Corporate Diversification, Relatedness, Group Affiliation, and Firm Value: Evidence from Korean Firms

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Abstract

We examine the valuation effects of diversification activities for Korean firms by diversification type, chaebol affiliation, and the occasion of the Korean financial crisis. Employing data of 2,894 firm-years during the 1994-2000 period, we find that diversification activities by Korean firms are associated with a decline in firm value over the entire period examined, though the effect of diversification on firm value is sensitive to the way firm value is measured. Of particular interest are our findings on the significantly different effects of related versus unrelated diversification on firm value. Specifically, unrelated diversification by Korean firms decreases firm value, whereas related diversification has a non-negative, though not positive, effect on firm value, regardless of how the firm value is measured. Our results further show an important role of the Korean financial crisis on the diversification activities by chaebol-affiliated firms. Related diversification by chaebol-affiliated firms is associated with an increase in firm value before the financial crisis, but has a significant negative impact on firm value during the post-crisis period. These results indicate that once-dominant chaebol-affiliated firms find it difficult to generate gains from related diversification following the Korean financial crisis.

JEL Classification: G34, G31

Keywords: corporate diversification, related and unrelated diversification, firm value, Korean firms, chaebol

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Extensive literature has examined the consequences of corporate diversification. On the one hand, earlier empirical studies document a diversification discount that diversified firms trade at an average discount relative to single-segment firms (Berger and Ofek (1995), Lang and Stulz (1994), Servaes (1996)). On the other hand, correcting for sample selection bias, later studies find a diversification premium (Villalonga (1999), Whited (2001), Campa and Kedia (2002), Graham et al. (2002), Villalonga (2004a, 2004b))[1].

While the existing literature has actively focused on the corporate diversification of developed countries including the U.S., the international evidence regarding the valuation effect of corporate diversification in emerging markets is limited and inconclusive. Furthermore, the inquiry into the valuation effect of firm diversification requires an investigation into the supposedly different valuation effect of two diversification types of related and unrelated diversification, as well as the marginal valuation effect of diversification relative to non-diversification. This issue should not be taken lightly since a firm's targeted diversification can have a vastly different effect on firm value depending on the relatedness of the new business to the current business (Rumelt (1974), Chatterjee and Wernerfelt (1991), Fan and Lang (2003)). We intend to fill this gap by examining how related and unrelated corporate diversifications affect the market values of Korean firms.

Our study makes significant contribution to the existing literature on corporate diversification in several respects. First, we provide new empirical evidence on corporate diversification for firms in Korea, one of leading emerging markets. Unlike developed markets, emerging markets are characterized with the lack of reliable information and a high degree of information asymmetry, which would lead to a high degree of market imperfection. This suggests that there may be a great room to enhance firm value if a firm creates an internal production market through diversification. On the contrary, diversification by firms in emerging markets may decrease firm value because the greater information asymmetry and lower

monitoring of firms by the market may increase the agency costs associated with diversification. Due to these differences, the empirical evidence documented for firms in the developed markets would not be directly applicable to firms in emerging markets. A number of prior studies offer unsettled evidence on this issue for emerging market firms. Lins and Servaes (2002) argue that the severe market imperfections found in emerging markets increase the potential agency costs associated with diversification and that greater asymmetric information allows management and large shareholders to exploit minority shareholders more easily. Consistent with these arguments, they find that diversified firms from East Asian markets trade at a discount of approximately 7% compared to single-segment firms. Baek et al. (2004) also find that highly diversified Korean firms have significantly lower share returns than undiversified counterparts. In contrast, Khanna and Palepu (2000) argue that diversification may be more valuable in emerging markets than in more developed economies. Fauver et al. (2003) find a diversification premium or no discount for firms in less developed economies. The majority of prior studies, however, use only a limited number of large firms in emerging markets available in the Worldscope database.

Second, we shed new empirical lights on the relation between firm value and two types of diversification, related and unrelated diversification. Our study is the first of its kind that examines this issue for Korean firms. Related diversification refers to one into the category of existing lines of business, and unrelated diversification refers to one into an industry different from existing lines of business. As Chatterjee and Wernerfelt (1991) note, optimal diversification would be different according to firm 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, and existing literature offers mixed evidence on this issue (see Lewellen (1971), Rumelt (1974), Amihud and Lev (1981), Nayyar (1993), Markides and Williamson (1994), Claessens et al. (2003), Doukas and Kan (2004)).

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[1] See Martin and Sayrak (2003) for a survey of recent literature on the effect of corporate diversification on shareholder value.

Third, Korean firms also offer a unique opportunity to compare the valuation effect of corporate diversification for large business groups, known as chaebols, to other business groups during both pre- and post-1997 Korean financial crisis periods.[2] Korean chaebol affiliates have been known to make investment and financing decisions as a group and allocate funds among the member firms to serve group-level purpose, creating an explicit internal capital market. Shin and Park (1999) find evidence of overinvestment and cross-subsidization by Korean chaebols. In a study of top thirty Korean chaebols from 1990 to 1995, Ferris et al. (2003) document 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. During the past three decades of Korea's economic growth, Korean chaebols were often criticized to have been involved in reckless expansion schemes in the name of diversification and played a contributory role to the 1997 Korean financial crisis. Following the crisis, Korean firms have been driven to make fundamental changes in corporate governance and corporate diversification strategies, among others, by both internal and external forces. In spite of the strong need of continuous changes in corporate financing and diversification strategies, however, there still appears to be lack of genuine efforts by Korean firms, with a limited success. In this regard, we test whether the Korean financial crisis has brought a significant change in Korean firms' diversification strategies and their effects on firm value.

Finally, we use alternative measures of both firm value and the degree of a firm's diversification activities to avoid methodological problems associated with these two key measures in the Berger and Ofek's (1995) excess value method to assess gain or loss from diversification.[3] More extant studies, however, suggest that the Berger and Ofek's method causes a possible downward bias in computing firm

[2] A business group is a set of legally independent business entities that operate under close cooperation and hence can be viewed as a diversified conglomerate. Chaebols are large business groups more or less controlled by founding families.

[3] Excess value of a diversified firm is obtained from the natural logarithm of the ratio of a firm's actual value to its imputed value. 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). Hence, 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

value (see, e.g., Villalonga (1999), Campa and Kedia (2002), Graham et al. (2002)). Along with the methodological problems, there is practical limitation in securing the median ratios from representative firms in the same lines of business since there are often only a few firms available in the same industry in the emerging markets.

Employing data of 2,894 firm-years during the 1994-2000 period, we find that diversification activities by Korean firms are on average associated with a decline in firm value, though this evidence is sensitive to the way the firm value is measured. When the diversification is classified into two types of diversification, we find a strikingly different valuation effect of related diversification, compared to unrelated diversification, on firm value. Specifically, related diversification is associated with a non-negative, though not positive, effect on firm value, while unrelated diversification is associated with a significant negative effect on firm value.

