



# Diversity, outside directors and firm valuation: Korean evidence<sup>☆</sup>

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## ABSTRACT

This paper examines the relationship between the diversity of independent outside directors and the valuation of Korean firms after Korea's 1998 corporate-governance reforms. First, the study finds consistent positive relationships between firm valuation and the proportion of independent outside directors with government experience, but finds negative relationships between firm valuation and the proportion of independent outside directors who are accountants. Second, the study finds that the diversity of independent outside directors' academic majors or age has consistently positive effects on firm valuation. This result implies that not only the quantity but also the quality of independent outside directors affects the valuation of Korean companies.

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## 1. Introduction

The monitoring role of the board of directors and its effect on firm valuation is prevalent in corporate finance literature (Berle and Means, 1933; Jensen and Meckling, 1976; Fama and Jensen, 1985). However, the evidence of independent outside directors' monitoring role and their effect on firm value is still inconclusive both in U.S. and international studies (Hermalin and Weisbach, 2003; Denis and McConnell, 2003).

Recently, Choi et al. (2007) find that in Korea, after the country's 1998 corporate-governance reforms, the effect of independent outside directors on firm valuation is strongly positive. However, they argue that the effects depend on board composition as well as the nature of the markets in which a firm operates. In addition, another study finds evidence that independent outside directors in Korea actually have a weak monitoring role (Baek et al., 2006).

With a different perspective from previous literature, this paper provides evidence of the positive effect of independent outside directors on the valuation of Korean companies after the corporate-

governance reforms of 1998. The objective is to extend the knowledge of the relationship between independent outside directors and firm valuation by studying all the manufacturing firms listed on the Korea Stock Exchange. Doing so also contributes to the related literature on the effect of boards of directors on firm valuation.

Previous literature focuses on the effects of the *quantity* of independent outside directors, such as the number and proportion of independent outside directors, but the literature neglects the *quality* of these directors. Thus, this paper focuses on the effects of the quality (age, education, or industry experience) and diversity of independent outside directors on Korean companies. The Outside Director's Human Capital Database shows that many Korean companies have appointed independent outside directors with different age, education levels, and experience since the corporate-governance reforms of 1998.

The study uses Korean data because the independent outside directors of Korean firms have become a more diverse group since the corporate-governance reforms of 1998. The role of independent outside directors as monitors and their effects on firm valuation are weak in Korea (Baek et al., 2006) but strengthened after the corporate-governance reforms (Choi et al., 2007). This change is incentive to investigate the effects of other characteristics of independent outside directors on firm valuation. Finally, a significant difference exists in many Korean firms between shareholders with cash flow rights and shareholders with control rights, which leads to agency problems. Thus, the monitoring role of independent outside directors is very important, particularly when gray (or affiliated) independent outside directors have an incentive to maintain their affiliations at the potential expense of shareholder wealth (Byrd and Hickman, 1992).

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The study's main empirical results are as follows. First, consistent positive relationships exist between firm valuation and the education levels of independent outside directors after controlling for financial ratios, board size, and industry. Second, independent outside directors with government experience consistently have positive effects on firm valuation, but those who are accountants have consistently negative effects on firm valuation. Finally, the diversity of independent outside directors' academic majors has consistently positive effects on firm valuation.

The nature of corporate-governance reform in 1998 comes from the aftermath of the Asian financial crisis. Korean government, through the Securities Listing Regulations in February 1998, required all Korea Stock Exchange listed companies to have at least 25% of the board composed of outside directors. The reform expects outside directors to be independent. So, people expect the improved transparency and monitoring role of the board of directors from this reform. As we can see from [Appendix A](#), a great deal of diversity is found in Korea Stock Exchange firms since this reform is made public. As the reform focuses on independent outside directors, we also focus this study on independent outside directors. Also, we focus on Korea Stock Exchange listed companies because the reform required all Korea Stock Exchange listed companies to have certain proportion of outside directors within their board. Based on the related literature, and by using several different variables to categorize independent outside directors, two hypotheses follow.

**Hypothesis 1.** The education level, age or professional experience of independent outside directors on firm valuation is an empirical issue.

According to [Becker \(1993\)](#), human capital encompasses the knowledge, information, ideas, skills, and health of individuals; age and education reflect those characteristics. Although companies' increased emphasis on education explains the enormous rise in the market-price-to-book-value-of-assets ratio for publicly traded companies, the productivity of independent outside directors decreases after a certain age ([Leibenstein, 1957, 1958](#)). Also [Chun \(2006\)](#) argues that the education level of independent outside directors does not have any effect on IPO firm valuation in Korea.

Experience in a specific industry enables independent outside directors to access tacit knowledge of the opportunities, threats, competitive conditions, technology, and regulations. Experience can also help independent outside directors evaluate and guide management proposals for growth wisely ([Kor and Sundaramurthy, forthcoming](#)).

