

An Empirical Study on the Effect of Financial Structure on Investment: Does Debt Covenant Shrink Corporate Investment?

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After the crisis, affiliated firms of the business conglomerates selected as *main debtor groups* are mandated to contract the debt covenant that enforces to improve financial structure. This paper examines how the regulation on financial structure of main debtor groups affects investment of affiliated firms. Even though several economists insist that the regulation of the debt covenant—including 200% *debt ratio cap*—makes the investment of main debtor groups decline, there is no empirical work testing the effect of the regulation on the investment in Korea. The empirical results of this study show that due to the debt covenant, the effect of debt on investment decreased after the crisis, and that specially during 1998 to 2000, the facility investment of affiliated firms in main debtor groups remarkably declined. Additionally, we examine whether a firm's control-ownership disparity affected its investment. Contrary to existing empirical papers, results of this study show that control-ownership disparity is not related with investment statistically, and so mean that a firm's ownership structure does not induce its excess investment.

Keywords: Investment, Debt covenant, Main debtor group,
Financial regulation

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I. Introduction

A. Backgrounds and Purposes

Since the Asian financial crisis has been, the financial structure of Korean corporations has witnessed the decline in ratio of debt as the most drastic change. At the end of 1997, right before the crisis, the debt ratio of Korean manufacturing industries averaged at 396.3%, more than double that of the U.S. (153.8%) and that of Japan (186.4%).¹ But as of the end of 2003, Korean manufacturing industries have the record-low average debt ratio of 116.1%, significantly low figure even compared to those of other countries in 2002 (the U.S.: 154.3%, Japan: 156.2%).² Slashing the average debt ratio into less than one-third of the original one over a time span of seven years is rare case globally. Although there can be some controversy over whether the corporate debt ratio was brought down thanks to the government's regulatory policy of placing cap on debt ratio, set at 200% as part of the corporate restructuring policy after the financial crisis it is undeniable that the effort by the government played an important role in lowering the debt ratio. Such regulations governing the financial structure as the 200% debt ratio cap had reducing the risks of going bankrupt, but at the same time, could be constraint on financing. As management strategies of a company are closely connected with its financial structure, regulations on financial structure can influence corporate strategies. Nevertheless, most research studies on reduction of debt ratio have been conducted in a broad perspective and there is a lack of microscopic study testing how lower debt ratio affected the management's decision making.

This study aims at examining how investment decision, as corporate strategy was influenced by regulations on financial structure like the 200% debt ratio cap. Enterprise value or corporate profit margin are resulted from financial or business strategies, so it is inappropriate to select corporate performance as the output best reflecting corporate decision making. Meanwhile, investment is an important variable influencing enterprise value as well as a strategic decision by the management, thereby facilitating the direct and indirect examination on decision making by the management. Accordingly, this study deals with invest-

¹ Financial Service Commission (2001).

² Korea Development Bank (2004).

ment as an appropriate object to be analyzed in looking into how the debt ratio regulation affected decision making by the corporate management. The main focus of the study is placed on analyzing what is the effect of debt on investment caused by the debt ratio regulation.

Additionally, we analyze how the ownership and controlling structure affect on investment decision. Senior executives who belong to controlling shareholders are known to have the incentive to seek their self-interest through expansion of corporate scale. In analyzing the effect of ownership structure on investment, the method adopted in this study is different from those of existing studies, in order to empirically test whether senior executives really have such incentive of maximizing the size of their companies.

B. Debt Ratio Cap and Main Debtor Groups

Right after the economic crisis in the late 1990s, higher interest rates continued, which rapidly raised the likelihood of bankruptcy for business conglomerates whose debt ratio was excessively high. Consequently, the government had to come up with policies to improve financial structure. Policies in line with such effort include requiring main creditor banks to conclude the debt covenant that enforces to improve financial structure with business groups to which new loans or extension of existing loans are to be given. Accordingly, business groups selected as main debtor groups have become the parties to enter into this covenant since 1998.³ In addition to the requirement to lower the debt ratio below 200%, the covenant encompassed reorganizing the structure of affiliated enterprises as well as shedding non-essential subsidiaries, disallowing inter-subsidiary payment guarantees, and appointing the certain number of outside directors and auditors. But the most important enforcement clause in this covenant was the demand of lowering the debt ratio below 200% by the end of 1999, which called for every possible measure, such as capital increase for value and capital revaluation, to be taken by business groups selected as main debtor groups. This restriction to debt ratio became less compulsory as the Ministry of Finance and Economy announced that the debt ratio cap of 200% would not be enforced any longer to companies even with debt ratio higher than 200% according to their combined financial statements at July 30 in 2000. As of 2004, main creditor banks do not

³The list of Main Debtor Groups (1998-2002) were shown in the Appendix Table 1.

regard the 200% debt ratio cap as a compulsory rule, but still must induce main debtor groups to enhance their financial structure ("Regulation of Supervision on Banking Business" Article 82 ③), must not handle loans whose payment is guaranteed by their affiliated enterprises (Article 81 ②), must concentrate on the management of business information regarding business groups selected as main debtor groups (Article 82 ①).

Although regulations on the financial structure under which the debt ratio is kept below a certain level are rare, there exist some cases in foreign countries. In the 1830s, the British government set a limit on loans to railroad companies, keeping the amount below one-third of their capital, in an attempt to curb the exploding number of railroad companies.⁴ In addition, the current Corporate Act of California stipulates that dividend can be paid only when debt ratio stands at less than 400%.⁵ But the purpose of the British government's control on debt ratio was to deterring railroad companies even without paid-in capital, as such companies usually relied on only loans. Likewise, the Corporate Act of California imposes debt ratio limit regarding only dividend, without regulations to the financial structure of companies. As these examples illustrate, Korea's debt covenant enforcing the improvement of financial structure is virtually unprecedented case globally as such a compulsory policy requiring certain selected business groups to adjust debt ratios of their affiliated enterprises below a certain level. While this means that the economic crisis was really precarious even having to push for globally unprecedented policies, lack of preparation for possible negative side effects is suggested.

II. Previous Literature and Analytical Method

A. Previous Literature

The corporate investment is determined by various factors. It is affected by the industrial structure, organizational forms, financial structure, ownership structure, profitability, internal finance, and so on. Comments on the literature will be made by factors influencing investment.

⁴ See Micklethwait and Wooldridge (2003), pp. 76-80.

⁵ Corporate Act of California §Article 500 (b) (2).

a) Financial Structure

In determining the financial structure or the debt ratio, corporate investment is generally regarded as having a negative effect, as interpreted by Myers (1977) arguing that firms with many investment opportunities are likely to use less debts to bring down agency costs of under investment because indebtedness tends to cause under investment. The negative relationship between the debt ratio and investment has been confirmed by empirical studies, such as Titman and Wessels (1988), Friend and Lang (1988), Smith and Watts (1992), and Gaver and Gaver (1993). The reason why the increase in investment opportunities leads to the decline in debt ratio is that the presence of asymmetrical information increases the issue of debts and accordingly firms come to prefer capital increase for value to borrowing, as explained by Myers and Majluf (1984). Korajczyk, Lucas, and McDonald (1991) proves that firms facing less asymmetrical information are inclined to choose capital increase for value rather than borrowing, so greater asymmetry of information between banks and firms prompts financing by the issue of debts. According to Jung, Kim, and Stulz (1996) conducting analysis of the relationship among the issues of stock, debt, and investment expenditure, however, investment can have a statistically significant positive effect on the debt ratio decision in case of firms with fewer opportunities to make investment, empirically suggesting the possibility of a positive correlation between the debt ratio and investment. Jung, Kim, and Stulz (1996) noted that despite fewer opportunities to invest, which make it inevitable to issue debts according to the pecking-order theory in financing, some companies issued instead stocks. The paper explained the stock issues as an attempt to disguise themselves as firms with many investment opportunities, further confirming the fact that debt ratio and investment are fundamentally in a negative relation.

Lang, Ofek, and Stulz (1996) is empirical research on the effect of debt ratio on investment, indicating that only firms with low corporate value show the negative effect of debt ratio on investment. In other words, only when firms have a Tobin's Q less than 1, debt ratio is statistically significant to investment like the existing studies.

When companies have a statistically significant negative effect, and their Tobin's Q exceed 1, debt ratio's effect on investment is not shown, according to the explanation suggested in the study. The supplying funds through debts may discourage corporate investment and growth, only firms with high debt ratio resulted from poor performance have

such negative effects of debt. Hence, the constrained opportunities to grow may not pose a serious problem once investment opportunities are adequately recognized by outside investors.

As stated above, most foreign studies show a negative association between investment and debt ratio. Among studies on Korean companies to analyze the relationship between investment and debt ratio, some have findings consistent with those from foreign studies, and others do not reveal any statistically significant relationship. But the significant number of studies produce findings contradictory to those from foreign studies. Representative studies include Yoon and Oh (1999), estimating financing function, investment function, and corporate value function of listed manufacturers through simultaneous equations model from 1990 to 1997 and showing that the rise in debt ratio increases investment ratio. Researchers offer a cautious explanation that despite the possibility of tangible fixed assets serving as the sign to enhance the firm's ability in borrowing, Korean firms are influenced much more by the increase in investment expenditure financed by debts than the sign effect. Kim and Cheong (2000) presents an empirical analysis on listed manufacturers from 1990 to 1995 and states that debt ratio has a positive effect on investment. Especially, this positive effect of debt ratio on promoting investment can be observed for companies with low Tobin's Q and high investment expenditure, quite opposite to Lang, Ofek, and Stulz (1996). The researchers of the mentioned study put an interpretation similar to that of Yoon and Oh (1999) on the intriguing results, mentioning Korean firms' dependence on debts in financing and over-reaching investment expenditure without proper regard to their growth potential. After analyzing how debt ratio affects the investment in technological development, Lee (2001) provides quite different results for independent firms and affiliated enterprises belonging to business groups: no statistically significant relation for the former and significant positive effect of growing debt ratio on promoting investment in technological development for the latter. However, no explanation for the causes of these relations is mentioned in the research.

