The change in board independence
in the presence of firm risk and regulation

El cambio en la independencia del consejo de administración
ante el riesgo de la firma y la regulación

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Abstract

The purpose of the paper is to explore the impact of firm risk on board independence, typically the proportion of non-executive directors. Our sample is based on a panel data of publicly listed firms on the Vietnamese stock market over ten years (2007-2016). By applying a dynamic generalized method of moments (GMM) estimators, the results are robust to endogeneity issues and highlight the U-shaped nonlinear impact of firm risk on the non-executive director ratio. Besides, because the lack of information transparency in Vietnamese enterprises caused many risks for investors, the government issued the Circular 121/2012/TT-BTC dated July 26, 2012 on corporate governance applicable to public companies, which enhanced changes in the board structure of listed companies. Under the pressure of this regulation, high-risk companies increased the proportion of non-executive directors.

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Resumen

El objetivo de este trabajo es explorar el impacto del riesgo de la firma sobre la independencia del consejo, típicamente la proporción de consejeros no ejecutivos. Nuestra muestra se basa en datos de panel de firmas registradas en la bolsa de valores vietnamita durante diez años (2007-2016). Al aplicar estimadores de un dinámico método de momentos generalizados (GMM), los resultados son sólidos para temas de endogeneidad y resaltan el impacto no lineal en forma de U del riesgo de la firma sobre la proporción de consejeros no ejecutivos. Además, debido a que la falta de transparencia de la información en las empresas vietnamitas causaba muchos riesgos a los inversionistas, el gobierno emitió la Circular 121/2012/TT-BTC de julio 26 de 2012 sobre gobierno corporativo aplicable a compañías públicas, la cual resaltaba los cambios en la estructura del consejo de las compañías que cotizan en bolsa. Bajo la presión de esta regulación, las compañías con alto riesgo incrementaron la proporción de consejeros no ejecutivos.

Introduction

Corporate governance has received the attention of researchers over the past several decades, especially as the financial problems of companies appear due to the lack of monitoring. Severe shortcomings related to board independence, risk management, executive remuneration in corporate governance code and principles led to the collapse of many financial institutions and then triggering the crisis (*OECD, 2009*). For instance, the Asian crisis of 1997-1998 and the global financial crisis of 2007–2009 came from weakness in corporate governance mechanisms (*Cheah & Lee, 2009; Akbar et al., 2017*), partially due to the unclear *separation* of *control and management*. It is the motivation to promote the development of a suitable independent board to prevent such scandals in the future. While a large number of research papers have focused on the effect of board independence on firm risk, the opposite perspective has received relatively little attention. Therefore, two primary factors motivate the research question:

Firstly, so far, there has been debate over the effects of firm risk on board independence. According to many previous studies supported by the agency theory, the presence of non-executive directors can reduce risks for companies. Based on this argument, the organizational portfolio theory introduced by Donaldson (2000) suggests that in the case of high-risk periods, companies have many incentives to increase the number of non-executive directors on boards to prevent an unexpected low performance. High-risk companies often encounter agency conflicts and therefore need more board monitoring (*Bathala & Rao, 1995*). In contrast, Prendergast (2000) argues that in uncertain environments, increased monitoring is not appropriate because of the high information cost. It means that companies with high stock return volatility often face the problem of information asymmetry, so it is costly to transfer specific information to outsiders (*Raheja, 2005*). Thus, it is difficult to make a reasonable assessment of the impacts of firm risk on non-executive ratio.

Besides, compared with developed economies, the monitoring role of non-executive directors in Vietnamese listed companies as well as in other Southeast Asian companies may be different in terms of market characteristics, economic instability, the strength of institutions, government regulations, and so forth. For instance, non-executive directors in these countries are usually appointed by majority shareholders who have a strong tie with the management team. They are often perceived as a "rubber stamp" and are appointed for reasons other than monitoring (*Haniffa & Cooke, 2002*). For this reason, the results of the studies on corporate governance from developed markets might not be appropriate in developing markets. It is a great motivation for this paper to investigate whether firm risk drives demand for non-executive directors in Vietnamese companies.

Secondly, maintaining an independent board has become a major regulatory trend in corporate governance and forced many firms to change their board structure to comply, especially for high-risk firms. Governments have had significant interests in corporate governance to prevent the collapse of financial markets from a lack of transparency and disclosure in companies. For instance, in America, the Sarbanes-Oxley Act (2002) and the Dodd-Frank Act (2010) forced companies to appoint more independent directors and disclose more information about compensation. The Malaysian Code

on Corporate Governance formed promptly after the 1997-1998 Asian Crisis imposed the requirement on the appointment of more non-executive directors. In Vietnam, the Circular 121/2012/TT-BTC dated July 26, 2012 provided further regulations on corporate governance applicable to public companies. This is the first legal document to define the concept of non-executive directors in Vietnam. Therefore, this paper would like to investigate whether high-risk companies increase their board independence under the pressure of this regulation. In other words, whether has the enactment of this regulation helped high-risk firms to become better aware of the *monitoring role* of *non-executive directors*?

With a sample of 151 companies listed on the Vietnamese stock markets from 2007 to 2016, the primary purpose of this paper is to estimate the impact of firm risk on the proportion of non-executive directors. This relationship is further explored in the presence of regulation. The research results have two significant contributions. Firstly, it demonstrates the U-shaped nonlinear impact of firm risk on the non-executive director ratio. Listed companies in Vietnamese stock markets tend to decrease the proportion of non-executive directors when their risk increases or, in other words, the correlation, in this case, is negative because of the high cost of monitoring. However, the relationship becomes positive when firm risk is beyond a certain critical level because the companies would like to prevent unexpected low performance caused by too high risk. Secondly, the paper finds out that the Circular 121/2012/TT-BTC has had an impact on motivating companies to increase the percentage of non-executive directors, especially for high-risk firms.

The following section discusses the literature and develops hypotheses. The data and methodology are explained in Section 3. Section 4 presents the results of the empirical analysis. Section 5 concludes the research.

Literature review and hypothesis development

The risk management role of non-executive directors

A board of directors is described by agency theorists as the "internal control" (Fernández & Arrondo, 2005) to solve the conflicts between owners and managers in organizations (Hennessey, 2008; Fama & Jensen, 1983). The monitoring function of a board relates to selecting senior executives (especially the chief executive officer – CEO), evaluating and rewarding their performance, protecting shareholders' interests (Brickley & James, 1987). While the supervising activeness of a board is assessed by the frequency of official meetings each year (Jackling and Johl, 2009; Azim, 2012), any changes in board composition, such as gender (Hillman et al., 2007; Gul et al., 2011) or board independence (Brick et al., 2012; Chen et al., 2016; Tong & Zhang, 2014), can also affect the board monitoring performance. Indeed, many studies have typically considered the number of non-executive directors on board as one of the important risk-control mechanisms. Nevertheless, there have still been two competing views on the effect of non-executive directors' presence on risk management.