Independent outside directors with certain types of experience tend to take on certain roles. For example, [Agrawal and Knoeber \(2001\)](#) show that independent outside directors with backgrounds in politics, government, or law tend to play political roles in regulated firms. In addition, in countries with weak as well as strong legal systems, a positive correlation between the political connections of firm's board and the firm's valuation exists ([Faccio, 2006; Goldman et al., forthcoming](#)). However, in Korea, independent outside directors with government experience who manage affiliated firms that may have government-related projects tend to become very entrenched directors. Also, according to the 'Economic Reform Report' from [Solidarity for Economic Reform](#) in Korea, independent outside directors who have indirect relationships with its management is 37.5%, 35.44% or 32.09% in 2006, 2007 or 2008, respectively. The examples of the indirect relationship are high school alumni, former government officials related to firm's projects, former employees of subsidiary, former clients if independent outside directors are accountants or lawyers, and former executive students if they are professors.

Expertise in business or law enhances the efficiency of the advising role of independent outside directors for each firm. Similar empirical evidence exists regarding the management of firms conducting seasoned equity offerings ([Chemmanur et al., forthcoming](#)). Clearly, expertise in business, economics, or law can be a useful asset to the

firm. Thus, the education level, age or professional experience of independent outside directors on firm valuation is an empirical issue.

**Hypothesis 2.** The diversity of age, academic majors or professional experience among independent outside directors is positively correlated with firm valuation.

Diversity in the board structure embeds itself in the American enterprise system. For example, [Vance \(1978\)](#) argues that no two companies in his study had identical board structures and no single board follows the same boardroom blueprint today as it did a generation ago. In the field of economics, [Becker \(1993\)](#) argues that an individual's skill set and knowledge embed themselves in his or her age, education and experience. From the discussion in [Hypothesis 1](#), the relationship between age and firm valuation is an empirical issue because age has two different perspectives: productivity and experience. Young independent outside directors are productive, while old ones have experiences. If independent outside directors are diverse in terms of age within a board, productivity and experience can create a synergy. A more diverse board does help in a board's decision-making process through different perspectives and cognitive conflict, and in asserting board influence on management ([Kosnik, 1990; Westphal and Milton, 2000](#)). It also helps acquiring of critical resources for the organization ([Pfeffer, 1972; Pfeffer and Salancik, 1978](#)). Empirical evidence shows a positive relationship between board diversity and firm's activities or expected future cash flows ([Keys et al., 2003](#)). Further, [Kor and Sundaramurthy \(forthcoming\)](#) argue that independent outside directors' collective knowledge or experience positively affects the sales growth of the firm. In short, the more diverse the outside director's knowledge or experience is, the more the firm grows.

Some studies argue that board diversity may constrain prompt initiative to implement strategic changes in times of environmental turbulence ([Clegg, 1990; Powell, 1991; Goodstein et al., 1994](#)), facilitate inefficiencies and complexities in board work ([Jensen and Meckling, 1976; Adams and Ferreira, 2002](#)). Their argument stands on the basis of the fact that a conflict of interest arises from the trade-off between firm performance or valuation and board goals. Diverse group of people in the board hamper board goals even though that diversity can lead to an increased, or no effect on, firm performance or valuation. However, no empirical evidence, documenting the negative relationship between board diversity and firm performance or valuation, exists while evidences of positive relationship exist in the literature ([Carter et al., 2003; Krishnan and Daewoo, 2005; Auh and Menguc, 2006](#)). Related literature finds insignificant relationship between diversity within the boardroom ([Molz, 1988; Shrader et al., 1997; Kochan et al., 2003](#)) or outside the boardroom ([Moncrief et al., 2000](#)) and firm performance.

Thus, this study hypothesizes that the diversity of independent outside directors' academic majors, job experiences or age has relationships with firm valuation.

The rest of the paper proceeds as follows. [Section 2](#) describes the data and variable construction. [Section 3](#) discusses the empirical results. Finally, [section 4](#) concludes the paper by discussing the main findings.

## 2. Data and variable construction

### 2.1. Data

The data source for the characteristics of independent outside directors is from the Korea Companies Information TS2000 database in the Korea Listed Companies Association, or from the Repository of Korea's Corporate Filings on the Financial Supervisory Service website. When no relevant data from those two sources exists, the study refers to the KISline database of the Korea Information Service. The database provides the names, ages, education levels, and current or previous positions for independent outside directors of companies listed on the Korea Stock Exchange. Financial information comes from the TS2000

database, which provides all the financial information of firms listed on the Korea Stock Exchange or KOSDAQ (Korean Securities Dealers Automated Quotations).

Board size is from the KISline database, which provides ownership and board membership information. As mentioned in Section 1, the study only considers firms with independent outside directors. The term *outside directors* replaces *independent outside directors* for the rest of the paper because all outside directors in the sample are independent. The paper excludes financial firms from the sample, leaving a total of 593 firms and information spanning from 1999 to 2006. Remaining are 3039 firm–year observations. So, the study uses three data sources (TS2000 database, Repository of Korea's Corporate Filings and KISline database) to construct the sample and variables.

## 2.2. Variable construction

First, the study uses Tobin's  $q$  ( $Q_{i,t}$ ) as the dependent variable. The definition of  $Q_{i,t}$  in this paper is as follows.

$$Q_{i,t} = \frac{MV(Equity)_{i,t} + BV(Assets)_{i,t} - BV(Equity)_{i,t}}{BV(Assets)_{i,t}} \dots \quad (1)$$

where  $Q_{i,t}$ ,  $MV(Equity)_{i,t}$ ,  $BV(Assets)_{i,t}$ , and  $BV(Equity)_{i,t}$  represent Tobin's  $q$ , the market value of equity, the book value of assets, and the book value of equity for each firm  $i$  at year  $t$ , respectively. The paper calculates the market value of equity by multiplying the total number of common shares outstanding in fiscal year  $t$  by the stock price at the end of fiscal year  $t$  for each firm  $i$ .

