

# CEO 雙重性、公司治理與公司績效— 外部環境的角色

## CEO Duality, Corporate Governance, and Firm Performance – The Role of External Environment

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本文引用格式建議：湯惠雯，2017，「CEO 雙重性、公司治理與公司績效—外部環境的角色」，中山管理評論，25 卷 4 期：967~1008。

Suggested Citation: Tang, H. W., 2017, "CEO Duality, Corporate Governance, and Firm Performance – The Role of External Environment," **Sun Yat-Sen Management Review**, Vol. 25, No. 4, 967-1008.

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## 摘要

本研究採用兩階段最小平方法(two-stage least squares, 2SLS)檢測外部競爭與公司治理對企業領導結構選擇的影響，並進一步檢視外部競爭對領導結構與公司績效關係的調節效果。研究結果顯示，領導結構的選擇係由內生決定。在快速成長或高度競爭環境下，企業會傾向採用CEO雙重性領導結構，因應快速變動的環境、加強競爭力。當企業具有較大規模董事會，較高董事持股、管理者持股及機構投資人持股，會傾向採用非雙重性領導結構，避免CEO權利過度集中。在控制領導結構選擇的內生性之下，CEO雙重性領導結構與資產報酬率(return on assets, ROA)呈現負向顯著的關係，與Tobin's q呈現不顯著的關係。值得一提的是，在快速成長與變動的環境、或高度競爭市場中，CEO雙重性領導結構有助於增進公司未來績效。

**關鍵詞：**CEO雙重性、競爭環境、公司治理、公司績效、市場競爭

## Abstract

This study employs a two-stage least squares (2SLS) regression to investigate the influence of external competition and corporate governance on leadership structure chosen, and further examine the moderating effect of external competition on the relationship between leadership structure and firm performance. This study shows that the choice of leadership structure is endogenously determined. In a rapid growth environment or a great market competition, a firm inclines adopting a dual-leadership structure to adjust to changing environments and enhancing competitiveness. A firm with a large board, high director ownership, high managerial ownership, or high institutional shareholdings favors a non-dual leadership structure to avoid CEO power concentration. Controlling the endogeneity of leadership structure, CEO duality is significantly and negatively related to return on assets and insignificantly related to Tobin's q. Notably, dual-leadership structure enhances future firm value in a rapid growth/dynamic environment or a great competitive market.

**Keywords:** CEO Duality, Competitive Environment, Corporate Governance, Firm Performance, Market Competition

## 1. Introduction

Whether a firm should adopt CEO duality as its leadership structure has been a prominent topic in prior research. From the perspective of organizational leadership, CEO duality (i.e., dual appointment as chairman of the board and CEO) not only creates a centralized leadership structure and facilitates intercommunication between a CEO and board of directors (Stoeberl & Sherony, 1985), but it also favors high responsiveness to market and environmental changes (Brickley et al., 1997; Faleye, 2007; Yang & Zhao, 2014). Contrarily, agency theory posits that CEO duality structure assigns too much power to the CEO, limits board supervision efficiency on decision making, and introduces interest conflicts to strategic management and evaluation by the CEO. In other words, it allows for CEOs to abuse their power and infringe upon the rights and interests of stakeholders for personal gain (Fama & Jensen, 1983; Jensen, 1993). Therefore, whether a board chairman should also be appointed as the CEO is a dilemma because it is a choice between enhancing decision-making efficiency and reducing agency costs.

Previous studies on the relationship between CEO duality and firm performance have reported inconsistent conclusions. Dahya & Travlos (2000) show that dual-leadership structure positively influences firm performance. Yang & Zhao (2014) find that duality firms outperform non-duality firms by 3%–4% when competitive environments change. Conversely, Duru et al. (2016) show that CEO duality has statistically significant negative influence on firm performance, whereas this effect can be moderated by board independence. However, some studies have indicated that the influence of leadership structure on firm performance is nonsignificant (Dalton et al., 1998; Iyengar & Zampelli, 2009). Chen et al. (2008) consider that the optimal leadership structure should be determined according to its characteristics and ownership structure. They find that the relationship between leadership structure and firm performance is nonsignificant.

Obviously, neither decision-making efficiency nor agency theory explains the inconsistency in the aforementioned findings. As indicated by previous studies, there is no optimal board leadership structure (Faleye, 2007<sup>1</sup>; Zona, 2014).

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<sup>1</sup> Faleye (2007) finds that whether CEO duality contributes to firm performance depends on

Independent leadership facilitates firm growth for some companies, and CEO duality is ideal for others (Pham et al., 2015). In particular, external environment factors have a substantial influence on a firm's organizational structure and leadership structure, as well as on moderating the relationship between organizational structure and firm performance (Simerly & Li, 2000; Ensley et al., 2006). However, critical questions are in what types of external environment do the benefits of CEO duality exceed their agency costs, and under what conditions do a leader with dual identities urged to focus on improving firm competitive advantages to securing his/her position.

The majority of relevant studies have argued that environmental dynamism is the most influential factor affecting firm performance (Dess & Beard, 1984; Simerly & Li, 2000; Goll & Rasheed, 2004). Hambrick & Finkelstein (1987) suggest that in highly dynamic environments, CEO duality increases the responsibilities of the person in charge and integrates the power of the two roles. Bourgeois III & Eisenhardt (1988) consider that in such environments, decision speed has a considerable influence on firm performance; thus, a centralized leadership facilitates a superior and efficient decision-making. Furthermore, Ensley et al. (2006) also indicate that environmental dynamism significantly influences the leadership structure and performance of new companies.

Prior studies have shown that product market competition effectively overcomes the principal–agent problem between managers and shareholders (Scharfstein, 1988; Knyazeva & Knyazeva, 2012; Gupta et al., 2017). A highly competitive environment compels managers to make effective decisions to enhance firm competitiveness; otherwise, managers may lose their jobs or lead the company into bankruptcy. Allen & Gale (2000) argue that product market competition facilitates in effectively supervising managers and is a substitute to corporate governance mechanism. Chou et al. (2011) find that, in highly competitive industries, firms with strong corporate governance did not generate significantly high abnormal returns; however, in low-competition industries, corporate

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firm characteristics (i.e., organizational complexity) and the board chairman (e.g., reputation of the CEO). Therefore, firms should adopt a leadership structure according to their characteristics; governments should not mandate the two roles to be separated.

governance has a significant impact on firm performance. Therefore, they suggest that product market competition can act as a substitute for corporate governance and serve as an external mechanism for ensuring transparency.

Notably, few studies have investigated the relationship between CEO duality and firm performance from the perspective of external competitive environments. If uncertainty in the external environment has a significant influence on the relationship between a firm's leadership structure and performance, the enterprise can enhance its business resilience, reduce its susceptibility to environmental uncertainty, and enhance its competitiveness by adopting an appropriate leadership structure. Boyd (1995) explores the impact of external environment on the relationship between CEO duality and ROI. However, Boyd does not consider the endogeneity of leadership structure chosen and uses ordinary least squares (OLS) to investigate this issue without controlling factors influencing firm performance<sup>2</sup>. Chen et al. (2008) explore the relationship between leadership structure and firm performance. They do not consider the role of external environments on the relationship between CEO duality and firm performance. Therefore, this study adopts 2SLS including an instrumental variable and controlling the endogeneity of leadership structure chosen, external competition, corporate governance and firm characteristics to examine the relationship between CEO duality and firm performance. Particularly, this study investigates the effect of competitive environments on the relationship. Accordingly, estimation bias is reduced and the inconsistent results of previous studies can be explained.

The empirical results show that the choice of leadership structure is endogenous. Enterprises faced with rapid environmental growth or highly competitive markets tend to adopt CEO duality to enhance business resilience and competitiveness. However, this is not the case for firms with a large board, high director ownership, high managerial ownership, or high institutional shareholdings; in such firms, non-dual leadership structure ensures that CEOs do not become overly dominant. Controlling the endogeneity of leadership structure, such as external environments and internal governance, our regression results shows that

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<sup>2</sup> Faleye (2007) finds that firm characteristics and ownership structure influences firm performance and the choice of leadership structure.

CEO duality has a negative influence on return on assets, but does not have a significant influence on Tobin's q. Environmental growth, environmental dynamism, and product market competition have significant influences on firm performance. It is worth noting that, dual-leadership structure contributes to firm future value (Tobin's q) in a rapid growth/dynamic environment and a highly competitive market. Accordingly, this study infers that the choice of leadership structure is the result of factors such as the external environment, ownership structure, and firm characteristics. Firms that choose their best leadership structure based on firm characteristics, corporate governance and external environments leads to better performance.

To the best of the author's knowledge, no research has been made to explore the moderating effect of external competitions on the relationship between CEO duality and firm performance controlling for the endogeneity of leadership structure chosen. Therefore, this study adds an important new dimension to the duality-performance literature and fills the gaps of previous studies.

The remainder of this paper is organized as follows: Section 2 provides literature reviews and hypotheses. Section 3 describes research variables and methodology. The empirical results and additional tests are presented in Section 4. The final section offers the conclusion of the study and managerial implications of the findings.