Another key finding of our study is the significantly different valuation effect of related diversification by chaebol-affiliated firms during the post-financial crisis period, compared to the pre-crisis period. An expansion into related business by chaebol-affiliated firms adds firm value during the pre-crisis period, but decreases firm value during the post-crisis period. These results suggest that it became more difficult for chaebol-affiliated firms to generate gains even from related diversification activities during the post-crisis period. Our findings are in general consistent with those from previous studies that document evidence supporting that the economic crisis in Korea has a significant and negative effect on the value of firms, in particular, chaebol-affiliated firms.

I. Diversification and Firm Value

Existing literature documents both costs and benefits associated with corporate diversification. On the one hand, corporate diversification may enhance firm value in several respects. First, multidivisional firms can operate efficiently by coordinating specialized divisions (Chandler (1977)).

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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.

Second, diversification can mitigate the underinvestment problem through an efficient allocation of assets by creating an internal capital market (Stulz (1990), Weston (1970)). Third, diversification can help lower capital costs and increase capital raising capacity since earnings streams from diversified divisions have low correlations to make corporate cash flows stabilized (Lewellen (1971)). Fourth, related diversification is advantageous in building up economies of scale and utilizing strategic assets (Markides and Williamson (1994)).

On the other hand, corporate diversification may destroy firm value for several reasons. First, diversified firms may engage in investment projects with a negative NPV by making a bad use of increased capital raising capacity and free cash flow (Jensen (1986), Stultz (1990)). Second, multidivisional firms may delay withdrawal of failed segments by allowing cross-subsidization (Meyer, Milgrom, and Roberts (1992)). Third, multidivisional firms may face greater information asymmetry costs than independent firms because of increased information asymmetry between headquarters and divisions (Harris, Kriebel, and Raviv (1982), Myerson (1982)).

Methodologically, a key measure in the analysis of valuation effects 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). Hence, 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. Numerous subsequent studies apply the Berger and Ofek's methodology and offer evidence that diversification firms on average trade at a discount relative to single-segment firms.

More recent studies show, however, 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 et al. (2002) note that the Berger and Ofek's 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.[4] They assert that Berger and Ofek's (1995) results stem from their not controlling sampling errors when computing imputed values.[5] They show that half or more 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 that diversified firms exhibit a discount. Overall, the findings of the more recent studies suggest that diversification, in itself, does not destroy value.

Gomes and Livdan (2004) develop a general dynamic model of the optimal behavior of a firm that predicts that diversified firms have, on average, a lower value of Tobin's q than focused firms do. In their model, firms diversify only when they become relatively unproductive in their current industries. They argue that this endogenous selection mechanism accounts for the lower valuation of diversified firms. Using three different treatment effects estimators, Villalonga (2004b) find that on average, diversification does not destroy value, consistent with evidence in Villalonga (1999), Campa and Kedia (2002), and Graham et al. (2002).

In this study, we test two different views of the effect of diversification on firm value for Korean firms before and after the Korean financial crisis. Focusing on a single country in this way allows us to examine diversification index measures at a level of detail that would be hard to aggregate across countries.

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

[5] 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.

II. Data and Measurement of Diversification Indexes

A. Data

Our sample represents publicly traded manufacturing firms which are listed on the Korean Stock Exchange from 1994-2000 and whose base industry (or main line of industry) belongs to Korea Standard Industrial Classification (KSIC) 15 through 36. Hence, we exclude firms in the financial services and utility industries. 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. Each sales item is classified with reference to KSIC three-digit level, excluding those noted as 'others' or those with an ambiguous classification. We also exclude firms without necessary accounting entries, stock return data or sales data. Our final sample consists of 2,894 manufacturing firms in twenty-one industries over the 1994-2000 period.

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 measure of diversification index, CINDX, is computed as:

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

where J = total number of product 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.

The next two measures of 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.[6] 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 regarded as related diversification. This classification is controversial, and hence we use an alternative way to classify related and unrelated diversification.[7]

The second measure of diversification index, CINDX2, considers only two-digit KSCI codes and thus measures the degree of a firm's unrelated inter-industry diversification. Similar to CINDX, CINDX2 is computed as:

$$CINDX2 = \sum_{j=1}^{J} p_j d_{jH} \tag{2}$$

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

The third measure of diversification index, CINDX3, 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. Hence, it measures the degree of a firm's related intra-industry diversification. Similar to CINDX and CINDX2, CINDX3 is computed as:

$$CINDX3 = \sum_{j=1}^{J} p_j d_{jH} \tag{3}$$

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

[6] 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.
[7] 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.

C. Regression Model for the Effects of Diversification on Firm Value

We conjecture that if diversification increases firm value, the diversification measure of CINDX would be positively related to the measure of firm value in a regression with the effects of other variables being controlled. Since a firm's value can be affected by factors other than the firm's diversification activities, we use three widely used measures based on Tobin's q theory as control variables in the regressions (see, e.g., Bhagat and Welch (1995), Chauvin and Hirschey (1993)). The three control variables are natural log of total assets (LASST) as proxy for firm size, R&D expenditures divided by total sales (RNDPS) as proxy for firm's growth, and the standard deviation of daily stock returns (SRSTD) as proxy for firm's risk. Data for all accounting items and daily stock returns are collected from the Korea Investors Service database. 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 entire manufacturing industries in the Korean market except for the tobacco industry (KSIC 16) which is not included due to the lack of sufficient sample firms.

We examine the relation between diversification and firm value in the following regression model:

$$FV_i = a_0 + a_1 LASST_i + a_2 RNDPS_i + a_3 SRSTD_i + a_4 CINDX_i + \sum_{k=1}^{20} a_{4+k} IND_i + \zeta_i \qquad (4)$$

where *FV* is firm value, *LASST* is 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, *CINDX* is the Caves weighted index of diversification computed in equation (1), and *IND* is industry dummy variable.

D. Measurement of Firm Value

Due to the methodological problems associated with computing imputed values of diversified firms and 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 three representative accounting items of total sales, total assets, and EBIT, as used in the extant literature on diversification.

A preliminary examination of the three measures of standardized firm value indicates that their values vary widely. To be more specific, firm values range from 0.0009 at the minimum to 1,911.40 at the maximum when being standardized by sales, from 0.35 to 16.4 when being standardized by total assets, and from -55,191.18 to 8,327.21 when being standardized by EBIT. Jarque-Bera test statistics of these standardized firm values reject the null hypothesis of normal distribution in all cases. Hence, using the standardized firm values as dependent variable in a regression may cause a serious heteroskedasticity problem. One way to solve this problem would be to exclude these peculiar values from the data set. If the peculiar 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 is difficult to sort out peculiar ones from the data set.

Due to the potential problem with the above approach, 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. Hence, according to this classification, 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 as follows (see Greene (2000), pp. 875-878):

$$y_i^* = A'x_i + e_i \tag{5}$$

The observed category for y_i is based on unobserved variable y_i^*, according to the following rules:

$$y = 0 \text{ if } y^* \leq \gamma_1$$

$$y = 1 \text{ if } \gamma_1 \leq y^* \leq \gamma_2$$

$$y = 2 \text{ if } \gamma_2 \leq y^*.$$

The threshold values of γ_1 and γ_2 and the slope coefficients of A' are estimated using the maximum likelihood method. The ordered dependent variable model can be either probit model or 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 logit model for our estimation.

