Related and Unrelated Corporate Diversification and Firm Value: Evidence from Korean Business Groups

Sung C. Bae*, Taek Ho Kwon, Jang W. Lee

March 2007

* Corresponding author
Bae is with Department of Finance, College of Business Administration, Bowling Green State University, Bowling Green, OH 43403, USA, Tel) 419-372-8714, E-mail) bae@bgsu.edu. Taek Ho Kwon is with Department of International Commerce, Chonnam National University, Yosu, Chonnam, Korea, E-mail) thk5556@chonnam.ac.kr. Jang W. Lee is with Division of Finance and Real Estate, College of Commerce and Economics, Dongeui University, Busan, Korea, E-mail) jangwoo@deu.ac.kr. The authors wish to thank Sridhar Gogineni, Sung Wook Joh, Jun-Koo Kang, and Young Seok Park for many helpful comments and Hana Bae for extensive editorial assistance on the earlier version of the paper. The usual disclaimer applies.

Related and Unrelated Corporate Diversification and Firm Value:
Evidence from Korean Business Groups

Abstract

We investigate the valuation effects of diversification activities by Korean business groups known as chaebols before and after the 1997 Korean financial crisis. Employing a unique dataset of 2,894 firm-year observations for the 1994-2000 period, we document the following main results. First, chaebol firms are, on average, significantly less valuable than non-chaebol firms, indicating that a firm's chaebol affiliation comes with a value discount. Second, both chaebol and non-chaebol firms experience a significant decline in firm value following the financial crisis. Third, unrelated diversification by chaebol firms erodes in firm value throughout the whole period examined. In contrast, their related diversification is associated with a significant value gain before the financial crisis but turns into a significant value loss post-crisis. Overall, our study provides strong evidence on the significantly different valuation effects of related versus unrelated diversification by Korean business groups and the importance of the Korean financial crisis on these relations. Our findings are robust to different regression estimation specifications.

JEL Classification: G34, G31
Keywords: related diversification, unrelated diversification, business groups, Korean financial crisis

Related and Unrelated Corporate Diversification and Firm Value:
Evidence from Korean Business Groups

I. Introduction

A large body of previous studies has examined the valuation effect of corporate diversification.[1] Several studies further show that the effect of diversification on firm value varies according to a firm's affiliation to a large business group. On the one hand, Hoshi, Kashyap, and Scharfstein (1990, 1991) and Prowse (1992) find that a Japanese firm's strong link to an industrial group (keiretsu) leads to reductions in agency, bankruptcy, and monitoring costs as well as liquidity constraints. Likewise, Khanna and Palepu (2000) and Fauver, Houston, and Naranjo (2003) find that diversified industry groups in India generally outperform their stand-alone counterparts. On the other hand, other studies show that a firm's affiliation to a large business group decreases firm value.[2] Indeed, Lins and Servaes (1999) find that keiretsu-affiliated Japanese firms experience a value loss due to conglomerating, whereas independent Japanese firms have a diversification premium. According to them, this is because keiretsu groups already achieve internal capital market benefits and thus do not generate any additive benefits from diversification. Ferris, Kim, and Kitsabunnarat (2003) also report that over the 1990-1995 period, the top thirty business group firms in Korea suffer a value loss relative to non-group firms.

While these studies document different valuation effects of diversification by business group firms relative to non-business group firms for different countries, they focus exclusively on the unrelated diversification of business groups and ignore the degree of relatedness of a firm's diversification activity to the current lines of business. In this paper, we extend the existing literature on the role of group affiliation in corporate diversification. Using a unique dataset of Korean firms' diversification activities

[1] While earlier studies by Lang and Stulz (1994), Berger and Ofek (1995), and Servaes (1996) document a diversification discount, later studies, correcting for sample selection bias, show a diversification premium (see, e.g., Villalonga (1999), Whited (2001), Campa and Kedia (2002), Graham, Lemmon, and Wolf (2002), Villalonga (2004a, 2004b)). See Martin and Sayrak (2003) for a survey of existing literature on the valuation effect of corporate diversification.

[2] Later studies of keiretsu show significant costs to group membership due to the presence of affiliated banks (see, e.g., Weinstein and Yafeh (1998), Morck and Nakamura (1999), Kang and Stulz (2000)).

surrounding the Korean financial crisis, we investigate the valuation effects of two types of diversification, related and unrelated, on Korean business groups known as chaebols.

Korean chaebols are often compared to Japanese keiretsu and Indian pyramids, but differ in that neither are anchored heavily upon main banking systems like Japanese keiretsu nor held in the same kind of pyramid structure as Indian companies. Rather, cross-shareholdings among group member firms are the more common mechanism of controlling firms within Korean business groups, allowing chaebol's owner-managers to enjoy full control over group member firms (Baek, Kang, and Lee (2006)). Hence, Korean firms offer a unique opportunity to compare the valuation effect of corporate diversification by Korean chaebols with that of other countries' business groups.

Korean chaebol affiliates are known for making investment and financing decisions as a group and for allocating funds among the member firms to serve group-level purposes, thus creating an explicit internal capital market. Shin and Park (1999) find evidence of overinvestment and cross-subsidization by Korean chaebols. They also report that because of their internal capital markets, the top thirty Korean business groups are subject to fewer financing constraints than other non-chaebol Korean firms. In a study of these top thirty chaebols from 1990 to 1995, Ferris, Kim, and Kitsabunnarat (2003) find similar traits that chaebol firms overinvest in low performing industries and cross-subsidize the weaker members of their group, suffering a value loss relative to non-chaebol firms. Bae, Kang, and Kim (2002) find that while controlling shareholders gain from mergers of Korean chaebols, minority shareholders lose because the acquisition enhances the value of other firms in the business group. By examining equity-linked private securities offerings by Korean chaebols during 1989-2000, Baek, Kang, and Lee (2006) also provide strong evidence to support a high degree of tunneling activities through which controlling shareholders of Korean chaebols divert resources out of firms to increase their wealth.

Our study makes important contributions to the literature on corporate diversification of business groups in at least three respects. First, our study is the first of its kind in examining and providing new empirical evidence on the effects of two types of diversification, related and unrelated, on the value of Korean business groups. Related diversification refers to expansion into the existing lines of business,

while unrelated diversification refers to expansion into an industry different from existing lines of business. As Chatterjee and Wernerfelt (1991) note, optimal diversification varies according to firm's resources, suggesting that the diversification type is directly linked to firm value. Related diversification may offer both positive and negative valuation effects relative to unrelated diversification. Indeed, existing studies offer mixed evidence on this issue.[3] Taken as a whole, they suggest that related diversification can generate a positive effect on firm value if adequately carried out. They also suggest that the motives for related diversification may be different from those for unrelated diversification and that the effect of diversification on firm value may depend on the diversification type.

Second, we shed new empirical light on the effect of the 1997 Korean financial crisis on the diversification activities of Korean business groups. During the past decades of economic growth, Korean chaebols have been frequently criticized for their involvement in reckless expansion schemes in the name of diversification, arguably playing a contributory role in the financial crisis (Baek, Kang, and Park (2004)). Following the crisis, Korean firms were driven to make fundamental changes in corporate governance and corporate diversification strategies. In spite of the strong need for continuous changes in these areas, there still appears to be a lack of genuine efforts for change by Korean firms, with resulting limited success. In this regard, we examine whether the Korean financial crisis has in fact brought a significant change in Korean chaebols' diversification strategies and their effects on firm value.

