

Disappearing Internal Capital Markets: Evidence from Diversified Business Groups in Korea*

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Abstract

This paper examines how the onset of a financial crisis affects the operation of internal capital markets among firms within a diversified business group. We find that active internal capital markets within Korean business groups (*chaebols*) attenuated the financial constraints of the group-affiliated firms, allowing them to make efficient capital allocations during the early 1990s. However, these markets are barely functioning after the financial crisis of 1997. Instead, we observe public debt markets serving as a substitute for internal capital markets. Our results suggest that *chaebol* firms' coordinated attempts to achieve healthier financial structures in the wake of the crisis have taken place at the expense of investment efficiency.

JEL Classification: G31

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1. Introduction

A number of recent studies show that corporate divisions of a diversified firm are not financially independent. Accordingly, internal capital markets play a major role in allocating capital in diversified firms and numerous papers have investigated the benefits and costs of these markets during the past few years.¹ In this paper, we examine capital investment decisions of diversified firms and the operation of internal capital markets using a unique dataset from Korean large business groups (*chaebols*) during the period 1993-2005.² We further examine how the onset of a financial crisis affects the operation of internal capital markets and the efficiency of capital allocation among firms within a diversified business group. In particular, we analyze whether the capital expenditures of *chaebol*-affiliated firms (hereafter *chaebol* firms) are justified by the investment opportunities and resources available to them. Our sample period encompasses the Korean financial crisis that erupted in late 1997, an event that is a natural structural break for examination. Since the crisis, the Korean government carried out a series of restructuring programs for *chaebol* groups.³ We investigate whether *chaebol* firms' capital allocation and investment activities were different before and after the crisis.

This study makes several contributions to the literature. First, up until now, the empirical studies on corporate diversification and internal capital markets have mainly focused on US conglomerates (Lamont, 1997; Shin and Stulz, 1998; Khanna and Tice, 2001; Jandik and Makhija, 2005). Korean *chaebols* are similar to US conglomerates in two fundamental ways: first, being well-diversified, they both allocate funds according to the needs of each group firm (or division); second, they share similarities in corporate strategic planning. Thus, our findings add to this

¹ Evidence on the existence of internal capital markets within a diversified firm is provided by Lamont (1997) and Shin and Stulz (1998). See also Stein (2003) for a detailed discussion of the benefits and costs of internal capital markets.

² The sample period excludes the years 1997 and 1998 to disregard the abnormal investment behavior during the transition period around the financial crisis.

³ After the onset of the financial crisis, *chaebols* were commonly criticized by the media for debt overhang problems along with excessive diversification and over-investment. The *chaebol* restructuring programs typically comprise five major tasks: (1) business consolidation into core competence areas; (2) improvement of financial structure; (3) elimination of cross-debt guarantees; (4) enhancement of transparency; (5) improvement of accountability. See Lee (2000) for a comprehensive discussion of the *chaebol* reforms.

growing body of literature, providing international evidence that can be used to make future generalizations. Second, we analyze the impact of a financial crisis on the operation of internal capital markets. The Korean economy experienced a financial crisis in late 1997 and has since recovered. Given that *chaebols* were at the core of the crisis, they represent an interesting case study on the impact of a financial crisis on capital allocation behavior.

Recent empirical work on the Korean financial crisis has examined the effectiveness of governance reform programs adopted after the crisis. For example, Choi et al. (2007) examine the valuation effects of regulatory changes concerning board structure in Korea, while Chang and Shin (2006) examine the effect of governance reforms on CEO turnover sensitivity to performance. To our knowledge, the current paper is the first to comprehensively examine the function of post-crisis internal capital markets and how these markets affect the efficiency of capital allocation among Korean *chaebol* firms. Finally, by using firm-level data, our study is not subject to the segment-level data limitations reported in prior studies (Lamont, 1997; Shin and Stulz, 1998).⁴

In contrast to anecdotal evidence, our results show that during the early 1990s active internal capital markets existed within *chaebols*. Along with the *chaebols*' easier access to external financing, the internal capital markets attenuated the financial constraints of group-affiliated firms, allowing capital to be allocated to its best use. These results of our study in the pre-crisis period are close to those of Khanna and Tice (2001), who document that in the discount retail industry, investments of diversified firms in the discount retail division are more sensitive to performance than those of focused firms, evidence consistent with well-functioning internal

⁴ Our firm-level dataset has several advantages over the US segment-level (or division-level) dataset. First, as discussed in Scharfstein (1998) and Shin and Park (1999), US conglomerates often allocate capital expenditures and assets arbitrarily across segments. In contrast, Korean *chaebol* groups have less latitude in doing so since they are comprised of independent firms. We therefore should expect our Korean *chaebol* dataset to provide less arbitrary accounting information. Second, divisional Tobin's Q , a proxy for a division's investment opportunities, is not available in the US dataset. Hence, Lamont (1997), Shin and Stulz (1998), and Scharfstein (1998) use industry Q instead of divisional Q . A raised concern of using industry Q is that it may not be related to a division's actual investment prospects. In contrast, using our dataset, we can compute a firm-specific Q for each public *chaebol* firm and thus mitigate the concern over industry Q .

capital markets. Jandik and Makhija (2005) also report similar results from the US electric utility industry.

These studies do not, however, investigate the link between a financial crisis and the operation of internal capital markets. In contrast, our study makes a step forward in addressing this link. The pre-crisis efficiency of these internal capital markets seems to have been at a barely functional level after the onset of the financial crisis in 1997. It appears that *chaebol* firms were discouraged from making large investments, a reversal mainly driven by the government-initiated corporate restructuring program set in place after the crisis.

In our analysis, we first characterize the investment patterns of *chaebol* firms *relative* to that of non-*chaebol* firms by examining each class of firm's sensitivity of investment to Tobin's Q , a proxy for investment opportunities, and to cash flow. Our results suggest that *chaebol* firms' investment practices were quite different from non-*chaebol* firms' practices in the pre-crisis period. More specifically, in the pre-crisis period, *chaebol* firms' investment decisions are more sensitive to investment opportunities and own cash flow than those of non-*chaebol* firms. We also examine whether the investment activities of each individual *chaebol* firm are related to the resources available from other affiliated firms in the same *chaebol* group. Using the sample over the pre-crisis period, we find that *chaebol* firms' investment decisions are positively related to the cash flow of other firms in the same *chaebol* group, which is consistent with the findings of Shin and Park (1999). This finding adds to the evidence of cross-subsidization among diversified firms, as reported in Lamont (1997) and Shin and Stulz (1998). In this study we further investigate the efficiency of cross-subsidization since internal capital markets are argued to have both bright and dark sides.

In an efficient internal capital market, a business group directs corporate resources to their best use. We thus expect firms with better investment opportunities to have higher priority in accessing group resources (Shin and Stulz, 1998). Hence, to test for efficiency, we allow for investment sensitivity to cash flow to vary across firms by the *relative* ranking of investment

opportunities within each *chaebol* group. To this end, we define dummy variables to select firms with *relatively* high growth potential in each *chaebol* group and add to the equation their interactions with cash flow variables. Under this specification, our estimation results suggest that *chaebol* groups' headquarters are indeed successful at picking winner firms and making efficient reallocations of group funds across affiliated firms. This implication is consistent with the studies of Stein (1997) and Villalonga (2004), which posit the positive perspective of diversification.

Following the crisis, however, as a central part of the structural reforms by the government, *chaebol* firms were required to lower their debt-to-equity ratios to less than 200%. Cross-subsidization seems to disappear; we find that *chaebol* firms' investment decisions become little affected by the cash flow of other group firms. Instead, public debt markets seem to be functioning as a substitute for internal capital markets after the crisis. It would appear that the malfunctioning of internal capital markets as a result of the crisis, along with the reduced level of leverage, drove *chaebol* firms to be financially constrained, preventing them from fully exploiting subsequent investment opportunities. Taken together, our results suggest that as the crisis unfolded, *chaebol* firms underwent drastic changes in their investment decisions, tending toward improved financial structures and enhanced transparency at the expense of efficiency. Our post-crisis findings are closely related to the findings of Kim et al. (2004), in that they provide evidence of the post-crisis market's disciplining of *chaebols*. They document that main banks have gained power by charging higher interest rates to their client *chaebol* firms after the onset of the crisis.