## 2. Literature Review and Hypotheses

### *2.1 Management efficiency and agency theory in the context of CEO duality*

Whether a dual leadership structure promotes better firm performance has been one of the most discussed issue in finance and management research. From the perspectives of organizational and management theory, CEO duality creates a centralized leadership structure that grants a considerable amount of decision-making power to the leader; therefore, where product market competition and environmental dynamism are high, adopting a CEO duality leadership structure provides flexibility for leaders to make appropriate decisions efficiently. Brickley et

al. (1997) indicate that CEOs are typically familiar with business operations and possess a high level of business knowledge; by adopting dual-leadership structure, organizations can enable the CEO to make timely and effective decisions and to consistently execute such decisions. According to agency theory, a board of directors is a supervisory mechanism that is established to protect the rights and interests of stakeholders; only when a board of directors is independent can it effectively oversee the decisions made by a CEO and ensure that his or her decisions accord with the best interests of the stakeholders. According to Fama & Jensen (1983) and Jensen (1993), when a CEO makes decisions on behalf of the board chair, the supervisory function of the board becomes inefficient if the CEO makes decisions based on personal interests, thereby increasing the agency costs of the enterprise and reducing firm performance.

Empirical studies on the relationship between CEO duality and firm performance have reported conflicting results. Donaldson & Davis (1991) find that enterprises adopting CEO duality as a leadership structure generate a higher ROE than those adopting non-dual leadership structure do. Brickley et al. (1997) investigate large enterprises in the United States and find that dual-leadership structure does not significantly reduce the accounting performance or market return of the investigate enterprises. Dey et al. (2011) indicate that firms that split the CEO and chairman positions under investors' pressure have significantly lower announcement returns and performance. Conversely, Lin & Lee (2008) find that dual-leadership structure is negatively related to accounting performance. Duru et al. (2016) employ System Generalized Method of Moments (System GMM)<sup>3</sup> to estimate a dynamic model of firm operating performance (ROA, ROE and profit margin). They show that CEO duality has statistically significant negative influence on firm performance, whereas this effect can be moderated by board independence. Chaganti et al. (1985) examine paired samples of 21 bankrupt and nonbankrupt retail companies in the United States and find that CEO duality does not significantly influence firm performance. Other studies have also indicated that CEO duality is not significantly related to firm performance (Baliga et al., 1996; Dahya & Travlos, 2000; Faleye, 2007; Chen et al., 2008; Iyengar & Zampelli,

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<sup>3</sup> System Generalized Method of Moments method constitutes both dynamic endogeneity and unobserved heterogeneity in panel data models.

2009).

## ***2.2 Endogeneity of CEO duality***

Kang & Zardkoohi (2005) review 30 studies investigating the relationship between CEO duality and firm performance between 1978 and 2003, and raise a critical issue that has often been overlooked; specifically, the leadership structure of a firm is not the result of a random selection process. This accords with the concept of the endogenous framework proposed by Hermalin & Weisbach (1998). Kang & Zardkoohi (2005) summarize the premises of the CEO duality leadership structure as follows: (a) CEO duality is used as a reward for the excellent performance of a CEO; (b) CEO duality is used as a solution to environmental complexity and dynamism; (c) CEO duality is adopted according to industry conventions; (d) CEO duality results from the mutual benefits of companies; and (e) CEO duality results from the powerful CEOs enforcing their personal will. The authors of that study consider the choice to adopt dual leadership structure is appropriate when based on the first two premises because it has a positive influence on firm performance under such conditions, whereas the opposite is true when the choice is based on the last three premises.

Chen et al. (2008) find that the choice to adopt CEO duality is based on endogenous factors; in other words, the leadership structure of a company is determined according to firm characteristics and ownership structure. The characteristics of firms with CEO duality differ significantly from those of other firms, and the number of companies that separate the role of board chair from the role of CEO is increasing. They show that neither CEO duality nor a change in leadership structure significantly influence Tobin's q. Faleye (2007) indicates that duality is not significantly related with Tobin's q, and leadership structure chosen is a rational decision that is based on a firm's requirements and its governance characteristics. Thus, the government should not mandate the separation of the two roles. Iyengar & Zampelli (2009) adopt an endogenous switching regression model framework to examine whether CEO duality influences firm performance. Among the numerous firms investigated in that study, they find no evidence that the choice of leadership structure is made on the basis of optimizing firm performance.

## 2.3 *The external environment, leadership structure and firm performance*

The external environment is a crucial factor in the success of business operations. To survive in the high dynamic and competitive environment, firms must have a suitable management structure that enables it to respond to environmental change (Venkatraman & Prescott, 1990). In other words, the ideal management system and organizational structure of a firm are the products of how a firm responds to its external environment (Drazin & Van de Ven, 1985). The level of influence that environmental characteristics exert on a firm varies significantly by industry. Therefore, whether a firm can become successful depends on the efficiency that it responds to environmental factors.

Dess & Beard (1984) identify three dimensions of environmental uncertainty: environmental dynamism, environmental munificence, and environmental complexity. Among these dimensions, environmental dynamism (Simerly & Li, 2000; Goll & Rasheed, 2004; Schilke, 2014) and environmental munificence (Boyd, 1995; Iyengar & Zampelli, 2009) have been the most frequently discussed. Dess & Beard (1984) define environmental dynamism as the degree of unpredictability present in an external environment. For example, during the early stage of developing new products, or when technologies and markets are in a state of uncertainty, firms are difficult to predict future trends. In addition, environmental dynamism involves an increase in the number and scale of firms in an industry and the speed of technological change. Starbuck (1976) indicates that environmental munificence is the degree to which an environment can sustain the growth of an industry; moreover, the growth and stability of an industry determine whether organizations have ample resources for research and development (R&D) and product innovation.

Because environmental uncertainty has a considerable influence on corporate profits, the moderating role of environmental uncertainty between organization structure and firm performance has often been discussed in the research of this field. High munificence environment supports the growth of firm resources, provides support against competition and environmental threats, and even allows firms to access external resources in the face of internal and external problems (Hambrick &

Finkelstein 1987). In munificence environment, firms take steps to balance or reduce overall risk leading to increased performance; a firm's performance tends to be lower in the less munificent environments (Keats & Hitt, 1988). On the other hand, Baum & Wally (2003) suggest that, in dynamic environment, organic firms perform better than mechanic firms depending on strategies; dynamic environment is negatively related to a firm's performance. Keats & Hitt (1988) indicate that a firm might adopt a simplified organization structure (i.e., CEO duality) to rapidly and reliably respond to environmental dynamism. Boyd (1990) notes that firms that perform well in uncertain external environments tend to select a small board of directors to facilitate decision making and establishing centralized control mechanisms. He finds that dual-leadership structure is positively related to firm performance in low munificence environment, and has an insignificant positive effect on firm performance in high dynamism environment. Therefore, in highly uncertain environments, the integration of CEO's responsibility and power is advantageous to the company and the consequent benefits are greater than the potential agency costs.

Product market competition is also a critical factor influencing the leadership structure and firm performance. Several theoretical models show that product market competition is a powerful force that can overcome the principal–agent problem between shareholders and managers (Hart, 1983; Schmidt, 1997; Ammann et al., 2013; Gupta et al., 2017). A highly competitive environment compels managers to make optimal decisions to enhance their companies' competitiveness; otherwise, managers may lose their jobs and lead their companies into bankruptcy. Allen & Gale (2000) consider that when an enterprise operates in a highly competitive industry, the role of the enterprise governance mechanism becomes insignificant. Because poorly managed enterprises are more prone to being acquired by well-managed companies, a highly competitive environment can force managers to endeavor to operate their companies effectively in order to prevent takeovers and bankruptcy and to secure their jobs. Chou et al. (2011) find that firms in high competition environments or with low market power are likely to have weak corporate governance structures. Furthermore, in high competition environments, well govern firms do not report significantly higher abnormal returns than poorly governed firms do. Conversely, in low-competition environments,

strong governance firms perform better than poor governance firms. Therefore, Chou et al. (2011) suggest that highly competitive environments could replace governance quality as a governance mechanism. Competitive environment may exert down pressure on cost, reduce slack and increase organizational efficiency for productivity, and lead to future innovations. Furthermore, strategic decision-making would be more frequently in highly competitive market compared with in low competitive environments (Nickell, 1996). Therefore, this study infers that dual-leadership structure would be more beneficial to firm value in highly competitive environments.

This present study infers that a firm's decision to select CEO duality as its leadership structure is a nonrandom process that is made accordance with its characteristics, governance structure and external environment. When an enterprise is faced with a highly growth and dynamic environment or competitive market, it tends to adopt CEO duality in response to such environmental conditions. Accordingly, leadership structure may not be necessarily correlated with firm performance but contingent on external competitive environments. Environmental munificence and dynamism as well as product market competition would likely to mitigate the relationship between CEO duality and corporate performance. This study proposes three hypotheses as follows<sup>4</sup>:

**Hypothesis 1:** The choice of dual-leadership structure is positively related to highly competitive environments.

**Hypothesis 2:** Dual-leadership structure is not necessarily related to firm performance after controlling for the endogeneity of leadership structure.