Third, methodologically, our study uses alternative measures of both firm value and the degree of a firm's diversification activities to avoid related methodological problems in the Berger and Ofek (1995) excess value method to assess gain or loss from diversification. Subsequent studies suggest that the Berger and Ofek's method causes a possible downward bias in computing firm value (see, e.g., Villalonga

[3] On the one hand, Rumelt (1974), Nayyar (1993), and Markides and Williamson (1994) point out several merits associated with related diversification, such as economies of scope in the short run by utilizing accumulated core competence, and the potential to build strategic assets by using such core competence and skills in the long run. Doukas and Kan (2004) find that bidders engaging in unrelated acquisitions experience a valuation discount. Likewise, based on the findings from the BITS data, Villalonga (2004a) suggests a value discount to unrelated diversification but a value premium to related diversification. On the other hand, Lewellen (1971) argues that the insurance effect from unrelated diversification would be so insignificant that an increase in firm value by way of debt capacity augmentation would not take shape. Amihud and Lev (1981) also show that unrelated diversification

(1999), Campa and Kedia (2002), Graham, Lemmon, and Wolf (2002)). In addition, there is also a practical limitation in securing an adequate number of representative firms in the same lines of business since there are often only a few firms available in each industry in Korea. Hence, following the extant literature, we measure firm value as the standardized value of the sum of market value of common stock, book value of preferred stock, and book value of debt by total assets. Furthermore, unlike previous studies such as Berger and Ofek (1995), we instead measure the degree of a firm's related and unrelated diversification separately using the Caves' diversification index method. We construct and employ a unique data set of 2,894 firm-years that covers all manufacturing industries in Korea during the 1994-2000 period, including three years before and after the 1997 financial crisis.

Overall, our results show a significantly different valuation effect of related diversification relative to unrelated diversification by Korean business groups and consequently highlight the importance of the Korean financial crisis on their diversification activities. Our results remain robust to different estimation specifications. Our analyses yield the following key findings.

First, Korean chaebol firms are characterized by larger size (measured by total assets), greater investment in R&D, and lower stock return volatility than non-chaebol firms. These firm characteristics, however, change considerably after the financial crisis; chaebol firms spend significantly less in R&D, and the risk level of both chaebol and non-chaebol firms increases significantly. During the examined period, chaebol firms are found to engage in more diversification activities, both related and unrelated, than non-chaebol firms, with the unrelated diversification being the more common type among Korean firms, regardless of the firm's chaebol affiliation. Interestingly enough, however, the diversification activities of chaebol firms weaken considerably following the financial crisis, whereas no such change is observed for non-chaebol firms.

Second, chaebol firms have significantly lower firm value than non-chaebol firms, indicating that a firm's affiliation to large Korean business groups comes with a value discount rather than a value

---

is associated with lower firm risk due to the existence of multiple lines of business with imperfectly correlated returns.

premium. This finding is consistent with those of previous studies on Japanese (keiretsu) and Korean business groups by Lins and Servaes (1999), Kang and Stulz (2000), and Ferris, Kim, and Kitsabunnarat (2003), but is contrary to those on Indian business groups by Khanna and Palepu (2000) and Fauver, Houston, and Naranjo (2003).

Third, unrelated diversification by chaebol firms is associated with a significant value loss, but related diversification by chaebol firms is associated with a significant value gain. Furthermore, while a firm's unrelated diversification erodes firm value, the firm's affiliation to large business groups aggravate, rather than mitigate, this value loss associated with unrelated diversification. Drawing from the existing literature (e.g. Lins and Servaes (1999)), we interpret these findings as suggesting that Korean business groups already achieve internal capital market benefits and thus do not generate any additive benefits from unrelated diversification.

Finally, during the pre-crisis period, chaebol firms yield a significant value gain from related diversification but a significant value loss from unrelated diversification. Following the financial crisis, unrelated diversification by chaebol firms continues to erode firm value. In contrast, the significant value gain associated with related diversification by chaebol firms during the pre-crisis period turns into an even more significant value loss post-crisis than that from unrelated diversification. Drawing from the existing literature (e.g. Lins and Servaes (1999)), we interpret these findings as suggesting that Korean business groups already achieve internal capital market benefits and thus do not generate any additive benefits from unrelated diversification. Hence, chaebol-affiliated firms suffer a loss in firm value from diversification activities regardless of the type of diversification during the post-crisis period. These results suggest that significant corporate restructuring reforms and changes in corporate governance following the financial crisis have brought in a non-trivial negative effect of diversification on the value of Korean business groups.

II. Reforms Following the Korean Financial Crisis

Several studies investigate various issues relating to the Korean financial crisis and document evidence supporting significant changes and reforms post-crisis across the financial, corporate, and public sectors. Chang, Kang, and Shin (2004) describe two major changes following the financial crisis. First, business rules of the financial sector gradually became more aligned with global standards. Under the reform programs, commercial banks with a capital adequacy (BIS) ratio of below 2% were to be given management improvement orders from the government such as the complete write-off equity capital, suspension of operation, and merger with healthier financial institutions. In addition, financial institutions with a certain asset size were required to appoint outside directors, set up an auditing committee, and appoint a compliance officer. All of these reforms resulted in significant improvement in the soundness and profitability of the financial sector. The average BIS ratio of commercial banks increased from around 7.0% at the end of 1998 to 10.5% at the end of 2002. The average debt to equity ratio of manufacturing companies fell to below 140% in 2002, a significant decline from a level near 400% in 1998.

Second, at the urge of the International Monetary Fund and the Korean government, the Korean corporate sector has undergone massive restructuring reforms on shareholder rights, corporate governance, management transparencies, and financial structures, among others. For example, cross-debt guarantees declined to almost zero by 2000 among affiliates of the top five chaebols, and by 2002 included those of the remaining 30 largest chaebols. In addition, legislative reforms on corporate governance made it obligatory for the companies listed on the Korea Stock Exchange (KSE) to appoint outside directors (effective in 1998), and for large KSE-listed companies to establish audit committees (effective in 1999). Hence, by the end of 2001, the average number of outside directors per KSE-listed companies increased to 2.3 per firm, accounting for 34.8% of the total number of directors. Furthermore, by the end of 2001, more than 22% of KSE-listed companies introduced auditing committees. A fair disclosure system was also installed to enhance management transparency in accounting practices and to increase firms' responsibilities for their public information announcements. Along with the financial sector's gradual

adoption of global standards, reforms in the corporate sector are believed to have helped restore the principle of shareholder value maximization among Korean companies.

Despite these reforms, however, Korean chaebols have continued to operate as conglomerate business groups. De facto CEOs and owners of chaebols remain members of founding family. Furthermore, chaebol-affiliated firms are linked to one another through circular shareholdings, and consequently share the same brand, business philosophy, and pool of manpower. In this regard, it is a critical issue of whether or not the post-crisis reforms in the corporate and financial sectors brought fundamental changes in the diversification trend of Korean firms, particularly chaebols, and whether or not the reforms affected the relationship between diversification and firm value.

III. Data and Measurement of Key Variables

A. Data

The sample of our paper represents publicly traded manufacturing firms listed on the KSE during the 1994-2000 period and whose base or main line of industry belongs to Korea Standard Industrial Classification (KSIC) 15 through 36. Accordingly, firms in the financial services and utility industries are excluded. Sales volume is used as a basis for determining the base industry and computing the degree of diversification. We collect sales data from the Korean Association of Listed Companies database. We classify each sales item with reference to KSIC three-digit level and exclude those noted as ‘others’ or those with an ambiguous classification. We also exclude firms lacking necessary accounting entries, stock return data, or sales data. The final sample consists of 2,894 manufacturing firms in twenty-one industries over the 1994-2000 period. The definitions of the twenty-one industries and their KSIC codes are given in the Appendix.

B. Measurement of Diversification Indexes

We employ three measures of the degree of a firm's diversification drawn from the Caves weighted index of diversification (Caves et al. (1980), pp. 199-200). The first diversification index, CDX, is computed as:

$$CDX = \sum_{j=1}^{J} p_j d_{jH} \quad (1)$$

where J = the total number of products in a firm;
p_j = sales of product j as a percentage of total sales;
d_{jH} = 0 if product j belongs to the same three-digit KSIC as the base product H,
1 if product j belongs to a different three-digit KSIC than but the same two-digit KSIC as the base product H,
2 if product j belongs to a different two-digit KSIC than the base product H.

As used extensively in the economics and finance literature, CDX measures the degree to which a firm's operations are diversified into both related and unrelated lines of business. A higher value of CDX indicates a greater diversification of a firm's operations.

