-taking in Tunisia. This research was conducted to analyze how board characteristics and incentives affect performance and risk-taking in the banking industry. The researchers used a sample of 11 large Tunisian commercial banks in the period from 1997 to 2006. The dependent variable of firm performance was measured by return on assets (ROA) and return on equity (ROE), and bank risk-taking was measured by Z-score calculated by the ROA and capital asset ratio, divided by the standard deviation of asset returns. Size, independence, and CEO ownership were used to measure corporate board characteristics. The researchers investigated the correlation using the system of generalized least squares (GLS), random effect, and generalized method of moments (GMM).

They found that banks with smaller boards showed better achievement and higher risk-taking behavior. The results also demonstrate that the existence of independent directors negatively affects firm performance, whereas the presence of independent directors has no notable effect on risk-taking. CEO ownership was also

found to inversely affect the performance of Tunisian banks and is positively related to bank risk. High charter value banks generated lower ROA, ROE, and bank risk. Smaller banks tend to have lower risk. Rachdi and Ameer (2011) concluded that board characteristics are capable of influencing bank performance and risk-taking.

Kim (2014) explored the relationship between board heterogeneity (or diversity) and firm risk in order to find its effect. Empirical research was conducted using a sample of 295 US firms from the Fortune 1000 list in 2003. The dependent variable of firm performance was measured by the return on invested capital, and firm risk was divided into two types: internal accounting risk, which was measured by the standard deviation of ROA for the period from 1999 to 2003, and external market risk, measured by beta of stock for 2003. The board's heterogeneity was assessed using functional background, education specialty, and tenure of directors. The findings of this study showed that board heterogeneity is negatively associated with firm performance when that firm operates in the volatile managerial context of higher risk. Specifically, board heterogeneity in terms of functional background and educational specialty is negatively associated with firm performance when such firm is high-risk. The findings imply that higher firm risk increases the demand for process efficiency at the corporate end, and hence board heterogeneity becomes more important.

Wang (2012) explored the relationship between board size and firm risk-taking to justify their relevance in risky policy choices. Firm risk-taking was measured by certain variables: sensitivity of the CEO's wealth on stock price (delta), sensitivity of the CEO's wealth on stock return volatility (vega), investment policy assessed by R&D expenditure as high-risk, capital expenditure as low risk investment, debt policy measured by leverage ratio, future firm risk employing the volatility of monthly stock

yield at around 12 and 24 months, the variation of income before extraordinary items, and depreciation minus dividends scaled by assets. The explanatory variable is board size. A sample was applied consisting of a panel of 1,618 US listed firms in the period from 1992 to 2004. It was found that both delta and vega were negatively related to board size. This finding indicates that smaller boards tend to provide managers with higher remuneration and this motivates them to accept higher risk. The researcher found that firms with smaller boards had a lower leverage ratio and made more risky investments. The results also show that firms with smaller board size have higher future risk. Finally, the researcher concludes that board size has a negative influence on firm risk-taking.

Ayadi and Boujèlbène (2012) conducted research on the relationship between board characteristics, CEO compensation, and bank risk-taking to explain the effects of bank leaders' remuneration on risk-taking. The technique of static panel data for 30 European commercial banks was employed for the period from 2004 to 2009. The dependent variable of bank risk-taking was measured by insolvency risk. The explanatory variables were CEO cash compensation and board characteristics assessed by board size, board independence, the presence of a remuneration committee, frequency of board meetings, and duality of the board. The results of the study showed a negative relationship between CEO remuneration and the risk of insolvency. Likewise, board duality and the frequency of the board meetings negatively affected the risk of insolvency. Board size, the presence of independent board members, and existence of a remuneration committee had no significant effect on insolvency risk. The study gave an overview on the fact that board characteristics and CEO remuneration had a significant and governing role in controlling the management of

European commercial banks. Hence, CEO compensation is considered to be a motivating mechanism manifested by the board to strengthen the internal control of the banks.

Cheikh (2014) explored the connection between CEO power and characteristics and firm risk-taking, and identified the impact of CEO power on risk-taking in listed firms and supported the strategic role of the CEO from their personal profile. The researcher collected a sample of 78 managers from 39 Tunisian listed firms over the period from 2000 to 2010. Information on managerial characteristics was obtained by conducting interviews and distributing questionnaires. Firm risk-taking was calculated using the standard deviation of daily stock returns during the year. The main independent variables were CEO power and characteristics. The CEO's position on the board of directors, status as firm founder, and whether the CEO was chairman of the board were used to measure CEO power. To measure other independent variables of CEO characteristics, the author used tenure, age, education level, gender, and professional experience. The empirical results show that the greater power managers held, the more risky decisions they made. CEOs with internal positions have a tendency to take the highest risk regardless of their position or competence. Education level and professional experience show no significant relationship with firm risk-taking. Older managers, especially those past retirement age, were more reluctant to take risks. On the contrary, the tenure of the CEO has a positive relationship with firm risk.

Lenard *et al.* (2014) researched the effect of board diversity in terms of gender on firm risk. The objective was to examine the relationship between the gender diversity of the board of directors, and risk management and firm performance,

measured by the volatility of stock market returns. The sample consisted of data from 5,754 firms over the period from 2007 to 2011. The authors then used gender diversity, adopting board size and CEO duality as other measures of board characteristics. The dependent variable of firm risk was mainly calculated by the variability in stock market returns and other measurements were used as alternatives: volatility of corporate performance, variation of ROA, volatility of Tobin's Q, and firm value by the present value of future cash flow. The findings demonstrated that a high proportion of female directors could decrease the dispersion of stock market yield, implying lower firm risk. Furthermore, the higher the board gender diversity, the lower the volatility of firm performance. Board size and CEO duality have negative effects on firm risk. The research design and findings also presented that the position of women in corporate leadership is related to other risk measurements in a negative way. The authors suggest that the presence of female board members may be related to corporate performance.

Ferrero-Ferrero *et al.* (2012) studied the impact of board characteristics on corporate performance and risk-taking before and during the global financial crisis. The purpose of their paper was to examine the effectiveness of corporate governance mechanisms and whether or not the board equitably safeguards the interests of stakeholders by reducing corporate risk-taking with proper management. The sample consisted of Standard and Poor's 500 index firms (S&P 500) from 2005 to 2008, divided into two different economic contexts: an economic growth period before the financial crisis (2005 to 2007), and a recession period during the last global financial crisis (2008). The methodology implemented takes into account the bidirectional causality and addresses the endogeneity problem using a simultaneous equation

system with the three-stage least squares estimation method. The dependent variables were: firm performance—measured by earnings before extraordinary items and after taxes to total assets (EBEITAT), and firm risk—measured by the standard deviation of stock returns. Board characteristics were measured by the following: board size, independent board composition, board fees, and chairman duality.

Ferrero-Ferrero *et al.* (2012) found that board size negatively affected firm performance and risk before the financial crisis. However, during the financial crisis, board size is shown to have no effect on firm performance and risk. Before the financial crisis, board composition did not affect firm risk but had a positive relationship with firm performance. However, during the financial crisis it shows a negative relationship toward firm risk but no relationship was found toward corporate performance. Chairman duality was positively related to firm performance from 2005 to 2007, although it did not have any connection in 2008. Chairman duality did not affect firm risk during either economic context. The author found higher board fees and risk levels in both periods. The results imply that corporate governance effectiveness is sensitive to the economic context, and board structure in terms of composition was capable of reducing the levels of corporate risk-taking during the crisis. The researchers suggest that effective corporate governance mechanisms may have lessened excessive corporate risk-taking and protected stakeholders' interests in both periods: before and during the global financial crisis.

Merle (2013) examined the relationship between board characteristics and capital adequacy risk-taking at bank holding companies (BHCs) for the purpose of testing a relationship between the board characteristics of US BHCs and capital adequacy risk-taking of banks. The researcher used a sample of 354 US BHCs for

2007. The dependent variable of capital adequacy risk was measured by the Tier 1 capital leverage ratio of the bank. The characteristics of the board of directors were represented by the independent variables of board size, board composition or percentage of outside directors, CEO/board chair duality, proportion of stock held by board members, average total years of service of board members or board tenure, the average age of board members, and the average number of other boards on which the members serve. Independent variables also measured CEO compensation, divided into CEO base pay relative to total bank assets, and CEO incentive pay relative to total bank assets. Other independent variables included market power and total assets. The findings of this research stated that a rise in stock ownership by the board, CEO base pay, and CEO incentive pay all increased the Tier 1 capital leverage ratio of the banks, creating a decrease in capital risk.

Table 2-1: Summary of Previous Studies

Title	Author	Year	Major findings
Board Characteristics, Performance and Risk-Taking Behavior in Tunisian Banks	Rachdi and Ameer	2011	The findings indicated that board size has a negatively significant relationship with firm risk-taking while CEO ownership is positively related to bank risk. Board size, board independence, and CEO ownership have a negative connection with firm performance.
Board Heterogeneity: Double-Edged Sword? Focusing on the Moderating Effects of Risk on Heterogeneity-Performance Linkage	Kim	2014	The researcher found that board heterogeneity in terms of functional background and educational specialty is negatively associated with firm performance when the firm is high-risk.
Board Size and Firm Risk-Taking	Wang	2012	The author stated that smaller boards tend to give CEOs higher remuneration and require them to

Title	Author	Year	Major findings
			accept more risk. Smaller board firms use lower leverage but take more risky investments and have higher future risk.
Compensation of the CEO, Board of Directors and Bank Risk-Taking	Ayadi and Boujèlbène	2012	The results of the study stated that CEO remuneration, board duality, and frequency of board meetings have a negative effect toward the risk of insolvency.
Determinants of CEO Power and Characteristics of Managerial Profile: Implications for Risk-Taking in Listed Tunisian Firms	Cheikh	2014	The empirical results stated that the more power CEOs hold, the more risky decisions they make. Older managers were more risk-averse but long tenure CEOs have a tendency to accept higher risk.
Impact of Board Gender Diversity on Firm Risk	Lenard, Yu, York, and Wu	2014	The findings noted that a high percentage of female directors impact firm risk by reducing the variability of stock market returns, implying a lower level of firm risk.
The impact of the board of directors characteristics on corporate performance and risk-taking before and during the global financial crisis	Ferrero-Ferrero, Fernández-Izquierdo and Muñoz-Torres	2012	The findings stated that before the financial crisis, board size negatively affected firm performance and risk; board composition did not affect firm risk but had a positive relationship with firm performance, and chairman duality was positively related to firm performance. During the financial crisis, board composition had a negative relationship toward firm risk. The authors found that board fees positively affected risk in both periods.
An examination of the relationship between board characteristics and capital adequacy risk-taking at BHCs	Merle	2013	The findings of this research stated that the stock ownership of board members, CEO base pay, and CEO incentive pay have a negative relationship with capital adequacy

Title	Author	Year	Major findings
			risk.

Chapter 3: Research Framework

In this chapter, important aspects of the research framework are determined, divided into four parts: the first of which explains the theoretical framework. Secondly, the conceptual framework demonstrates the research points. This is then followed by the research model and hypotheses. Each section mentioned above includes justification and explanation. In addition, information from previous empirical research and statistics is provided.

3.1 Theoretical Framework

In this study, seven research models are applied to develop the conceptual framework. The first research model was developed by Merle (2013) in a study entitled “An examination of the relationship between board characteristics and capital adequacy risk-taking at BHC.” The second research model was developed by Rachdi and Ameer (2011) who studied “Board Characteristics, Performance and Risk-Taking behavior in Tunisian banks.” The third research model on “Board Size and Firm Risk-Taking” was developed by Wang (2012). The fourth research model was developed by Ayadi and Boujèlbène (2012) on “Compensation of the CEO, Board of Directors and Bank risk-taking.” The fifth research model on “Determinants of CEO Power and Characteristics of Managerial Profile: Implications for Risk-Taking in Listed Tunisian firms” was developed by Cheikh (2014). The sixth research model was developed by Lenard *et al.* (2014) in a study on the “Impact of Board Gender Diversity on Firm Risk.” The final research model was developed by Ferrero-Ferrero *et al.* (2012), who

studied “The impact of board of directors’ characteristics on corporate performance and risk-taking before and during the global financial crisis.” Full details of these studies are presented as follows:

Merle (2013) examined the relationship between board characteristics and capital adequacy risk-taking at BHCs for the purpose of testing the relationship between the board characteristics of US BHCs and capital adequacy risk-taking of banks. The researcher used a sample of 354 US BHCs for 2007. The dependent variable of capital adequacy risk is measured by the Tier 1 capital leverage ratio of the bank. The characteristics of the board of directors are represented by the independent variables of board size, board composition or percentage of outside directors, CEO/board chair duality, average total years of service of board members or board tenure, the average age of board members, proportion of stock held by members of the board, and the average number of other boards on which the members serve. Independent variables also measure CEO compensation, divided into CEO base pay and CEO incentive pay in relation to total bank assets. Other independent variables include market power and total assets.

Multiple linear regression is the methodology used to test the relationship between board characteristics and capital adequacy risk-taking. After exploring the relationship, the author stated that only board ownership, CEO base pay, CEO incentive pay, and the total assets of the bank have a significant relationship with capital adequacy risk. The findings of this research show that a rise in the stock ownership of the board, CEO base pay, and CEO incentive pay all increase the Tier 1 capital leverage ratio of banks, implying a decrease in capital adequacy risk. Total

bank assets were negatively related to the capital leverage ratio, and hence positively related to capital adequacy risk.

Rachdi and Ameur (2011) studied the relationship between board characteristics, firm performance, and bank risk-taking in Tunisia. This research was conducted to analyze how board characteristics affect performance and incentivize risk-taking in the banking industry. The researchers used a sample of 11 large Tunisian commercial banks from 1997 to 2006. ROA and ROE were used to measure the dependent variable of firm performance. Another dependent variable; bank risk-taking, was measured by Z-score calculated by the ROA plus capital asset ratio divided by the standard deviation of asset returns. Corporate board characteristics were measured by board size, board independence, and CEO ownership percentage. The control variables used were bank size by total assets, charter value, and previous mergers and acquisitions.

The researchers explored the correspondence by using the GLS random effect and GMM, and found that a smaller board is associated with better performance but higher risk-taking. The existence of independent directors negatively affected performance. However, it did not have a remarkable impact on firm risk. CEO ownership negatively affected Tunisian bank performance but was positively related to bank risk. Banks with high charter value had lower performance, measured by the ROA and ROE. High charter value banks generated higher risk. Banks with smaller boards tend to have lower risk. Rachdi and Ameur (2011) concluded that board characteristics are a determinant factor in bank performance and risk-taking.

Wang (2012) explored the relationship between board size and firm risk-taking to justify its relevance in risky policy choices. This paper measured firm risk-taking

using the following variables: sensitivity of CEO wealth to stock price (delta), sensitivity of CEO wealth to stock return volatility (vega), investment policy assessed by R&D expenditure as high-risk investment, capital expenditure as low risk investment, debt policy measured by the leverage ratio, future firm risk employing the volatility of monthly stock returns over 12 and 24 months, the dispersion of income before extraordinary items, and depreciation minus dividends divided by assets. The explanatory variable is board size. The author also controls firm size, using the market value of equity, growth opportunity, the market value of assets over book value, cash flow, income before extraordinary items and depreciation minus dividends—scaled by assets, prior volatility, and the volatility of cash flow.

The researcher employed a sample of 1,618 US listed firms from 1992 to 2004, and a regression model with fixed effects, using the dynamic panel data estimation procedure. While considering the influence of CEO compensation on investment and debt policy, the researcher found that smaller board firms have a lower leverage ratio. However, they have more risky investments and are related to higher future risk. Smaller boards have a tendency to provide managers with more incentives to encourage them to work harder and accept more risk. From these results, the researcher concluded that board size has a negative impact on firm risk-taking. Regarding the control variables, cash flow and firm size negatively affected every risk measurement, while prior stock volatility had a positive effect.

Ayadi and Boujèlbène (2012) conducted research on the relationship between board characteristics, CEO compensation, and bank risk-taking. The study explains the effects of the board of directors and the remuneration of bank leaders toward risk-taking. This research employed the static panel data technique for 30 European

commercial banks in Belgium, France, Germany, and Finland over the period from 2004 to 2009. The dependent variable of bank risk-taking was measured by insolvency risk. The following explanatory variables were used: CEO cash compensation, board characteristics assessed by board size, board independence, presence of a remuneration committee, frequency of board meetings, and duality of the board. The control variables were total assets and the debt to equity ratio of the bank. Static panel data and fixed effect models were used as the methodology. The results of the study showed a negative relationship between CEO remuneration and the risk of insolvency. Likewise, board duality and the frequency of board meetings negatively affected the risk of insolvency. Board size, the presence of independent members, and existence of a remuneration committee did not have a significant effect on insolvency risk. As to the control variables, the total assets of the bank had a positive relationship with insolvency risk. The study provided an overview regarding the fact that both board characteristics and remuneration of the CEO have a significant and governing role in controlling the management of European commercial banks. Hence, CEO compensation is considered to be a motivating control mechanism manifested by the board to strengthen internal control.

Cheikh (2014) explored the connection between CEO power and characteristics toward firm risk-taking. The main contribution of this paper identified the impact of CEO power on risk-taking in listed firms and supported the strategic role of the CEO from their personal profile. The researcher collected a sample of 78 managers from 39 Tunisian listed firms over the period from 2000 to 2010. Information on managerial characteristics was obtained by conducting interviews and distributing questionnaires. Firm risk-taking was calculated by the standard deviation

of daily stock returns during the year. The main independent variables CEO power and characteristics, the CEO's position on the board, status as a firm founder, and whether or not the CEO was chairman of the board, were used to measure CEO power. Other independent variables used to measure CEO characteristics were tenure, age, education level, gender, and professional experience. The control variables used were firm size measured by total assets, debt to equity ratio, and market-to-book ratio. The fixed effect regression model was applied in the study. The empirical results stated that the three power measurements had no effect on risk-taking and the more power managers held, the more risky decisions they made. A CEO with an internal position on the board has a tendency to take the highest risk, regardless of his position or competence. Education level and professional experience show no significant relationship with firm risk-taking. Older managers, especially those past retirement age, and females were more reluctant to take risks. On the contrary, CEO tenure has a positive relationship with firm risk. Regarding control variables, total assets positively affect firm risk, while market-to-book value is negatively related and the correlation of debt ratio is considered insignificant.

Lenard *et al.* (2014) researched the effect of board gender diversity toward firm risk-taking, measured by the dispersion of stock market yield. The researchers used a sample of 5,754 observations over the period from 2007 to 2011, and gender diversity as the main explanatory variable, adopting board size and CEO duality to measure board characteristics. The dependent variable of firm risk was mainly evaluated by the variation of stock market yield. This research also employed other methods as alternative risk indicators: variability in corporate performance, dispersion of ROA, dispersion of Tobin's Q, and firm value by the present value of future cash

flow. In order to gain better understanding of the correlation of board gender diversity and corporate risk, the researchers controlled the market value of equity, ROA, debt level, sales growth, and capital expenditure scaled by assets and loss, adopting cross-sectional time series panel regression with a fixed effect model. The findings presented that a higher proportion of female board members create a reduction in the dispersion of stock market yield. Furthermore, the higher the board gender diversity, the lower the abnormality of corporate performance. These results implied a lower level of firm risk. Board size and CEO duality have a negative effect toward firm risk. The research findings also expressed that the role of women in corporate leadership positions has a negative correlation with other risk measurements. The authors suggest that the presence of female board members could affect corporate performance. For control variables, the market values of equity and ROA have a negative relationship with firm risk-taking. On the other hand, sales growth, debt level, and loss have a positive relationship with firm risk.