This paper is organized as follows. In Section 2, we describe those structural weaknesses of *chaebol* firms that seem to be related to the eruption of the Korean financial crisis. Section 3 discusses the data used in our paper. Section 4 presents and discusses the empirical results. Section 5 presents the concluding remarks.

2. Korean *chaebols* and the financial crisis

Chaebols are large business conglomerates in South Korea. Since the 1960s, they have played a major role in developing the Korean economy. At the same time, however, they are criticized as one of the main causes of the 1997 financial crisis.

Chang et al. (1998) describe the causes and consequences of the 1997 Korean financial crisis. From the early 1990s, the Korean government started removing controls over the financial sector and accelerated financial liberalization. Among other liberalization plans, capital account liberalization was the most important and had a great impact on the economy. By 1995, the government significantly reduced its regulation on foreign borrowings, which increased from \$44 billion in 1993 to \$120 billion in 1997. Even though foreign debt grew fast the debt service ratio measured by total debt service to exports of goods and services was only 5.8% in 1996, which was far less than the World Bank's "warning threshold of 18%." However, Korea's foreign debt had a problem of maturity structure mismatching. The share of short-term debt in total debt was too high because short-term debt did not require detailed information and permission from the Ministry of Finance and Economy. Merchant banks tended to borrow for short term and lend for long term. Corporations also borrowed short-term debt. Furthermore, the demise of industrial policy allowed several companies to over-invest in already overcrowded industries such as the steel industry by *Hanbo* and the automobile industry by *Samsung*. This exacerbated the 1997 financial crisis.

Foreign banks, which had been lending heavily to Asian corporations, had a surge in non-performing loans during the Asian financial crisis. In response they withdrew short-term loans from Korean merchant banks and large corporations all at once. As described above, Korean merchant banks and large corporations could not make their short-term loan repayments to foreign banks because Korean merchant banks lent long-term to Korean firms and large corporations invested in long-term assets such as land and buildings. Many Korean banks and

corporations were bankrupted during the Asian financial crisis, and it motivated the establishment of government-led corporate governance reforms.

Following the Asian financial crisis, the Korean government required a mandatory proportion of independent directors in the board of directors of firms with assets of more than 2 billion Korean won. It also has requested an internal audit committee, a performance evaluation committee, and a CEO search committee consisting of outsiders only. However, Chang et al. (2006) argue that though the Korean corporate governance system had problems, such as continued family control and poor quality of financial reporting, the problems could be rectified without changing the fundamental nature of the system. They assert that an American style of corporate governance system adversely affects competitiveness and investment of Korean corporations.

Out of the many corporate governance reforms, the prohibition of cross-loan guarantees and cross-shareholdings among *chaebol* affiliated firms has affected internal capital markets the most. Cross-loan guarantees and cross-shareholdings were an indirect way of financing other affiliated firms' projects a *chaebol* firm has stable cash flow and enough debt capacity. Therefore, the prohibition of cross-loan guarantees and cross-shareholdings is equivalent to the prohibition of functioning internal capital markets among affiliated *chaebol* firms.

Three stylized facts appear to be related to structural weaknesses in the corporate sector (*chaebol* firms, in particular). First, empowered by the government's favored influence on credit allocation, most *chaebol* firms were severely indebted (Lee et al., 2000). When economy took a downturn following the adverse terms-of-trade shocks in 1996 and 1997, the highly leveraged *chaebol* firms could not service their debts, thereby increasing the fragility of the financial institutions that had excessive exposure to them. Second, the emphasis of expansion, apparently facilitated by high leverage, led to the overinvestment of *chaebol* firms (Lee, 2000). Given that the benefits to the controlling shareholders of a business group are usually proportional to its scale of operations, their endeavor to increase group size, even at

the expense of the profitability of individual group-affiliated firms, is not surprising. The benefits include social, political, and economic rewards. For example, if a *chaebol* group acquires a new business division, its controlling shareholders can appoint hand-picked subordinates to executive positions in the new business division. Ferris et al. (2003) also provide evidence of *chaebol* firms' overinvestment over the period 1990 to 1995. The focus on growth seems not to have been confined to *chaebol* firms. The government economic development plans gave financing priority to large export-sector firms through the provision of low loan rates. This practice gave both *chaebol* and non-*chaebol* firms an added incentive to emphasize sales growth over profit maximization.

Finally, the weak corporate governance structure of *chaebol* firms has been criticized as a source of the financial crisis (Lee, 2000). Despite the size and diversification of *chaebols*, the majority of affiliated firms in *chaebol* groups are still under the control of their founding family owners. The affiliated firms are linked to each other by direct or indirect shareholdings, with the founder of the group's core company typically serving as chairman of the entire group. Thus, management decisions are prone to depend on the owners' private interests rather than on economic feasibility. Recent empirical work has documented that governance had a significant influence on corporate performance during the crisis (see Mitton, 2002; Lemmon and Lins, 2003; Baek et al., 2004). For example, using Korean *chaebol* data, Baek et al. (2004) show that firms with better governance measures experience a smaller drop in firm value during the crisis.

3. Data

The dataset used in this study is provided by the Seoul-based Korea Information Service (KIS). KIS is affiliated with the Moody's and is a leading provider of credit-related information and services for financial and commercial business transactions among corporations and consumer individuals in Korea. The company profiles and financial information data are

compiled from financial statements, business reports, and audit reports that every company is mandated to produce on an annual basis.⁵ Most of the previous studies on Korean firms have employed the PACAP database, but it provides limited information on accounting numbers and stock prices. For example, research and development (R&D) expenditures and accounts receivable from *chaebol* group-affiliated firms are not available from the PACAP Korea database. Our dataset constructed from KIS contains more comprehensive financial information regarding firms listed in the Korea Stock Exchange (KSE). The stock price data for Tobin's Q are from the DataGuide Pro database of FN DataGuide.

This study covers the period 1993 to 2005. The sample firms are all industrial firms listed in the KSE. Although the KIS database includes firms listed both in the KSE and KOSDAQ stock markets, we exclude firms listed in the KOSDAQ market since their firm characteristics and behavior are quite different from those of *chaebol* firms.⁶ We also exclude those firms whose financial information or stock price is not available from the sources identified above.

To examine the capital allocation and investment practices of *chaebol* firms and non-*chaebol* firms, we first identify whether each sample firm is affiliated with a *chaebol* group. For the definition of *chaebol*, we follow the guidelines of the Korea Fair Trade Commission (KFTC).⁷ Among the business groups designated by the KFTC, we choose to define the top 30 groups based on total assets as *chaebol* groups each year over the sample period, referring to all others as non-*chaebol* groups. Thus, each year we allow a different composition of business groups in our *chaebol* sample. We examine capital allocation behavior, after classifying all sample firms into

⁵ Shin and Park (1999) and Chang and Shin (2006), among others, also use the KIS database. On the other hand, Joh (2003) employ financial statement data from the National Information and Credit Evaluation (NICE), another major credit ratings firm in Korea. All listed firms regularly report their financial statement information to the Financial Supervisory Service and credit ratings firms use the information as their primary source for constructing their financial statement database.

⁶ Established in 1996, the KOSDAQ stock market is a Korean version of the NASDAQ market, listing a large number of fast-growing young technology firms. Interestingly, the bubble burst in the KOSDAQ market around the same time as it did in the NASDAQ in early 2000.