The next two measures of the diversification index assess the degree of relatedness of a firm's new diversification activity relative to the current lines of business. Berger and Ofek (1995) consider firms operating in less than two-digit SIC codes as practicing related diversification. They measure the degree of relatedness as the difference between the total number of segments reported by a diversified firm and the number of segments with a different main two-digit SIC code.[4] The Berger and Ofek's definition of relatedness, however, may be misleading. For example, according to Berger and Ofek (1995), if a firm currently engages in unrelated diversification at the two-digit SIC level and subsequently diversifies into a three-digit SIC business within the previous unrelated two-digit SIC level, this latter diversification is then regarded as related diversification. This classification is controversial, and hence we use an alternative way to classify related and unrelated diversification.[5]

[4] Their regression results show a positive and significant relation between firm value and related diversification, which they interpret as suggesting that relatedness mitigates the value loss from diversification.
[5] Rumelt (1974) uses a combination of objective and subjective criteria to classify relatedness. Fan and Lang (2000) use commodity flow data in U.S. input-output (IO) tables and construct IO-based measures, so as to capture interindustry and intersegment (within a diversified firm) vertical relatedness and complementarity.

The second diversification index, CDXU, considers only two-digit KSCI codes and thus measures the degree of a firm's unrelated inter-industry diversification. Similar to CDX, CDXU is computed as:

$$CDXU = \sum_{j=1}^{J} p_j d_{jH} \tag{2}$$

where J = the total number of products in a firm;
p_j = sales of product j as a percentage of total sales;
d_{jH} = 1 if product j belongs to a different two-digit KSIC than the base product H,
0 if product j belongs to the same two-digit KSIC as the base product H.

The third diversification index, CDXR, is computed by first selecting a base industry with the largest sales volume within two-digit KSIC industries for each firm and then estimating the diversification index based on the three-digit KSIC codes within the two-digit KSIC base industries. In sum, it measures the degree of a firm's related intra-industry diversification. Similar to CDX and CDXU, CDXR is computed as:

$$CDXR = \sum_{j=1}^{J} p_j d_{jH} \tag{3}$$

where J = the total number of products in a firm;
p_j = sales of product j as a percentage of total sales;
d_{jH} = 1 if product j belongs to a different three-digit KSIC than the base product H within two-digit KSIC base industry,
0 otherwise.

C. Measurement of Firm Value

Methodologically, another key measure other than the diversification measure in the analysis of the valuation effect of diversification is firm value. Berger and Ofek (1995) measure excess value as the percentage difference between a firm's total value and the sum of imputed values for its segments as stand-alone entities to assess gain or loss in value from diversification. The imputed value of each segment is measured by the median ratio of a firm's total capital to its total assets (or sales or earnings) within the industry the single segment belongs to, multiplied by the segment's total assets (or sales or earnings). Thus, the sum of the imputed values of a firm's segments represents the value of the firm as if

all of its segments are operated as stand-alone businesses. Berger and Ofek (1995) document that comparing the sum of these stand-alone values to the firm's actual value shows a 13% to 15% average value loss from diversification during 1981-1991. Several subsequent studies applying this methodology offer evidence that diversification firms on average trade at a discount relative to single-segment firms.

Additional studies, however, show that the discount is only the product of sample selection bias. Villalonga (1999) and Campa and Kedia (2002) find that diversified firms trade at a discount prior to diversifying, suggesting that firms diversify to enhance firm value. Controlling for the endogeneity of the decision to diversify, both studies find that the diversification discount disappears or even turns into a premium. Graham, Lemmon, and Wolf (2002) note that the Berger and Ofek method is likely to overestimate diversification discounts since it assumes that diversified segments can attain the industrial average firm value, hence underestimating gain from the diversification.[6] They assert that Berger and Ofek's (1995) results stem from sampling errors that they fail to control when computing imputed values.[7] They show that at least half of the discount appears because the segments acquired by diversifying firms were also discounted prior to their acquisition. Given that both diversifying firms and their targets trade at a discount prior to diversification, it is not surprising then to observe that these firms exhibit a discount.

Due to the methodological problems associated with computing the imputed values of diversified firms and the lack of sufficient single-segment firms in the same industry in the Korean market, we do not employ the excess value method developed by Berger and Ofek (1995). Instead, we measure firm value as the sum of market value of common stock, book value of preferred stock, and book value of debt and standardize it by total assets as used in the extant literature on diversification.

D. Classification of Chaebol Affiliation

[6] For instance, when managerial problems drive a firm to take over another firm whose value is below the industrial average, the Berger and Ofek method using industrial averages is likely to underestimate excess value of the diversified firm.

[7] Mansi and Reeb (2002) argue that diversification reduces shareholder value but enhances bondholder value. They report that Berger and Ofek's (1995) results are obtained because debt value is estimated as book value. When both equity and debt are estimated as market value, they find no evidence of diversification discount.

In order to examine the potentially different diversification effects between chaebol-affiliated firms and non chaebol-affiliated firms, we divide sample firms into two groups: a group of the top 30 chaebol-affiliated firms and a group of non chaebol-affiliated firms. We follow the Korea Fair Trade Commission's (KFTC) yearly classification based on the size of each firm's total assets. Joh (2003) also selects the 30 largest chaebols following the KFTC classification and then identifies 40 additional chaebols which have bank loan restrictions and an equity investment ceiling. She shows that using debt size rather than asset size to select chaebols results in nearly the same choices. Baek, Kang, and Park (2004) use the top 50 and the top 70 as alternative definitions of chaebol by noting that the top 30 is an arbitrary category created by the Korean government for its own purposes and that other smaller chaebols are organized in a similar fashion as the top 30 chaebols.

IV. Summary Statistics of Firm Characteristics and Diversification Indexes

A. Summary Statistics of Firm Characteristics

Table I presents results from comparing several firm characteristics, including firm value of chaebol and non-chaebol firms, over the pre- and post-crisis period. Looking first at the firm characteristics by period as reported in Panels A through C, chaebol firms are characterized by larger size (measured by total assets), greater investment in R&D, and lower stock return volatility than non-chaebol firms over the full period examined in our study. These firm characteristics between the two sample firms remain virtually the same over the pre- and post-crisis periods.

Panels D and E report firm characteristics peculiar to each sample firm between the pre- and post-crisis periods. The average ratio of R&D expenditures to sales for chaebol firms is significantly less over the post-crisis period than over the pre-crisis period, while the ratio changes little for non-chaebol firms. Hence, Korean chaebol firms spend significantly less in R&D investments after the financial crisis than before the crisis. It is also shown that firm risk measured by the standard deviation of daily stock returns is significantly (at the 1% level) greater after the crisis for both chaebol and non-chaebol firms, indicating that the risk level for all firms increases significantly following the crisis.

More importantly, both mean and median firm values for chaebol firms are significantly smaller than those for non-chaebol firms regardless of the period examined. Therefore, Korean business group firms suffer value losses relative to non-group firms. These findings are consistent with those documented in previous studies (Weinstein and Yafeh (1998), Morck and Nakamura (1999), Kang and Stulz (2000), Ferris, Kim, and Kitsabunnarat (2003)). When the firm value is compared between the two subperiods, both chaebol and non-chaebol firms experience significant declines in firm value during the post-crisis period relative to the pre-crisis period. These results support the implications of previous studies that the Korean financial crisis has negatively affected the value of Korean firms.

B. Sample Distributions and Characteristics of Diversification Index Measures

Table II presents distributions of sample chaebol and non-chaebol firms by year for each of three diversification index measures. CDX follows the Caves' index (1980, pp. 199-200) and considers up to three-digit KSIC codes. CDXU computes the index within two-digit KSIC codes only and measures the degree of a firm's unrelated inter-industry diversification. CDXR, which measures the degree of a firm's related intra-industry diversification, computes the index by selecting an industry with the biggest sales volume within two-digit KSIC industries and then computing the index within the three-digit KSIC codes among them.

Looking first at the general trend of the number of firms that engage in any type of diversification (CDX, CDXU, and CDXR) over the entire sample period of 1994-2000, we find that the number of chaebol firms increases steadily over the pre-crisis period (1994-1996), peaks in 1997, and then declines steadily over the post-crisis period (1998-2000). In contrast, the number of non-chaebol firms that engage in diversification continues to increase steadily over the sample period.

For the entire sample period, 72.3% (272/376) of chaebol-affiliated firms engage in diversification activities, encompassing an average of 36.5% of total annual sales as shown in the CDX measure. Among these diversified chaebol firms, 82.7% (225/272) engage in unrelated diversification across different industries by diversifying 29.9% of total annual sales within the two-digit KSlC level, as

evidenced by CDXU. In contrast, a much smaller 48.5% (132/272) of diversified chaebol firms engage in related, intra-industry diversification by diversifying 6.3% of total annual sales, as evidenced by CDXR. Although not explicitly reported in Table II, 31.3% of diversified chaebol firms engage in both related and unrelated diversification during the 1994-2000 period.

