

Investment by Korean Chaebols before and after the Crisis*

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Abstract

This paper analyzes the investment behavior of the Korean corporate sector before and after the 1997 financial crisis. Using firm-level data, we find that after controlling for investment profitability and cash flows, chaebol-affiliated firms, particularly ones with weak corporate governance structure, made significantly higher investments than non-chaebol firms before the crisis. In contrast, there were no differences between chaebol and non-chaebol firms in terms of investment volume over the period following the crisis. While excessive investment by chaebol firms disappeared over the recovery and reform process, we do not find evidence that chaebol groups have improved the efficiency of investment allocation. We find that intragroup resource sharing through the internal capital market was strengthened in the post-crisis period.

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I. Introduction

The financial crisis of 1997 brought a recession of unprecedented magnitude to the Korean economy. The GDP growth rate plunged in 1998 from the pre-crisis average of 7.0 percent to -6.7 percent and the unemployment rate increased from less than 3 percent to 7 percent. Since the shock of the financial crisis was more severe than anyone could have expected, numerous studies have focused on the characteristics of the Korean economy that contributed to exacerbate the severity and depth of the crisis.

The initial sharp contraction of GDP in 1998 was largely caused by the collapse in investment. As Figure 1 shows, the level of domestic capital formation decreased by 24 percent, and the investment rate dropped from 34 percent in 1997 to 21 percent in 1998. The sharp decrease in aggregate investment during this period suggests that the Korean crisis had a feature of a corporate crisis in essence. Although initially triggered by a sudden reversal of foreign capital flows and subsequent illiquidity of financial institutions, structural weaknesses of the corporate sector were one of the main factors that magnified the effect of foreign disturbances in the Korean crisis. In particular, excessive investment and the resultant low profitability and high leverage of Korean firms are noted as some of the structural problems that made the entire economy extremely vulnerable to financial panic and economic crisis (Borensztein and Lee [1999], World Bank [2000], and Joh [2003]).

The excessive investment and high leverage in the corporate sector was often attributed to one special feature of the Korean economy—*chaebol*, a conglomerate of many companies in diversified industries. Chaebol firms are governed by a parent company, which in turn is owned by one family. Thus, while the direct ownership of

the controlling family in chaebol firms is typically very low, the controlling family effectively controls the entire chaebol group. Such weak corporate governance of chaebol firms is believed to have caused severe agency problems and promoted the so-called “empire-building” tendency in Korea before the crisis. At the same time, financial institutions believed that the government would protect those “too-big-to-fail” chaebols from any bankruptcies, and financed many risky or unprofitable investments.

As a result, the investment rate continued to increase throughout the 1970s and 1980s, reaching about 40 percent of GDP in the 1991 (Figure 1). Also, the high investment by chaebols was financed mostly through debts (Lee, Lee, and Lee, 2000). The median of the debt-equity ratio of chaebol firms was almost 400 percent in 1997. This system became a destabilizing factor for the Korean economy when it was heavily hit by an unfavorable terms of trade shocks in 1995 and 1996. The financial trouble of one chaebol firm could easily lead to a disaster of the whole group, and six of the thirty largest chaebol groups went bankrupt in 1997 before the crisis.¹

Since 1998, Korea has recovered rather quickly from the crisis and has substantially improved its macroeconomic and structural conditions. The growth rate rebounded to 10.9 percent in 1999 and 9.3 percent in 2000 (Figure 1). Capital structure of chaebols also improved substantially, with the median debt-equity ratio dropping to about 200 percent in 2000, and a number of new institutional measures were introduced to enhance corporate governance system after the crisis. However, it is not clear as yet whether these macroeconomic and structural improvements led to significant improvements in corporate investment behavior. The investment rate

¹ They are Hanbo, Sammi, Jinro, Kia, Haitai, and New-Core groups.

recorded 27 percent in 2001, far below the pre-crisis level. This may imply that the lavish debt-financed investment practice by the Korean firms, particularly chaebol firms, has disappeared. But, it may reflect instead that the corporate sector is not yet fully recovered, with many firms unsure of what to do with their investments. Also, the lower level of investment does not necessarily guarantee more efficient allocation of investment funds.

In this paper, we examine empirically the investment behavior of the Korean corporate sector, with a particular emphasis on possible changes in the corporate investment behavior between the periods before and after the 1997 financial crisis. Despite the importance of the corporate problems in Korea, there have been few systematic studies on the investment behavior of the Korean corporate sector, particularly chaebol firms in the post-crisis period. The purpose of this study is to fill this gap. First, we investigate whether chaebol firms had inefficiency in investment compared to non-chaebols during the pre-crisis period. Then, we examine whether and how the investment behavior of chaebol firms changed after the crisis. Our empirical investigation is based on comprehensive firm-level panel data that consist of about 3000 observations over the 1994 - 2001 period.

The remainder of this paper is organized as follows. Section II provides a brief review of previous studies on the investment behavior of firms. Section III describes the data and variables we use in the paper and presents the empirical results. Section IV concludes the paper.

II. Previous Studies on Corporate Investment

Our review of previous studies on corporate investment will be brief and selective. For the purposes of this paper, we will focus mainly on the previous studies that examine investment by diversified firms or business groups. Hubbard (1998) and Stein (2001), among others, provide a more comprehensive survey of the literature.

Investment by Diversified Firms or Business Groups

The issue of investment by diversified firms or business groups is relatively new and unsettled. The main question in this area is whether and how diversified firms / business groups differ from independent firms in terms of investment levels and the within-firm allocation of investment funds.

There are many reasons why investment levels of diversified firms / business groups may be higher than those of independent firms. In general, any firms with the manager-stockholder agency conflict may exhibit the tendency of overinvestment out of the “empire-building” preference (Jensen (1993)), overconfidence (Heaton (1998)), or resistance to changes (Bertrand and Mullainathan (2000)) by the managers. If the agency conflict is greater for diversified firms / business groups, because for instance the manager or the controlling shareholder of these firms typically has a lower equity stake, the overinvestment problem will be more pronounced for these firms. However, as Stein (2001) points out, this tendency does not necessarily mean that there will be overinvestment by diversified firms *ex post*. The tendency of overinvestment may be balanced out by, for example, endogenous selection of the capital structure by the managers and stockholders of the firm. Thus, whether diversified firms / business groups will overinvest *ex post* is an empirical question. Most existing studies do not

find evidence for overinvestment by diversified firms (see, for example, Berger and Ofek (1995)).

Diversified firms / business groups may exhibit higher investment levels for other reasons as well. If they can raise more external financing than stand-alone firms can, for instance, through coinsurance among diversified divisions, they may invest more on average compared to stand-alones (Lewellen (1971), Hadlock, Rynagaert and Thomas (2001)). This argument typically presupposes that the external capital market is imperfect and the investment projects by stand-alone firms are underfinanced. Thus, unlike in the previous case of overinvestment tendency, higher investment levels by diversified firms / business groups in this case are efficiency improving. However, as mentioned before, direct empirical evidence on whether diversified firms invest substantially more than stand-alones or not is scarce.

Another important distinguishing feature of diversified firms / business groups is the possibility of reallocation of investment funds inside firms. Given the level of available funds, the CEO of a diversified firm / business group may reallocate funds internally across divisions for various reasons. Most empirical studies find that the internal capital markets are indeed actively operating (see, for examples, Lamont (1987) and Shin and Stulz (1998)).

However, it is not clear either theoretically or empirically whether the reallocation by the internal capital market will be (in)efficient. If the CEO in an internal capital market is better informed about the firm's prospects than outside creditors are, and if the CEO acts benevolently on behalf of the shareholders, the internal allocation may result in more efficient investment (Williamson (1975), Gertner, Scharfstein, and Stein (1994), Stein (1997)). Or business groups may outperform

stand-alone firms through more stable management, lower transaction costs, and greater risk-sharing and economies of scale that the internal capital market can provide (Leff (1978), Khanna and Palepu (2000)). On the other hand, the agency problem between the CEO and the division managers in a diversified firm can make the internal allocation inefficient (Rajan, Servaes, and Zingales (2000), Scharfstein and Stein (2000)). Thus, depending on the relative importance of the agency problem and the imperfection of the external capital market, the internal capital market may enhance or reduce efficiency.

In accordance with this theoretical ambiguity, empirical results are also inconclusive. Rajan, Servaes, and Zingales (2000) and Scharfstein (1998) find that low (high)-q divisions of a conglomerate tend to invest more (less) than stand-alone firms in the same industry. Moreover, these studies find that this “socialism” of cross-subsidization is more evident in conglomerates with more diversified divisions and a lower management ownership. On the other hand, Khanna and Tice (2001) stress the positive side of the internal capital market. According to their result, investment by divisions of diversified firms is more responsive to the division profitability than investment by focused firms.

Also, although not directly related with investment decisions by diversified firms, many studies examine whether diversification is value-adding or not. Lang and Stulz (1994) and Berger and Ofek (1995) report that, due to the inefficiency of diversification, the stocks of a diversified firm are traded at lower prices than those of a comparable independent firm. This “discount” is positively correlated with the diversity of a firm (Rajan, Servaes, and Zingales (2000)) or the divergence between voting and cash-flow rights of the ultimate owners of the firm (Classens, Djankov, Fan,

and Lang (2002)). In addition, Johnson, La Porta, Lopez-de-Silanes and Shleifer (2000), and Bertrand, Metha and Mullainathan (2002) report that “tunneling” of resources by controlling shareholders of a business group can be quite substantial, particularly in developing economies with poor corporate governance. These studies provide indirect evidence on inefficient reallocation of investment funds by diversified firms.