Ferrero-Ferrero *et al.* (2012) studied the impact of board of director characteristics on corporate performance and risk-taking before and during the global financial crisis. This paper examines the effectiveness of corporate governance mechanisms and whether or not the board of directors equitably safeguarded the interests of stakeholders by reducing corporate risk-taking with proper management. The sample consisted of Standard and Poor's 500 index firms (S&P 500) from 2005 to 2008, divided into two different economic contexts: an economic growth period before the financial crisis (2005 to 2007) and a recession period during the last global financial crisis (2008). The methodology implemented takes into account the bidirectional causality and addresses the endogeneity problem using a simultaneous

equation system with the three-stage least squares estimation method. The dependent variables were firm performance measured by EBEIAT and firm risk measured by the standard deviation of stock returns. Board characteristics were measured by the following: board size, independent board composition, board fees, and chairman duality. The researcher employed cross-sectional regression analysis.

Ferrero-Ferrero *et al.* (2012) found that board size negatively affected firm performance and risk before the financial crisis. However, during the financial crisis board size had no such effect. Before the financial crisis, board composition did not affect firm risk but had a positive relationship with firm performance, while during the financial crisis a negative relationship toward firm risk is shown but no relationship with corporate performance. Chairman duality was positively related to firm performance from 2005 to 2007, although it did not have any connection in 2008. Chairman duality did not affect firm risk during either economic context. The author found that higher board fees resulted in an increased risk level for both periods. The results imply that corporate governance effectiveness is sensitive to the economic context and board structure in terms of board composition, and is capable of reducing the levels of corporate risk-taking during the crisis. The researchers suggest that effective corporate governance mechanisms should lessen excessive corporate risk-taking and protect the interests of stakeholders for both periods: before and during the global financial crisis.

3.2 Conceptual Framework

The conceptual framework in this study was constructed from the theoretical framework of previous researchers mentioned in 3.1. This study concentrates on the relationship between firm risk-taking and board characteristics.

The dependent variable for this study is firm risk-taking, classified as capital adequacy risk (Tier 1 capital leverage ratio), business risk (volatility of returns), financial risk (debt ratio), and investment risk (capital expenditure scaled by assets). Board characteristics are considered as the main independent variable of this study and measured by board size, board composition, board leadership structure, board compensation, board of directors' ownership, board meetings, remuneration committee, board age, and board gender diversity. The researcher also includes CEO compensation as another independent variable since it is also used in related literature as a factor which may affect firm risk-taking. Other factors which could affect firm risk-taking are added as control variables: firm size, cash flow, firm performance (ROA), and charter value.

The dependent, independent, and control variables used in this research have all been used in previous studies as follows:

Merle (2013) examined the relationship between broad characteristics and capital adequacy risk-taking at BHCs in the US. The dependent variable of capital adequacy risk is measured by the Tier 1 capital leverage ratio of the bank. The characteristics of the board of directors represented by the independent variables are size, composition or percentage of outside directors, CEO/board chair duality, the average age of members, and the proportion of stock held by board members. Other independent variables include market-to-book asset ratio and total assets.

Rachdi and Ameer (2011) studied the relationship between board characteristics, firm performance, and bank risk-taking in Tunisia. They used board size and independence to measure corporate characteristics. The control variables were bank size by total assets and charter value.

Wang (2012) explored the relationship between board size and firm risk-taking to justify the relevance of board size and the risky policy choices of US firms. This paper measured firm risk-taking using the following variables: investment policy assessed by R&D expenditure as high-risk investment, capital expenditure as low risk investment, debt policy measured by the leverage ratio, future firm risk employing the volatility of monthly stock yield for periods of 12 and 24 months, the dispersion of income before extraordinary items, and depreciation minus dividends scaled by assets. Board size is the independent variable. The author also controls firm size using growth opportunity and the market value of assets over book value, cash flow using income before extraordinary items and depreciation minus dividends, scaled by assets, prior volatility and the volatility of cash flow.

Ayadi and Boujèlbène (2012) conducted research on the relationship between board characteristics, CEO compensation, and bank risk-taking in Europe. Explanatory variables were: CEO cash compensation and board characteristics assessed by board size, board independence, the presence of a remuneration committee, frequency of board meetings, and duality of the board. The control variables are the total assets and debt to equity ratio of the bank.

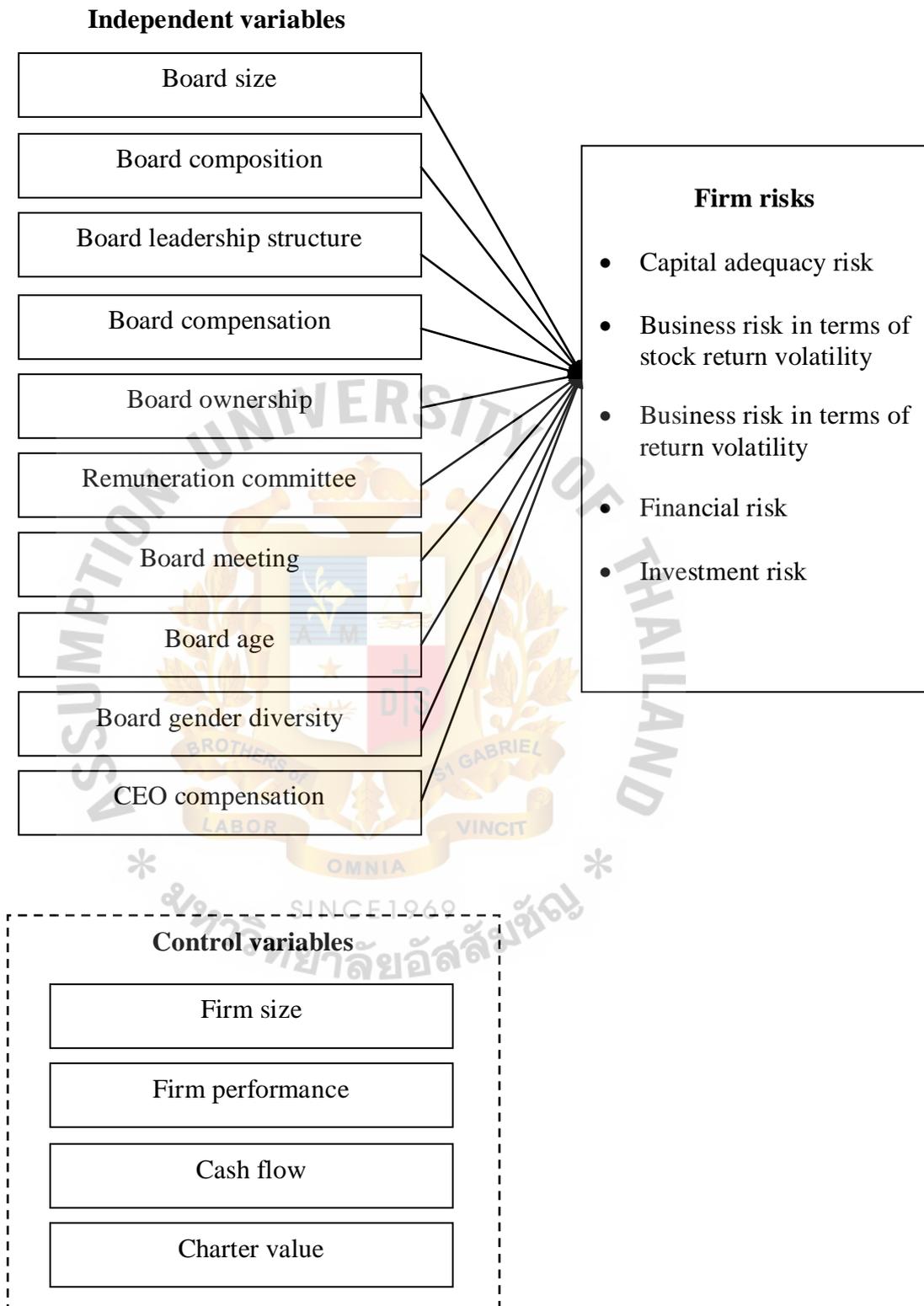
Cheikh (2014) explored the connection between CEO power and characteristics toward firm risk-taking in Tunisia. Firm risk-taking was calculated by the standard deviation of daily stock returns during the year. Main independent variables were CEO power and characteristics. The position of the CEO on the board of directors, status as a firm founder, and whether or not the CEO was chairman of the board were used to measure CEO power. To measure the other independent variable

of CEO characteristics, the author used age and gender control variables, including the size of the firm measured by total asset, debt to equity ratio, and market-to-book ratio.

Lenard *et al.* (2014) researched the effect of board diversity in terms of gender on firm risk. Gender diversity was used as the main board characteristic and board size and CEO duality were adopted as measurements. The dependent variable of firm risk was mainly measured by the variability in monthly stock market yield. The researcher controlled the market value of equity and firm performance by ROA, and adopted cross-sectional time series panel regression, with a fixed effect model.

Ferrero-Ferrero *et al.* (2012) studied the impact of board characteristics on corporate performance and risk-taking before and during the global financial crisis in the US. The dependent variable was firm risk which was measured by the standard deviation of stock returns. The board characteristics were measured by the following: board size, board composition, board fees, and chairman duality, employing cross-sectional regression analysis.

Figure 3-1: Conceptual Framework



Source: Created by author

3.3 Research Model

Literature on the relationship between firm risk and board characteristics generally employs the panel data regression model for analysis.

The fixed effect panel data regression model is adopted for this research in order to test the hypotheses of the impact of board characteristics on firm risk as shown in equations (1) to (5).

Model applied for the five-year period from 2010 to 2014:

$$\begin{aligned}
 \text{CAPRISK}_{i,t} = & \alpha + \beta_1 \text{BSIZE}_{i,t} + \beta_2 \text{OUTSIDE}_{i,t} + \beta_3 \text{DUAL}_{i,t} + \beta_4 \text{AGE}_{i,t} + \\
 & \beta_5 \text{PCT_F_DIR}_{i,t} + \beta_6 \text{BOARDOWN}_{i,t} + \beta_7 \text{BOARDFEES}_{i,t} + \beta_8 \text{MEYEAR}_{i,t} + \\
 & \beta_9 \text{COMTE}_{i,t} + \beta_{10} \text{REMU}_{i,t} + \theta_1 \text{SIZE}_{i,t} + \theta_2 \text{CashFlow}_{i,t} + \theta_3 \text{CV}_{i,t} + \theta_4 \text{ROA}_{i,t} + \\
 & \sum^{N-1} \gamma \text{Dummy}_i + \sum^{T-1} \gamma \text{Dummy}_t + u_{i,t}
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 \text{SD_RET}_{i,t} = & \alpha' + \beta_{11} \text{BSIZE}_{i,t} + \beta_{12} \text{OUTSIDE}_{i,t} + \beta_{13} \text{DUAL}_{i,t} + \beta_{14} \text{AGE}_{i,t} + \\
 & \beta_{15} \text{PCT_F_DIR}_{i,t} + \beta_{16} \text{BOARDOWN}_{i,t} + \beta_{17} \text{BOARDFEES}_{i,t} + \beta_{18} \text{MEYEAR}_{i,t} + \\
 & \beta_{19} \text{COMTE}_{i,t} + \beta_{20} \text{REMU}_{i,t} + \theta_5 \text{SIZE}_{i,t} + \theta_6 \text{CashFlow}_{i,t} + \theta_7 \text{CV}_{i,t} + \theta_8 \text{ROA}_{i,t} + \\
 & \sum^{N-1} \gamma \text{Dummy}_i + \sum^{T-1} \gamma \text{Dummy}_t + u_{i,t}
 \end{aligned} \tag{2}$$

$$\begin{aligned}
SD_IN_{i,t} = & \alpha'' + \beta_{21} BSIZE_{i,t} + \beta_{22} OUTSIDE_{i,t} + \beta_{23} DUAL_{i,t} + \beta_{24} AGE_{i,t} + \\
& \beta_{25} PCT_F_DIR_{i,t} + \beta_{26} BOARDOWN_{i,t} + \beta_{27} BOARDFEES_{i,t} + \beta_{28} MEYEAR_{i,t} + \\
& \beta_{29} COMTE_{i,t} + \beta_{30} REMU_{i,t} + \theta_9 SIZE_{i,t} + \theta_{10} CashFlow_{i,t} + \theta_{11} CV_{i,t} + \theta_{12} ROA_{i,t} + \\
& \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{3}$$

$$\begin{aligned}
DEB_{i,t} = & \alpha''' + \beta_{31} BSIZE_{i,t} + \beta_{32} OUTSIDE_{i,t} + \beta_{33} DUAL_{i,t} + \beta_{34} AGE_{i,t} + \\
& \beta_{35} PCT_F_DIR_{i,t} + \beta_{36} BOARDOWN_{i,t} + \beta_{37} BOARDFEES_{i,t} + \beta_{38} MEYEAR_{i,t} + \\
& \beta_{39} COMTE_{i,t} + \beta_{40} REMU_{i,t} + \theta_{13} SIZE_{i,t} + \theta_{14} CashFlow_{i,t} + \theta_{15} CV_{i,t} + \\
& \theta_{16} ROA_{i,t} + \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{4}$$

$$\begin{aligned}
INV_{i,t} = & \bar{\alpha} + \beta_{41} BSIZE_{i,t} + \beta_{42} OUTSIDE_{i,t} + \beta_{43} DUAL_{i,t} + \beta_{44} AGE_{i,t} + \\
& \beta_{45} PCT_F_DIR_{i,t} + \beta_{46} BOARDOWN_{i,t} + \beta_{47} BOARDFEES_{i,t} + \beta_{48} MEYEAR_{i,t} + \\
& \beta_{49} COMTE_{i,t} + \beta_{50} REMU_{i,t} + \theta_{17} SIZE_{i,t} + \theta_{18} CashFlow_{i,t} + \theta_{19} CV_{i,t} + \\
& \theta_{20} ROA_{i,t} + \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{5}$$

Where:

CAPRISK	= Capital adequacy risk
SD_RET	= Business risk using the standard deviation of monthly stock returns
SD_IN	= Business risk using the standard deviation of returns
DEB	= Financial risk calculated by debt ratio
INV	= Investment risk calculated by capital expenditure
BSIZE	= Board size or number of board members at the annual meeting
OUTSIDE	= Percentage of outside or independent board members in each year
DUAL	= Board chair duality
AGE	= Average age of board members in each year
PCT_F_DIR	= Percentage of female directors
BOARDOWN	= Board ownership
BOARDFEES	= Board compensation or annual board fees
MEYEAR	= Number of board meetings per year
COMTE	= Existence of a remuneration committee
REMU	= Total cash compensation of CEO
SIZE	= Size of firm by book value of total assets
CashFlow	= Cash flow of the firm
CV	= Charter value
ROA*	= Return on assets
α	= Constant term or an intercept
$\beta_1 \dots \beta_{50}$	= Regression coefficients
$\theta_1 \dots \theta_{20}$	= Regression coefficients for control variables
γ	= Regression coefficients for fixed effect dummy variable
Dummy _i	= Fixed effect dummy variable for cross section unit
Dummy _t	= Fixed effect dummy variable for time series period
N	= Number of total cross section unit
T	= Number of total time series period
i	= Firm i
t	= Year t
u	= Error

3.4 Hypotheses

This study contains eleven independent and five dependent variables to test the significant relationships between each by using the panel regression fixed effect model. The eleven independent variables may have different or identical impacts on firm risk. Therefore, fifty hypotheses (H_o , H_a) are developed according to the conceptual framework in this study, in order to test the significant relationships between the dependent and independent variables during the period from 2010 to 2014. The null hypothesis (H_o) and alternative hypothesis (H_a) for each are presented below.

Hypothesis 1:

H1_o: Board size (BSIZE) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_1 = \emptyset$]

H1_a: Board size (BSIZE) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_1 \neq \emptyset$]

Hypothesis 2:

H2_o: Board composition (OUTSIDE) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_2 = \emptyset$]

H2_a: Board composition (OUTSIDE) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_2 \neq \emptyset$]

Hypothesis 3:

H3_o: Board leadership structure (DUAL) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_3 = \emptyset$]

H3_a: Board leadership structure (DUAL) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_3 \neq \emptyset$]

Hypothesis 4:

H4_o: Board age (AGE) has no remarkable effect on capital adequacy risk (CAPRISK) [$\beta_4 = \emptyset$]

H4_a: Board age (AGE) has a remarkable effect on capital adequacy risk (CAPRISK) [$\beta_4 \neq \emptyset$]

Hypothesis 5:

H5_o: Board gender diversity (PCT_F_DIR) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_5 = \emptyset$]

H5_a: Board gender diversity (PCT_F_DIR) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_5 \neq \emptyset$]

Hypothesis 6:

H6_o: Board ownership (BOARDOWN) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_6 = \emptyset$]

H6_a: Board ownership (BOARDOWN) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_6 \neq \emptyset$]

Hypothesis 7:

H7_o: Board compensation (BOARDFEES) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_7 = \emptyset$]

H7_a: Board compensation (BOARDFEES) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_7 \neq \emptyset$]

Hypothesis 8:

H8_o: Board meetings (MEYEAR) have no significant effect on capital adequacy risk (CAPRISK) [$\beta_8 = \emptyset$]

H8_a: Board meetings (MEYEAR) have a significant effect on capital adequacy risk (CAPRISK) [$\beta_8 \neq \emptyset$]

Hypothesis 9:

H9_o: The remuneration committee (COMTE) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_9 = \emptyset$]

H9_a: The remuneration committee (COMTE) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_9 \neq \emptyset$]

Hypothesis 10:

H10_o: CEO compensation (REMU) has no significant effect on capital adequacy risk (CAPRISK) [$\beta_{10} = \emptyset$]

H10_a: CEO compensation (REMU) has a significant effect on capital adequacy risk (CAPRISK) [$\beta_{10} \neq \emptyset$]

Hypothesis 11:

H11_o: Board size (BSIZE) has no notable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{11} = \emptyset$]

H11_a: Board size (BSIZE) has a notable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{11} \neq \emptyset$]

Hypothesis 12:

H12_o: Board composition (OUTSIDE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{12} = \emptyset$]

H12_a: Board composition (OUTSIDE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{12} \neq \emptyset$]

Hypothesis 13:

H13_o: Board leadership structure (DUAL) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{13} = \emptyset$]

H13_a: Board leadership structure (DUAL) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{13} \neq \emptyset$]

Hypothesis 14:

H14_o: Board age (AGE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{14} = \emptyset$]

H14_a: Board age (AGE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{14} \neq \emptyset$]

Hypothesis 15:

H15_o: Board gender diversity (PCT_F_DIR) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{15} = \emptyset$]