**Hypothesis 3:** External competitive environments can mitigate the relationship between dual-leadership structure and firm performance.

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<sup>4</sup> This study also examines the influences of board characteristics and ownership structure on the choice of leadership structure. Because Chen et al. (2008) have documented the relationship between leadership structure and firm performance controlling for ownership structure, this study does not propose related hypotheses.

### 3. Data description and methodology

Previous studies have shown that firms tend to select their leadership structure according to external competitive environments, ownership structure and firm characteristics in order to maximize firm performance, suggesting that the choice of leadership structure is endogenous and not a random process. To resolve the endogeneity problem, this study adopts a two-stage least square (2SLS) regression with an instrumental variable (IV) to investigate the relationship between dual-leadership structure and performance, and particularly, the moderating effect of external competitive environment on the above-mentioned relationship.

The following of this section introduces variables assessment, including environmental variables, firm performance, corporate governance and firm characteristics, and then describes model specifications.

#### **3.1 Variable assessment**

##### **3.1.1 Environmental variables**

The environmental factors considered in this study are environmental munificence, environmental dynamism and market competition. To examine the influence of environmental uncertainty on leadership structure chosen, this study measures environmental munificence by industry sales growth rate (Dess & Beard, 1984) and R&D intensity growth rate (Castrogiovanni, 2002; Ensley et al., 2006), and measures environmental dynamism through industry sales volatility (Boyd, 1995) and R&D intensity volatility (Castrogiovanni, 2002; Ensley et al., 2006).

Boyd et al. (1993) indicate that using only time trends and its dispersion are insufficient for measuring environmental dynamism. Referring Boyd (1995), this study regresses industry sales on a time dummy variable for the past five 5 years, and then divides the regression coefficient by the average industry sales to obtain the industry sales growth rate (*IndSale\_G*), and divides the standard error of the regression coefficient by the average industry sales to obtain the volatility of industry sales (*IndSale\_V*). In addition, industries with high R&D intensity not only develop technology faster than other industries do, but they also exhibit faster growth. However, if the R&D intensity of an industry is unstable, environmental

dynamism is high (Castrogiovanni, 2002; Ensley et al., 2006). Similarly, this study performs the regression of industry R&D intensity (i.e., R&D expenses / sales) by using a time dummy variable for the past 5 years, and divides the regression coefficient by the average R&D intensity to obtain the industry R&D intensity growth rate (*IndResearch\_G*). This study also divides the standard error of the regression coefficient by the average industry R&D intensity to obtain the volatility of industry R&D intensity (*IndResearch\_V*). The environmental regression model in this study is expressed as shown in Equations 1 and 2.

$$IndSales_t = \phi_0 + \phi_1(t) + \kappa_t \quad (1)$$

$$IndResearch_t = \xi_0 + \xi_1(t) + \tau_t \quad (2)$$

where *IndSales<sub>t</sub>* and *IndResearch<sub>t</sub>* denote industry sales and industry R&D intensity, respectively;  $\phi_0$ ,  $\phi_1$ ,  $\xi_0$ , and  $\xi_1$  are the estimated coefficients; *t* denotes time; and  $\kappa_t$  and  $\tau_t$  represent residual errors. This study hypothesizes that in industries exhibiting rapid growth or high environmental dynamism, firms are more likely to adopt CEO duality to enhance their decision-making efficiency and improve their responsiveness to the rapidly changing environment.

Hölmstrom (1982) and Nalebuff & Stiglitz (1983) indicate that increasing market competition creates additional information when the number of market competitors increases that impacts on the costs of individual firms. Schmidt (1997) considers that fierce market competition and a high probability of liquidation can form a type of external governance mechanism that supervise managers and mitigates conflicting interests. Previous research generally used the Herfindahl–Hirschman index (HHI) to evaluate market concentration. When there are more firms in the industry, the market share of each firm is low and the level of competition is higher; thus, a small HHI indicates a competitive industry without dominant players. To facilitate the interpretation of empirical results, this study uses one minus HHI (One\_HHI) as market competition measure. The higher the One\_HHI is, the more competition in the market it is. The One\_HHI is expressed in Equation 3:

$$One\_HHI_i = 1 - \sum_{j=1}^J s_{ij}^2 \quad (3)$$

where  $s_{ij}$  denotes the market share of firm  $j$  in industry  $i$ , which is measured by dividing the annual firm sales by the total industry sales.<sup>5</sup> To enhance the accuracy of the results, this study adopts the mean of One\_HHI over the past 5 years to measure product market competition. This study hypothesizes that firms are more likely to adopt a dual-leadership structure to enhance firm performance in a high industry competition.

### **3.1.2 Firm performance**

In this study, return on assets (ROA) and Tobin's q (*TobinQ*) are employed to assess firm performance.<sup>6</sup> ROA is used to assess operating performance during a previous accounting period; *TobinQ* reflects investor expectations regarding future firm value.  $TobinQ = (\text{the total market value of common stock} + \text{the book value of preferred stock} + \text{the book value of liabilities}) / (\text{the book value of common stock} + \text{the book value of preferred stock} + \text{the book value of liabilities})$ . Specifically, ROA is a backing looking measure which concerns with previous accounting data, whereas Tobin's q is a forward looking measure which reveals a firm's future value from the stock market perspective. Meanwhile, ROA focuses on short-term performance, and Tobin's q is more concerned about long-term firm value. Thus, their meanings are not exactly the same.

### **3.1.3 Corporate governance**

Previous studies have indicated that a firm's governance structure influences both its performance and leadership structure; in addition, various governance mechanisms could replace or complement one another to mitigate agency problems (Faleye, 2007; Chen et al., 2008). If corporate governance mechanisms are adequate for controlling conflicts of interest caused by CEO duality, the roles of board chair and CEO need not be separated to avoid additional costs. As indicated by prior studies, CEO duality influences board independence and weakens the effectiveness of governance mechanisms; however, independent directors mitigate the agency problem (Duru et al., 2016). In addition, institutional investors typically

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<sup>5</sup> Because the information of non-public firms is difficult to obtain, total sales of all public firms is employed to estimate industry sales.

<sup>6</sup> The ROA and Tobin's q have been widely used in previous studies to assess firm performance (e.g., Brickley et al., 1997; Elsayed, 2007; Iyengar & Zampelli, 2009).

possess expert knowledge and oversee the activities of the management team (Gompers & Metrick, 2001). Such investors designate representatives as corporate directors and supervisors to overseeing the board operations. Thus, institutional investors play a critical role in corporate governance (Agrawal & Mandelker, 1990). Therefore, this study uses the proportion of independent director seats (*IndBoard*) and institutional ownership (*InstShare*) as the measures of external governance mechanisms. Following previous studies, this study examines the influence of board size (*Board*) (Yermack, 1996), the shareholding ratio of directors (*BShare*) (Klein, 1998), and the shareholding ratio of managers (*MgrShare*) (Demsetz & Villalonga, 2001) on leadership structure and firm performance.

### **3.1.4 Firm characteristics**

Referring previous studies, this study adopts the following firm characteristics as control variables in the performance model: debt ratio (*Debtratio*) ( Kao et al., 2012), sales growth rate (*SalesG*) (Hsu & Chen, 2008), and previous performance (*LagPerf*) (Tang, 2016). The industry dummy variable (*Industry dummy*) (*Industry dummy* = 1 for high-tech firms; otherwise, *Industry dummy* = 0), and year dummy variable (*Year dummy*) are also included (Chen et al., 2008). In the leadership structure model, firm scale (*LnSales*) (Iyengar, & Zampelli, 2009) and the industry dummy variable (*Industry dummy*) are included as control variables.

## **3.2 Research models**

As mentioned earlier, this study adopts a two-stage least square (2SLS) regression including an instrumental variable (IV) to investigate the relationship between dual-leadership structure and firm performance. A good instrumental variable should be related to endogenous explanatory variables, but not directly related to the dependent variable of the research model. Referring to Pham et al. (2015), this study uses the mean value of Duality for each industry (*IndDuality*) as the instrumental variable. If CEO duality is more common in the industry, firms are more likely to adopt a dual-leadership structure. However, the average industrial Duality is unlikely to be correlated to a specific firm's performance.