Investment by Korean Chaebols

Several studies examine investment decisions by chaebols in Korea. Shin and Park (1999) and Kim (2002) report that chaebols, compared to stand-alone firms, on average have lower q 's but higher investment ratios. This indicates that, with investment opportunities controlled for, chaebols tend to invest more. However, as mentioned before, this pattern may represent either too much investment by chaebols or too little investment by stand-alone firms.

Regarding internal reallocation of funds in chaebols, Shin and Park (1999) show that investments by high- q firms and low- q firms are not significantly different among chaebol-affiliated firms, whereas high- q firms invest significantly more than low- q firms among stand-alones.² Similarly, Kim (2002), applying the same approach as Scharfstein (1998) to Korean chaebols, shows that chaebol affiliates with good investment opportunities invest less than their stand-alone industry peers while chaebol affiliates with poor investment opportunities invest more than their stand-alone

² In some of their regressions, however, chaebol firms appear to be more responsive to Tobin's q than non-chaebol firms.

industry peers. Nahm et al. (2001) show that group cash flows or debt guarantees by chaebols do not particularly relieve the financial constraints of subsidiaries with good investment opportunities. Hahn (1999) argues that prior to the 1997 crisis top five chaebols invested more heavily in high-risk subsidiaries.

While these results are often regarded as indicating that the internal markets of chaebols reallocate resources in an inefficient way, they do not provide hard evidence. The results may instead indicate that stand-alone firms respond too much to investment opportunities (Shin and Park (1999)) or that investment opportunities are not properly controlled for in the analysis (Kim (2002), Hahn (1999)).

Among studies that examine the value consequence of diversification, Joh (2003) shows that chaebol-affiliated firms on average perform worse than independent firms. She also finds that the low profitability of chaebols can be related with the discrepancy between control rights and cash flow rights of controlling shareholders and the resulting agency problem between the controlling shareholders and outside shareholders. On the other hand, Kim and Lee (2003) find no significant correlation between the governance structure and stock prices. Also, Chang and Hong (2000) find that chaebols actually raised the values of the affiliate firms through the internal capital markets. Finally, Bae, Kang and Kim (2002) and Kang and Baek (2002) find that, when a chaebol-affiliated firm makes an acquisition or issues new stocks, its stock price on average falls while the stock price of other firms in the group increases. Thus, while minority shareholders of the firm making an acquisition lose, the controlling shareholder of the chaebol benefits. This supports the “tunneling” hypothesis.

III. Empirical Analysis of Investment Behavior by Korean Firms

This section examines the investment behavior of the Korean corporate sector during the periods before and after the 1997 financial crisis, based on the newly constructed firm-level data set for the period of 1994 - 2001. In particular, in accordance with the previous studies reviewed above, we investigate whether the average level of investment has been different between chaebols and non-chaebols and how the reallocation of investment funds within chaebols has been made. Our benchmark model is the standard q model that specifies investment as a linear function of Tobin's q and cash flow.

3.1. Data and Variables

The data we use in this paper are from the Korea Listed Companies Association (KLCA) and contain financial information of all listed firms in the Korea Stock Exchange for the period of 1994 through 2001.³ We do not consider non-listed firms, since Tobin's q (a key variable in our analysis) cannot be computed for these firms. The total number of firms in the KLCA data is about 600 for each year. Among these firms, we exclude firms in financial industries or services industries, for which it is not clear how to compute Tobin's q. We further exclude firms with missing values in other key variables such as investment expenditures, or cash flows. The resulting

³ There are two other sources in Korea that provide individual firm data. The NICE (National Information and Credit Evaluation) and the KIS (Korea Information Service) each covers both listed and non-listed firms. These sources provide both general financial information and their own credit evaluation of firms.

number of firms is about 400 for each year. The sample period is chosen such that we have the same number of years for the subperiods before and after the financial crisis—1994-1997 and 1998-2001.

Micro data normally contain outlier observations, and our data set is not an exception in that regard. Previous studies on corporate investment identify outliers using *ad hoc* criteria (such as whether an observation is away from the mean by arbitrary multiples of the standard deviation or by eyeball tests) or simply ignore them. In this paper, we rely on more objective criterion and use the method developed by Hadi (1994) for detecting outliers.⁴ With outliers excluded, the total number of firm-year observations is about 2900.

Our measure of investment is the change in the total capital stock over a year. The total capital stock is measured by the sum of individual tangible fixed assets such as land, buildings and structure, machinery, etc. Our dependent variable, the investment ratio, is defined as current investment divided by the previous year-end's capital stock. For Tobin's q , we follow the method in Hoshi and Kashyap (1990). While most previous studies compute the market value of the firm by summing the market value of stocks and the book value of debts, we compute the market value for both stocks and debts. In particular, we make adjustments to the book value of debts by utilizing data on interest payments and the market interest rate. Appendix 1 provides more details about the computation of the investment ratio and Tobin's q . Cash flow is defined as current net profit plus depreciation, divided by the total capital stock of the previous period.

⁴ Stata provides the routine for this procedure. We identify outliers for each variable, for the pre-crisis years and the post-crisis years separately. Main results do not change when outliers are identified from multivariate samples.

In addition to these variables, we use two-digit industry classification of firms provided by the KLCA to control for industry-specific effects. The number of industries in our sample is 21 in this classification.

In order to examine the role of corporate governance structure on investment decisions, we use data on the controlling-shareholder ownership. The NICE and the KIS both provide data on the share of stocks held by the largest shareholder and related individuals for each firm. The KFTC, on the other hand, uses a slightly different definition for the related individuals and publishes the ownership data for each chaebol group.⁵ Also, while the NICE / KIS measures of the ownership represent the shares in the number of outstanding stocks, the KFTC measures represent the shares in the market value of stocks. This paper uses both the KFTC's group-level data and the NICE / KIS firm-level data.⁶

Finally, in order to identify chaebols, we use data on chaebol affiliation of firms provided by the Korea Fair Trade Commission (KFTC). The KFTC defines a business group (chaebol) as “a group of companies of which more than thirty percent of shares are owned by the group's controlling shareholder and its affiliated companies,” and ranks each year the thirty largest business groups (chaebols) according to the size of total assets of all affiliated firms within each group. In our empirical analysis, we classify firms that belonged to the thirty largest groups in 1997 as chaebols and the rest as non-chaebols. This way, we can examine the investment

⁵ The KFTC computes each chaebol's ownership by taking asset-weighted averages of the ownership of member firms. Data on the ownership of individual member firms, however, are not public, except for the year of 2002.

⁶ The ownership data by the NICE and the KIS are based on business reports of individual firms, and firms follow the Securities and Exchange Law in reporting their stock ownership structure. On the other hand, the KFTC follows the Monopoly Regulation and Fair Trade Act in classifying the largest shareholder and related individuals.

behavior of a fixed set of firms (defined as chaebols) over time. Appendix 2 shows the thirty largest chaebols in 1997.⁷

Table 1 presents summary statistics of the main variables – the investment ratio, Tobin’s q , and cash flow – for chaebols and non-chaebols separately, for each of the pre-crisis period and the post-crisis period. In Table 1, we first find that chaebol firms had not only higher investment ratios but also better investment opportunities in the pre-crisis period. Thus, from Table 1 alone, it is not clear whether chaebols’ investment behavior prior to the crisis was inherently different from that of non-chaebols. Assuming the same investment function for chaebols and non-chaebols, chaebols are expected to invest more in response to their higher q . For the post-crisis period, we find that the investment ratio is about the same for chaebols and non-chaebols, even if Tobin’s q remains to be higher for chaebols. This suggests that the possible problem of overinvestment by chaebols (if it had existed prior to the crisis) dissolved in the post-crisis period.

Figure 2 shows the movement of the investment ratio in more detail and for a longer period. Patterns here are largely the same as before: the pre-crisis gap between chaebols and non-chaebols in the investment ratio disappeared after the crisis. One thing puzzling in Figure 2-A, however, is the fact that the investment ratio rises (not falls) sharply right after the 1997 crisis, in contrast to the movement of the aggregate investment rate in Figure 1. Upon re-examining the data, we find that the high investment of 1998 in Figure 2-A mostly represents increases in the value of real assets

⁷ In our sensitivity analysis below, we identify chaebol affiliates on the basis of KFTC’s classification for each year as well. The list of top 30 chaebols is very stable during the pre-crisis years but changes substantially after the crisis. As will be shown, however, main results are not sensitive to alternative chaebol classifications.

such as land and buildings. While real asset prices in Korea plunged following the crisis, many firms carried out asset revaluations after the crisis as a prerequisite for merges and acquisitions and also as a means to lowering their debt/asset ratio. In fact, out of total 562 cases of asset revaluations by listed firms over the period of 1980 through 2002, more than two thirds took place in 1998 through 2000 (255 in 1998, 70 in 1999, and 85 in 2000). As long as the market price of real assets in 1998 was higher than the book value, this surge in asset revaluation can generate the observed peak in investment ratio in Figure 2-A. Indeed, as Figure 2-B shows, the pattern of investment becomes more consistent with the aggregate data once we exclude those firms that carried out asset revaluation during the post-crisis period. For this reason, in our analysis we will present the results for the full sample and this restricted sub-sample separately.

Figures 3- A and B- similarly depict the movement of Tobin's q for chaebols and non-chaebols. Since 1995, the average q ratio shows a downward trend for both chaebols and non-chaebol. Also, consistent with Table 1, Tobin's q is persistently higher for chaebol firms. The basic pattern is quite similar when we restrict the sample by excluding those firms with asset revaluation (Figure 3-B).