⁷ The KFTC legitimately defines a business group as "a group of companies, more than 30 percent of whose shares are owned by some individuals or by companies controlled by those individuals," and announces the list of business groups every year. Most studies on Korean firms identify *chaebol* firms following the KFTC classification (for example, see Joh, 2003; Baek et al., 2004).

chaebol and non-*chaebol* categories, for each category of firms. We select a total of 1884 firm-year observations during the pre-crisis period (1993-1996). Among them, 506 firm-years are classified as *chaebol* firm observations and 1378 firm-years as non-*chaebol*. During the post-crisis period (1999-2005), we have 3975 firm-year observations with 840 firm-years classified as *chaebol* and the remaining 3135 firm-years as non-*chaebol*.

Table 1 presents important financial characteristics of *chaebol* firms and non-*chaebol* firms, as well as the statistical differences between those characteristics. To gauge the impact of the financial crisis (1997-1998) on these characteristics, we report the statistics separately for the periods before (Panel A) and after (Panel B) the crisis. We first observe that *chaebol* firms are significantly larger in size than non-*chaebol* firms. For example, in the pre-crisis period, the average (median) size of total assets of *chaebol* firms is about 1.36 (0.74) trillion Korean won (KRW), almost five (seven) times larger than about 0.28 (0.099) trillion KRW of non-*chaebol* firms. After the crisis, the difference in total assets is even larger: about 2.83 (1.10) trillion KRW for *chaebol* firms and about 0.48 (0.14) trillion KRW for non-*chaebol* firms. With almost the same order of magnitude in differences, sales are also greater for *chaebol* firms than for non-*chaebol* firms both before and after the crisis. This should hardly be surprising given the managerial objectives of growth and diversification widespread among Korean *chaebol* firms.

Given that our interest is in examining the capital allocation and investment activities of firms, capital expenditures become our main variable of interest. Capital expenditures are defined as expenditures for tangible and intangible leases and assets and for development costs.⁸ To control for size, we normalize capital expenditures by total assets. Panel A of Table 1 shows that capital expenditures of *chaebol* firms are greater on average than those of non-*chaebol* firms in the pre-crisis period. For example, in the pre-crisis period, the mean and median capital expenditures of *chaebol* firms are 5.4 percent and 2.9 percent of total assets respectively, while

⁸ The definition of capital expenditures used in this study is closer to the definition of COMPUSTAT capital expenditures than the definition used by most papers studying international data, that is, the changes in the sum of fixed assets and depreciation.

the mean and median capital expenditures are 4.0 percent and 2.2 percent of total assets respectively for non-*chaebol* firms. After the crisis period, both mean (3.9 percent of total assets) and median (2.8 percent of total assets) capital expenditures of *chaebol* firms continue to be greater and are statistically different from the mean (2.5 percent of total assets) and median (2.1 percent of total assets) expenditures of non-*chaebol* firms. Note that, despite the size increase in terms of total assets and sales, both *chaebol* and non-*chaebol* firms spend less capital on investment in the post-crisis period.

A firm's cash flow is defined as operating income plus depreciation, and it is also normalized by total assets. Table 1 reports that *chaebol* firms' mean cash flow is fairly equal to that of non-*chaebol* firms in the pre-crisis period. In the post-crisis period, though, *chaebol* firms' cash flow is greater than non-*chaebol* firms' in both mean and median values, which may be partly due to the somewhat depressed capital investment activities of *chaebol* firms during that period as documented above.

A firm's market-to-book ratio, a proxy for Tobin's Q , measures its investment opportunities.⁹ It is defined as book value of assets minus book value of equity plus market value of equity, divided by book value of assets. In both periods, the median market-to-book ratio is higher for *chaebol* firms than for non-*chaebol* firms, a result suggesting that median *chaebol* firms have better investment opportunities than median non-*chaebol* firms. However, given that the magnitude of difference in median market-to-book ratio is only 1.0 percent (7.8 percent) in the pre-crisis period (the post-crisis period) and that the market-to-book ratio is a noisy proxy for Tobin's Q , it is difficult to conclude that the investment opportunities of *chaebol* firms are better than those of non-*chaebol* firms. Note also that the market-to-book ratios have declined along with the passage of the financial crisis. For example, the average market-to-book ratio of *chaebol*

⁹ In a recent study on the performance of proxy variables in measuring investment opportunities, Adam and Goyal (2006) show that the market-to-book assets ratio (highly correlated with Q used in our paper) is the best proxy on a relative scale among other proxies tested.

(non-*chaebol*) firms is 1.05 (1.03) before the crisis, but the corresponding ratio is 0.94 (0.84) after the crisis. It is presumed that this trend may be driven by the downturn of the Korean stock market after the crisis.

A ratio of bank loans to total debt is slightly higher for *chaebol* firms than for non-*chaebol* firms in the pre-crisis period. After the crisis, however, we observe the opposite pattern: the non-*chaebol* firms' average and median ratios of bank loans to debt are higher by more than 50% than those of *chaebol* firms. This pattern is mainly driven by a post-crisis plunge in the ratio for *chaebol* firms. For example, after the crisis, *chaebol* firms' average (median) bank loan amount reduces to 19.6 (16.9) percent of total debt from pre-crisis 38.2 (38.4) percent. This is consistent with the finding of Kim et al. (2004) that banks charged higher loan rates to *chaebol* firms than to non-*chaebol* firms during the post-crisis period. Interestingly, we observe only a slight decrease in the bank loan-to-debt ratio for non-*chaebol* firms.

The prevalence of highly debt-ridden businesses within Korean *chaebol* firms is considered one of the main structural defects that made the entire economy vulnerable to the late 1997 financial crisis. To see the difference in debt structure between *chaebol* and non-*chaebol* firms, we can first compare their relative degrees of leverage. A firm's leverage is defined as total assets minus total equity, divided by total assets. Leverage is significantly higher for *chaebol* firms than for non-*chaebol* firms both before and after the crisis, which is consistent with prior studies (for example, Lee et al., 2000). The average leverage ratios are 75 percent in the pre-crisis period and 59 percent in the post-crisis period for *chaebol*-firms, but those are 62 percent in the pre-crisis period and 50 percent in the post-crisis period for non-*chaebol* firms. A discrepancy in leverage between *chaebol* firms and non-*chaebol* firms should be expected since the government intervened heavily in the banking system to channel credit to the government-favored *chaebol* firms. The overall decrease in leverage level after the financial crisis is worthy of notice for both classes of firms.

In summary, the descriptive statistics in Table 1 document that in comparison to non-*chaebol* firms, *chaebol* firms are, on average, significantly larger and make greater use of financial leverage. Backed by this high leverage, *chaebol* firms appear to have made excessive capital expenditures in the pre-crisis period. After the crisis, however, the investment expenditures by both *chaebol* and non-*chaebol* firms drop off gradually. This finding is supported by the market-to-book ratios in both the pre- and post-crisis periods, which seem to indicate that the investment opportunities of *chaebol* firms and non-*chaebol* firms have been decreasing.

4. Empirical results

4.1. Capital investment equation

We start our analysis by comparing the capital allocation and investment practices of *chaebol* firms with those of non-*chaebol* firms. More specifically, we test whether capital investment is sensitive to investment opportunities and firm cash flow for each class of firms. We further examine whether any differences in capital allocation are observed between the pre-crisis period and the post-crisis period. Our model builds on the approach of Scharfstein (1998) by *directly* relating investment to Tobin's Q in order to check the sensitivity of investment to growth opportunities. At the same time, we also look at the sensitivity of investment to cash flow, following the approach of Shin and Stulz (1998) to further explore the issue of investment efficiency.

The dependent variable is a firm's capital expenditures normalized by total assets. As a proxy for firm-specific investment opportunities, we use the beginning-of-period Tobin's Q for each firm. As touched on above, in investigating the capital allocations of 165 diversified conglomerates in 1979, Scharfstein (1998) used industry Q instead of divisional Q , as there was no divisional Q in his dataset. Industry Q , however, may not be related to each firm's actual investment prospects. A firm-specific Q should catch firm-specific investment prospects not

captured by industry Q ; thus, we use a firm-specific Q in our investment equation instead of industry Q .