Because CEO duality is a dummy variable that is set to 1 if the CEO chairs the board as well, and 0 otherwise, this study begins with employing a probit model

to estimate the determinants of CEO duality, and then, uses the predicted value of Duality to investigate the relationship between dual-leadership structure and firm performance. This study expresses the choice of leadership structure as shown in Equation 4. To examine the relationship between CEO duality and firm performance, this study establishes a model of firm performance on the basis of leadership structure, competitive environment, board characteristics, ownership structure, and firm characteristics as shown in Equation 5. This study also jointly estimates equations 4 and 5 in a simultaneous equation framework.

$$\begin{aligned}
 Duality_{it} = & \alpha_0 + \alpha_1 IndSale\_G_{it} + \alpha_2 IndSale\_V_{it} + \alpha_3 IndResearch\_G_{it} + \alpha_4 IndResearch\_V_{it} + \alpha_5 One\_HHI_{it} \\
 & + \alpha_6 Board_{it} + \alpha_7 IndBoard_{it} + \alpha_8 BShare_{it} + \alpha_9 MgrShare_{it} + \alpha_{10} InstShare_{it} \\
 & + \alpha_{11} LnSales_{it} + \alpha_{12} Industry\ dummy_{it} + \alpha_{13} IndDuality_{it} + \mu_{it}
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 Perf_{it} = & \beta_0 + \beta_1 Duality_{it} \\
 & + \beta_2 IndSale\_G_{it} + \beta_3 IndSale\_V_{it} + \beta_4 IndResearch\_G_{it} + \beta_5 IndResearch\_V_{it} + \beta_6 One\_HHI_{it} \\
 & + \beta_7 Board_{it} + \beta_8 IndBoard_{it} + \beta_9 BShare_{it} + \beta_{10} MgrShare_{it} + \beta_{11} S\_MgrShare_{it} + \beta_{12} InstShare_{it} \\
 & + \beta_{13} Debratio_{it} + \beta_{14} SalesG_{it} + \beta_{15} Lag\_Perf_{it} + \beta_{16} Industry\ dummy_{it} + \beta_{17} Year\ dummy_{it} + \eta_{it}
 \end{aligned} \tag{5}$$

where *Duality* denotes a dummy variable which is equal to 1 if the CEO chairs the board as well, and 0 otherwise; *Perf* denotes firm performance, including *ROA* and *Tobin q*; *IndSale\_G* is the industry sales growth rate; *IndSale\_V* is the volatility of industry sales growth rate; *IndResearch\_G* is the industry R&D intensity growth rate; *IndResearch\_V* is the volatility of industry R&D intensity growth rate; *One\_HHI* is one minus the Herfindahl–Hirschman index (HHI); *Board* is the board size; *IndBoard* is the proportion of independent directors; *BShare* is the shareholding ratio of directors; *MgrShare* is the shareholding ratio of managers; *S\_MgrShare* is the squared term for the shareholding ratio of managers; *InstShare* is the shareholding ratio of institutional investors; *LnSales* is the natural logarithm of firm sales; *Industry Dummy* is the dummy variable for industry, which is equal to 1 if the firm belongs to a high-tech industry, 0 otherwise; *IndDuality* is the mean value of Duality for each industry; *Debratio* is the debt ratio; *SalesG* is the growth

rate of firm sales;  $LagPerf$  is the previous performance, including  $LagROA$  and  $LagTobin\ q$ ;  $Year\ Dummy$  is the dummy variable for the year;  $\eta_{it}$  and  $u_{it}$  is the error term.

## 4. Empirical results

### 4.1 Samples and data sources

The research sample comprises listed and over-the-counter (OTC) firms in Taiwan from 2001 to 2010. The data are collected from the Taiwan Economic Journal (TEJ) database and the Market Observation Post System. The TEJ industry types are adopted as the industry categorization scheme. The financial industry differs substantially from other industries regarding legal regulations and industrial characteristics; therefore, financial firms are excluded from the sample. After the removal of incomplete data, the final sample comprises 9,163 firm-year observations.

### 4.2 Descriptive statistics

Table 1 presents the descriptive statistics of the sample. As shown in Table 1, 31.7% of the sample firms adopt CEO duality. The average ROA and Tobin's q are 7.5% and 1.368, separately. The average industry sales growth ( $IndSale\_G$ ), volatility in industry sales growth ( $IndSale\_V$ ), R&D intensity growth rate ( $IndResearch\_G$ ), and R&D intensity volatility ( $IndResearch\_V$ ) are 14.3%, 12.9%, 2.3%, and 4.7%, respectively. Therefore, during the study period, the industries exhibit a certain level of growth, and a considerable amount of capital invested in R&D to maintain industry sales growth. The average  $One-HHI$  is 0.935, indicating that the market share of each firm in the industry is small, and that the industry competition is high. The average board size ( $Board$ ) and the proportion of independent directors ( $IndBoard$ ) is 6.804 and 0.124, respectively. The average shareholding ratio by board members ( $BShare$ ), managers ( $MgrShare$ ), and institution investors ( $InstShare$ ) is 20.7%, 1.8% and 34.1%, separately.

Table 2 reports the Pearson correlation of leadership structure, firm performance and external competition. In the table, *Duality* is significantly and

negatively related to *ROA* and is insignificantly related to Tobin's q. Duality has a significant and positive relationship with *IndSale\_G* and *IndResearch\_G*, and *One\_HHI*. The findings indicate that firms in a high growth industry or high product market competition usually prefer a concentrated leadership to respond to the competitive environment.

Table 3 shows the mean and median difference test results for CEO duality and non-CEO duality firms, respectively. Both reports significant differences in the ROA, environmental variables, corporate governance, and firm characteristics between two types of leadership structure. Consisting with the correlation analysis, dual-leadership firms character with lower ROA, higher industry-sales growth rate (*IndSale\_G*), higher R&D intensity growth rate (*IndResearch\_G*), and higher competition (*One\_HHI*). In other words, a dual leadership structure may generate more agency costs; however, firms face with a rapid growth industry or high market competition are likely to adopt CEO duality in response to competitive environments. In contrast, firms with a large board, high director ownership, high managerial ownership, or high institutional shareholdings are less likely to adopt CEO duality, indicating that these firms are more concerned about agency costs than decision-making efficiency. Firms with small scale, poor previous ROA, or in a high-tech industry tend to adopt dual-leadership structure.

**Table 1: Descriptive statistics**

Variables	Mean	Median	Std.	Min.	Max.
Duality	0.317	0	0.465	0	1
ROA	0.075	0.073	0.109	-0.946	0.599
TobinQ	1.368	1.146	0.808	0.279	12.873
IndSale_G	0.143	0.121	0.09	-0.126	0.341
IndSale_V	0.023	0.022	0.011	0.005	0.069
IndResearch_G	0.129	0.105	0.166	-0.454	0.891
IndResearch_V	0.047	0.026	0.06	0.002	0.539
One_HHI	0.935	0.958	0.066	0.502	0.975
Board	6.804	7	2.342	3	27
IndBoard	0.124	0	0.16	0	0.667
BShare	0.207	0.175	0.128	0	0.953
MgrShare	0.018	0.006	0.027	0	0.283
InstShare	0.341	0.303	0.217	0	0.984
Sales (thousands)	10,852,941	2,322,151	52,640,222	507.000	2,313,129,125
DebtRatio	0.384	0.376	0.175	0.013	1.236
SalesG	0.253	0.047	8.544	-0.997	757.185
LagROA	0.079	0.075	0.111	-0.946	0.599
LagTobinQ	1.363	1.118	0.847	0.279	12.873
Industry dummy	0.546	1	0.498	0	1
IndDuality	0.315	0.352	0.069	0.087	0.5
# of Obs.			9163		

This table reports the descriptive statistics of research sample. *Duality* denotes a dummy variable which is equal to 1 if the CEO chairs the board as well, and 0 otherwise; *ROA* is the return on assets; *TobinQ* = (the total market value of common stock + the book value of preferred stock + the book value of liabilities) / (the book value of common stock + the book value of preferred stock + the book value of liabilities); *IndSale\_G* is the industry sales growth rate; *IndSale\_V* is the volatility of industry sales growth rate; *IndResearch\_G* is the industry R&D intensity growth rate; *IndResearch\_V* is the volatility of industry R&D intensity growth rate; *One\_HHI* is one minus the Herfindahl–Hirschman index (HHI); *Board* is the board size; *IndBoard* is the proportion of independent directors; *BShare* is the shareholding ratio of directors; *MgrShare* is the shareholding ratio of managers; *InstShare* is the shareholding ratio of institutional investors; *Sales* is the net sales revenue; *DebtRatio* is the debt ratio; *SalesG* is the growth rate of firm sales; *LagROA* is the previous year ROA; *LagTobinQ* is the previous year Tobin's Q; *Industry Dummy* is the dummy variable for industry, which is equal to 1 if the firm belongs to a high-tech industry, 0 otherwise; *IndDuality* is the mean value of Duality for each industry.