To support the presence of non-executive directors on boards, agency theory and resource dependence theory complement each other. Firstly, Jensen & Meckling (1976) and Florackis (2008) suggest that agency conflicts can be controlled and minimized by increasing the number of non-executive directors on board. The presence of non-executive directors is expected to be effective in monitoring as they are independent of management (Luan & Tang, 2007). Even firms with boards dominated by outside directors are more likely to fire poorly performing CEOs (Brick et al., 2012; Weisbach, 1988). Under the reputation hypothesis, non-executive directors would support investments in less risky projects or pursue the risk-reducing strategies of corporate diversification (Tong & Zhang, 2014) which will help firms avoid losses and thus protect the image of their firms (Pathan, 2009) as well as protect their own reputation in the labor market (Carcello et al., 2002). Secondly, increasing the presence of non-executive directors can also be explained under resource dependence theory that they can serve to coordinate organizational action, and provide external links to reduce risk (Singh, 2007). An empirical study by Rosenstein & Wyatt (1990) proves that the appointment of outside directors leads to significantly positive excess

returns. Uzun et al. (2004) also find that the incidence of corporate fraud decreases as the number of outside directors on board increases.

In contrast, non-executive directors may not be aware of all the risks that are being taken by executives. It is because non-executive directors typically do not engage in the day-to-day management of the organization. Additionally, non-executive directors do not have enough specific knowledge and experience regarding processes such as sector analysis, internal benchmarks, guidelines, and so forth, while executive directors are an essential source of firm-specific information for the board (Raheja, 2005).

Besides, the concentrated ownership and weak legal protection in Asian countries partly weaken the role of non-executive directors. In Vietnam, a listed company may be controlled by a single shareholder or a group of shareholders who own a large proportion of shares. They are well informed about the operation of the company and able to closely oversee the management. There is too much overlap between management and directors. As a result, non-executive directors can hardly perform their duties adequately because they are usually proposed by majority shareholders, so they gradually play the role of advisors other than supervisors.

The impacts of firm risk on non-executive director ratio

Based on the above arguments about the risk management role of non-executive directors, firm risk is likely to have two different impacts on the number of non-executive director positions on a board.

High-risk companies will have more incentives to increase the number of non-executive directors. Donaldson (2000) develop organizational portfolio theory to support this viewpoint. High risk is derived not only from internal factors (undiversification, undivisionalization, high leverage, and so on) but also from external factors (financial market downturn, business cycle change, and increasing competitors) that make a company's performance drop below the expected level. As a result, the board members are criticized for failing to protect the shareholders, and corporate governance becomes a severe problem. With a low and unacceptable performance, a typical board is independent of management: It means that the companies will tend to increase the number of non-executive directors or replace executives with non-executive directors (Hermalin & Weisbach, 1988). This is consistent with the argument of Pearce & Zahra (1992) that as firms compete in an uncertain environment, the representation of outside directors increases. Graham & Narasimhan (2004) also find out that companies with boards dominated by insiders are less likely to survive the depression. Because non-executive directors usually have different skills and backgrounds that help a company to pursue opportunities in a new market or industry, so they can play a linking role that connects a company to external resources (Chen et al., 2016). Bathala & Rao (1995) also state that high-risk companies often encounter agency conflicts and therefore need more board monitoring. This point of view is supported by Birnhaum (1984) who reported that lack of information and volatility might cause increased board size and outsiders' representation.

However, the negative impact of risk firm on the non-executive ratio is taken into more consideration. Prendergast (2000) states that monitoring is less desirable in uncertain environments because of information costs. Fama & Jensen (1983) also note that firms with high stock return volatility are more likely to have specific information unknown to outsiders. Consequently, firms with higher information asymmetry can have higher verification costs (Raheja, 2005). When verification costs are high, there are fewer incentives for the separation between management and ownership. As Maug (1997) shows, it is not optimal for firms with high information asymmetry to invite monitoring from independent directors because it is costly for firms to transfer firm-specific information to outsiders. In line with this viewpoint, Kim et al. (2014) also state that outside directors face higher costs to accumulate knowledge about the firm while inside directors may be better monitors thanks to the superior amount and quality of information they have about the operations of the firm.

Consequently, Adams & Ferreira (2007) and Raheja (2005) generally suggest that the number of outsiders decreases in the cost of monitoring.

Even so, the two above impacts are not entirely contrary to each other because Demsetz & Lehn (1985) and Linck et al. (2008) state that the optimal level of monitoring is determined by the tradeoff between the costs and benefits of monitoring. Therefore, companies are motivated to increase the percentage of non-executive directors when firm risk is too low or too high. In case that risk is too low, companies may increase their non-executive director ratio because of the low cost of information. On the contrary, companies that have too high risk may need more monitoring to ensure that their performance is not below the expectation level in the future. Hence, this research also expects a nonlinear relationship between firm risk and non-executive director ratio.

H1: Firm risk has a nonlinear impact on the proportion of non-executive directors

The moderating effect of regulation

Regulations might be considered as an additional external force to board independence (Hermalin & Weisbach, 2006; Romano, 2005). Shifts in the regulations motivate significant changes in board composition and leadership structure (Hillman, Cannella & Paetzold, 2000). Agrawal & Knoeber (1996) state that outsiders are sometimes added to boards for political reasons. Linck et al. (2006) document the additional monitoring costs imposed upon firms as a result of new regulations. For instance, in the United States, the Sarbanes-Oxley Act (2002) and the Dodd-Frank act (2010) forced companies to appoint more independent directors and disclose more information about compensation. In the context of the United Kingdom, the codes of best practice adopted, beginning with the Cadbury Report in 1992, provide a set of recommendations for the board's composition and responsibilities. The Cadbury Report (1992) required that at least three non-executives be on board; the Hampel Report (1998) also required that at least one-third of the board be non-executives, and the Higgs Report (2003) required at least 50%. Consequently, the London Stock Exchange witnessed a steady increase in the number of outside directors and their average shareholding ratio.

Moreover, regulations create pressures to force high-risk firms to alter their behavior to comply and to avoid potential costly stockholder litigation (Trueman, 1997). The research by Boyd (1995) shows that uncertainty, level of competition, and regulation affect board size, outsider ratio, and interlocks. Specifically, the Malaysian Code on Corporate Governance formed promptly after 1997-1998 Asian Crisis and the revised Malaysian Code on Corporate Governance (2007) required that non-executive directors should represent one-third of total board members (Cheah & Lee, 2009), which imposed the requirement on the appointment of more non-executive directors. As a result, Shakir (2012) found that the board composition was made up about 63.4% of non-executive directors by using 81 property sector companies listed on the Kuala Lumpur Stock Exchange (KLSE) for the period 1999 to 2005. Brick & Chidambaran (2008) also conclude that regulations have two effects on the level of board monitoring. First, the level of board independence will increase in response to the regulations. Second, the increase in the non-executive ratio is likely to be higher in high-risk firms.