Although the logit analysis using ordered dependent variable may not provide exact estimates of the relation between diversification and firm value, it would generate probabilistic directions of the effect of the diversification on firm value. 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 are discarded as outliers in prior studies.

III. Summary Statistics of Key Variables and Diversification Indexes

A. Summary Statistics of Key Variables

Table I presents results from comparing key variables by pre-Korean financial crisis period versus post-Korean financial crisis and by chaebol-affiliated firms versus non-chaebol affiliated firms. As shown in Panel A of Table I, both mean and median values of the ratio of R&D expenditures to sales for sample Korean firms are significantly larger for the pre-crisis period than for the post-crisis period. Hence, Korean firms spend significantly (at least at the 10% level) less in R&D investments during the post-crisis period. On the contrary, firm risk measured by the standard deviation of daily stock returns is significantly (at the 1% level) less for the pre-crisis period, indicating that the risk level of Korean firms increases significantly during the post-crisis period. More importantly, the three measures of firm value are larger for the pre-crisis period than for the post-crisis period, and the differences are significantly greater than zero in most cases. These results indicate that the value of Korean firms declines significantly following the financial crisis and are consistent with the implications of previous studies that the Korean financial crisis has affected negatively the value of Korean firms.

Panel B of Table I shows results for two sub-samples based on a firm's affiliation to chaebol. Over the entire period, chaebol-affiliated firms are characterized by greater investment in R&D and lower stock return volatility than non chaebol-affiliated firms are. However, there is no consistency in the three measures of firm value for chaebol-affiliated firms relative to non chaebol-affiliated firms.

B. Sample Distributions and Characteristics of Diversification Index Measures

Table II presents distribution of sample firms by year and descriptive statistics of three diversification index measures used in our paper. CINDX follows the Caves index (1980, pp. 199-200) and considers up to three-digit KSIC codes. CINDX2 computes the index within two-digit KSIC codes only, and CINDX3 computes the index by selecting an industry with the biggest sales volume within two-digit KSIC industries and then estimating index of diversification within the three-digit KSIC codes among them.

As shown in the CINDX measure, for the entire sample period of 1994-2000, 59.4% of sample firm-years (1,718/2,894) engage in diversification activities, encompassing an average of 25.7% of total annual sales. Among firm-years that are diversified during the same period, about 73.5% (1,263/1,178) engage in unrelated diversification across different industries by diversifying 9.9% of total annual sales within the two-digit KSlC level. On the other hand, about 40.7% of firm-years that are diversified (699/1,718) engage in related, intra-industry diversification by diversifying 4.5% of total annual sales, as evidenced by results on CINDX3, which indicates diversification within base industry. Although not reported explicitly in Table II, 224 firms, or 13% of firm-years that are diversified, engage in diversification into both two-digit KSIC level and three-digit KSIC level at the same time during the 1994-2000 period.

Table II also shows contrasting evidence on diversification activities of Korean industrial firms before and after the Korean financial crisis that broke out in late 1997. In terms of mean values of sales involved in diversification, both CINDX and CINDX2 diversification measures increase steadily over the pre-crisis period (1994-1996), reach the biggest values of 27.5% and 11.0% for CINDX and CINDX2,

respectively, in 1997, and declines steadily over the post-crisis period (1998-2000). A similar trend is observed for median values of sales for CINDX; sales peak at 8.9% in 1997. These findings are further supported by the evidence that the median value of sales for the CINDX measure during the post-crisis period is 0.00%, substantially lower than that of 6.5% during the pre-crisis period.

Overall, the results in Table II indicate that substantially more Korean firms engage in unrelated diversification into different industries in the two-digit KSIC level and that diversification activities of Korean firms change following the Korean financial crisis in late 1997.

C. Summary Statistics of Standardized Firm Value

Table III reports summary statistics of the three measures of standardized firm value by diversification activity (diversified firms vs. non-diversified firms) and period (pre-crisis period vs. post-crisis period). As shown in Panel A where diversification is measured by CINDX, diversified firms have lower firm values than non-diversified firms in terms of both mean and median values for the full period. In particular, the differences in means and medians of firm value divided by total assets are statistically significant at the 1% level. It is also evident that regardless of firm's diversification activities, Korean manufacturing firms experience a significant decrease in both measures of standardized firm value. Hence, the Korean financial crisis affected significantly and negatively the value of both diversified and non-diversified Korean firms.

Panel B shows means and medians of standardized firm value of firms that diversify into different industries of KSIC two digits from the base industry and offers similar results to those in Panel A. Both means and medians of three measures of standardized values for diversified firms are greater than those for non-diversified firms over the full period, and the differences in medians of two measures of standardized values (Firm Value/Sales and Firm Value/Assets) are statistically significant at the 5% level. It is also shown that both diversified firms and non-diversified firms suffer a significant value loss following the Korean financial crisis.

IV. Regression Analysis and Results

A. Pearson Correlation Coefficients

Before we perform logit regression analysis of firm value on diversification, we first examine correlation coefficients of dependent and independent variables used in the regression. Table IV shows Pearson correlation coefficients among three diversification index measures and three control variables in the regression. The correlation coefficient between CINDX and CINDX2 (measure of inter-industry, unrelated diversification) is 0.907 and significant at the 1% level, indicating that the diversification measure widely used in extant studies on diversification is indeed the inter-industry, unrelated diversification according to our classification. The correlation coefficient between CINDX and CINDX3 (measure of intra-industry diversification) is 0.275 and significant at the 1% level. On the contrary, the correlation coefficient between CINDX2 and CINDX3 is a negative 0.030 and is not significant at the 10% level, indicating that a firm's inter-industry diversification and intra-industry diversification are substitute.

LASST, a measure of firm size, has a positive and significant (at the 1% level) correlation with three diversification measures, implying that diversification is closely related to a firm's asset size. 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 return volatility. Finally, the chaebol dummy, CB30, has a positive and significant correlation coefficient with LASST and RNDPS but a negative and significant coefficient with SRSTD. These findings indicate that chaebol-affiliated firms are bigger, less risky, and invest more in R&D.

B. Logit Regression Analysis of Firm Value on Diversification

Table V presents results from logit analysis of diversification activities on firm value, as estimated by equation (4). The pseudo-R square ranges from the highest 0.09 when the dependent variable is firm value standardized by sales to the lowest 0.02 when the dependent variable is firm value

standardized by EBIT. RNDPS has a positive and significant (at the 1% level) estimate in all regression models, indicating that firms investing more in R&D have on average higher values. Most regression estimates of industry dummies are significant in the three regressions, suggesting that firm value is significantly influenced by the base industry a firm belongs to.