Cash flow is also included in our regression as a proxy for resource availability.¹⁰ As discussed above, many empirical papers have documented that the headquarters of diversified firms are engaged in cross-subsidization across divisions through the use of internal capital markets (see Lamont, 1997; Shin and Stulz, 1998; and Shin and Park, 1999). The extent to which a *chaebol* firm has access to internal capital markets can be measured by the sensitivity of its investments to the cash flow of other affiliated firms in the same *chaebol* group. We thus include the cash flow of other group-affiliated firms as well as own cash flow in the investment equation. Other cash flow is specifically defined as the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms. Although the sum of cash flow measures the total cash flow available under the same umbrella, its use may be likely to overstate the cash flow ready to use, especially for large *chaebol* groups. To address this concern, we use the median cash flow of all other firms in a *chaebol* group as a robustness check, instead of sum, in the investment equation and the re-estimated results remain the same. We also include year dummy variables to account for macroeconomic effects, as in Pinkowitz and Williamson (2001), but we do not report the coefficients in our tables to conserve space. We screen for outlying total assets values and book values by winsorizing the capital expenditures-to-assets and cash flow-to-assets ratios at their 1st and 99th percentiles and Tobin's Q at its 99th percentile.

4.2. Evidence of the operation of internal capital markets

Table 2 provides the OLS estimation results from the regressions testing the impact of investment opportunities, own cash flow, and other cash flow on capital expenditures during the pre-crisis period (Panel A) and the post-crisis period (Panel B) for *chaebol* and non-*chaebol* firms.

¹⁰ In Scharfstein (1998), the cash flow variable is employed to pick up both firm-specific investment prospects and firm-specific resources. It should be noted that in this study we define a separate proxy variable for each characteristic: own Q for investment prospects and cash flow for resource availability.

The pre-crisis period is from 1993 to 1996 and the post-crisis period is from 1999 to 2005. Overall, our results from Table 2 remain consistent with those of Table 1, indicating that *chaebol* firms' investment practices are quite different from those of non-*chaebol* firms during the pre-crisis period, but the difference becomes negligible after the crisis. In columns (1) to (3) of Panel A, the coefficients on firm-specific Q are positive and statistically significant at the 5% level, suggesting that *chaebol* firms took advantage of growth opportunities in their investment activities before the crisis. The results in columns (2) and (3) report that the coefficients on both own cash flow and other cash flow are significant during the pre-crisis period. This suggests that, engaged in cross-subsidization, *chaebol* firms were not financially constrained when making their capital investment decisions before the crisis. In summary, *chaebol* firms appear to make extensive capital expenditures for great growth potential in the pre-crisis period, a disposition which was seemingly backed by both high leverage and access to internal capital markets.

Since non-*chaebol* firms have no affiliated firms, we exclude other cash flow in our regression analysis for non-*chaebol* firms. The results for non-*chaebol* firms in columns (4)-(5) of Panel A in Table 2 show sharp contrast to those for *chaebol* firms during the pre-crisis period. The coefficients on firm-specific Q are not significant, but the coefficient on own cash flow is positive and significant at the 1% level, suggesting that non-*chaebol* firms' investment decisions were not associated with growth opportunities before the crisis. This pre-crisis period evidence for non-*chaebol* firms is partly consistent with the argument by Hoshi et al. (1991), which document that investment expenditures are positively related to cash flow for Japanese independent firms.

To test the significance of the difference in coefficients between the two classes of firms, we also perform pooled regression analysis by including a *chaebol* dummy variable, whose value is one for a firm in a *chaebol* group and zero otherwise. The results reported in column (6) of Panel A in Table 2 are consistent with our findings from columns (1)–(5). The overall results during the pre-crisis period are consistent with the findings of Shin and Park (1999) that *chaebol*

firms, compared to non-*chaebol* firms, invest in projects with better growth opportunities and that their investment decisions are less financially constrained through the operation of internal capital markets.¹¹

In contrast, the results in Panel B of Table 2 once again suggest that *chaebol* firms' investment behavior is not different from non-*chaebol* firms' behavior in the post-crisis period. In columns (1) to (3) of Panel B, we observe similar patterns on the coefficients on explanatory variables to those in Panel A, except for the coefficient on other cash flow. It appears that the operation of internal capital markets has substantially weakened after the crisis, which is strongly supported by the insignificance of the coefficient on other cash flow. Columns (4)-(5) in Panel B report that non-*chaebol* firms' investment behavior in the post-crisis period is similar to that of *chaebol* firms. There is a marked contrast, however, in non-*chaebol* firms' investment decisions between pre- and post-crisis periods: investment prospects considerably affect non-*chaebol* firms' investment decisions in the post-crisis period, while not in the pre-crisis period. Column (6) of Panel B shows pooled regression results for the post-crisis period and it clearly confirms inactive internal capital markets within a Korean business group. The interaction term between *chaebol* dummy and other cash flow turns out to be insignificant.

Overall, the findings are also consistent with the conventional pecking order theory, which states that internal cash is channeled into investments first before seeking for any financing outside the firm. We thus conclude that the attenuated operation of their internal capital markets after the financial crisis results in a reduction of cross-subsidization by *chaebol* firms.

4.3 External capital markets as a substitute for internal capital markets

Evidence in the earlier section suggests that prior to the financial crisis, internal capital markets are active within *chaebol* groups but its operation is limited in the post-crisis period. One

¹¹ The sample period in Shin and Park (1999) consists of 1994 and 1995, which is a sub-period of our pre-crisis period 1993-1996.

may then ask whether internal capital markets serve as a substitute for external financing in the pre-crisis period and whether any other external capital markets replaces the limited post-crisis internal capital markets. To address this issue, we introduce external financing variables such as a ratio of bank loans to debt and dummy variables for the existence of a bond issue and for an equity issue. The estimation results are shown in Table 3.

Panel A of Table 3 further confirms the existence of active internal capital markets during the pre-crisis period with significantly positive coefficients on the other cash flow variable even after controlling for *chaebol* firms' use of external capital. All three external financing variables are positive and significant, which suggests that *chaebol* firms with greater access to external capital markets, as well as to internal capital markets, tend to invest more. The post-crisis results in Panel B of Table 3 show sharp contrast to the results in Panel A. As noted in the previous section, we see that the coefficient on other cash flow continues to be insignificant, suggesting disappearing internal capital markets within *chaebol* firms. Turning to external capital markets, we observe that only the coefficient on the bond issue dummy variable continues to be significantly positive in the post-crisis period; both bank loan and equity issue dummy variables become insignificant. This indicates that public bond markets seem to be functioning as a substitute for internal capital markets after the crisis.

To directly measure the impact of the financial crisis on investment sensitivity, we also run pooled regressions by adding a post-crisis dummy variable and interacting it with major explanatory variables in our investment equations. The sample period covers both the pre-crisis sub-sample period from 1993 to 1996 and the post-crisis sub-sample period from 1999 to 2005. The estimation results reported in Table 4 confirm our earlier findings that active internal capital markets within *chaebol* groups are barely functioning after the financial crisis and that the public debt market instead serves as a substitute for internal capital markets. The coefficients on other cash flow are significantly positive for all equations, but the investment's reliance on other cash flow is substantially reduced in the post-crisis period by negative and significant coefficients on

the interaction term between other cash flow and post-crisis dummy. The sums of coefficients on other cash flow and its interaction term with post-crisis dummy ($\beta_6 + \beta_7$) are not different from zero in all models (1)-(4), indicating inactive internal capital markets during the post-crisis period. We also note that the coefficients on the interaction variables between post-crisis dummy and both bank loan and equity issue dummy are significantly negative, which is consistent with our finding in Table 3.

