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# The Relationship between Ownership Control Disparity and Firm Value: Empirical Evidence from High-Technology Firms in Korea\*

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## Abstract

We investigate the relationship between ownership control disparity and future firm value in high-technology industries, and whether the effect of ownership control disparity on future firm value is differentiated when high-tech industry firms belong to chaebol groups. Using 11,848 firm-year observations of Korean firms listed on the stock market from 2006 to 2019, we employ univariate analysis and Heckman 2 stage analysis to test our hypotheses. We define high-technology industries as ICT industries based on the Korean Standard Industrial Classification. We measure future firm value using average Tobin's  $q$  for the next three years and ownership control disparity using the shareholding ratio of affiliated companies. Our univariate test results show that mean of Tobin's  $q$  is higher in ICT firms than non-ICT firms and firms largely owned by affiliates. In multivariate test, we find that the ICT firms with higher ownership control disparity are positively associated with future firm value. However, this association is lessened when firms belong to a chaebol group. Based on our findings, we suggest ownership control disparity has an additional positive effect on future firm in high-technology industries. The negative impact of chaebol groups on the association suggests the possibility of diversification discount in business group.

**Keywords:** Ownership Control Disparity, High Technology Industry, Firm Value, Chaebol

**JEL Classification Code:** M41, F65, G30

## 1. Introduction

Many studies suggest that ownership control disparity – the difference between the cash flow and control rights of the controlling shareholder – negatively affects firm value. The separation between control and cash flow rights produces a conflict of interest between the controlling owner and the minority shareholders. Controlling owners can expropriate the wealth of minority shareholders and have an incentive to report based on self-interest, rather than shareholders' interests, to facilitate private benefits (Fan & Wong, 2002).

However, maintaining the owner's control may be positive when firms are in the market vulnerable to a hostile and unpredictable hazard, and when firms operate to achieve long-term value maximization (Bertrand & Schoar, 2006). In this sense, firms in high-technology industries that try to implement long-term strategies can be benefited by the strong ownership of controlling shareholders (Byun, 2018).

Moreover, raising capital without threatening the controlling owners is difficult in high-technology industries. Equity financing is likely to be utilized for firms in these industries because equity holders favor risk, unlike risk-averse bondholders. This difficulty of financing without share dilution for the controlling shareholders leads to a structure that permits the protection of controlling owners' control rights. Controlling owners in technology companies in Silicon Valley insist that this structure is required to survive in a highly uncertain and risky innovative industry (Howell, 2017).

In this study, we investigate whether the effect of ownership control disparity on future firm value varies between industries – specifically the information, communication, and technology (ICT) and non-ICT industries – in Korea. We conjecture that ownership control disparity may not reduce

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future firm value in high-technology industries. This is because it might be more effective to show entrepreneurship via the implementation of a long-term strategy when the controlling owner has power over a firm, even more so in risky innovative industries.

Furthermore, we examine whether the positive effect of ownership control disparity on future firm value is reduced when the firms belong to chaebol groups in high-technology industries, since chaebol groups, which have many subsidiaries and affiliates, suffer from diversification discount (Ferris, Kim, & Kitsabunnarat, 2003). The diversification discount of chaebol firms is emerged from subsidizing unprofitable segments (Rajan, Sarvaes, & Zingales, 2000; Stein, 1997). The ownership structure of chaebol groups giving controlling shareholders full control over the whole group may exist or even foster inefficient resource allocation in unrelated industries for the sake of controlling owners' wealth. Therefore, for ICT firms in chaebol groups, ownership control disparity may not necessarily increase firm value.

We test our hypotheses using Korean firms because the problem of separation between ownership and control is pronounced in Korea. Because a dual-class stock structure that guarantees the control rights of owners is not permitted, Korean firms alternatively use the cross-holding and pyramid structures, which allow controlling shareholders to maintain control of the firm with low equity investment, resulting in a disparity between ownership and control (Claessens, Djankov, & Lang, 2000). Although Korea's regulator monitors the complicated structure and transactions involved with affiliates, ownership control disparity is severe in Korean business groups.

Using 11,848 firm-year observations of Korean firms listed on the stock market from 2006 to 2019, we provide evidence that there is a more positive association between ownership control disparity and future firm value in ICT industries. These results reveal a positive effect of maintaining the control rights of controlling owners to implement a long-term strategy and displaying entrepreneurship in highly uncertain high-technology firms, rather than a negative effect of facilitating an incentive to pursue the private benefits of controlling owners. Moreover, we find that the positive association between ownership control disparity and future firm value in ICT industries weakens when firms belong to chaebol groups. We interpret that these results come from diversification in unrelated industries of chaebol groups.