The regression estimate of CINDX is negative and significant at the 5% level when firm value is standardized by total assets, suggesting a negative effect of diversification on firm value. On the contrary, the estimate of CINDX is positive but insignificant at the 10% level when firm value is standardized by either sales or EBIT. Hence, although our results provide some evidence on the diversification discount for Korean firms, it is also evident that the valuation effect of diversification is sensitive to how firm value is measured.

C. Logit Regression Analysis of Firm Value on Diversification Types

A firm's diversification can take either one or both of two types, related and unrelated diversification. Related diversification is one where a firm expands into the same line of business, and unrelated diversification is one where a firm expands into industries different from the base industry. Chatterjee and Wernerfelt (1991) argue that firms diversify in part to utilize firm-specific resources such as excess physical capacity, presence of intangible assets, availability of internal funds or unused debt capacity, or availability of equity capital. They document that firm-specific resources determine the type of a firm's optimal diversification, suggesting that the diversification type is directly linked to firm value. They further document that diversification in accordance with the firm's underlying resources leads to superior performance.

Existing literature documents mixed evidence on the valuation effects of related diversification relative to unrelated diversification. On the one hand, Markides and Williamson (1994) point out several merits associated with related diversification including economies of scope in the short run, utilizing accumulated core competence and the potential to build strategic assets by using such core competence in the long run. Rumelt (1974) asserts that related diversification can increase firm value because it can

allow firms to jointly use both skill and resources. Nayyar (1993) argues that benefits from a positive relation in an existing business and from economies of scope are available from related, but not from unrelated, diversification. Doukas and Kan (2004) find that bidders engaging in unrelated acquisitions experience larger excess cash flow declines and valuation discount than do bidders engaging in related acquisitions. Using the Business Information Tracking Series (BITS) as an alternative data source to estimate the valuation effect of diversification, Villalonga (2004a) finds that diversified firms trade on average at a significant premium relative to comparable portfolios of single-business firms. He interprets these findings as evidence that there is a discount to unrelated (conglomerate) diversification, but a premium to related diversification. Since related diversification is likely to predominate over conglomeration, when all diversification types are pooled together as they are in BITS, the net effect on firm value becomes a premium.

On the other hand, Lewellen (1971) argues that if diversification is carried out within similar industries, the insurance effect from unrelated diversification would be so insignificant that an increase in firm value by way of debt capacity augmentation will not take shape. Amihud and Lev (1981) also show that unrelated diversification is associated with lower firm risk due to the existence of multiple lines of business with imperfectly correlated returns.

As a whole, extant studies suggest that related diversification can generate a positive effect on firm value if adequately done. Existing literature also suggests that the motive for related diversification may be different from that for unrelated diversification and that the effect of diversification on firm value may be different depending on the diversification type, irrespective of the way the degree of diversification is measured.

Berger and Ofek (1995) consider firms operating in less than two-digit SIC codes as practicing related diversification and measure the degree of relatedness as the difference between the total number of segments reported by the diversified firms and the number of segments with a different main two-digit SIC code. They find a positive and significant relation between related diversification and firm value, which they interpret as evidence supporting that relatedness mitigates the value loss from diversification.

Berger and Ofek's definition of diversification, however, has some possibility of misleading. For example, if a firm first practices unrelated diversification at the two-digit SIC level and consecutively diversifies into the three-digit SIC business within the previous two-digit SIC code area, this kind of diversification is recognized as related diversification, which is controversial.

In order to examine the valuation effect of diversification type, related versus unrelated diversification, we estimate the regression equation (6) by substituting CINDX in equation (4) with CINDX2 and CINDX3 in the following manner:

$$FV_i = b_0 + b_1 LASST_i + b_2 RNDPS_i + b_3 SRSTD_i + b_4 CINDEX2_i + b_5 CINDEX3_i + \sum_{i=1}^{20} b_{5+i} IND_i + \eta_i \quad (6)$$

In equation (6), CINDX2 represents KSIC two-digit diversification index, measuring the degree of a firm's unrelated (inter-industry) diversification. CINDX3 represents three-digit KSIC diversification index within two-digit KSIC base industry, measuring the degree of a firm's related intra-industry diversification.

Table VI reports the estimation results from equation (6) in three periods—whole period (1994-2000), pre-Korean financial crisis period (1994-1996), and post-Korean financial crisis period (1998-2000). Regression estimates on industry dummies are not reported here. As shown in Panel A, the regression estimate of CINDX2 is negative in all three regressions for the full period examined, and is significant at the 5% level when firm value is standardized by assets. Hence, the findings suggest that unrelated diversification reduces firm value standardized by assets. On the contrary, the regression coefficient of CINDX3 is positive but insignificant at the 10% level in all three regressions, regardless of the dependent variable used. Hence, related diversification is not associated with an increase in firm value. In order to examine whether the regression coefficient of CINDX2 is different from that of CINDX3, we perform the Wald test to obtain a χ^2 value of 13.42, which rejects the null hypothesis of no difference between the two coefficients at the 1% level. Hence, related intra-industry diversification (CINDX3) causes a change in firm value significantly different than unrelated inter-industry diversification (CINDX2) does.

When firm value is standardized by assets, the coefficient of CINDX2 is negative and significant at the 1% level, while that of CINDX3 is positive and significant at the 1% level. Wald test also rejects the H_0 of no difference between the two coefficients at the 1% level. When firm value is standardized by EBIT, the coefficient of CINDX2 is negative but insignificant, while that of CINDX3 is positive and significant at the 1% level. Wald test also rejects the H_0 of no difference between the two coefficients at the 1% level. Overall, the regression results on the diversification type for the full period suggest that while unrelated inter-industry diversification has a negative effect on firm value, related intra-industry diversification has a negligible effect on firm value.

Panels B and C report regression estimates from the logit model for pre- and post-crisis periods. For the pre-crisis period, CINDX2 has a negative and significant (at the 1% level) regression coefficient when the dependent variable is firm value standardized by sales, whereas the coefficient of CINDX3 is all positive and significant at the 5% level when the dependent variable is firm value standardized by EBIT. Hence, the regression estimates for the pre-crisis period are in line with those for the full period. For the post-crisis period, the signs of regression estimates on CINDX2 and CINDX3 are mixed, and none of the regression coefficients is significant at the 10% level. The Wald test cannot reject the null hypothesis of no difference between the two coefficients. Hence, Korean firms' diversification activities following the Korean financial crisis seem to have little effect on firm value.

F. Logit Regression Analysis of Firm Valueon Chaebol Affiliation

Korea is known to have pursued its economic growth mainly by nursing large business groups of firms, called chaebols. Korean chaebols are often compared to Japanese keiretsu, which is anchored upon main banking systems. In this process, chaebols were frequently criticized for their involvement in reckless expansion schemes in the name of diversification, which appears to have played a contributory role to the 1997 Korean financial crisis. Since the financial crisis in late 1997, however, Korean firms have been driven to make fundamental changes in corporate governance and corporate diversification strategies by external forces such as the government and the market as well as by internal forces.