H15_a: Board gender diversity (PCT_F_DIR) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{15} \neq \emptyset$]

Hypothesis 16:

H16_o: Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{16} = \emptyset$]

H16_a: Board ownership (BOARDOWN) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{16} \neq \emptyset$]

Hypothesis 17:

H17_o: Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{17} = \emptyset$]

H17_a: Board compensation (BOARDFEES) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{17} \neq \emptyset$]

Hypothesis 18:

H18_o: Board meetings (MEYEAR) have no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{18} = \emptyset$]

H18_a: Board meetings (MEYEAR) have a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{18} \neq \emptyset$]

Hypothesis 19:

H19_o: The remuneration committee (COMTE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{19} = \emptyset$]

H19_a: The remuneration committee (COMTE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET) [$\beta_{19} \neq \emptyset$]

Hypothesis 20:

H20_o: CEO compensation (REMU) has no remarkable effect toward business risk in terms of stock return volatility (SD_RET) [$\beta_{20} = \emptyset$]

H20_a: CEO compensation (REMU) has a remarkable effect toward business risk in terms of stock return volatility (SD_RET) [$\beta_{20} \neq \emptyset$]

Hypothesis 21:

H21_o: Board size (BSIZE) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{21} = \emptyset$]

H21_a: Board size (BSIZE) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{21} \neq \emptyset$]

Hypothesis 22:

H22_o: Board composition (OUTSIDE) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{22} = \emptyset$]

H22_a: Board composition (OUTSIDE) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{22} \neq \emptyset$]

Hypothesis 23:

H23_o: Board leadership structure (DUAL) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{23} = \emptyset$]

H23_a: Board leadership structure (DUAL) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{23} \neq \emptyset$]

Hypothesis 24:

H24_o: Board age (AGE) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{24} = \emptyset$]

H24_a: Board age (AGE) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{24} \neq \emptyset$]

Hypothesis 25:

H25_o: Board gender diversity (PCT_F_DIR) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{25} = \emptyset$]

H25_a: Board gender diversity (PCT_F_DIR) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{25} \neq \emptyset$]

Hypothesis 26:

H26_o: Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{26} = \emptyset$]

H26_a: Board ownership (BOARDOWN) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{26} \neq \emptyset$]

Hypothesis 27:

H27_o: Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{27} = \emptyset$]

H27_a: Board compensation (BOARDFEES) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{27} \neq \emptyset$]

Hypothesis 28:

H28_o: Board meetings (MEYEAR) have no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{28} = \emptyset$]

H28_a: Board meetings (MEYEAR) have a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{28} \neq \emptyset$]

Hypothesis 29:

H29_o: The remuneration committee (COMTE) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{29} = \emptyset$]

H29_a: The remuneration committee (COMTE) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{29} \neq \emptyset$]

Hypothesis 30:

H30_o: CEO compensation (REMU) has no remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{30} = \emptyset$]

H30_a: CEO compensation (REMU) has a remarkable effect on business risk in terms of return volatility (SD_IN) [$\beta_{30} \neq \emptyset$]

Hypothesis 31:

H31_o: Board size (BSIZE) has no significant effect on financial risk (DEB) [$\beta_{31} = \emptyset$]

H31_a: Board size (BSIZE) has a significant effect on financial risk (DEB) [$\beta_{31} \neq \emptyset$]

Hypothesis 32:

H32_o: Board composition (OUTSIDE) has no significant effect on financial risk (DEB) [$\beta_{32} = \emptyset$]

H32_a: Board composition (OUTSIDE) has a significant effect on financial risk (DEB) [$\beta_{32} \neq \emptyset$]

Hypothesis 33:

H33_o: Board leadership structure (DUAL) has no significant effect on financial risk (DEB) [$\beta_{33} = \emptyset$]

H33_a: Board leadership structure (DUAL) has a significant effect on financial risk (DEB) [$\beta_{33} \neq \emptyset$]

Hypothesis 34:

H34_o: Board age (AGE) has no remarkable effect on financial risk (DEB) [$\beta_{34} = \emptyset$]

H34_a: Board age (AGE) has a remarkable effect on financial risk (DEB) [$\beta_{34} \neq \emptyset$]

Hypothesis 35:

H35_o: Board gender diversity (PCT_F_DIR) has no significant effect on financial risk (DEB) [$\beta_{35} = \emptyset$]

H35_a: Board gender diversity (PCT_F_DIR) has a significant effect on financial risk (DEB) [$\beta_{35} \neq \emptyset$]

Hypothesis 36:

H36_o: Board ownership (BOARDOWN) has no significant effect on financial risk (DEB) [$\beta_{36} = \emptyset$]

H36_a: Board ownership (BOARDOWN) has a significant effect on financial risk (DEB) [$\beta_{36} \neq \emptyset$]

Hypothesis 37:

H37_o: Board compensation (BOARDFEES) has no significant effect on financial risk (DEB) [$\beta_{37} = \emptyset$]

H37_a: Board compensation (BOARDFEES) has a significant effect on financial risk (DEB) [$\beta_{37} \neq \emptyset$]

Hypothesis 38:

H38_o: Board meetings (MEYEAR) have no significant effect on financial risk (DEB) [$\beta_{38} = \emptyset$]

H38_a: Board meetings (MEYEAR) have a significant effect on financial risk (DEB) [$\beta_{38} \neq \emptyset$]

Hypothesis 39:

H39_o: The remuneration committee (COMTE) has no significant effect on financial risk (DEB) [$\beta_{39} = \emptyset$]

H39_a: The remuneration committee (COMTE) has a significant effect on financial risk (DEB) [$\beta_{39} \neq \emptyset$]

Hypothesis 40:

H40_o: CEO compensation (REMU) has no significant effect on financial risk (DEB) [$\beta_{40} = \emptyset$]

H40_a: CEO compensation (REMU) has a significant effect on financial risk (DEB) [$\beta_{40} \neq \emptyset$]

Hypothesis 41:

H41_o: Board size (BSIZE) has no significant effect on investment risk (INV) [$\beta_{41} = \emptyset$]

H41_a: Board size (BSIZE) has a significant effect on investment risk (INV) [$\beta_{41} \neq \emptyset$]

Hypothesis 42:

H42_o: Board composition (OUTSIDE) has no significant effect on investment risk (INV) [$\beta_{42} = \emptyset$]

H42_a: Board composition (OUTSIDE) has a significant effect on investment risk (INV) [$\beta_{42} \neq \emptyset$]

Hypothesis 43:

H43_o: Board leadership structure (DUAL) has no significant effect on investment risk (INV) [$\beta_{43} = \emptyset$]

H43_a: Board leadership structure (DUAL) has a significant effect on investment risk (INV) [$\beta_{43} \neq \emptyset$]

Hypothesis 44:

H44_o: Board age (AGE) has no remarkable effect on investment risk (INV) [$\beta_{44} = \emptyset$]

H44_a: Board age (AGE) has a remarkable effect on investment risk (INV) [$\beta_{44} \neq \emptyset$]

Hypothesis 45:

H45_o: Board gender diversity (PCT_F_DIR) has no significant effect on investment risk (INV) [$\beta_{45} = \emptyset$]

H45_a: Board gender diversity (PCT_F_DIR) has a significant effect on investment risk (INV) [$\beta_{45} \neq \emptyset$]

Hypothesis 46:

H46_o: Board ownership (BOARDOWN) has no significant effect on investment risk (INV) [$\beta_{46} = \emptyset$]

H46_a: Board ownership (BOARDOWN) has a significant effect on investment risk (INV) [$\beta_{46} \neq \emptyset$]

Hypothesis 47:

H47_o: Board compensation (BOARDFEES) has no significant effect on investment risk (INV) [$\beta_{47} = \emptyset$]

H47_a: Board compensation (BOARDFEES) has a significant effect on investment risk (INV) [$\beta_{47} \neq \emptyset$]

Hypothesis 48:

H48_o: Board meetings (MEYEAR) have no significant effect on investment risk (INV) [$\beta_{48} = \emptyset$]

H48_a: Board meetings (MEYEAR) have a significant effect on investment risk (INV) [$\beta_{48} \neq \emptyset$]

Hypothesis 49:

H49_o: The remuneration committee (COMTE) has no significant effect on investment risk (INV) [$\beta_{49} = \emptyset$]

H49_a: The remuneration committee (COMTE) has a significant effect on investment risk (INV) [$\beta_{49} \neq \emptyset$]

Hypothesis 50:

H50_o: CEO compensation (REMU) has no significant effect on investment risk (INV) [$\beta_{50} = \emptyset$]

H50_a: CEO compensation (REMU) has a significant effect on investment risk (INV) [$\beta_{50} \neq \emptyset$]

Chapter 4: Research Methodology

The following chapter determines the data and sampling procedure, data treatment, the research method used, and statistical treatment of data. Information included in this chapter is based on existing empirical studies relating to the actual problem.

4.1 Research Method

Causal research, also known as explanatory research is the investigation of research into cause-and-effect relationships (Brains, Willnat, Manheim, & Rich, 2011) and is applied in this research. Causal research is used to investigate the effect of board characteristics and CEO compensation on firm risk for listed service companies in Thailand.

The data used in this research came from the 56-1 report and financial statements from SETSMART and Bloomberg. Some data and ratios are calculated and arranged by the researcher, and the results are shown after calculation. In order to analyze the relationship between board characteristics and CEO compensation for listed service firms on the SET, and firm risk for the years 2010 to 2014, the fixed effect panel data regression model is applied as followed by Lenard *et al.* (2014).

4.2 Data and Sampling Procedure

The target population in the study includes 83 listed service companies on the SET from 2010 to 2014. The researcher analyzed data from the 2010 financial year because it is the first year for which complete corporate governance and financial data are available for sampling. This is due to the Thai government prioritizing service industry development and allocating most of the BOI-approved investment capital

from January to September 2009, accounting for 66,800 million baht to services and public utilities (BOI, 2010).

In order to obtain samples for the research, judgment sampling is applied. Judgment sampling is non-random or non-probability sampling where researchers use their own opinions and judgment to select sample members of the population. Due to the incomplete data available for some listed service firms, the researcher eliminated companies where certain data could not be found (i.e., information for 2010 was either unavailable or did not cover board age, frequency of board meetings, etc.). The researcher used a sample of 65 listed service firms on the SET index for the years 2010 to 2014. Due to incomplete data for certain companies, the researcher had to decrease the number of sample companies from 83 to 65. Some data have been calculated and arranged in order to get complete data for 65 companies from 2010 to 2014.

Table 4-1: Number of Service Firms by Sub-Industry Classification

Sub-Industry	Firms	
	Total	Sample
Transportation & Logistics	16	13
Commerce	14	13
Media & Publishing	24	16
Health Care Services	13	3
Tourism & Leisure	13	11
Professional Services	3	9
Total	83	65

Several sources were used to collect secondary data for the research. The Bloomberg and SETSMART databases were used as sources for financial data. The Bloomberg database is an online center for data, providing current and historical

financial information on individual stocks, stock market indices, fixed-income securities, currencies, commodities, futures market, news in business, and data analysis. SETSMART is a web-based application provided by the SET, and a comprehensive source of Thai listed company data providing historical stock prices, historical indices, listed company profiles, and historical news. Board characteristics and CEO compensation were obtained from Form 56-1 on the website of the Securities and Exchange Commission. (<http://www.sec.or.th/en/Pages/Home.aspx>). Some data for the research are not directly available from the above sources, and the researcher therefore calculated and organized certain information to make it usable for the data analysis.

Table 4-2: Summary o Data Used in the Research

Data	Time Period	Data Source(s)
<ul style="list-style-type: none"> • Capital leverage ratio • Standard deviation of stock returns • Standard deviation of income before extraordinary items and taxes • Capital expenditure 	31/12/2010 to 31/12/2014	Bloomberg and SETSMART Databases
<ul style="list-style-type: none"> • Board characteristics • CEO compensation 	31/12/2010 to 31/12/2014	Form 56-1 from the website of the Securities and Exchange Commission

4.3 Data Treatment

This study uses four dependent variables and ten independent variables to explore the relationship between firm risk-taking and board characteristics as well as

four control variables. Information regarding the treatment of variables in this study is provided as follows:

4.3.1 Dependent Variables

4.3.1.1 Capital Adequacy Risk

Capital adequacy risk can be measured by the Tier 1 capital leverage ratio (Merle, 2013). The Tier 1 capital leverage ratio is expressed as Tier 1 capital, which includes common stock, common stock surplus, retained earnings, and some perpetual preferred stock as a proportion of total adjusted assets (Estrella *et al.*, 2000). Merle (2013) stated that the higher the Tier 1 capital leverage ratio, the lower the capital adequacy risk.

$$\text{Tier 1 capital leverage ratio} = \frac{\text{Tier 1 capital}}{\text{Total adjusted assets}}$$

4.3.1.2 Business Risk

Allayannis and Weston (2003) used earning volatility to study its relationship with firm value. Earnings volatility and stock returns volatility were used alternatively to measure firm risk (Wang, 2012). Wang (2012) used earnings volatility measured by the standard deviation of income before extraordinary items and depreciation, minus dividends, divided by the total assets over a three-year period. Lenard *et al.* (2014) used the standard deviation of monthly stock returns in each year to measure firm risk.

4.3.1.3 Financial Risk

For the measurement of financial risk, Wang (2012) proposed the use of the leverage ratio (debt ratio also known as debt to assets ratio), which is calculated as total debt scaled by total assets.

$$\text{Debt ratio} = \frac{\text{Total Debt}}{\text{Total assets}}$$

4.3.1.4 Investment Risk

The investment period also indicates a risk to assets; the longer money is invested, the bigger the risk (Gitman *et al.*, 2011). Wang (2012) used capital expenditure scaled by assets as the measurement for low investment risk and R&D expenditure scaled by assets to measure high investment risk. This research used capital expenditure scaled by assets as the measurement for investment risk due to R&D expenditure being unavailable during the period of data collection.

4.3.2 Independent Variables

4.3.2.1 Board Size

Board of directors' size is an instrument for limiting managerial moral hazard behavior. Conforming with agency theory, when the board is large, it can dominate managers, leading to conflict of interest between them and the board of directors (Jensen, 1993). Board size refers to the number of board members at the annual board meeting (Merle, 2013).

4.3.2.2 Board Composition

Board composition is defined by Pathan (2009) as the presence of independent directors and business professionals not employed by the firm. Board composition is

measured by the proportion of independent board members, calculated as the number of independent directors scaled by the number of board members (Belkhir, 2009).

4.3.2.3 Board Leadership Structure

Board leadership structure or CEO duality refers to whether the company has a chairman of the board assuming the role of CEO, or if it assigns these positions to different individuals (Abdullah, 2004; Elsayed & Wahba, 2013). Board leadership structure is measured by a dummy variable, taking the value 1 when the CEO assumes the position of board chair and 0 otherwise (Belkhir, 2009).

4.3.2.4 Board Age

Harikanth and Pragathi (2012) stated that investment decisions also depend on the type of investors, risk tolerance capacity, education, occupation, age, sex, income, marital status, family background, residential area and environment, as well as attachment to the financial advisor etc. Board age refers to the average age of board members (Merle, 2013).

4.3.2.5 Board Gender Diversity

Gender diversity may increase the effectiveness and efficiency of the board of directors (Adams & Ferreira, 2009). Lenard *et al.* (2014) used the percentage of female directors out of the total number of board members as the gender diversity measurement.

4.3.2.6 Board Ownership

Board of directors' ownership refers to the percentage of stock owned by board members (Merle, 2013). Cheikh (2014), who studied the effect of CEO power

toward firm risk-taking, stated that stock ownership is an indicator of CEO power. The more shares CEOs own, the more power they hold, and therefore when board members own company stock they have more power and can weaken the power of the CEO and enhance their controlling function. When CEOs hold fewer shares, firm growth and risk-taking can improve. On the contrary, when CEOs own a large number of stocks, they may be discouraged toward corporate risk-taking.

4.3.2.7 Board Compensation

Board compensation (or board fee) is one of the factors used to measure board characteristics by Ferrero-Ferrero *et al.* (2012). The researchers define board compensation as fees for directors' services on the board plus fees to attend board meetings.

4.3.2.8 Board Meetings

Board meetings refer to the frequency of board meetings per year (Andres and Vallelado, 2008). Meeting frequency is a tool for strengthening the controlling activities of the board of directors, and therefore the advisory role is solidified. Vafeas (1999) examined whether the frequency of board meetings is a solution to the problem of limited director cooperation. The researcher stated that board meeting frequency may affect the way the board works since it allows members to meet, discuss, and exchange ideas on bank strategy and find ways to monitor managers.

4.3.2.9 Remuneration Committee

The presence of a remuneration committee is measured by the dummy variable taking the value 1 if a remuneration committee exists and 0 otherwise (Belkhir, 2009).

4.3.2.10 CEO Compensation

Ayadi and Boujèlbène (2012) suggested that CEO remuneration is a tool designed to reduce moral hazard by rewarding CEOs based on their performance, and could help to lessen the agency problem between the principal (owner) and his agent (manager). CEO compensation is annual salary plus bonus (Barro & Barro, 1990).

4.3.3 Control Variables

4.3.3.1 Firm Size

Total firm assets are used as a proxy for firm size (Ayadi & Boujèlbène, 2012; Cheikh, 2014; Merle, 2013; Rachdi & Ameur, 2011). From the related literature, firm size has often been used as a control variable to study concerned firm risk and found to have a positive effect on it (Cheikh, 2014).

4.3.3.2 Cash Flow

Cash flow refers to income before extraordinary items and depreciation, minus dividends, and scaled by assets (Wang, 2012). Cash flow represents the amount of cash available for new investment. A negative and significant relationship has been found between cash flow and firm risk-taking (Wang, 2012).

4.3.3.3 Charter Value

Charter value is calculated as the sum of the market value of equity plus the book value of liabilities, divided by the book value of total assets (Rachdi & Ameur, 2011). Charter value, also called market-to-book assets ratio by Merle (2013), represents the market power and competitive structure of banks. Charter value has been found to have a positive effect toward firm risk through greater use of leverage

by asset substitution (Keeley, 1990). This result is supported by the findings of Rachdi and Ameer (2011), which state that charter value has a positive significant relationship with insolvency risk.

4.3.3.4 Firm Performance

ROA is an overall profitability measurement for a firm, reflecting its effectiveness regarding the use of assets. A higher ROA implies more effective asset usage and is calculated by dividing the net income by total assets (Weygandt *et al.*, 2006). Following Lenard *et al.* (2014), the researcher adopted ROA as the proxy to represent firm performance. The findings state that ROA has a negative significant relationship with firm risk-taking.