We make several important contributions to the business and accounting literature. First, our findings provide empirical evidence that the effects of ownership control disparity on firm value differ across industries. This study highlights the positive side of securing the owner's control for firm value maximization. Furthermore, our findings are meaningful because high-technology firms are increasingly

adopting structures to induce ownership control disparity based on the positive effect of strengthening the control rights of owners.

The rest of the study is organized as follows. Section 2 reviews prior studies and develops our hypotheses. Section 3 presents our research methods and sample selection process. Section 4 shows the results of our empirical analyses. Finally, Section 5 presents the conclusions of this study.

## 2. Literature Review and Hypothesis Development

### 2.1. Effect of Ownership Structure on Future Firm Value in High-technology Industries

Majority owners who strengthen their control through cross-shareholdings or a pyramid firm ownership structure are easy to find in East Asia (Claessens et al. 2000; Kanthapanit & Kanthapanit, 2020; La Porta, Lopez-de-Silanes, & Shleifer, 1999). Controlling shareholders often have significant control rights over firms in excess of their cash flow rights, particularly through pyramid structures in Korea (Han, Kang, & Shin, 2016; Polwittoon & Tawatnuntachai, 2020; Shin 2016).

Prior research on the agency problems between the ultimate owners and minority shareholders has shown that these majority shareholders, with control rights in excess of their cash flow rights, have an incentive to reduce minority shareholders' wealth to maximize their private benefits (Masulis, Wang, & Xie, 2009). Furthermore, this majority shareholders' incentive leads to a negative effect on firm value (Fan & Wong, 2002; Kim & Yi, 2006). Fan and Wong (2002) examine the relationships between earnings informativeness and the ownership structure of companies in East Asia. The authors' find that concentrated ownership, and the associated pyramidal and cross-holding structures create an agency problem between controlling owners and minority shareholders. They suggest that controlling owners are perceived to report accounting information for self-interested purposes, causing the reported earnings to lose credibility among outside investors. Kim and Yi (2006) investigate whether the deviation of controlling shareholders' control from ownership affects the extent of earnings management in Korea. They find that when ownership control disparity increases, controlling shareholders tend to engage more in opportunistic earnings management to hide their behavior.

However, other studies suggest that ownership control disparity may not have a negative effect on firm value in high-technology industries. High-technology firms have untraditional environments due to the ambiguous, unique, and uncertain nature of innovation (Gupta & Singh, 2015). In these industries, many leaders exert innovative leadership

to effectively cope with their highly competitive and technologically advanced environments because innovations can take years before they are transformed from scientific knowhow into the desired outputs (Hwang & Park, 2015). Hence, long-term perspectives are required for success, and innovative leadership is particularly important in high-technology industries (Byun, 2018). Implementing a long-term strategy for new and uncertain high-technology businesses requires leaders who show entrepreneurship and attract stable, long-term shareholders. Therefore, securing controlling shareholders, who are stable and long-term, is important for attaining long-term value maximization in an unpredictable environment. This is because minority shareholders are usually interested in short-term firm performance (Bertrand & Schoar, 2006).

Concerning financial management, firms in high-technology industries cannot easily raise capital from the external capital market without threatening the control rights of controlling owners. Firm valuation is difficult since these firms face uncertain, risky environments. Hall (2010) shows that investments in these firms usually consist of research and development (R&D) spending. This research suggests that the important feature of R&D investment is the degree of uncertainty associated with its output. Although high-technology firms such as Microsoft, Google, and Facebook are characterized by very high returns on the initial investment, many similar start-ups fail in the market. Moreover, information between the firm and the capital market is asymmetric in these industries. The risk premium for R&D and innovation is higher than that for ordinary investments because investors have more difficulty distinguishing good projects from bad ones when the projects are long-term R&D investments, than when they are short-term or low-risk projects (Leland & Pyle, 1977).

Therefore, high-technology firms are therefore exposed to the risk of dilution of shares owned by controlling shareholders. Because debt instruments that are secured by the value of capital assets are not likely to provide a useful source of funding for high-technology firms. Bondholders seek more salvage value, whereas equity holders favor an unbounded upside to the returns, and therefore, prefer risk (Hall, 2010).

This difficulty of financing without threatening the owner's control rights leads to requests for a governance structure that allows their protection. Maintaining the owner's control is important for companies operating in hostile and unpredictable environments in a way that ensures long-term value maximization, although minority shareholders are usually interested in short-term firm performance (Bertrand & Schoar, 2006). For example, Facebook and Google adopted a dual-class stock structure, resulting in an ownership control disparity, to protect the owner's control rights. Google founders, Larry Page and Sergey Brin, have

15% of the shares, but 56% of the voting rights. They insist that it is important to investors that Google keeps its long-term focus and is not be distracted by short-term stock price movements or fear of management takeovers (Howell, 2017).