As seen above, considerable studies engaging in empirical analysis of Korean companies show a positive correlation between investment and debt ratio, different from findings of foreign research, but do not provide any substantial theoretical explanation for that and merely interpret it as having a high level of dependence on debts in financing investment funds. This explanation is thought to be originated from the widely accepted view of attributing it to the substantial difference in the

corporate financial environment between Korea and other countries. These studies, except for Choi, Ham, and Kim (2003) and Lee (2001), produce findings from examining the relationship between investment and debts before the economic crisis. Even in Choi, Ham, and Kim (2003), the relationships between investment and debts before and after the economic crisis are not classified in analysis. In particular, research conducted on firms selected as main debtor groups subject to the 200% debt ratio cap are rarely found.

b) Ownership Structure

Generally, studies of Korean companies to conduct analysis on how investment is affected by ownership structure conclude that rising stakes held by senior executives who are controlling shareholders leads to the decrease in investment. Jeong (1994) provided the finding that rising stakes held by executive officers measuring shares owned per controlling shareholder brought about the decline in research and development investment. Cho and Yoon (2000) stated that the investment in research and development diminishes as stakes held by executive officers increase. In Kim and Cheong (2000), investment rate and the ratio of share held by controlling shareholder are in a statistically significant negative relation. For companies which have low future profitability (Tobin's Q) and focus on size maximization (investment expenditure), decreasing ownership leads to the rise in investment under the certain level of ownership stakes. The researchers explain that lower ratio of stakes owned by controlling shareholder means deviation of their interests from those of minority shareholders, and causes greater incentive for controlling shareholders to seek maximization of size. The raising investment expenditure in case of lower stakes owned by controlling shareholders is identified also in Lee, Ryu, and Yoon (2003), which regards this as an explanation for why Korean large business groups essentially seek size maximization. According to Choi, Ham, and Kim (2003), companies whose controlling shareholders hold stocks below the average level show lower investment ratio as controlling shareholders increase their equity ratio. Possible interpretation for this is that companies with low ratio of stakes owned by controlling shareholders might be generally the large size affiliated firms and controlling shareholders try to increase investment rate with lower risks.

But in analyzing the effect of the ownership structure on investment, it is difficult to decide whether the negative relation between investment

ratio and equity ownership of controlling shareholders is originated from their pursuit of size maximization or the mere attempt to reduce risk bearing, based on the results estimated from using the ratio of shares owned by controlling shareholders as the single explanatory variable. The stakes of controlling shareholders are part of all stocks issued and controlling shareholders benefit from rising stock prices as much as their ratio of share. The ratio of share held by executive officers who are controlling shareholders is called ownership, and they have the incentive to increase the corporate value as their equity ownership becomes greater. Meanwhile, the decline in the equity ownership of executive officers who are controlling shareholders does not necessarily mean increasing their incentive to seek size maximization. Park (1999) argues that the controlling shareholders govern companies also through their equity ownership of subsidiaries, so the combined ratio of stakes held by controlling shareholders and affiliates — the internal ownership — means their actual voting rights, which represents the very control rights to seek size maximization. Theoretical results from Park (1999) indicate that controlling shareholders make a decision on production and investment towards maximizing corporate value as their ownership increases, while the greater control rights translates into the increase in production and investment for their own interests through the expansion in scale. Given the findings from this research, the share directly owned by controlling shareholders (ownership) implies a duality of increasing their ownership as well as their voting rights (control rights). Therefore, the rise in their equity ownership increases the incentive to maximize corporate value, while the resulting growth of internal ownership signifying control adds the incentive to maximize size. As the ratio of share held by executive officers who are controlling shareholders represents two opposing incentives of maximizing corporate value and size at the same time, it poses a limit on analyzing the effect of ownership structure on investment.

c) Factors in Terms of Industrial Organization

From the perspective of industrial organization, corporations deciding on investment should put the demand from the market first among issues to consider. Corporations predict changes in demand of the market, keep track of stocks, and decide whether to expand production facilities to increase output. Accordingly, empirical analyses where estimation of investment functions is made adopt sales ratios or growth rates of sales as control variables of the market demand. However, the

corporate decision on investment is not made instantly in response to changes in demand. Even though it is assumed that a response can be produced at the right time, soaring demand will not lead to facility expansion by corporation when they have already sufficient production facilities, so the correlation between the growth rate of sales and investment rate may not show a clear trend.

The market share of corporations can influence investment as well as market concentration within industry. Dominant players in the market seek to exclude competitions from the market by increasing their spending on facilities to keep the high market share, or to block new entry in advance. On the contrary, there can be the incentive to expand facilities through intensive investment in order to overcome the present low market share. So, the effect of market share on investment can enormously vary.

Another determining factor of corporate investment is capital intensity. Once facility investment is made in capital-intensive industries, the scale of such investment is massive, likely to cause a greater scale of investment in facility than the one required to keep up with a certain demand level. It is also difficult to respond to declining demand by reducing the appropriate amount of capital stock in the short term. Therefore, variables of investment and capital intensity are expected to be positively correlated. Meanwhile, capital-intensive companies have a high ratio of fixed costs to variable costs. When competition becomes fierce due to reduction in demand, such companies with high capital intensity may have the incentive to maintain or reduce existing facilities in order to relieve the burden from fixed costs.

d) Internal Financing and Future Profitability

The sensitivity of cash flow to investment means how corporations manage internal funds for investment. This sensitivity can serve as a variable explaining moral hazard caused by the presence of asymmetrical information and financing constraints. Jensen (1986) argued that executive officers who have free cash flow, defined as cash in excess of that required, pursue their own interests of scale maximization by increasing investment expenditure despite low profitability. Therefore, according to the theory suggested in Jensen (1986), greater free cash flow leads to increase in investment expenditure, and lowering the ratio of shares owned by executive officers makes cash flow more sensitive to investment. Fazzari, Hubbard, and Petersen (1988) adopted cash flow as an explanatory variable and empirically proved that under the

presence of asymmetrical information and incomplete capital market, financing constraints influence investment. They point out that companies with low dividend payout ratio are constrained in financing as they have to rely on internal funds for investment due to high costs of raising funds from outside. Therefore, the findings showed that firms with low dividend payout ratio have high sensitivity of cash flow, attributing it to the financing constraints. Hoshi, Kashyap, and Scharfstein (1991) conducted a study on Japanese manufactures and drew a comparison between subsidiaries of business groups having a close connection with main creditor banks and independent enterprises without such close relation with banks regarding their investment. The findings from the research provided a higher sensitivity to cash flow for independent enterprises compared to subsidiaries of business groups. The researchers explained that subsidiaries of business groups faced relaxed constraints on financing thanks to the long-term fixed relationship with main creditor banks while independent enterprises failed to form a tie with banks to consistently exchange information, so became highly sensitive to cash flow.

Tobin's Q , representing the forecast on future profitability, also acts as an important determinant in estimating investment. After studies like Devereux and Schiantarelli (1989), Hayashi and Inoue (1991), and Blundell, Bond, Devereux, and Schiantarelli (1992) made use of Tobin's Q investment model where the function of adjustment costs are explicitly introduced in estimating investment function, the model is commonly used as the one to control expected future profitability. But some researchers point out shortcomings of Tobin's Q , which is difficult to measure and requires strong assumptions. Empirical results from empirical analysis at home and abroad offers a positive association between investment ratio and Tobin's Q , even though there remain discrepancies among estimates.

B. The Analytical Method

a) Analysis of How Debt Ratio Cap Affects Investment

This research aims at examining how the empirically proven positive relation between investment and debt ratio changes for the regulated firms selected as main debtor groups subject to the debt covenant requiring improvement of financial structure including the 200% debt ratio cap. After the financial crisis, Korean companies improve their financial structure through repayment of debts to banks and capital re-

valuation. Therefore, these changes are likely to influence the investment-debt ratio relation. Especially the firms of business conglomerates selected as main debtor groups subject to the 200% debt ratio cap (the regulated firms) are expected to experience changes different from firms without such constraints on financial structure (the unregulated firms).

The comparison of debt ratio effect on investment is made by breaking the period into before and after the crisis, then between business groups selected as main debtor groups and those not selected. Like the equity investment regulation, called *Total Equity Investment Ceiling Rule*, the covenant as main debtor groups is applied only to the upper class of business conglomerates in terms of asset. So the investment-debt ratio relation will be separately analyzed between the upper class of business groups and firms regulated by the covenant as main debtor groups.

b) Analysis of How Ownership Structure Affects Investment

Whether controlling shareholders come to have the incentive to maximize size due to ownership structure will be identified through the analysis in this research. As mentioned earlier, analyzing the effect of ownership structure on investment calls for more than the ratio of share owned by executive officers who are controlling shareholders, so the internal ratio of share representing their control needs to be considered. Because the internal share ratio also contains the share owned by controlling shareholders, it is not appropriate to adopt these two as explanatory variables at the same. Therefore, this research use control-ownership disparity as explanatory variable. As stated in Park (1999), controlling shareholders have the incentive to enhance corporate value in proportion to their ownership while seek to expand corporate scale in a relative correlation with control. The control-ownership disparity is an index reflecting the difference in the two incentives, which executive officers who are controlling shareholders have. This means, greater control-ownership disparity shows growing effect of control against ownership, likely to induce executive officers to attempt the size expansion further. Consequently, if empirical analysis reveals that control-ownership disparity has a positive effect on investment ratio, the incentive to seek size maximization is thought to be present, which promotes investment. If the disparity index fails to have a statistically significant effect on investment or the disparity index and investment are in a negative association, controlling shareholders cannot be regarded as making investment in pursuit of size maximization.

III. Data and Model

A. Data

Using the data from the Korea Information Service Inc. (KIS), we select the annual 100 business groups from 1988 to 2003, and compose panel data by choosing only their affiliated firms with the status more than external auditor. The 100 business groups are selected based on asset of manufacturers exclusive of financial affiliates, and the selected 100 business groups have at least 3 to 5 affiliates annually. The data of companies to be analyzed is collected from only manufacturers for the analytical purposes. To focus on the investment decision by private enterprises, we rule out public enterprises in analysis.