Regulations about non-executive directors in Vietnam.

International practices distinguish different categories of directors according to levels of responsibility, segregation of control and policy development, and often divide them into three categories: executive, non-executive, and independent directors. In Vietnam, there was no clear distinction for three categories of directors in the law on enterprises before 2012. They were only mentioned very ambiguously in Decision 15 of the Ministry of Finance dated March 19, 2007 on the model charter applicable to listed companies on the stock exchange and in Decision 12 of the Ministry of Finance dated March 13,

2007 providing regulations on corporate governance applicable to listed companies. Both of them only classified directors into two categories: (i) executive directors, and (ii) non-executive and independent directors but provided no specific definition of the term "non-executive and independent directors".

Board Structure

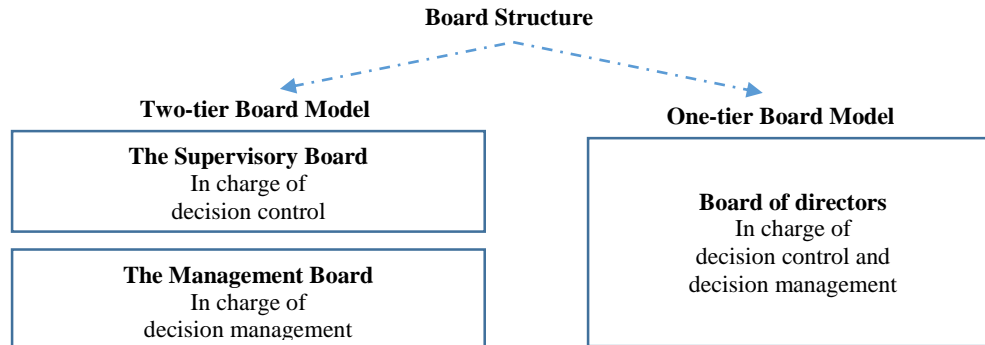| Two-tier Board Model	One-tier Board Model
The Supervisory Board In charge of decision control	**Board of directors** In charge of decision control and decision management
The Management Board In charge of decision management	

Figure 1. One-tier and two-tier board structure

Source: Maassen, G. F. (1999).

Until 2012, the Circular 121/2012/TT-BTC issued on July 26, 2012 provided further regulations on corporate governance applicable to public companies, in which the concepts of "non-executive directors" and "independent directors" were presented quite clearly. A non-executive director must be a member of the supervisory board and not be a general manager, deputy general manager, chief accountant, or any other managers appointed by the supervisory board. It is noted that the board structure for Vietnamese listed companies is categorized as two tiers including a management board (the lower tier) which is responsible for firms' operation and a separate supervisory board (the upper tier) which assumes supervisory functions as to the management and operation of the company (Belot et al., 2014). In a two-tier board system, the supervisory board is led by a chairman while the top leader of the executive management board is a CEO. Such a dual board structure is popular in Germanic countries of continental Europe, such as Germany and the Netherland while The United States and the United Kingdom provide examples of unitary board structure which gathers both managing board and supervisory board in one group (Douma, 1997).

Basically, the Circular 121/2012/TT-BTC has promoted the change in the supervisory board structure of listed firms to create credibility for the market (Nguyen & Phan, 2016). This regulation required that the number of supervisory board members shall be from three to eleven, and at least one third (1/3) of the supervisory board must be the non-executive director for listed companies. It caused a challenge to some publicly listed firms which had not met the minimum requirement of the non-executive director ratio (Vu et al., 2017). Furthermore, clearly defining the position and responsibility of non-executive director in this regulation made an essential contribution to ensuring corporate accountability and protecting the legitimate interests of shareholders and investors (Roberts et al., 2005; Daily, Dalton & Cannella, 2003). As a result, the non-executive ratio becomes one of the criteria for investors to monitor and evaluate the supervisory board 's transparency and reliability (Chang et al., 2006). Hence, companies tend to increase this ratio properly to bring confidence to investors, lenders, and shareholders, especially for high-risk companies.

H2: Regulation plays as a moderating factor in the relationship between firm risk and the percentage of non-executive directors

Data, variables, and methodology

Research data

Data for this paper are collected by reviewing annual reports of 151 non-financial companies listed on Vietnamese stock markets from 2007-2016. The year 2007 is chosen as the starting year because Vietnamese Securities Law, which prescribes additional rules for listing stocks, transparency and the disclosure of information by public companies, was issued in June 2006 and took effect on January 1, 2007. However, this paper also needs to know the change in the supervisory boards between the current year and the previous year; therefore, financial reports in 2006 are essential. They are available on the official websites of the two Vietnamese stock exchanges, HOSE (Ho Chi Minh City Stock Exchange) and HNX (Hanoi Stock Exchange). The total numbers of listed financial and nonfinancial companies on two securities trading center HNX and HOSE in 2006 are 87 and 106, respectively. Hence, the selected sample is highly representative.

Following the ICB Industry Classification Benchmark, these companies are from nine of the ten industry groups except the telecommunication industry. The financial companies such as banks, insurance, and financial services are excluded from the sample because they act as market makers, and more specifically, the board structure of these companies must comply with some regulations from the state bank. As shown in Figure 2, industrials and consumer goods account for significant proportions in the sample.
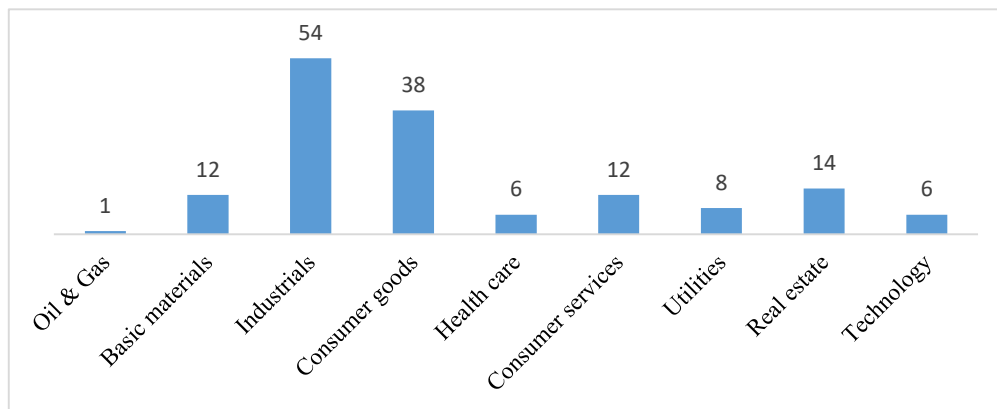
Figure 2. Industry distribution

Source: Research data

Dependent variable

Because listed firms in Vietnamese stock markets apply a two-tier board system, the proportion of non-executive directors (NON_EX) in this research is measured as the number of non-executive directors to total supervisory board members ratio. The calculation helps to evaluate the change in the percentage of non-executive directors more appropriately in the absence of management board members. It is different from the non-executive director measure used in most of the previous papers such as Florackis & Ozkan (2009), De Andres & Vallelado (2008) which concentrate on investigating one-tier boards (the number of non-executive directors is therein divided by the total members in a one-tier board).