In many countries, including Korea, with no dual-class stock structures, the controlling shareholders of firms have conceived of a way to hold more voting rights by utilizing ownership control disparity. The controlling owner of NAVER, Korea's leading information technology company, has less than 4% of shares, but controls the group through shares owned by NAVER and affiliated companies (Byun, 2018). The reasons for the adoption of this governance structure and resulting ownership control disparity are similar to those given by Google's founders.

Prior studies and cases, thus, suggest that controlling owners play a positive role in the survival strategy of high-technology firms. Many such companies build a structure designed to maintain the control of controlling owners. Therefore, we conjecture that ownership control disparity, which comes from that structure, has positive effects on firm value because the structure facilitates the implementation of long-term strategies in high-technology industries. Hence, we propose our first hypothesis that the relationship between ownership control disparity and future firm value varies according to the industries:

***H1:** There is a more positive association between ownership control disparity and future firm value in high-technology industries than in other industries.*

## **2.2. Effects of Ownership Structure on Future Firm Value in Chaebol Groups**

A typical characteristic of chaebol groups is their composition of firms in various industries. In the pursuit of economic development, chaebol groups have been supported to expand business in diverse industries by Korean government. Furthermore, ownership of a chaebol firm is heavily concentrated in an owner-manager who controls all firms in the group. This ownership structure gives significant power to the owner-managers of chaebol firms with regard strategic decision-making. With huge controlling power, the owner-managers of chaebol firms are motivated to expand their group into different industries to maximize the value of whole group, or their wealth, rather than maximize the firm's value (Bae, Kang, & Kim, 2002). Frequently, they decide to enter unrelated industries, for example, to prove the legitimacy of father-to-son succession (Seo, 2006). Hence, diversification of chaebol groups can lead to value loss.

Several researchers suggest that chaebol groups invest resources in businesses with poor investment prospects (Ferris et al., 2003). They contend that the owner-managers of chaebol groups with high level of internal funds in

profitable firms are likely to invest these funds in less profitable projects. Meyer, Milgrom, and Roberts (1992) show that an unprofitable business can continue to operate through funding from profitable segments when that business belongs to a business group. They predict that unprofitable business segments create more value loss as part of a business group than as stand-alone firms. Ferris et al. (2003) find consistent evidence that the existence of one or more unprofitable firms in a chaebol group explains its overall value loss.

Furthermore, we find that chaebol groups are diversified in our sample. We have 2,223 business groups (108 of them are chaebol groups, 2,115 are non-chaebol groups), which belong to ICT industries. They have 3,462 affiliated companies: 2,641 in ICT industries and 821 in non-ICT industries. Table 1 shows the average ratio of affiliated companies in ICT industries to total affiliated companies by business group involved in ICT industries within our sample. Among the affiliates in chaebol groups, 45.91% belong to ICT industries, while the remainder operates in non-ICT industries. When firms' assets are used as a measurement tool, similar results are observed. Meanwhile, for non-chaebol groups, the number of affiliated companies in ICT industries comprises 93.06% of all affiliated companies and 91.77% of total assets. This large difference in the ratio reiterates that chaebol groups are more diversified with respect to the industry. According to the hedging strategy of diversified firms, chaebol groups are less likely to pursue a specific industry (i.e., ICT industry). Rather, chaebol groups transfer the resources from one industry to the other industry within the business group to maximize the value of the group as a whole.

Taken together, evidences from prior studies and our sample indicate that chaebol groups in ICT industries are widely diversified. This leads to a discount in firm value these firms in ICT industries due to inefficient investment caused by transferring resources from profitable businesses to unprofitable ones. We, thus, propose our second hypothesis as follows.

**H2:** *A positive association between ownership control disparity and future firm value is lessened when the firms belong to chaebol groups in high-technology industries.*

### 3. Empirical Methodology

#### 3.1. Data and Sample

The sample for this study comprises companies listed on the Korea Stock Exchange (KSE) and Korean Securities Dealers Automated Quotations (KOSDAQ) from 2006 to 2019. Our sample only includes firms that have affiliated companies because controlling owners in Korea usually use affiliates to reinforce control rights (Seo, 2017).

Following previous research (Chung, 2015), we define high-technology industries as ICT industries based on the Korean Standard Industrial Classification (KSIC). We include firms belonging to the following industries: manufacturers of electronic components and computers; manufacturers of visual, sound, and communication equipment; wholesalers of computers, peripheral computer equipment, and software; wholesalers of communication and broadcasting apparatuses and parts; software publishing; telecommunications; computer programming, consultancy, and related activities; and information service activities.