Our analysis sets on these affiliates of the 100 business groups to examine investment behavior of affiliates belonging to business groups selected as main debtor groups "*the regulated firms*" and affiliates of business groups exempt from such regulation "*the unregulated firms*." The designation of main debtor groups was introduced in the early 1970s, and as stated previously, those selected since the 1998 have to conclude the covenant to improve financial structure. Since the covenant was a newly introduced regulation right after the crisis, in our analysis, all firms from 1988 to 1997 are *the unregulated firms* and part of firms after 1998 are *the regulated firms*.

B. Model

Lang, Ofek, and Stulz (1996), Yoon and Oh (1999), Kim and Cheong (2000), and Choi, Ham, and Kim (2003) use the investment to asset as investment ratio, and their explanatory variables have asset as denominator. The same investment function model is adopted in this research. To properly control variables influencing investment and focusing on the effect of explanatory variables in analysis, analytical model of investment is established like the estimated Equation (1). Explanatory variable in the estimated model of analyzing the effect of the covenant to improve financial structure is debt ratio, while ownership-control disparity plays a role of explanatory variable in the model for the ownership-control structure.

$$\begin{aligned} \text{investment ratio}_t = & \alpha_0 + \alpha_1 \text{utilization rate}_t + \alpha_2 \text{market share}_t \\ & + \alpha_3 \text{capital intensity}_t + \alpha_4 \text{operating profits}_{t-1} + \alpha_5 \text{cash flow}_t \end{aligned} \quad (1)$$

$$+ \beta \text{Debt Ratio} + \gamma \text{Ownership} + \text{Year Dummies} + \varepsilon$$

To begin with, investment ratio is obtained by dividing the investment amount (subtracting acquisition of land from the changes in tangible fixed assets) by asset. The equation for investment ratio is:

$$\text{investment rate}_t = \frac{(Tfasset_t - Tfasset_{t-1}) - L \text{acquisition}_t}{\text{asset}_t} \times 100$$

where $Tfasset$ represents tangible fixed assets and $L \text{acquisition}$ means the land acquisition.

From the perspective of industrial organization, rate of utilization, market share, and capital intensity are control variables regarding investment. First, utilization rate shows the rate at which facilities in plants operate, so the 100% utilization rate means the absence of excess facilities. As the rate indicates how much facilities in plants are making use of their fixed capacity in the short term, it reflects the short-term demand shock. The rate of utilization exceeding 100% means overcapacity beyond the given one through additional operational activities such as nightwork. The rate of utilization more than 100% can be shown only temporarily because it is caused by insufficient capacity of facilities, encouraging firms to expand their facilities through additional investment in facilities. By contrast, firms with low utilization rate do not have any incentives to add up facility investment, and even facilities are sold when they are operated at an extremely low rate. Consequently, it is common for firms to operate their facilities of plants at a rate lower than 100%. The rate of utilization is a crucial variable in explaining the corporate behavior of investment as its rise sends a signal for facility investment to establish additional facilities and its decline put facility investment on hold. Next, market share is based on sales of each firm in industry classified at four-digit level based on sales. The market share of a firm is used as a variable representing the market structure. Third, capital intensity is calculated as amount of tangible fixed assets divided by sales (multiplied by 100), and an index of the level at which the firm is provided with capital equipment. Capital intensity is included in the estimated equation because it represents the corporate equipment level and serves as proxy variable showing industrial traits of capital demand.

Operating profit ratio and cash flow are control variables from the

perspective of corporate finance. First, operating profit ratio is a variable representing corporate profitability. Even though Tobin's Q is commonly used to analyze the effect of expected future profitability on investment, operating profit ratio is chosen as corporate profitability due to the inclusion of companies that are going public or subject to external audit in the analysis.⁶ For looking into the investment practice of companies highly profitable for the previous year, we use operating profit ratio in the previous year. The operating profit ratio is the variable calculated by dividing the earlier-year operating profit by asset in the previous year and then multiplied by 100. Second, as mentioned earlier, cash flow is in common use as exemplified in free cash flow theory or the sensitivity analysis of cash flow, where it is adopted as major variable accounting for investment. So in this research, cash flow is adopted as variable representing the corporate operation of internal funds. Cash flow is calculated by the sum of short-term net profit and depreciation and amortization divided by asset.

Debt ratio and ownership are explanatory variables for analysis in this research. To begin with, debt ratio is calculated as the corporate debt amount divided by asset, representing the dependence on borrowing in corporate financing. The financing scheme of Korean firms before the Asian currency crisis was highly dependent on external borrowing, marking the debt ratio of around 70%.⁷ But after Korea suffered the financial crisis, financing by external borrowing becomes difficult due to the changing financial environment including surging interest rates and the covenant imposed on main debtor groups required to obey the debt ratio regulation. As a result, Korean companies veer towards direct financing, which sharply lowers debt ratio. By analyzing the effect of debt ratio on investment, this study delves into how the covenant imposed on main debtor groups influences investment.

As for the definition of ownership, Baek, Kang, and Park (2004) follows suit by accepting cash flow right as the proper definition like Claessens, Djankov, and Lang (2000). But Baek, Kang, and Park (2004) only targets listed companies, excluding cash flow right through unlisted companies from calculation. Also limited data sets hinder the researchers from identifying accurate share-holding matrix within busi-

⁶ Referred to Joh (2001).

⁷ Since we use the level of debt amount divided by asset as debt ratio variable, debt ratio of the firm with 200% debt-capital ratio is 67% in this research.

ness groups, generating errors in calculation of cash flow right. Meanwhile, the analytical objects in Joh (2003) are firms counted as part of top ranking enterprises subject to more than external audit and ownership in the research is defined as direct ownership of controlling shareholders, in line with the method adopted in Lemmon and Lins (2003). Although indirect ownership is omitted in Joh (2003)'s method, it has the virtue of calculating direct ownership of controlling shareholders after correct understanding. Following Joh (2003), this study also defines ownership as ratio of shares owned by controlling shareholders and by those deemed as having special relationships with them. Regarding the definition of voting rights, this study corresponds with Lemmon and Lins (2003) and Joh (2003), so definition of voting rights is internal ownership, as the sum of ownership and shares in affiliates, excluding stocks to be bought back from internal ownership. In denoting the gap between ownership and management control, Joh (2003) and La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2002) choose control-ownership disparity, difference between ownership and voting rights. On the other hand, Lemmon and Lins (2003) and Kim, Ryu, Bin, and Lee (2003) see voting right leverage index which is the ratio between control and ownership as gap index.

In this study, the ratio of ownership shares are divided into that of controlling shareholders and affiliates. The ratio of controlling shareholders means the share held by the single head as the same identity. The ratio of shares owned by those having special relationships is composed by adding up the shares of special interest individuals, including relatives of controlling shareholders and top executives. As affiliates are not counted as those having special interests in this study, the ratio of shares owned by special interest individuals are separated from the one by affiliates. So, the ratio of shares held by special interest individuals is an appropriate variable representing the incentives of facilities of controlling shareholders and all the parties concerned. The ratio of shares owned by affiliates indicates shares of investment in the firm in question made by affiliates, through which along with that of special interest individuals controlling shareholders govern the firm. Consequently, ownership-control disparity representing the difference between them can be described as shares of affiliates.

Voting right multiplier index is the ratio of control to ownership, and there is an argument that the index more properly embodies the concept of disparity as "management control by controlling shareholders is multiplied several times through affiliates in spite of their marginal

share-holdings.” This study uses two voting right multiplier index. The voting right multiplier index 1 is defined as ownership or internal ownership divided only by the ratio of shares owned by the single controlling shareholders (same identity). The voting right multiplier index 2 is obtained by dividing internal ownership by the ratio of shares owned by those deemed as having special relationships with that person (the same identity, relatives, top executives, and nonprofit organizations). To test whether greater ownership-control disparity translates into rise in investment as controlling shareholders have growing incentives to seek size maximization, voting right multiplier index is used as proxy variable of ownership structure.

C. Estimated Equation of Effect from Debt Ratio

Estimation 1: Analysis of Debt Ratio’s Effect on Investment (1988-2003)

First, Estimation 1 covers all the time span including both before and after the economic crisis to analyze debt ratio’s effect on investment like estimated Equation (2). To estimate the change in the effect from debt ratio before and after the economic crisis, estimation is made by separate variables of debt ratio, as shown in estimated Equation (3).

$$\begin{aligned} \text{investment ratio}_t = & \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t \\ & + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operating profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\ & + \beta_1 \text{ Debt Ratio} + \gamma_1 \text{ owner's share} + \gamma_2 \text{ affiliated firms' total share} \\ & + \text{Year Dummies} + \varepsilon \end{aligned} \quad (2)$$

$$\begin{aligned} \text{investment ratio}_t = & \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t \\ & + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operating profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\ & + \beta_2 \text{ Debt Ratio} \cdot D_{1988-1997} + \beta_3 \text{ Debt Ratio} \cdot D_{1998-2003} \\ & + \gamma_1 \text{ owner's share} + \gamma_2 \text{ affiliated firms' total share} \\ & + \text{Year Dummies} + \varepsilon \end{aligned} \quad (3)$$

Here, $D_{1988-1997}$ is dummy variable before the economic crisis, whose value is 1 for before the crisis or 0 for after the crisis, while $D_{1998-2003}$ is dummy variable after the economic crisis, whose value is 0 for before the crisis or 1 for after the crisis. In line with a considerable number of domestic empirical research, estimate of β_2 is forecasted to be a positive value. Estimate of β_3 signifies the effect of debt on investment after the economic crisis, through which the relation between

investment and debt after the economic crisis can be understood. Variable of γ_1 represents shares owned by those deemed as having special relationships and this means ownership shares of controlling shareholders, as mentioned earlier. The effect of shares owned by affiliates is shown through γ_2 , also representing the effect of ownership-control disparity as difference between them. The positive value of γ_1 indicates the endorsement of alignment hypothesis. In contrast, if γ_1 has a minus value, shrinking ratio of shares owned by controlling shareholders means increasing investment ratio. The positive value of γ_2 means increases in control rights raise the investment expenditure, which indicates the presence of controlling shareholders' incentives to seek size maximization. But statistically insignificant effect of γ_2 suggests that controlling shareholders does not have the incentive to maximize size.