4.4. Efficiency of internal capital markets

As it is discussed in the literature such as Stein (1997), Scharfstein and Stein (2000), and Rajan et al. (2000), internal capital markets have both bright and dark sides. On the bright side, a business group's headquarters is presumably well-informed about the growth potential of each of its member firms, redistributing capital to firms with the greatest potential from other group firms, thus maximizing the efficiency of capital allocation. On the dark side, managerial agency problems may result in misallocations of capital, thus depreciating the value of a diversified firm. In this section, we further examine the efficiency of capital allocation in *chaebol* groups' active internal capital markets during the pre-crisis period.

Efficient internal capital markets should reallocate internal resources, such as cash flow, out of firms with poor investment opportunities and into firms with good investment opportunities. Hence, to check for efficiency, we need to allow investment sensitivity to cash flow to vary across firms in the same *chaebol* group by their *relative* investment opportunities. To this end, we define a dummy variable *Max_Q* to single out firms with the best investment opportunities in each *chaebol* group. *Max_Q* takes the value of one if a firm has the highest Tobin's *Q* in its *chaebol* group and zero otherwise. To the extent that Tobin's *Q* is a noisy measure of investment opportunities, the use of *Max_Q* may not accurately capture the efficiency of internal capital markets. To address this concern about measurement error, we define another dummy variable, *Above_median_Q*, which takes the value of one if a firm's *Q* is both above

median within its *chaebol* group and above median among all sample firms (including non-*chaebol* firms), and zero otherwise. Note that our definition of *Above_median_Q* is quite conservative in the sense that it filters firms with good investment opportunities in both relative and absolute senses. For example, the variable takes a value of zero if a firm has poorer investment opportunities than the overall market, even though the firm has the best investment opportunities within its group. The intuition is that, even in the presence of efficient internal capital markets, a firm with poor overall business prospects will be less likely to benefit from it although the firm commands relatively good prospects within its group.

Thus, we effectively divide our sample firms into two equally-sized sub-samples based on each firm's rank of investment opportunities, relative not only to their respective business groups, but also to one other. We then add the interaction terms between the two dummy variables and the cash flow variables to the investment equations. The intuition is that, in the presence of efficient internal capital markets, firms with good investment opportunities should be less constrained by internal funds, and take more advantage of cross-subsidization than other firms with poor opportunities in the same group. By this logic, each dummy variable's interaction with own cash flow (other cash flow) should attract a negative (positive) coefficient in the investment equations.

Table 5 presents the estimation results under this model specification. In Panel A, the significance of coefficients on the cash flow variables depends on the choice of dummy variables for relative investment opportunities. As can be seen in columns (1) and (3), the coefficients on both own and other cash flow variables are significantly positive, indicating active internal capital markets in the pre-crisis period. In contrast, the coefficients on the interactions between *Max_Q* dummy and (own and other) cash flow variables are not significant, which suggests that the firm with the best opportunities in a *chaebol* group was not necessarily the recipient of collective group funds.

The regression results using *Above_median_Q* are reported in columns (2) and (4) of Table 5. Interestingly, the coefficient on own cash flow is significantly positive but the coefficient on other cash flow is insignificant. This suggests that a subset of *chaebol* firms with poor (below-median) growth potential indeed made quite a conservative investment even before the crisis. Specifically, those firms appeared not to benefit from internal capital markets and their investments were considerably sensitive to own cash flow. On the other hand, the coefficient on the interaction of *Above_median_Q* with other cash flow turns out to be significantly positive. This indicates that internal capital markets were functioning well and that there was efficient capital allocation within *chaebol* firms during the pre-crisis period. Additionally, firms with high (above-median) growth opportunities in each group were more able to pursue investments by internal cash flow through cross-subsidization. All three external financing variables are significant and positive, indicating that internal capital markets seem to be active even after controlling for access to external capital markets. We also note that both coefficients on own cash flow's interactions with *Max_Q* and *Above_median_Q* are negative, albeit insignificant. Our findings are consistent with the argument by Stein (1997), suggesting that *chaebols* did a good job of picking winner firms and of making efficient redistributions of resources across their group firms during the pre-crisis period. The view that diversified firms are making more efficient investments through active internal capital markets is also documented by prior studies examining internal capital markets in different industries (for example, see Khanna and Tice, 2001 for the US discount retail industry; Jandik and Makhija, 2005 for the US electric utility industry).

As can be seen in Panel B of Table 5, the post-crisis results are consistent with our earlier findings that internal capital markets within *chaebol* groups have been barely functioning after the onset of the financial crisis. Panel B further reports the insignificant relationship between capital expenditures and both bank loan and equity issue dummy, and the positive relationship between capital expenditures and bond issue dummy, confirming our earlier finding that mainly public debt markets serve as a substitute for internal capital markets in the post-crisis period.

4.5. Robustness of results

Note that the main focus of this study is to test the existence and efficiency of internal capital markets, which we do by studying the evidence of firms' cross-subsidization activities. Since a firm normally resorts to internal capital markets when it needs capital for investment, it is difficult to expect any fundamental link between a firm's divestiture activity and its internal capital markets.¹² To determine whether our main results are sensitive to restricting our sample to a subset of *chaebol* firms with positive capital expenditures, we estimate truncated regression models. Specifically, we first estimate our investment equations for a truncated sub-sample of *chaebol* firms whose capital expenditures are positive using ordinary least squares (OLS) regression. Since the truncated sub-sample is no longer a random sample, the standard OLS regression can incur biased estimates. Therefore, we also estimate our investment equations for the sub-sample using maximum likelihood estimation (MLE) regression. Both estimation results using OLS and MLE regressions are reported in Table 6. The estimates are generally consistent with those reported in Table 5 and thus our main results do not change with the truncated sub-sample of firms.

In investigating *chaebol* groups' capital allocation across their affiliated firms, we identify each business group's *chaebol* status for each year of our sample period 1993 to 2005. This identification allows us to have distinct samples of *chaebol* firms each year. One could argue that the diverging investment behavior we observe between the before- and after-crisis periods is driven simply by a different composition of sample firms. For instance, only 17 of the initial 30 *chaebol* groups retain their *chaebol* status throughout the entire sample period. To address this potential concern, as a robustness check, we select a sample of *chaebol* groups at the beginning of the sample period and maintain that sample throughout the entire 13-year period, to follow their

¹² Shin and Stulz (1998) use capital expenditures from the COMPUSTAT Business Information Files, which are non-negative by definition; those represent the funds used for additions to property, plant, and equipment, excluding amounts arising from acquisitions.

time-series investment behavior. In other words, the top 30 business groups as of 1993 are chosen as our new *chaebol* sample in the robustness tests. Table 7 reports the estimation results with our new sample of *chaebol* firms. A comparison of the coefficients in Table 7 with those in Table 5 reveals that using the new sample of firms does not change our main results. The significantly positive coefficients on the interaction term of a *Max_Q* dummy variable and other cash flow in columns (1) and (3) strengthen our earlier finding of efficient internal capital markets in the pre-crisis period. Overall, our results do not appear to be driven by any distinct composition of sample firms or by survivorship biases.

4.6. Summary and discussion of results

Our empirical analysis shows that, in the pre-crisis period, *chaebol* firms' investment decisions are sensitive to investment opportunities, own cash flow, and other group firms' cash flow even after controlling for access to external capital markets. This is evidence of *chaebol* firms' active investment practices through the use of well-functioning internal capital markets during the pre-crisis period. It appears, furthermore, that *chaebol* firms' pre-crisis internal capital markets are quite efficient in the sense that the group's headquarters successfully reallocate group funds to firms with better business prospects from firms with worse prospects. However, these internal capital markets are barely functioning after the crisis, plausibly due to the government's implementation of *chaebol* reforms. While these reforms contributed to the improvement of the financial structures of *chaebol* firms, to their transparency, they appear not to have contributed to improving the efficiency of their capital investments.