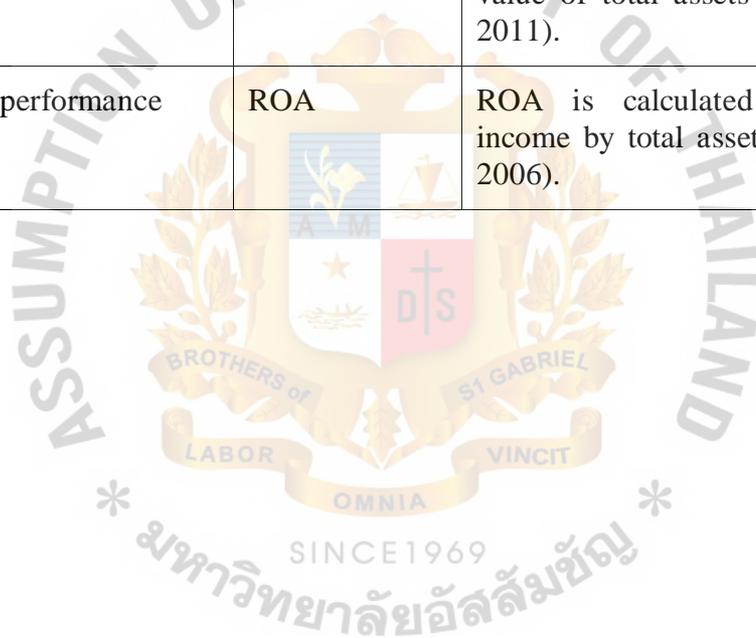
$$ROA = \frac{\text{Net income}}{\text{Total assets}}$$

Table 4-3: Summary of Data Treatment

Variables	Abbreviation	Measurement
Dependent Variables		
Capital adequacy risk	CAPRISK	The Tier 1 capital leverage ratio is expressed as Tier 1 capital, which includes common stock, common stock surplus, retained earnings, and some perpetual preferred stock as a proportion of total adjusted assets (Estrella <i>et al.</i> , 2000).
Business risk	SD_IN	The standard deviation of income before extraordinary items and depreciation minus dividends, divided by total assets over a three-year period (Wang, 2012).
	SD_RET	Standard deviation of monthly stock returns in each year as firm risk measurement (Lenard <i>et al.</i> , 2014).

Variables	Abbreviation	Measurement
Financial risk	DEB	Debt ratio or debt to assets ratio calculated as total debt scale by total assets (Wang, 2012).
Investment risk	INV	The proportion of capital expenditure on total assets (Wang, 2012).
Independent Variables		
Board size	BSIZE	Board size refers to the number of board members at the annual board meeting (Merle, 2013).
Board composition	OUTSIDE	The proportion of independent board members calculated as the number of independent directors scaled by the total number of board members (Belkhir, 2009).
Board leadership structure	DUAL	The dummy variable that takes the value 1 when CEO assume the position of board chair and 0 otherwise (Belkhir, 2009).
Board age	AGE	Board age refers to the average age of board members (Merle, 2013).
Board gender diversity	PCT_F_DIR	The percentage of female directors out of the total number of board members (Lenard <i>et al.</i> , 2014).
Board ownership	BOARDOWN	Board of director ownership refers to the percentage of stock owned by board members (Merle, 2013).
Board compensation	BOARDFEES	The fees for directors' services on the board plus fees to attend board meetings (Ferrero-Ferrero <i>et al.</i> , 2012).
Board meetings	MEYEAR	The frequency of board meetings per year (Andres & Vallelado, 2008).
Remuneration committee	COMTE	The dummy variable that takes the value 1 if a remuneration committee exists and 0 otherwise (Belkhir, 2009).
CEO compensation	REMU	CEO compensation is annual salary plus

Variables	Abbreviation	Measurement
		bonus (Barro & Barro, 1990).
Control Variables		
Firm size	SIZE	Total assets of the companies are used as the proxy for firm size (Cheikh, 2014).
Cash flow	CashFlow	Cash flow refers to income before extraordinary items and depreciation minus dividends, scaled by assets (Wang, 2012).
Charter value	CV	Charter value is calculated as the sum of the market value of equity plus the book value of liabilities divided by the book value of total assets (Rachdi & Ameer, 2011).
Firm performance	ROA	ROA is calculated by dividing net income by total assets (Weygandt <i>et al.</i> , 2006).



4.4 Statistical Treatment of Data

In this research, the fixed effect panel data regression model was applied to examine the effect of independent variables toward dependent variables or firm risk, including board characteristics and CEO compensation.

This study adapted the two-tailed t-test for hypothesis testing at a 90% confidence level. The t-statistic tests the hypothesis by comparing the difference between the sample mean and hypothesized population mean, whether there is a significant difference or not. If there is a significant difference between the sample mean and hypothesized population mean, the null hypothesis will be rejected. Details of the fixed effect panel data regression model and two-tailed t-test are mentioned below.

4.4.1 Multiple Linear Regression Model

Simple linear and multiple linear regressions are part of a statistical method called regression analysis which is applied to examine the impact of independent variables on dependent variables (Houston, 2001). A multiple linear regression model is applied when more than one independent variable can affect the dependent variable (Brook, 2008). This research adopted multiple linear regressions to test the influence of multiple explanatory variables toward different dependent variables. Brook (2008) assumes that there are k explanatory variables or regressors as well as the constant term, the researcher determines $\beta_0, \beta_1, \dots, \beta_k$ in the following equation:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + u_i$$

Assuming i is serving as the representative number of entities from 1 to n , the

equation can be written in matrix form as:

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} \beta_0 + \beta_1 x_{11} + \beta_2 x_{21} + \dots + \beta_k x_{k1} \\ \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \dots + \beta_k x_{k2} \\ \vdots \\ \beta_0 + \beta_1 x_{1n} + \beta_2 x_{2n} + \dots + \beta_k x_{kn} \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}$$

and

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_{11} & x_{21} & \dots & x_{k1} \\ 1 & x_{12} & x_{22} & \dots & x_{k2} \\ \vdots & \vdots & \vdots & \dots & \vdots \\ 1 & x_{1n} & x_{2n} & \dots & x_{kn} \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}$$

The prior matrix form could be written in a compressed form as follows:

$$Y = X\beta + u$$

Assuming Y , X , and u are matrix with n rows; and β is a matrix with $k+1$ rows along with constant term.

β value (the estimated value of the real β) is calculated by applying the ordinary least squares (OLS) method which minimizes the sum of squared residuals (SSR) from the prior multiple linear regression equation, where:

$$SSR = \sum_{i=1}^n u_i^2 = \sum_{i=1}^n (y_i - \widehat{\beta}_0 - \widehat{\beta}_1 x_{1i} - \dots - \widehat{\beta}_k x_{ki})^2$$

and the set of β_s acquired from the OLS method which may minimize SSR can compute by applying the following matrix algebra:

$$\hat{\beta} = [X'X]^{-1}X'Y$$

The $\hat{\beta}$ in the model mentioned above represents a matrix with $k+1$ rows, which comprise the value of all β_s (from β_0 to β_k).

4.4.2 Fixed Effects Panel Data Regression Model

The fixed effects panel data model is one of two classes of panel estimator approaches widely adopted in financial research (Brooks, 2008). The fixed effects panel data regression model used in this study relates to the fixed quantity of individual variables, which is a unique set of data from each year and from each company; the fixed effect method prevents prejudice in the results (Torres-Reyna, 2007). When research volumes are organized, the fixed effects panel data model is used as a statistical model to determine the tested volumes for the research variables (Houston, 2001). The fixed effects model has an estimator which is helpful to the research coefficients (Houston, 2001). The fixed effects model allows the regression model to change cross-sectionally but not over time, while all slope estimates are fixed both cross-sectionally and over time (Brooks, 2008). The model gives assistance to the control of variables which could not observe or measure particular cultural factors or different business practices across the companies, and variables where diversity is steady over time and associated with explanatory variables (Torres-Reyna, 2007). The fixed effects panel data model is used to explore the relationship between dependent variables and explanatory variables with certain entities, since each firm has its own features which are capable of influencing research results (Houston, 2001). The association between dependent and independent variables within an entity such as a country, person, company, etc. are assessed by the fixed effect (Torres-

Reyna, 2007). For every entity, characteristics are individual, and may possibly influence the explanatory variables (Torres-Reyna, 2007). According to Houston (2001), there is theorization that some bias will affect the outcome of the study. The researcher needs to control any bias that may occur from individual aspects to prevent independent or dependent variables when using the fixed effect, as this can lead to an error in terms of correlation assumption (Torres-Reyna, 2007). The predictors of dependent variables can explore the net effect when the constant characteristics have been eliminated over time by the fixed effects (Torres-Reyna, 2007). An assumption of the fixed effects panel data regression model should not be associated with other individual or time-invariable characteristics (Torres-Reyna, 2007).

The unobserved effects model (UEM) or fixed effects model has the equation for the observation i , as follows (Houston, 2001):

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + \varepsilon_{it}$$

Where Z_{it} is an unobserved variable that differs from area to area but time-invariable (for example, Z_{it} may be a proxy for cultural attitudes concerning drinking while driving). It estimates β_1 , as the effect on Y of X , holding constant the unobserved stated characteristics Z . Since Z_i varies from one area to another but does not change over time, the population regression model could be explained as having n

constants for each area. Precisely, let $\alpha_i = \beta_0 + \beta_z Z_i$. Therefore, the fixed effects regression model can be written as:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \varepsilon_{it}$$

In which $\alpha_i, \dots, \alpha_n$ are treated as unknown constants to be estimated for each area. The meaning of α_i as an area-specific constant comes from regarding the population regression line for the i^{th} area; this population regression line is

$$\alpha_i - \beta_1 Z_{it}$$

To form the fixed effects regression model using binary variables, such model can be written as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \gamma_2 D2_i + \gamma_3 D3_i + \dots + \gamma_n Dn_i + \varepsilon_{it}$$

Where $\beta_0, \beta_1, \gamma_2, \dots, \gamma_n$ are unknown coefficients to be estimated. In order to inspire the association between the coefficient and constants in this equation, consider the population regression equation for the first area as $\beta_0 + \beta_1 X_{it}$, hence $\alpha_1 = \beta_0$. The next area and the remainder are considered as $\beta_0 + \beta_1 X_{it} + \gamma_i$, while $\alpha_i = \beta_0 + \gamma_i$ for $i \geq 2$. In this way, β_1 is the only hypothesis test for the significance of the relationship between dependent and explanatory variables.

4.4.3 Two-Tailed t-Test

This research tested the significance of risk on listed service firms in Thailand, namely capital adequacy risk, business risk, financial risk, and investment risk. This research employed a two-tailed t-test to test the significance of firm risk. The two-tailed t-test is the statistical method used for testing whether a hypothesis is rejected or not.

Equation for a multiple linear regression model:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \mu$$

In order to test whether or not there is a significant linear relationship between y and x_1 , the researcher has to examine whether β_1 is equal to zero or not. The meaning of the null hypothesis β_1 being equal to zero is that there is no significant linear relationship between y and x_1 . The formula for calculating t-statistics for the two-tailed t-test is presented as follows:

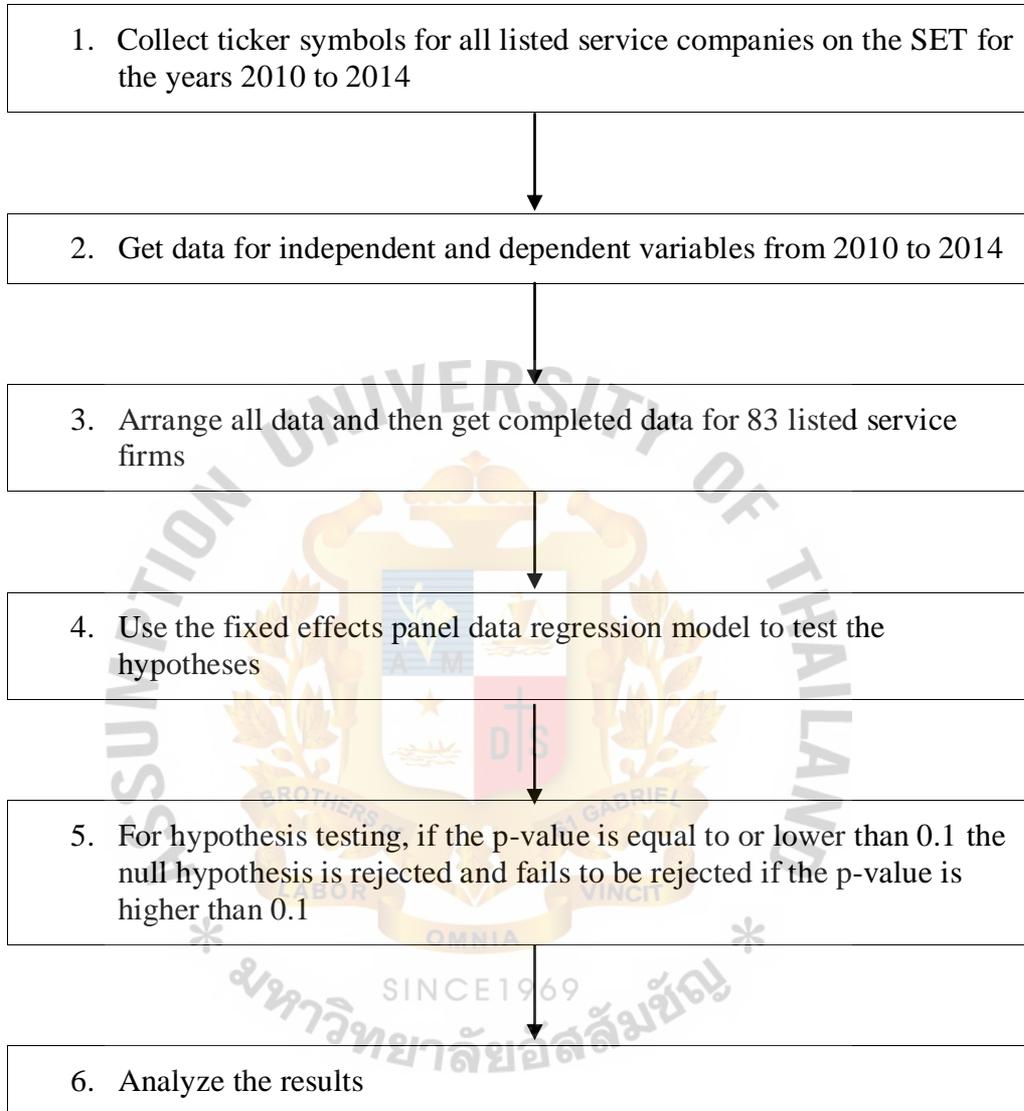
$$t - \text{statistic} = \frac{\widehat{\beta}_1 - 0}{SE(\widehat{\beta}_1)}$$

From the ratio above, $\widehat{\beta}_1$ refers to the estimated regression coefficient of real β_1 and $SE(\widehat{\beta}_1)$ refers to the estimated standard error of $\widehat{\beta}_1$ (or the square root of the estimated variance in the distribution of $\widehat{\beta}_1$).

When the absolute value of a t-statistic is greater than the critical value from the t-table at the required significance level, the null hypothesis can be rejected. In addition, the p-value of the t-statistic is another more common method for approaching the t-test. A p-value for a t-statistic serves as the lowest significance level at which the null hypothesis can be rejected (Brook, 2008).

This study applies the t-statistic to the entire ten predictor variables with 90% confidence. The t-statistic can be used in hypothesis testing by comparing the percentage difference between the sample mean and hypothesized population mean. The researcher used the two-tailed t-test to test the null hypotheses (H_0). If the t-stat value falls in the critical area, it means a rejection of the null hypotheses at the significance level of 90%. For this research, if the p-value of the t-stat is less than 0.1 (10%), then H_0 can be rejected or there is a significant correlation between the dependent and independent variables. On the other hand, if the p-value of the t-stat is more than 0.1 (10%), then H_0 fails to be rejected or there is no significant correlation between the dependent and independent variables. Figure 4-1 provides a summary of the data treatment process.

Figure 4-1 Summary of the Statistical Data Treatment Process



Chapter 5: Data Analysis

In this chapter, the researcher analyzes the secondary data and presents the empirical results of the research: data analysis and model analysis. This chapter focuses on the analysis of the secondary data on service industry companies listed on the SET during the years 2010 to 2014.

5.1 Descriptive Statistics

Data were obtained from 65 firms on the SET during the years 2010 to 2014 which accounted for 325 observations.

Table 5-1: Statistics calculated for Capital adequacy risk (CAPRISK), Business risk in terms of return volatility (SD_IN), Business risk in terms of stock return volatility (SD_RET), Financial risk (DEB), and Investment risk (INV) for service companies listed on the Stock Exchange of Thailand from 2010 to 2014

	CAPRISK	SD_IN	SD_RET	DEB	INV
Mean	0.632573	0.517071	0.108414	0.367100	0.704428
Median	0.653940	0.032055	0.085005	0.346060	0.746333
Maximum	0.998649	49.73885	2.018159	1.307274	0.992067
Minimum	-0.307274	0.000905	0.000000	0.001351	0.144630
Std. Dev.	0.225192	4.486543	0.134480	0.224958	0.218634
Skewness	-0.583907	9.849813	10.42026	0.588101	-0.659652
Kurtosis	3.366583	100.1102	136.4153	3.381689	2.495216
Jarque-Bera	20.28773	132958.5	246918.4	20.70704	27.02064
Probability	0.000039	0.000000	0.000000	0.000032	0.000001
Sum	205.5861	168.0481	35.23439	119.3076	228.9391
Sum Sq. Dev.	16.43046	6521.817	5.859514	16.39631	15.48747
Observations	325	325	325	325	325

The statistics for the listed service firms on the SET during 2010 to 2014 show that: the mean value for capital adequacy risk is 0.632573, mean of business risk in terms of return volatility is 0.517071, mean of business risk in terms of stock return volatility is 0.108414, mean of financial risk is 0.367100, and the mean of investment risk is 0.704428. The maximum and minimum values for capital adequacy risk is 0.998649 and -0.307274, business risk in terms of return volatility is 49.73885 and 0.000905, business risk in terms of stock return volatility is 2.018159 and 0, financial risk is 1.307274 and 0.001351, and investment risk is 0.992067 and 0.144630.

Table 5-2: Statistics calculated for Board size (BSIZE), Board composition (OUTSIDE), Board leadership structure (DUAL), Board age (Age), and Board gender diversity (PCT_F_DIR) for service companies listed on the Stock Exchange of Thailand from 2010 to 2014

	BSIZE	OUTSIDE	DUAL	AGE	PCT_F_DIR
Mean	11.36000	0.388843	0.313846	59.50159	0.156912
Median	11.00000	0.363636	0.000000	58.50000	0.125000
Maximum	18.00000	0.800000	1.000000	74.71429	0.625000
Minimum	5.000000	0.230769	0.000000	46.57143	0.000000
Std. Dev.	2.690220	0.085908	0.464770	5.861334	0.137985
Skewness	0.278060	1.690653	0.802293	0.182998	0.843805
Kurtosis	2.455098	6.703261	1.643674	2.285556	3.303465
Jarque-Bera	8.208777	340.5374	59.77719	8.726021	39.81407
Probability	0.016500	0.000000	0.000000	0.012740	0.000000
Sum	3692.000	126.3741	102.0000	19338.02	50.99643
Sum Sq. Dev.	2344.880	2.391163	69.98769	11131.09	6.168928
Observations	325	325	325	325	325

The statistics of the listed service firms on the SET during 2010 to 2014 show that the mean value for board size is 11.36000 which is within the range

recommended by SET (2012) of five to twelve members. Board composition average is 0.388843% which is considered to be slightly above the requirement of the Securities and Exchange Commission at 0.3% of board size. Board leadership structure average accounts for 0.313846%, and the mean board age is 59.50159. The average percentage of female directors is 0.156912 which agrees with the findings of Lenard *et al.* (2014), who investigated the proportion of women directors in US companies, and found that on average, female directors accounted for 0.117%. The maximum and minimum values for board size are 18.00000 and 5.000000, board composition 0.800000 and 0.230769, board leadership structure 1.000000 and 0, board age 74.71429 and 46.57143, and board gender diversity 0.625000 and 0.