3.2. Empirical Results

Level of Investment by Chaebols

The summary statistics in Table 1 indicate that chaebol firms had not only higher investment ratios, but also better growth opportunities than non-chaebol firms in the pre-crisis period. As mentioned in Section II, previous studies by Shin and Park

(1999) and Kim (2002) reported that chaebols, compared to stand-alone firms, on average have higher investment ratios but lower q's. Unlike these studies, our results suggest that at least a part of the chaebol's relatively high investment can be attributed to its higher investment profitability.

In this section, we test whether chaebol firms had 'over-investment' relative to non-chaebols during the pre-crisis period, even after controlling for its relatively high investment profitability. As mentioned in Section II, many believe that Korean chaebols invested more excessively than can be warranted by the investment opportunities observed in the market.

Also, this section examines whether there occurred any change in chaebols after the crisis in terms of their investment levels. Table 1 indicates that the difference in the level of investment between chaebols and non-chaebols disappeared in the post-crisis period. In this section, we check whether such change is observed in multiple regression analysis as well.

Table 2 presents the estimation results of the standard q model of investment for the period of 1994- 2001.⁸ The sample contains both chaebol and non-chaebol firms.⁹ In order to reduce the endogeneity bias, both Tobin's q and the cash flow variable are one-year lagged. Since our goal is to find out changes in the corporate investment behavior after the crisis, we divide the sample into two periods, the pre crisis period (1994-1997) and the post crisis period (1998-2001). For each period, we

⁸ The results reported below do not change qualitatively, however, when we extend the data set into the earlier period.

⁹ If chaebol firms are less financially constrained, for instance due to its internal capital market, than non-chaebol firms, then the sensitivity of investment to cash flows would systematically differ between chaebol and non-chaebol firms. However, we could not find such patterns in our data set. Thus, our model assumes the same sensitivity coefficient for all firms.

define Tobin's q and the cash flow variable separately, by multiplying the variables with the pre-crisis period and the post-crisis period dummies.

The regression has year dummies in order to control for unknown time-specific disturbances such as macroeconomic shocks. It also includes industry dummies in order to control for industry-specific effects. The regression is estimated allowing for random effects, controlling for unobserved firm characteristics.

(1) Pre-Crisis Period

We first describe the upper panel of Table 2 that corresponds to the pre-crisis period. Estimation result in column (1) of Table 2 indicates that the standard investment model is consistent with investment decision of Korean firms. Coefficients on both Tobin's q and cash flow terms are positive and statistically significant at the 1 percent level.

In column (2) of Table 2, we test whether there are significant differences in the investment ratio between chaebol and non-chaebol firms, by adding a dummy variable that equals 1 for firms that belonged to the largest thirty chaebols in 1997. As column (2) shows, the coefficient on the chaebol-affiliation dummy for the pre-crisis period turns out to be significantly positive, indicating that chaebol-affiliated firms had significantly higher investment ratios than non-chaebol firms prior to the crisis. The estimated coefficient indicates that an affiliation with a chaebol increases the investment ratio by about 9 percentage points.¹⁰ This margin cannot be explained by

¹⁰ We can also distinguish between the top five largest chaebols and 6-30th largest chaebols. The five largest chaebols were substantially bigger than the others in terms of asset size and economic and political influence. When we include dummies separately for each chaebol group, both group-affiliation

differences in investment opportunities or availability of internal fund between chaebol and non-chaebol firms.

The fact that high investments by chaebols cannot be fully explained by the model, however, does not necessarily mean that chaebol firms made inefficient investment. The investment gap between chaebol and non-chaebol firms may be the outcome of inefficiently low investment by non-chaebol firms. For further investigations, one needs to turn to cross sectional implications of the theory. Here, we examine whether the tendency of high investment is more pronounced among chaebols with weak corporate governance structure. The literature reviewed in Section II explains that chaebols may over-invest relative to non-chaebols because the agency problem is likely to be more severe for chaebols. Extending this logic to intra-chaebol analysis, one can expect that chaebols with poorer governance structure will tend to invest more than others.

In order to test for this hypothesis, columns (3) through (5) of Table 2 add various dummy variables that represent chaebols with weak governance. The weak-governance dummy in column (3) takes the value of 1 if a firm in a given year belongs to a chaebol of which the controlling-shareholder ownership is lower than the median of all chaebols. In column (4), the weak-governance dummy equals 1 if a firm in a given year belongs to a chaebol where the equity share held by its own affiliates is greater than the median of all chaebols. Since cross-shareholdings by affiliated firms are the main channel through which the parent firm controls the entire group with

dummies are statistically significant, and the coefficient on the dummy for the top five largest chaebols (0.12) is larger than that for the 6-30th largest chaebols (0.05).

minimal direct ownership, the equity share by other affiliates can be regarded as a measure of the divergence between the ownership and controlling rights. These two dummy variables are based on the chaebol-level data provided by the KFTC and thus have the same value for firms in the same chaebol group in a given year. On the other hand, the weak-governance dummy in column (5) is based on the ownership data of individual firms provided by the NICE. Similar to the one in column (3), this dummy variable equals 1 if the ownership of the controlling shareholder of a chaebol-affiliated firm in a given year is lower than the median of all chaebol-affiliated firms.

Unfortunately, a measure of the gap between the ownership and controlling rights at the individual firm level is not readily available and thus not used in this paper.¹¹

Columns (3) through (5) in the upper panel of Table 2 show that the coefficient on the weak-governance dummies is positive and statistically significant at the 1 percent level for all three measures considered. This result supports the view that poor corporate governance structure of chaebols and the resulting agency problem caused chaebols to make inefficiently high investments during the pre-crisis period.

(2) Post-Crisis Period

The lower panel of Table 2 corresponds to the post-crisis period. Column (1) shows that the standard q-model of investment is consistent with the post-crisis period as well. In particular, the hypothesis of equality of the estimated coefficients on the q

¹¹ There are a few studies that use their own measures for this gap, but it is not clear how reliable the measures are.

ratio for the pre-crisis period and the post-crisis period is not rejected by a Wald test with a p-value of 0.58.

However, as column (2) shows, the estimated coefficient on the chaebol dummy for the post-crisis period turns out to be insignificant, suggesting that the overinvestment by chaebols observed during the pre-crisis period disappeared after the crisis. Also we find from columns (3) through (5) that coefficients on the dummies for weak-governance firms are all insignificant in the post-crisis period. This suggests that the drop in the investment ratio of chaebols after the crisis can be largely attributed to chaebols' weak corporate governance: chaebols with weak corporate governance exhibited the overinvestment problem prior to the crisis, but not any more in the post-crisis period.

While we related above the high investment of chaebols in the pre-crisis period with their weak governance structure, it is not clear whether the change in chaebols' investment behavior after the crisis can be explained by changes in the governance structure. Among the three measures that we used in constructing our weak-governance dummies, one measure (ownership at the individual firm level) improved but the other two measures (ownership and the ownership-control right gap at the chaebol level) deteriorated after the crisis, either for all chaebol firms or for chaebol firms with weak governance. We suspect that, in order to explain the change in chaebols' investment, one needs to examine factors other than governance structure. Our own views on what caused the change will be described later.

In Table 3, we restrict our sample by dropping firms that carried out asset revaluation during the post-crisis period, and estimate the same specification as in Table 2. The result is roughly the same as before.

Allocation of Investment Funds by Chaebols

While Tables 2 and 3 compared the overall level of investment between chaebols and non-chaebols, this section examines allocation of investment funds by chaebols. Our main concern here is whether allocation of investment funds by chaebols is efficient. As explained in Section II, several previous studies claimed that diversified business groups such as chaebols reallocate investment funds among member firms through the internal capital market, and that the reallocation is inefficient. This section examines whether such patterns are observed among Korean chaebols in the pre-crisis and the post-crisis periods.

In order to achieve this goal, we derive an investment equation that formalizes the idea of reallocation of funds through the internal capital market. Suppose that the investment ratio of a chaebol-affiliated firm is determined as follows:

$$\begin{aligned} invest_{i,t} &= \alpha * q_{i,t} + \beta * \overline{cash\ flow}_{i,t} + \varepsilon_{i,t} \\ \overline{cash\ flow}_{i,t} &= \lambda * cash\ flow_{i,t} + (1 - \lambda) * \frac{\sum_{j=1}^N cash\ flow_{j,t}}{N}, \end{aligned} \quad (1)$$

where $invest_{i,t}$ denotes the investment ratio of firm i in year t , $cash\ flow_{i,t}$ the cash flow to asset ratio of firm i in year t , and $\varepsilon_{i,t}$ the error term. The variable $\overline{cash\ flow}_{i,t}$ represents cash flow after intra-chaebol transfer is made among the affiliated firms, and it is defined as a weighted average of firm i 's own cash flow and the average of cash flow of all firms that belong to the same chaebol group with firm i .