**Table 2: Pearson correlation**

N=9163

	Duality	ROA	TobinQ	IndSale_G	IndSale_V	IndResearch_G	IndResearch_V	One_HHI
Duality	1	-0.064*** (<.0001)	0.003 0.757	0.084*** (<.0001)	0.000 (0.984)	0.069*** (<.0001)	-0.002 0.835	0.098*** (<.0001)
ROA		-0.064*** (<.0001)	1 (<.0001)	0.451*** (<.0001)	0.100*** (<.0001)	-0.027*** (0.009)	0.005 (0.618)	-0.063*** (<.0001)
TobinQ			0.003 (0.757)	0.451*** (<.0001)	1 (<.0001)	0.140*** (<.0001)	0.031*** (0.003)	0.030*** (0.004)
IndSale_G				0.084*** (<.0001)	0.100*** (<.0001)	0.140*** (<.0001)	1 (<.0001)	-0.133*** (<.0001)
IndSale_V					-0.027*** (0.984)	0.031*** (0.009)	-0.133*** (<.0001)	1 (0.521)
IndResearch_G						0.069*** (<.0001)	0.005 (0.618)	0.305*** (0.004)
IndResearch_V							-0.007 (0.521)	1 (0.030)
One_HHI								-0.273*** (<.0001)
								0.464*** (<.0001)
								-0.143*** (<.0001)
								0.023** (0.030)
								-0.248*** (<.0001)
								1 (<.0001)

This table shows the Pearson correlation coefficients for the variables. \*\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

**Table 3: The difference tests of Non-CEO duality and CEO duality firms**

Variables	Non-CEO Duality		CEO Duality		t value	z value
	Mean	Median	Mean	Median		
ROA	0.080	0.075	0.065	0.069	5.98 ***	4.51 ***
TobinQ	1.366	1.143	1.372	1.152	-0.32	-1.48
IndSale_G	0.138	0.114	0.154	0.141	-7.98 ***	-7.94 ***
IndSale_V	0.023	0.022	0.023	0.022	-0.02	-0.96
IndResearch_G	0.122	0.105	0.146	0.120	-6.59 ***	-8.66 ***
IndResearch_V	0.047	0.026	0.047	0.026	0.21	0.64
One_HHI	0.931	0.958	0.945	0.964	-10.21 ***	-9.88 ***
Board	7.061	7.000	6.249	6.000	17.75 ***	-5.75 ***
IndBoard	0.120	0.000	0.131	0.000	-2.98 ***	-2.96 ***
BShare	0.213	0.178	0.195	0.168	6.59 ***	4.76 ***
MgrShare	0.018	0.007	0.017	0.006	2.76 ***	3.71 ***
InstShare	0.362	0.326	0.297	0.253	13.91 ***	13.13 ***
Sales (thousands)	11,621,441	2,624,203	9,195,755	1,759,885	14.23 ***	13.86 ***
DebtRatio	0.385	0.377	0.383	0.369	0.62	0.67
SalesG	0.250	0.049	0.260	0.042	-0.06	2.01 **
LagROA	0.084	0.077	0.069	0.071	5.95 ***	4.50 ***
LagTobin	1.363	1.116	1.362	1.123	0.08	-1.36
Industry dummy	0.516	1.000	0.611	1.000	-8.56 ***	-8.45 ***
# of Obs.	6260		2903			

This table shows the mean and median difference tests results for CEO duality and non-CEO duality firms, respectively. \*\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

Taken together, the difference test results indicate that a firm's choice of leadership structure is endogenous and subject to influence by the aforementioned factors. Therefore, the 2SLS with an instrumental variable is adopted to control the endogeneity of the choice of leadership structure and to examine the influence of dual-leadership structure on firm performance.

### **4.3 Determinants of CEO duality**

Table 4 and 5 show the probit model results of leadership-structure models, in which ROA and Tobin's q are used to assess firm performance in the second stage, respectively. Table 4 and 5 also report the simultaneous equation results of leadership-structure models, jointly estimated by equations 4 and 5. As shown in the tables, the growth rate of industry sales (*IndSale\_G*) has a significantly positive influence on a firm's selecting CEO duality as its leadership structure. The results imply that when a firm is faced with a rapidly growing market, the firm tends to adopt CEO duality to facilitate rapidly responding to the highly competitive environment, which consists with the hypothesis 1. Moreover, the board size and shareholding ratios of directors, managers, and institutional investors significantly and negatively influence the decision to adopt CEO duality. These results imply that when the board is large or when the shareholding ratios of directors, managers, and institutional investors are high, firms tend to avoid CEO duality to reduce their agency costs. Small-sized firms tend to adopt CEO duality to reduce information costs, to improve decision-making efficiency, and to enhance their responsiveness to environmental change. Therefore, the probit model and the simultaneous equation results for a firm's choice of leadership structure are mostly in line with the difference test results.

**Table 4: The probit model of a firm's choice of leadership structure - ROA**

Variables	Predicted Sign	The depend variable is Duality	
		1 <sup>st</sup> stage Probit 2SLS	1 <sup>st</sup> stage Simultaneous equations
		The depend variable is Duality	
Intercept	?	2.351 *** (10.71)	1.911 *** (4.53)
IndSale_G	+	1.141 *** (6.88)	0.715 *** (2.74)
IndSale_V	+	3.436 (1.57)	2.482 (1.50)
IndResearch_G	+	0.407 (2.33)	0.247 (1.55)
IndResearch_V	+	-1.679 * (3.22)	-1.030 * (-1.89)_
One_HHI	+	-0.981 (1.99)	-0.756 * (-1.84)
Board	-	-0.169 *** (116.87)	-0.091 *** (-9.88)
IndBoard	-	-0.130 (0.66)	-0.094 (-0.97)
BShare	-	-0.771 *** (10.45)	-0.526 *** (-3.73)
MgrShare	-	-6.405 *** (43.68)	-3.717 *** (-6.60)
InstShare	-	-0.848 *** (38.82)	-0.431 *** (-5.30)
LnSales	-	-0.172 *** (65.04)	-0.129 *** (-10.10)
Industry dummy	?	-0.153 (2.51)	-0.072 (-1.26)
IndDuality	+	5.781 *** (93.11)	3.221 *** (9.40)
# of Obs.		9163	9163
Log Likelihood		-5373.802	8691

This table shows the probit model results of leadership-structure models (the first-stage regression results), in which ROA is used to assess firm performance in the second stage. The simultaneous equations are jointly estimated by equations 4 and 5. The number in parentheses is the chi square values. \*\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

**Table 5: The probit model of a firm's choice of leadership structure – Tobin's q**

Variables	Predicted Sign	The depend variable is Duality	
		1 <sup>st</sup> stage	1 <sup>st</sup> stage
		Probit 2SLS	Simultaneous equations
Intercept	?	2.351 *** (10.71)	1.567 *** (3.66)
IndSale_G	+	1.141 *** (6.88)	0.689 *** (2.63)
IndSale_V	+	3.436 (1.57)	1.984 (1.20)
IndResearch_G	+	0.407 (2.33)	0.246 (1.53)
IndResearch_V	+	-1.679 * (3.22)	-0.927 * (-1.68)
One_HHI	+	-0.981 (1.99)	-0.759 * (-1.81)
Board	—	-0.169 *** (116.87)	-0.098 *** (-10.71)
IndBoard	—	-0.130 (0.66)	-0.073 (-0.75)
BShare	—	-0.771 (10.45)	-0.477 *** (-3.36)
MgrShare	—	-6.405 *** (43.68)	-3.728 *** (-6.59)
InstShare	—	-0.848 *** (38.82)	-0.511 *** (-6.28)
LnSales	—	-0.172 *** (65.04)	-0.104 *** (-8.06)
Industry dummy	?	-0.153 (2.51)	-0.077 (-1.34)
IndDuality	+	5.781 *** (93.11)	3.372 *** (9.50)
# of Obs.		9163	9163
Log Likelihood		-5373	-8890

This table shows the probit model results of leadership-structure models (the first-stage regression results), in which Tobin's q is used to assess firm performance in the second stage. The simultaneous equations are jointly estimated by equations 4 and 5. The number in parentheses is the chi square values. \*\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

#### **4.4 Relationship between CEO duality and firm performance**

Table 6 and 7 report regression results for the relationship between CEO duality and ROA as well as Tobin's q, respectively. Table 6 shows that CEO duality significantly and negatively correlated with ROA, consistent with previous studies (Lin & Lee, 2008; Duru et. al, 2016). This result suggests that dual-leadership structure increases a CEO's power over the board, reducing board independence and accounting performance. Table 7 reveals that CEO duality has no significant impact on Tobin's q, which is in line with Faleye (2007), Chen et al. (2008), and Iyengar & Zampelli (2009). These results also consist with the correlation analysis and the difference test results in this study. As mentioned previously, ROA is a backlog-looking measure which concerns with previous accounting data, whereas Tobin's q is a forward-looking measure which reveals investors' perspective on a firm's future value. Accordingly, the results are not conflict. This study infers that dual-leadership structure may negatively correlate with a firm's previous operating performance, but have no negative influence on future firm value. These results accords with hypothesis 2.

In addition, table 6 and 7 reveal that *IndSales\_G* and *IndResearch\_G* are significantly positively related to ROA; *IndSales\_G* also has significantly positive influence on Tobin's q. High industry sales growth and R&D intensity growth indicate a high environmental munificence. These results suggest that environmental munificence supports a firm's resource growth, provides a spare in response to market competition and environmental threats, and allows firms to access external resources for supports (Baum & Wally, 2003). Therefore, environmental munificence has a positive influence on firm performance. *IndSale\_V* is significantly and negatively correlated with ROA. Because high industry-sales volatility is associated with uncertainty and environmental volatility, it therefore has a significantly negative influence on firm performance (Keats & Hitt, 1988; Baum & Wally, 2003). *One-HHI* has a significantly positive influence on Tobin's q. This result implies that an increase in competition may raise profit sensitivity to managers' action, leading to less managerial slack and higher firm value (Nickell, 1996). Taken together, this study shows that external competition has a significant influence on firm performance, which is consistent with prior

studies.