Through these efforts, the average debt level of Korean firms has declined notably from their peak level before the financial crisis. In addition, a large number of Korean firms have gone through a significant corporate restructuring process voluntarily and involuntarily by liquidating a large portion of non-core corporate assets and refocusing their businesses to a few core businesses. In spite of the strong need of continuous changes in corporate financing and diversification strategies, however, there still appears to be lack of sincere efforts from Korean firms, with limited success. Therefore, it will be interesting to examine whether the Asian financial crisis in 1997 has brought significant changes in the diversification strategies and their impact on firm value of chaebol firms relative to non-chaebol firms.

Extant literature shows that the effect of diversification on firm value is different according to whether a firm is affiliated to a large business group or not. Lins and Servaes (1999) examine the valuation effect of diversification for large samples of firms in Germany, Japan, and the United Kingdom for the 1992-1994 period and find a different valuation effect of diversification for a different country; no significant diversification discount in Germany, but a significant diversification discount in Japan and the U.K. They further show that for Japan, only firms with strong links to an industrial group (keiretsu) have a diversification discount. It is because, they explain, Japanese industrial groups already achieve internal capital market benefits, there are no additive benefits from diversification. Khana and Palepu (2000) compare the profitability of Indian firms belonging to industrial groups to that of independent Indian firms and find that diversified business groups do add value.

Shin and Park (1999) argue that chaebols allocate funds among the member firms to serve group-level purpose, creating an explicit internal capital market. They find that owing to their internal capital markets, Korean firms belonging to the top 30 business groups are subject to fewer financing constraints than other non-chaebol Korean firms. Ferris et al. (2003) study the top 30 Korean chaebols from 1990 to 1995 and find that chaebol affiliates suffer a value loss relative to non-chaebol firms. They also find that chaebol firms pursue earnings stability, over-invest in low performing industries, and cross-subsidize weaker members of their group.

Existing literature document mixed evidence on Japanese business groups of Keiretsu. Hoshi et al. (1990, 1991), Prowse (1992), and Ferris et al. (1995) find that keiretsu affiliation leads to reductions in agency, bankruptcy, and monitoring costs as well as liquidity constraints. On the contrary, later studies of keiretsu report significant costs to group membership due to the presence of an affiliated bank (see, e.g., Weinstein and Yafeh (1998), Morck and Nakamura (1999), and Kang and Stulz (2000)). Lins and Servaes (1999) find that Japanese keiretsu firms experience a value loss due to conglomerating, but are unable to establish whether their findings result from a main bank or a conglomeration effect. Emerging markets taken together, the evidence is also mixed. Khanna and Palepu (2000) and Fauver et al. (1998) find no convincing evidence of a diversification discount in emerging markets, while Lins and Servaes (1998) document a serious diversification discount in seven emerging markets. These studies on global markets suggest that the discounted value of conglomerate firms is not merely a U.S. phenomenon but an international phenomenon. A diversification effect is not restricted to multi-segment firms, but is also present in diversified business groups.

In order to examine the potentially different diversification effect between chaebol firms and non-chaebol firms, we divide entire sample into two groups: a chaebol-affiliated group and a non-chaebol-affiliated group based on the yearly reports from Korea Fair Trade Commission. To differentiate the two groups, we use a dummy variable of CB30 for which a numeric value of 1 is assigned if a firm is affiliated to top 30 chaebol groups and 0 otherwise. Since the dummy variable of CB30 is highly correlated with the firm size, LASST, we exclude LASST in the estimation.

We classify our sample firms into top 30 chaebol business groups following the Korea Fair Trade Commission (KFTC) classification based on the size of 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 other smaller chaebols are organized in the similar way as the top 30 chaebols.

We also employ two interactive variables of CINDX2*CB30 and CINDX3*CB30 to examine the interactions between the type of diversification and chaebol affiliation. Hence, CINDX2*CB30 measures the marginal effect of the unrelated inter-industry diversification by chaebol firms on firm value, and CINDX3*CB30 measures the marginal effect of the related intra-industry diversification by chaebol firms on firm value. The regression equation is presented as:

$$FV_i = c_0 + c_1 RNDPS_i + c_2 SRSTD_i + c_3 CINDX2_i + c_4 CINDX3_i + c_5 CINDX2_i * CB_i + c_6 CINDX3_i * CB_i + \sum_{k=1}^{20} c_{6+k} IND_i + \varepsilon_i \quad (7)$$

Since Korean chaebols underwent unprecedented environmental changes including diversification activities following the Korean financial crisis in 1997, it is expected that the effects of chaebol firms' diversification activities on firm value would differ significantly between the pre-crisis period and the post-crisis period. For this purpose, we estimate equation (7) in two subperiods of the pre-crisis period of 1994-1996 and the post-crisis period of 1998-2000 as well as the whole period of 1994-2000.

Several studies investigate various issues related to the Korean financial crisis and document evidence supporting significant changes and reforms across the financial sector, corporate sector, and public sector. Chang, Kang and Shin (2004) describe two major changes following the Korean 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 auditing committee, and appoint a compliance officer. All these reforms resulted in a 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 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 level by 2000 among affiliates of the top five chaebols, and by 2002 among those of the remaining thirty 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 an audit committee (effective in 1999). Hence, by the end of 2001, the average number of outside directors per KSE-listed companies increased to 2.3, 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 increase firms' responsibilities for their public information announcements.

Reforms in the corporate sector along with the financial sector's gradual adoption of global standards are believed to help restoring the principle of shareholder value maximization among Korean companies. Despite these reforms, Korean chaebols have continued to operate as conglomerate business group. de facto CEO and owner of chaebols are still members of founding family. Furthermore, the affiliates of chaebols are linked to each other through circular shareholdings, share a same brand, same business philosophy, and same pool of manpower. In this regard, it is a critical empirical issue whether the reforms in the corporate and financial sectors following the Korean financial crisis brought in fundamental changes in the diversification trend of Korean firms, especially chaebol firms, and their impact on the relation between the diversification and firm value.

Table VII shows estimation results from logit regressions of firm value on related and unrelated diversification by chaebol firms versus non-chaebol firms in three periods. For all three periods, regression estimates for measures of related and unrelated diversification, represented by CINDX2 and

CINDX3, respectively, are consistent with those reported in Table VI. Looking at the regression results from firm value standardized by assets as dependent variable, CINDX2 has a negative and significant coefficient, and CINDX3 has a negative but insignificant coefficient for the full period. Hence, unrelated diversification decreases firm value, whereas related diversification has little impact on firm value.

We now turn to regression estimates of two interaction variables of diversification index and chaebol affiliation, CINDX2*CB30 and CINDX3*CB30, to examine the effects on firm value of related and unrelated diversification by chaebol affiliated firms. As shown in Panel A, for the full period, CINDX2*CB30 has a negative and significant (at the 1% level) coefficient, and CINDX3*CB30 has a positive but insignificant (at the 10% level) coefficient, when firm value is standardized by assets. These results indicate that expansion activities into industries unrelated to base industry by top 30 chaebol-affiliated firms are associated with a significant decline in firm value, while expansion into related industries by top 30 chaebol-affiliated firms has little, though not negative, impact on firm value.