On the other hand, a substantially smaller proportion of non-chaebol firms (1,446 out of 2,518 or 57.4%) engage in diversification activities. Of the diversified non-chaebol firms, 71.8% engage in unrelated diversification, and 39.2% engage in related diversification. During the entire period, 11% of diversified non-chaebol firms engage in both related and unrelated diversification.

Table II also shows differing evidence on diversification activities of Korean chaebol firms relative to non-chaebol firms from before and after the crisis. The number of chaebol firms that engage in diversification declines from 122 before the crisis to 105 after the crisis, but the number of corresponding non-chaebol firms increases from 546 to 687. The mean and median values of the sales volume involved in diversification of CDX, CDXU, and CDXR for chaebol firms post-crisis also supports the decrease in their diversification activities, whereas the opposite patterns are observed for non-chaebol firms between the two periods.

Overall, the findings in Table II indicate that diversification activities, both related and unrelated, are more prevalent among chaebol-affiliated firms than non chaebol-affiliated firms over the 1994-2000 period and that the unrelated diversification is more common among Korean firms, regardless of the firm's chaebol affiliation. The findings also suggest that the diversification activities of Korean chaebol-affiliated firms weaken noticeably following the Korean financial crisis, whereas no such change is observed for Korean non chaebol-affiliated firms.

V. Regression Analysis and Results

A. Logit Regression Analysis of Firm Value on Chaebol Affiliation

We conjecture that if diversification increases firm value, the diversification measure should be positively related to the measure of firm value in a regression where the effects of other variables are

controlled. Since a firm's value can be affected by factors other than the firm's diversification activities, we employ three widely used measures based on Tobin's q theory as control variables in the regressions: the natural log of total assets (*LASST*) as proxy for firm size; R&D expenditures divided by total sales (*RNDPS*) as proxy for a firm's growth; and the standard deviation of daily stock returns (*SRSTD*) as proxy for a firm's risk (see, e.g., Chauvin and Hirschey (1993), Bhagat and Welch (1995)). In addition, we include twenty industry dummy variables to control for industry differences in the regression. The industry dummy variables span a total of twenty-one industries from food and beverage (KSIC 15) to furniture manufacturer (KSIC 36), covering all Korean manufacturing industries except for the tobacco industry (KSIC 16), which is not included due to the lack of sufficient sample firms. We collect data for all accounting items and daily stock returns from the Korea Investors Service database.

To differentiate chaebol-affiliated firms from non chaebol-affiliated firms in the regression, we use a dummy variable of *CB30* for which a numeric value of one is assigned if a firm is affiliated to the top 30 chaebol groups, and 0 if otherwise. We also employ two interactive variables of *CDXU*CB30* and *CDXR*CB30* to examine the interactions between the type of diversification and chaebol affiliation. Therefore, *CDXU*CB30* measures the marginal effect of the unrelated inter-industry diversification by chaebol firms on firm value, while *CDXR*CB30* measures the same for related intra-industry diversification. We estimate the following regression equation:

$$FV_i = \beta_0 + \beta_1 LASST_i + \beta_2 RNDPS_i + \beta_3 SRSTD_i + \beta_4 CDXU_i + \beta_5 CDXR_i + \beta_6 CB30_i + \beta_7 CDXU_i * CB30_i + \beta_8 CDXR_i * CB30_i + \sum_{k=1}^{20} \beta_{8+k} IND_i + \varepsilon_i \quad (4)$$

where *FV* is firm value, *LASST* is the natural log of total assets, *RNDPS* is the ratio of R&D expenditures to total sales, *SRSTD* is the standard deviation of daily stock returns, and *IND* is the industry dummy variable.

A preliminary examination of the measure of firm value standardized by total assets indicates that the values vary widely, ranging from 0.35 to 16.4. Jarque-Bera test statistics of these standardized firm values reject the null hypothesis of normal distribution on this variable. Thus, using the raw values of the

standardized firm value as the dependent variable in a regression may cause a serious heteroskedasticity problem. One solution would be to exclude these aberrant values from the data set. If these values are the outcome of firms' diversification activities, however, this approach would cause a selection bias and yield a biased estimation of the relation between diversification and firm value. Moreover, since the peculiar values are rather evenly distributed, it would be difficult to sort out the peculiar ones in the data set.

Due to the potential problems associated with the above approaches, we employ an alternative approach in which we first rank the standardized firm values according to their magnitude each year, and then assign a numeric value of two to the top 40% of firm values, one to the middle 20% of firm values, and zero to the bottom 40% of firm values. According to this classification, therefore, firms with a numeric value of two (zero) represent firms with high (low) firm value in a particular year. Because of the categorical and ordinal nature of the dependent variable, we employ the ordered dependent variable model for estimation (see Greene (2000), pp. 875-878) using the maximum likelihood method. The ordered dependent variable model can be either a probit model or a logit model based on the distribution assumptions on residuals, and the estimation results from both models are known to have little difference (see Greene (2000)). We employ a logit model for our estimation.[8]

Although the logit analysis using the ordered dependent variable may not provide exact estimates of the relation between diversification and firm value, it generates probabilistic directions of the effects. For example, a positive (negative) coefficient for an independent variable would indicate that an increase in the independent variable is associated with an increase (decrease) in firm value. The ordered dependent variable model used in our study has the merit of preserving peculiar values for the analysis, which were discarded as outliers in prior studies.

[8] We also estimated ordinary least squares regression models using raw values of standardized firm values. The regression results from this analysis were qualitatively similar to those from the logit model except for slightly lower R-squares.

Since Korean chaebols underwent unprecedented environmental changes to their diversification activities following the 1997 financial crisis, it is expected that the effects of their diversification activities on firm value would differ significantly between the pre-crisis period and the post-crisis period. In this regard, we estimate the regression equation (4) in two subperiods of the pre-crisis period of 1994-1996 and the post-crisis period of 1998-2000, as well as the full period of 1994-2000.

B. Pearson Correlation Coefficients

Before we perform logit regression analysis of firm value on diversification of chaebol-affiliated firms relative to non chaebol-affiliated firms, we first examine correlation coefficients of dependent and independent variables used in the regression. Table III shows Pearson correlation coefficients among three diversification index measures and three control variables in the regression. The correlation coefficient between *CDX* and *CDXU* (measure of unrelated, inter-industry diversification) is 0.907 and is significant at the 1% level, indicating that the measure widely used in studies on diversification is indeed the unrelated, inter-industry diversification. The correlation coefficient between *CDX* and *CDXR* (measure of related, intra-industry diversification) is 0.275 and significant at the 1% level. On the contrary, the correlation coefficient between *CDXU* and *CDXR* is a negative 0.030 and is not significant at the 10% level, indicating that a firm's unrelated inter-industry diversification and related intra-industry diversification are substitutes.

LASST, a measure of firm size, has a positive and significant (at the 1% level) correlation with three diversification measures, implying that a firm's diversification activity is closely related to its asset size and that a diversified firm generally has a larger asset size than a non-diversified firm. *LASST* is also significantly positively correlated with *RNDPS* (R&D expenses divided by total sales) but significantly negatively with *SRSTD* (standard deviation of daily stock returns); hence, a larger firm tends to invest more in R&D and have lower risk in terms of stock return volatility.

Finally, the chaebol dummy, *CB30*, has a positive and significant correlation coefficient with *LASST* and *RNDPS* but has a negative and significant coefficient with *SRSTD*. These findings indicate

that chaebol-affiliated firms are bigger, less risky, and more R&D-intensive. It is also shown that *CB30* has a positive and significant (at the 1% level) correlation coefficient with all three diversification index measures of *CDX, CDXU,* and *CDXR*. Thus, the chaebol-affiliated firms engage in more diversification activities than the non chaebol-affiliated firms, whose evidence is consistent with our findings reported in Table II in terms of both the number of firms and the sales volume involved in diversification.