Estimation 2: Impact of Regulations Imposed on Main Debtor Groups (1988-2003)

Estimation 2 uses dummy variable of the regulated firms selected as main debtor groups in an effort to understand the relationship between debt and investment in the firms of main debtor groups. By including D_1 , dummy variable of the regulated firms selected as main debtor groups in estimated Equation (4), how regulations have an effect before and after the economic crisis as well as on the main debtor groups can be identified. To grasp the effect of the 200% debt ratio cap during its strong enforcement period from 1998 to 2000, dummy variable of this period is added to estimated Equation (5).

$$\begin{aligned}
 \text{investment rate}_t = & \alpha_0 + \alpha_1 \text{utilization rate}_t + \alpha_2 \text{market share}_t \\
 & + \alpha_3 \text{capital intensity}_t + \alpha_4 \text{operating profits}_{t-1} + \alpha_5 \text{cash flow}_t \\
 & + \beta_2 \text{Debt Ratio}_t \cdot D_{1988-1997} + \beta_3 \text{Debt Ratio}_t \cdot D_{1998-2003} \\
 & + \beta_4 \text{Debt Ratio}_t \cdot D_1 \cdot D_{1998-2003} + \gamma_1 \text{owner's share}_t \\
 & + \gamma_2 \text{affiliates' share}_t + \text{Year Dummies} + \varepsilon
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 \text{investment rate}_t = & \alpha_0 + \alpha_1 \text{utilization rate}_t + \alpha_2 \text{market share}_t \\
 & + \alpha_3 \text{capital intensity}_t + \alpha_4 \text{operate profits}_{t-1} + \alpha_5 \text{cash flow}_t \\
 & + \beta_2 \text{Debt Ratio}_t \cdot D_{1988-1997} + \beta_5 \text{Debt Ratio}_t \cdot D_{1998-2000} \\
 & + \beta_6 \text{Debt Ratio}_t \cdot D_1 \cdot D_{1998-2000} + \beta_7 \text{Debt Ratio}_t \cdot D_{2001-2003} \\
 & + \beta_8 \text{Debt Ratio}_t \cdot D_1 \cdot D_{2001-2003} \\
 & + \gamma_1 \text{owner's share}_t + \gamma_2 \text{affiliates' share} + \text{Year Dummies} + \varepsilon
 \end{aligned} \tag{5}$$

Here, dummy variable D_1 has a value of 1 in case of the regulated firms as main debtor groups, and 0 for the unregulated firms. Estimate of $\beta_3 + \beta_4$ from estimated Equation (4) throws light on the investment-debt relation in the regulated firms as main debtor groups. Meanwhile, the period between the post-economic crisis and 2000 and the period after 2001 are sorted out by dummy variables of $D_{1998-2000}$ and $D_{2001-2003}$. Hence, comparing estimates of $\beta_5 + \beta_6$ and $\beta_7 + \beta_8$ reveals the difference in the effect caused by regulations applied to main debtor groups between the period of strong enforcement of the 200% debt ratio cap and the period of declining influence.

Estimation 3: Effects of Regulation on Investment (1998-2003)

To examine whether regulations applied to main debtor groups are discouraging corporate investment, Estimation 3 makes an analysis using a model including dummy variable of the firms in main debtor groups for the period ranging from 1998 to 2003, as illustrated in estimated Equation (6). If regression analysis of Estimation 3 produces a minus value for estimate of β_9 , the regulated firms as main debtor groups invest less than the unregulated firms.

$$\begin{aligned}
 \text{investment rate}_t = & \alpha_0 + \alpha_1 \text{utilization rate}_t + \alpha_2 \text{market share}_t \\
 & + \alpha_3 \text{capital intensity}_t + \alpha_4 \text{operate profits}_{t-1} + \alpha_5 \text{cash flow}_t \\
 & + \beta_2 \text{Debt Ratio}_t + \beta_9 D_1 \\
 & + \gamma_1 \text{owner's share}_t + \gamma_2 \text{affiliates' share} + \text{Year Dummies} + \varepsilon
 \end{aligned} \quad (6)$$

Estimation 4: Main Debtor Group Covenant and Equity Investment Restriction (1998-2003)

Main debtor groups are selected based on the size of loans, therefore mainly composed of the top business groups. So the traits resulted from the analysis here may be originated from their status as the top business groups, not as firms subject to regulations for main debtor groups. To go over this problem, comparison with the business groups subject to the Equity Investment Restriction called *Total Equity Investment Ceiling Rule* is made in this study as they belong to the top large business groups.⁸ The following estimated Equation (7) shows the investment-debt relations by classifying firms based on whether they are subject to both regulations as main debtor groups and the Total

⁸The list of business groups under Equity Investment Restriction is presented in Appendix Table 2.

Equity Investment Ceiling Rule, either of them, or free from both regulations.

$$\begin{aligned}
 \text{investment rate}_t = & \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t \\
 & + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operate profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\
 & + \beta_{10} \text{ Debt Ratio}_t \cdot D_0 \cdot E_0 + \beta_{11} \text{ Debt Ratio}_t \cdot D_1 \cdot E_0 \\
 & + \beta_{12} \text{ Debt Ratio}_t \cdot D_0 \cdot E_1 + \beta_{13} \text{ Debt Ratio}_t \cdot D_1 \cdot E_1 \\
 & + \gamma_1 \text{ owner's share}_t + \gamma_2 \text{ affiliates' share} + \text{Year Dummies} + \varepsilon
 \end{aligned} \tag{7}$$

Here, firms under the Total Equity Investment Ceiling Rule gives the value of 1 for dummy variable E_1 , and E_0 has the value of 1 when firms are not regulated by the Total Equity Investment Ceiling Rule. The value 1 is given to dummy variable D_1 if firms are selected as main business groups and dummy variable D_0 of firms which do not belong to the selected main debtor groups is 1. Among firms not regulated by the Total Equity Investment Ceiling Rule, estimates of β_{10} and β_{11} will be compared. For firms under the Total Equity Investment Ceiling Rule, comparison of estimates of β_{12} and β_{13} will be made.

D. Estimated Equation of Effect from Voting Right Leverage Index

Estimation 5: Effect of Voting Right Multiplier Index on Investment (1988-2003)

Estimation 5 encompasses all the periods, including both before and after the economic crisis, in analyzing the effect of voting right leverage index on investment, as shown in estimated Equation (8).

$$\begin{aligned}
 \text{investment rate}_t = & \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t \\
 & + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operate profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\
 & + \beta_1 \text{ Debt Ratio}_t \\
 & + \gamma_3 \text{ voting right multiplier index} + \text{Year Dummies} + \varepsilon
 \end{aligned} \tag{8}$$

Estimation 6: Effects of Voting Right Multiplier Index on Investment (before and after the economic crisis)

In Estimation 6, estimates of voting right leverage index are separately obtained before and after the economic crisis, as illustrated in estimated Equation (9), to estimate the change in the effect from voting right leverage index during this period.

$$\text{investment rate}_t = \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t$$

$$\begin{aligned}
& + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operate profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\
& + \beta_1 \text{ Debt Ratio}_t \\
& + \gamma_4 \text{ voting right multiplier index} \cdot D_{1988-1997} \\
& + \gamma_5 \text{ voting right multiplier index} \cdot D_{1998-2003} \\
& + \text{Year Dummies} + \varepsilon
\end{aligned} \tag{9}$$

Similar to estimated Equation (3), $D_{1988-1997}$ and $D_{1998-2003}$ are dummy variables denoting before and after the economic crisis, respectively. The positive estimate of γ_3 means that increasing ownership-control disparity leads to greater incentives to seek size maximization by controlling shareholders and consequently the increase in investment. Estimates of γ_4 and γ_5 are variables representing the relationship between voting right multiplier index and investment, before and after the economic crisis respectively.

Estimation 7: Effects of Voting Right Multiplier Index on Investment (1998-2003)

The period to be analyzed in Estimation 7 is limited to the time span from 1998 to 2003 in assessing the effect of voting right leverage index. As estimated Equation (10) illustrates, the periods from 1998 to 2000 and from 2001 to 2003 are separately analyzed.

$$\begin{aligned}
\text{investment rate}_t = & \alpha_0 + \alpha_1 \text{ utilization rate}_t + \alpha_2 \text{ market share}_t \\
& + \alpha_3 \text{ capital intensity}_t + \alpha_4 \text{ operate profits}_{t-1} + \alpha_5 \text{ cash flow}_t \\
& + \beta_1 \text{ Debt Ratio}_t \\
& + \gamma_6 \text{ voting right multiplier index} \cdot D_{1998-2000} \\
& + \gamma_7 \text{ voting right multiplier index} \cdot D_{2001-2003} \\
& + \text{Year Dummies} + \varepsilon
\end{aligned} \tag{10}$$

The positive values of γ_3 to γ_7 included in Estimation 5 to Estimation 7 mean that rising voting right multiplier index translates into the rise in investment ratio, suggesting the presence of controlling shareholders' incentive to seek size maximization. But if γ_3 to γ_7 have statistically insignificant effects, controlling shareholders do not have the incentive to seek size maximization.

Basic statistical data used in this research are arranged in the following Table 1.