In addition, non-executive directors in our sample need to retain their seats for more than six months in a fiscal year to ensure that their involvement can have an impact on the performance. This approach helps to determine more exactly whether firm risk drives companies to change their supervisory board structures.

Independent variables

To investigate the impacts of firm risk on the non-executive ratio, the research uses 2 proxies for risk measurement. Firstly, RISK1 equals the standard deviation of daily stock return for 2 years preceding the end of the fiscal year. Secondly, RISK2 equals the standard deviation of the residuals from the model: $R_{it} = \alpha_i + \beta_i RM_t + \varepsilon_{it}$ for two years preceding the end of the fiscal year (where, R_{it} donates the daily stock return; RM_t represents the daily market return based on the VN-index; the ε_{it} stands for the residuals). The two risk measures are used much in the previous studies related to the link between governance structure and firm risk (Cheng, 2008; Nakano & Nguyen, 2012; Wang, 2012; Brick & Chidambaran, 2008).

The squared value of firm risk (RISK_SQ) is used to capture the nonlinear effect of firm risk on the proportion of non-executive directors. RISK_REG is an interaction variable between firm risk and regulation (RISK*REG). REG is a dummy variable for the Circular 121/2012/TT-BTC (REG equals 1 for the post-2012 period, and 0 otherwise).

Control variables

The research uses several control variables, including board size (BSIZE), firm size (FSIZE), debt maturity (STDEBT), dividend payout ratio (DIV), and replacement director ratio (REPLACE).

BSIZE and FSIZE are the natural logarithm of the total number of supervisory board members and total assets, respectively. Denis & Sarin (1999) and Weisbach (1988) also suggest that board composition may be related to board size and firm size.

STDEBT is current liabilities over the sum of current liabilities and long-term debt (Demirguc-Kunt & Maksimovic, 1999). It serves as short-term debt is a "powerful tool to monitor managers" (Stulz, 2000) and facilitates creditors to monitor managers with minimum efforts (Rajan & Winton, 1995). Burkart et al. (2003) argue that short-term debt can be used as a mechanism to mitigate any potential agency conflicts in weak investor protection countries. On the other hand, monitoring by debtholders could substitute for board monitoring, which would imply a negative coefficient.

DIV is the ratio of dividend payments to total assets. Easterbrook (1984) proposes that dividend reduces the agency cost of free cash flow and minimize suboptimal managerial behavior. Dividend payout is considered as an outcome of strong corporate governance in emerging markets (Mitton, 2004). Therefore, companies that have a history of high dividend payments are less likely to require more control from non-executive directors.

REPLACE is calculated as the number of replacement directors (the new directors replace another board members) to the total number of board members. It is noted that an additional appointment to expand board size is not considered as a replacement in this paper because an increase in the number of directors through additional appointments is captured by BSIZE variable. Following Rosenstein & Wyatt (1990) that replacement announcements are ''noisier'' than board expansion announcements, using REPLACE variable is necessary to investigate the impact of board structure reform on the non-executive ratio. According to Baysinger & Butler (1985), corporate board reform efforts generally result in the growth of outside directors' representation to solve an agency problem between shareholders and managers.

Method of testing research hypotheses

Following Brick & Chidambaran (2008), this paper includes both RISK_SQ and RISK_REG into the model to test these two above hypotheses simultaneously. Additionally, all right-side control variables are used with a one-year lag to establish the direction of causality (Brammer & Pavelin, 2008). Analytically, the regression model with nonlinear and moderating effects on board independence is shown by equation (1). An F-test of joint significance for all independent variables is also significant.

$$NON\_EX_{it} = \beta_0 + \beta_1 RISK_{it} + \beta_2\ RISK\_SQ_{it} + \beta_3 REG_{it} + \beta_4 RISK\_REG_{it} + \beta_5 REPLACE_{it-1} + \beta_6 BSIZE_{it-1} +$$
$$\beta_7 FSIZE_{it-1} + \beta_8 STDEBT_{it-1} + \beta_9 DIV_{it-1} + \varepsilon_{it} \tag{1}$$

Although the common econometric methodologies employed for panel data are fixed effects (FE) and random effects (RE) with firm-level clustered standard errors, fixed and random effect estimators may be biased and inconsistent in case of potential endogenous problems. Most empirical corporate finance researchers acknowledge that there are three types of endogeneity: unobservable heterogeneity, simultaneity, and dynamic endogeneity.

Firstly, simultaneity might exist in the relationship between non-executive director ratio and firm risk. As mentioned above, high return volatility in a period may lead to a change in the non-executive ratio in that period while the reserve can also be accepted – the non-executive ratio has an impact on firm risk. In this case, non-executive ratio and firm risk are simultaneously determined.

The second endogeneity – unobservable heterogeneity - stems from omitted variables that can affect both the proportion of non-executive directors and the explanatory variables such as the managerial ability. Hermalin & Weisbach (1998) suggest that firms with many high-ability managers require fewer outsider directors because those managers can have enough skills and knowledge to control risks better.

Finally, dynamic endogeneity is usually ignored due to the difficulty in identifying exogenous instruments. This endogeneity arises from the possibility that the current firm risk and some explanatory variables are affected by the past non-executive ratio. Although unobservable heterogeneity can be eliminated by the application of fixed effects models, the reported coefficient estimates may still be biased if the current values of explanatory variables are not entirely independent of the lagged dependent variable (Wintoki et al., 2012).

Consequently, this paper will re-estimate the impacts of firm risk on board independence in a dynamic framework. It means that the lags of the dependent variable are included to capture the dynamic effect of past board independence (Nguyen et al., 2014). Following Akbar et al. (2017) and Wintoki et al. (2012), we estimate an OLS regression of NON_EX_{it} on NON_EX_{it-1}, NON_EX_{it-2}, NON_EX_{it-3}, controlling for other firm characteristics, to determinate how many lags should be included. We find no effect of NON_EX_{it-2} on NON_EX_{it}, which means including the one-year lagged dependent variable to be enough to capture the past effect of board independence. Zhou et al. (2014) also suggest that a first-order autoregressive structure is more commonly used in empirical corporate finance studies due to the limited length of the time dimension in panel data. Therefore, our model is rewritten as follows:

$$NON\_EX_{it} = \beta_0 + \beta_1 NON\_EX_{it-1} + \beta_2 RISK_{it} + \beta_3\ RISK\_SQ_{it} + \beta_4 REG_{it} + \beta_5 RISK\_REG_{it} + \beta_6 REPLACE_{it-1} +$$
$$\beta_7 BSIZE_{it-1} + \beta_8 FSIZE_{it-1} + \beta_9 STDEBT_{it-1} + \beta_{10} DIV_{it-1} + \varepsilon_{it} \tag{2}$$

The model is estimated by the system GMM estimator proposed by Blundell and Bond (1998) and Roodman (2009). This method relies on the lags of dependent and explanatory variables which are used as instruments. Using a list of proper instrumental variables, the application of dynamic GMM also helps to remove heteroskedasticity, multicollinearity and serial autocorrelation problem in our model (Ruhashyankiko & Yehoue, 2006).