We collect financial data for firms from the FN-Guide and KIS-Value databases and data on the shares owned by affiliated companies from the TS 2000 database. The final sample comprises 11,848 firm-year observations.

As presented in Table 2, in the total sample, firms belonging to ICT and non-ICT industries comprise 2,641 and 9,207 firm-year observations, respectively. Our sample consists of 5,535 firm-year observations with affiliated company shareholders and 6,313 firm-year observations without the same. Of the ICT industry sample, 39.23% of firms have shares held by affiliated companies; of the non-ICT industry sample, 48.86% have shares held by affiliated companies. Chaebol firm-year observations take up 14.03% of full sample and 9.58% of the ICT industry sample, implying that chaebol firms are less likely to enter ICT industry.

#### 3.2. Research Models

##### 3.2.1. Research Model to Examine Hypothesis H1

Our research question ascertains whether the shareholding ratio by affiliated firms has a more positive effect on future

**Table 1:** Average Ratio of Affiliated Companies in ICT Industries by Group

	Average Ratio of No. of Affiliated Companies in ICT to Total Affiliated Companies	Average Ratio of Total Assets of Affiliated Companies in ICT to Total Affiliated Companies
(1) Non-Chaebol	0.9306	0.9177
(2) Chaebol	0.4591	0.5757
(3) Total	0.9077	0.9011

**Table 2:** Sample Composition

	ICT	Non-ICT	All
(1) Samples with shares held by affiliated companies	1,036 (39.23%)	4,499 (48.86%)	5,535 (46.72%)
(2) Samples without shares held by affiliated companies	1,605 (60.77%)	4,708 (51.14%)	6,313 (53.28%)
(3) Total	2,641 (100%)	9,207 (100%)	11,848 (100%)
Chaebol	253 (9.58%)	1,409 (15.30%)	1,662 (14.03%)
Non-Chaebol	2,388 (90.42%)	7,798 (84.70%)	10,186 (85.97%)

firm value in ICT industries. Selection bias may arise if the unobservable characteristics of firms with and without affiliated company shareholders are systematically different from each other. If these unobservable characteristics systematically differ from each other, it could distort the results of the analysis. Therefore, we employ a Heckman 2 stage model to control sample selection bias to test the hypotheses when we use the full sample to conduct our analyses.

We use equation (1), a probit model using the number of affiliates within its business group as instrument variable at the first stage. The probit model provides an estimate of the mean of the conditional error, Inverse Mills Ratio (IMR), which are included in the second stage.

First Stage Model

$$dAFFIL_{it} = \beta_0 + \beta_1 NAFFIL_{it} + \beta_2 MARKET_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 ROA_{it} \quad (1)$$

Second Stage Model

$$avgTQ_{it} = \beta_0 + \beta_1 AFFIL_{it} + \beta_2 ICT_{it} + \beta_3 AFFIL * ICT_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 OCF_{it} + \beta_7 ROA_{it} + \beta_8 LOSS_{it} + \beta_9 RET_{it} + \beta_{10} VOL_{it} + \beta_{11} FOR_{it} + \beta_{12} GRW_{it} + \beta_{13} MARKET_{it} + \beta_{14} BIG4_{it} + \beta_{15} IMR_{it} + Yr + lnd + \varepsilon_{it} \quad (2)$$

where,

- dAFFIL = Dummy variable indicating having affiliated companies as its shareholders;
- NAFFIL = The number of affiliated companies within business group;
- avgTQ = Average TQ from  $t + 1$  to  $t + 3$ ;
- AFFIL = Shareholding ratio of affiliated companies;
- ICT = Dummy variable for ICT industries;
- SIZE = Natural logarithm of total assets;

- LEV = Total liability divided by total assets;
- OCF = Operating cash flows divided by total assets;
- ROA = Net income divided by total assets;
- LOSS = Dummy variable for net loss;
- RET = Annual stock return;
- VOL = Stock return volatility;
- FOR = Foreign investors' shareholding ratio;
- GRW = (Total assets in year  $t$  – total assets in year  $(t - 1)$ )/total assets in year  $(t - 1)$ ;
- MARKET = Dummy variable for the stock market, which takes 1 if a firm listed on the KSE, and 0 if a firm is listed on the KOSDAQ;
- BIG4 = Dummy variable for auditors, which takes 1 for big 4 clients, and 0 otherwise;
- IMR = Inverse mill's ratio estimated from first stage model;
- Yr = Year dummies;
- Ind = Industry dummies; and
- $\varepsilon$  = Error term.

We measure firm value using Tobin's  $Q$  (TQ) and use average TQ from year  $t + 1$  to  $t + 3$  to estimate future firm value, our dependent variable.