TABLE 1
BASIC STATISTICAL DATA

| Variables | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | Total |
|---------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Investment rate | | | | | | | | | | | | 2.86 | -0.64 | 0.90 | -0.18 | -0.28 | -0.56 | 0.46 |
| Regulated firms | | | | | | | | | | | | 0.54 | -1.05 | 0.46 | -0.90 | -2.54 | -1.18 | 2.45 |
| Non-Regulated firms | | | | | | | | | | | | 1.66 | -0.87 | 0.66 | -0.57 | -1.80 | -0.96 | 2.09 |
| Total | | 6.25 | 5.59 | 4.19 | 5.43 | 3.11 | 2.45 | 3.10 | 3.76 | 4.00 | 2.81 | 1.66 | -0.87 | 0.66 | -0.57 | -1.80 | -0.96 | 2.09 |
| Rate of utilization | | | | | | | | | | | | 77.29 | 75.99 | 83.47 | 83.88 | 81.69 | 81.44 | 79.95 |
| Regulated firms | | | | | | | | | | | | 73.73 | 78.17 | 79.38 | 70.92 | 79.69 | 79.73 | 79.31 |
| Non-Regulated firms | | | | | | | | | | | | 75.72 | 77.03 | 81.48 | 77.68 | 80.46 | 80.36 | 79.38 |
| Total | | 79.12 | 79.37 | 78.89 | 78.26 | 78.29 | 77.89 | 78.27 | 83.63 | 79.18 | 80.47 | 75.72 | 77.03 | 81.48 | 77.68 | 80.46 | 80.36 | 79.38 |
| Market share | | | | | | | | | | | | 12.33 | 13.51 | 13.38 | 12.47 | 15.53 | 14.34 | 13.46 |
| Regulated firms | | | | | | | | | | | | 6.34 | 5.65 | 5.43 | 6.03 | 5.39 | 5.12 | 9.87 |
| Non-Regulated firms | | | | | | | | | | | | 9.25 | 9.04 | 8.99 | 9.11 | 8.73 | 8.42 | 10.49 |
| Total | | 15.65 | 14.92 | 14.15 | 13.26 | 11.99 | 11.85 | 11.17 | 10.67 | 10.05 | 9.41 | 9.15 | 9.04 | 8.99 | 9.11 | 8.73 | 8.42 | 10.49 |
| Capital intensity | | | | | | | | | | | | 79.94 | 71.48 | 61.21 | 63.48 | 56.34 | 50.75 | 63.84 |
| Regulated firms | | | | | | | | | | | | 53.16 | 52.58 | 56.93 | 52.25 | 53.98 | 49.54 | 53.48 |
| Non-Regulated firms | | | | | | | | | | | | 63.74 | 60.79 | 58.85 | 57.66 | 54.76 | 49.97 | 55.28 |
| Total | | 46.10 | 47.52 | 52.34 | 56.18 | 54.36 | 57.14 | 58.18 | 55.83 | 52.27 | 53.96 | 63.74 | 60.79 | 58.85 | 57.66 | 54.76 | 49.97 | 55.28 |
| Operating profit rate | | | | | | | | | | | | 10.07 | 9.13 | 8.69 | 8.95 | 8.77 | 8.19 | 9.00 |
| Regulated firms | | | | | | | | | | | | 9.48 | 9.98 | 9.51 | 8.57 | 9.17 | 8.35 | 9.07 |
| Non-Regulated firms | | | | | | | | | | | | 9.77 | 9.62 | 9.13 | 8.76 | 9.03 | 8.29 | 9.06 |
| Total | | 10.04 | 9.77 | 8.70 | 9.03 | 8.97 | 8.46 | 9.10 | 9.25 | 8.91 | 8.46 | 9.16 | 9.16 | 9.13 | 8.76 | 9.03 | 8.29 | 9.06 |
| Cash flow | | | | | | | | | | | | -3.00 | 3.25 | 2.96 | 4.48 | 2.67 | 4.91 | 2.93 |
| Regulated firms | | | | | | | | | | | | -2.03 | 6.04 | 8.40 | 3.60 | 8.92 | 1.52 | 5.08 |
| Non-Regulated firms | | | | | | | | | | | | -2.50 | 4.83 | 5.94 | 4.12 | 6.84 | 2.70 | 5.00 |
| Total | | 8.28 | 8.10 | 6.13 | 5.40 | 5.07 | 4.94 | 5.61 | 6.40 | 6.20 | 4.19 | 1.02 | -2.50 | 4.83 | 5.94 | 4.12 | 6.84 | 2.70 |
| Debt ratio | | | | | | | | | | | | 66.01 | 59.07 | 58.80 | 55.18 | 55.78 | 52.76 | 58.12 |
| Regulated firms | | | | | | | | | | | | 61.95 | 55.29 | 53.07 | 53.28 | 50.06 | 48.33 | 65.50 |
| Non-Regulated firms | | | | | | | | | | | | 63.94 | 56.99 | 55.66 | 54.21 | 52.05 | 49.96 | 64.23 |
| Total | | 69.55 | 67.64 | 67.29 | 69.36 | 71.23 | 72.16 | 71.01 | 70.59 | 69.54 | 70.35 | 72.12 | 63.94 | 56.99 | 55.66 | 54.21 | 52.05 | 49.96 |
| Voting right multiplier 1 | | | | | | | | | | | | 9.26 | 10.35 | 8.62 | 7.73 | 7.54 | 8.12 | 8.68 |
| Regulated firms | | | | | | | | | | | | 4.30 | 7.67 | 4.25 | 4.93 | 4.94 | 4.16 | 5.01 |
| Non-Regulated firms | | | | | | | | | | | | 6.66 | 9.02 | 6.72 | 6.44 | 5.78 | 5.69 | 5.78 |
| Total | | 9.00 | 2.31 | 2.67 | 3.48 | 4.11 | 6.18 | 5.34 | 4.08 | 5.63 | 6.33 | 6.66 | 9.02 | 6.72 | 6.44 | 5.78 | 5.69 | 5.78 |
| Voting right multiplier 2 | | | | | | | | | | | | 7.73 | 6.77 | 5.98 | 6.83 | 8.15 | 7.73 | 7.14 |
| Regulated firms | | | | | | | | | | | | 3.34 | 4.32 | 5.18 | 3.72 | 3.96 | 3.04 | 3.47 |
| Non-Regulated firms | | | | | | | | | | | | 5.59 | 5.67 | 5.62 | 5.29 | 5.26 | 4.70 | 4.23 |
| Total | | 4.35 | 1.93 | 2.73 | 2.28 | 3.29 | 2.57 | 3.14 | 2.77 | 3.03 | 3.43 | 4.63 | 5.59 | 5.67 | 5.29 | 5.26 | 4.70 | 4.23 |

IV. Estimation Results

A. Estimation Method

In this study, we use panel data set of affiliate firms comprising the top 100 business groups from 1988 to 2003. The Hausman test is conducted on a model, and the test result indicates the problem of fixed error term by firm, and this study adopts within estimator to solve fixed effect problem.

B. Estimation Results

Regression results reveal positive estimates of the utilization rate in most regressions. As the utilization rate is variable reflecting demand shock, the results indicate that investment responds to demand shock very sensitively. Estimates of market share have both positive and negative values. The positive estimates are not significant, and only statistically significant negative estimates are obtained in the last Estimation 7 (estimated Equation (10)) in the analysis of the effect from ownership-control structure. While high market share induces firms to lead the market through facility expansion, firms having pushed their market share through already sufficient facility investment hesitate to invest more in facilities. If all aspects of estimation results are considered, these two opposing effects seem to make the market share-investment relation statistically insignificant. Estimates of capital intensity have almost invariably positive values in regressions, and almost every one has a statistically significant value. Therefore, firms or industries with higher capital intensity tend to embark on more facility investments. Meanwhile, all estimates of the previous year's operating profit ratio have positive values, and statistically significant value can be found in the analysis of the effect from the ownership-control structure. In the estimation model for analysing effect of debt ratio, most estimates of operating profit rate are not statistically significant, but the *t*-values of estimates approach the critical value. Judging from this and the entire regression results, ratio of operating profit can be regarded as statistically significant effect on investment. All estimates of cash flow have positive values, and most are statistically significant. This is consistent with findings from the existing studies in that higher cash flow encourages investment when firms decide on investment.

TABLE 2
ESTIMATION 1: EFFECT OF DEBT RATIO ON INVESTMENT (1988-2003)

| | Equation (2) | | Equation (3) | |
|--------------|-----------------------|---------------------|-----------------------|----------------------|
| | Fixed effects | Random effects | Fixed effects | Random effects |
| α_0 | -12.946 (-3.39)*** | 0.835 (0.36) | -15.676 (-4.49)*** | -1.666 (-0.86) |
| α_1 | 0.037 (1.91)* | 0.001 (0.07) | 0.035 (1.82)* | 0.0004 (0.04) |
| α_2 | 0.066 (0.86) | -0.010 (-0.73) | 0.061 (0.80) | -0.009 (-0.65) |
| α_3 | 0.108 (8.71)*** | 0.066 (11.59)*** | 0.107 (8.67)*** | 0.067 (11.67)*** |
| α_4 | 0.090 (1.21) | 0.085 (1.45) | 0.110 (1.48) | 0.099 (1.68)* |
| α_5 | 19.628 (3.46)*** | 13.819 (3.38)*** | 19.338 (3.41)*** | 13.418 (3.28)*** |
| β_1 | 0.161 (4.79)*** | 0.043 (2.32)** | | |
| β_2 | | | 0.204 (5.78)*** | 0.070 (3.48)*** |
| β_3 | | | 0.124 (3.43)*** | 0.005 (0.23) |
| γ_1 | -0.070 (-1.83)* | -0.012 (-0.63) | -0.073 (-1.90)* | -0.017 (-0.87) |
| γ_2 | -0.014 (-0.56) | -0.027 (-2.50)** | -0.016 (-0.62) | -0.030 (-2.75)*** |
| Year Dummies | Included | Included | Included | Included |
| R^2 | 0.1395 | 0.1636 | 0.1419 | 0.1640 |
| Hausman Test | $\chi^2(23) = 97.60$ | | $\chi^2(23) = 253.51$ | |

Notes: 1) *t* values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

a) Results of Estimating Effects of Debt Ratio Regulations

Results from Estimation 1 regarding the effect of debt ratio on investment are illustrated in Table 2. According to estimated Equation (2), estimates of β_1 are positive values and statistically significant, indicating the positive effect of debt ratio on investment during the entire analytical period ranging from 1988 to 2003. From the results of estimated Equation (3), estimates of β_2 and β_3 are all statistically significant, showing the positive effect of debt ratio on investment both