The weight on the average cash flow, $(1-\lambda)$, indicates the degree of resource pooling among affiliates. The total number of firms in the chaebol group is given by N . Thus, equation (1) shows that a chaebol-affiliated firm's investment is determined by its investment opportunity and net cash flow after the pooling. From equation (1), one can derive the following:

$$\begin{aligned}
 invest_{i,t} &= \alpha * q_{i,t} + \beta\lambda * cash\ flow_{i,t} + \beta(1-\lambda) * \frac{\sum_{j=1}^N cash\ flow_{j,t}}{N} + \varepsilon_{i,t} \\
 &= \alpha * q_{i,t} + \beta\lambda * cash\ flow_{i,t} + (1-\lambda) * \frac{\sum_{j=1}^N invest_{j,t}}{N} - \alpha(1-\lambda) * \frac{\sum_{j=1}^N q_{j,t}}{N} + \eta_{i,t},
 \end{aligned} \tag{2}$$

where $\eta_{i,t}$ is the error term. The first specification in equation (2) states that the investment decision of a firm is governed by cash flow of its own and of other firms. Shin and Park (1999) estimated an equation similar to this in their analysis of chaebols' investment behavior. The second specification, on the other hand, relates a firm's investment with investment by other affiliates. We prefer the second specification because the coefficient on pooled cash flow (in the first specification) is of second order and thus will be hard to estimate. Also, since our sample covers only listed firms, the pooled cash flow variable in the first specification needs to be proxied by average cash flow of listed firms. This can be problematic if the internal capital market of a chaebol reallocates funds across all member firms (both listed and non-listed firms). To be sure, investment by all other affiliates in the second specification is also unobservable. One can show, however, that the measurement error problem is smaller

for the second specification especially for a high degree of resource pooling (a small λ in equation (2)).¹²

The second specification of equation (2) is equal to the standard model if $\lambda = 1$ (no pooling). If $0 < \lambda < 1$, we have two additional terms, the average investment and the average q of other firms. The coefficient on the average- q variable is of second order and thus is likely to be small. Also note that the coefficient on q ($= \alpha$) is independent of the degree of resource pooling ($= 1 - \lambda$), i.e., that the internal capital market can either enhance or decrease efficiency.

Estimation results of chaebols' investment equation are reported in Table 4. As before, we divide the sample into the pre crisis period (1994-1997) and the post crisis period (1998-2001). In order to avoid the endogeneity problem, the average q and the average investment variables in equation (2) are defined as the averages over all member firms except for i .¹³

(1) Pre-Crisis Period

The upper panel of Table 4 corresponds to the pre-crisis period. Column (1) estimates the standard investment model for chaebol firms, and column (2) estimates equation (2). On the whole, the estimation result shows that chaebols' investment behavior before the crisis was well consistent with the standard model: while the coefficients on q and cash flow are both significantly positive, investments and q of

¹² A similar logic has been examined in studies that examine the issue of consumption insurance or risk sharing in consumption. In these studies, consumption growth of an individual is related with aggregate consumption growth. See, for examples, Mace (1991), Obstfeld (1994), and Crucini (1999).

¹³ One can easily check that this modification is straightforward and it does not change the main implications of equation (2).

other firms are not significant. This suggests that, although chaebols made inefficiently high investment prior to the crisis (Table 2), allocation of investment funds among chaebol firms was not substantially different from that of non-chaebol firms.¹⁴

This result contrasts with the findings by previous studies that examine chaebols' investment in the pre-crisis period. Shin and Park (1999), and Kim (2002) report that chaebols do not respond to the q ratio. Also, Shin and Park (1999) report that investment by chaebol firms are not confined by their own cash flow but by group-wide cash flow. This discrepancy may stem from the different measures of Tobin's q that we use in this paper. This result will be more explained later in sensitivity analysis.

(2) Post-Crisis Period

We have shown above that allocation of investment funds by chaebols in the pre-crisis period was not particularly different from that of non-chaebols. This pattern changes somewhat in the post-crisis period. As columns (1) and (2) in the lower panel of Table 3 show, the coefficient on the q-ratio is still (marginally) significant (with a p-value of 0.06 in column (1)), even if smaller than before. At the same time, however, investment by other affiliates enters with a significantly positive sign, suggesting that investment by firms in the same chaebol group tend to move in the same direction. This result may suggest that the role of the internal capital market became more evident in the post-crisis period. Also, while most previous studies stressed the "socialist" allocation of the internal capital market, our result suggests that the internal

¹⁴ Although not reported in this paper, we found that the coefficient on q is not significantly different between chaebols and non-chaebols, for both pre-crisis and post-crisis periods.

capital market does not necessarily decrease allocational efficiency. As equation (2) shows, a greater role of the internal capital market only implies a smaller role of one's own cash flow.

The coefficient on the average q of other firms is small and insignificant, but it is not in violation of equation (2) which predicts a second-order impact for this variable.

Table 5 estimates the same specification as in Table 4 after excluding firms that carried out asset revaluation during the post-crisis period. The results are qualitatively the same as before: for the pre-crisis period, investment by chaebols can be explained by the q -ratio and cash flow; for the post-crisis period, the role of the internal capital market should be considered additionally.

What Caused the Change?

The findings suggest that the investment behavior of chaebols changed substantially after the crisis. Prior to the crisis, chaebols made inefficiently high investment. After the crisis, the over-investment problem dissolved but at the same time the role of the internal capital market strengthened. In this section, we briefly consider what may have caused such changes in the investment behavior of chaebols.

Previous studies usually relate inefficiency of chaebols with the poor governance structure of chaebols and the resulting agency problem. However, the changes in the investment behavior of chaebols reported in this paper cannot be easily explained by changes in governance structure. As mentioned before, while governance structure of chaebols deteriorated by most measures after the crisis, investment by

chaebols decreased. Also, although not reported here, we find that the tendency of co-movement of investment among member firms does not vary depending on governance structure.

The factor we consider instead is capital structure. One of the most important and visible changes that occurred during the post-crisis period was the cut in the debt-equity ratio. After the crisis broke out, the Korean government introduced a maximum debt-equity ratio of 200 percent for all firms, which was to be met by the end of 1999. At the same time, several large chaebols went bankrupt, undermining the belief that chaebols are “too big to fail.” We suspect that, with the traditionally high debt-equity ratio of chaebols, these changes posed credible threat to chaebols. In order to meet the newly set ceiling and to reduce default risk, chaebols had to cut down on their borrowings and investment expenditures more aggressively than non-chaebols. As a consequence, the overinvestment problem of chaebols dissolved.

The changes regarding the debt-equity ratio can potentially explain the greater role of the internal capital market as well. One way to reduce borrowings of member firms with particularly high debt-equity ratios is to turn to the internal capital market. By pooling resources from member firms, the chaebol could keep some of those member firms with particularly poor capital structure and maintain the empire.

In order to test for this hypothesis, we divide chaebol firms in the post-crisis period into two groups depending on their debt-equity ratio in 1997 and generate a dummy variable accordingly, with 1 indicating a debt-equity ratio greater than the median. Chaebol firms who had a higher debt-equity ratio prior to the crisis are expected to have reduced investment more aggressively and to have exhibited stronger co-movement with other member firms after the crisis. Columns (3) and (4) of Table 4

test this implication. In column (3), the dummy variable for high debt is insignificant, suggesting that the level of investment is not systematically affected by the capital structure. In column (4), however, the interaction term of the high-debt dummy and the average investment of other affiliates is significantly positive. This is consistent with the prediction that the pattern of investment co-movement is greater for firms who had a higher debt-equity ratio prior to the crisis.

We suspect that the high-debt dummy variable appears insignificant in column (3) only because a substantial portion of investment adjustments by chaebols were made by selling and liquidating some of the affiliated firms. Since firms that are sold or liquidated are not in the sample any more, large adjustments in investment or in capital structure by those firms cannot be detected in our estimation. In order to avoid this problem, one needs to consider investment adjustments at the individual chaebol level, not at the individual firm level. In Figure 4, we relate the debt-equity ratio in 1997 with the growth rate of total asset during the post-crisis period for each chaebol group. The figure clearly shows a negative correlation between the two series. This supports the view that the need to reduce debt was the main cause of the sharp investment reduction by chaebols in the post-crisis period.

When firms with asset revaluations are excluded in Table 5, the high-debt variables are insignificant, probably because the sample size is not sufficiently large.

3.3. Sensitivity Analysis

For sensitivity analysis, we consider two modifications in particular. First, instead of using a fixed set of chaebols and non-chaebols, we re-classify chaebols and

non-chaebols for each year following KFTC's classification. One may suspect that the dissolution of the over-investment problem of chaebols in the post-crisis period as reported in Table 2 was an artifact generated by inaccurate classification of chaebol and non-chaebol firms. If some of the firms affiliated with chaebols in 1997 became independent firms in the post-crisis period, the investment level of chaebol firms (as of 1997) may appear less different from that of non-chaebol firms in the post-crisis period. Column (1) of Table 6, however, shows that the new classification does not change the main pattern. The chaebol dummy is significant for the pre-crisis period, but not for the post-crisis period. Patterns in columns (2) and (3) are also the same as before.

Second, we use a standard measure of the q-ratio instead of our own one. In the previous tables of this paper, the coefficients on the q-ratio were always significant for chaebols in the pre-crisis period. This result may change when our measure of q is replaced with the standard one. The standard measure of Tobin's q is defined as the $(\text{market value of stocks} + \text{book value of debt}) / (\text{book value of total asset})$. According to columns (4) through (6) of Table 6, this measure of q is insignificant for both chaebols and non-chaebols, and for both the pre-crisis and the post-crisis periods. Thus, even with the alternative measure of q, we cannot conclude that allocation of investment funds by chaebols was more inefficient compared to chaebols.

Although not reported here, we have considered other specifications as well. We have estimated fixed-effects models instead of random-effects models. We have used more years of observations for the pre-crisis period. We have considered various combinations of the specifications mentioned here. Main results do not change by these modifications.

IV. Concluding Remarks

The role of large chaebols in the Korean financial crisis has been an issue of controversies. Critics pointed out poor corporate governance system, inefficient management and excessive investment of chaebol-affiliated firms as main features that rendered the Korean economies vulnerable to the crisis.

Our paper examines the investment behavior of the Korean corporate sector, in particular chaebol groups, and tests whether chaebol firms made over-investment relative to non-chaebol firms. Our empirical results show that before the 1997 crisis, there was over-investment by chaebol firms with weak corporate governance structure.