Prior to the onset of the Asian financial crisis, internal capital markets were functioning well within Korean business groups through three major instruments: (1) intra-group trade; (2) cross-shareholding; and (3) cross-debt guarantees. First, as documented by Chang and Hong (2000), *chaebol* firms allocate funds through intra-group transactions. Accompanied by flexible trade credit terms, these groupwise trades create internal capital markets through accounts

receivable and accounts payable. Deloof (2001) shows similar evidence for large Belgian firms and argues that the existence of intra-group claims lessens the need for liquid reserves. Second, similar to the cases in Japan as discussed by Hoshi et al. (1991), cross-shareholding among affiliated firms in the same *chaebol* group allows the firms to purchase a significant percentage of each other's shares. Through this mechanism, *chaebol* group's founding owner and his/her family can become controlling shareholders with virtually no capital infusion, and their control rights at the whole group level improve resource transfers across affiliated firms. Last, cross-debt guarantees allow a *chaebol* firm to borrow money without collateral or good credit ratings since other group-affiliated firms guarantee the debt payment in case it cannot pay. This practice enables *chaebol* firms to have easier access to capital and undertake projects that they cannot afford otherwise. These corporate finance practices have been criticized because the controlling shareholders of *chaebol* groups may benefit at the expense of minority shareholders of a particular group-affiliated firm.

Following the 1997-1998 financial crisis, Korean government thus made substantial interventions on *chaebols'* corporate finance practices. The prohibition of cross-shareholding and cross-debt guarantees among affiliated firms, part of the various restructuring programs, indirectly blocks the channels of resource transfer between affiliated firms and thus limits the operation of internal capital markets. The findings of this paper suggest that, unless external capital markets are working efficiently, imposing government-driven governance reforms on business groups that restrict internal capital markets may result in an unwanted outcome: underinvestment and inefficient investment.

Since Korean *chaebols* have some distinct characteristics setting them apart from other diversified firms around the globe, this study contributes unique evidence on the role of internal capital markets within diversified firms during the pre-crisis period. Firstly, in the *chaebol* system, one business group can own both diversified and focused affiliated firms. Almost all group-affiliated firms, however, are connected to each other through the trading of raw materials,

intermediate goods, and services. This can provide both formal and informal benefits of network inside a *chaebol*. Secondly, unlike Japanese *keiretsu* and Indian business groups, Korean business groups are highly centralized in ownership structure and management style. Khanna and Palepu (2000) document the limited role of internal capital markets in Indian business groups and argue that this may be due to their organizational structure as a collection of independent firms without centralized ownership. Although each *chaebol* affiliate exists as an independent, legal identity, the group's headquarters actively overview and facilitate the management of all group firms. In this sense, Korean *chaebols* are most similar to US conglomerates with multiple segments across diverse industries.

The findings of our paper call for the following strategic considerations. Firstly, as noted above *chaebol* firms continue to have network benefits after the crisis which may largely account for their profitability. This view is posited by such studies as Guillen (2000) and Chang and Hong (2000). Also as noted in Khanna and Palepu (2000) for highly diversified Indian business groups, *chaebol* firms have the scope and scale economy to justify the fixed costs created in the internal structures. Secondly, since their formation in early 1970s, *chaebols* have had greater opportunities for larger international investments, which as a form of real options had greater value and better performance following the increased uncertainty in the post-crisis period.¹³ A number of firms were able to effectively shift their business to international subsidiaries with domestic credit shocks. Thirdly, corporate governance reforms were instituted in Korea after the crisis. In particular, as noted in Choi et al. (2007), the role of outside directors in enhancing firm value is statistically significant when at least half of the board members in large *chaebol* firms are outside directors. Also Chang and Shin (2006) show that CEO turnover sensitivity to performance is greater in *chaebol* firms than in stand-alone firms after the crisis, a finding indicating that an improved monitoring function of the board is at work. Finally, well-functioning external capital markets should be noted. As is shown in Table 3, a greater access to public debt markets for

¹³ See Kogut and Kulatilaka (1994) for a detailed discussion on this issue.

chaebol firms after the crisis provides better opportunities to perform in product markets. From a corporate finance strategy perspective, a greater presence in global bond markets offer *chaebol* firms a better environment for competing with multi-national firms in product markets, if *chaebol* have limited access to financing from domestic banks.

5. Conclusion

Internal capital markets play a major role in allocating capital in diversified firms. The question of whether internal capital markets lead to efficient capital allocation, however, is still under debate and provides the need for further empirical investigation across different countries, industries, and periods. In this paper, we examine how the onset of a financial crisis affects the operation of internal capital markets among firms within a diversified business group.

We find that active internal capital markets within *chaebols*, along with their easier access to external financing, attenuated the financial constraints of group-affiliated firms and allowed them to make efficient capital investments during the early 1990s. In contrast to anecdotal evidence, the operation of these internal capital markets indeed enhanced the efficiency of capital allocation during that period, helping *chaebol* firms to successfully direct group cash flow away from those firms with poor growth opportunities and toward the firms with attractive future investment opportunities. However, the government's efforts in the way of structural reforms after the crisis seem to have deterred the operation of internal capital markets. Instead, we observe public debt markets serving as a substitute for internal capital markets.

Overall, our results suggest that *chaebol* firms have gone through drastic changes in their capital allocation and investment practices with the passage of the financial crisis. These changes may be, on one hand, understood as *chaebol* firms' coordinated attempts to achieve healthier financial structures in the wake of the crisis. On the other hand, however, they appear to have taken place at the expense of investment efficiency.

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Table 1Descriptive statistics: *Chaebol* firms vs. *Non-chaebol* firms

	<i>Chaebol</i> firms	<i>Non-chaebol</i> firms	Difference
<i>Panel A: Pre-crisis period (1993 - 1996)</i>			
Total assets (in billions of KRW)	1,369.092 [742.386]	284.238 [99.064]	1,084.854 *** 643.322 ***
Sales (in billions of KRW)	1,531.735 [547.551]	191.095 [84.899]	1,340.640 *** 462.652 ***
Capital expenditures / total assets	0.054 [0.029]	0.040 [0.022]	0.013 *** 0.008 ***
Cash flow / total assets	0.079 [0.072]	0.084 [0.082]	-0.005 * -0.010 ***
Market-to-book ratio	1.059 [1.030]	1.039 [1.020]	0.019 0.010 **
Bank loans / total debt	0.382 [0.384]	0.356 [0.347]	0.026 *** 0.037 ***
Leverage	0.755 [0.764]	0.628 [0.640]	0.128 *** 0.125 ***
Number of observations	506	1,378	
<i>Panel B: Post-crisis period (1999 - 2005)</i>			
Total assets (in billions of KRW)	2,833.563 [1103.781]	478.977 [139.736]	2,354.586 *** 964.045 ***
Sales (in billions of KRW)	2,993.309 [1028.686]	347.467 [126.091]	2,645.841 *** 902.595 ***
Capital expenditures / total assets	0.039 [0.028]	0.025 [0.021]	0.014 *** 0.007 ***
Cash flow / total assets	0.101 [0.094]	0.075 [0.080]	0.026 *** 0.014 ***
Market-to-book ratio	0.943 [0.850]	0.844 [0.772]	0.099 *** 0.078 ***
Bank loans / total debt	0.196 [0.169]	0.317 [0.314]	-0.121 *** -0.145 ***
Leverage	0.591 [0.608]	0.502 [0.493]	0.089 *** 0.114 ***
Number of observations	840	3,135	

This table presents the mean [median] values of characteristics of *chaebol* firms and *non-chaebol* firms in the pre-crisis period (panel A) and in the post-crisis period (panel B). The pre-crisis sample period is from 1993 to 1996 and the post-crisis sample period is from 1999 to 2005. The differences in the means between *chaebol* firms and *non-chaebol* firms are evaluated using *t*-statistics and the differences in the medians are evaluated using Z-statistics (Wilcoxon rank-sum test or Mann-Whitney two-sample statistic). Capital expenditures are defined as expenditures for tangible and intangible lease and assets and development costs. Cash flow is defined as operating income plus depreciation. Market-to-book ratio is defined as book value of assets minus book value of equity plus market value of equity, divided by book value of assets. Leverage is defined as total assets minus total equity, divided by total assets. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 2