TABLE 3
ESTIMATION 2: EFFECT OF REGULATIONS APPLIED TO
MAIN DEBTOR GROUPS (1988-2003)

| | Equation (4) | | Equation (5) | |
|---------------------|-----------------------|----------------------|-----------------------|----------------------|
| | Fixed effects | Random effects | Fixed effects | Random effects |
| α_0 | -15.472 (-4.43)*** | -1.850 (-0.95) | -15.180 (-4.11)*** | -1.346 (-0.65) |
| α_1 | 0.034 (1.75)* | 0.0006 (0.05) | 0.034 (1.75)* | 0.0008 (0.07) |
| α_2 | 0.068 (0.89) | -0.004 (-0.28) | 0.068 (0.88) | -0.004 (-0.31) |
| α_3 | 0.107 (8.63)*** | 0.068 (11.89)*** | 0.107 (8.62)*** | 0.069 (11.90)*** |
| α_4 | 0.117 (1.57) | 0.104 (1.77)* | 0.116 (1.56) | 0.105 (1.78)* |
| α_5 | 18.823 (3.32)*** | 13.463 (3.30)*** | 18.750 (3.27)*** | 13.226 (3.22)*** |
| β_2 | 0.196 (5.54)*** | 0.069 (3.47)*** | 0.193 (5.02)*** | 0.065 (3.13)*** |
| β_3 | 0.155 (3.89)*** | 0.034 (1.30) | | |
| β_4 | -0.043 (-1.85)* | -0.039 (-2.31)** | | |
| $\beta_3 + \beta_4$ | 0.111 (3.02)*** | | | |
| β_5 | | | 0.152 (3.17)*** | 0.026 (0.79) |
| β_6 | | | -0.046 (-1.72)* | -0.041 (-1.92)* |
| β_7 | | | 0.161 (3.01)*** | 0.053 (1.25) |
| β_8 | | | -0.036 (-1.04) | -0.033 (-1.22) |
| $\beta_5 + \beta_6$ | | | 0.106 (2.49)** | |
| $\beta_7 + \beta_8$ | | | 0.125 (2.33)** | |
| γ_1 | -0.077 (-2.01)** | -0.022 (-1.10) | -0.077 (-2.00)** | -0.021 (-1.07) |
| γ_2 | -0.015 (-0.60) | -0.029 (-2.70)*** | -0.016 (-0.61) | -0.029 (-2.66)*** |
| Year Dummies | Included | Included | Included | Included |
| R^2 | 0.1452 | 0.1679 | 0.1453 | 0.1683 |
| Hausman Test | $\chi^2(24) = 182.00$ | | $\chi^2(26) = 284.97$ | |

Notes: 1) t values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

TABLE 4
 ESTIMATION 3: DECLINE IN INVESTMENT CAUSED BY REGULATIONS APPLIED
 TO MAIN DEBTOR GROUPS (1998-2003)

| | Equation (6) | |
|--------------|----------------------|------------------|
| | Fixed effects | Random effects |
| α_0 | -14.593 (-1.72)* | -2.766 (-0.68) |
| α_1 | 0.007 (0.16) | 0.009 (0.33) |
| α_2 | 0.082 (0.41) | -0.033 (-0.87) |
| α_3 | 0.091 (2.51)** | 0.046 (3.32)*** |
| α_4 | 0.096 (0.53) | -0.078 (-0.59) |
| α_5 | 40.190 (3.40)*** | 27.068 (3.65)*** |
| β_2 | 0.239 (2.79)*** | 0.087 (2.06)** |
| β_9 | -5.000 (-1.85)* | -1.836 (-1.28) |
| γ_1 | -0.219 (-2.24)** | -0.036 (-0.85) |
| γ_2 | -0.078 (-1.03) | -0.063 (-2.04)** |
| Year Dummies | Included | Included |
| R^2 | 0.1359 | 0.0877 |
| Hausman Test | $\chi^2(14) = 45.00$ | |

Notes: 1) *t* values in parenthesis

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

before and after the economic crisis. In particular, the lower estimate of β_3 than that of β_2 implies the declining importance of debt in financing investment after the economic crisis.

Results of Estimation 2 are obtained from regression of regulatory effect on main debtor groups and collected in Table 3. Results of estimated Equation (4) reveal statistically significant minus value for estimate of β_4 , signifying the effect of the covenant applied to main debtor groups, and estimates of $\beta_3 + \beta_4$ are lower than that of β_3 . Although debt is still one of important financing vehicles of investment for the firms selected as main debtor groups, financing through debt comes to account for lesser portion due to the regulation. In results from estimated Equation (5), estimate of β_6 represents the regulatory effect from 1998 to 2000 when the 200% debt ratio cap was explicitly enforced, and has a minus value of -0.046, which is statistically significant. Estimate of β_8 shows the regulatory effect from 2001 to 2003 when the debt ratio cap became relaxed, and it remains in negative territory marking -0.036 but fails to be statistically significant. Estimate of β_6 (-0.046) is lower than that of β_8 (-0.036), and β_8 is not statisti-

TABLE 5
ESTIMATION 4: COMPARISON OF FIRMS SUBJECT TO MAIN DEBTOR GROUPS
COVENANT AND THE TOTAL EQUITY INVESTMENT CEILING RULE
(1998-2003)

| | Equation (7) | |
|---------------------------|----------------------|------------------|
| | Fixed effects | Random effects |
| α_0 | -19.580 (-2.28)** | -3.354 (-0.84) |
| α_1 | 0.013 (0.30) | 0.010 (0.40) |
| α_2 | 0.098 (0.48) | -0.035 (-0.96) |
| α_3 | 0.100 (2.70)*** | 0.044 (3.20)*** |
| α_4 | 0.100 (0.55) | -0.081 (-0.62) |
| α_5 | 40.690 (3.42)*** | 26.601 (3.57)*** |
| β_{10} | 0.294 (3.14)*** | 0.090 (1.96)** |
| β_{11} | 0.217 (2.35)** | 0.068 (1.29) |
| β_{12} | 0.431 (1.99)** | 0.121 (1.32) |
| β_{13} | 0.200 (2.13)** | 0.070 (1.65)* |
| $\beta_{10} + \beta_{12}$ | 0.725 (2.76)*** | |
| $\beta_{11} + \beta_{13}$ | 0.417 (2.38)** | |
| γ_1 | -0.212 (-2.15)** | -0.030 (-0.71) |
| γ_2 | -0.061 (-0.77) | -0.062 (-2.04)** |
| Year Dummies | Included | Included |
| R^2 | 0.1377 | 0.0869 |
| Hausman Test | $\chi^2(23) = 96.66$ | |

Notes: 1) t values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

cally significant while β_6 is statistically significant. This fact enables us to notice the sharply diminishing role of debt in financing investment for the firms selected as main debtor groups when the debt ratio cap was strictly imposed. That is, strong imposition of regulation on debt ratio enormously undermines the role of debt in financing investment. As a result, estimate of $\beta_5 + \beta_6$ (0.106) is lower than that of $\beta_7 + \beta_8$ (0.125).

Table 4 presents regression results of Estimation 3 to test whether regulations applied to main debtor groups discourage investment. As estimate of β_9 has a statistically significant minus value, lower investment by those selected firms than the unregulated counterparts is confirmed. The investment ratio of the regulated firms as main debtor groups is about 5% lower than the unregulated firms (See Table 4).

Table 5 demonstrates results from Estimation 4, where the difference

between firms under the Total Equity Investment Ceiling Rule and subject to the regulations as main debtor groups. Among the firms exempt from the Total Equity Investment Ceiling Rule, the firms regulated as main debtor groups have a lower estimate of β_{11} (0.217) than that of the unselected firms β_{10} (0.294). Out of the firms under the Total Equity Investment Ceiling Rule, the regulated firms as main debtor groups show a lower estimate of β_{13} (0.200), compared to the unselected firms (with estimate of β_{12} at 0.431). Regardless of whether firms are under the Total Equity Investment Ceiling Rule or not, firms selected as the main debtor groups mark a lower estimate of debt ratio. Accordingly, it is not because they are members of the top business groups that the regulated firms as main debtor groups exhibit a lower dependence on debt ratio compared to the unregulated counterparts.

The positive effects of debt ratio on investment appear both before and after the economic crisis, suggesting that the helpful role of debts in promoting investment persists not only before but also after the economic crisis. The decrease in estimate of debt ratio after the economic crisis is suggestive of the diminishing influence of debt in promoting investment. The influence of debt marks a sharper fall in the regulated firms as main debtor groups than the unregulated firms. Especially, debt of the regulated firms as main debtor groups exerted the lowest influence on investment when the 200% debt ratio cap was explicitly stipulated.

b) Results of Estimating Effect of Ownership-Control Disparity

Results from estimations 5 to 7 analyzing the effect of voting right multiplier index on investment are presented in Table 6, Table 7, and Table 8. Regression results unanimously conclude that the rise in voting right multiplier index does not drive the increase in investment ratio. Results of Estimation 5 in Table 6 offer estimate of γ_3 , showing the effect of voting right multiplier index on investment from 1988 to 2003, whose value is close to 0 and statistically insignificant for both voting right multiplier index 1 and index 2. According to the results from Estimation 6 in Table 7, the effect of voting right leverage index is separately represented in γ_4 for the period before the economic crisis and in γ_5 for the period after the economic crisis. Their estimates are all close to 0 and statistically insignificant. From results of Estimation 7 in Table 8, γ_6 and γ_7 are established to separately analyze voting right multiplier index 1 before and after the economic crisis, and their estimates are all statistically insignificant. Regarding voting right multi-

TABLE 6

ESTIMATION 5: EFFECT OF VOTING RIGHT LEVERAGE INDEX ON INVESTMENT
(ENTIRE PERIOD)

| Equation (8) | | | | |
|--------------|---------------------------|----------------------|---------------------------|----------------------|
| | Voting Right Multiplier 1 | | Voting Right Multiplier 2 | |
| | Fixed effects | Random effects | Fixed effects | Random effects |
| α_0 | -21.494 (-4.19)*** | -8.251 (-2.66)*** | -14.389 (-3.52)*** | -7.163 (-2.82)*** |
| α_1 | 0.080 (3.11)*** | 0.022 (1.52) | 0.062 (2.89)*** | 0.015 (1.27) |
| α_2 | 0.023 (0.29) | 0.001 (0.08) | -0.008 (-0.13) | -0.001 (-0.06) |
| α_3 | 0.084 (5.08)*** | 0.061 (7.71)*** | 0.047 (4.98)*** | 0.047 (8.12)*** |
| α_4 | 0.315 (3.05)*** | 0.195 (2.54)** | 0.290 (3.46)*** | 0.173 (2.80)*** |
| α_5 | 12.669 (1.62) | 11.343 (2.04)** | 12.240 (1.90)* | 13.902 (2.99)*** |
| β_1 | 0.162 (3.48)*** | 0.084 (3.33)*** | 0.113 (3.08)*** | 0.083 (4.16)*** |
| γ_3 | 0.008 (0.85) | 0.004 (0.63) | -0.002 (-0.47) | -0.0002 (-0.09) |
| Year Dummies | Included | Included | Included | Included |
| R^2 | 0.1235 | 0.1375 | 0.0960 | 0.1260 |
| Hausman Test | $\chi^2(22) = 34.40$ | | $\chi^2(22) = 32.97$ | |

Notes: 1) t values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

plier index 2, however, both estimates of γ_6 and γ_7 are statistically significant. Rather, voting right leverage index 2 has a negative effect on investment. But such estimates are too small (-0.064 and -0.022, respectively) to argue that increasing difference between control and ownership discourages investment based on estimates of γ_6 and γ_7 corresponding to effect of voting right multiplier index 2. Hence, our judgment based on regression results is that it is not reasonable to argue that excessive control relative to ownership promotes investment as controlling shareholders are induced to seek size maximization.