Besides, board size (*Board*) significantly and negatively correlates with ROA and Tobin's q, indicating that small boards are efficient at making decisions and tend to achieve excellent firm performance. The number of independent directors is significantly and positively correlated with both ROA and Tobin's q, suggesting that an increase in independent directors helps supervising over business operations and enhances firm performance. Board ownership (*BShare*) has a significant negatively influence on Tobin's q, supporting the entrenchment hypothesis. Managerial shareholdings (*MgrShare*) exerts a significantly positive influence on Tobin's q; however, the squared term (*S\_mgrShare*) correlates significantly and negatively with ROA and Tobin's q. In other words, the relationship between managerial ownership and firm performance exhibits an inverted U-shaped relationship, which is in line with the results of previous studies. The finding indicates that, when managerial ownership is low, an increase in managerial shareholdings can converge managers' wealth with firm interests, prevent managers from wasting firm resources, and promote value-enhanced decision making. The results support the convergence-of-interest hypothesis. However, when managerial ownership is excessively high, managers can easily abuse their power for personal gains and harm the interests of the firm and other stakeholders, supporting the entrenchment hypothesis. The abovementioned results are mostly significant at the 1% level. Besides, an increase in institutional investor shareholdings (*InstShare*) enhances the effectiveness of governance mechanisms on both ROA and Tobin's q. Debt ratio (*Debtratio*), the growth rate of firm sales (*SalesG*), and previous performance (*LagROA/LagTobin's q*) also significantly influence firm performance at the 1% level.

**Table 6: The regression of ROA on leadership structure**

Variables	Predicted Sign	The depend variable is ROA	
		2nd stage Probit 2SLS	2nd stage Simultaneous equations
Intercept	?	0.090 *** (6.44)	0.087 *** (5.98)
Duality	+/-	-0.069 *** (-7.25)	-0.032 *** (-5.06)
IndSale_G	+	0.057 *** (3.62)	0.046 *** (2.88)
IndSale_V	-	-0.344 *** (-3.33)	-0.355 *** (-3.38)
IndResearch_G	+	0.015 ** (2.00)	0.008 (1.01)
IndResearch_V	-	-0.010 (-0.49)	-0.021 (-1.00)
One_HHI	+	-0.003 (-0.21)	-0.022 (-1.44)
Board	+/-	-0.003 *** (-6.39)	-0.002 *** (-4.20)
IndBoard	+	0.017 *** (4.26)	0.016 *** (3.91)
BShare	+/-	-0.004 (-0.69)	-0.001 (-0.23)
MgrShare	+	0.072 (1.57)	0.130 *** (2.87)
S_mgrshare	-	-0.734 ** (-2.25)	-0.824 ** (-2.51)
InstShare	+	0.026 *** (6.82)	0.034 *** (9.94)
DebtRatio	-	-0.081 *** (-21.57)	-0.079 *** (-20.92)
SalesG	+	0.105 *** (47.03)	0.106 *** (47.55)
LagROA	+	0.450 *** (80.00)	0.453 *** (79.97)
Industry dummy	?	-0.004 (-1.64)	-0.004 (-1.57)
Year dummy		Yes	Yes
# of Obs.		9163	9163
Log Likelihood			8691
Adj. R <sup>2</sup>		0.63	
F-value		616.27 ***	

This table shows the regression results of ROA on leadership structure (the 2nd stage regression results). The simultaneous equations are jointly estimated by equations 4 and 5. The number in parentheses is the t-statistics\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

**Table 7: The regression of Tobin's q on leadership structure**

Variables	Predicted Sign	The depend variable is TobinQ	
		2nd stage Probit 2SLS	2nd stage Simultaneous equations
Intercept	+/-	0.419 *** (4.34)	0.416 *** (4.32)
Duality	+	0.011 (0.18)	0.029 (0.61)
IndSale_G	+	0.651 *** (6.02)	0.647 *** (6.03)
IndSale_V	-	-0.509 (-0.71)	-0.504 (-0.71)
IndResearch_G	+	-0.012 (-0.24)	-0.016 (-0.31)
IndResearch_V	-	0.390 *** (2.81)	0.385 *** (2.78)
One_HHI	+	0.388 *** (3.73)	0.379 *** (3.74)
Board	+/-	-0.006 * (-1.93)	-0.005 ** (-1.96)
IndBoard	+	0.221 *** (8.04)	0.221 *** (8.04)
BShare	+/-	-0.114 *** (-3.13)	-0.113 *** (-3.11)
MgrShare	+	0.944 *** (2.97)	0.982 *** (3.18)
S_mgrshare	-	-4.611 ** (-2.06)	-4.738 ** (-2.12)
InstShare	+	0.268 *** (10.22)	0.273 *** (11.38)
DebtRatio	-	-0.311 *** (-12.46)	-0.310 *** (-12.50)
SalesG	+	0.327 *** (21.17)	0.328 *** (21.31)
LagTobinQ	+	0.383 *** (74.84)	0.383 *** (74.99)
Industry dummy	?	-0.017 (-1.02)	-0.018 (-1.03)
Year dummy		Yes	Yes
# of Obs.		9163	9163
Log Likelihood			-8990
Adj. R <sup>2</sup>		0.58	
F-value		516.37 ***	

This table shows the regression results of Tobin's q on leadership structure (the 2nd stage regression results). The simultaneous equations are jointly estimated by equations 4 and 5. The number in parentheses is the t-statistics. \*\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definition of variables.

Table 8 and 9 report the moderating effects of external environments on the relationship between Duality and ROA. These two tables show that the coefficients on the interaction terms of Duality and external environments are all positive but not significant, indicating that external environments have no significant influence on the relationship between Duality and accounting performance. Table 10 and 11 report the moderating effects of external environments on the relationship between Duality and Tobin's q. In table 10, Duality is not related to Tobin's q, but significantly and positively correlates with Tobin's q in table 11. Notably, the interaction terms of Duality and external environments, including *D\_IndSaleG*, *D\_IndSaleV*, *D\_IndRDIG*, and *D\_OneHHI*, are significantly and positively related to Tobin's q. The results indicate that dual-leadership structure improves future firm value when a firm faces with higher environmental munificence, greater environmental dynamism and strong product market competition. A CEO with dual role as chairman will be given a high degree of responsibility and power consolidation, which enables the CEO to quickly respond to a dynamic and competitive market (Hambrick & Finkelstein, 1987; Bourgeois III & Eisenhardt, 1988). Therefore, the relationship between dual-leadership structure and firm performance is likely to be contingent on external competitive environments, supporting hypothesis 3.

**Table 8: The interaction between external environment and leadership structure on ROA  
- Full models**

Variables	Predicted value	The depend variable is ROA				
		Probit 2SLS				
Intercept	?	0.090 *** (6.45)	0.091 *** (6.46)	0.090 *** (6.43)	0.091 *** (6.50)	0.091 *** (6.46)
Duality	+/-	-0.070 *** (-7.34)	-0.069 *** (-7.28)	-0.070 *** (-7.34)	-0.071 *** (-7.37)	-0.070 *** (-7.34)
IndSale_G	+	0.054 *** (3.38)	0.057 *** (3.62)	0.057 *** (3.60)	0.058 *** (3.65)	0.057 *** (3.62)
IndSale_V	-	-0.344 *** (-3.34)	-0.354 *** (-3.39)	-0.344 *** (-3.33)	-0.345 *** (-3.34)	-0.343 *** (-3.33)
IndResearch_G	+	0.015 ** (2.00)	0.015 ** (2.00)	0.012 (1.58)	0.015 ** (1.98)	0.015 ** (2.00)
IndResearch_V	-	-0.010 (-0.48)	-0.010 (-0.48)	-0.010 (-0.49)	-0.018 (-0.85)	-0.010 (-0.49)
One_HHI	+	-0.003 (-0.20)	-0.003 (-0.22)	-0.003 (-0.17)	-0.003 (-0.23)	-0.004 (-0.23)
D_IndSaleG	-	0.009 (1.33)				
D_IndSaleV	+		0.034 (0.68)			
D_IndRDIG	-			0.009 (1.32)		
D_IndRDIV	+				0.030 (1.31)	
D_One_HHI	+					0.002 (1.18)
Board	+/-	-0.003 *** (-6.38)	-0.003 *** (-6.39)	-0.003 *** (-6.38)	-0.003 *** (-6.41)	-0.003 *** (-6.39)
IndBoard	+	0.017 *** (4.26)	0.017 *** (4.26)	0.017 *** (4.27)	0.017 *** (4.26)	0.017 *** (4.25)
BShare	+/-	-0.004 (-0.69)	-0.004 (-0.69)	-0.004 (-0.70)	-0.004 (-0.68)	-0.004 (-0.69)
MgrShare	+	0.073 (1.58)	0.073 (1.58)	0.072 (1.58)	0.073 (1.58)	0.073 (1.59)
S_mgrshare	-	-0.736 ** (-2.26)	-0.737 ** (-2.26)	-0.736 ** (-2.26)	-0.746 ** (-2.29)	-0.742 ** (-2.28)
InstShare	+	0.026 *** (6.85)	0.026 *** (6.82)	0.026 *** (6.84)	0.025 *** (6.74)	0.026 *** (6.82)
DebtRatio	-	-0.081 *** (-21.56)	-0.081 *** (-21.57)	-0.081 *** (-21.57)	-0.081 *** (-21.58)	-0.081 *** (-21.57)
SalesG	+	0.105 *** (47.03)	0.105 *** (47.03)	0.105 *** (47.02)	0.105 *** (46.99)	0.105 *** (47.03)
LagROA	+	0.450 *** (80.01)	0.450 *** (79.99)	0.450 *** (79.99)	0.450 *** (79.97)	0.450 *** (80.01)
Industry dummy	?	-0.004 (-1.64)	-0.004 (-1.64)	-0.004 (-1.64)	-0.004 (-1.06)	-0.004 (-1.64)
Year dummy		Yes	Yes	Yes	Yes	Yes
# of Obs.		9163	9163	9163	9163	9163
Adj. R <sup>2</sup>		0.63	0.63	0.63	0.63	0.63
F-value		592.68 ***	592.55 ***	592.68 ***	592.68 ***	592.65 ***