Second, the study incorporates age and education measures of outside directors.  $Age_{i,t}$  is the average age of the outside directors for firm  $i$  at year  $t$ . The study calculates the average education level of the outside directors for firm  $i$  at year  $t$  ( $edu_{i,t}$ ). Then, the paper calculates  $edu_{i,t}$  by averaging the education levels of outside directors ( $edu1_{i,t}$ ,  $edu2_{i,t}$ ,  $edu3_{i,t}$  and  $edu4_{i,t}$ ) for firm  $i$  at year  $t$ .  $edu1_{i,t}$ ,  $edu2_{i,t}$ ,  $edu3_{i,t}$  or  $edu4_{i,t}$  represents the percentage of outside directors with an associate's degree or less, bachelor's degree, a master's degree or a doctorate degree, respectively.  $Outside_{i,t}$  is the ratio of total outside directors to the all directors.  $Manufacturing_{i,t}$  is that of total outside directors with manufacturing industry experience to all outside directors.  $Government_{i,t}$  is that of total outside directors with government experience to all outside directors.  $Financial_{i,t}$  is that of total outside directors with financial industry experience to all outside directors.  $Accountant_{i,t}$  is that of total outside directors who are accountants to all outside directors.  $Professor_{i,t}$  is that of outside directors who are professors to all outside directors.  $Lawyer_{i,t}$  is that of outside directors who are lawyers to all outside directors.

Based on the hypotheses, three diversity variables are as follows. First, the paper separates the outside directors into seven different categories according to their academic majors: business and economics, law, liberal arts and social sciences, basic science and engineering, medical and pharmacy, military, and arts and physical education, respectively. Then, the paper divides the number of outside directors in each category by the total number of outside directors for each firm and for each year. Finally, the study squares and adds the results up, and subtracts this sum from one.

Second, the outside directors divide themselves into eight categories according to their job experience: domestic and foreign manufacturing, government, domestic and foreign financial, accountant, professor, organization member, attorney (including patent attorney), and media and research institute. Then, the study divides the number of outside directors in each category by the total number of outside directors for each firm and for each year. Finally, the study squares and adds the results up, and subtracts this sum from one. If the firm has no outside directors or the outside directors don't fall into any of these categories, then the value equals zero. The formula below reflects the process.

Finally, the outside directors divide themselves into seven categories according to their age: 20–30, 30–40, 40–50, 50–60, 60–70, 70–80 and greater than 80 years old. Then, the paper divides the number of outside directors in each category by the total number of outside directors for each firm and for each year. Finally, the study squares and adds the results up, and subtracts this sum from one. If the firm has no outside directors or the outside directors don't fall into any of these categories, then the value equals zero.

$$\begin{aligned} summajor_{i,t} &= 1 - \left[ \sum_{j=1}^n \left( \frac{outmajor_j}{outtotal} \right)^2 \right]_{i,t} \\ sumjob_{i,t} &= 1 - \left[ \sum_{j=1}^n \left( \frac{outjob_j}{outtotal} \right)^2 \right]_{i,t} \quad sumage_{i,t} = 1 - \left[ \sum_{j=1}^n \left( \frac{outage_j}{outtotal} \right)^2 \right]_{i,t} \dots \end{aligned} \quad (2)$$

where  $\left[ \sum_{j=1}^n \left( \frac{outmajor_j}{outtotal} \right)^2 \right]_{i,t}$ ,  $\left[ \sum_{j=1}^n \left( \frac{outjob_j}{outtotal} \right)^2 \right]_{i,t}$  or  $\left[ \sum_{j=1}^n \left( \frac{outage_j}{outtotal} \right)^2 \right]_{i,t}$  are the

sum of the squared proportions of outside directors with major  $j$  to total outside directors, the sum of the squared proportions of outside directors with job experience  $j$  or the sum of the squared proportions of outside directors with age range  $j$  for firm  $i$  at year  $t$ , respectively. This measure is a modification of the widely used Hirschmann–Herfindahl Index (HHI) used to measure market concentration. Because the HHI is a concentration measure, higher  $summajor$ ,  $sumjob$  or  $sumage$  indicates more diversity in outside directors' majors, job experience or age.