Empirical results from estimations 5 to 7 analyzing the effect of voting right multiplier index, defined as the ratio between control and ownership, suggest that the ownership-control disparity does not have

TABLE 7

ESTIMATION 6: EFFECT OF VOTING RIGHT LEVERAGE INDEX ON INVESTMENT
(BEFORE AND AFTER THE ECONOMIC CRISIS)

| | Equation (9) | | | |
|--------------|---------------------------|---------------------|---------------------------|---------------------|
| | Voting Right Multiplier 1 | | Voting Right Multiplier 2 | |
| | Fixed effects | Random effects | Fixed effects | Random effects |
| α_0 | -15.198 (-4.29)*** | -2.622 (-1.22) | -11.028 (-3.31)*** | -2.742 (-1.33) |
| α_1 | 0.057 (3.14)*** | 0.018 (1.66)* | 0.049 (2.75)*** | 0.012 (1.21) |
| α_2 | 0.021 (0.33) | 0.001 (0.12) | 0.003 (0.05) | 0.002 (0.18) |
| α_3 | 0.097 (8.58)*** | 0.070 (12.17)*** | 0.062 (7.32)*** | 0.057 (11.33)*** |
| α_4 | 0.146 (2.01)** | 0.098 (1.74)* | 0.142 (2.02)** | 0.092 (1.70)* |
| α_5 | 17.994 (3.30)*** | 13.177 (3.25)*** | 14.587 (2.76)*** | 14.340 (3.63)*** |
| β_1 | 0.153 (4.72)*** | 0.048 (2.70)*** | 0.130 (4.19)*** | 0.057 (3.36)*** |
| γ_4 | 0.00004 (0.06) | -0.001 (-2.05)** | -0.00004 (-0.08) | -0.0002 (-1.13) |
| γ_5 | 0.0002 (0.27) | 0.0002 (0.29) | 0.0002 (0.27) | 0.0001 (0.34) |
| Year Dummies | Included | Included | Included | Included |
| R^2 | 0.1191 | 0.1441 | 0.0996 | 0.1279 |
| Hausman Test | $\chi^2(22) = 46.14$ | | $\chi^2(22) = 34.61$ | |

Notes: 1) t values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

an effect on the corporate decision on investment. Even in Estimations 1-4 (See Table 2-Table 5) where the effect of the ratio of shares owned by affiliates on effect are tested as the ratio demonstrates ownership-control disparity, estimate of γ_2 is not statistically significant. So, the fact that ownership-control disparity does not influence investment is confirmed again. These regression results suggest that executive officers who are controlling shareholders do not have the incentive to seek size maximization. So the argument that lower stake of controlling shareholders increases their incentive to seek size maximization and results

TABLE 8
ESTIMATION 7: EFFECT OF VOTING RIGHT LEVERAGE INDEX ON INVESTMENT
(AFTER THE ECONOMIC CRISIS)

| Equation (10) | | | | |
|---------------|---------------------------|-----------------------|---------------------------|-----------------------|
| | Voting Right Multiplier 1 | | Voting Right Multiplier 2 | |
| | Fixed effects | Random effects | Fixed effects | Random effects |
| α_0 | -14.284 (-1.22) | -15.801 (-2.87)*** | -5.069 (-0.58) | -12.318 (-2.87)*** |
| α_1 | 0.264 (4.28)*** | 0.088 (2.47)** | 0.221 (4.52)*** | 0.077 (2.69)*** |
| α_2 | -1.482 (-5.72)*** | -0.041 (-0.76) | -1.484 (-6.72)*** | -0.040 (-0.84) |
| α_3 | 0.091 (1.46) | 0.060 (3.19)*** | -0.003 (-0.20) | 0.031 (2.63)*** |
| α_4 | 0.701 (2.31)** | 0.199 (0.99) | 0.571 (2.53)** | 0.134 (0.86) |
| α_5 | 16.476 (1.09) | 15.005 (1.36) | 16.159 (1.30) | 15.228 (1.68)* |
| β_1 | 0.165 (1.28) | 0.120 (2.00)** | 0.176 (1.77)* | 0.112 (2.26)** |
| γ_6 | 0.005 (0.05) | 0.001 (0.08) | -0.064 (-2.24)** | -0.011 (-0.55) |
| γ_7 | 0.010 (0.12) | -0.008 (-0.21) | -0.022 (-2.74)*** | -0.0004 (-0.14) |
| Year Dummies | Included | Included | Included | Included |
| R^2 | 0.3130 | 0.1079 | 0.2775 | 0.0830 |
| Hausman Test | $\chi^2(13)=53.52$ | | $\chi^2(13)=61.14$ | |

Notes: 1) t values in parenthesis.

2) ***, **, * represent statistically significant with 1%, 5%, 10% level.

in the increase in investment cannot be supported. The statistically significant minus estimate of γ_1 in Estimations 1-4 is consistent with empirical results of other researchers. This is not caused by controlling shareholders' incentive to seek size maximization. Rather, as Choi, Ham, and Kim (2003) explains, lower stake by them reduces risk bearing and consequently raise the investment ratio.

V. Summary and Conclusion

In this study, the effect of debt on corporate investment is analyzed

to know how the firms subject to regulations, such as the covenant to improve the financial structure including the 200% debt ratio cap, experience the change caused by the enforcement of them. Whether ownership-control disparity encourages controlling shareholders to seek size maximization is also scrutinized.

This study confirms that debt generates a positive effect on investment both before and after the economic crisis. In addition, debt's declining influence on investment after the economic crisis is verified. When companies are selected as main debtor groups and then are forced to comply with the covenant requiring improvement of their financial structure, their debt shows much lower effect on investment compared to the other unregulated counterparts. During the period of the strongest imposition of the 200% debt ratio cap, it is proven that the debts of firms selected as the main debtor groups exert the lowest influence on investment. The confirmed findings from our research is that the effect of debt on investment as well as investment ratio itself are low in case of the firms selected as main debtor groups. Possible speculation for these low figures is that the regulated firms as main debtor groups are subject to regulations when they seek to make use of debt to facilitate investment. It is also verified that the firms have to suffer such constraints not because they are affiliates of conglomerates but because regulations applied to main debtor groups are enforced. Therefore, empirical results from this research offer strong likelihood that sluggish investment in the regulated firms as main debtor groups are triggered by enforcement of regulations calling for improvement in financial structure like the 200% debt ratio cap.

In dealing with a dangerous situation right after the economic crisis, the government implemented a reasonable policy of requiring the conclusion of the covenant to improve financial structure with firms selected as main debtor groups. So, it is rather unfair to brush the measures aside as quickie policy. Although the leverage is one of financing methods to make funds for doing business, debts financing has been even considered as a sin after the economic crisis. Given that it takes considerable time for the capital market in Korea to mature, corporate finance through leverage from banks still remain important. According to the results of analysis in this research, loans from banks still play an important role as financial resources.

To examine whether increasing ownership-control disparity prompts controlling shareholders to maximize the scale, the effect of voting right leverage index on investment is analyzed. The regression results of

various estimated models suggest no significant relations between them. On top of that, when ownership-control disparity (the ratio of shares owned by affiliates) as difference between ownership and control is analyzed to determine its effect on investment, the estimation produces no significant results regarding its effect on investment. Therefore, the argument that the lower share of controlling shareholders contributes to the rise in investment as their incentives to size expansion grow cannot be endorsed. In conclusion, the increasing ratio of investment followed by declining ownership of controlling shareholders shown in a considerable number of studies conducted in Korea, including this paper is thought to be attributable to the lower risk bearing, not to the growing incentive to seek size maximization.