This table shows the interaction between external environments and leadership structure on ROA. The number in parentheses is the t-statistics\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definitions of variables.

**Table 9: The interaction between external environment and leadership structure on ROA  
- Partial models**

Variables	Predicted value	The depend variable is ROA Probit 2SLS				
		0.077 *** (11.50)	0.087 *** (12.05)	0.080 *** (11.88)	0.079 *** (11.73)	0.065 *** (5.27)
Intercept	?	-0.062 *** (-7.46)	-0.057 *** (-7.02)	-0.063 *** (-7.28)	-0.055 *** (-6.57)	-0.061 *** (-6.91)
Duality	+/-	0.045 *** (2.86)				
IndSale_G	+		-0.306 *** (-3.25)			
IndSale_V	-			0.013 * (1.82)		
IndResearch_G	+				-0.021 (-1.09)	
IndResearch_V	-					0.018 (1.30)
One_HHI	+					0.002 (1.18)
D_IndSaleG	+	0.009 (1.29)				
D_IndSaleV	+		0.033 (0.68)			
D_IndRDIG	+			0.009 (1.31)		
D_IndRDIV	+				0.028 (1.27)	
D_One_HHI	+					0.002 (1.18)
Board	+/-	-0.003 *** (-6.06)	-0.003 *** (-5.85)	-0.003 *** (-6.11)	-0.002 *** (-5.63)	-0.003 *** (-5.88)
IndBoard	+	0.018 *** (4.51)	0.016 *** (4.02)	0.017 *** (4.34)	0.017 *** (4.28)	0.017 *** (4.21)
BShare	+/-	-0.002 (-0.47)	-0.001 (-0.25)	-0.002 (-0.41)	-0.001 (-0.22)	-0.002 (-0.30)
MgrShare	+	0.092 ** (2.07)	0.090 ** (2.01)	0.085 * (1.89)	0.101 ** (2.25)	0.087 * (1.90)
S_mgrshare	-	-0.809 ** (-2.49)	-0.756 ** (-2.33)	-0.770 ** (-2.37)	-0.815 ** (-2.51)	-0.768 ** (-2.36)
InstShare	+	0.027 *** (7.56)	0.028 *** (7.68)	0.027 *** (7.30)	0.028 *** (7.70)	0.027 *** (7.32)
DebtRatio	-	-0.081 *** (-22.15)	-0.080 *** (-21.88)	-0.081 *** (-22.03)	-0.081 *** (-21.92)	-0.082 *** (-22.00)
SalesG	+	0.105 *** (47.11)	0.106 *** (47.74)	0.106 *** (47.49)	0.106 *** (47.61)	0.106 *** (47.58)
LagROA	+	0.451 *** (80.34)	0.454 *** (81.98)	0.453 *** (81.59)	0.454 *** (81.87)	0.453 *** (81.72)
Industry dummy	?	-0.003 (-1.47)	0.003 ** (2.26)	0.001 (0.90)	0.002 (1.05)	0.001 (0.83)
Year dummy		Yes	Yes	Yes	Yes	Yes
# of Obs.		9163	9163	9163	9163	9163
Adj. R <sup>2</sup>		0.63	0.63	0.63	0.63	0.63
F-value		698.47 ***	698.39 ***	697.94 ***	697.36 ***	697.48 ***

This table shows the interaction between external environments and leadership structure on ROA. The number in parentheses is the t-statistics\*\*, \*\*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definitions of variables.

**Table 10: The interaction between external environment and leadership structure on Tobin's q  
-Full models**

Variables	Predicted value	The depend variable is Tobin's q					
		Probit 2SLS					
Intercept	+/-	0.420 *** (4.35)	0.426 *** (4.41)	0.416 *** (4.31)	0.422 *** (4.37)	0.423 *** (4.38)	
Duality	+/-	-0.003 (-0.05)	-0.003 (-0.05)	-0.003 (-0.05)	0.003 (0.05)	-0.007 (-0.12)	
IndSale_G	+	0.608 *** (5.56)	0.653 *** (6.03)	0.648 *** (5.99)	0.653 *** (6.04)	0.652 *** (6.02)	
IndSale_V	-	-0.519 (-0.73)	-0.732 (-1.02)	-0.507 (-0.71)	-0.513 (-0.72)	-0.503 (-0.71)	
IndResearch_G	+	-0.012 (-0.23)	-0.012 (-0.24)	-0.049 (-0.90)	-0.013 (-0.25)	-0.012 (-0.23)	
IndResearch_V	-	0.393 *** (2.83)	0.391 *** (2.81)	0.389 *** (2.80)	0.356 ** (2.45)	0.390 *** (2.80)	
One_HHI	+	0.390 *** (3.75)	0.384 *** (3.69)	0.395 *** (3.79)	0.387 *** (3.71)	0.383 *** (3.68)	
D_IndSaleG	+	0.128 *** (2.64)					
D_IndSaleV	+		0.706 ** (2.07)				
D_IndRDIG	+			0.117 ** (2.51)			
D_IndRDIV	+				0.127 (0.82)		
D_OneHHI	+					0.020 ** (2.26)	
Board	+/-	-0.006 * (-1.91)	-0.006 * (-1.92)	-0.006 * (-1.91)	-0.006 * (-1.94)	-0.006 * (-1.93)	
IndBoard	+	0.221 *** (8.05)	0.221 *** (8.05)	0.222 *** (8.07)	0.221 *** (8.04)	0.221 *** (8.05)	
BShare	+/-	-0.114 *** (-3.13)	-0.114 *** (-3.13)	-0.115 *** (-3.15)	-0.114 *** (-3.12)	-0.114 *** (-3.13)	
MgrShare	+	0.951 *** (3.00)	0.951 *** (2.99)	0.947 *** (2.98)	0.946 *** (2.98)	0.957 *** (3.01)	
S_mgrshare	-	-4.634 ** (-2.07)	-4.662 ** (-2.08)	-4.631 ** (-2.07)	-4.656 ** (-2.08)	-4.719 ** (-2.10)	
InstShare	+	0.270 *** (10.28)	0.269 *** (10.24)	0.269 *** (10.25)	0.267 *** (10.16)	0.268 *** (10.23)	
DebtRatio	-	-0.310 *** (-12.45)	-0.311 *** (-12.47)	-0.310 *** (-12.45)	-0.311 *** (-12.46)	-0.311 *** (-12.47)	
SalesG	+	0.327 *** (21.16)	0.327 *** (21.16)	0.327 *** (21.15)	0.327 *** (21.14)	0.327 *** (21.16)	
LagTobinQ	+	0.383 *** (74.88)	0.383 *** (74.86)	0.383 *** (74.87)	0.383 *** (74.84)	0.383 *** (74.86)	
Industry dummy	?	-0.017 (-1.02)	-0.018 (-1.03)	-0.017 (-1.02)	-0.017 (-1.00)	-0.018 (-1.03)	
Year dummy		Yes	Yes	Yes	Yes	Yes	
# of Obs.		9163	9163	9163	9163	9163	
Adj. R <sup>2</sup>		0.59	0.59	0.59	0.58	0.59	
F-value		497.10 ***	496.85 ***	497.04 ***	496.52 ***	496.90 ***	

This table shows the interaction between external environments and leadership structure on Tobin's q. The number in parentheses is the t-statistics\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definitions of variables.