We define ownership control disparity as the shareholding ratio of affiliated companies (AFFIL). Because Korea does not permit the use of a "control enhancing mechanism" like dual-class stocks, controlling owners usually use affiliated companies to reinforce their control rights (Seo, 2017).

Our variable of interest is the interaction term of AFFIL and ICT (AFFIL\*ICT) and the significant positive coefficient of AFFIL\*ICT would indicate that ownership control disparity has an additional positive effect on future firm value for firms in ICT industries.

We control for several firm-specific characteristics that may be associated with firm value according to the literature

(Fama & French, 1992, 1993; Pittman & Fortin, 2004): firm size (SIZE), leverage (LEV), operating cash flows (OCF), return on assets (ROA), net loss (LOSS), stock return (RET), stock return volatility (VOL), foreign investors' ownership (FOR), growth of total assets (GRW), market (MARKET), and auditor (BIG4). To reduce the effects of outliers, we winsorize all continuous variables at the 1<sup>st</sup> and 99<sup>th</sup> percentiles.

### 3.2.2. Research Model to Examine Hypothesis H2

We employ a Heckman 2 stage model to examine Hypothesis 2 regarding the relationship between ownership control disparity and future firm value of chaebol firms in high-technology industries. We use equation (1) to estimate the choice of AFFIL. Then, we use equation (3) to test Hypothesis 2.

$$\begin{aligned} \text{avgTQ}_{it} = & \beta_0 + \beta_1 \text{AFFIL}_{it} + \beta_2 \text{ICT}_{it} + \beta_3 \text{AFFIL}_{it} * \\ & \text{ICT}_{it} + \beta_4 \text{CHAEBOL}_{it} + \beta_5 \text{AFFIL}_{it} * \\ & \text{CHAEBOL}_{it} + \beta_6 \text{ICT}_{it} * \text{CHAEBOL}_{it} \\ & + \beta_7 \text{AFFIL}_{it} * \text{ICT}_{it} * \text{CHAEBOL}_{it} \\ & + \beta_8 \text{SIZE}_{it} + \beta_9 \text{LEV}_{it} + \beta_{10} \text{OCF}_{it} \\ & + \beta_{11} \text{ROA}_{it} + \beta_{12} \text{LOSS}_{it} + \beta_{13} \text{RET}_{it} \\ & + \beta_{14} \text{VOL}_{it} + \beta_{15} \text{FOR}_{it} + \beta_{16} \text{GRW}_{it} \\ & + \beta_{17} \text{MARKET}_{it} + \beta_{18} \text{BIG4}_{it} + \beta_{19} \text{IMR}_{it} \\ & + \text{Yr} + \text{Ind} + \varepsilon_{it} \end{aligned} \quad (3)$$

where,

CHAEBOL = dummy variable for chaebol firms, which takes 1 for chaebol firms and 0 otherwise.

Our variable of interest for hypothesis 2 is the three-way interaction term of AFFIL\*ICT\*CHAEBOL. A significantly negative coefficient of AFFIL\*ICT\*CHAEBOL would indicate that chaebol firms have a less positive association between ownership control disparity and future firm value compared to non-chaebol firms in ICT industries.

## 4. Results and Discussion

### 4.1. Descriptive Statistics

We present the descriptive statistics of the entire sample in Table 3. Descriptive statistics of each sample also show the comparison between mean values of firms in ICT and non-ICT industries. The mean value of AFFIL, our variable of interest, is 0.1348 for all industries. The mean value of AFFIL in ICT industries (0.1050) is significantly lower than that in non-ICT industries (0.1434). The mean value of avgTQ is 1.3156 for the full sample. Furthermore, the mean value of avgTQ in ICT industries (1.4676) is significantly higher than that in non-ICT industries (1.2720). The mean values of CHAEBOL for the full sample, the sample of ICT industries, and the sample of non-ICT industries are 0.1403,