Table 5-3: Statistics calculated for Board ownership (BOARDOWN), Board compensation (BOARDFEES), Board meeting (MEYEAR), and Remuneration committee (COMTE) for service companies listed on the Stock Exchange of Thailand 2010 to 2014

	BOARDOWN	BOARDFEES	MEYEAR	COMTE
Mean	0.198950	7257030.	7.870769	0.630769
Median	0.085800	4520000	7.000000	1.000000
Maximum	7.490210	60846000	21.00000	1.000000
Minimum	0.000000	0.000000	2.000000	0.000000
Std. Dev.	0.459796	8629288.	3.888322	0.483341
Skewness	12.46099	2.882856	1.008200	-0.541940
Kurtosis	195.9997	13.83034	3.461452	1.293699
Jarque-Bera	512822.6	2038.559	57.94213	55.33476
Probability	0.000000	0.000000	0.000000	0.000000
Sum	64.65861	2.36E+09	2558.000	205.0000
Sum Sq. Dev.	68.49752	2.41E+16	4898.572	75.6923
Observations	325	325	325	325

The statistics for listed service firms of the SET during 2010 to 2014 show that the mean value for board ownership is 0.198950, the mean of board compensation is 7257030, and the mean of the remuneration committee is 0.630769. The average frequency of board meetings accounts for 7.870769 times, which is slightly higher than that recommended by the SET (2012) of six times per year. The maximum and minimum values for board ownership are 7.490210 and 0, board compensation 60846000 and 0, board meetings 21 and 2, and remuneration committee 1 and 0.

Table 5-4: Statistics calculated for CEO compensation (REMU), Firm size (SIZE), Cash Flow (CashFlow), Charter value (CV), and Firm performance (ROA) for service companies listed on the Stock Exchange of Thailand from 2010 to 2014

	REMU	SIZE	CashFlow	CV	ROA
Mean	42821627	1.77E+10	1.43E+09	2.525477	0.052486
Median	30556950	2.78E+09	1.15E+08	1.610000	0.055734
Maximum	3.18E+08	3.07E+11	1.04E+11	32.57000	0.728454
Minimum	2036000.	48367640	-7.26E+09	0.250000	-0.690947
Std. Dev.	47468921	4.77E+10	6.87E+09	3.326616	0.136285
Skewness	2.806318	4.559155	11.17441	5.720856	-0.786914
Kurtosis	12.89767	24.46179	159.1817	44.41648	14.90127
Jarque-Bera	1753.180	7363.306	337081.6	25001.13	1951.586
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	1.39E+10	5.76E+12	4.64E+11	820.7800	17.05802
Sum Sq. Dev.	7.30E+17	7.36E+23	1.53E+22	3585.506	6.017866
Observations	325	325	325	325	325

The statistics for listed service firms on the SET during 2010 to 2014 show that the mean value for CEO compensation is 42821627, mean of firm size is 1.77E+10, mean

of cash flow is 1.43E+09, mean of charter value is 2.525477, and mean of firm performance is 0.052486. The maximum and minimum values for CEO compensation are 3.18E+08 and 2036000, firm size 3.07E+11 and 48367640, cash flow 1.04E+11 and -7.26E+09, charter value 32.57000 and 0.250000, and firm performance 0.728454 and -0.690947.

5.2 Correlation Matrix

According to Table 5-5, there is no multicollinearity problem because all correlations between independent variables are between -0.8 and 0.8. Accordingly, the removal of any independent variable from the regression equations is unnecessary.



Table 5-5: Correlation Matrix

	BFSIZE	OUTSIDE	DUAL	AGE	BOARDDOWN	BOARDFEES	MEYEAR	PCT_F_DIR	COMTE	REMU	SIZE	CASHFLOW	ROA	CV
BFSIZE	1.00E+00	-2.54E-01	-1.80E-01	2.18E-01	-4.80E-02	5.32E-01	2.14E-01	-3.35E-01	1.43E-01	3.79E-01	3.58E-01	1.17E-01	2.31E-01	2.99E-02
OUTSIDE	-2.54E-01	1	1.03E-01	-1.25E-02	8.05E-03	-9.20E-02	1.26E-01	5.54E-02	9.79E-02	-1.34E-01	1.50E-01	4.29E-02	-2.48E-01	-1.19E-01
DUAL	-1.80E-01	1.03E-01	1	1.25E-01	2.21E-01	-0.14695	-1.34E-02	1.96E-01	-8.71E-02	-1.36E-01	-1.40E-01	-0.04565	3.87E-02	-2.33E-03
AGE	2.18E-01	-1.25E-02	1.25E-01	1	6.16E-03	2.17E-01	-3.71E-02	-1.84E-02	-3.25E-02	2.25E-02	-7.00E-04	-8.39E-02	1.33E-01	1.00E-02
BOARDDOWN	-4.80E-02	8.05E-03	2.21E-01	6.16E-03	1.00E+00	-4.48E-02	-1.50E-01	1.07E-01	1.66E-02	-7.31E-02	-1.06E-01	-6.52E-02	4.66E-02	3.29E-02
BOARDFEES	5.32E-01	-9.20E-02	-0.14695	2.17E-01	-4.48E-02	1	2.53E-01	-2.81E-01	5.51E-02	5.86E-01	5.30E-01	0.183865	2.15E-01	1.29E-01
MEYEAR	2.14E-01	1.26E-01	-1.34E-02	-3.71E-02	-1.50E-01	2.53E-01	1	-1.34E-01	1.93E-01	-5.66E-02	3.68E-01	2.15E-01	-1.68E-01	1.92E-03
PCT_F_DIR	-3.35E-01	5.54E-02	1.96E-01	-1.84E-02	1.07E-01	-2.81E-01	-1.34E-01	1.00E+00	-1.28E-02	-2.16E-01	-2.48E-01	-1.20E-01	1.32E-02	6.67E-02
COMTE	1.43E-01	9.79E-02	-8.71E-02	-3.25E-02	1.66E-02	5.51E-02	1.93E-01	-1.28E-02	1.00E+00	-3.72E-02	8.67E-02	-3.23E-02	-9.41E-02	-1.02E-01
REMU	3.79E-01	-1.34E-01	-1.36E-01	2.25E-02	-7.31E-02	5.86E-01	-5.66E-02	-2.16E-01	-3.72E-02	1.00E+00	4.37E-01	1.96E-01	1.30E-01	6.12E-02
SIZE	3.58E-01	1.50E-01	-1.40E-01	-7.00E-04	-1.06E-01	5.30E-01	3.68E-01	-2.48E-01	8.67E-02	4.37E-01	1.00E+00	4.34E-01	-1.83E-02	-4.24E-02
CASHFLOW	1.17E-01	4.29E-02	-0.04565	-8.39E-02	-6.52E-02	0.183865	2.15E-01	-1.20E-01	-3.23E-02	1.96E-01	4.34E-01	1	-3.64E-02	-6.17E-02
ROA	2.31E-01	-2.48E-01	3.87E-02	1.33E-01	4.66E-02	2.15E-01	-1.68E-01	1.32E-02	-9.41E-02	1.30E-01	-1.83E-02	-3.64E-02	1.00E+00	3.24E-01
CV	2.99E-02	-1.19E-01	-2.33E-03	1.00E-02	3.29E-02	1.29E-01	1.92E-03	6.67E-02	-1.02E-01	6.12E-02	-4.24E-02	-6.17E-02	3.24E-01	1.00E+00



5.3 Results of Hypotheses Testing

In this section, regression analysis is used as a tool to identify the relationship between board characteristics and CEO compensation and firm risk for service companies listed on the SET during 2010 to 2014, using the regression models referred to in Chapter 3 .

Model applied for the period from 2010 to 2014:

$$\begin{aligned}
 CAPRISK_{i,t} = & \alpha + \beta_1 BSIZE_{i,t} + \beta_2 OUTSIDE_{i,t} + \beta_3 DUAL_{i,t} + \beta_4 AGE_{i,t} + \\
 & \beta_5 PCT_F_DIR_{i,t} + \beta_6 BOARDOWN_{i,t} + \beta_7 BOARDFEES_{i,t} + \beta_8 MEYEAR_{i,t} + \\
 & \beta_9 COMTE_{i,t} + \beta_{10} REMU_{i,t} + \theta_1 SIZE_{i,t} + \theta_2 CashFlow_{i,t} + \theta_3 CV_{i,t} + \theta_4 ROA_{i,t} + \\
 & \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
 \end{aligned} \tag{1}$$

$$\begin{aligned}
 SD_RET_{i,t} = & \alpha' + \beta_{11} BSIZE_{i,t} + \beta_{12} OUTSIDE_{i,t} + \beta_{13} DUAL_{i,t} + \beta_{14} AGE_{i,t} + \\
 & \beta_{15} PCT_F_DIR_{i,t} + \beta_{16} BOARDOWN_{i,t} + \beta_{17} BOARDFEES_{i,t} + \beta_{18} MEYEAR_{i,t} + \\
 & \beta_{19} COMTE_{i,t} + \beta_{20} REMU_{i,t} + \theta_5 SIZE_{i,t} + \theta_6 CashFlow_{i,t} + \theta_7 CV_{i,t} + \theta_8 ROA_{i,t} + \\
 & \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
 \end{aligned} \tag{2}$$

$$\begin{aligned}
SD_IN_{i,t} = & \alpha'' + \beta_{21} BSIZE_{i,t} + \beta_{22} OUTSIDE_{i,t} + \beta_{23} DUAL_{i,t} + \beta_{24} AGE_{i,t} + \\
& \beta_{25} PCT_F_DIR_{i,t} + \beta_{26} BOARDOWN_{i,t} + \beta_{27} BOARDFEES_{i,t} + \beta_{28} MEYEAR_{i,t} + \\
& \beta_{29} COMTE_{i,t} + \beta_{30} REMU_{i,t} + \theta_9 SIZE_{i,t} + \theta_{10} CashFlow_{i,t} + \theta_{11} CV_{i,t} + \theta_{12} ROA_{i,t} + \\
& \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{3}$$

$$\begin{aligned}
DEB_{i,t} = & \alpha''' + \beta_{31} BSIZE_{i,t} + \beta_{32} OUTSIDE_{i,t} + \beta_{33} DUAL_{i,t} + \beta_{34} AGE_{i,t} + \\
& \beta_{35} PCT_F_DIR_{i,t} + \beta_{36} BOARDOWN_{i,t} + \beta_{37} BOARDFEES_{i,t} + \beta_{38} MEYEAR_{i,t} + \\
& \beta_{39} COMTE_{i,t} + \beta_{40} REMU_{i,t} + \theta_{13} SIZE_{i,t} + \theta_{14} CashFlow_{i,t} + \theta_{15} CV_{i,t} + \\
& \theta_{16} ROA_{i,t} + \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{4}$$

$$\begin{aligned}
INV_{i,t} = & \alpha + \beta_{41} BSIZE_{i,t} + \beta_{42} OUTSIDE_{i,t} + \beta_{43} DUAL_{i,t} + \beta_{44} AGE_{i,t} + \\
& \beta_{45} PCT_F_DIR_{i,t} + \beta_{46} BOARDOWN_{i,t} + \beta_{47} BOARDFEES_{i,t} + \beta_{48} MEYEAR_{i,t} + \\
& \beta_{49} COMTE_{i,t} + \beta_{50} REMU_{i,t} + \theta_{17} SIZE_{i,t} + \theta_{18} CashFlow_{i,t} + \theta_{19} CV_{i,t} + \\
& \theta_{20} ROA_{i,t} + \sum^{N-1} \gamma Dummy_i + \sum^{T-1} \gamma Dummy_t + u_{i,t}
\end{aligned}
\tag{5}$$

Hypothesis 1:

H1₀: Board size (BSIZE) has no significant effect on capital adequacy risk (CAPRISK)

H1_a: Board size (BSIZE) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-6: Analysis of the relationship between board size and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BFSIZE	-0.008081	0.006852	-1.179357	0.2394

The results of the hypothesis are shown in Table 5-6. The result from the p-value of board size equals 0.2394, which is more than 0.05; the null hypothesis H1₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board size and capital adequacy risk during the years 2010 to 2014.

Hypothesis 2:

H2₀: Board composition (OUTSIDE) has no significant effect on capital adequacy risk (CAPRISK)

H2_a: Board composition (OUTSIDE) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-7: Analysis of the relationship between board composition and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTSIDE	-0.374467	0.141135	-2.653245	0.0085

The results of the hypothesis are shown in Table 5-7. The result from the p-value of board composition equals 0.0085, which is less than 0.01; the null hypothesis H_{2_0} can be rejected at a 1% level of significance. The coefficient value is -0.374467. This means that there is a negative relationship between board composition and capital adequacy risk during the years 2010 to 2014.

Hypothesis 3:

H_{3_0} : Board leadership structure (DUAL) has no significant effect on capital adequacy risk (CAPRISK)

H_{3_a} : Board leadership structure (DUAL) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-8: Analysis of the relationship between board leadership structure and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUAL *	-0.05288	0.039646	-1.333806	0.1835

The results of the hypothesis are shown in Table 5-8. The result from the p-value of board leadership structure equals 0.1835, which is more than 0.05; the null hypothesis H_{3_0} cannot be rejected at a 5% level of significance. This means that there is no relationship between board leadership structure and capital adequacy risk during the years 2010 to 2014.

Hypothesis 4:

H4_o: Board age (AGE) has no remarkable effect on capital adequacy risk (CAPRISK) [$\beta_4 = \emptyset$]

H4_a: Board age (AGE) has a remarkable effect on capital adequacy risk (CAPRISK) [$\beta_4 \neq \emptyset$]

Table 5-9: Analysis of the relationship between board age and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	0.000596	0.00469	0.127075	0.899

The results of the hypothesis are shown in Table 5-9. The result from the p-value of the board age equals 0.899, which is more than 0.05; the null hypothesis H4_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board age and capital adequacy risk during the years 2010 to 2014.

Hypothesis 5:

H5_o: Board gender diversity (PCT_F_DIR) has no significant effect on capital adequacy risk (CAPRISK)

H5_a: Board gender diversity (PCT_F_DIR) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-10: Analysis of the relationship between board gender diversity and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_F_DIR	-0.017016	0.134314	-0.126688	0.8993

The results of the hypothesis are shown in Table 5-10. The result from the p-value of board gender diversity equals 0.8993, which is more than 0.05; the null hypothesis H5₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board gender diversity and capital adequacy risk during the years 2010 to 2014.

Hypothesis 6:

H6₀: Board ownership (BOARDOWN) has no significant effect on capital adequacy risk (CAPRISK)

H6_a: Board ownership (BOARDOWN) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-11: Analysis of the relationship between board ownership and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDOWN	-0.010026	0.017931	-0.559115	0.5766

The results of the hypothesis are shown in Table 5-11. The result from the p-value of board ownership equals 0.5766, which is more than 0.05; the null hypothesis H_{6_0} cannot be rejected at a 5% level of significance. This means that there is no relationship between board ownership and capital adequacy risk during the years 2010 to 2014.

Hypothesis 7:

H7₀: Board compensation (BOARDFEES) has no significant effect on capital adequacy risk (CAPRISK)

H7_a: Board compensation (BOARDFEES) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-12: Analysis of the relationship between board compensation and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDFEES	5.23E-09	2.35E-09	2.222515	0.0272

The results of the hypothesis are shown in Table 5-12. The result from the p-value of board compensation equals 0.0272, which is less than 0.05; the null hypothesis H_{7_0} can be rejected at a 5% level of significance. The coefficient value is 5.37E-09. This means that there is a positive relationship between board compensation and capital adequacy risk during the years 2010 to 2014.

Hypothesis 8:

H8_o: Board meetings (MEYEAR) have no significant effect on capital adequacy risk (CAPRISK)

H8_a: Board meetings (MEYEAR) have a significant effect on capital adequacy risk (CAPRISK)

Table 5-13: Analysis of the relationship between board meetings and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MEYEAR	0.004196	0.004088	1.026627	0.3056

The results of the hypothesis are shown in Table 5-13. The result from the p-value of board meetings equals 0.3056, which is more than 0.05; the null hypothesis H8_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board meetings and capital adequacy risk during the years 2010 to 2014.

Hypothesis 9:

H9_o: The remuneration committee (COMTE) has no significant effect on capital adequacy risk (CAPRISK)

H9_a: The remuneration committee (COMTE) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-14: Analysis of the relationship between the remuneration committee and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMTE	-0.134136	0.062617	-2.142184	0.0332

The results of the hypothesis are shown in Table 5-14. The result from the p-value of the remuneration committee equals 0.0332, which is less than 0.05; the null hypothesis H_{9_0} can be rejected at a 5% level of significance. The coefficient value is -0.134136. This means that there is a negative relationship between the remuneration committee and capital adequacy risk during the years 2010 to 2014.

Hypothesis 10:

H10₀: CEO compensation (REMU) has no significant effect on capital adequacy risk (CAPRISK)

H10_a: CEO compensation (REMU) has a significant effect on capital adequacy risk (CAPRISK)

Table 5-15: Analysis of the relationship between CEO compensation and capital adequacy risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REMU	-1.07E-09	5.71E-10	-1.87278	0.0623

The results of the hypothesis are shown in Table 5-15. The result from the p-value of CEO compensation equals 0.0623, which is more than 0.05 but less than 0.1; the null hypothesis H_{10_o} cannot be rejected at a 10% level of significance. The coefficient value is $-1.07E-09$. This means that there is a negative relationship between CEO compensation and capital adequacy risk during the years 2010 to 2014.