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Appendix

APPENDIX TABLE 1
THE LIST OF MAIN DEBTOR GROUPS

| 1998 | | 1999 | | 2000 | | 2001 | | 2002 | | 2003 | | |
|--------|-----------|---------|-----------|---------|--------------|---------|-----------------|---------|-------------------|---------|-------------------|---------|
| Groups | Bank | Groups | Bank | Groups | Bank | Groups | Bank | Groups | Bank | Groups | Bank | |
| 1 | Hyundai | KEB | Hyundai | KEB | Hyundai | KEB | Hyundai | KEB | Samsung | Hanbit | Samsung | Woori |
| 2 | Samsung | Hanil | Daewoo | Cheil | Samsung | Hanbit | LG | Hanbit | LG | Hanbit | LG | Woori |
| 3 | Daewoo | Cheil | Samsung | Hanbit | Daewoo | Hanbit | Samsung | Hanbit | SK | Cheil | SK | Hana |
| 4 | LG | Sangub | LG | Hanbit | LG | Hanbit | SK | Cheil | Hyundai Auto | KEB | Hyundai Auto | KEB |
| 5 | Hanjin | Hanil | Hanjin | Hanbit | SK | Cheil | Hyundai Auto | KEB | Hanjin | Hanbit | Hanjin | Woori |
| 6 | SK | Cheil | SK | Cheil | Hanjin | Hanbit | Hanjin | Hanbit | Hyundai | KEB | Hyundai | KEB |
| 7 | Ssangyong | Chohung | Ssangyong | Chohung | Ssangyong | Chohung | Kumho | Chohung | Kumho | Chohung | Kumho | Chohung |
| 8 | Hanhwa | Hanil | Kohap | Hanbit | Kohap | Hanbit | Hyundai Ref. | Hanbit | Hyosung | Hanbit | Lotte | Chohung |
| 9 | Daelim | Hanil | Hanhwa | Hanbit | Kumho | Chohung | Kohap | Hanbit | Doosan | Hanbit | Doosan | Woori |
| 10 | Kumho | Chohung | Kumho | Chohung | Dong A | Seoul | Ssangyong | Chohung | Hyundai Ref. | Hanbit | Hanhwa | Woori |
| 11 | Kohap | Hanil | Dong A | Seoul | Hyundai Ref. | Hanbit | Hyosung | Hanbit | Hanhwa | Hanbit | Hyosung | Woori |
| 12 | Doosan | Sangub | Hyosung | Hanbit | Daewoo Elec. | Hanbit | Hanhwa | Hanbit | Hyundai Heavy | KEB | Dongbu | KDB |
| 13 | Dong A | Seoul | Daelim | Hanbit | Hyosung | Hanbit | Daewoo Elec. | Hanbit | Dongbu | Seoul | Dongyang | Woori |
| 14 | Hyosung | Hanil | Anam | Chohung | Hanhwa | Hanbit | Dongkuk | Seoul | Dongkuk | KDB | Dongkuk | KDB |
| 15 | Anam | Chohung | Dongkuk | Seoul | Hansol | Hanbit | Hansol | Hanbit | Lotte | Hanbit | KT | KB |
| 16 | Dongkuk | Seoul | Doosan | Hanbit | Daelim | Hanbit | POSCO | Hanbit | Dongyang | Hanbit | Hyundai Heavy | KEB |
| 17 | Hansol | Hanil | Shinho | Cheil | Anam | Chohung | Doosan | Hanbit | CJ | Hanbit | Kolong | Woori |
| 18 | | | Hansol | Hanbit | Dongkuk | Seoul | Lotte | Hanbit | Daewoo Ship B | KDB | Hyundai Oil | Woori |
| 19 | Kolong | Hanil | Gabl | Hanbit | Doosan | Hanbit | Dongbu | Seoul | Kolong | Hanbit | Daewoo Ship B | KDB |
| 20 | Shinho | Cheil | Dongbu | Seoul | Dongyang | Hanbit | Dongyang | Hanbit | Hansol | Hanbit | Sambo | KDB |
| 21 | Haitai | Chohung | Kolong | Hanbit | Gabl | Hanbit | CJ | Hanbit | KT | KB | Hansol | Woori |
| 22 | Lotte | Sangub | Dongkuk T | Cheil | Haitai | Chohung | Kolong | Hanbit | Daesang | Hanbit | Hankook T | Woori |
| 23 | Gabl | Sangub | Jindo | Seoul | Lotte | Hanbit | Daesang | Hanbit | Sambo | Cheil | CJ | Woori |
| 24 | Saehan | Hanil | Haitai | Chohung | Dongkuk T | Cheil | Daewoo C | Cheil | Hankook T | Hanbit | Daehan E | Hana |
| 25 | Dongkuk T | Cheil | Woobang | Seoul | Jindo | Seoul | Saehan | Hanbit | YungPung | Chohung | Hanaro Telecom | KDB |
| 26 | | Seoul | Dongyang | Hanbit | Shinho | Cheil | YungPung | Chohung | Poongsan | KDB | YungPung | KEB |
| 27 | Dongbu | Sangub | Saehan | Hanbit | Dongbu | Seoul | Hankook T | Hanbit | Daehan E | Seoul | Poongsan | KDB |
| 28 | Samyang | Cheil | Byuksan | Hanbit | Daewoo Auto | KEB | Dongkuk T | Cheil | POSCO | Hanbit | Daesang | Woori |
| 29 | Tongl | Hanil | Shirwon | KEB | Saehan | Hanbit | Gabl | Hanbit | Daehan T | Hana | Daelim | Woori |
| 30 | Dongyang | Seoul | Kangwon | Chohung | Hankook T | Hanbit | Daelim | Hanbit | Dongyang C | Chohung | | |
| 31 | Woobang | Sangub | Lotte | Hanbit | S Oil | KDB | Shinho | Cheil | Hanaro Telecom | KDB | | |
| 32 | Byuksan | Hanil | CJ | Hanbit | Byuksan | Hanbit | Poongsan | KDB | Samyang | Hanbit | | |
| 33 | CJ | Seoul | Samyang | Hanbit | CJ | Hanbit | Dongyang C | Chohung | Sungsin | KDB | | |
| 34 | Jindo | Hanil | Sungsin | KDB | Kolong | Hanbit | Jindo | Seoul | Daelim | Hanbit | | |
| 35 | Hankook T | Seoul | Hankook T | Hanbit | Shirwon | KEB | Sambo | Cheil | Dooroonet | KDB | | |
| 36 | Daehan E | Seoul | Daesang | Hanbit | Daesang | Hanbit | Daewoo Intl | Cheil | | | | |

(Appendix Table 1 Continued)

APPENDIX TABLE 2
BUSINESS GROUPS REGULATED BY EQUITY INVESTMENT RESTRICTION

| | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|----|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|----------------|---------------|---------------|
| 1 | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai | Hyundai |
| 2 | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung | Samsung |
| 3 | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | Daewoo | LG | LG | LG | LG |
| 4 | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG | Harjin | Harjin | Harjin | Harjin |
| 5 | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | Harjin | SK | SK | SK | SK |
| 6 | SK | SK | SK | SK | SK | SK | SK | SK | SK | SK | SK | SK | Ssangyong | Ssangyong | Hanhwa | Hanhwa |
| 7 | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Ssangyong | Kohap | Kohap | Kumho | Kumho |
| 8 | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Kohap | Hanhwa | Hanhwa | Doosan | Doosan |
| 9 | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Hanhwa | Kumho | Kumho | Dongbu | Dongbu |
| 10 | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Kumho | Dong A | Hyosung | Hyundai Ref. | Hyundai Auto |
| 11 | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Dong A | Hyosung | Daelim | Hyundai Auto | Hyundai Heavy |
| 12 | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Hyosung | Daelim | Dongkook | Hyundai Heavy | KT |
| 13 | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Daelim | Aram | Doosan | KT | |
| 14 | Dongkook | Dongkook | Dongkook | Dongkook | Dongkook | Dongkook | Dongkook | Dongkook | Dongkook | Anam | Anam | Anam | Dongkook | Hansol | | |
| 15 | Doosan | Doosan | Doosan | Doosan | Doosan | Doosan | Doosan | Doosan | Doosan | Dongkook | Dongkook | Dongkook | Doosan | Dongbu | | |
| 16 | Dongbu | Dongbu | Dongbu | Dongbu | Dongbu | Dongbu | Dongbu | Dongbu | Hansol | Doosan | Doosan | Doosan | Hansol | Kolong | | |
| 17 | Kolong | Kolong | Kolong | Kolong | Kolong | Kolong | Kolong | Kolong | Dongbu | Shinho | Shinho | Shinho | Dongbu | Dongyang | | |
| 18 | Haitai | Haitai | Haitai | Haitai | Haitai | Haitai | Haitai | Haitai | Kolong | Hansol | Hansol | Hansol | Kolong | Lotte | | |
| 19 | Lotte | Lotte | Lotte | Lotte | Lotte | Dongyang | Dongyang | Dongyang | Haitai | Dongbu | Dongbu | Dongbu | Dongyang | CJ | | |
| 20 | Miwon | Miwon | Miwon | Miwon | Miwon | Byulsan | Byulsan | Byulsan | Dongyang | Kolong | Kolong | Kolong | Sachan | Yung Pung | | |
| 21 | Sanhwan | Sanhwan | Sanhwan | Sanhwan | Sanhwan | Lotte | Lotte | Lotte | Byulsan | Haitai | Haitai | Haitai | Lotte | Dongyang C | | |
| 22 | Hanbo | Hanla | Hanla | Hanla | Hanla | Miwon | Miwon | Miwon | Lotte | Dongyang | Dongyang | Dongyang | CJ | Taekwang | | |
| 23 | Sammi | Hanbo | Hanbo | Hanbo | Hanbo | Hanla | Hanla | Hanla | Hanla | Lotte | Sachan | Sachan | Yung Pung | POSCO | | |
| 24 | Hanil | Sammi | Sammi | Sammi | Sammi | Jinro | Hanbo | Hanbo | Hanbo | Miwon | Lotte | Lotte | Jinro | Sinsaege | | |
| 25 | Kukdong | Hanil | Hanil | Hanil | Hanil | Sammi | Jinro | Jinro | Jinro | Hanla | Daesang | CJ | Sinsaege | Hyundai Ref. | | |
| 26 | Shin Dong A | Kukdong | Kukdong | Kukdong | Kukdong | Hanil | Sammi | Sammi | Sammi | Jinro | Hanla | Sanyang | Daewoo | Daewoo Elec. | | |
| 27 | Haryang | Haryang | Haryang | Haryang | Haryang | Kukdong | Hanil | Hanil | Hanil | Gupyung | Jinro | Daesang | Hyundai Ref. | Hyundai I-Park | | |
| 28 | Bumyang | Bumyang | Bumyang | Bumyang | Bumyang | Haryang | Kukdong | Kukdong | Newfca | Hanil | Gupyung | Hanla | Daewoo Elec. | Hyundai Auto | | |
| 29 | Daehan Ship B | Woosung | Woosung | Woosung | Woosung | Woosung | Woosung | Woosung | Kukdong | Newfca | Newfca | Jinro | Hyundai I-Park | Hyundai Dept. | | |
| 30 | Kia | Kia | Kia | Kia | Kia | Kia | Kia | Kia | Kia | Kia | Kangwon | Kangwon | S Oil | Hanaro Telecom | | |

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