**Table 3:** Descriptive Statistics

Variable	ALL (N = 11,848)					ICT	Non-ICT	Diff.	T-Value
	Mean	Median	Max	Min	S.D.	(n = 2,641)	(n = 9,207)		
						Mean	Mean		
avgTQ	1.316	1.067	6.307	0.459	0.797	1.468	1.272	0.196	11.176***
AFFIL	0.135	0.000	0.701	0.000	0.195	0.105	0.143	-0.038	-8.953***
SIZE	25.853	25.556	30.768	22.695	1.433	25.371	25.991	-0.621	-19.953***
LEV	0.411	0.406	0.954	0.028	0.200	0.370	0.422	-0.052	-11.872***
OCF	0.044	0.045	0.346	-0.301	0.094	0.057	0.041	0.016	7.665***
ROA	0.009	0.029	0.292	-0.616	0.119	0.004	0.010	-0.005	-2.020**
LOSS	0.267	0.000	1.000	0.000	0.443	0.314	0.254	0.060	6.162***
RET	0.154	0.021	3.158	-0.713	0.627	0.165	0.151	0.015	1.054
VOL	0.032	0.030	0.067	0.009	0.012	0.035	0.032	0.003	12.466***
FOR	0.067	0.015	0.531	0.000	0.111	0.061	0.068	-0.008	-3.171***
GRW	0.104	0.055	1.768	-0.408	0.265	0.111	0.102	0.010	1.628
MARKET	0.438	0.000	1.000	0.000	0.496	0.191	0.509	-0.318	-30.122***
BIG4	0.546	1.000	1.000	0.000	0.498	0.525	0.553	-0.027	-2.482**
CHAEBOL	0.140	0.000	1.000	0.000	0.347	0.096	0.153	-0.057	-7.482***

Note: \*, \*\*, and \*\*\* represent significance levels at 10%, 5%, and 1%, respectively. All variables are defined in research models.

0.0958, and 0.1530, respectively. This shows that the mean value for firms in ICT industries is significantly lower than in non-ICT industries.

The mean values of SIZE, LEV, ROA, FOR, MARKET, BIG4, and CHAEBOL in ICT industries are significantly lower than that in non-ICT industries. The mean values of OCF, LOSS, and VOL in ICT industries are significantly higher than that in non-ICT industries.

## 4.2. Correlation Analysis

Table 4 displays the correlations among the study's variables by sub-sample. We show the results in Panel A for the full sample. AFFIL, SIZE LEV, ROA, MARKET, BIG4, and CHAEBOL are negatively correlated with avgTQ. OCF, LOSS, RET, VOL, FOR, and GRW are positively correlated with avgTQ. AFFIL is not significantly correlated with avgTQ in ICT industries while AFFIL are negatively correlated with avgTQ in non-ICT industries. The correlation results suggest that a different association between ownership control disparity and future firm value is observed depending on the industries.

## 4.3. Main Results

### 4.3.1. Univariate Difference-in-Differences Analysis

We examine Hypothesis 1 using a univariate differences-in-differences approach. We exclude the sample without shares held by affiliated companies to verify the effect of ownership control disparity on future firm value depending on the level of ownership control disparity.

We compare avgTQ of high and low ownership control disparity from ICT industries to non-ICT industries. First, we separate our sample into 3 groups, top, middle, and bottom, by shareholding ratio of affiliated companies. We define a treated group, high ownership control disparity firms, as the top group and control group, and low ownership control disparity firms as the bottom group.

Table 5 shows the results of the univariate differences-in-differences analysis for Hypothesis 1. avgTQ of high AFFIL firms is significantly higher than that of low AFFIL firms in ICT industries. Meanwhile, the difference in avgTQ of high and low AFFIL firms in non-ICT industries is not significant.

Importantly, the difference-in-difference of avgTQ by level of AFFIL in ICT industries and non-ICT industries is significant at 1% level, thereby supporting Hypothesis 1.

Table 5 also shows the results of the univariate differences-in-differences analysis for Hypothesis 2. We compare avgTQ of high and low ownership control disparity

from chaebol and non-chaebol firms in ICT and non-ICT industries, respectively.

Among ICT industries, avgTQ of high AFFIL firms is not significantly different from that of low AFFIL firms among chaebol firms. However, avgTQ of high AFFIL firms is significantly higher than that of low AFFIL firms among non-chaebol firms. The difference-in-difference of avgTQ by level of AFFIL in chaebol and non-chaebol firms is significant at the 5% level.

However, in non-ICT industries, avgTQ of high AFFIL firms is not significantly different from that of low AFFIL firms among both chaebol and non-chaebol firms. Furthermore, the difference-in-difference of avgTQ by level of AFFIL in chaebol and non-chaebol firms is not significant. The results support Hypothesis 2.

### 4.3.2. Heckman 2 Stage Analysis

We examine Hypothesis 1 on whether the association between the ownership disparity and future firm value for ICT industry is positive.

Table 6 shows the results of the Heckman 2 stage analysis for Hypothesis 1.

We find that ownership control disparity has an additional positive effect on future firm value for ICT industries, given the results regarding the coefficient of AFFIL\*ICT. The coefficient of AFFIL\*ICT is significantly positive. These results support Hypothesis 1.

LEV, OCF, RET, VOL, FOR, and GRW are all positively related with all TQ variables, while SIZE and ROA are negatively related. IMR is significantly related with TQ in general. The results suggest that the possibility of the sample selection bias comes from the characteristics of firms with and without affiliated company shareholders.