Finally, control variables include firm-specific variables measuring profitability, operational or financial profiles, and board characteristics. Finance literature uses return on assets as a profitability measure because empirical evidence shows a positive relationship between return on assets and firm valuation. However, it does not have significant relationship with firm valuation in Korea based on Choi et al. (2007). So, the paper expects an insignificant relationship between return on assets and firm valuation. The research-and-development-to-total assets ratio and the advertising-expense-to-total-assets ratio are proxies for intangible assets as in Dunning (1980). Empirical evidence shows a positive relationship with firm valuation. The capital-expenditures-to-total-assets ratio is a proxy for a firm's investment intensity and McConnell and Muscarella (1985) show a positive relationship with firm valuation. The long-term-debt-to-total-assets ratio measures a firm's financial risk. The expected relationship between the long-term-debt-to-total-assets ratio and firm valuation is negative as in Morck et al. (1998). The log of total assets is a proxy for firm size, which Choi et al. (2007) shows a negative relationship with firm valuation. However, the negative relationship is insignificant in Morck et al. (1988). Previous literatures frequently use these profitability, operational, or financial variables (Morck et al., 1988; McConnell and Servaes, 1995; Choi et al., 2007). The effect of board size on firm valuation is different among the countries in the literature, so the study includes board size as a control variable. The effect is negative in the United States (Morck et al., 1988), while it is positive in Korea (Choi et al., 2007). The detailed description of control variables is in Appendix B.

## 3. Empirical results

### 3.1. Summary statistics

Table 1 shows the summary statistics for 593 firms with data from 1999 to 2006. The average  $Q$  is 0.89 (median, 0.79). The average  $age$  is 56.44 (median, 56.96). The average  $edu$  is 0.76 (median, 1). As we can see from the number of outside directors with bachelor's degree ( $edu2$ ), roughly half of outside directors receive bachelor's degree. The average  $manufacturing$  and  $financial$  is 0.28 (median, 0) and 0.13 (median, 0), respectively, suggesting that Korean firms tend to have

**Table 1**

Summary statistics: overall sample.

	<i>N</i>	Mean	Median	Standard deviation	Minimum	Maximum
<i>Panel A: dependent variable</i>						
<i>Q</i>	3039	0.89	0.79	0.44	0.25	5.60
<i>Panel B: explanatory variables</i>						
<i>age</i>	3037	56.44	56.96	7.99	29	86.58
<i>edu</i>	3035	0.76	1	0.27	0.11	1
<i>edu1</i>	87	0.59	0.5	0.25	0.25	1
<i>edu2</i>	1670	0.79	1	0.26	0.11	1
<i>edu3</i>	672	0.67	0.5	0.28	0.14	1
<i>edu4</i>	625	0.77	1	0.28	0.13	1
<i>outside</i>	3039	0.27	0.25	0.12	0.07	0.77
<i>manufacturing</i>	3039	0.28	0	0.39	0	1
<i>government</i>	3039	0.16	0	0.29	0	1
<i>financial</i>	3039	0.13	0	0.27	0	1
<i>accountant</i>	3039	0.08	0	0.22	0	1
<i>professor</i>	3039	0.19	0	0.32	0	1
<i>lawyer</i>	3039	0.07	0	0.20	0	1
<i>summajor</i>	3039	0.28	0.32	0.29	0	0.97
<i>sumjob</i>	3039	0.28	0.38	0.29	0	0.89
<i>sumage</i>	3039	0.24	0	0.25	0	0.75
<i>Panel C: control variables</i>						
<i>roa</i>	3039	0.07	0.07	0.09	−0.66	0.39
<i>lta</i>	3039	19.30	19.06	1.45	16.15	24.05
<i>dta</i>	3039	0.20	0.19	0.14	0	0.64
<i>rdta</i>	3039	0.0007	0	0.003	0	0.03
<i>advertisingta</i>	3039	0.008	0.001	0.02	0	0.12
<i>capex</i>	3039	0.04	0.02	0.05	0	0.31
<i>bsize</i>	3039	7.44	7	2.47	3	21

The dependent variable is Tobin's *q* (*Q*). Explanatory variables are the average age of outside directors (*age*), the average percentage education level of outside directors (*edu*) (*Edu* is divided into four categories: the percentage of outside directors with associate degree or less (*edu1*), that of outside directors with undergraduate degree (*edu2*), that of outside directors with master's degree (*edu3*) and that of outside directors with doctoral degree (*edu4*), the ratio of outside directors to total directors (*outside*), the ratio of outside directors who have experience in the manufacturing industry to total outside directors (*manufacturing*), the ratio of outside directors who have government experience to total outside directors (*government*), the ratio of outside directors who have experience in the financial industry to total outside directors (*financial*), the ratio of outside directors who are accountants to total outside directors (*accountant*), the ratio of outside directors who are professors to total outside directors (*professor*), the ratio of outside directors who are lawyers to total outside directors (*lawyer*), the diversity of outside directors' academic majors (*summajor*), the diversity of outside directors' job experiences (*sumjob*) and the diversity of outside directors' age (*sumage*) from the modification of Hirschmann–Herfindahl Index. Control variables are as follows. *roa*, *bsize*, *rdta*, *advertisingta*, *capex*, *dta*, and *lta* represent return on assets, board size, research-and-development-to-total-assets ratio, advertising-expense-to-total-assets ratio, capital-expenditures-to-total-assets ratio, long-term-debt-to-total-assets ratio, and the log of total assets, respectively. *N* represents the total number of firm–year observations for each variable (593 firms, 1999–2006).

**Table 2**

Correlation table.