Results and discussion

Description statistics and correlation matrix

Descriptive statistics of the research variables are presented in Table 1. The average total risk (idiosyncratic risk) in Vietnamese companies is 0.032 (0.029). The average proportion of non-executive directors is around 63.1%. From 2008 to 2012, the non-executive director ratio was maintained at around 61.6% with relatively slow growth while the average level of firm risk is quite high. During the later period of the research, Figure 3 shows that there is an apparent increase in the proportion of non-executive directors (from below 63% to 67%), and firm risk remains slightly lower. The diagram creates an expectation of a negative correlation between these two variables.

Table 1

Description statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RISK1	1306	0.032	0.008	0.003	0.074
RISK2	1306	0.029	0.008	0.012	0.074
NON_EX	1510	0.631	0.178	0.143	1.000
REPLACE	1510	0.116	0.186	0.000	1.000
BSIZE	1510	1.706	0.191	1.099	2.565
FSIZE	1510	13.215	1.340	9.734	17.319
STDEBT	1510	0.829	0.222	0.074	1.000
DIV	1510	0.033	0.044	0.000	0.359

Notes: The table presents descriptive statistics among the variables of this study, where RISK1 is total risk, RISK2 is idiosyncratic risk, NON_EX is non-executive director ratio, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio.
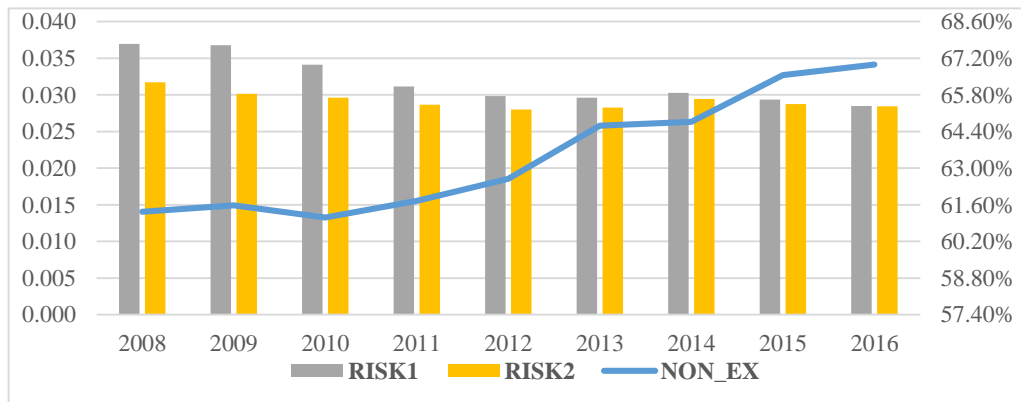
Figure 3. The mean of firm risk and non-executive director ratio by year from 2008 to 2016

Source: Research data

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Table 2

Correlation matrix

	NON_EX	RISK1	RISK1_SQ	RISK1_REG	REPLACE	BSIZE	FSIZE	STDEBT
RISK1	-0.073							
RISK1_SQ	-0.061	0.981						
RISK1_REG	0.114	-0.006	0.011					
REPLACE	0.152	-0.012	-0.008	0.094				
BSIZE	0.174	-0.172	-0.165	-0.053	-0.133			
FSIZE	0.119	-0.383	-0.364	0.016	0.000	0.317		
STDEBT	-0.010	-0.019	-0.015	-0.009	-0.002	-0.141	-0.330	
DIV	0.049	-0.176	-0.147	-0.117	-0.040	0.011	-0.098	0.185
	NON_EX	RISK2	RISK2_SQ	RISK2_REG	REPLACE	BSIZE	FSIZE	STDEBT
RISK2	-0.046							
RISK2_SQ	-0.026	0.980						
RISK2_REG	0.112	0.215	0.225					
REPLACE	0.152	0.007	0.012	0.097				
BSIZE	0.174	-0.218	-0.197	-0.063	-0.133			
FSIZE	0.119	-0.470	-0.426	-0.008	0.000	0.317		
STDEBT	-0.010	0.055	0.046	0.001	-0.002	-0.141	-0.330	
DIV	0.049	-0.168	-0.139	-0.117	-0.040	0.011	-0.098	0.185

Notes: The table presents the correlation matrix among the variables of this study, where RISK1 is total risk, RISK2 is idiosyncratic risk, RISK1_SQ is the squared value of total risk, RISK2_SQ is the squared value of idiosyncratic risk, RISK1_REG is the interaction term of total risk and regulation, RISK2_REG is the interaction term of idiosyncratic risk and regulation, NON_EX is the proportion of non-executive directors, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio.

Table 2 presents the correlation matrix among the variable of this research. The correlations between non-executive directors and firm risk, RISK1 and RISK2, are -0.073 and -0.046, respectively, while the negative relationships with the squared firm risk are lower (-0.061 and -0.026, respectively). It demonstrates the gradually improved percentage of non-executive directors as companies face higher risks. Notably, the correlation between RISK1_REG/RISK2_REG and NON_EX is positive. The result indicates that in the presence of regulation, the effect of risk on the proportion of non-executive directors may have been changed. According to Gujarati (2003), if the correlation coefficients are 0.8 or higher, the model is at risk of violating multicollinearity. As evident in Table 2, the high values (0.981 and 0.980) between RISK and RISK_SQ show the potential collinearity problem. However, this problem is so common when there is an interaction term between 2 variables or other higher-order terms such as the square of a variable. Additionally, Brambor et al. (2006) state that the omission of essential variables is much more problematic than multicollinearity because omitted variable bias causes the coefficients to be wrong. In this research, GMM is used to treat this problem, as mentioned above.

The impacts of firm risk and regulation

Table 3 and Table 4 show that there are not much statistically significant differences in the impact of the explanatory variables on the independent variable, regardless of the application of fixed effects or random effects.