Next, we examine whether the association between ownership control disparity and future firm value in ICT industries varies depending on chaebol groups, as described in Hypothesis 2.

Table 6 provides the results of the Heckman 2 stage analysis for Hypothesis 2. The coefficient of AFFIL \* ICT \* CHAEBOL is significantly negative. Given these results, we suggest that ownership control disparity has an additional negative effect on future firm value for chaebol firms in ICT industries. These results support Hypothesis 2 by revealing a less positive association between ownership control disparity and future firm value for chaebol firms in high-technology industries.

To avoid the effect of the firms without affiliated company shareholders, we use a sample restricted to shares held by affiliated companies. Unreported test results are not qualitatively different from the main results provided in Table 6.

Table 4: Correlation Analysis

	avgTQ	AFFIL	SIZE	LEV	OCF	ROA	LOSS	RET	VOL	FOR	GRW	MARKET	BIG4
AFFIL	-0.045	1.000											
	0.000												
SIZE	-0.173	0.266	1.000										
	0.000	0.000											
LEV	-0.075	0.083	0.235	1.000									
	0.000	0.000	0.000										
OCF	0.022	0.070	0.142	-0.189	1.000								
	0.017	0.000	0.000	0.000									
ROA	-0.093	0.087	0.213	-0.287	0.491	1.000							
	0.000	0.000	0.000	0.000	0.000								
LOSS	0.112	-0.068	-0.184	0.235	-0.386	-0.681	1.000						
	0.000	0.000	0.000	0.000	0.000	0.000							
RET	0.139	-0.007	-0.027	-0.049	0.115	0.195	-0.166	1.000					
	0.000	0.483	0.004	0.000	0.000	0.000	0.000						
VOL	0.172	-0.155	-0.377	0.156	-0.232	-0.321	0.282	0.207	1.000				
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000					
FOR	0.071	0.050	0.506	-0.067	0.196	0.188	-0.163	0.005	-0.222	1.000			
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.597	0.000				
GRW	0.080	-0.012	0.014	0.011	0.032	0.230	-0.149	0.163	0.113	0.013	1.000		
	0.000	0.195	0.140	0.241	0.001	0.000	0.000	0.000	0.000	0.156			
MARKET	-0.196	0.233	0.533	0.157	0.010	0.076	-0.090	-0.023	-0.252	0.245	-0.077	1.0000	
	0.000	0.000	0.000	0.000	0.259	0.000	0.000	0.014	0.000	0.000	0.000		
BIG4	-0.023	0.229	0.372	0.057	0.104	0.100	-0.089	-0.040	-0.191	0.231	-0.029	0.223	1.000
	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	
CHAEBOL	-0.025	0.312	0.565	0.131	0.073	0.077	-0.078	-0.017	-0.185	0.300	-0.006	0.285	0.307
	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.000	0.000	0.533	0.000	0.000

Refer to the equation (1) for variable definitions.



**Table 5:** Univariate Difference-in-Differences Analysis

<b>Hypothesis 1 (H1)</b>				
ALL	avgTQ (N = 3,694)	ICT (N = 645)	Non-ICT (N = 3,049)	Diff. (ICT-Non ICT)
	high AFFIL (N = 1,842)	1.6640 (N = 279)	1.1950 (N = 1,563)	0.4690 (10.43)***
	low AFFIL (N = 1,852)	1.3800 (N = 366)	1.1690 (N = 1,486)	0.2110 (5.23)***
	Diff. (high-low)	0.284 (5.16)***	0.026 (1.04)	0.2580 (4.27)***
<b>Hypothesis 2 (H2)</b>				
ICT	avgTQ (N = 645)	CHAEBOL (N = 108)	Non-CHAEBOL (N = 537)	Diff. (CHAEBOL-Non_CHAEBOL)
	high AFFIL (N = 279)	1.3490 (N = 77)	1.7840 (N = 202)	-0.4350 (-4.59)***
	low AFFIL (N = 366)	1.3060 (N = 31)	1.3870 (N = 335)	-0.0810 (-0.61)
	Diff. (high-low)	0.0430 (0.29)	0.3970 (6.30)***	-0.3540 (-2.17)**
Non-ICT	avgTQ (N = 3,049)	CHAEBOL (N = 720)	Non_CHAEBOL (N = 2,329)	Diff. (CHAEBOL-Non_CHAEBOL)
	high AFFIL (N = 1,563)	1.261 (N = 509)	1.1640 (N = 1,054)	0.0970 (2.63)***
	low AFFIL (N = 1,486)	1.2010 (N = 211)	1.1640 (N = 1,275)	0.0370 (0.73)
	Diff. (high-low)	0.0600 (1.06)	0.0000 (-0.01)	0.0600 (0.96)

Note: \*, \*\*, and \*\*\* represent significance levels at 10%, 5%, and 1%, respectively.