	<i>log(age)</i>	<i>log(1 + edu)</i>	<i>outside</i>	<i>manufacturing</i>	<i>government</i>	<i>financial</i>	<i>accountant</i>	<i>professor</i>	<i>lawyer</i>	<i>summajor</i>	<i>sumjob</i>	<i>sumage</i>
<i>Panel A: explanatory variables</i>												
<i>log(age)</i>	1.00											
<i>log(1 + edu)</i>	−0.04	1.00										
<i>outside</i>	−0.02	−0.45	1.00									
<i>manufacturing</i>	0.03	0.13	−0.12	1.00								
<i>government</i>	0.17	−0.09	0.08	−0.29	1.00							
<i>financial</i>	0.09	0.05	0.02	−0.23	−0.14	1.00						
<i>accountant</i>	−0.12	0.06	−0.06	−0.19	−0.14	−0.12	1.00					
<i>professor</i>	−0.14	−0.16	0.12	−0.32	−0.16	−0.20	−0.15	1.00				
<i>lawyer</i>	−0.18	0.00	0.01	−0.20	−0.12	−0.11	−0.06	−0.07	1.00			
<i>summajor</i>	0.02	−0.46	0.48	−0.03	0.07	−0.04	−0.08	0.02	0.08	1.00		
<i>sumjob</i>	0.06	−0.57	0.54	−0.22	0.04	0.02	−0.02	0.05	0.09	0.60	1.00	
<i>sumage</i>	−0.04	−0.47	0.38	−0.04	−0.01	−0.03	−0.03	0.08	0.03	0.46	0.50	1.00
<i>roa</i>	0.11	−0.10	0.01	−0.03	0.06	−0.06	0.01	0.03	0.01	0.06	0.07	0.07
<i>lta</i>	0.18	−0.43	0.53	−0.18	0.14	0.03	−0.09	0.14	−0.03	0.31	0.39	0.35
<i>dta</i>	0.00	0.01	0.06	0.02	0.03	0.11	−0.04	0.00	−0.11	−0.03	−0.04	−0.01
<i>rdta</i>	−0.04	−0.03	0.06	−0.01	−0.01	0.00	−0.03	0.07	−0.04	0.02	0.02	−0.02
<i>advertisingta</i>	−0.03	−0.02	−0.02	−0.02	0.00	−0.07	0.00	0.05	0.03	0.00	0.02	0.08
<i>capex</i>	0.00	−0.02	0.05	−0.02	−0.05	0.02	0.00	0.04	0.00	−0.03	0.02	−0.01
<i>lsize</i>	0.07	−0.52	0.14	−0.03	0.04	0.00	−0.09	0.06	0.02	0.53	0.52	0.52
	<i>roa</i>		<i>lta</i>		<i>dta</i>		<i>rdta</i>		<i>advertisingta</i>		<i>capex</i>	<i>lsize</i>
<i>Panel B: control variables</i>												
<i>roa</i>	1.00											
<i>lta</i>	0.21	1.00										
<i>dta</i>	−0.25	0.04	1.00									
<i>rdta</i>	−0.04	0.01	−0.03	1.00								
<i>advertisingta</i>	0.19	0.03	−0.12	−0.01	1.00							
<i>capex</i>	0.10	0.00	0.02	0.00	0.01	1.00						
<i>lsize</i>	0.13	0.44	−0.06	−0.06	0.09	−0.01	1.00					



more outside directors with manufacturing experience than with financial-industry experience. The data also suggest that Korean firms prefer outside directors with government experience to those with experience in the financial industry (the average government is 0.16 (median, 0)). The average *accountant* is 0.08 (median, 0), but the average *professor* is 0.19 (median, 0), suggesting that outside directors who are accountants are less common than those who are professors. The average *lawyer* is 0.07 (median, 0), which indicates that outside directors with legal backgrounds are the least common within the sample. The average *summajor* is 0.28 (median, 0.32), and the average *sumjob* is 0.28 (median, 0.38), which suggests that the outside directors' academic majors are as diverse as their job experience. The median is higher for the job experience variable, but in general, the difference in the diversity of academic majors and job experience is small within the sample. The average *sumage* is 0.24 (median, 0). The diversity of age among outside directors is lower than that of *summajor* or *sumjob*. Also, as we can see from the median value, no age diversity of outside directors is found for many firms within the sample. The average *bsize* is 7.44 (median, 7), which is lower than that of U.S. firms documented in Yermack (1996), where the mean was 12.25 (Table 2).

### 3.2. Random-effects estimation with robust standard error: age, education level, job experience, and board experience of outside directors

The correlation between *summajor* and *sumjob* is 60%. Thus, the study runs separate regressions for these variables. The paper performs

the random-effects estimation of panel data with robust standard errors as in Wooldridge (2002), which shows statistical evidence of the presence of random effects via the Lagrangian Multiplier test as in Breusch and Pagan (1980). The Chi-squared test statistic rejects the null hypothesis of no unit-specific unobserved effect suggesting that a unit-specific error component for each regression equation exists. The baseline random-effects model is as follows.