Regression of capital expenditures on Q , own cash flow, and other group firms' cash flow:
Chaebol firms vs. *Non-chaebol* firms

	<i>Chaebol</i> firms			<i>Non-chaebol</i> firms		Pooled
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A: Pre-crisis period (1993 - 1996)</i>						
Own Q	0.067*** (3.51)	0.051** (2.40)	0.046** (2.21)	0.005 (0.81)	0.002 (0.45)	0.003 (0.50)
Own cash flow		0.375*** (5.87)	0.355*** (5.46)		0.212*** (6.83)	0.210*** (6.82)
Other cash flow			0.103** (2.40)			
<i>Chaebol</i> dummy * Own Q						0.042** (2.00)
<i>Chaebol</i> dummy * Own cash flow						0.153** (2.25)
<i>Chaebol</i> dummy * Other cash flow						0.109*** (2.71)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	506	506	502	1378	1378	1880
Adjusted R^2	0.248	0.317	0.321	0.160	0.198	0.244
<i>Panel B: Post-crisis period (1999 - 2005)</i>						
Own Q	0.048*** (6.15)	0.035*** (4.55)	0.032*** (4.54)	0.013*** (4.79)	0.014*** (5.25)	0.014*** (5.34)
Own cash flow		0.302*** (7.94)	0.308*** (8.17)		0.244*** (8.64)	0.244*** (8.66)
Other cash flow			0.048 (1.63)			
<i>Chaebol</i> dummy * Own Q						0.017** (2.30)
<i>Chaebol</i> dummy * Own cash flow						0.065 (1.38)
<i>Chaebol</i> dummy * Other cash flow						0.045 (1.55)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	840	840	805	3135	3135	3940
Adjusted R^2	0.095	0.189	0.198	0.017	0.108	0.129

This table presents results from OLS regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The pre-crisis sample period (panel A) is from 1993 to 1996 and the post-crisis sample period (panel B) is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; and *Chaebol* dummy is a dummy variable with a value of one for a firm in a *chaebol* group and zero otherwise. For each model, heteroschedasticity-corrected t -statistics are provided in parentheses. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 3Regression of capital expenditures on Q , own cash flow, other group firms' cash flow, and external financing control variables: *Chaebol* firms

	<i>Panel A: Pre-crisis period (1993 - 1996)</i>			<i>Panel B: Post-crisis period (1999 - 2005)</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
Own Q	0.032* (1.87)	0.032* (1.87)	0.029* (1.68)	0.043*** (4.32)	0.043*** (4.39)	0.043*** (4.45)
Own cash flow	0.394*** (5.87)	0.406*** (6.13)	0.405*** (6.29)	0.314*** (7.02)	0.314*** (7.05)	0.314*** (7.09)
Other cash flow	0.107** (2.50)	0.112** (2.57)	0.093** (2.13)	0.039 (1.18)	0.039 (1.16)	0.039 (1.17)
Bank loan	0.035* (1.90)	0.035* (1.91)	0.037** (2.00)	-0.014 (0.74)	-0.013 (0.74)	-0.014 (0.76)
Bond issue dummy		0.009* (1.94)	0.009* (1.91)		0.011** (2.46)	0.011** (2.42)
Equity issue dummy			0.014** (2.07)			-0.001 (0.12)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	502	502	502	805	805	805
Adjusted R^2	0.323	0.327	0.333	0.211	0.215	0.214

This table presents results from OLS regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The pre-crisis sample period (panel A) is from 1993 to 1996 and the post-crisis sample period (panel B) is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; Bank loan is the ratio of bank loans to total debt; Bond issue dummy is a dummy variable with a value of one for a firm with increased bond outstanding and zero otherwise; and Equity issue dummy is a dummy variable with a value of one for a firm with proceeds from stock issuances and zero otherwise. For each model, heteroschedasticity-corrected t -statistics are provided in parentheses. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 4

Regression of *Chaebol* firms' capital expenditures on Q , own cash flow, other group firms' cash flow, and external financing control variables: using a post-crisis dummy variable

	(1)	(2)	(3)	(4)
Post-crisis dummy	0.014 (0.69)	0.035 (1.61)	0.038* (1.82)	0.033 (1.57)
Own Q	0.042** (2.30)	0.042** (2.34)	0.042** (2.36)	0.035** (1.99)
Own Q * Post-crisis dummy	0.002 (0.08)	0.000 (0.02)	0.001 (0.07)	0.008 (0.41)
Own cash flow	0.474*** (7.28)	0.495*** (7.53)	0.507*** (7.81)	0.496*** (7.98)
Own cash flow * Post-crisis dummy	-0.154* (1.94)	-0.182** (2.28)	-0.194** (2.44)	-0.181** (2.36)
Other cash flow (β_6)	0.213*** (4.96)	0.210*** (4.90)	0.214*** (4.95)	0.169*** (3.83)
Other cash flow * Post-crisis dummy (β_7)	-0.171*** (3.19)	-0.176*** (3.23)	-0.180*** (3.27)	-0.135** (2.42)
Bank loan		0.038* (1.91)	0.038* (1.93)	0.040** (2.08)
Bank loan * Post-crisis dummy		-0.052** (1.98)	-0.052** (1.99)	-0.055** (2.11)
Bond issue dummy			0.011*** (3.42)	0.011*** (3.37)
Equity issue dummy				0.023*** (3.52)
Equity issue dummy * Post-crisis dummy				-0.022** (2.22)
Number of observations	1307	1307	1307	1307
Adjusted R^2	0.210	0.212	0.218	0.224
$\beta_6 + \beta_7$	0.042 (1.33)	0.034 (1.01)	0.034 (0.99)	0.034 (1.01)

This table presents results from OLS regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The pre-crisis sample period is from 1993 to 1996 and the post-crisis sample period is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; Post-crisis dummy is a dummy variable with a value of one for observations in the post-crisis period and zero otherwise; Bank loan is the ratio of bank loans to total debt; Bond issue dummy is a dummy variable with a value of one for a firm with increased bond outstanding and zero otherwise; and Equity issue dummy is a dummy variable with a value of one for a firm with proceeds from stock issuances and zero otherwise. For each model, heteroschedasticity-corrected t -statistics are provided in parentheses. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 5Regression of capital expenditures on Q , own cash flow, other group firms' cash flow, and interactive dummy variables: *Chaebol* firms

	Panel A: Pre-crisis period (1993 - 1996)				Panel B: Post-crisis period (1999 - 2005)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Own Q	0.026 (1.24)	0.009 (0.47)	0.022 (1.08)	0.006 (0.31)	0.043*** (3.99)	0.044*** (3.49)	0.043*** (4.07)	0.043*** (3.57)
Own cash flow	0.384*** (5.39)	0.392*** (5.70)	0.413*** (5.97)	0.421*** (6.25)	0.316*** (7.47)	0.307*** (6.62)	0.311*** (7.45)	0.298*** (6.42)
Other cash flow	0.099** (2.23)	0.066 (1.39)	0.083* (1.84)	0.051 (1.05)	0.047 (1.43)	0.055 (1.64)	0.040 (1.16)	0.050 (1.40)
Max_ Q _dummy * Own cash flow	-0.060 (0.47)		-0.047 (0.39)		0.009 (0.09)		0.011 (0.11)	
Max_ Q _dummy * Other cash flow	0.112 (1.01)		0.104 (0.97)		-0.007 (0.07)		-0.006 (0.06)	
Above_median_ Q _dummy * Own cash flow		-0.061 (0.45)		-0.051 (0.41)		0.031 (0.40)		0.040 (0.51)
Above_median_ Q _dummy * Other cash flow		0.246** (2.56)		0.236*** (2.63)		-0.041 (0.57)		-0.045 (0.64)
Bank loan			0.036** (2.00)	0.037** (1.99)			-0.014 (0.74)	-0.013 (0.72)
Bond issue dummy			0.009* (1.88)	0.009* (1.87)			0.011** (2.45)	0.011** (2.53)
Equity issue dummy			0.014** (2.07)	0.014** (2.08)			-0.001 (0.12)	-0.001 (0.14)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	502	502	502	502	805	805	805	805
Adjusted R^2	0.319	0.329	0.332	0.341	0.209	0.209	0.212	0.213