**Table 6:** Heckman 2 Stage Analysis

	<b>Hypothesis 1</b>	<b>Hypothesis 2</b>
	<b><math>\beta</math> (t-value)</b>	<b><math>\beta</math> (t-value)</b>
<b>1<sup>st</sup> stage</b>		
Constant	-3.9094 (-13.941)***	-3.9094 (-13.941)***
NAFFIL	0.1957 (22.386)***	0.1957 (22.386)***
MARKET	0.4609 (16.248)***	0.4609 (16.248)***
SIZE	0.1230 (10.747)***	0.1230 (10.747)***
LEV	0.2294 (3.423)***	0.2294 (3.423)***
ROA	0.4621 (4.050)***	0.4621 (4.050)***
<b>2<sup>nd</sup> stage</b>		
Constant	3.3273 (6.365)***	3.2857 (6.299)***
AFFIL	-0.0690 (-1.386)	-0.1756 (-3.100)***
ICT	-0.2646 (-3.348)***	-0.2621 (-3.282)***
AFFIL*ICT	0.3400 (2.746)***	0.6343 (4.610)***
CHAEBOL		0.1050 (1.923)*
AFFIL*CHAEBOL		0.2660 (2.206)**
ICT*CHAEBOL		-0.0987 (-0.767)
AFFIL*ICT*CHAEBOL		-0.7314 (-2.024)**

(Continued)

Table 6: (Continued)

	Hypothesis 1	Hypothesis 2
	$\beta$ (t-value)	$\beta$ (t-value)
SIZE	-0.0975 (-9.175)***	-0.1066 (-10.148)***
LEV	0.1801 (3.361)***	0.1920 (3.630)***
OCF	0.5956 (5.270)***	0.5783 (5.137)***
ROA	-0.3332 (-2.614)***	-0.3033 (-2.388)**
LOSS	0.0583 (2.185)**	0.0617 (2.322)**
RET	0.1298 (7.687)***	0.1312 (7.808)***
VOL	9.4471 (9.475)***	9.2373 (9.289)***
FOR	1.2634 (13.159)***	1.3037 (13.480)***
GRW	0.1408 (3.881)***	0.1465 (4.053)***
MARKET	-0.1560 (-5.956)***	-0.1209 (-4.347)***
BIG4	0.0462 (2.345)**	0.0280 (1.414)
IMR	-0.2696 (-5.166)***	-0.1743 (-2.746)***
Chi <sup>2</sup>	2,155.9518	2,257.5811
N	11,848	11,848

Note: T-value are presented in parentheses. \*, \*\*, and \*\*\* represent significance levels at 10%, 5%, and 1%, respectively. All variables are defined in research models.

## 5. Conclusion

Prior studies have shown that ownership control disparity negatively affects firm value. They further indicate that ownership control disparity can cause a conflict of interest between the controlling owner and the minority shareholders. When ownership control disparity increases, the private benefits for the controlling owner also increase.

However, the relationship between ownership control disparity and firm value is often different in high-technology industries. Some research as well as the founders of Silicon Valley firms, insist that sustaining the owner's control is important for protecting the ownership from a hostile and unpredictable environment, and for allowing the company to pursue long-term goals. The structure associated with ownership control disparity can be used to implement long-term strategies in high-technology firms.

In this study, therefore, we investigate if ownership control separation has a different effect on firm value in high-technology industries.

We find a more positive effect of ownership control disparity on future firm value among high-technology industries. Our results indicate that maintaining the control

rights of controlling owners may have positive effects by allowing the implementation of a long-term strategy and a display of entrepreneurship in the highly uncertain environments of high-technology firms. Furthermore, we find that the positive association between ownership control disparity and future firm value is reduced when the firms belong to chaebol groups in high-technology industries. We conjecture that this is a result of the diversification discount in chaebol groups.

We contribute to the literature by providing empirical evidence that ownership control disparity has different effects on firm value across industries. By focusing on the positive firm value effects of securing owner control, this study differs from previous studies that focus on the negative effects of ownership control disparity due to the agency problems between controlling owners and minority shareholders. Our results are particularly meaningful because high-technological firms are increasingly adopting structures that generate ownership control disparity in the belief that they are required for survival in highly uncertain environments.

Many countries in East Asia have recently adopted the policy of strengthening the control rights of controlling owners to attract innovative companies. Our finding that

ownership control separation affects firms differently depending on their industry provides important practical implications to both regulators and researchers.

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