$$Q_{i,t} = \alpha_{i,t} + \beta_1 * outside_{i,t} + \beta_2 * roa_{i,t} + \beta_3 * lta_{i,t} + \beta_4 * dta_{i,t} + \beta_5 * rdt_{i,t} + \beta_6 * adverti_{i,t} + \beta_7 * capex_{i,t} + \beta_8 * lsize_{i,t} + \gamma * inddummy_{i,t} + c_i + u_{i,t} \dots \quad (3)$$

where *lsize*<sub>*i,t*</sub> equals the natural log of board size. *inddummy*<sub>*i,t*</sub> is the industry dummy variable.  $\alpha_{i,t}$  is a constant.  $c_i$  is a unit-specific error component.  $u_{i,t}$  is the remaining error component. Subscript *i* and *t* refer to each firm *i* in year *t*. From the baseline random-effects model, the study adds the natural logarithms of *age* and *educ*. We also include the squared term of *age* (*age*<sup>2</sup>) to control for the nonlinear feature of *age*. The study also adds *manufacturing*, *government*, *financial*, *accountant*, *professor*, and *lawyer* to see the separate effects of outside directors with different job experiences. Finally, the study adds *summajor*, *sumjob* or *sumage*. The study winsorizes the financial variables at the upper and lower 0.5% level before performing the regression analyses.

The main results of the random-effects estimation of the panel data with robust standard errors and without *summajor*, *sumjob* or *sumage* are as follows. In regression (1), the study evaluates whether the presence of outside directors has a positive effect on firm valuation.

**Table 3**  
Random-effects estimation with robust standard error: the age, education level, job experience, and board experience of outside directors.

Dependent variable: Q	Regression (1)	Regression (2)	Regression (3)	Regression (4)	Regression (5)	Regression (6)	Regression (7)	Regression (8)
log( <i>age</i> )	−0.59 (−1.52)	−0.59 (−1.50)	−0.64 (−1.64)	−0.55 (−1.41)	−0.67 (−1.73)*	−0.57 (−1.44)	−0.56 (−1.39)	−0.62 (−1.51)
<i>age</i> <sup>2</sup>	0.0001 (1.43)	0.0001 (1.41)	0.0001 (1.49)	0.0001 (1.35)	0.0001 (1.58)	0.0001 (1.39)	0.0001 (1.38)	0.0001 (1.47)
log(1 + <i>edu</i> )	0.04 (0.59)	0.04 (0.59)	0.04 (0.63)	0.05 (0.76)	0.04 (0.61)	0.05 (0.70)	0.04 (0.62)	0.06 (0.87)
<i>outside</i>	0.54 (5.02)***	0.54 (5.01)***	0.54 (5.02)***	0.55 (5.12)***	0.53 (4.96)***	0.54 (5.11)***	0.54 (5.03)***	0.55 (5.16)***
<i>manufacturing</i>		−0.003 (−0.09)						0.02 (0.63)
<i>government</i>			0.09 (3.05)***					0.09 (2.38)**
<i>financial</i>				−0.06 (−2.65)***				−0.02 (−0.69)
<i>accountant</i>					−0.15 (−3.61)***			−0.10 (−2.27)**
<i>professor</i>						0.04 (1.28)		0.05 (1.26)
<i>lawyer</i>							0.10 (1.03)	0.11 (1.15)
<i>roa</i>	−0.07 (−0.49)	−0.07 (−0.49)	−0.07 (−0.50)	−0.08 (−0.52)	−0.07 (−0.48)	−0.07 (−0.51)	−0.07 (−0.49)	−0.08 (−0.52)
<i>lta</i>	−0.01 (−0.67)	−0.01 (−0.69)	−0.01 (−0.77)	−0.01 (−0.68)	−0.01 (−0.65)	−0.01 (−0.78)	−0.01 (−0.71)	−0.01 (−0.87)
<i>dta</i>	−0.20 (−2.50)**	−0.20 (−2.50)**	−0.20 (−2.49)**	−0.19 (−2.39)**	−0.20 (−2.54)**	−0.20 (−2.48)**	−0.19 (−2.44)**	−0.19 (−2.38)**
<i>rdta</i>	15.05 (5.33)***	15.06 (5.33)***	15.13 (5.38)***	15.05 (5.35)***	14.74 (5.28)***	14.93 (5.32)***	15.06 (5.35)***	14.75 (5.34)***
<i>advertisingta</i>	2.54 (2.52)**	2.54 (2.51)**	2.56 (2.52)**	2.52 (2.50)**	2.59 (2.56)**	2.53 (2.50)**	2.56 (2.52)**	2.58 (2.53)**
<i>capex</i>	0.40 (2.29)**	0.40 (2.29)**	0.41 (2.36)**	0.40 (2.32)**	0.40 (2.28)**	0.40 (2.26)**	0.40 (2.30)**	0.41 (2.35)**
<i>lsize</i>	0.13 (2.59)***	0.13 (2.60)***	0.13 (2.64)***	0.14 (2.65)***	0.12 (2.39)**	0.13 (2.64)***	0.13 (2.60)***	0.13 (2.58)***
R-squared	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14
Sample size	3033	3033	3033	3033	3033	3033	3033	3033
LM test statistic ( <i>X</i> <sup>2</sup> )	933.22***	932.95***	941.54***	935.46***	939.83***	926.05***	930.38***	938.06***

The results of random-effects estimation of panel data with robust standard errors are provided. A total of 3033 firm–year observations, including 593 firms from 1999 to 2006, are used in the regression analysis. The definitions of variables are the same as in Table 1. The regression coefficients of industry group dummies are not reported in the regression. LM test statistic (*X*<sup>2</sup>) represents Lagrangian Multiplier test statistic of random effects as in Breusch and Pagan (1980). The chi-squared test statistic is presented. Z-statistics are in parentheses. \*, \*\*, and \*\*\* represent 1, 5, and 10% significance level, respectively.