During the crisis and subsequent recovery process, Korea has accomplished a great deal in alleviating the structural weaknesses of corporate sector. There has been considerable progress in corporate debt workout and operational restructuring. We find that, after controlling for profitability and cash flows, there are no more significant differences in terms of investment ratios between chaebols and non-chaebols. This indicates that the over-investment by chaebols during the pre-crisis period disappeared after the crisis. We also find that the role of the internal capital market became more strengthened after the crisis. By pooling resources in the time of financial instability, the internal capital market mitigated sharp investment adjustments of some of the member firms and thereby helped the chaebol structure to remain.

It is not clear, however, whether the reported changes in the investment behavior of chaebols represent structural changes. Since the financial and corporate sectors in post-crisis years are presumably inherently different than in ordinary years, the changes may only reflect the transitional nature of the post-crisis period. Analysis of a longer

period or other countries with similar crisis experiences will be informative.

Reference

- Bae, K.H., J.K. Kang and J.M. Kim, "Tunneling or Value-Added: Evidence from Mergers by Korean Business Groups," *Journal of Finance* 57, 2002, 2695-2740.
- Berger, P. and E. Ofek, "Diversification's Effect on Firm Value," *Journal of Financial Economics* 37, 1995, 154-181.
- Bertrand, M., P. Mehta and S. Mullainatham, "Ferretting Out Tunneling: An Application to Indian Business Groups," *Quarterly Journal of Economics* 118, 2002, 121-148.
- Borensztein, E. and J.W. Lee, "Financial Crisis and Credit Crunch in Korea: Evidence from Firm-Level Data," *Journal of Monetary Economics*, 2002, 853-875.
- Chang, S.J. and J.B. Hong, "Economic Performance of Group Affiliated Companies in Korea: Intragroup Resource Sharing and Internal Business Transaction," *Academy of Management Journal* 43, 2000, 429-448.
- Claessens, S., S. Djankov, J.P.H. Fan and L.H.P. Lang, "The Benefits and Costs of Group Affiliation: Evidence from East Asia," mimeo, 2002.
- Gertner, R.H., D.S. Scharfstein and J.C. Stein, "Internal Versus External Capital Markets," *Quarterly Journal of Economics*, 1994, 1211-1230.
- Hadi, A.S., "A Modification of a Method for the Detection of Outliers in Multivariate Samples," *Journal of the Royal Statistical Society*, 1994, 393-396.
- Hadlock, C., M. Ryngaert and S. Thomas, "Corporate Structure and Equity Offerings: Are There Benefits to Diversification?" *Journal of Business*, 2001, 613-635.
- Hahn, C.H., "Overinvestment by Chaebols: An Empirical Analysis," *KDI's Journal of Economic Policy*, 1999, 3-58 (in Korean).
- Heaton, J.B., "Managerial Optimism and Corporate Finance," *Financial Management*,

2002, 33-45.

Hoshi, T. and A.K. Kashyap, "Evidence on q and Investment for Japanese Firms,"

Journal of Japanese and International Economics, 1990, 371-400.

Hubbard, R.G., "Capital-Market Imperfections and Investment," *Journal of Economic*

Literature, 1998, 193-225.

Hyun, J.K. and H.K. Pyo, "Estimation of the Depreciation Rate of Tangible Fixed

Assets: Comparison of the Capital Stock Approach and the Microeconomic

Approach," *Proceedings of Panel Discussions for the Analysis of the Korean*

Economy, 1997, 154-181 (in Korean).

Jensen, M.C., "The Modern Industrial Revolution, Exit, and the Failure of Internal

Control Systems," *Journal of Finance*, 1993, 831-880.

Joh, S.W., "Corporate Governance and Firm Profitability: Evidence from Korea before

the Crisis," *Journal of Financial Economics* 68, 2003, 287-322.

Johnson, S., R. LaPorta, F. Lopez-de-Silanes and A. Shleifer, "Tunneling," *American*

Economic Review Papers and Proceedings 90, 2000, 22-27.

Kang, J.K. and J.S. Baek, "Chaebols and the Maximization of Shareholder Wealth in

New Equity Issues," *The Korea Journal of Finance*, 2002, 1-47 (in Korean).

Khanna, T. and K. Palepu, "Is Group Affiliation Profitable in Emerging Markets? An

Analysis of Diversified Indian Business Groups." *Journal of Finance*, 2000,

867-891.

Khanna, N. and S. Tice, "The Bright Side of Internal Capital Markets," *Journal of*

Finance, 2001, 1489-1528.

Kim, B.M. and I.M. Lee, "Agency Problems and Performance of Korean Companies

During the Asian Financial Crisis: Chaebol vs. Non-Chaebol Firms," *Pacific*

- Basin Finance Journal*, forthcoming, 2003.
- Kim, C.S., "Is the Investment of Korean Conglomerates Inefficient?" *The Korean Economics Review*, 2002, 5-24.
- Kim, K.S., W.T. Kim, T.H. Chang, "Estimation of Tobin's q: Korean Listed Firms," *Proceedings of Panel Discussions for the Analysis of the Korean Economy*, 1996, 147-169 (in Korean).
- Lamont, O., "Cash Flow and Investment: Evidence from Internal Capital Markets," *Journal of Finance* 52, 1997, 83-110.
- Lang, L.H.P. and R. Stulz, "Tobin's q, Corporate Diversification, and Firm Performance," *Journal of Political Economy*, 1994, 1248-1280.
- Leff, N., "Industrial Organization and Entrepreneurship in the Developing Countries," *Economic Development and Cultural Change*, 1978, 661-675.
- Lewellen, W.G., "A Pure Financial Rationale for the Conglomerate Merger," *Journal of Finance*, 1971, 521-537.
- Lee, J.W., Y.S. Lee and B.S. Lee, "The Determination of Corporate Debt in Korea," *Asian Economic Journal* 14, 2000, 333-356.
- Nahm, J.H., T.H. Jin, S.J. Lee, "Cross Debt Guarantees and Internal Capital Markets of Chaebols," mimeo, 2001 (in Korean).
- Rajan, R.G., H. Servaes and L. Zingales, "The Cost of Diversity: The Diversification Discount and Inefficient Investment," *Journal of Finance* 55, 2000, 35-79.
- Scharfstein, D.S. and J.C. Stein, "The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment," *Journal of finance*, 2000, 2537-2564.
- Scharfstein, D.S. "The Dark Side of Internal Capital Market II: Evidence from Diversified Conglomerates," *NBER Working Paper No. W6352*, January 1998.

Shin, H.H. and R.M. Stulz, "Are Internal Capital Markets Efficient?" *Quarterly Journal of Economics* 113, 1998, 531-552.

Shin, H.H. and Y.S. Park, "Financing Constraints and Internal Capital markets: Evidence from Korean Chaebols," *Journal of Corporate Finance*, 1999, 169-191.

Stein, J.C., "Internal Capital Markets and the Competition for Corporate Resources." *Journal of Finance* 52, 1997, 111-133.

Stein, J.C., "Agency, Information and Corporate Investment," *NBER Working Paper No. W 8342*, 2001.

Williamson, O.E., *Markets and Hierarchies: Analysis and Antitrust Implications*, Collier Macmillan Publishers, Inc., New York, 1975.

World Bank, *East Asia: Recovery and Beyond*, 2000.

Table 1. Summary Statistics Comparing Chaebols and Non-Chaebols

Sample	All Firms		Chaebols		Non-Chaebols		
	1994-1997	1998-2001	1994-1997	1998-2001	1994-1997	1998-2001	
No. of Obs.	1598	1376	357	247	1241	1129	
Investment Ratio	Median	0.028	-0.008	0.091	-0.008	0.016	-0.008
	Mean	0.097	0.137	0.165	0.141	0.077	0.136
	S.D.	0.249	0.426	0.267	0.423	0.240	0.426
Tobin's q	Median	1.506	1.164	1.605	1.343	1.461	1.131
	Mean	1.535	1.228	1.636	1.407	1.506	1.189
	S.D.	0.332	0.406	0.298	0.406	0.336	0.396
Cash Flow	Median	0.217	0.222	0.189	0.186	0.227	0.233
	Mean	0.257	0.274	0.200	0.214	0.274	0.288
	S.D.	0.278	0.460	0.237	0.382	0.286	0.475

Notes: Outliers are identified as explained in the text and excluded.

Table 2. Investment Equation: Before and After the Crisis, 1994 to 2001, with All Sample Firms

Sample: All Firms	(1)	(2)	(3)	(4)	(5)
D94-97*Q	0.106** (0.026)	0.087** (0.027)	0.088** (0.028)	0.090** (0.028)	0.085** (0.038)
D94-97*Cash Flow	0.179** (0.030)	0.197** (0.031)	0.189** (0.032)	0.189** (0.032)	0.193** (0.031)
D94-97*Chaebol		0.092** (0.020)	0.040 (0.032)	0.056 (0.031)	0.047 (0.027)
D94-97*Chaebol Firms with Weak Governance1			0.105* (0.042)		
D94-97*Chaebol Firms with Weak Governance2				0.084* (0.041)	
D94-97*Chaebol Firms with Weak Governance3					0.088* (0.037)
D98-01*Q	0.126** (0.023)	0.129** (0.024)	0.134** (0.024)	0.132** (0.024)	0.132** (0.024)
D98-01*Cash Flow	0.101** (0.020)	0.101** (0.020)	0.115** (0.020)	0.114** (0.020)	0.102** (0.020)
D98-01*Chaebol		-0.012 (0.024)	0.014 (0.031)	-0.018 (0.032)	0.004 (0.031)
D98-01*Chaebol Firms with Weak Governance1			-0.053 (0.044)		
D98-01*Chaebol Firms with Weak Governance2				0.020 (0.044)	
D98-01*Chaebol Firms with Weak Governance3					-0.029 (0.043)
R-squared	0.093	0.097	0.104	0.103	0.101
Nobs	2974	2974	2863	2863	2926

Notes to Table 2:

The dependent variable is the investment to capital ratio for each equation. “Chaebol” is a dummy variable that takes the value of 1 for firms that belong to the largest 30 chaebols and 0 otherwise. “Chaebol Firms with Weak Governance1” is a dummy variable that equals 1 if a firm belongs to a chaebol group where the groupwise controlling shareholders’ ownership is below the median of all chaebol groups. “Chaebol Firms with Weak Governance2” is a dummy variable that equals 1 if a firm belongs to a chaebol group where the ownership by its own affiliated firms is greater than the median of all chaebol groups. “Chaebol Firms with Weak Governance3” is a dummy variable that equals 1 for chaebol affiliated firms if the controlling shareholders’ ownership is below the median of all chaebol affiliated firms.