Firstly, Table 3 and Table 4 display a hypothesized U-shaped relationship between firm risk and non-executive director ratio. At first glance, most of the negative coefficients on RISK1/RISK2 appear to be significant at 5% level in Table 3 and Table 4, which means that companies tend to reduce the non-executive director ratio when firm risk increases. In other words, the proportion of non-executive directors has not been assessed as an essential factor in controlling risk as well as helping firms improve their performance due to high monitoring costs (Adams & Ferreira, 2007; Raheja, 2005). This result is in contrast to Guest (2008), who found a positive effect of stock return volatility on board independence by using a large sample of UK firms from 1981 to 2002. It is because the monitoring role of outside directors is more highly appreciated in developed countries. Meanwhile, the previous research by Van Tuan & Tuan (2016) concludes that the presence of non-executive directors has a significantly negative influence on the financial performance of Vietnamese companies. As stated above, non-executive directors are not regularly involved in the day-to-day running of the business, so they have low insights into different aspects of the business. It hinders them from performing their oversight activities and assess risks effectively. More remarkably, the appointment of non-executive directors in Vietnamese companies are usually driven by friend or family relationship with majority shareholders rather than by expertise and experience. As a result, they do not have many incentives to monitor, or they are not likely to oversee management activities because of being not qualified professionals. In this case, their presence on board may increase the conflicts between majority shareholders and minority shareholders, so leading to the devaluation of companies by investors.

However, the risk management role of non-executive directors is not entirely denied because the coefficients on the squared firm risks are significantly positive, indicating that the need for non-executive directors starts to increase again when firm risk reached a certain critical level. It is because firms tend to require more separation between ownership and management, especially when more severe agency problems arise between controlling and non-controlling shareholders, with a view to improving firm performance and regaining investors' confidence. This result can also be explained under the resource dependence theory that the increased presence of non-executive directors provides access to external resources to mitigate risk. Generally, the effects of RISK and RISK_SQ on NON_EX confirm a nonlinear relationship between firm risk and non-executive director ratio. The findings are supported by the argument of Demsetz & Lehn (1985) and Linck et al. (2008) that the optimal level of monitoring is determined by the tradeoff between the costs and benefits of monitoring.

Secondly, by hierarchical analysis, the results also support the hypothesis that regulation plays as a moderating factor in the relationship between firm risk and non-executive ratio. In column 2 and 5, all the coefficients on REG are significantly positive at 1% level, indicating that the Circular 121 has an impact on board independence. This result is once again different from Guest (2008), who do not support that the recommendations of Cadbury (1992) Hampel (1998) on board independence can change UK firms' board structure, because such regulations have been voluntary. On the contrary, Chen & Al-Najjar (2012) indicate that requirements on independent directors from the Chinese Security Regulation Commission have imposed pressure on Chinese firms to increase board independence. However, the question whether such regulation will make a board more efficient should be considered with caution because adding more non-executives to the board may be only a temporary response to the pressure of the Circular. For instance, companies may randomly invite non-executive directors to participate on their boards to merely demonstrate that they comply strictly with the rule. In that case, the presence of non-executive directors on the board may not necessarily have a beneficial impact on the independence of the board (Van Tuan & Tuan, 2016; Chen, & Al-Najjar, 2012). For this reason, the impact of the interaction between regulation and firm risk on the non-executive ratio should be examined to evaluate the efficiency of the regulation. In columns 3 and 6, the interaction term RISK1_REG/RISK2_REG is also significantly positive, but the coefficients on REG are insignificantly negative. All the results show that REG is a pure moderator, indicating that the enactment of the Circular 121 has increased the proportion of non-executive directors, especially for high-risk companies. This is consistent with the

prior published study by Brick & Chidambaran (2008), which suggests that high-risk firms would be pushed by regulations to increase board independence, and thereby intensify monitoring and supporting activities.

Table 3

Fixed effects

Dependent variable NON_EX	RISK = RISK1 (Total risk)			RISK = RISK2 (Idiosyncratic risk)		
	(1)	(2)	(3)	(4)	(5)	(6)
RISK	-5.637**	-3.622	-5.555**	-5.446**	-4.913**	-5.814**
	(-2.18)	(-1.44)	(-2.34)	(-2.09)	(-2.01)	(-2.57)
RISK_SQ	99.05**	76.30**	90.63***	107.9***	96.77***	96.33***
	(2.59)	(2.12)	(2.74)	(2.79)	(2.75)	(2.98)
REG		0.0357***	-0.0300		0.0324***	-0.0246
		(3.24)	(-0.90)		(3.04)	(-0.77)
RISK_REG			2.087*			1.938*
			(1.84)			(1.66)
REPLACE$_{(t-1)}$	0.0708***	0.0646***	0.0644***	0.0705***	0.0649***	0.0644***
	(4.25)	(4.12)	(4.13)	(4.26)	(4.16)	(4.17)
FSIZE$_{(t-1)}$	0.0407***	0.0197	0.0198	0.0387***	0.0159	0.0173
	(3.22)	(1.39)	(1.39)	(3.07)	(1.11)	(1.23)
BSIZE$_{(t-1)}$	0.0484	0.0522	0.0558	0.0484	0.0546	0.0563
	(1.41)	(1.49)	(1.58)	(1.42)	(1.55)	(1.59)
STDEBT$_{(t-1)}$	0.0553**	0.0378	0.0434	0.0556*	0.0369	0.0452
	(1.98)	(1.33)	(1.54)	(1.97)	(1.29)	(1.59)
DIV$_{(t-1)}$	0.272**	0.285**	0.298**	0.292**	0.292**	0.297**
	(2.23)	(2.41)	(2.50)	(2.39)	(2.47)	(2.51)
Constant	0.0245	0.254	0.290	0.0376	0.324	0.322
	(0.13)	(1.28)	(1.42)	(0.21)	(1.65)	(1.64)
Obs	1306	1306	1306	1306	1306	1306
F-statistic	7.26***	7.05***	7.23***	7.04***	7.05***	7.15***
R-sq within	0.0516	0.0725	0.0774	0.0553	0.0730	0.0776
R-sq between	0.0277	0.0404	0.0441	0.0324	0.0540	0.0528
R-sq overall	0.0339	0.0521	0.0564	0.0394	0.0590	0.0610

Notes: The table presents the results of the fixed effects estimator. RISK1 is total risk, RISK2 is idiosyncratic risk, RISK_SQ is the squared value of total risk/idiosyncratic risk, RISK_REG is the interaction term of total risk/idiosyncratic risk and regulation, NON_EX is the proportion of non-executive directors, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio. Robust t-statistics adjusted for firm-level clustering are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 4