Consistent with the related literature (e.g., Choi et al., 2007), *outside* has a positive relationship with *Q* within the 1% significance level after controlling for financial or operating ratios, board size, and industry group dummies. One standard deviation increase in *outside* increases *Q* by 4%. This result is not consistent with Yermack (1996), which argues that no statistical relationship between the percentage of outside directors and firm valuation exists.

The *edu* variable does not have any correlation with *Q* in all the regressions. The result is consistent with Chun (2006). The education level of independent outside directors does not affect firm valuation in Korea. Also, *age* has an insignificant relationship with *Q*, though *age* may act as proxy for the activity level of outside directors. Because activity level decreases with age, *age* can thus have a negative effect on firm valuation. On the other hand, *age* is also a proxy for experience. Because experience increases with age, *age* can also have a positive effect on firm valuation. Thus, the insignificance of *age* on firm valuation may actually be the effect of the two factors canceling each other out.

*Government* has a positive relationship with *Q*, but *financial* and *accountant* have negative relationships with *Q*. Outside directors with government experience appear to have positive effects on firm valuation, but those with financial industry experience or those who are accountants have negative effects on firm valuation. The results are consistent with Hypothesis 1. However, when including *manu-*

*facturing*, *government*, *financial*, *accountant*, *professor*, and *lawyer*, the effect of *financial* on *Q* disappears. One standard deviation increase in *government* increases *Q* by 2.4% in regression (3) and increases *Q* by 1.9% in regression (8). One standard deviation increase in *financial* decreases *Q* by 2.1% in regression (4). Finally, one standard deviation increase in *accountant* decreases *Q* by 2.9% in regression (5) and decreases *Q* by 1.8% in regression (8). The negative relationship between *financial* or *accountant* and *Q* is interesting. According to 'Economic Reform Report', outside directors who are accountants or ones with financial industry experience have an indirect relationship with the management of affiliated firms. For example, outside directors worked at a bank which has a primary lending relationship to the affiliated firms. Also, outside directors are partners at accounting firms whose previous or potential customers are the affiliated firms. So, the possibility of outside directors being entrenched with affiliated firms is high. The result of control variables is consistent with the predictions.

### 3.3. Random-effects estimation with robust standard error: the diversity of academic major and job experience of outside directors

Table 4 provides the results of random-effects estimation of panel data with robust standard errors including diversity measures.

**Table 4**  
Random-effects estimation with robust standard errors: diversity of major and job experience of outside directors.

Dependent variable: <i>Q</i>	Regression (1)	Regression (2)	Regression (3)	Regression (4)
<i>log(age)</i>	−0.66 (−1.70)*	−0.55 (−1.41)	−0.70 (−1.70)*	−0.61 (−1.48)
<i>age</i> <sup>2</sup>	0.0001 (1.61)	0.0001 (1.31)	0.0001 (1.66)*	0.0001 (1.41)
<i>log(1 + edu)</i>	−0.001 (−0.02)	−0.03 (−0.39)	0.01 (0.21)	−0.01 (−0.07)
<i>manufacturing</i>			0.03 (0.77)	0.03 (0.75)
<i>government</i>			0.10 (2.57)***	0.10 (2.64)***
<i>financial</i>			−0.01 (−0.33)	−0.01 (−0.41)
<i>accountant</i>			−0.10 (−2.17)**	−0.11 (−2.30)**
<i>professor</i>			0.05 (1.35)	0.05 (1.19)
<i>lawyer</i>			0.10 (1.07)	0.11 (1.15)
<i>summajor</i>	0.12 (3.27)***		0.12 (3.17)***	
<i>sumjob</i>		0.02 (0.60)		0.03 (0.97)
<i>sumage</i>	0.08 (2.22)**	0.10 (2.64)***	0.09 (2.39)**	0.11 (2.73)***
<i>roa</i>	−0.09 (−0.62)	−0.09 (−0.63)	−0.10 (−0.65)	−0.09 (−0.64)
<i>lta</i>	0.01 (0.41)	0.01 (0.38)	0.003 (0.22)	0.003 (0.19)
<i>dta</i>	−0.22 (−2.67)***	−0.21 (−2.57)***	−0.21 (−2.57)***	−0.20 (−2.46)**
<i>rdta</i>	15.10 (5.34)***	15.42 (5.47)***	14.81 (5.35)***	15.14 (5.48)***
<i>advertisingta</i>	2.49 (2.45)**	2.51 (2.47)**	2.53 (2.47)**	2.55 (2.50)**
<i>capex</i>	0.40 (2.32)**	0.40 (2.28)**	0.42 (2.38)**	0.41 (2.35)**
<i>lbsize</i>	0.02 (0.52)	0.06 (1.17)	0.02 (0.47)	0.05 (1.02)
<i>R-squared</i>	0.11	0.11	0.12	0.12
<i>Sample size</i>	3033	3033	3033	3033
<i>LM test statistic (X<sup>2</sup>)</i>	993.60***	979.80***	993.30***	978.46***

The results of random-effects estimation of panel data with robust standard errors including diversity measures (*summajor*, *sumjob* and *sumage*) are presented. A total of 3033 firm-year observations including 593 firms from 1999 to 2006, are used in the regression analysis. The definitions of variables are the same as in Table 1. The regression coefficients of industry group dummies are not reported in the regression. The LM test statistic ( $X^2$ ) represents the Lagrangian Multiplier test statistic of random effects as in Breusch and Pagan (1980). The chi-squared test statistic is presented. Z-statistics are in parentheses. The \*, \*\*, and \*\*\* represent the 1, 5, and 10% significance level, respectively.