Estimation is by random effects panel regressions with 8 year dummies and 21 industry (manufacturing industries at two-digit) dummies (not shown on the table). Standard errors are in parentheses. “D94-97” is a dummy variable that equals 1 if observations correspond to the 1994 to 1997 period and zero otherwise. “D98-2001” represents a dummy variable corresponding to the 1998 to 2001 period. Two asterisks (**) denote statistical significance at the 1 percent level, and one asterisk (*) at the 5 percent level.

Table 3. Investment Equation: Before and After the Crisis, 1994 to 2001, with the Sample of Firms with Asset Revaluation Excluded

Sample: No Asset Revaluation	(1)	(2)	(3)	(4)	(5)
D94-97*Q	0.112** (0.023)	0.092** (0.023)	0.089** (0.024)	0.090** (0.023)	0.090** (0.023)
D94-97*Cash Flow	0.172** (0.027)	0.189** (0.026)	0.180** (0.027)	0.179** (0.027)	0.186** (0.026)
D94-97*Chaebol		0.093** (0.018)	0.045 (0.027)	0.062* (0.026)	0.050* (0.024)
D94-97*Chaebol Firms with Weak Governance1			0.103** (0.035)		
D94-97*Chaebol Firms with Weak Governance2				0.080* (0.035)	
D94-97*Chaebol Firms with Weak Governance3					0.083** (0.032)
D98-01*Q	0.132** (0.025)	0.134** (0.026)	0.144** (0.026)	0.142** (0.026)	0.137** (0.026)
D98-01*Cash Flow	0.136** (0.021)	0.134** (0.021)	0.139** (0.021)	0.138** (0.021)	0.135** (0.021)
D98-01*Chaebol		-0.008 (0.030)	0.049 (0.036)	0.002 (0.037)	-0.004 (0.038)
D98-01*Chaebol Firms with Weak Governance1			-0.115* (0.055)		
D98-01*Chaebol Firms with Weak Governance2				0.013 (0.054)	
D98-01*Chaebol Firms with Weak Governance3					0.000 (0.054)
R-squared	0.079	0.091	0.096	0.093	0.091
Nobs	2357	2357	2251	2251	2310

Table 4. Investment Equation for Chaebols: Before and After the Crisis, 1994-2001, with All Sample Firms

Sample: Chaebols	(1)	(2)	(3)	(4)	(5)
D94-97*Q	0.244** (0.063)	0.232** (0.065)	0.219** (0.066)	0.245** (0.064)	0.223** (0.067)
D94-97*Cash Flow	0.245** (0.078)	0.246** (0.079)	0.252** (0.081)	0.245** (0.079)	0.253** (0.080)
D94-97* Investment by Other Affiliates		-0.037 (0.098)	-0.075 (0.106)		-0.072 (0.106)
D94-97* Q of Other Affiliates			0.138 (0.108)		0.134 (0.108)
D98-01*Q	0.107 (0.056)	0.096 (0.058)	0.130* (0.064)	0.116* (0.057)	0.138* (0.065)
D98-01*Cash Flow	0.091 (0.055)	0.123* (0.057)	0.136* (0.059)	0.087 (0.055)	0.139* (0.059)
D98-01* Investment by Other Affiliates		0.392** (0.075)	0.389** (0.076)		0.247** (0.094)
D98-01* Q of Other Affiliates			-0.082 (0.071)		-0.088 (0.071)
D98-01*High Debt				-0.041 (0.044)	-0.055 (0.051)
D98-01*Investment by Other Affiliates*High Debt					0.303* (0.121)
R-squared	0.198	0.256	0.260	0.199	0.269
Nobs	604	557	548	604	548

Notes: See Table 2. “Investment by Other Affiliates” is the average of the investment ratio of other firms in the same chaebol. “Q of Other Affiliates” is the average of Tobin’s q of other firms in the same chaebol. “High Debt” is a dummy variable that equals 1 if the debt to total asset ratio of a firm in 1997 is greater than or equal to the median.

Table 5. Investment Equation for Chaebols: Before and After the Crisis, 1994 to 2001- with the Sample of Firms with Asset Revaluation Excluded

Sample: Chaebols	(1)	(2)	(3)	(4)	(5)
D94-97*Q	0.214** (0.058)	0.206** (0.062)	0.190** (0.063)	0.205** (0.058)	0.186** (0.063)
D94-97*Cash Flow	0.265** (0.072)	0.249** (0.075)	0.252** (0.075)	0.267** (0.072)	0.253** (0.075)
D94-97* Investment by Other Affiliates		-0.036 (0.092)	-0.067 (0.099)		-0.067 (0.099)
D94-97* Q of Other Affiliates			0.110 (0.101)		0.103 (0.101)
D98-01*Q	0.044 (0.066)	0.114 (0.071)	0.178* (0.078)	0.091 (0.071)	0.223** (0.086)
D98-01*Cash Flow	0.143 (0.068)	0.109 (0.072)	0.156* (0.077)	0.129 (0.069)	0.128 (0.079)
D98-01* Investment by Other Affiliates		0.319** (0.111)	0.310** (0.112)		0.191 (0.135)
D98-01* Q of Other Affiliates			-0.191* (0.093)		-0.151 (0.098)
D98-01*High Debt				-0.103 (0.063)	-0.115 (0.087)
D98-01*Investment by Other Affiliates*High Debt					0.283 (0.192)
R-squared	0.158	0.180	0.190	0.163	0.196
Nobs	475	436	430	475	430

Table 6. Sensitivity Analysis

	New Chaebol Classification			Standard Measures of Q		
	All Firms (1)	Chaebols (2) (3)		All Firms (4)	Chaebols (5) (6)	
D94-97*Q	0.090** (0.027)	0.279** (0.079)	0.285** (0.079)	0.037 (0.041)	0.028 (0.121)	0.036 (0.121)
D94-97*Cash Flow	0.192** (0.031)	0.263** (0.091)	0.263** (0.091)	0.197** (0.032)	0.256** (0.081)	0.258** (0.081)
D94-97*Chaebol	0.100** (0.022)			0.103** (0.021)		
D94-97*Investment by Other Affiliates		0.029 (0.118)	0.034 (0.118)		-0.007 (0.106)	-0.008 (0.106)
D94-97*Q of Other Affiliates		0.007 (0.098)	0.005 (0.098)		-0.116 (0.207)	-0.099 (0.207)
D98-01*Q	0.131** (0.024)	0.235** (0.067)	0.251** (0.069)	0.052 (0.030)	-0.040 (0.102)	-0.039 (0.103)
D98-01*Cash Flow	0.115** (0.020)	-0.010 (0.062)	-0.003 (0.063)	0.083** (0.020)	0.075 (0.059)	0.075 (0.059)
D98-01*Chaebol	0.011 (0.025)			0.009 (0.024)		
D98-01*Investment by Other Affiliates		0.183* (0.092)	0.050 (0.106)		0.425** (0.078)	0.294** (0.097)
D98-01*Q of Other Affiliates		-0.007 (0.082)	-0.011 (0.082)		0.022 (0.105)	0.003 (0.106)
D98-01* High Debt			-0.075 (0.055)			-0.033 (0.053)
D98-01*Investment by Other Affiliates*High Debt			0.326* (0.130)			0.295* (0.127)
R-squared	0.098	0.274	0.283	0.086	0.222	0.244
Nobs	2924	487	485	2947	536	536

Notes: See Table 4. In columns (1) through (3), chaebols and non-chaebols are classified following KFTC's 1997 classification. In column (4) through (6), firms that carried out asset revaluation during the post-crisis period are dropped.