Hypothesis 11:

H11_o: Board size (BSIZE) has no notable effect on business risk in terms of stock return volatility (SD_RET)

H11_a: Board size (BSIZE) has a notable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-16: Analysis of the relationship between board size and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BSIZE *	0.008317	0.008132	*1.022759	0.3074

The results of the hypothesis are shown in Table 5-16. The result from the p-value of board size equals 0.3074, which is more than 0.05; the null hypothesis H11_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board size and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 12:

H12_o: Board composition (OUTSIDE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H12_a: Board composition (OUTSIDE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-17: Analysis of the relationship between board composition and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTSIDE	0.048146	0.167497	0.287447	0.774

The results of the hypothesis are shown in Table 5-17. The result from the p-value of board composition equals 0.774, which is more than 0.05; the null hypothesis H12_o cannot be rejected at a 5% level of significance. This means there is no relationship between board composition and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 13:

H13_o: Board leadership structure (DUAL) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H13_a: Board leadership structure (DUAL) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-18: Analysis of the relationship between board leadership structure and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUAL	-0.006938	0.047051	-0.147458	0.8829

The results of the hypothesis are shown in Table 5-18. The result from the p-value of board leadership structure equals 0.8829, which is more than 0.05; the null hypothesis H13₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board leadership structure and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 14:

H14₀: Board age (AGE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H14_a: Board age (AGE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-19: Analysis of the relationship between board age and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.009469	0.005567	-1.701105	0.0902

The results of the hypothesis are shown in Table 5-19. The result from the p-value of board age equals 0.0902, which is less than 0.1; the null hypothesis H14_o can be rejected at a 10% level of significance. The coefficient value is -0.010011. This means that there is a negative relationship between board age and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 15:

H15_o: Board gender diversity (PCT_F_DIR) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H15_a: Board gender diversity (PCT_F_DIR) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-20: Analysis of the relationship between board gender diversity and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_F_DIR	-0.525317	0.159401	-3.295563	0.0011

The results of the hypothesis are shown in Table 5-20. The result from the p-value of board gender diversity equals 0.0011, which is less than 0.01; the null hypothesis H15_o can be rejected at a 1% level of significance. The coefficient value is -0.525317. This means that there is a negative relationship between board gender diversity and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 16:

H16_o: Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H16_a: Board ownership (BOARDOWN) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-21: Analysis of the relationship between board ownership and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDOWN	-0.005946	0.02128	-0.279425	0.7802

The results of the hypothesis are shown in Table 5-21. The result from the p-value of board ownership equals 0.7802, which is more than 0.05; the null hypothesis H16_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board ownership and business risk in terms of stock return volatility during the years 2010 to 2014.⁶⁹

Hypothesis 17:

H17_o: Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H17_a: Board compensation (BOARDFEES) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-22: Analysis of the relationship between board compensation and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDFEES	2.77E-09	2.79E-09	0.992167	0.3221

The results of the hypothesis are shown in Table 5-22. The result from the p-value of board compensation equals 0.3221, which is more than 0.05; the null hypothesis H17₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board compensation and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 18:

H18₀: Board meetings (MEYEAR) have no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H18_a: Board meetings (MEYEAR) have a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-23: Analysis of the relationship between board meetings and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MEYEAR	-0.005117	0.004851	-1.054771	0.2926

The results of the hypothesis are shown in Table 5-23. The result from the p-value of board meetings equals 0.2926, which is more than 0.05; the null hypothesis H18_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board meetings and business risk in terms of stock return volatility during the s 2010 to 2014.

Hypothesis 19:

H19_o: The remuneration committee (COMTE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H19_a: The remuneration committee (COMTE) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-24: Analysis of the relationship between the remuneration committee and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMTE	-0.043676	0.074312	-0.587734	0.5573

The results of the hypothesis are shown in Table 5-24. The result from the p-value of the remuneration committee equals 0.5573, which is more than 0.05; the null hypothesis H19_o cannot be rejected at a 5% level of significance. This means that there is no relationship between the remuneration committee and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 20:

H20_o: CEO compensation (REMU) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)

H20_a: CEO compensation (REMU) has a remarkable effect on business risk in terms of stock return volatility (SD_RET)

Table 5-25: Analysis of the relationship between CEO compensation and business risk in terms of stock return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REMU	-5.81E-10	6.77E-10	-0.857465	0.392

The results of the hypothesis are shown in Table 5-25. The result from the p-value of CEO compensation equals 0.392, which is more than 0.05; the null hypothesis H20_o cannot be rejected at a 5% level of significance. This means that there is no relationship between CEO compensation and business risk in terms of stock return volatility during the years 2010 to 2014.

Hypothesis 21:

H21_o: Board size (BSIZE) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H21_a: Board size (BSIZE) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-26: Analysis of the relationship between board size and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BFSIZE	0.087751	0.151604	0.578817	0.5633

The results of the hypothesis are shown in Table 5-26. The result from the p-value of board size equals 0.5633, which is more than 0.05; the null hypothesis H21_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board size and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 22:

H22_o: Board composition (OUTSIDE) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H22_a: Board composition (OUTSIDE) has a remarkable effect on business risk in terms of return volatility (SD_IN) 9

Table 5-27: Analysis of the relationship between board composition and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTSIDE	-2.336161	3.122624	-0.74814	0.4551

The results of the hypothesis are shown in Table 5-27. The result from the p-value of board composition equals 0.4551, which is more than 0.05; the null hypothesis H22_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board composition and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 23:

H23_o: Board leadership structure (DUAL) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H23_a: Board leadership structure (DUAL) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-28: Analysis of the relationship between board leadership structure and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUAL *	-0.257334	0.877169	-0.293368	0.7695

The results of the hypothesis are shown in Table 5-28. The result from the p-value of board leadership equals 0.7695, which is more than 0.05; the null hypothesis H23_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board leadership structure and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 24:

H24_o: Board age (AGE) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H24_a: Board age (AGE) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-29: Analysis of the relationship between board age and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.001728	0.103777	-0.01665	0.9867

The results of the hypothesis are shown in Table 5-29. The result from the p-value of board age equals 0.9867, which is more than 0.05; the null hypothesis H24_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board age and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 25:

H25_o: Board gender diversity (PCT_F_DIR) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H25_a: Board gender diversity (PCT_F_DIR) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-30: Analysis of the relationship between board gender diversity and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_F_DIR	0.337787	2.971693	0.113668	0.9096

The results of the hypothesis are shown in Table 5-30. The result from the p-value of board gender diversity equals 0.9096, which is more than 0.05; the null hypothesis H25₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board gender diversity and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 26:

H26₀: Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H26_a: Board ownership (BOARDOWN) has a remarkable effect on business risk in terms of return volatility (SD_IN) 9

Table 5-31: Analysis of the relationship between board ownership and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDOWN	0.063833	0.396724	0.160901	0.8723

The results of the hypothesis are shown in Table 5-31. The result from the p-value of board ownership equals 0.8723, which is more than 0.05; the null hypothesis $H26_0$ cannot be rejected at a 5% level of significance. This means that there is no relationship between board ownership and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 27:

$H27_0$: Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of return volatility (SD_IN)

$H27_a$: Board compensation (BOARDFEES) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-32: Analysis of the relationship between board compensation and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDFEES	2.89E-08	5.21E-08	0.554099	0.58

The results of the hypothesis are shown in Table 5-32. The result from the p-value of board compensation equals 0.58, which is more than 0.05; the null hypothesis $H27_0$ cannot be rejected at a 5% level of significance. This means that there is no relationship between board compensation and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 28:

H28_o: Board meetings (MEYEAR) have no remarkable effect on business risk in terms of return volatility (SD_IN)

H28_a: Board meetings (MEYEAR) have a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-33: Analysis of the relationship between board meetings and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MEYEAR	-0.171069	0.090437	-1.891586	0.0597

The results of the hypothesis are shown in Table 5-33. The result from the p-value of board meetings equals 0.0597, which is less than 0.1; the null hypothesis H28_o can be rejected at a 10% level of significance. The coefficient value is -0.171069. This means that there is a negative relationship between board meetings and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 29:

H29_o: The remuneration committee (COMTE) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H29_a: The remuneration committee (COMTE) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-34: Analysis of the relationship between the remuneration committee and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMTE	0.455164	1.385395	0.328544	0.7428

The results of the hypothesis are shown in Table 5-34. The result from the p-value of the remuneration committee equals 0.7428, which is more than 0.05; the null hypothesis H29₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between the remuneration committee and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 30:

H30₀: CEO compensation (REMU) has no remarkable effect on business risk in terms of return volatility (SD_IN)

H30_a: CEO compensation (REMU) has a remarkable effect on business risk in terms of return volatility (SD_IN)

Table 5-35: Analysis of the relationship between CEO compensation and business risk in terms of return volatility

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REMU	1.91E-09	1.26E-08	0.150926	0.8802

The results of the hypothesis are shown in Table 5-35. The result from the p-value of CEO compensation equals 0.8802, which is more/less than 0.05; the null hypothesis H_{30_0} cannot be rejected at a 5% level of significance. This means that there is no relationship between CEO compensation and business risk in terms of return volatility during the years 2010 to 2014.

Hypothesis 31:

H_{31_0} : Board size (BSIZE) has no significant effect on financial risk (DEB)

H_{31_a} : Board size (BSIZE) has a significant effect on financial risk (DEB)

Table 5-36: Analysis of the relationship between board size and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BSIZE	0.008145	0.006794	1.198719	0.2318

The results of the hypothesis are shown in Table 5-31. The result from the p-value of board size equals 0.2318, which is more than 0.05; the null hypothesis H_{31_0} cannot be rejected at a 5% level of significance. This means that there is no relationship between board size and financial risk during the years 2010 to 2014.

Hypothesis 32:

H_{32_0} : Board composition (OUTSIDE) has no significant effect on financial risk (DEB)

H32_a: Board composition (OUTSIDE) has a significant effect on financial risk (DEB)

Table 5-37: Analysis of the relationship between board composition and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTSIDE	0.373692	0.139945	2.670275	0.0081

The results of the hypothesis are shown in Table 5-37. The result from the p-value of board composition equals 0.0081, which is less than 0.01; the null hypothesis H32_o can be rejected at a 1% level of significance. The coefficient value was 0.373692. This means that there is a positive relationship between board composition and financial risk during the years 2010 to 2014.

Hypothesis 33:

H33_o: Board leadership structure (DUAL) has no significant effect on financial risk (DEB)

H33_a: Board leadership structure (DUAL) has a significant effect on financial risk (DEB)

Table 5-38: Analysis of the relationship between board leadership structure and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
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DUAL	0.052264	0.039312	1.329476	0.1849
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The results of the hypothesis are shown in Table 5-38. The result from the p-value of board leadership structure equals 0.1849, which is more than 0.05; the null hypothesis H33_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board leadership structure and financial risk during the years 2010 to 2014.

Hypothesis 34:

H34_o: Board age (AGE) has no remarkable effect on financial risk (DEB)

H34_a: Board age (AGE) has a remarkable effect on financial risk (DEB)

Table 5-39: Analysis of the relationship between board age and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.000748	0.004651	-0.160735	0.8724

The results of the hypothesis are shown in Table 5-39. The result from the p-value of board age equals 0.8724, which is more than 0.05; the null hypothesis H34_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board age and financial risk during the years 2010 to 2014.

Hypothesis 35:

H35_o: Board gender diversity (PCT_F_DIR) has no significant effect on financial risk (DEB)

H35_a: Board gender diversity (PCT_F_DIR) has a significant effect on financial risk (DEB)

Table 5-40: Analysis of the relationship between board gender diversity and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_F_DIR	0.016118	0.133181	0.121021	0.9038

The results of the hypothesis are shown in Table 5-40. The result from the p-value of board gender diversity equals 0.9038, which is more than 0.05; the null hypothesis H35_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board gender diversity and financial risk during the years 2010 to 2014.

Hypothesis 36:

H36_o: Board ownership (BOARDOWN) has no significant effect on financial risk (DEB)

H36_a: Board ownership (BOARDOWN) has a significant effect on financial risk (DEB)

Table 5-41: Analysis of the relationship between board ownership and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDOWN	0.010375	0.01778	0.583521	0.5601

The results of the hypothesis are shown in Table 5-41. The result from the p-value of board ownership equals 0.5601, which is more than 0.05; the null hypothesis H36₀ cannot be rejected at a 5% level of significance. This means that there is no relationship between board ownership and financial risk during the years 2010 to 2014.

Hypothesis 37:

H37₀: Board compensation (BOARDFEES) has no significant effect on financial risk (DEB)

H37_a: Board compensation (BOARDFEES) has a significant effect on financial risk (DEB)

Table 5-42: Analysis of the relationship between board compensation and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDFEES	-5.20E-09	2.33E-09	-2.229518	0.0267

The results of the hypothesis are shown in Table 5-42. The result from the p-value of board compensation equals 0.0267, which is less than 0.05; the null hypothesis H37_o can be rejected at a 5% level of significance. The coefficient value is -5.20E-09. This means that there is a negative relationship between board compensation and financial risk during the years 2010 to 2014.

Hypothesis 38:

H38_o: Board meetings (MEYEAR) have no significant effect on financial risk (DEB)

H38_a: Board meetings (MEYEAR) have a significant effect on financial risk (DEB)

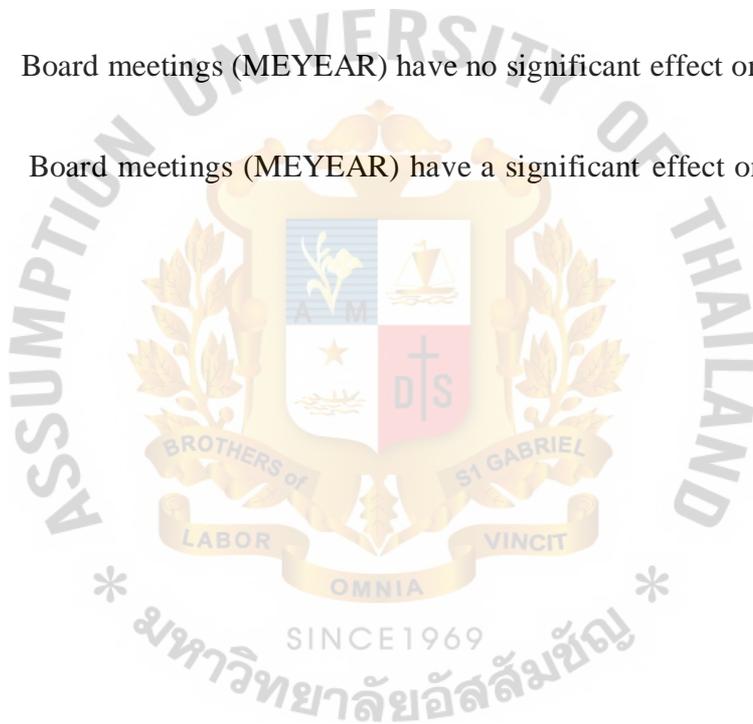


Table 5-43: Analysis of the relationship between board meetings and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MEYEAR	-0.004406	0.004053	-1.087095	0.2781

The results of the hypothesis are shown in Table 5-43. The result from the p-value of board meetings equals 0.2781, which is more than 0.05; the null hypothesis $H38_0$ cannot be rejected at a 5% level of significance. This means that there is no relationship between board meetings and financial risk during the years 2010 to 2014.

Hypothesis 39:

H39₀: The remuneration committee (COMTE) has no significant effect on financial risk (DEB)

H39_a: The remuneration committee (COMTE) has a significant effect on financial risk (DEB)

Table 5-44: Analysis of the relationship between the remuneration committee and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMTE	0.135182	0.062089	2.17724	0.0304

The results of the hypothesis are shown in Table 5-44. The result from the p-value of the remuneration committee equals 0.0304, which is less than 0.05; the null hypothesis H39_o can be rejected at a 5% level of significance. The coefficient value was 0.135182. This means that there is a positive relationship between the remuneration committee and financial risk during the years 2010 to 2014.

Hypothesis 40:

H40_o: CEO compensation (REMU) has no significant effect on financial risk (DEB)

H40_a: CEO compensation (REMU) has a significant effect on financial risk (DEB)

Table 5-45: Analysis of the relationship between CEO compensation and financial risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REMU	1.07E-09	5.66E-10	1.898333	0.0588

The results of the hypothesis are shown in Table 5-45. The result from the p-value of CEO compensation equals 0.0588, which is more than less than 0.1; the null hypothesis H40_o can be rejected at a 10% level of significance. The coefficient value is 1.07E-09. This means that there is a positive relationship between CEO compensation and financial risk during the years 2010 to 2014.

Hypothesis 41:

H41_o: Board size (BSIZE) has no significant effect on investment risk (INV)

H41_a: Board size (BSIZE) has a significant effect on investment risk (INV)

Table 5-46: Analysis of the relationship between board size and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BSIZE	-0.003844	0.005868	-0.655009	0.5131

The results of the hypothesis are shown in Table 5-46. The result from the p-value of board size equals 0.5131, which is more than 0.05; the null hypothesis H41_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board size and investment risk during the years 2010 to 2014.

Hypothesis 42:

H42_o: Board composition (OUTSIDE) has no significant effect on investment risk (INV)

H42_a: Board composition (OUTSIDE) has a significant effect on investment risk (INV)*

Table 5-47: Analysis of the relationship between board composition and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OUTSIDE	0.082074	0.120874	0.679006	0.4978

The results of the hypothesis are shown in Table 5-47. The result from the p-value of board composition equals 0.4978, which is more than 0.05; the null hypothesis H42_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board composition and investment risk during the years 2010 to 2014.

Hypothesis 43:

H43_o: Board leadership structure (DUAL) has no significant effect on investment risk (INV)

H43_a: Board leadership structure (DUAL) has a significant effect on investment risk (INV)

Table 5-48: Analysis of the relationship between board leadership structure and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUAL *	0.013616	0.033954	-0.401002	0.6888

The results of the hypothesis are shown in Table 5-48. The result from the p-value of board leadership structure equals 0.6888, which is more than 0.05; the null hypothesis H43_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board leadership structure and investment risk during the years 2010 to 2014.

Hypothesis 44:

H44_o: Board age (AGE) has no remarkable effect on investment risk (INV)

H44_a: Board age (AGE) has a remarkable effect on investment risk (INV)

Table 5-49: Analysis of the relationship between board age and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.003365	0.004017	-0.837723	0.403

The results of the hypothesis are shown in Table 5-49. The result from the p-value of board age equals 0.403, which is more than 0.05; the null hypothesis H44_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board age and investment risk during the years 2010 to 2014.

Hypothesis 45:

H45_o: Board gender diversity (PCT_F_DIR) has no significant effect on investment risk (INV)

H45_a: Board gender diversity (PCT_F_DIR) has a significant effect on investment risk (INV)

Table 5-50: Analysis of the relationship between board gender diversity and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_F_DIR	0.262296	0.115031	2.280213	0.0235

The results of the hypothesis are shown in Table 5-50. The result from the p-value of board gender diversity equals 0.0235, which is less than 0.05; the null hypothesis H45_o can be rejected at a 5% level of significance. The coefficient value is 0.262296. This means that there is a positive relationship between board gender diversity and investment risk during the years 2010 to 2014.

Hypothesis 46:

H46_o: Board ownership (BOARDOWN) has no significant effect on investment risk (INV)

H46_a: Board ownership (BOARDOWN) has a significant effect on investment risk (INV)

Table 5-51: Analysis of the relationship between board ownership and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDOWN	-0.020263	0.015357	-1.319513	0.1882

The results of the hypothesis are shown in Table 5-51. The result from the p-value of board ownership equals 0.1882, which is more than 0.05; the null hypothesis H46_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board ownership and investment risk during the years 2010 to 2014.

Hypothesis 47:

H47_o: Board compensation (BOARDFEES) has no significant effect on investment risk (INV)

H47_a: Board compensation (BOARDFEES) has a significant effect on investment risk (INV)

Table 5-52: Analysis of the relationship between board compensation and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOARDFEES	-7.28E-10	2.02E-09	-0.360844	0.7185

The results of the hypothesis are shown in Table 5-52. The result from the p-value of board compensation equals 0.7185, which is more than 0.05; the null hypothesis H47_o cannot be rejected at a 5% level of significance. This means that there is no relationship between board compensation and investment risk during the years 2010 to 2014.