Panels B and C of Table VII report regression estimates for two subperiods of pre-financial crisis period (1994-1996) and post-financial crisis period (1998-2000), respectively. Estimation results for the pre-crisis period are in line with those for the whole period. As reported in Panel B, unrelated diversification by top 30 chaebol-affiliated firms has a negative and significant (at the 10% level) impact on firm value and that related diversification by such firms has a positive and significant (at the 10% level) impact on firm value.

For the post-crisis period, CINDX2*CB30 has a negative and significant (at the 10% level) regression coefficient, indicating a negative impact of unrelated diversification by top 30 chaebol affiliated firms on firm value. These findings are consistent with those for the pre-crisis period. On the contrary, regression estimates of CINDX3*CB30 for the post-crisis period are strikingly different from those of CINDX3*30 for the pre-crisis period and the full period. The estimated coefficient of CINDX3*CB30 is negative and significant at the 10% level when firm value is standardized by assets. Hence, unlike the pre-crisis period, related diversification by top 30 chaebol-affiliated firms during the post-crisis period results in a significant decrease in firm value. These findings suggest that expansion

into the same industries as the base industry by chaebol-affiliated firms following the Korean financial crisis fails to boost firm value.

Overall, our results show that diversification activities by Korean manufacturing firms for the period of 1994-2000 are associated with a decline in firm value. The negative impact of diversification on firm value, however, is found to be sensitive to the accounting item used to standardize firm value. When firm value is related to two types of diversification, unrelated diversification decreases firm value, but related diversification has little negative impact on firm value. Hence, related diversification generates a significantly less negative (or more positive) effect on the value of Korean manufacturing firms than unrelated diversification. When total sample firms are classified into firms affiliated with top 30 chaebol business groups and those unaffiliated with chaebol business groups, we find strikingly different valuation effects between these two sample firms. During the pre-Korean financial crisis period, unrelated and related diversification by chaebol-affiliated firms are associated with a significant increase and decrease, respectively, in value. Following the financial crisis, related diversification by chaebol-affiliated firms as well as unrelated diversification is translated into a negative firm value. Hence, chaebol-affiliated firms suffer a loss in firm value from expansion activities regardless of the type of diversification during the post-crisis period.

Existing literature on Korean firms' diversification documents evidence supporting that the economic crisis in Korea has a significant and negative effect on firm value, but with a large cross-sectional variation. Our regression results are in general consistent with those from previous studies. Kim and Park (2001) and Lins and Servaes (2002) show that diversification activities by Korean chaebol-affiliated firms decrease firm value. 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.

V. Summary and Conclusion

In this study, we extend the existing literature on the valuation effect of corporate diversification activities to Korean firms. In particular, we investigate how different diversification types (related versus unrelated diversification), chaebol affiliation, and the occasion of the Korean financial crisis affect the relation between diversification and firm value for Korean firms.

Employing data of 2,894 firm-years during the 1994-2000 period, we find that diversification activities by Korean firms on average decrease firm value during the sample period, though the evidence on this relation is sensitive to the way the firm value is measured. When the sample firms are divided into two types of diversification, we find a strikingly different valuation effect of related diversification, compared to unrelated diversification, on firm value. Specifically, related diversification is associated with a non-negative, though not positive, effect on firm value, but unrelated diversification is associated with a significant negative effect on firm value.

Our results also show that there exists a significantly different valuation effect of related diversification by chaebol-affiliated firms during the post-financial crisis period than during the pre-crisis period. An expansion into related business by chaebol-affiliated firms adds firm value during the pre-crisis period, but decreases firm value during the post-crisis period. These results strongly indicate that chaebol-affiliated Korean firms have difficulty in generating gains even from related diversification during the post-crisis period. These findings are in general consistent with those from previous studies that the economic crisis in Korea has a significant and negative effect on the value of firms, in particular, chaebol-affiliated firms.

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Table I
Summary Statistics of Key Variables Classified by Periods and Chaebol Firms

The sample consists of 2,894 firm-years for the period 1994-2000. Full period is from 1994 to 2000, pre-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, and is standardized by total sales, total assets, and EBIT. Data for all accounting items and daily stock returns are collected from the Korea Investors Service database. Means are given with medians below in parentheses except for t-statistics and z-statistics.

Classification	Variables					No. of Obs.
	R&D/Sales	SRSTD	Firm Value/Sales	Firm Value/Assets	Firm Value/EBIT	
	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)	
All Firms	0.007 (0.00007)	0.041 (0.039)	3.812 (1.339)	1.064 (0.981)	-5.367 (11.631)	2894
Panel A. Pre-Crisis Period vs. Post-Crisis Period						
Pre-Crisis Period	0.007 (0.0003)	0.026 (0.026)	5.839 (1.384)	1.803 (1.037)	15.589 (13.616)	1146
Post-Crisis Period	0.005 (0)	0.055 (0.053)	2.679 (1.239)	1.023 (0.859)	9.830 (8.351)	1326
t-statistics	1.81*	-68.14***	1.84*	2.64***	1.74*	
z-statistics	9.19***	-6.39***	4.10***	4.39***	2.61***	
Panel B. Chaebol Firms vs. Non-Chaebol Firms						
Chaebol Firms	0.012 (0.002)	0.037 (0.035)	1.812 (1.477)	0.968 (0.948)	14.002 (13.098)	376
Non-Chaebol Firms	0.006 (0.00002)	0.042 (0.040)	4.110 (1.302)	1.079 (0.992)	8.259 (11.486)	2518
t-statistics	4.83***	-6.18***	-0.77	-3.61***	0.39	
z-statistics	9.19***	-6.39***	4.10***	-4.39***	2.61***	

***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table II
Descriptive Statistics of Diversification Indices

CINDX follows Caves, Porter, Spence, and Scott (1980, pp. 199-200) which considers KSIC three-digits. CINDX2 computes the index within KSIC two-digits only, and CINDX3 computes the index by selecting an industry with the biggest sales volume within two-digit industries and then estimating index of diversification within three-digits among them.

Year	Total No. of Firms[a]	CINDX[b]			CINDX2			CINDX3		
		No. of Firms	Mean	Median	No. of Firms	Mean	Median	No. of Firms	Mean	Median
1994	320	181	0.240	0.059	132	0.092	0	74	0.046	0
1995	402	233	0.249	0.056	171	0.097	0	98	0.044	0
1996	424	254	0.265	0.071	189	0.103	0	109	0.050	0
1997	422	258	0.275	0.089	199	0.110	0	96	0.043	0
1998	443	260	0.260	0.046	191	0.101	0	105	0.041	0
1999	428	260	0.258	0.063	189	0.096	0	104	0.046	0
2000	455	272	0.248	0.048	192	0.092	0	113	0.044	0
94-96	1146	668	0.253	0.065	492	0.098	0	281	0.047	0
98-00	1326	792	0.255	0.000	572	0.096	0	322	0.043	0
94-00	2894	1718	0.257	0.063	1263	0.099	0	699	0.045	0

Table III

Distributional Characteristics of Standardized Firm Values by Diversification and Period

The sample consists of 2,894 firm-years for the period 1994-2000. Full period is from 1994 to 2000, pre-crisis period is from 1994 to 1996, and post-crisis period is from 1998 to 2000. CINDX follows Caves, Porter, Spence, and Scott (1980, pp. 199-200) which considers KSIC three-digits. CINDX2 is computed within KSIC two digits only, and CINDX3 is computed by selecting an industry with the biggest sales volume within two-digit industries and then estimating index of diversification within three-digits among them. Firm value is measured as the sum of market value of common stock, book value of preferred stock, and book value of debt. Means are given with medians below.