Figure 1. Aggregate GDP Growth and Investment Rate in Korea, 1989-2001

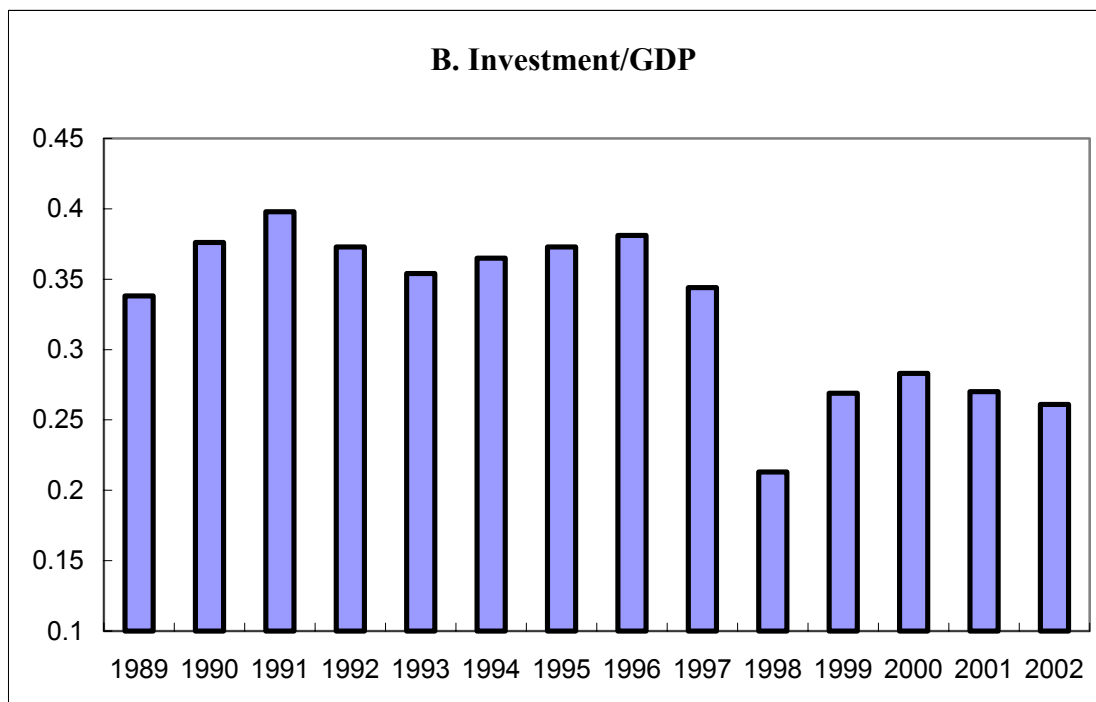
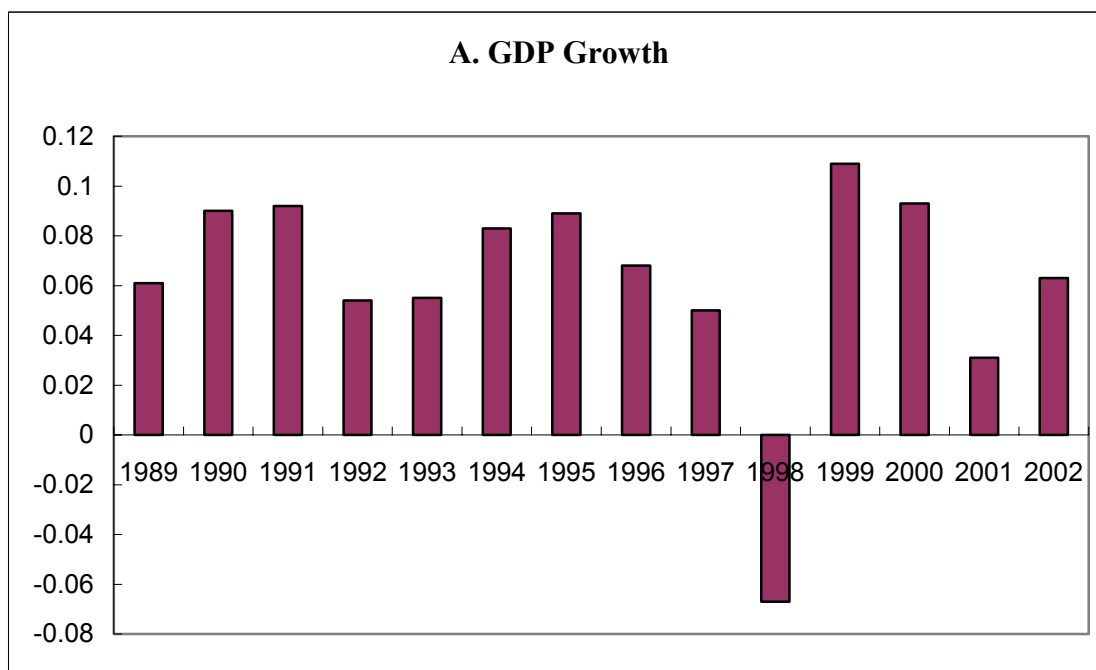
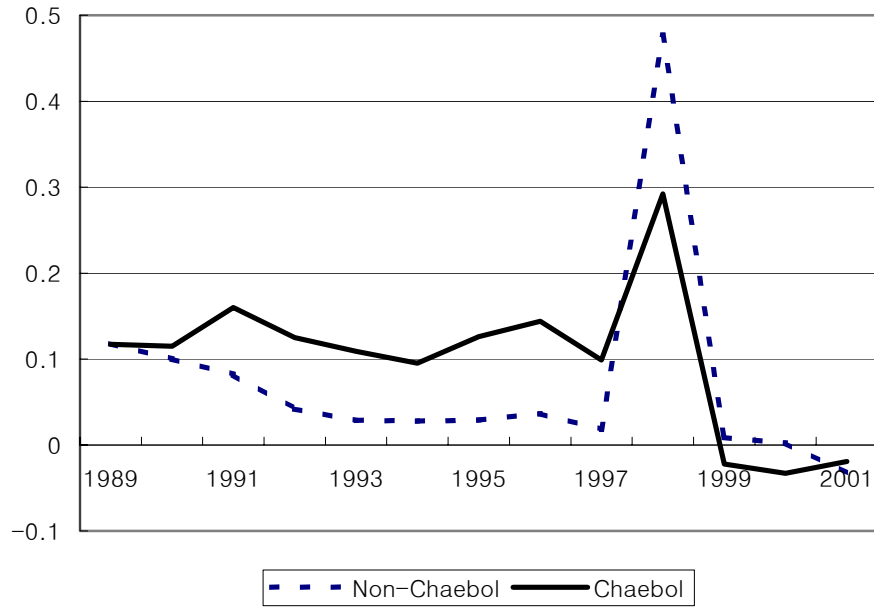


Figure 2. Sample Investment Ratio, 1989-2001

A. All Sample Firms



B. Sample Firms with Asset Revaluation Excluded

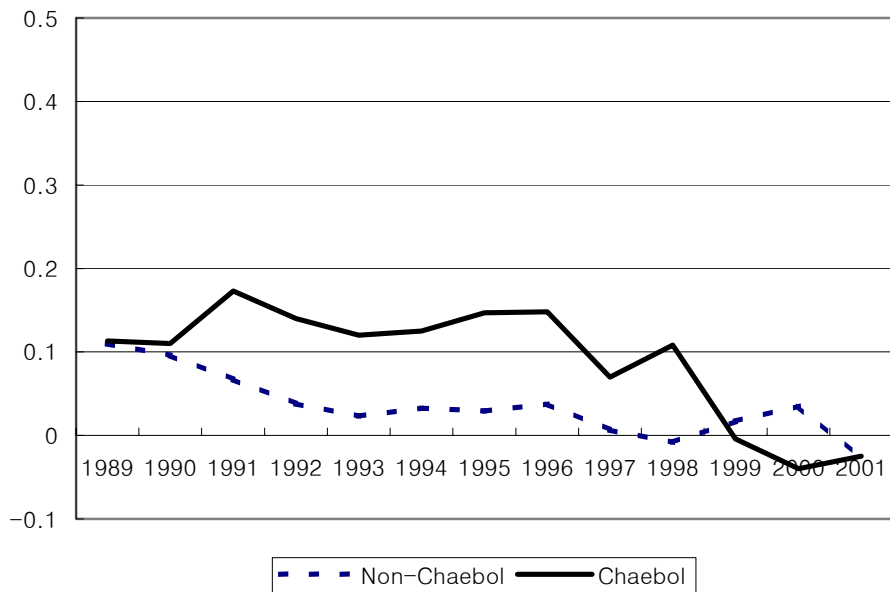
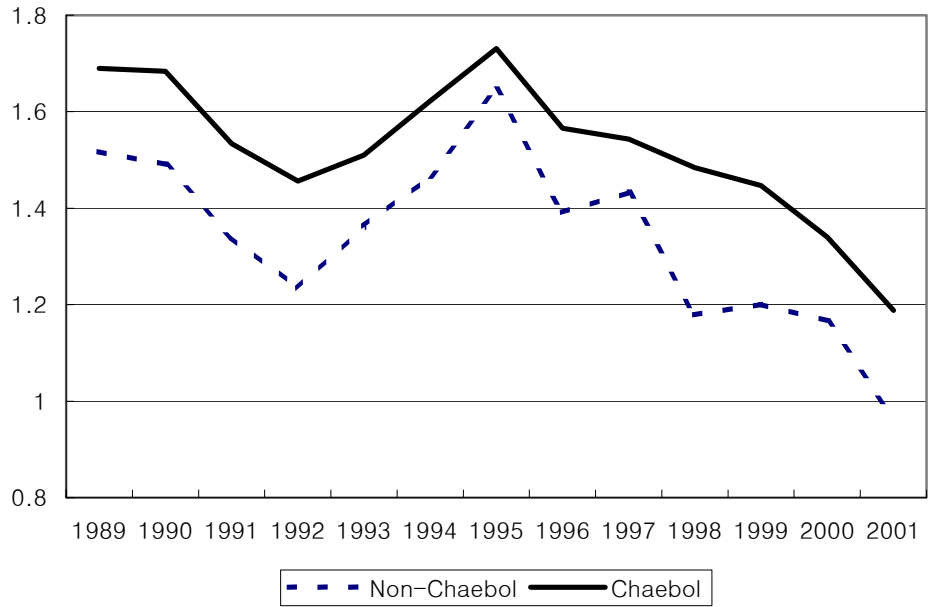