Hypothesis 48:

H48_o: Board meetings (MEYEAR) have no significant effect on investment risk (INV)

H48_a: Board meetings (MEYEAR) have a significant effect on investment risk (INV)

Table 5-53: Analysis of the relationship between board meetings and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MEYEAR	-0.006556	0.003501	-1.872807	0.0623

The results of the hypothesis are shown in Table 5-53. The result from the p-value of board meetings equals 0.0623, which is less than 0.1; the null hypothesis H_{48_0} can be rejected at a 10% level of significance. The coefficient value is -0.006556. This means that there is a negative relationship between board meetings and investment risk during the years 2010 to 2014.

Hypothesis 49:

H49₀: The remuneration committee (COMTE) has no significant effect on investment risk (INV)

H49_a: The remuneration committee (COMTE) has a significant effect on investment risk (INV)

Table 5-54: Analysis of the relationship between the remuneration committee and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMTE	0.11038	0.053627	2.058284	0.0406

The results of the hypothesis are shown in Table 5-54. The result from the p-value of the remuneration committee equals 0.0406, which is less than 0.05; the null hypothesis H_{49_0} can be rejected at a 5% level of significance. The coefficient value is 0.11038. This means that there is a positive relationship between the remuneration committee and investment risk during the years 2010 to 2014.

Hypothesis 50:

H_{50_0} : CEO compensation (REMU) has no significant effect on investment risk (INV)

H_{50_a} : CEO compensation (REMU) has a significant effect on investment risk (INV)

Table 5-55: Analysis of the relationship between CEO compensation and investment risk

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REMU	1.53E-10	4.89E-10	0.313924	0.7538

The results of the hypothesis are shown in Table 5-55. The result from the p-value of the CEO compensation equals 0.7538, which is more than 0.05; the null hypothesis H_{50_0} cannot be rejected at a 5% level of significance. This means that there is no relationship between CEO compensation and investment risk during the years 2010 to 2014.

Chapter 6: Summary of Findings, Conclusion, and Recommendations

In this chapter, a summary of the study results is presented, including hypotheses testing, discussions, conclusions, and implications in support of the study based on previous research as well as recommendations. The last section covers suggestions for further study by other researchers.

6.1 Summary of Findings

The study analyzes the effect of board characteristics and CEO compensation toward firm risk in service companies on the SET from 2010 to 2014. The data cover a five-year period from 2010 to 2014, on a total of 65 firms. A summary of the findings are shown in Table 6.1.

Table 6-1: Summary of the hypotheses results

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
H1	Board size (BSIZE) has no significant effect on capital adequacy risk (CAPRISK)	-0.008081	0.2394	Failed to reject Ho
H2	Board composition (OUTSIDE) has no significant effect on capital adequacy risk (CAPRISK)	-0.374467	0.0085	Reject Ho
H3	Board leadership structure (DUAL) has no significant effect on capital adequacy risk (CAPRISK)	-0.05288	0.1835	Failed to reject Ho
H4	Board age (AGE) has no remarkable influence on capital adequacy risk (CAPRISK)	0.000596	0.899	Failed to reject Ho
H5	Board gender diversity (PCT_F_DIR) has no significant	-0.017016	0.8993	Failed to reject Ho

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
	effect on capital adequacy risk (CAPRISK)			
H6	Board ownership (BOARDOWN) has no significant effect on capital adequacy risk (CAPRISK)	-0.010026	0.5766	Failed to reject Ho
H7	Board compensation (BOARDFEES) has no significant effect on capital adequacy risk (CAPRISK)	5.23E-09	0.0272	Reject Ho
H8	Board meetings (MEYEAR) have no significant effect on capital adequacy risk (CAPRISK)	0.004196	0.3056	Failed to reject Ho
H9	The remuneration committee (COMTE) has no significant effect on capital adequacy risk (CAPRISK)	-0.134136	0.0332	Reject Ho
H10	CEO compensation (REMU) has no significant effect on capital adequacy risk (CAPRISK)	-1.07E-09	0.0623	Reject Ho
H11	Board size (BSIZE) has no notable effect on business risk in terms of stock return volatility (SD_RET)	0.008317	0.3074	Failed to reject Ho
H12	Board composition (OUTSIDE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	0.048146	0.774	Failed to reject Ho
H13	Board leadership structure (DUAL) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-0.006938	0.8829	Failed to reject Ho
H14	Board age (AGE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-0.009469	0.0902	Reject Ho
H15	Board gender diversity	-0.525317	0.0011	Reject Ho

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
	(PCT_F_DIR) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)			
H16	Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-0.005946	0.7802	Failed to reject Ho
H17	Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	2.77E-09	0.3221	Failed to reject Ho
H18	Board meetings (MEYEAR) have no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-0.005117	0.2926	Failed to reject Ho
H19	The remuneration committee (COMTE) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-0.043676	0.5573	Failed to reject Ho
H20	CEO compensation (REMU) has no remarkable effect on business risk in terms of stock return volatility (SD_RET)	-5.81E-10	0.392	Failed to reject Ho
H21	Board size (BSIZE) has no remarkable effect on business risk in terms of return volatility (SD_IN)	0.087751	0.5633	Failed to reject Ho
H22	Board composition (OUTSIDE) has no remarkable effect on business risk in terms of return volatility (SD_IN)	-2.336161	0.4551	Failed to reject Ho
H23	Board leadership structure (DUAL) has no remarkable effect on business risk in terms of return volatility (SD_IN)	-0.257334	0.7695	Failed to reject Ho

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
H24	Board age (AGE) has no remarkable effect on business risk in terms of return volatility (SD_IN)	-0.001728	0.9867	Failed to reject Ho
H25	Board gender diversity (PCT_F_DIR) has no remarkable effect on business risk in terms of return volatility (SD_IN)	0.337787	0.9096	Failed to reject Ho
H26	Board ownership (BOARDOWN) has no remarkable effect on business risk in terms of return volatility (SD_IN)	0.063833	0.8723	Failed to reject Ho
H27	Board compensation (BOARDFEES) has no remarkable effect on business risk in terms of return volatility (SD_IN)	2.89E-08	0.58	Failed to reject Ho
H28	Board meetings (MEYEAR) have no remarkable effect on business risk in terms of return volatility (SD_IN)	-0.171069	0.0597	Reject Ho
H29	The remuneration committee (COMTE) has no remarkable effect on business risk in terms of return volatility (SD_IN)	0.455164	0.7428	Failed to reject Ho
H30	CEO compensation (REMU) has no remarkable effect on business risk in terms of return volatility (SD_IN)	1.91E-09	0.8802	Failed to reject Ho
H31	Board size (BSIZE) has no significant effect on financial risk (DEB)	0.008145	0.2318	Failed to reject Ho
H32	Board composition (OUTSIDE) has no significant effect on financial risk (DEB)	0.373692	0.0081	Reject Ho
H33	Board leadership structure (DUAL)	0.052264	0.1849	Failed to reject

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
	has no significant effect on financial risk (DEB)			Ho
H34	Board age (AGE) has no remarkable effect on financial risk (DEB)	-0.000748	0.8724	Failed to reject Ho
H35	Board gender diversity (PCT_F_DIR) has no significant effect on financial risk (DEB)	0.016118	0.9038	Failed to reject Ho
H36	Board ownership (BOARDOWN) has no significant effect on financial risk (DEB)	0.010375	0.5601	Failed to reject Ho
H37	Board compensation (BOARDFEES) has no significant effect on financial risk (DEB)	-5.20E-09	0.0267	Reject Ho
H38	Board meetings (MEYEAR) have no significant effect on financial risk (DEB)	-0.004406	0.2781	Failed to reject Ho
H39	The remuneration committee (COMTE) has no significant effect on financial risk (DEB)	0.135182	0.0304	Reject Ho
H40	CEO compensation (REMU) has no significant effect on financial risk (DEB)	1.07E-09	0.0588	Reject Ho
H41	Board size (BSIZE) has no significant effect on investment risk (INV)	-0.003844	0.5131	Failed to reject Ho
H42	Board composition (OUTSIDE) has no significant effect on investment risk (INV)	0.082074	0.4978	Failed to reject Ho
H43	Board leadership structure (DUAL) has no significant effect on investment risk (INV)	0.013616	0.6888	Failed to reject Ho
H44	Board age (AGE) has no remarkable effect on investment	-0.003365	0.403	Failed to reject Ho

No.	Null Hypothesis (Ho)	Coefficient	Prob.	Result
	risk (INV)			
H45	Board gender diversity (PCT_F_DIR) has no significant effect on investment risk (INV)	0.262296	0.0235	Reject Ho
H46	Board ownership (BOARDOWN) has no significant effect on investment risk (INV)	-0.020263	0.1882	Failed to reject Ho
H47	Board compensation (BOARDFEES) has no significant effect on investment risk (INV)	-7.28E-10	0.7185	Failed to reject Ho
H48	Board meetings (MEYEAR) have no significant effect on investment risk (INV)	-0.006556	0.0623	Reject Ho
H49	The remuneration committee (COMTE) has no significant effect on investment risk (INV)	0.11038	0.0406	Reject Ho
H50	CEO compensation (REMU) has no significant effect on investment risk (INV)	1.53E-10	0.7538	Failed to reject Ho

In this study if the p-value is less than the significant level at 10% or 0.1, the null hypothesis is rejected. On the other hand, if the p-value is more than the significant level at 10% or 0.1, the null hypothesis is accepted. According to Table 6-1, the null hypotheses of board composition, board compensation, the remuneration committee, and CEO compensation toward capital adequacy risk are rejected. Similarly, the null hypotheses of board age and board gender diversity toward business risk in terms of stock return volatility are rejected. Moreover, the null hypothesis of Board meetings toward business risk in terms of return volatility is rejected. In addition, the null hypotheses of board composition, board compensation,

the remuneration committee, and CEO compensation toward financial risk are rejected. Lastly, the null hypotheses of board gender diversity, board meetings, and remuneration committee toward investment risk are rejected.

Table 6-2: Regression results

	CAPRISK	SD_RET	SD_IN	DEB	INV
	0.947634	0.708386	1.132387	0.061278	0.844831
C	(3.189848)	(2.009222)	(0.172282)	(0.208022)	(3.320506)
	-0.00808	0.008317	0.087751	0.008145	-0.00384
BSIZE	(-1.179357)	(1.022759)	(0.578817)	(1.198719)	(-0.655009)
	-0.374467***	0.048146	-2.33616	0.373692***	0.082074
OUTSIDE	(-2.653245)	(0.287447)	(-0.74814)	(2.670275)	(0.679006)
	-0.05288	-0.00694	-0.25733	0.052264	0.013616
DUAL	(-1.333806)	(-0.147458)	(-0.293368)	(1.329476)	(0.401002)
	0.000596	-0.009469*	-0.00173	-0.00075	-0.00337
AGE	(0.127075)	(-1.701105)	(-0.01665)	(-0.160735)	(-0.837723)
	-0.01003	-0.00595	0.063833	0.010375	-0.02026
BOARDOWN	(-0.559115)	(-0.279425)	(0.160901)	(0.583521)	(-1.319513)
	5.23E-09**	2.77E-09	2.89E-08	-5.2E-09**	-7.28E-10
BOARDFEES	(2.222515)	(0.992167)	(0.554099)	(-2.229518)	(-0.360844)
	0.004196	-0.00512	-0.171069*	-0.00441	-0.006556*
MEYEAR	(1.026627)	(-1.054771)	(-1.891586)	(-1.087095)	(-1.872807)
	-0.01702	-0.525317***	0.337787	0.016118	0.262296**
PCT_F_DIR	(-0.126688)	(-3.295563)	(0.113668)	(0.121021)	(2.280213)
	-0.134136**	-0.04368	0.455164	0.135182**	0.11038**
COMTE	(-2.142184)	(-0.587734)	(0.328544)	(2.17724)	(2.058284)
	-1.07E-09*	-5.81E-10	1.91E-09	1.07E-09*	1.53E-10
REMU	(-1.87278)	(-0.857465)	(0.150926)	(1.898333)	(0.313924)
	-1.27E-12***	3.60E-13	3.20E-12	1.28E-12***	2.13E-12***
SIZE	(-2.633071)	(0.630404)	(0.300273)	(2.669316)	(5.15671)
	1.04E-12	-1.24E-12	1.96E-10	-1.07E-12	6.13E-13
CASHFLOW	(0.899764)	(-0.898359)	(7.639944)	(-0.926231)	(0.617295)
	0.238623***	-0.07655	-2.4638	-0.238708***	-0.280102***
ROA	(2.913831)	(-0.787669)	(-1.359796)	(-2.939664)	(-3.993687)
	-0.009509***	0.003179	-0.0099	0.009548***	-0.005148**
CV	(-3.274276)	(0.92239)	(-0.154001)	(3.315577)	(-2.069609)

Note: *, **, *** Significant at 10, 5, and 1% respectively, t-statistics are in parentheses.

6.2 Discussion and Conclusion

Following analysis, the researcher found that board composition had a significant negative effect on the Tier 1 capital leverage ratio. This result represents that the higher the number of independent directors, the lower the Tier 1 capital leverage ratio or the higher the capital adequacy risk. This result is in agreement with agency theory that boards should be composed of more independent directors to give advice and counsel executives since they have a tendency to protect their reputation as effective independent decision-makers (Fama & Jensen, 1983). Independent directors are a resource, offering broad experience and knowledge, thus leading to improved decision-making (Merle, 2013). Wright and Helms (2000) also found that boards with higher independence levels are more effective and take higher risks.

The regression results show that board compensation has a significant and positive effect toward capital leverage ratio. This means that higher board compensation and capital leverage ratio result in lower capital adequacy risk. Although incentives could encourage boards to take risks, if the compensation provided is too high, it is likely to obstruct their effectiveness and discourage risk-taking since members want to maintain their positions (Merle, 2013). Additionally, in the past year, service industry performance has continuously fallen (Asian Development Bank, 2015), which may result in boards with high incentives maintaining their position and wealth to accumulate a higher level of capital.

According to the regression results, the existence of a remuneration committee has a significant negative relationship with the Tier 1 capital leverage ratio. The result implies that when a remuneration committee is present, firms have a lower level of capital, leading to higher capital adequacy risk. The remuneration committee improves corporate governance quality, thus enhancing firm performance along with risk (Ayadi & Boujèlbène, 2012). Boards with a remuneration committee are more effective since their responsibilities regarding the compensation of the board and executives are eased. The remuneration committee's role also reduces conflict of interest between the board and management teams which improve corporate governance thus enabling them to accept higher risk and reduce the level of capital.

The results show that CEO compensation has a significant negative relationship with the Tier 1 capital leverage ratio, meaning higher CEO compensation, a lower capital level, and a higher capital adequacy risk. The result is in agreement with the findings of Saunders, Strock, and Travlos (1990) who also found that high CEO compensation promotes the company risk levels. High CEO compensation encourages CEOs to accept higher risk and promote the growth and innovativeness of the company (Wright & Helms, 2000). Due to the continuous drop in the performance of the Thai service industry (Koonnathamdee, 2013), it is likely that boards will give CEOs higher incentives in order to promote corporate performance and growth, consequently leading to increased debt financing and decreased capital levels.

From the analysis results, some board characteristics such as board size, board leadership structure, board age, board ownership, board meetings, and board gender diversity were found to have no relationship with capital adequacy risk. The results

imply that no matter how these factors change, the capital levels of the firm are unlikely to be affected. The result of board size is in agreement with Merle (2013) who also found no evidence to support a relationship between board size and capital adequacy risk. Yammeesri and Herath (2010) suggested that board size can only represent the number of board members, and thus it is incapable of reflecting the board's ability to perform its role. Thus board size is unable to affect a firm's capital level. Secondly, the researcher was unable to find evidence to support a relationship between board leadership structure and capital adequacy risk. The results could be supported by Yammeesri and Herath (2010) who proposed that a CEO assuming the role of board chair is not a good tool for internal control as the authors found that duality reduces firm performance. Thus, the board leadership structure is not an effective internal control tool. Thirdly, board age is found to have no relationship with capital adequacy risk. The researcher found that service industry boards contain groups of people with rich experience of the business (Kim *et al.*, 2012) which tends to lead to a management-friendly board. Vafeas (2003) suggested that this type of board may lose their objectives and independence, leading to poor performance. A long serving board may become management-friendly and the age of its members can have an effect toward risk. Fourthly, the findings present that board gender diversity has no relationship with capital adequacy risk. The result is supported by Atkinson *et al.* (2003) who found no difference between the managerial decision-making of male and female managers, and thus for the Thai service industry, the presence of female directors has no effect toward a firm's capital levels.

The fifth characteristic is board ownership, which was found to have no effect toward capital adequacy risk. Merle (2013) stated that a high level of ownership encourages CEOs to focus on their personal wealth rather than risk level and performance of the firm. Most Thai firms are family businesses (Yammeesri & Herath, 2010), with a considerable amount of ownership. Board ownership in the Thai service industry averages 20% which is considerably higher compared to Merle (2013), who found that US BHCs accounted for 13%. Therefore, boards with too much ownership may focus on their personal wealth rather than on the firm's financial policy. Lastly, board meetings do not have a relationship with the capital adequacy risk of a firm. The frequency of meetings does not necessarily bring benefit as it may obstruct the monitoring role of the board, especially that of independent directors (Jackling & Johl, 2009). As a consequence, too many board meetings can become an obstacle so do not affect capital adequacy risk.

The regression results present that board age has a significant negative relationship with business risk in terms of stock returns volatility. This finding means the older the board, the lower the risk they accept. The results agree with the research findings of MacCrimmon and Wehrung (1990), who stated that boards with greater seniority are more risk-averse than those more junior. Cheikh (2014) found that age is contradictory to firm risk-taking. Older boards have a tendency to become risk-averse, thus reducing business risk.

The findings show that board gender diversity, measured by the percentage of female directors has a significant negative effect toward business risk in terms of stock return volatility. This means a higher number of female directors, results in

lower business risk. Lenard *et al.* (2014) found that high board gender diversity contributes to firms by lowering the risk and raising performance. According to Schubert (2006), who found that female directors were more cautious concerning profit than male. Thus, the presence of female directors may lower firm risk because female directors possess more risk-averse characteristics.

Following analysis, several board characteristics such as board size, board composition, board leadership structure, board ownership, board compensation, board meetings, a remuneration committee, and CEO compensation were found to have no relationship with business risk in terms of stock return volatility. The results imply that no matter how these factors change, the standard deviation of stock returns or future risk have no effect on the firm. Board size has no effect toward business risk as supported by the research findings of Yammeesri and Herath (2010) who state that the number of directors does not reflect how the board performs its role, and thus it cannot affect firm value. Moreover, Ferrero-Ferrero *et al.* (2012) stated that larger boards have less sense of responsibility which makes them inferior in promoting firm performance as well as risk-taking. The next board characteristic is composition. The findings show that no matter how many independent directors are on the board, business risk remains unchanged. This case is complementary to Yammeesri and Herath (2010), who found that board composition has no effect toward firm value because most Thai firms have independent directors in order to fulfill the requirements of the SET.