Generally, the regression results for *age*, *edu*, *manufacturing*, *government*, *financial*, *accountant*, *professor*, and *lawyer* are consistent with those in Table 3. For control variables, the results are consistent with those in Table 3, except for *lsize*. The study also runs the same regressions without *lsize* (not reported) with similar results. *Summajor* or *sumage* has consistent positive effects on *Q*, which is consistent with Hypothesis 2; *Sumjob* has an insignificant effect on *Q*. One standard deviation increase in *summajor* increases *Q* by 2.6% in regression (1) and increases *Q* by 2.5% in regression (3). One standard deviation increase in *sumage* increases *Q* by 1.8%, 2.1%, 1.9% or 2.2% in each regression. These results imply that the diversity of outside directors' academic majors and age add value to Korean firms (Table 4).

#### 4. Conclusion

The major contribution of this paper is to investigate the *quality* (age, education or industry experience) and *diversity* (academic majors and job experience) of independent outside directors and its effect on firm valuation in Korea. This study is the first one to look at the relationship between them for Korean firms.

Consistent with previous literature, the study finds that the proportion of outside directors on a board has a positive effect on firm valuation. Also, outside directors with government experience have positive effects on firm valuation, but accountants and those with financial experience have negative effects on firm valuation. The result is consistent with Hypothesis 1. The diversity of the outside directors' academic majors or age has a consistent positive effect on firm valuation. The result is consistent with Hypothesis 2.

Also, this study provides several implications for US firms. For example, the role of outside directors in US firms has changed since post-Enron period. However, no study investigates the relationship between the diversity of outside directors and firm valuation in terms of academic majors, professional experience or age.

#### Appendix A

The distribution table of outside directors of Korean firms by age, education level and occupation in 2005.

Categories	Percentage
<b>Panel A: Occupation</b>	
Entrepreneur	53.7
Professor	20.3
Accountant/tax specialist	14
Lawyer	7.3
Other	4.7
<b>Panel B: Age</b>	
30	0.2
40	14.7
50	31.3
60	49.1
70	4.6
80	0.1
<b>Panel C: Education</b>	
Ph.D.	27
Masters	36.4
Undergraduate	35.8
Other	0.7
Total	100

Source: outside director's human capital database, website: <http://www.outside-director.or.kr>.

#### Appendix B

Variable descriptions.

Definitions	Descriptions
<b>Panel A: dependent variable</b>	
<i>Q</i>	The market value of common stock and book value of preferred stock and total debts, divided by the book value of total assets for each firm and year
<b>Panel B: explanatory variables</b>	
<i>age &amp; edu</i>	The average age and education level of outside directors for each firm and year.
<i>outside</i>	The ratio of independent outside directors, those who do not have current or potential business ties to the firms, to total directors for each firm and year.
<i>manufacturing</i>	The ratio of outside directors who have experiences in manufacturing industry to total outside directors for each firm and year.
<i>government</i>	The ratio of outside directors who have government experiences to total outside directors for each firm and year.
<i>financial</i>	The ratio of outside directors who have experiences in financial industry to total outside directors for each firm and year.
<i>accountant</i>	The ratio of outside directors who are accountants to total outside directors for each firm and year.
<i>professor</i>	The ratio of outside directors who are professors to total outside directors for each firm and year.
<i>lawyer</i>	The ratio of outside directors who are attorneys to total outside directors for each firm and year.
<i>summajor</i>	The diversity of outside directors' majors from the modification of Hirschman–Herfindahl Index for each firm and year.
<i>sumjob</i>	The diversity of outside directors' job experiences from the modification of Hirschman–Herfindahl Index for each firm and year.
<i>sumage</i>	The diversity of outside directors' age from the modification of Hirschman–Herfindahl Index for each firm and year.
<b>Panel C: control variables</b>	
<i>roa</i>	The ratio of earnings before interest, tax, depreciation and amortization (EBITDA) to total assets in Korean won for each firm and year.
<i>lta</i>	The natural log of the total assets in Korean won for each firm and year.
<i>dta</i>	The ratio of long-term debts to total assets in Korean won for each firm and year.
<i>rdta</i>	The ratio of research and development expenses to total assets in Korean won for each firm and year.
<i>advertisingta</i>	The ratio of advertising expenses to total assets in Korean won for each firm and year.
<i>capex</i>	The ratio of capital expenditure to total assets in Korean won for each firm and year.
<i>bsize</i>	The number of directors within the board.

The sample consists of 593 firms spanning from 1999 to 2006, measured at the end of each year. Sources: The Korea Stock Exchange, the Financial Supervisory Service, the Korea Listed Companies Association and the Korea Information Service.

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