Figure 3. Tobin's Q: Chaebols and Non-Chaebols, 1989-2001

A. All Sample Firms



B. Sample Firms with Asset Revaluation Excluded

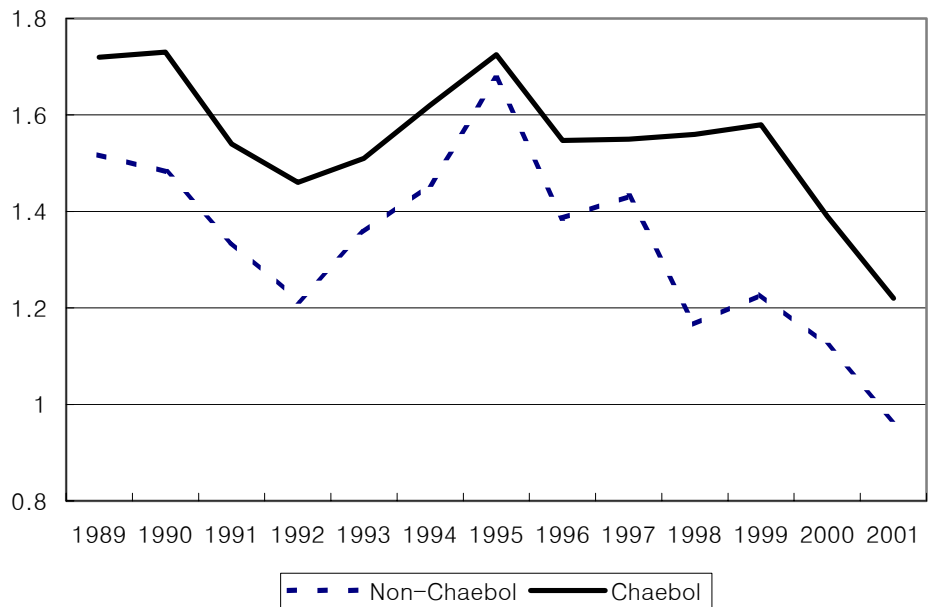
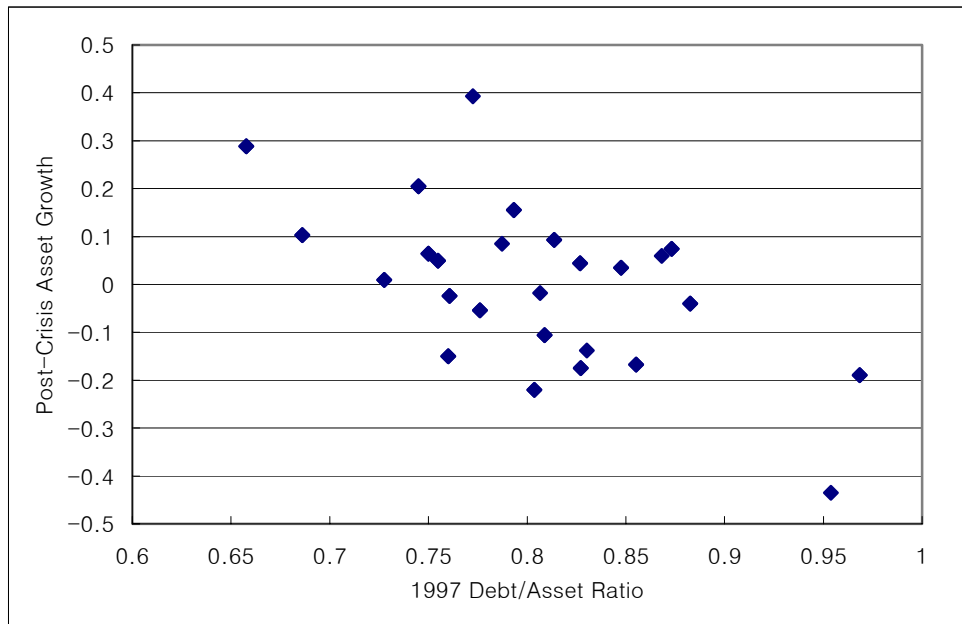


Figure 4. Pre-Crisis Debt/Asset Ratio and Post-Crisis Asset Growth by Chaebols



Appendix 1. Calculation of the Investment Ratio and Tobin's Q

Investment expenditure is defined as the sum of changes in individual tangible fixed assets. Tangible fixed assets have six categories, i.e., land, buildings, structure, general machinery, transportation equipment, others. For each asset category, we compute the change in the stock between two adjacent periods.

The investment ratio is obtained by dividing current investment expenditure by the total capital stock at the end of the previous period. The total capital stock is the sum of the six tangible fixed assets. We have constructed the current value of each asset using the perpetual inventory method. We use the capital stock for 1988 as an initial value. For depreciation rates for each asset, we use the estimates by Hyun and Pyo (1997). For deflators, we use various price indexes such as the land price index (by Ministry of Construction and Transportation) and the producer price indexes for general machinery & transportation equipments and for buildings & structure (by the Bank of Korea).

Tobin's q is defined as the ratio of the market value to the replacement cost of the firm. In computing the market value and the replacement cost, we follow the method in Hoshi and Kashyap (1990) and Kim, Kim, and Chang (1996). The market value is the sum of the market value of stocks and the market value of debts. The market value of stocks is obtained by multiplying the number of stocks by the common stock price. For the market value of debts, we distinguish between long-term liabilities and current liabilities with maturities of less than one year. We further divide current liabilities into two groups, one for interest paying liabilities and the other for non-interest paying ones. For non-interest paying current liabilities, we treat the book value as the market value. For interest paying liabilities, on the other hand, we compute the

discounted present value of interest payments and the book value of debts as follows:

$$\text{Market value of long-term domestic debt} = d\text{lint} \left[\frac{1 - \frac{1}{(1 + dlr)^3}}{dlr} \right] + \frac{dl\text{debt}}{(1 + dlr)^3}$$

$$\text{Market value of short-term debt} = \frac{s\text{int} + s\text{debt}}{1 + sr}$$

$$\text{Market value of bonds} = b\text{int} \left[\frac{1 - \frac{1}{(1 + br)^3}}{br} \right] + \frac{\text{bond}}{(1 + br)^3}$$

$$\text{Market value of long-term foreign debt} = f\text{lint} \left[\frac{1 - \frac{1}{(1 + flr)^3}}{flr} \right] + \frac{fl\text{debt}}{(1 + flr)^3}$$

sint	short-term interest payments	dlint	long-term domestic interest payments
sdebt	book value of short-term debt	dldebt	book value of long-term domestic debt
sr	CD interest rate	dlr	bank loan interest rate
blint	bond interest payments	flint	long-term foreign interest payments
br	bond interest rate	fldebt	book value of long-term foreign debt
bond	book value of bonds	flr	LIBOR + 1.5

Appendix 2: Thirty Largest Chaebols in Korea (April 1th, 1997)

Chaebols ¹⁾	Total Asset (billion wons) ²⁾	Equity/Asset Ratio(%)	Number of Subsidiaries	Number of Listed Subsidiaries	Controlling Shareholders Ownership(%) ³⁾
1. Hyundai	59,325 (7.25)	17.9	57	20	13.8
2. Samsung	82,438 (10.08)	17.9	80	16	3.6
3. LG	45,482 (5.56)	21.1	49	11	5.4
4. Daewoo	37,497 (4.58)	24.1	30	10	6.1
5. SK	23,998 (2.93)	20.4	46	6	14.1
6. Ssangyong	18,305 (2.24)	20.5	25	11	3.6
7. Hanjin	17,594 (2.15)	14.3	24	9	18.7
8. Kia	14,508 (1.77)	16.3	28	6	20.8
9. Hanwha	14,388 (1.76)	11.3	31	7	5.9
10. Lotte	7,925 (0.97)	33.8	30	4	3.4
11. Kumho	8,551 (1.05)	15.4	26	4	2.1
12. Halla	6,657 (0.81)	4.8	18	4	18.7
13. Dong Ah	8,873 (1.08)	13.2	19	4	12.0
14. Doosan	6,402 (0.78)	12.6	25	8	13.4
15. Daelim	6,810 (0.83)	21.2	21	5	8.8
16. Hansol	6,431 (0.79)	18.8	23	7	3.7
17. Hyosung	6,131 (0.75)	21.3	18	2	13.6
18. Dongkuk	6,764 (0.83)	21.0	17	7	15.6
19. Jinro	3,881 (0.47)	2.7	24	4	16.6
20. Kolon	4,638 (0.57)	20.5	24	4	7.7
21. Kohap	3,810 (0.47)	14.7	13	3	8.6
22. Dongbu	4,638 (0.57)	17.6	34	6	12.8
23. Tong Yang	3,810 (0.47)	13.6	24	4	4.8
24. Haitai	3,398 (0.42)	13.2	15	3	3.9
25. New Core	2,803 (0.34)	7.6	18	0	36.4
26. Anam	2,792 (0.34)	17.1	21	2	9.8
27. Hanil	2,599 (0.32)	14.8	7	2	11.2
28. Keopyung	4,963 (0.61)	14.0	22	5	17.5
29. Miwon	2,235 (0.27)	19.4	25	5	15.7
30. Shinho	2,237 (0.27)	17.0	25	6	9.9
Total	425,226 (52.0)	18.2 ⁴⁾	819	185	11.3 ⁴⁾

Source: Korea Fair Trade Commission. and Lee, et al. (2000).

Note: 1) Chaebols ranked by the Korea Fair Trade Commission based on the size of total “official” assets (after readjusting assets in the financial sector).

2) Figures in parentheses indicate the share of each chaebol's asset in total assets of the corporate sector.

3) Asset-weighted averages. 4) Averages.