		Firm Value/ Sales	Firm Value/ Assets	Firm Value/ EBIT	No. of Firms (EBIT < 0)
Panel A. Diversification vs. Non-diversification Based on CINDX					
Full Period	Diversified	3.274	1.038	13.874	1718
	Firms	1.312	0.971	11.992	(240)
	Non-Diversified	4.597	1.103	-33.476	1176
	Firms	1.362	1.005	11.207	(155)
	t-statistics	0.65	3.09***	-1.20	
	z-statistics	1.16	3.52***	-1.31	
Pre-Crisis Period	Diversified	4.398	1.059	15.143	668
	Firms	1.346	1.028	13.900	(35)
	Non-Diversified	7.853	1.117	16.212	478
	Firms	1.408	1.055	12.895	(30)
	t-statistics	0.71	3.95***	0.28	
	z-statistics	1.31	3.60***	-3.22***	
Post-Crisis Period	Diversified	2.842	0.99	6.351	792
	Firms	1.231	0.851	8.491	(171)
	Non-Diversified	2.437	1.071	14.991	534
	Firms	1.251	0.87	8.192	(101)
	t-statistics	-0.29	1.95**	1.61	
	z-statistics	0.25	1.51	0.20	
Tests for Differences in Means and Medians between Pre-Crisis Period and Post-Crisis Period					
Diversified Firms					
	t-statistics	0.54	2.42**	2.60***	
	z-statistics	3.18***	13.45***	15.37***	
Non-Diversified Firms					
	t-statistics	1.36	1.20	0.19	
	z-statistics	3.55***	10.42***	10.33***	
Panel B. Diversification in KSIC Two Digits vs. Non-diversification Based on CINDX2					
Full Period	Diversified	3.867	1.047	14.745	1263
	Firms	1.361	0.973	12.033	(180)
	Non-Diversified	3.769	1.077	-20.942	1631
	Firms	1.304	0.991	11.367	(215)
	t-statistics	-0.05	1.43	-0.91	
	z-statistics	1.99**	1.97**	1.26	
Pre-Crisis Period	Diversified	5.479	1.059	14.821	492
	Firms	1.392	1.02	13.783	(24)
	Non-Diversified	6.11	1.102	16.166	654
	Firms	1.38	1.052	13.393	(41)

	t-statistics	0.13	2.89***	0.36	
	z-statistics	0.56	3.04***	1.78*	
Post-Crisis Period	Diversified Firms	3.225	1.008	5.504	572
		1.288	0.859	8.491	(130)
	Non-Diversified Firms	2.265	1.034	13.112	754
		1.195	0.859	8.208	(142)
	t-statistics	-0.70	0.63	1.43	
	z-statistics	2.19**	0.16	0.27	
Tests for Differences in Means and Medians between Pre-Crisis Period and Post-Crisis Period					
Diversified Firms					
	t-statistics	0.57	1.40	2.14**	
	z-statistics	2.20**	11.24***	12.98***	
Non-Diversified Firms					
	t-statistics	1.34	2.30**	0.64	
	z-statistics	4.41***	12.80***	13.02***	
Panel C. Diversification within Base Industry vs. Non-diversification Based on CINDX3					
Full Period	Diversified Firms	1.612	1.008	5.531	699
		1.283	0.95	12.24	(81)
	Non-Diversified Firms	4.512	1.082	-8.838	2195
		1.353	0.995	11.441	(314)
	t-statistics	1.23	3.05***	-0.32	
	z-statistics	-2.88***	-4.73***	2.04**	
Pre-Crisis Period	Diversified Firms	1.534	1.049	12.881	281
		1.368	1.027	14.832	(17)
	Non-Diversified Firms	7.237	1.095	16.468	865
		1.382	1.04	13.212	(48)
	t-statistics	1.02	2.67***	0.83	
	z-statistics	-0.40	-2.54***	3.55***	
Post-Crisis Period	Diversified Firms	1.923	0.938	9.206	323
		1.148	0.825	8.252	(60)
	Non-Diversified Firms	1.887	1.02	9.465	1018
		1.24	0.862	8.071	(248)
	t-statistics	0.84	2.46***	0.48	
	z-statistics	-3.34***	-3.17***	0.70	
Tests for Differences in Means and Medians between Pre-Crisis Period and Post-Crisis Period					
Diversified Firms					
	t-statistics	-0.47	3.66***	1.28	
	z-statistics	4.10***	10.07***	10.34***	
Non-Diversified Firms					
	t-statistics	1.36	1.51	1.42	
	z-statistics	3.14***	13.87***	15.26***	

***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table IV
Pearson Correlation Coefficients

The sample consists of 2,894 firm-years for the period 1994-2000. CINDX follows Caves weighted diversification index, which considers KSIC three digits. CINDX2 measures inter-industry diversification and considers KSIC two digits only. CINDX3 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 affiliation with a numeric value of 1 if chaebol affiliated and zero otherwise.

	CINDX	CINDX2	CINDX3	LASST	RNDPS	SRSTD
CINDX2	0.907***					
CINDX3	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***

***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table V
Logit Regression of Firm Value on Diversification Index

The sample consists of 2,894 firm-years for the period 1994-2000. 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 of γ_1 and γ_2 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. CINDX follows Caves weighted diversification index, which considers KSIC three digits. IND17-IND36 are industry dummy variables and cover a total of twenty-one manufacturing industries from a base industry of food and beverage (KSIC 15) to furniture manufacturer (KSIC 36) in the Korean market except for the tobacco industry which is not included due to the lack of sufficient sample firms.