C. Logit Regression Results

Table IV shows estimation results from logit regressions of firm value on related and unrelated diversification by chaebol versus non-chaebol firms in three periods. For all three periods, the regression coefficient of *LASST* is negative and significant at the 1% level, and the regression coefficients of *RNDPS* and *SRSTD* are positive and significant at the 1% level. Hence, the firm value is positively related to the firm's investment in R&D and stock return volatility but negatively related to the firm size.

Looking first at the regression results for the full period, we find that while the regression coefficient of *CDXU* is negative and significant at the 5% level, the regression coefficient of *CDXR* is negative but insignificant. Hence, unrelated diversification by Korean industrial firms is associated with a decline in firm value, but their related diversification has little impact on firm value. Consistent with our earlier findings, the regression coefficient of *CB30* is negative and significant at the 1% level, indicating that for the full period of 1994-2000, the standardized firm value of chaebol-affiliated firms is significantly lower than that of non chaebol-affiliated firms.

When the chaebol dummy variable of *CB30* interacts with each of the two diversification measures of *CDXU* and *CDXR*, we observe contrasting results concerning the effects of related versus unrelated diversification on firm value. *CDXU*CB30* has a negative and significant (at the 1% level) coefficient, but *CDXR*CB30* has a positive and significant (at the 10% level) coefficient. These results point out that diversification into industries unrelated to base industry by top 30 chaebol-affiliated firms is associated with a significant value loss. In contrast, diversification into related industries by the same firms is associated with a significant value gain. It is also worthwhile to note that the regression

coefficient of the interactive variable *CDXU*CB30* is substantially more negative than that of *CDXU*, indicating that while a firm's unrelated diversification decreases firm value, a firm's affiliation to large business groups aggravates, rather than mitigates, this value loss associated with unrelated diversification.

These findings are consistent with those of previous studies on Japanese (keiretsu) and Korean business groups by Lins and Servaes (1999), Kang and Stulz (2000), and Ferris, Kim, and Kitsabunnarat (2003), but are contrary to those of studies on Indian business groups by Khanna and Palepu (2000) and Fauver, Houston, and Naranjo (2003). Drawing from Lins and Servaes (1999), we interpret our findings as suggesting that Korean business groups already achieve internal capital market benefits and thus do not generate any additive benefits from unrelated diversification.

We then turn to estimation results for two subperiods of pre-financial crisis period (1994-1996) and post-financial crisis period (1998-2000). In general, the estimation results for the pre-crisis period are in line with those for the full period, exhibiting similar magnitudes and signs of regression coefficients for all variables between the two periods. Among others, the two interactive variables of *CDXU*CB30* and *CDXR*CB30* carry significant (at least at the 10% level) regression coefficients but with opposite signs. Accordingly, during the pre-crisis period, Korean chaebol-affiliated firms generate a significant value gain from related diversification, but incur a significant value loss from unrelated diversification.

For the post-crisis period, we obtain contrasting estimation results on several key variables compared to the pre-crisis period. *CDXU* and *CDXR* both now carry positive estimated coefficients, though not significant. Thus, the diversification activities by Korean industrial firms are not associated with a value loss, although there is still no value gain. These results suggest that the substantial changes in both internal and external corporate environments following the Korean financial crisis seem to have driven Korean firms to become more value-conscious in their diversification activities and more selective in their diversification targets.

Looking at the estimation results for chaebol-affiliated firms, *CB30* continues to carry a negative and significant coefficient during the post-crisis period, indicating a significantly lower firm value for chaebol firms than non-chaebol firms. We observe more strikingly different results on the regression

coefficients of two interactive variables. *CDXU*CB30* carries the same negative and marginally significant (at the 10% level) regression coefficient for the pre-crisis period, depicting a significant negative impact of unrelated diversification on firm value. On the contrary, the regression estimate of *CDXR*CB30* for the post-crisis period is negative and significant at the 10% level, a result which is strikingly different from that of *CDXR*CB30* for the pre-crisis period. Hence, unlike the pre-crisis period, related diversification by Korean chaebol-affiliated firms during the post-crisis period is associated with a significant value loss, indicating that diversification into the same industries post-crisis fails to boost firm value. These findings provide evidence supporting the negative impact of the financial crisis on the corporate diversification activities of chaebol-affiliated firms.

D. Robustness Tests

To ensure the robustness of our results, we examine additional regression model specifications. In regression (4), we add a period dummy of *POST* with a numeric value of one for the period after the Korean financial crisis (1998-2000) and zero for the period before the crisis (1996-1998). In conjunction with the period dummy, additional interactive variables are included to test the joint effects of the diversification index measure, chaebol dummy, and period dummy in the following regression model:

$$\begin{aligned} FV_i = {} & c_0 + c_1 LASST_i + c_2 RNDPS_i + c_3 SRSTD_i + c_4 CDXU_i(CDXR_i) + c_5 CB30_i + c_6 POST_i \\ & + c_7 CB30_i * POST_i + c_8 CDXU_i(CDXR_i) * CB30_i + c_9 CDXU_i(CDXR_i) * CB30_i * POST_i \\ & + \sum_{k=1}^{20} c_{9+k} IND_i + \varepsilon_i \end{aligned} \quad (5)$$

In regression (5), the interactive variable of *CB30*POST* measures the marginal effect of overall diversification by chaebol-affiliated firms during the post-crisis period, and *CDXU (CDXR)*CB30* measures the marginal effect of unrelated (related) diversification by chaebol firms. The last interactive variable of *CDXU(CDXR)*CB30*POST* measures the marginal effect of unrelated, inter-industry (related, intra-industry) diversification by chaebol firms on firm value during the post-crisis period.

The results from the three logit regression models are presented in Table V. Model 1 includes the related and unrelated diversification index, the chaebol dummy, and the period dummy. Models 2 and 3 include different sets of interactive variables. The overall regression results in Table V support our earlier findings of the valuation effects of diversification index measures.

Across the three regression models, the coefficient of *CDXU* is negative and significant at the 1% level, indicating that unrelated diversification by Korean industrial firms during the 1994-2000 period is associated with a significant decrease in firm value. On the contrary, the coefficient of *CDXR* is positive and insignificant in two of the three regression models. Hence, related diversification by Korean firms during the full period is associated with neither a value loss nor a value gain.

Both the coefficients of *CB30* and *POST* are separately negative and significant at the 1% level in both Models 1 and 3, demonstrating a significant decrease in firm value associated with diversification activities by chaebol-affiliated Korean firms post-crisis. When these two variables are combined together, the interactive variable of *CB30*POST* further demonstrates a negative and significant regression coefficient at the 10% level, reaffirming a significant value loss post-crisis relative to the pre-crisis period.

Lastly, the coefficient of the interactive variable of *CDXU*CB30* is also negative and significant at the 10% level, whereas *CDXR*CB30* carries a positive but insignificant estimated coefficient. Hence, for the whole period examined in our study, unrelated diversification by chaebol-affiliated firms is associated with a decline in firm value, while related diversification by chaebol firms is associated with neither a diversification discount nor a diversification premium. When the period dummy of *POST* is added, the estimated coefficient of *CDXU*CB30*POST* stays negative in Models 2 and 3, though not significant at the 10% level. Unrelated diversification of chaebol-affiliated firms, therefore, continues to generate a non-positive value during the post-crisis period. In contrast, the new coefficient of *CDXR*CB30*POST* changes to a negative and significant value, at least at the 10% level in Models 2 and 3. These results strongly indicate that even related diversification by chaebol-affiliated firms is associated with a decrease in firm value during the post-crisis period, hence failing to generate a gain through previously-value-added related diversification activities.

Overall, our regression results show vastly different valuation effects of related and unrelated diversification between chaebol-affiliated firms and non chaebol-affiliated firms before and after the Korean financial crisis. During the pre-crisis period, unrelated diversification by chaebol-affiliated firms is associated with a significant value loss, while related diversification is associated with a significant value gain. Following the financial crisis, unrelated diversification by chaebol firms continues to reduce firm value. In contrast, the significant value gain associated with the related diversification by chaebol firms during the pre-crisis period turns to a significant value loss following the financial crisis. Thus, chaebol-affiliated firms suffer a loss in firm value from diversification activities, regardless of the type of diversification used during the post-crisis period. Our regression results are in general consistent with those from previous studies on Korean business groups (e.g., Kim and Park (2001), Lins and Servaes (2002), and Baek, Kang and Park (2004)).[9]

VI. Summary and Conclusions

In this paper, we examine two important issues pertinent to the valuation effect of corporate diversification by business groups. First, our study is the first of its kind to investigate the effects of related and unrelated diversification on the value of Korean business groups known as chaebols relative to non-business groups. Second, we shed new empirical lights on the effect of the 1997 Korean financial crisis on the diversification activities of Korean chaebols.