The researcher found no evidence to prove a relationship between board leadership structure and future firm risk. The results were similar to those of Ferrero-

Ferrero *et al.* (2012), who found that there was no relationship between board leadership structure and firm risk during a financial crisis. This implied that in a risky environment CEO duality does not affect firm risk. According to the Asian Development Bank (2015), the Thai service industry is in a relatively risky situation as its performance has consistently fallen. For this reason board leadership structure is unable to affect business risk. The fourth board characteristic is ownership. The case for board ownership is supported by Wright and Helms (2000), who stated that a high level of ownership is disadvantageous to the growth and innovativeness of a firm, including risk-taking behavior. Thai firms are mostly family businesses which have a noteworthy amount of ownership. Thus boards tend to become conservative and do not affect business risk. The fifth characteristic of board compensation has no effect toward business risk in terms of stock return volatility.

High board fees are a sign of weak corporate governance (Ferrero-Ferrero *et al.*, 2012). Merle (2013) stated that high compensation obstructs board effectiveness and causes it to become conservative. These reasons might result in the board's inability to affect risk. The remuneration committee was also found to have no effect toward business risk in terms of stock return volatility. According to Guthrie *et al.* (2012), no relationship was found between independent remuneration committees and CEO compensation which could cause the authors to question the effectiveness of the committee. If the remuneration committee is ineffective it is unable to affect stock return volatility. The findings show that board meetings do not affect business risk. Jackling and Johl (2009) found that firms with busy boards have lower firm performance. Ineffective board room communication and long rituals such as

management report presentations tend to obstruct directors in monitoring the firm (Lipton & Lorsch, 1992). As the results show, board meetings do not affect firm performance, and as a consequence, business risk. Lastly, CEO compensation was found to have no effect toward business risk in terms of stock return volatility. CEO compensation is not necessarily a good tool for motivating CEOs in promoting firm growth because Merle (2013) found that high CEO compensation tends to make CEOs reluctant to take risks. According to research by the Asian Development Bank (2015), the poor performance of the Thai service industry could discourage CEOs to promote growth and focus more on maintaining their status. Consequently, CEO compensation does not affect business risk in terms of stock return volatility.

Conforming to the hypotheses results, board meeting frequency has a significant negative effect toward business risk in terms of return volatility. This means that more frequent board meetings result in lower acceptable risk levels. Excessive board meetings can obstruct board effectiveness in monitoring, thereby reducing the firm's performance risk level (Jackling & Johl, 2009). In addition, due to the disadvantageous situation of the Thai service industry, it is likely that frequent board meetings may cause boards choosing less risky strategies to maintain the company's status, resulting in lower returns.

According to the regression results, the researcher also found that several characteristics such as board size, board composition, board leadership structure, board ownership, board age, board gender diversity, board compensation, the remuneration committee, and CEO compensation were found to have no relationship with business risk in terms of return volatility. According to Yammeesri and Herath

(2010), board size was found to have no effect toward firm value since it does not represent the knowledge and skills used by the board in performing their duties. In addition, the authors also stated that board composition plays an insignificant role in Thai business as most companies have independent directors in order to fulfill the requirements of the SET. Ferrero-Ferrero *et al.* (2012) found that in uncertain situations the leadership structure does not affect firm risk-taking as boards want to maintain their position and reputation. The Thai service industry has not been in a favorable position in recent years (Koonathamdee, 2013), and thus leadership structure, board ownership, board age, board gender diversity, board compensation, the remuneration committee, and CEO compensation have not affected volatility.

According to Table 6-2, board composition has a positive effect toward debt ratio which means highly independent boards result in increased debt financing as a consequence of increased financial risk. Independent directors can act as mediators between shareholders and executives to reduce conflict of interest and the agency problem. Moreover, independent directors have a tendency to maintain their status as liberated and competent decision-makers (Fama & Jensen, 1983), causing firms to operate more effectively. For this reason, highly independent boards may improve effectiveness, allowing them to accept more financial risk.

Following analysis, board compensation was found to have a significant negative relationship with debt ratio. The results represent that the higher the board compensation, the lower the level of debt and financial risk. Board compensation may correspond with board meeting frequency and performance effort, and this is related to board effectiveness (Adam, 2003). According to Ferrero-Ferrero *et al.* (2012), high

board fees may weaken corporate governance. Boards with high incentives have a tendency to maintain their status rather than focusing on the improvement of firm performance, resulting in lower financial risk.

From the regression results, existence of the remuneration committee has a significant positive relationship with debt ratio. According to the SET (2012), remuneration committees exist to act as arbitrators between the board of directors and executives by assuming a design incentive role. The separation of duties may reduce conflict of interest issues between the board and CEO, thus resolving agency problems to enable the board to work more effectively and improve firm performance, and as a consequence, firm risk (Ayadi & Boujèlbène, 2012). Therefore, boards with remuneration committees have higher work quality and can accept more risk, so they apply more debt financing, resulting in higher financial risk.

CEO compensation has a positive effect toward debt ratio. This means high CEO compensation may lead to increased firm debt level and financial risk. This result is in agreement with Wang (2012), who stated that higher CEO compensation relate to a higher debt ratio. CEO compensation is a tool for merging the interests of owners and managers, which may reduce the conflict of interest problem (Ayadi & Boujèlbène, 2012). As encouragement for CEOs to take more managerial risk, small boards usually offer high compensation (Hermalin & Weisbach, 2003). Accordingly, higher CEO compensation may reduce the conflict of interest problem, thus promoting firm effectiveness and performance, as well as encouraging CEOs to take risky financial decisions, which in turn increases risk.

According to the regression results, the researcher also found that board characteristics such as board size, board leadership structure, board ownership, board age, board gender diversity, and board meetings were found to have no relationship with debt ratio. According to the study by Yammeesri and Herath (2010), no evidence could be found to prove a relationship between board size and firm value since these factors did not take account of the knowledge and skills which the board contributes to the firm. While Ferrero-Ferrero *et al.* (2012) presented that CEO duality did not affect firm risk levels in disadvantageous situations such as during a financial crisis because boards want to maintain their position and status. According to Koonathamdee (2013), during the years from 2010 to 2014, the Thai service industry was considered to be in a disadvantageous position, and thus boards needed to maintain their status since they had to depend on debt financing. This may have therefore affected board size, board leadership structure, board ownership, board age, board gender diversity, and board meetings.

Following analysis, the researcher found that board meeting frequency has a negative effect toward long-term investment. The results agreed with those of Vafeas (1999), who found that the frequency of board meetings has a negative effect toward firm value due to time constraints. Meetings may obstruct the board in the exchange of important information and also increase costs such as travel, refreshments, directors' meeting fees, and lost operation time—all of which affect firm performance. Moreover, board meetings involve such rituals as management report presentations, which are time consuming and obstruct directors in monitoring the firm (Lipton &

Lorsch, 1992). Therefore, busy boards tend to reduce board effectiveness and discourage risk-taking.

The findings show that the presence of female directors has a positive proportionate relationship with long-term investment. This implies that a board with more women tends to be involved in more long-term investment, thus generating investment risk. The findings are complementary to those of Srinidhi *et al.* (2011), who found that a high gender diverse board generates higher earnings, with a consequential higher risk. Boards with high gender diversity have superiority in terms of creativity, innovativeness, and an understanding of the market; hence they perform better (Carter *et al.*, 2003). Boards with more female directors have advantages regarding innovativeness, creativity, and market knowledge, and hence generate higher long-term investment, and as a consequence, increase investment risk.

According to the regression results, the remuneration committee has a significant positive relationship with long-term investment. The result implies that when boards with a remuneration committee make more long-term investments, they incur a higher risk. Saat and Kallamu (2013) stated that the remuneration committee is beneficial to corporate performance. According to agency theory, board and executive remuneration is strongly related to shareholder value and capable of producing maximum performances for the board and executives (Jensen & Meckling, 1976). For boards to effectively perform their roles, tasks which could cause conflict of interest within the organization such as setting executive remuneration, should be conducted separately by remuneration committees (McClogan, 2001). Remuneration may reduce

the agency problem, thus improving board effectiveness and their ability to choose riskier investments in order to promote the growth of service firms.

According to the regression results, the researcher also found that board characteristics such as board size, board composition, board leadership structure, board ownership, board compensation, board age, and CEO compensation were found to have no effect toward the proportion of long-term investments. Ferrero-Ferrero *et al.* (2012) presented that board leadership structure has no effect toward firm risk during a financial crisis since boards want to maintain their position and status, and tend to become conservative. The research by the Asian Development Bank (2015) stated that the Thai service industry performance during recent years has been rather inferior compared to other developed countries in Asia and the Pacific. For this reason, during the study period, boards were in rather a difficult situation, and had to preserve their position and wealth and were unable to sway the proportion of higher risk long-term investment.

The results indicate that the Thai service industry from 2010 to 2014, the coefficients of some board characteristics such as board composition, board age, board compensation, board meetings, board gender diversity, the remuneration committee and CEO compensation are significantly related to firm risk.

The hypotheses result indicate that the coefficient of board composition is negatively significant to capital adequacy risk but positively related to financial risk, which means that highly independent boards are more willing to take risks. The results agree with agency theory and several researchers. Agency theory proposes that

independent directors are more competent than insiders regarding conflict of interest, agency cost reduction, and the moral hazard problem (Fama & Jensen, 1983). Liang and Li (1999) support this theory by stating that outside directors can act as moderators to solve disputes between shareholders and managers which lessen agency costs. High levels of independence may increase board effectiveness, allowing the acceptance of more risk. These results also agree with those of Lin *et al.* (2009), who found that board independence may increase firm efficiency because of its strong corporate governance. In agreement with Dahya *et al.* (2009), boards with more outside directors are also highly efficient in monitoring management and raising the firm's market share. Therefore, the researcher concludes that highly independent boards may increase firm risk since independent directors can act as mediators to solve the agency problem and improve firm efficiency, enabling them to accept higher risks.

The researcher found that the coefficient of board age is negatively significant to business risk in terms of stock return volatility. The results were agreeable with the research findings of MacCrimmon and Wehrung (1990), who stated that older board members had greater seniority and tend to be more risk-averse. Similar results were also found in studies by Hambrick and Fukutomi (1991), Barker and Mueller (2002), and Cheikh (2014). Cheikh (2014) stated that mature executives are more conservative and unwilling to take risks. They hardly ever accept new ideas or techniques and remain inflexible, which results in a lower level of firm risk.

The regression results show that a higher percentage of female directors negatively affects business risk in terms of stock return volatility, but positively

affects financial risk or the amount of debt. The presence of female directors may lower business risk in terms of stock return volatility, and this is consistent with the findings of Lenard *et al.* (2014). However, a higher percentage of female directors also positively affects financial risk or the amount of debt as well as investment risk, and this is in agreement with the findings of Maxfield *et al.* (2010), who conducted research using the Simmons 2008 Gender and Risk database and found that the risk acceptance level of female managers is equivalent to male managers in organizational decision-making. Atkinson *et al.* (2003) investigated the performance of male and female managers in fixed-income mutual funds and found that there was no noteworthy difference in performance or risk. Carter *et al.* (2003) stated that board gender diversity could improve firm creativity, innovativeness, marketing proficiency, and problem-solving effectiveness. These factors are components of a firm's effectiveness. In other words, gender diversity may improve board effectiveness to enable them to generate more investment, thereby increasing risk. The researcher concludes that although female directors may have a tendency to be risk-averse, they can improve board effectiveness, allowing firms to accept more financial and investment risk.

In the Thai service industry context from 2010 to 2014, the analysis results present that board compensation is negatively associated with firm risk since board compensation was found to have an inverse relationship with capital adequacy and financial risk. Board compensation implies laboriousness in firm monitoring tasks (Adams, 2003; Brick *et al.*, 2002; Ferrero-Ferrero *et al.*, 2012). Board compensation can measure its effectiveness because this method is capable of capturing the number

of board meetings during a year, the skills and effort of the board in discussing and establishing overall strategic management, surveillance of financial and managerial actions, and evaluating the performance of executive management (Adams, 2003). However, high board compensation can discourage risk-taking because members want to maintain their position and wealth (Merle, 2013). Furthermore, the performance of the Thai service industry has consistently fallen in recent years (Asian Development Bank, 2015) which may indicate that the situation for boards has been difficult. Hence, the researcher concludes that higher board fees affect industry performance, causing members to be over cautious, leading to lower firm risk-taking.

Analysis of the results also presents that the coefficient of board meetings is negatively and significantly related to business risk in terms of return volatility and investment. The results agree with the teachings of agency theory which recommend that boards have a fair amount of meetings to strengthen their controlling activities and advisory role (Wijethilake *et al.*, 2015). The results are also consistent with the findings of Ayadi and Boujèlbène (2012) and Vafeas (1999). Vafeas (1999) stated that board meetings allow members to meet, discuss, and exchange ideas on strategy, and find ways to monitor managers, which is one reason why board meetings may have a positive effect toward firm value. On the other hand, a high frequency of board meetings also obstructs effective firm monitoring (Jackling & Johl, 2009). In addition, during the study period, the Thai service industry was in a slightly difficult position, which may have resulted in boards with high meeting frequency to exchange information and be more vigilant, thereby reducing the level of firm risk-taking behavior.

According to the regression results, the presence of a remuneration committee increases capital adequacy and investment risk, as well as the amount of debt, meaning that it can increase overall firm risk. The teachings of agency theory state that remuneration significantly affects shareholder value, together with the capability and performance of the board and executives (Jensen & Meckling, 1976). The results also agree with the study by Saat and Kallamu (2013) who found that the remuneration committee is beneficial to corporate performance, which implies increased firm risk. The existence of the remuneration committee may improve board effectiveness because the design of executive remuneration duties are subdivided and conflict between the board and executives is therefore reduced (McClogan, 2001). Therefore, the remuneration committee may promote board effectiveness, allowing members to accept higher risk, with a consequential increase in risk to the firm.

The results show that higher CEO compensation causes higher firm risk as CEO compensation is positively related to capital adequacy and financial risk. This result is in agreement with Core *et al.* (1999) and Belkhir and Chazi (2010). Companies providing high levels of CEO compensation have high performance expectations which encourage CEOs to take more risks in order to increase returns (Core *et al.*, 1999). Belkhir and Chazi (2010) also found that high CEO compensation may encourage management to take higher risks, thereby increasing firm risk-taking.

The results indicate that for the Thai service industries from 2010 to 2014, the coefficients of certain board characteristics, namely board size, board leadership structure, and board ownership are not significantly related to any firm risk measurements.

Board size hypotheses results oppose the agency theory which proposes that smaller boards are more effective than larger ones, and the research findings of Yermack (1996) and Cheng *et al.* (2008) state that board size has a negative relationship to firm value. Similar results were found by Ferrero-Ferrero *et al.* (2012) who studied the effect of board characteristics toward firm risk-taking before and during the global financial crisis. They state that larger boards led to lower firm performance and risk-taking before the global financial crisis. However, during the financial crisis board size did not have any affect toward firm risk-taking because directors in larger boards became unwilling to take risks in order to maintain their position and reputation. Yammeesri and Herath (2010) who investigated the relationship between board characteristics and firm performance in Thailand during 2004 suggest that board size only represents the number of directors, and thus it might not relate to their ability, knowledge, and skills for improving firm performance.

According to Koonnathamdee (2013), during the 10 years prior to the sample period, the Thai service sector share in GDP has consistently fallen. The directors of large service firms may have become indecisive in taking risk after facing a loss in income over a long period of time. This might explain why board leadership structure or CEO duality and board ownership are not affected by any risk measurements. CEO duality may reduce risk to the firm because a CEO, who is also chairman of the board, constantly strives to protect his position and tends to make decisions involving less risk, which may mean reduced returns for stockholders (Merle, 2013). This idea is consistent with the research by Pathan (2009), who found that the power of the CEO is negatively associated with banking risk. Where the CEO chairs the board there is

lower risk to the bank which means duality is negatively and statistically significant in all risk measures.

Furthermore, Merle (2013) also found no evidence that board size and board leadership structure are related to firm risk-taking. In agreement with Wright and Helms (2000), when CEOs hold fewer shares the growth and risk-taking of the firm can improve. Conversely, when CEOs own a large number of stocks, they may be discouraged toward corporate risk-taking. If incentives permit a significant amount of CEO share ownership, they have a tendency to focus on their personal wealth and utility management rather than corporate risk-taking and firm performance (Merle, 2013). Therefore, the researcher concludes that a long-term decrease in income discourages a board to take risks and instead members tend to focus on their personal wealth, position, reputation, and utility management.

6.3 Recommendations

This study may benefit both insiders and outsiders, in evaluating the potential risk of a given company by providing an understanding of the effect of board characteristics on firm risk in Thailand's service sector. Such knowledge may give rise to board construction being based on the firm's desired risk levels since shareholders or owners could select board members with certain characteristics, thus influencing risk-taking. This knowledge can also assist investors when considering the risk of a given stock and their decision as to whether or not to invest. This research can also assist those studying corporate governance in Thailand. Furthermore, the results of this study should provide some guidance into the review and amendments of Thai Public Limited Companies Act and the Principles of Good Corporate

Governance. For example, Stock Exchange of Thailand could consider include age limit of directors as well as suitable range of board meeting frequency to the Principles of Good Corporate governance since the research results indicated that older average board age together with too much board meeting could lower effectiveness of board.

Service companies in Thailand, policy makers, board of directors and management committees could use these findings as a guideline, which is, what to focus on improvements of board roles or activities and improvements on the ways of conducting and organizing meetings. In the context of Thai service firms, certain recommendations are made based on the findings. Firstly, in order to control risk levels, firms could consider setting up a board with high seniority, high compensation, as well as holding frequent board meetings. The researcher suggests that boards be composed of members with high seniority as boards with older members tend to have a lower risk acceptance level, resulting in reduced firm risk. The results also suggest that boards given high fees tend to become conservative, and as a consequence, reduce firm risk. Furthermore, frequently held board meetings allow members to meet, discuss, and exchange ideas on strategy, and find ways to monitor managers which enables service firms to control their risk levels.

On the contrary, for the purpose of promoting performance at the cost of increased risk, firms could consider setting up a highly independent board, along with a remuneration committee and high CEO compensation—since the findings suggest that service firms with a high proportion of independent directors take more risks. The findings also imply that boards with a remuneration committee responsible for the

design of management compensation work more effectively, and may therefore accept higher risks. Lastly, firms permitting high management salary levels tend to be more risk-taking, which may result in improved performance.

6.4 Further Study

For future study, it is suggested that different measurements and independent variables not mentioned in the current research are applied to identify other factors which may affect firm risk. For example, boards with an educational background in accounting and/or finance may affect firm risk. This research involves the Thai service industry during the period from 2010 to 2014 which has a time limitation. The researcher suggests that identifying and extending the time period, location, and even the scope of the industry can provide deeper understanding of firm risk.

In the current study, the researcher found that the relationship between certain board characteristics could have been examined further, especially those involving board gender diversity and the remuneration committee. The relationship between board gender diversity and firm risk in this study is inconclusive. Hence, the researcher suggests that this issue be investigated further. While the effectiveness of the remuneration committee in this research is questionable, the researcher suggests investigating its relationship to firm risk, in more depth, including the independence aspect.

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