**Table 11: The interaction between external environment and leadership structure on Tobin's q  
- Partial models**

Variables	Predicted value	The depend variable is Tobin's q					
		Probit 2SLS					
Intercept	+/-	0.693 *** (15.22)	0.724 *** (14.75)	0.720 *** (15.75)	0.714 *** (15.66)	0.421 *** (4.97)	
Duality	+/-	0.128 ** (2.28)	0.196 *** (3.55)	0.173 *** (2.93)	0.174 *** (3.04)	0.101 * (1.69)	
IndSale_G	+	0.589 *** (5.52)					
IndSale_V	-		-0.495 (-0.76)				
IndResearch_G	+			0.025 (0.49)			
IndResearch_V	-				0.264 * (1.94)		
One_HHI	+					0.399 *** (4.10)	
D_IndSaleG	+	0.125 *** (2.58)					
D_IndSaleV	+		0.714 ** (2.08)				
D_IndRDIG	+			0.115 ** (2.46)			
D_IndRDIV	+				0.112 (0.72)		
D_OneHHI	+					0.020 ** (2.24)	
Board	+/-	-0.002 (-0.83)	-0.001 (-0.23)	-0.001 (-0.48)	-0.002 (-0.51)	-0.003 (-1.03)	
IndBoard	+	0.228 *** (8.30)	0.216 *** (7.86)	0.218 *** (7.95)	0.218 *** (7.95)	0.210 *** (7.67)	
BShare	+/-	-0.106 *** (-2.92)	-0.089 ** (-2.47)	-0.093 *** (-2.56)	-0.089 ** (-2.46)	-0.097 *** (-2.68)	
MgrShare	+	1.287 *** (4.17)	1.365 *** (4.41)	1.322 *** (4.24)	1.311 *** (4.23)	1.119 *** (3.55)	
S_mgrshare	-	-5.693 ** (-2.55)	-5.701 ** (-2.55)	-5.593 ** (-2.50)	-5.618 ** (-2.51)	-4.920 ** (-2.19)	
InstShare	+	0.305 *** (12.12)	0.313 *** (12.46)	0.309 *** (12.11)	0.302 *** (11.80)	0.291 *** (11.36)	
DebtRatio	-	-0.292 *** (-11.89)	-0.290 *** (-11.80)	-0.289 *** (-11.77)	-0.294 *** (-11.95)	-0.305 *** (-12.30)	
SalesG	+	0.330 *** (21.40)	0.340 *** (22.08)	0.339 *** (21.98)	0.338 *** (21.97)	0.338 *** (21.96)	
LagTobinQ	+	0.384 *** (75.17)	0.388 *** (76.18)	0.387 *** (76.17)	0.387 *** (76.16)	0.386 *** (75.93)	
Industry dummy	?	-0.017 (-1.11)	0.055 *** (5.57)	0.051 *** (5.15)	0.067 *** (6.09)	0.036 *** (3.40)	
Year dummy		Yes	Yes	Yes	Yes	Yes	
# of Obs.		9163	9163	9163	9163	9163	
Adj. R <sup>2</sup>		0.58	0.58	0.58	0.58	0.58	
F-value		585.00 ***	580.87 ***	581.20 ***	581.00 ***	582.79 ***	

This table shows the interaction between external environments and leadership structure on Tobin's q. The number in parentheses is the t-statistics\*\*, \*\*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definitions of variables.

#### **4.5 Additional test**

To test the moderating effect of corporate governance quality on the relationship between leadership structure and firm performance, this study builds a corporate governance index (*CGI*) referring to Chen et al. (2007). As shown in Table 12, *CGI* is significantly and positively associated with ROA and Tobin's q, respectively. The coefficients of interaction terms on *Duality* and *CGI* (*D\_CGI*) are significant and positive at 1% level though *Duality* is significantly negatively related to ROA and insignificantly related to Tobin's q, separately. Thus, the findings suggest that strong corporate governance can moderate the disadvantage of CEO power concentration, and therefore, enhance firm value.

**Table 12: The interaction between corporate governance and leadership structure on ROA and Tobin's q**

Variables	Predicted Sign	The depend variable is ROA		The depend variable is	
		Probit 2SLS	Simultaneous	Probit 2SLS	Simultaneous
Intercept	+/-	0.087 *** (6.14)	0.091 *** (6.47)	0.352 *** (3.63)	0.425 *** (4.41)
Duality	+	-0.068 *** (-7.17)	-0.079 *** (-7.62)	0.021 (0.33)	-0.137 * (-1.95)
CGI	+	0.002 ** (2.15)		0.029 *** (5.87)	
D_CGI	+		0.005 ** (2.44)		0.073 *** (5.01)
IndSale_G	+	0.056 *** (3.56)	0.057 *** (3.63)	0.641 *** (5.93)	0.658 *** (6.09)
IndSale_V	-	-0.344 *** (-3.33)	-0.345 *** (-3.34)	-0.512 (-0.72)	-0.521 (-0.73)
IndResearch_G	+	0.015 * (1.94)	0.015 ** (1.98)	-0.020 (-0.39)	-0.014 (-0.26)
IndResearch_V	-	-0.010 (-0.47)	-0.010 (-0.48)	0.396 *** (2.85)	0.394 *** (2.83)
One_HHI	+	-0.004 (-0.26)	-0.004 (-0.28)	0.375 *** (3.61)	0.375 *** (3.61)
Board	+/-	-0.003 *** (-5.82)	-0.003 *** (-6.07)	-0.002 (-0.74)	-0.004 (-1.37)
IndBoard	+	0.017 *** (4.18)	0.017 *** (4.17)	0.217 *** (7.92)	0.218 *** (7.94)
BShare	+/-	-0.001 (-0.24)	-0.002 (-0.31)	-0.070 * (-1.90)	-0.087 ** (-2.36)
MgrShare	+	0.077 * (1.67)	0.078 * (1.69)	1.041 *** (3.28)	1.031 *** (3.24)
S_mgrshare	-	-0.758 ** (-2.33)	-0.772 ** (-2.37)	-5.125 ** (-2.29)	-5.206 ** (-2.32)
InstShare	+	0.024 *** (6.13)	0.024 *** (6.17)	0.232 *** (8.63)	0.242 *** (9.03)
DebtRatio	-	-0.080 *** (-21.49)	-0.080 *** (-21.54)	-0.308 *** (-12.39)	-0.311 *** (-12.50)
SalesG	+	0.105 *** (47.08)	0.105 *** (47.07)	0.329 *** (21.35)	0.329 *** (21.28)
LagROA		0.450 *** (80.02)	0.451 *** (80.04)		
LagTobinQ	+			0.382 *** (74.91)	0.382 *** (74.86)
Industry dummy	?	-0.004 (-1.48)	-0.004 (-1.52)	-0.011 (-0.63)	-0.014 (-0.80)
Year dummy		Yes	Yes	Yes	Yes
# of Obs.		9163	9163	9163	9163
Adj. R <sup>2</sup>		0.63	0.63	0.59	0.59
F-value		592.98 ***	593.12 ***	499.65 ***	498.79 ***

This table shows the interaction between corporate governance and leadership structure on ROA and Tobin's q, respectively. The number in parentheses is the t-statistics\*\*, \*\*, and \* represent significance levels at 1%, 5%, and 10%, respectively. Please refer to Table 1 for the definitions of variables.

## 5. Conclusion

Using the 2SLS with an instrumental variable, this study investigates the relationship between leadership structure and firm performance, and particularly, the moderating effect of external competitions on the relationship. The mean and median different tests results reveal significant differences in the environmental variables, board size, ownership structure, and firm characteristics between the firms that adopt CEO duality and those that do not. The results for the first stage of estimation show that a firm's choice of leadership structure is endogenous and is influenced by its external environment, board of directors, and ownership structure. When firms are faced with a rapidly growing, they tend to adopt the dual-leadership structure to enhance adaptability and competitiveness to reduce the impact of environmental uncertainty. However, when the board is large or the shareholding ratios of directors, managers, and institutional investors are high, firms tend to avoid CEO duality to prevent CEOs from acquiring excessive power and to mitigate reduced board supervisory effect.

The second stage results show that CEO duality significantly and negatively correlates to ROA, whereas CEO duality has no significant impact on Tobin's q. ROA measures previous accounting performance (backing-looking), whereas Tobin's q discloses investors' perspective on future firm value (forward-looking). These results are in line with previous study findings. Notably, external competition environment has a significant and positive moderating effect on the relationship between CEO duality and Tobin's q, suggesting that dual-leadership structure improves future firm value when a firm faces with higher growth/dynamic market or competitive environment. Therefore, the relationship between dual-leadership structure and firm performance could be contingent on external competitive environments.

Dual-leadership structure may generate high agency costs. Financial supervisory agencies worldwide typically encourage firms to separate the role of board chair from that of the CEO. Notably, CEO duality facilitates power integration, improves decision-making efficiency, and overcomes potential agency problems, particularly in highly growth and competitive environments. Changing

external environment and competitive market are likely to serve as external supervision in moderating the influence of dual-leadership structure on firm performance. It might not need to force the distinction between the chairman and the CEO. Thus, the results can serve as a reference for firms to select an appropriate leadership structure to cope with their external environments and for financial governance agencies in developing related policies.

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