Using alternative measures of both firm value and the degree of a firm's diversification activities, we measure the degree of a firm's related and unrelated diversification separately using the Caves' diversification index method. Employing a unique dataset of 2,894 firm-years during the 1994-2000 period and covering all manufacturing industries in Korea, we document the following major findings.

[9] Baek, Kang, and Park (2004) show that chaebol firms with concentrated ownership by owner-managers and those with concentrated ownership by affiliated firms experience a larger drop in firm value. Using three measures of diversification as in Mitton (2002), they also find similar valuation effects for highly diversified firms.

First, Korean chaebol-affiliated firms are on average larger in size (measured by total assets), invest more in R&D, and are less risky than non chaebol-affiliated firms. Following the crisis, chaebol firms spend significantly less in R&D investments, and the risk level of both chaebol and non-chaebol firms increases significantly.

Second, our study indicates that chaebol firms suffer a significant value loss relative to non-chaebol firms. These findings are consistent with those of previous studies. Furthermore, both chaebol and non-chaebol firms experience a significant decline in firm value following the financial crisis.

Third, chaebol firms engage in more diversification activity, both related and unrelated, than non-chaebol firms during the entire period, with the unrelated diversification being more common among Korean firms, regardless of the firm's chaebol affiliation. Interestingly, the diversification activities of chaebol firms weaken noticeably following the financial crisis, whereas no such change is observed for non-chaebol firms.

Finally, our results highlight the differing valuation effects between related and unrelated diversification by Korean chaebol firms, as well as the importance of the Korean financial crisis on their diversification activities. During the pre-crisis period, chaebol firms yield a significant value gain from related diversification but a significant value loss from unrelated diversification. Following the financial crisis, unrelated diversification by chaebol firms continues to erode firm value. In contrast, the significant value gain associated with related diversification by chaebol firms during the pre-crisis period turns into an even more significant value loss post-crisis than that from unrelated diversification. Inferring from the existing literature, we interpret these findings as suggesting that Korean business groups already achieve internal capital market benefits and thus do not generate any additive benefits from unrelated diversification. Hence, chaebol firms suffer a loss in firm value from diversification activities, regardless of the type of diversification during the post-crisis period. These results suggest that significant corporate restructuring reforms and changes in corporate governance following the financial crisis seem to have brought in a non-trivial negative effect of diversification on the value of Korean business groups.

References

Amihud, Yakov and Baruch Lev, 1981, Risk reduction as a managerial motive for conglomerate mergers, *Rand Journal of Economics* 12, 605-618.

Bae, Kee-Hong, Jun-Koo Kang, and Jin-Mo Kim, 2002, Tunneling or value added? Evidence from mergers by Korean business groups, *Journal of Finance* 57, 2695-2740.

Baek, Jae-Seung, Jun-Koo Kang, and Kyung Suh Park, 2004, Corporate governance and firm value: Evidence from the Korean financial crisis, *Journal of Financial Economics* 71, 265-313.

Baek, Jae-Seung, Jun-Koo Kang, and Inmoo Lee, 2006, Tunneling and business groups: Evidence from private securities offerings by Korean chaebols, *Journal of Finance* 61, 2415-2448.

Bhagat, Sanjai and Ivo Welch, 1995, Corporate research & development investments: International comparisons, *Journal of Accounting and Economics* 19, 443-470.

Berger, Philip G., and Eli Ofek, 1995, Diversification's effect on firm value, *Journal of Financial Economics* 37, 39-65.

Campa, Jose Manuel and Simi Kedia, 2002, Explaining the diversification discount, *Journal of Finance* 62, 1731-1762.

Caves, Richard E., Michael E. Porter, A. Michael Spence, and John T. Scott, 1980, *Competition in the open economy: A model applied to Canada*, Harvard University Press, Boston, MA.

Chang, James Jinho, Won Kang, and Hyun-Han Shin, 2004, Business group discount surrounding the Asian Financial Crisis, working paper, Yonsei University, Seoul, Korea.

Chatterjee, Sayan and Birger Wernerfelt, 1991, The link between resources and type of diversification: Theory and evidence, *Strategic Management Journal* 12, 33-48.

Chauvin, Keith W. and Mark Hirschey, 1993, Advertising, R&D expenditures, and the market value of the firm, *Financial Management* 22, 128-140.

Doukas, John A. and Ozgur B. Kan, 2004, Excess cash flows and diversification discount, *Financial Management* 33, 71-88.

Fan, Joseph P.H. and Larry H.P. Lang, 2000, The measurement of relatedness: An application to corporate diversification, *Journal of Business* 73, 629-660.

Fauver, Larry, Joel Houston, and Andy Naranjo, 2003, Capital market development, international integration, legal systems, and the value of corporate diversification: a cross-country analysis. *Journal of Financial and Quantitative Analysis* 38, 135-157.

Ferris, Steven, Kenneth Kim, and P. Kitsabunnarat, 2003, The costs (and benefits) of diversified business groups: The case of Korean chaebols, *Journal of Banking and Finance* 27, 251-273.

Graham, John R., Michael L. Lemmon, and Jack G. Wolf, 2002, Does corporate diversification destroy value? *Journal of Finance* 62, 695-720.

Greene, William H., 2000, *Econometric analysis*, 4th edition, Prentice-Hall, New York, NY.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1990, The role of banks in reducing costs of financial distress in Japan, *Journal of Financial Economics* 27, 67-88.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1991, Corporate structure, liquidity, and investment: Evidence from Japanese industrial group, *Quarterly Journal of Economics* 106, 33-60.

Joh, Sung Wook, 2003, Corporate governance and firm profitability: Evidence from Korea before the economic crisis, *Journal of Financial Economics* 68, 287-322.

Kang, Jun-Koo and René M. Stulz, 2000, Do Banking shocks affect borrowing firm performance? An analysis of the Japanese experience, *Journal of Business* 73, 1-23.

Khanna, Tarun and Krishna Palepu, 2000, Is group affiliation profitable in emerging markets? An analysis of diversified Indian business groups, *Journal of Finance* 55, 867-891.

Kim, Byoung-Gon and Sang-Hyun Park, 2001, Effect of the interrelationship between diversification and capital structure on corporate value, *Korean Journal of Business Studies* 30, 1365-1387.

Lang, Larry, H.P. and René M. Stulz, 1995, Tobin's q, corporate diversification, and firm performance, *Journal of Political Economy* 102, 1248-1280.

Lewellen, W. G., 1971, A pure financial rationale for the conglomerate merger, *Journal of Finance* 26, 521-537.

Lins, Karl V. and Henri Servaes, 1999, International evidence on the value of corporate diversification, *Journal of Finance* 54, 2215-2239.

Lins, Karl V. and Henri Servaes, 2002, Is corporate diversification beneficial in emerging markets? *Financial Management* 31, 5-31.

Mansi, Sattar A. and David M. Reeb, 2002, Corporate diversification: What gets discounted? *Journal of Finance* 59, 2167-2183.

Markides, Constantinao C. and Peter J. Williamson, 1994, Related diversification, core competences and corporate performance, *Strategic Management Journal* 15, 149-165.

Martin, John D. and Akin Sayrak, 2003, Corporate diversification and shareholder value: A survey of recent literature, *Journal of Corporate Finance* 9 (2003), 37-57.

Meyer, Margaret, Paul Milgrom, and John Roberts, 1992, Organizational prospects, influence costs, and ownership changes, *Journal of Economics and Management Strategy* 1, 9-35.

Mitton, Todd, 2002, A cross-firm analysis of the impact of corporate governance on the east Asian financial crisis, *Journal of Financial Economics* 64, 215-241.

Morck, Randall, and Masao Nakamura, 1999, Banks and corporate control in Japan, *Journal of Finance* 54, 319-339.