Random effects

Dependent variable NON_EX	RISK = RISK1 (Total risk)			RISK = RISK2 (Idiosyncratic risk)		
	(1)	(2)	(3)	(4)	(5)	(6)
RISK	-5.918**	-3.534	-5.554**	-5.386**	-4.766**	-5.695**
	(-2.35)	(-1.47)	(-2.37)	(-2.18)	(-2.07)	(-2.56)
RISK_SQ	97.27***	72.07**	87.06***	105.1***	93.44***	93.13***
	(2.68)	(2.13)	(2.70)	(2.92)	(2.90)	(2.97)
REG		0.0371***	-0.0317		0.0336***	-0.0241
		(3.64)	(-0.97)		(3.42)	(-0.76)
RISK_REG			2.182**			1.968*
			(1.98)			(1.70)
REPLACE$_{(t-1)}$	0.0758***	0.0686***	0.0682***	0.0754***	0.0688***	0.0682***
	(4.56)	(4.38)	(4.39)	(4.56)	(4.41)	(4.41)
FSIZE$_{(t-1)}$	0.0272***	0.0145	0.0148	0.0281***	0.0127	0.0138
	(2.97)	(1.58)	(1.61)	(3.02)	(1.38)	(1.49)
BSIZE$_{(t-1)}$	0.0690**	0.0748**	0.0782**	0.0680**	0.0764**	0.0777**
	(2.28)	(2.45)	(2.51)	(2.26)	(2.49)	(2.52)
STDEBT$_{(t-1)}$	0.0533*	0.0389	0.0442	0.0551**	0.0385	0.0460*
	(1.92)	(1.42)	(1.62)	(1.97)	(1.39)	(1.67)
DIV$_{(t-1)}$	0.268**	0.289**	0.302***	0.293**	0.295***	0.302***
	(2.32)	(2.58)	(2.66)	(2.50)	(2.63)	(2.66)
Constant	0.163	0.274*	0.309**	0.128	0.314**	0.318**
	(1.09)	(1.91)	(2.09)	(0.86)	(2.17)	(2.19)
Obs	1306	1306	1306	1306	1306	1306
Chi-sq	148.34***	148.08***	163.13***	147.59***	151.83***	166.54***
R-sq within	0.0494	0.0718	0.0768	0.0535	0.0725	0.0771
R-sq between	0.0587	0.0781	0.0826	0.0638	0.0874	0.0889
R-sq overall	0.0572	0.0776	0.0826	0.0625	0.0835	0.0866

Notes: The table presents the results of the random effects estimator. RISK1 is total risk, RISK2 is idiosyncratic risk, RISK_SQ is the squared value of total risk/idiosyncratic risk, RISK_REG is the interaction term of total risk/idiosyncratic risk and regulation, NON_EX is the proportion of non-executive directors, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio. Robust t-statistics adjusted for firm-level clustering are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. The industrial dummies are included but are not reported.

Table 5

Dynamic GMM results

Dependent variable NON_EX	RISK = RISK1 (Total risk)			RISK = RISK2 (Idiosyncratic risk)		
	(1)	(2)	(3)	(4)	(5)	(6)
NON_EX$_{(t-1)}$	0.748***	0.752***	0.715***	0.697***	0.700***	0.685***
	(8.48)	(8.70)	(7.85)	(7.84)	(8.29)	(8.06)
RISK	-7.176**	-7.207**	-8.296**	-9.692**	-9.749**	-10.75***
	(-2.03)	(-2.04)	(-2.22)	(-2.46)	(-2.44)	(-2.74)
RISK_SQ	89.48*	90.07*	88.90*	132.1**	133.3**	126.9**
	(1.95)	(1.96)	(1.72)	(2.31)	(2.30)	(2.22)
REG		0.260*	-0.0287		0.368**	-0.0193
		(1.68)	(-0.93)		(2.40)	(-0.64)
RISK_REG			1.778**			1.667*
			(2.06)			(1.79)
REPLACE$_{(t-1)}$	0.0381	0.0371	0.0101	0.0464	0.0464	0.0150
	(0.66)	(0.65)	(0.22)	(0.80)	(0.80)	(0.32)
FSIZE$_{(t-1)}$	-0.0104	-0.0102	-0.0117	-0.0160*	-0.0160*	-0.0161*
	(-1.09)	(-1.06)	(-1.11)	(-1.81)	(-1.80)	(-1.72)
BSIZE$_{(t-1)}$	0.129*	0.126*	0.132*	0.149*	0.146**	0.157**
	(1.73)	(1.70)	(1.72)	(1.96)	(2.00)	(2.16)
STDEBT$_{(t-1)}$	-0.0306	-0.0318	-0.0232	-0.0324	-0.0332	-0.0102
	(-0.60)	(-0.66)	(-0.47)	(-0.60)	(-0.65)	(-0.18)
DIV$_{(t-1)}$	-0.0580	-0.0569	-0.0256	-0.104	-0.101	-0.0788
	(-0.26)	(-0.25)	(-0.12)	(-0.47)	(-0.46)	(-0.37)
Constant	0.232		0.299*	0.334**		0.339**
	(1.52)		(1.92)	(2.12)		(2.24)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs	1306	1306	1306	1306	1306	1306
Wald X2-statistics	17.06***	1772.76***	18.74***	11.71***	1636.46***	14.70***
AR (1)	0.000	0.000	0.000	0.000	0.000	0.000
AR (2)	0.462	0.463	0.518	0.497	0.498	0.556
Hansen test	0.351	0.344	0.428	0.512	0.502	0.493
No of instruments	105	106	108	105	106	108

This table reports the two-step GMM system estimators with robust adjustment for a small sample. Explanatory variables: RISK1 is total risk, RISK2 is idiosyncratic risk, RISK_SQ is the squared value of total risk/idiosyncratic risk, RISK_REG is the interaction term of total risk/idiosyncratic risk and regulation, NON_EX is the proportion of non-executive directors, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals under the null of no serial correlation. Sargan/Hansen test of over-identification is under the null that all instruments are valid. The instruments are the lags of the explanatory variables, and YEAR dummies are treated as strictly exogenous variables. Statistically significant at 1%(***), 5%(**), and 10%(*), respectively.

Table 6

Robustness checks with two alternative measures of firm risk

Dependent variable NON_EX	RISK = RISK3		RISK = RISK4	
	(1)	(2)	(3)	(4)
NON_EX$_{(t-1)}$	0.768***	0.757***	0.767***	0.758***
	(8.21)	(7.92)	(8.08)	(7.90)
RISK	-0.984*	-1.536**	-0.371*	-0.596**
	(-1.81)	(-2.39)	(-1.75)	(-2.36)
RISK_SQ	3.209**	1.717*	0.486**	0.257*
	(2.12)	(1.77)	(2.04)	(1.78)
REG	0.394**	-0.0279	0.381**	0.266**
	(2.58)	(-1.08)	(2.52)	(2.18)
RISK_REG		1.108*		0.439*
		(1.82)		(1.85)
REPLACE$_{(t-1)}$	0.0230	0.0158	0.0290	0.0186
	(0.53)	(0.34)	(0.65)	(0.40)
FSIZE$_{(t-1)}$	-0.000261	0.00429	0.000459	0.00493
	(-0.03)	(0.57)	(0.06)	(0.68)
BSIZE$_{(t-1)}$	-0.0778	-0.0772	-0.0797	-0.0743
	(-1.08)	(-1.08)	(-1.16)	(-1.07)
STDEBT$_{(t-1)}$	-0.0915*	-0.0473	-0.0856*	-0.0422
	(-1.82)	(-0.99)	(-1.68)	(-0.89)
DIV$_{(t-1)}$	0.129	0.0714	0.106	0.0790
	(0.59)	(0.37)	(0.52)	(0.43)
Constant		0.319**		
		(2.54)		
Year Dummies	Yes	Yes	Yes	Yes
Obs	906	906	906	906
Wald X2-statistics	1589.94***	8.22***	1623.38***	1886.02***
AR (1)	0.000	0.000	0.000	0.000
AR (2)	0.146	0.112	0.151	0.112
Hansen test	0.165	0.349	0.145	0.392
No of instruments	104	108	104	108