This table presents results from OLS regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The pre-crisis sample period (panel A) is from 1993 to 1996 and the post-crisis sample period (panel B) is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; Max_ Q dummy is a dummy variable with a value of one for a firm with the highest Q within a *chaebol* group and zero otherwise; Above_median_ Q dummy is a dummy variable with a value of one for a firm with above-median Q within a *chaebol* group and zero otherwise; Bank loan is the ratio of bank loans to total debt; Bond issue dummy is a dummy variable with a value of one for a firm with increased bond outstanding and zero otherwise; and Equity issue dummy is a dummy variable with a value of one for a firm with proceeds from stock issuances and zero otherwise. For each model, heteroschedasticity-corrected t -statistics are provided in parentheses. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 6

Truncated regression of capital expenditures on Q , own cash flow, other group firms' cash flow, and interactive dummy variables: *Chaebol* firms with positive capital expenditures

	<i>Panel A: Pre-crisis period (1993 - 1996)</i>				<i>Panel B: Post-crisis period (1999 - 2005)</i>			
	OLS	MLE	OLS	MLE	OLS	MLE	OLS	MLE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Own Q	0.019 (0.93)	0.020* (0.083)	-0.001 (0.04)	0.001 (0.936)	0.040*** (3.90)	0.123*** (0.001)	0.041*** (3.38)	0.133*** (0.000)
Own cash flow	0.362*** (4.99)	0.554*** (0.000)	0.365*** (5.17)	0.664*** (0.000)	0.268*** (6.78)	1.372*** (0.000)	0.240*** (5.91)	1.556*** (0.000)
Other cash flow	0.079* (1.71)	0.084** (0.029)	0.045 (0.91)	0.068* (0.065)	0.030 (0.96)	0.316 (0.117)	0.046 (1.45)	0.286 (0.132)
Max_ Q _dummy * Own cash flow	-0.024 (0.19)	0.015 (0.871)			-0.002 (0.03)	-0.185 (0.491)		
Max_ Q _dummy * Other cash flow	0.074 (0.66)	0.068 (0.353)			0.050 (0.53)	0.271 (0.437)		
Above_median_ Q _dummy * Own cash flow			-0.016 (0.13)	-0.111 (0.126)			0.064 (0.86)	-0.312 (0.181)
Above_median_ Q _dummy * Other cash flow			0.223** (2.46)	0.348*** (0.000)			-0.043 (0.64)	0.219 (0.401)
Bank loan	0.037* (1.84)	0.054*** (0.000)	0.037* (1.82)	0.042*** (0.000)	0.001 (0.11)	0.020 (0.809)	0.002 (0.17)	0.011 (0.869)
Bond issue dummy	0.007 (1.27)	0.020*** (0.000)	0.006 (1.22)	0.024*** (0.000)	0.007* (1.73)	0.054* (0.051)	0.007* (1.86)	0.052** (0.025)
Equity issue dummy	0.013* (1.92)	0.027*** (0.001)	0.013* (1.93)	0.021*** (0.003)	0.005 (0.68)	0.044 (0.271)	0.005 (0.63)	0.048 (0.110)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	447	447	447	447	732	732	732	732
Adjusted R^2 / Log Likelihood	0.293	955.560	0.304	957.495	0.241	1475.973	0.242	1476.464

Table 6 (continued)

This table presents results from regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The estimates from both ordinary least squares (OLS) and maximum likelihood estimation (MLE) regressions are reported. The pre-crisis sample period (panel A) is from 1993 to 1996 and the post-crisis sample period (panel B) is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; Max_ Q dummy is a dummy variable with a value of one for a firm with the highest Q within a *chaebol* group and zero otherwise; Above_median_ Q dummy is a dummy variable with a value of one for a firm with above-median Q within a *chaebol* group and zero otherwise; Bank loan is the ratio of bank loans to total debt; Bond issue dummy is a dummy variable with a value of one for a firm with increased bond outstanding and zero otherwise; and Equity issue dummy is a dummy variable with a value of one for a firm with proceeds from stock issuances and zero otherwise. For each model, p -values are provided in parentheses. Significant at 1% (***), 5% (**), and 10% (*) levels.

Table 7

Regression of capital expenditures on Q , own cash flow, other group firms' cash flow, and interactive dummy variables: Firms with *chaebol* status as of 1993

	<i>Panel A: Pre-crisis period (1993 - 1996)</i>				<i>Panel B: Post-crisis period (1999 - 2005)</i>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Own Q	0.012 (0.61)	-0.013 (0.77)	0.010 (0.49)	-0.015 (0.87)	0.040*** (3.75)	0.033** (2.36)	0.041*** (3.70)	0.033** (2.38)
Own cash flow	0.388*** (5.49)	0.361*** (5.30)	0.409*** (5.88)	0.385*** (5.76)	0.371*** (7.43)	0.353*** (6.47)	0.363*** (7.36)	0.342*** (6.27)
Other cash flow	0.109** (2.49)	0.103** (2.29)	0.106** (2.38)	0.098** (2.13)	0.003 (0.09)	0.012 (0.32)	-0.001 (0.02)	0.009 (0.23)
Max_ Q _dummy * Own cash flow	-0.127 (1.19)		-0.108 (1.02)		0.004 (0.03)		0.007 (0.06)	
Max_ Q _dummy * Other cash flow	0.181* (1.82)		0.167* (1.69)		-0.167 (1.37)		-0.161 (1.27)	
Above_median_ Q _dummy * Own cash flow		0.039 (0.29)		0.039 (0.30)		0.044 (0.47)		0.053 (0.55)
Above_median_ Q _dummy * Other cash flow		0.199** (2.03)		0.198** (2.12)		-0.049 (0.60)		-0.055 (0.65)
Bank loan			0.018 (1.02)	0.018 (1.03)			-0.011 (0.51)	-0.013 (0.56)
Bond dummy			0.010** (2.12)	0.010** (2.17)			0.010** (2.19)	0.010** (2.31)
Equity increase			0.007 (1.15)	0.008 (1.23)			-0.005 (0.72)	-0.006 (0.88)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	475	475	475	475	541	541	541	541
Adjusted R^2	0.339	0.348	0.345	0.353	0.200	0.192	0.202	0.196

Table 7 (continued)

This table presents results from OLS regressions that estimate the impact of investment opportunities and cash flows on a firm's investment. The pre-crisis sample period (panel A) is from 1993 to 1996 and the post-crisis sample period (panel B) is from 1999 to 2005. The dependent variable is capital expenditures divided by total assets. Own Q is the beginning-of-period Q of a firm; Own cash flow is a firm's own cash flow divided by total assets, where cash flow is operating income plus depreciation; Other cash flow is the sum of cash flow of all other group-affiliated firms divided by the sum of total assets of all other group-affiliated firms; Max_ Q dummy is a dummy variable with a value of one for a firm with the highest Q within a *chaebol* group and zero otherwise; Above_median_ Q dummy is a dummy variable with a value of one for a firm with above-median Q within a *chaebol* group and zero otherwise; Bank loan is the ratio of bank loans to total debt; Bond issue dummy is a dummy variable with a value of one for a firm with increased bond outstanding and zero otherwise; and Equity issue dummy is a dummy variable with a value of one for a firm with proceeds from stock issuances and zero otherwise. For each model, heteroschedasticity-corrected t -statistics are provided in parentheses. Significant at 1% (***) , 5% (**), and 10% (*) levels.