Nayyar, Praveen R., 1993, Stock market reactions to related diversification moves by service firms seeking benefits from information asymmetry and economies of scope, *Strategic Management Journal* 14, 469-509.

Prowse, Stephen D., 1992, The structure of corporate ownership in Japan, *Journal of Finance* 47, 1121-1140.

Rumelt, Richard P., 1974, *Strategy, structure and economic performance*, Harvard University Press, Boston, MA.

Servaes, Henri, 1996, The value of diversification during the conglomerate merger wave, *Journal of Finance* 51, 1201-1225.

Shin, Hyun-Han and Young Park, 1999, Financing constraints and international capital markets: Evidence from Korean chaebols, *Journal of Corporate Finance* 5, 169-191.

Stulz, Rene M., 1990, Managerial direction and optimal financing policies, *Journal of Financial Economics* 26, 3-27.

Villalonga, Belen, 1999, Does diversification cause the “diversification discount? Working paper, Harvard University.

Villalonga, Belen, 2004a, Diversification discount or premium? New evidence from the business information tracking series, *Journal of Finance* 59, 479-506.

Villalonga, Belen, 2004b, Does diversification cause the diversification discount? *Financial Management* 33, 5-27.

Weinstein, David E. and Yishay Yafeh, 1998, On the costs of a bank-centered financial system: Evidence from the changing main bank relations in Japan, *Journal of Finance* 53, 635-672.

Whited, Toni M., 2001, Is it inefficient investment that causes the diversification discount? *Journal of Finance* 56, 1667-1691.

Table I
Summary Statistics of Firm Characteristics by Group Affiliation and Period

The sample consists of 2,894 firm-years for the 1994-2000 period. Full period is from 1994 to 2000, pre-financial crisis period is from 1994 to 1996, and post-crisis period is from 1998 to 2000. SRSTD is standard deviation of daily stock returns. Firm value is measured as the sum of market value of common stock, book value of preferred stock and book value of debt, standardized by total assets. t-statistics and z-statistics in Panels A through C test differences between chaebol and non-chaebol firms. t-statistics and z-statistics in Panels D and E test differences between post-crisis period and pre-crisis period. *** and ** denote significance at the 1% and 5% level, respectively.

Classification	Total Assets (billion won) Mean (Median)	R&D/ Sales Mean (Median)	SRSTD Mean (Median)	Firm value/ Assets Mean (Median)	No. of Obs.
Panel A. Full Period					
Chaebol Firms	2,225	0.012	0.037	0.968	376
	(996)	(0.002)	(0.035)	(0.948)	
Non-chaebol Firms	445	0.006	0.042	1.079	2,518
	(212)	(0.000)	(0.040)	(0.992)	
t-statistic	12.47***	4.83***	-6.18***	-3.61***	
z-statistic	21.87***	9.19***	-6.39***	-4.39***	
Panel B. Pre-Crisis Period					
Chaebol Firms	1,629	0.015	0.024	1.027	170
	(875)	(0.004)	(0.023)	(0.994)	
Non-chaebol Firms	353	0.006	0.028	1.093	976
	(113)	(0.000)	(0.027)	(1.046)	
t-statistics	8.43***	4.57***	-6.96***	-3.21***	
z-statistics	13.95***	6.92***	-7.56***	-4.04***	
Panel C. Post-Crisis Period					
Chaebol Firms	2,872	0.008	0.051	0.887	147
	(1,424)	(0.000)	(0.050)	(0.797)	
Non-Chaebol Firms	509	0.005	0.055	1.040	1,179
	(128)	(0.000)	(0.053)	(0.869)	
t-statistics	9.04***	1.49	-4.02***	-2.35***	
z-statistics	14.59***	3.94***	-3.80***	-2.74***	
Panel D. Chaebol-Affiliated Firms					
Pre-Crisis period	1,629	0.015	0.024	1.027	170
	(875)	(0.004)	(0.023)	(0.994)	
Post-Crisis period	2,872	0.008	0.051	0.887	147
	(1,424)	(0.000)	(0.050)	(0.797)	
t-statistic	3.09***	-2.47***	30.56***	-5.16***	
z-statistic	3.30***	-4.10***	15.26***	-8.70***	
Panel E. Non Chaebol-Affiliated Firms					
Pre-Crisis period	353	0.006	0.028	1.093	976
	(113)	(0.000)	(0.027)	(1.046)	
Post-Crisis period	509	0.005	0.055	1.040	1,179
	(128)	(0.000)	(0.053)	(0.869)	
t-statistic	1.55	-0.80	62.26***	-2.05**	
z-statistic	3.53***	-6.72***	39.53***	-15.25***	

Table II
Sample Distributions and Characteristics of Diversification Index Measures

The sample consists of 2,894 firm-years for the 1994-2000 period. CDX follows Caves, Porter, Spence, and Scott (1980, pp. 199-200) which considers KSIC three-digits. CDXU measures a firm's unrelated, inter-industry diversification and computes the index within KSIC two-digits only. CDXR measures a firm's related, intra-industry diversification and computes the index by selecting an industry with the biggest sales volume within two-digit industries and then computing the index within KSIC three-digits among them.

Year	Total Chae-bol Firms	Total Non-Chaebol Firms	CDX				CDXU				CDXR			
			Chaebol		Non-Chaebol		Chaebol		Non-Chaebol		Chaebol		Non-Chaebol	
			No. of Firms	Mean (Median)	No. of Firms	Mean (Median)	No. of Firms	Mean (Median)	No. of Firms	Mean (Median)	No. of Firms	Mean (Median)	No. of Firms	Mean (Median)
1994	51	269	36	0.367	145	0.216	29	0.298	103	0.1633	20	0.067	54	0.042
				(0.208)		(0.024)		(0.016)		(0.000)		(0.000)		(0.000)
1995	60	342	42	0.371	191	0.227	35	0.311	136	0.174	20	0.059	78	0.041
				(0.250)		(0.029)		(0.117)		(0.000)		(0.000)		(0.000)
1996	59	365	44	0.411	210	0.242	38	0.343	151	0.184	21	0.073	88	0.046
				(0.264)		(0.044)		(0.112)		(0.000)		(0.000)		(0.000)
1997	59	363	45	0.401	213	0.255	39	0.341	160	0.200	22	0.064	74	0.040
				(0.226)		(0.068)		(0.127)		(0.000)		(0.000)		(0.000)
1998	57	386	39	0.336	221	0.249	33	0.270	158	0.191	17	0.048	88	0.040
				(0.125)		(0.034)		(0.042)		(0.000)		(0.000)		(0.000)
1999	51	377	37	0.297	223	0.253	30	0.229	159	0.188	16	0.059	88	0.044
				(0.123)		(0.053)		(0.025)		(0.000)		(0.000)		(0.000)
2000	39	416	29	0.362	243	0.237	21	0.287	171	0.175	16	0.078	97	0.041
				(0.089)		(0.043)		(0.001)		(0.000)		(0.000)		(0.000)
94-96	170	976	122	0.384	546	0.230	102	0.318	390	0.175	61	0.066	220	0.044
				(0.250)		(0.035)		(0.112)		(0.000)		(0.000)		(0.000)
98-00	147	1179	105	0.329	687	0.246	84	0.260	488	0.184	49	0.060	273	0.041
				(0.125)		(0.043)		(0.038)		(0.000)		(0.000)		(0.000)
94-00	376	2518	272	0.365	1446	0.241	225	0.299	1038	0.183	132	0.063	567	0.042
				(0.217)		(0.044)		(0.077)		(0.000)		(0.000)		(0.000)

Table III
Pearson Correlation Coefficients

The sample consists of 2,894 firm-years for the 1994-2000 period. CDX follows Caves, Porter, Spence, and Scott (1980, pp. 199-200) which considers KSIC three-digits. CDXU measures inter-industry diversification and considers KSIC two digits only. CDXR measures intra-industry diversification and is computed by selecting an industry with the biggest sales volume within two-digit industries and then estimating index of diversification within KSIC three digits among them. LASST is natural logarithm of total assets. RNDPS is R&D expense divided by total sales. SRSTD is standard deviation of daily stock returns. CB30 is a dummy variable for top 30 chaebol affiliations with a numeric value of one if chaebol affiliated and zero otherwise. *** and ** denote significance at the 1% and 5% level, respectively.