This table reports the two-step GMM system estimators with robust adjustment for a small sample. Explanatory variables: RISK3 is the volatility of a firm 's return on assets (ROA) over five-year overlapping periods, RISK4 is the difference between maximum and minimum ROA over five overlapping years, RISK_SQ is the squared value of RISK3/RISK4, RISK_REG is the interaction term of RISK3/RISK4 and regulation, NON_EX is non-executive director ratio, REPLACE is replacement director ratio, BSIZE is board size, FSIZE is firm size, STDEBT is short-term debt maturity, DIV is dividend payout ratio. AR (1) and AR (2) are tests for first-order and second-order serial correlation in the first-differenced residuals under the null of no serial correlation. Sargan/Hansen test of over-identification is under the null that all instruments are valid. The instruments are the lags of the explanatory variables, and YEAR dummies are treated as strictly exogenous variables. Statistically significant at 1% (***), 5%(**), and 10%(*), respectively.

However, the signs of some control variables, such as STDEBT and DIV are not in line with expectations, which can be caused by unsolved endogenous problems. Therefore, the two-step system GMM approach should be used to obtain more consistent results.

Table 5 reports the results of system GMM estimation, according to Arellano & Bover (1995) and Blundell & Bond (1998). To obtain estimates of system GMM, this paper applies xtabond2 in Stata, where the instruments are the lags of the dependent and explanatory variables (Roodman, 2009). We specify the function for small-sample adjustment and report t-statistics and Wald chi-square as opposed to Z-statistics and F-tests. We also use robust standard errors, which are consistent with panel-specific autocorrelation and heteroskedasticity. Furthermore, we add year dummies into GMM analysis to capture macro conditions that equally affect all firms. Since Vietnamese corporate governance reform is mainly driven by the government and a time-frame is set for listed companies to increase non-executive directors and board independence should increase over the period. Following Wintoki et al. (2012), we treat year dummies as strictly exogenous variables.

The interpretation of the results in table 5 is similar to those reported in Table 3 and Table 4. With regard to the impacts of firm risk, the coefficients on firm risk as well as squared risk are significant for all the columns, reinforcing the aforementioned results. The results also imply that firm risk is an economically important factor in predicting whether a firm should adjust board independence or not. From another perspective, pursuing a stable or risky business strategy is crucial to appointing and inviting non-executive directors to the board of directors. This argument is supported by Rosenstein and Wyatt (1990), who suggests that ''the addition of an outside director signals a change in firm strategy''. Also, the moderating role of regulation remains unchanged, indicating that high-risk firms changed their supervisory board structure towards increasing the separation of ownership and management to comply with the Circular 121/2012/TT-BTC. In other words, this new regulation significantly contributes to reforming high-risk companies' board structure. Because high-risk firms often face significant information asymmetries and minority shareholders' benefits are often not guaranteed, such a new regulation on the corporate governance plays a role in motivating more transparency and then increasing investors' confidence. Additionally, the lag of NON_EX is highly significant, which justifies its inclusion in our model specification. The diagnostics tests for GMM estimations show that the models are well-fitted with statistically insignificant test statistics for both second-order autocorrelations in second differences and Hansen tests of over-identifying restrictions. They indicate that the instruments are valid in the estimation. Finally, the number of instruments used in the model is less than the panel (151), which makes the Hansen tests more reliable.

After controlling for potential endogeneity by dynamic GMM regressions, the coefficients on control variables such as firm size, debt maturity, and dividend payout in Table 5 turn out to be insignificantly negative. Regarding firm size, Brick & Chidambaran (2008) also show its impact on the percentage of independent directors is changed into insignificantly negative by using 2SLS regressions to solve the endogeneity problem in their model. Meanwhile, STDEBT and DIV variables present a negative sign as expected above.

In Table 6, we conduct additional robustness checks to make sure that our results are not spurious. Following John et al. (2008) and Faccio et al. (2011), we use two alternative measures to proxy for firm risk: RISK3 is the volatility of a firm 's return on assets (ROA) over five-year overlapping periods and RISK4 is the difference between maximum and minimum ROA over five overlapping years. As reported in Table 6, all coefficients on firm risk as well as squared risk are significant for all the columns, reinforcing the non-linear effect. Regarding regulation, although the effect of REG in column 4 is different from those in the other models, its coefficient is significantly positive. Therefore, the moderating role of REG remains valid. In brief, all the above robustness checks provide persuasive evidence of the nonlinear effect of firm risk and the moderating effect of regulation.

Conclusions

The impact of firm risk on the change in board structure has still received little attention from researchers, especially for developing countries such as Vietnam. In addition, building an independent board has become a trend in corporate governance. Indeed, governments have enacted legislation to re-establish corporate governance after the past financial market crises which partially stemmed from weak board monitoring. In Vietnam, the government also issued the Circular 121/2012/TT-BTC dated July 26, 2012 on corporate governance applicable to public companies, which caused changes in listed companies' supervisory board structure. Hence, this paper investigates the impact of firm risk on the non-executive director ratio and the moderating effects of regulation to serve current corporate risk management.

The research results indicated the U-shaped nonlinear impact of firm risk on the non-executive director ratio. The monitoring role of non-executive directors became less important when the stock return volatility became higher; however, there is a limit beyond which the benefits outweigh the costs of monitoring. This result supports that the optimal level of monitoring was determined by the tradeoff between the costs and benefits of monitoring (Demsetz & Lehn, 1985; Linck et al., 2008). Other outcomes show that in the presence of regulation, high-risk firms have more incentives to increase the percentage of non-executive directors because the probability of poor performance is higher for high-risk firms, and the supervisory board is often criticized for having failed in their duties to protect shareholders, especially for minority shareholders.

However, our study was limited to the identification of non-executive directors' characteristics. It would, therefore, be interesting to investigate the impact of firm risk on the proportion of female or foreign non-executive directors. From another perspective, non-executive directors' ownership also attracts the attention of researchers, especially in emerging markets. Such further studies could improve the understanding of the non-executive directors' risk management role.

Finally, our findings also offer some implications of corporate governance in Vietnam as well as in emerging countries. Firstly, decisions on board independence should be made after considering environmental and strategic factors. Secondly, improving the regulations on corporate governance towards dispersed ownership and management control is essential to enhance the quality of governance systems and risk management. In brief, the effect of firm risk on the proportion of non-executive directors will give more significant insights into the role of non-executive directors in Vietnamese listed companies and helps lawmakers improve corporate governance legislations.

Acknowledgments

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