Independent Variable	Dependent Variable					
	Firm Value/Sales		Firm Value/Assets		Firm Value/EBIT	
	Reg. Coef.	z-value	Reg. Coef.	z-value	Reg. Coef.	z-value
LASST	-0.003	-0.15	-0.222	-12.38***	0.055	3.23***
RNDPS	22.127	9.72***	7.769	4.31***	1.333	1.29
SRSTD	15.099	10.60***	9.764	6.99***	-1.834	-1.35
CINDX	0.026	0.37	-0.138	-2.00**	0.003	0.05
IND17	0.600	5.36***	-0.440	-3.84***	0.047	0.43
IND18	0.224	1.77*	-0.284	-2.28**	-0.440	-3.47***
IND19	-0.406	-1.97**	-0.037	-0.20	0.163	0.87
IND20	0.522	2.15**	-0.271	-1.13	0.106	0.45
IND21	0.513	4.25***	-0.049	-0.41	-0.205	-1.69*
IND22	0.572	2.03**	0.524	1.75*	0.058	0.21
IND23	-1.112	-3.99***	0.295	1.57	0.059	0.32
IND24	0.671	7.56***	-0.125	-1.45	-0.057	-0.67
IND25	0.387	3.00***	-0.200	-1.55	0.034	0.27
IND26	1.126	9.14***	-0.500	-4.02***	0.019	0.16
IND27	0.281	2.71***	0.012	0.12	0.210	2.08**
IND28	0.095	0.59	-0.240	-1.58	0.187	1.23
IND29	0.495	3.96***	0.271	2.17**	0.543	4.37***
IND30	0.055	0.27	0.749	3.55***	-0.256	-1.30
IND31	0.451	3.75***	0.335	2.83***	0.437	3.74***
IND32	0.372	3.53***	0.661	6.17***	0.160	1.58
IND33	1.190	4.65***	0.274	1.10	0.265	1.16
IND34	-0.299	-2.51**	0.258	2.30**	0.378	3.40***
IND35	1.032	4.28***	0.331	1.54	0.075	0.34
IND36	0.675	3.59***	0.268	1.42	0.180	0.96
No. of Obs.	2894		2894		2894	
LR Statistics	526.30***		488.11***		114.43	
Pseudo-R^2	0.09		0.08		0.02	

***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table VI

Logit Regression of Firm Value on Diversification Types by Periods

The sample consists of 2,894 firm-years for the period 1994-2000. 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 of γ_1 and γ_2 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. CINDX2 measures inter-industry diversification and considers KSIC two digits only. CINDX3 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. IND17-IND36 are industry dummy variables and cover a total of twenty-one manufacturing industries from a base industry of food and beverage (KSIC 15) to furniture manufacturer (KSIC 36) in the Korean market except for the tobacco industry which is not included due to the lack of sufficient sample firms.

	Dependent Variable					
	Firm Value/Sales		Firm Value/Assets		Firm Value/EBIT	
Independent Variable	Reg. Coef.	z-value	Reg. Coef.	z-value	Reg. Coef.	z-value
Panel A. Full Period (1994-2000)						
LASST	-0.001	-0.05	-0.223	-12.37***	0.054	3.14***
RNDPS	22.410	9.79***	7.896	4.37***	1.370	1.32
SRSTD	15.138	10.63***	9.764	6.99***	-1.792	-1.32
CINDX2	-0.044	-0.60	-0.182	-2.48**	-0.042	-0.60
CINDX3	0.115	0.52	0.139	0.62	0.355	1.64
No of Observations	2894		2894		2894	
LR Statistics	526.81***		490.82***		117.60	
Pseudo-R^2	0.09		0.08		0.02	
Panel B. Pre-Crisis Period (1994-1996)						
LASST	0.039	1.11	-0.234	-6.85***	0.098	2.91***
RNDPS	26.793	7.00***	9.045	2.91***	6.567	2.26
SRSTD	45.077	5.18***	14.799	1.73	29.927	3.54***
CINDX2	-0.012	-0.10	-0.363	-3.09***	-0.043	-0.38
CINDX3	0.392	1.09	-0.018	-0.05	0.851	2.43**
No of Observations	1146		1146		1146	
LR Statistics	308.77***		189.82***		124.05	
Pseudo-R^2	0.13		0.08		0.05	
Panel C. Post-Crisis Period (1998-2000)						
LASST	0.040	1.54	-0.076	-2.89***	0.124	4.52***
RNDPS	-0.764	-0.55	6.206	2.40**	17.286	4.80***
SRSTD	-10.445	-4.07***	33.610	12.20***	44.981	14.84***
CINDX2	-0.090	-0.84	0.037	0.33	-0.085	-0.76
CINDX3	-0.125	-0.38	0.341	1.01	0.009	0.03
No of Observations	1326		1326		1326	
LR Statistics	64.02		341.95***		364.60***	
Pseudo-R^2	0.02		0.12		0.13	

***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table VII

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

The sample consists of 2,894 firm-years for the period 1994-2000. 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 of γ_1 and γ_2 are estimated using the maximum likelihood method. RNDPS is R&D expenses divided by total sales. SRSTD is standard deviation of daily stock returns. CINDX2 measures inter-industry diversification and considers KSIC two digits only. CINDX3 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. 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 term denotes interaction of diversification index and chaebol dummy. Fifteen industry dummy variables of IND17 through IND36 are included in the regressions but their estimation results are not reported here.

Independent Variable	Dependent Variable					
	Firm Value/Sales		Firm Value/Assets		Firm Value/EBIT	
	Reg. Coef.	z-value	Reg. Coef.	z-value	Reg. Coef.	z-value
Panel A. Full Period (1994-2000)						
RNDPS	22.782	9.90***	5.788	3.51***	1.558	1.49
SRSTD	15.087	10.63***	10.892	7.89***	-2.241	-1.66
CINDX2	-0.009	-0.11	-0.175	-2.24**	-0.020	-0.26
CINDX3	-0.028	-0.12	-0.139	-0.59	0.331	1.41
CINDX2*CB30	-0.216	-1.42	-0.664	-3.99***	-0.018	0.12
CINDX3*CB30	0.825	1.56	0.091	0.18	0.501	1.00
No of Observations	2894		2894		2894	
LR Statistics	530.30***		352.04***		108.879	
Pseudo-R^2	0.09		0.06		0.02	
Panel B. Pre-Crisis Period (1994-1996)						
RNDPS	28.908	7.53***	4.821	1.71*	8.979	3.07***
SRSTD	39.458	5.14***	42.816	5.64***	17.613	2.38**
CINDX2	0.105	0.80	-0.407	-3.22***	0.062	0.49
CINDX3	0.391	0.98	-0.528	-1.37	0.778	2.02**
CINDX2*CB30	-0.379	-1.60	-0.437	-1.77*	-0.289	-1.22
CINDX3*CB30	0.309	0.38	1.492	1.86*	0.903	1.14
No of Observations	1146		1146		1146	
LR Statistics	310.11***		147.52***		117.71	
Pseudo-R^2	0.13		0.06		0.05	
Panel C. Post-Crisis Period (1998-2000)						
RNDPS	18.324	5.02***	6.247	2.42**	-0.702	-0.51
SRSTD	41.036	14.18***	35.190	13.04***	-11.454	-4.61***
CINDX2	-0.013	-0.11	0.078	0.67	-0.068	-0.60
CINDX3	0.043	0.12	0.481	1.34	-0.037	-0.11
CINDX2*CB30	-0.027	-0.10	-0.472	-1.71*	0.018	0.07
CINDX3*CB30	0.877	1.03	-1.552	-1.82*	-0.168	-0.22
No of Observations	1326		1326		1326	
LR Statistics	345.14***		341.99***		61.70	
Pseudo-R^2	0.12		0.12		0.02	

***, **, * Significant at the 1%, 5%, 10% level, respectively.

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.