	CDX	CDXU	CDXR	LASST	RNDPS	SRSTD
CDXU	0.907***					
CDXR	0.275***	-0.030				
LASST	0.154***	0.143***	0.096***			
RNDPS	0.035	0.050**	-0.010	0.059**		
SRSTD	-0.007	-0.011	-0.034	-0.137***	-0.032	
CB30	0.123***	0.122***	0.066***	0.463***	0.089***	-0.114***

Table IV
Logit Regression of Firm Value on Diversification Types and Chaebol Firms by Periods

The sample consists of 2,894 firm-years for the 1994-2000 period. For the dependent variable, the standardized firm value of each firm is first ranked according to its magnitude each year, and then a numerical value of two is assigned to the top 40%, one to the middle 20%, and zero to the bottom 40% of firm values. Hence, firms with a numerical value of two (zero) represent firms with high (low) firm value in a given year. The threshold values are estimated using the maximum likelihood method. LASST is natural logarithm of total assets. RNDPS is R&D expenses divided by total sales. SRSTD is standard deviation of daily stock returns. CDXU measures unrelated, inter-industry diversification and considers KSIC two digits only. CDXR measures related, intra-industry diversification and is computed by selecting an industry with the biggest sales volume within two-digit industries and then estimating index of diversification within KSIC three digits among them. CB30 is a dummy for affiliation to top 30 chaebol groups, with a numeric value of one if a firm is affiliated to chaebol and zero otherwise. The multiplication terms denote interactions of diversification index and chaebol dummy. Twenty industry dummy variables of IND17 through IND36 are included in the regressions. ***, **, and * denote significance at the 1%, 5%, 10% level, respectively.

Independent Variable	Period					
	Full Period (1994-2000)		Pre-Crisis Period (1994-1996)		Post-Crisis Period (1998-2000)	
	Reg. Coeff.	z-value	Reg. Coeff.	z-value	Reg. Coeff.	z-value
LASST	-0.221	-11.76***	-0.250	-10.20***	-0.165	-8.21***
RNDPS	5.788	3.51***	4.821	1.71*	6.247	2.42**
SRSTD	10.892	7.89***	42.816	5.64***	35.190	13.04***
CDXU	-0.175	-2.24**	-0.407	-3.22***	0.078	0.67
CDXR	-0.139	-0.59	-0.528	-1.37	0.481	1.34
CB30	-0.447	-2.75***	-0.861	-3.37***	-0.506	-1.95*
CDXU*CB30	-0.664	-3.99***	-0.437	-1.77*	-0.472	-1.71*
CDXR*CB30	0.991	1.88*	2.492	2.86***	-1.552	-1.82*
IND17	-0.743	-3.89***	-0.797	-2.69***	-0.678	-2.29**
IND18	-0.433	-2.10**	-0.682	-2.17**	-0.055	-0.17
IND19	-0.012	-0.04	-0.015	-0.03	0.429	0.95
IND20	-0.422	-1.09	-0.314	-0.48	-0.341	-0.60
IND21	-0.058	-0.29	-0.089	-0.29	0.304	0.98
IND22	0.916	1.78*	0.457	0.58	1.605	1.84*
IND23	0.596	1.95*	1.033	2.22**	0.436	0.91
IND24	-0.188	-1.31	-0.207	-0.93	0.194	0.86
IND25	-0.297	-1.39	-0.108	-0.33	-0.066	-0.19
IND26	-0.768	-3.63***	-0.695	-2.15**	-0.947	-2.78*
IND27	0.060	0.35	0.205	0.78	0.002	0.01
IND28	-0.352	-1.41	0.143	0.37	-0.518	-1.34
IND29	0.493	2.39**	0.799	2.20**	0.541	1.80*
IND30	1.302	3.57***	1.047	1.69*	1.919	3.23***
IND31	0.604	3.05***	0.486	1.52	0.943	3.15***
IND32	1.161	6.38***	0.921	3.20***	1.747	6.13***
IND33	0.511	1.20	0.757	0.90	0.922	1.55
IND34	0.478	2.57**	0.779	2.53**	0.446	1.60
IND35	0.768	2.18**	0.430	0.71	1.210	2.36**
IND36	0.430	1.38	0.115	0.22	0.611	1.35
No. of Observations	2894		1146		1326	
LR Statistics	500.60***		207.10***		364.95***	
Pseudo-R^2	0.08		0.09		0.13	

Table V
Logit Regression of Firm Value on Diversification Types, Chaebol Affiliation, and Periods

The sample consists of 2,894 firm-years for the 1994-2000 period. For the dependent variable, the standardized firm value of each sample firm is first ranked according to its magnitude each year, and then a numerical value of two is assigned to the top 40%, one to the middle 20%, and zero to the bottom 40% of firm values. Hence, firms with a numerical value of two (zero) represent firms with high (low) firm value in a given year. The threshold values are estimated using the maximum likelihood method. LASST is natural logarithm of total assets. RNDPS is R&D expenses divided by total sales. SRSTD is standard deviation of daily stock returns. CDXU measures unrelated, inter-industry diversification and considers KSIC two digits only. CDXR measures related, intra-industry diversification and is computed by selecting an industry with the biggest sales volume within two-digit industries and then estimating index of diversification within KSIC three digits among them. CB30 is a dummy for affiliation to top 30 chaebol groups, with a numeric value of one if a firm is affiliated to chaebol and zero otherwise. POST is a period dummy with a numeric value of one if the period is post-crisis period and zero otherwise. The multiplication term denotes interaction of either two or three of the diversification index, chaebol dummy, and period dummy. Twenty industry dummy variables of IND17 through IND36 are included in the regressions but their estimation results are not reported here. ***, **, and * denote significance at the 1%, 5%, 10% level, respectively.

Independent	Model 1		Model 2		Model 3	
Variable	Reg. Coeff.	z-statistic	Reg. Coeff.	z-statistic	Reg. Coeff.	z-statistic
LASST	-0.166	-8.24***	0.0153	0.80	-0.169	-8.35***
RNDPS	6.776	3.80***	21.926	9.46***	6.832	3.82***
SRSTD	24.808	11.22***	18.312	11.38***	24.910	11.25***
CDXU	-0.202	-2.74***	-0.178	-1.79*	-0.217	-2.87***
CDXR	0.169	0.755	0.584	1.90*	0.204	0.88
CB30	-0.208	-2.65***			-0.297	-3.11**
POST	-0.639	-8.94***			-0.670	-9.13***
CB30*POST					-0.206	-1.73*
CDXU*CB30			-0.290	-1.83*		
CDXR*CB30			0.676	1.27		
CDXU*CB30*POST			-0.197	-1.28	-0.177	-1.16
CDXR*CB30*POST			-0.309	-1.85*	-0.509	-2.03**
Number of Observations	2894		2894		2894	
LR Statistics	575.96***		551.04***		580.80	
Pseudo-R^2	0.10		0.09		0.10	

Appendix
Korea Standard Industrial Classification (KSIC) Code and Industry

KSIC Code	Definition of Industry
15	Manufacture of Food Products and Beverages
16	Manufacture of Tobacco Products
17	Manufacture of Textiles, Except Sewn Wearing apparel
18	Manufacture of Sewn Wearing Apparel and Fur Articles
19	Tanning and Dressing of Leather, Manufacture of Luggage and Footwear
20	Manufacture of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials
21	Manufacture of Pulp, Paper and Paper Products
22	Publishing, Printing and Reproduction of Recorded Media
23	Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel
24	Manufacture of Chemicals and Chemical Products
25	Manufacture of Rubber and Plastic Products
26	Manufacture of Other Non-metallic Mineral Products
27	Manufacture of Basic Metals
28	Manufacture of Fabricated Metal Products, Except Machinery and Furniture
29	Manufacture of Other Machinery and Equipment
30	Manufacture of Computers and Office Machinery
31	Manufacture of Electrical Machinery and Apparatuses n.e.c.
32	Manufacture of Electronic Components, Radio, Television and Communication Equipment and Apparatuses
33	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks
34	Manufacture of Motor Vehicles, Trailers and Semitrailers
35	Manufacture of Other Transport Equipment
36	Manufacture of Furniture; Manufacturing of Articles n.e.c.