

# **Spillover Effects within Business Groups: The Case of Korean Chaebols**

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# **Spillover Effects within Business Groups: The Case of Korean Chaebols**

## **Abstract**

We examine the spillover effects that occur within Korean business groups (i.e., chaebols) by focusing on the market reactions of event firms to announcements of credit rating changes. We find that spillovers driven by the market reactions of event firms exist: both positive spillovers (owing to positive market reactions) and negative spillovers (owing to negative market reactions). Our analyses indicate that negative spillovers are more dominant than positive spillovers. Moreover, a spillover driven by a leading firm within a business group has stronger effects on other firms in the group than that driven by a non-leading firm, suggesting that the market evaluation of a business group is conducted more on the basis of a leading firm than a non-leading firm within a group. Finally, we show that the spillover effects analyzed in our study are more noticeable when the business relationship between the event firm and other affiliated firms is closer.

*JEL classification:* G14, G24.

*Keywords:* Credit Rating Change; Event Study; Spillover; Business Group; Chaebol

## **1. Introduction**

This paper investigates the spillover effects within business groups by focusing on the market reactions of firms to announcements of credit rating changes. While the literature on market contagion and spillovers generally examines correlations of financial market responses from an industry perspective, this paper focuses on the idea that group affiliated firms experience co-movements within a business group during contagious events. Chang and Hong (2000) report that in Korea, group-affiliated firms benefit from their group membership through sharing many forms of resources with other member firms. This practice suggests that firms within a Korean business group (i.e., chaebol) maintain significant business ties with other affiliated firms within the group.

Indeed, Bae et al. (2008) delve into the implications of spillover effects within a Korean business group. They report that the earnings announcement by a firm has spillover effects on the stock returns of non-announcing firms within the same group, indicating that there is a relationship between the firms in the same business group. However, in this study, we employ credit rating events instead of earnings announcements. A credit rating is evaluated by outsiders and independent rating agencies, while a numerical value of earnings can be allowably adjusted by insiders of a business group. We focus on spillover effects driven by market participants across firms within a business group, and therefore, announcements concerning credit ratings are more suitable for the purpose of our study. Moreover, credit ratings have become more important for chaebol firms since the 1997 Asian financial crisis. Bereskin et al. (2015) note that governance reforms after the 1997 crisis have caused an increased dependence on external financing, and many of these changes in financing are concentrated in chaebol firms. Therefore,

the announcements of credit rating changes are most suited for examining the phenomena regarding chaebol firms.

We use Korean chaebols because they have certain characteristics that make them especially suitable for the examination of spillover effects within a business group. One particular feature is the heavily concentrated ownership of chaebol firms, which allows the controlling owner to exercise significant control over the entire group. It also allows each chaebol firm to pursue a group level strategy rather than acting as a stand-alone company. Another important feature is the strong business ties between companies in the same chaebol group. They share both the tangible and intangible resources within the same group. For example, Korean chaebols typically set up group-level R&D centers to support sustainable development of the whole group. They share not only technological innovations but also human resource by the transfer of key personnel among affiliates within the group. Internal capital markets within chaebols also play a role in allocating capital in group member firms (Shin and Park, 1999). Lastly, Korean chaebols participate in various industries and influence the Korean economy. They effortlessly participated in diverse industries under the policy support of the government during Korea's rapid economic growth. A diverse set of industries is the basic characteristic of Korean chaebols.

To show the existence of the spillover effects among chaebol-affiliated firms, we examine the relationship between the abnormal returns of an event firm and the abnormal returns of the portfolio of other firms in the same group. Our analyses demonstrate that spillover effects among chaebol-affiliated firms as a result of credit rating changes exist in the stock market. Specifically, we focus on the market reaction of an event firm rather than the event itself. The basic intuition behind these analyses is as follows: Chaebol-affiliated firms experience co-

movements within a business group during firm-specific events because the close relationship between firms in the same group is well known to the market participants. Thus, the abnormal market reaction to an event is more important than characteristics of the event with regard to spillovers within a business group. In other words, whether the market participants view the rating change of an event firm favorably or unfavorably is more meaningful than whether the rating change of the firm is upgraded or downgraded. For example, when the NICE credit rating agency decides to downgrade the credit rating of Hyundai Motor Company, the effect on the stock prices of Hyundai Motor Group members depends on the stock price of Hyundai Motor Company. If the abnormal return of Hyundai Motor Company is positive even though its credit rating was just downgraded, the abnormal returns of Hyundai Motor Group affiliates will also be positive on average. Indeed, our evidence suggests that the market evaluation of a firm by an event plays an important role in determining the characteristics of spillover effects within a business group.

Furthermore, we extend our analyses by comparing negative spillovers (owing to negative market reactions of event firms) with positive spillovers (owing to positive market reactions of event firms). Because the negative events (or bad news) generally have a significant impact on the market participants rather than the positive events (or good news),<sup>1</sup> it could be worth asking if spillover effects driven by the market reactions are asymmetric. Essentially, our results indicate that spillover effects have differential impacts according to the signs of market reactions: Negative spillovers are more dominant than positive spillovers. These findings also

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<sup>1</sup> Under prospect theory (Kahneman and Tversky, 1979), asymmetric reaction to good and bad news can be explained by responding differently to positive and negative perception. In general, people pay more attention to a loss in utility than they do to a gain of equal magnitude. Soroka (2006) notes that responses to positive and negative information are asymmetric: Reactions to negative information are much greater than reactions to positive information.

suggest that market participants react strongly against the concerns for specific events caused by group-affiliated firms.

Korean business groups consist of leading firms that symbolically represent all their chaebol groups. This is generally characterized by their large asset size as well as their highly profitable and mature nature.<sup>2</sup> Not only insiders of a chaebol group but also market investors regard a leading firm as the prominent one in a group. For example, in the case of the Samsung Group, Samsung Electronics should ideally be the leading company because it is the biggest and the most influential firm in the group. This practice suggests that spillovers driven by a leading firm are stronger than those driven by a non-leading firm. Our results conform to this argument as our findings reflect the implications of market perspectives on a business group: Market participants are more interested in a leading firm and also are more sensitive to negative reactions with regard to spillovers within a business group (i.e., negative spillovers are more dominant than positive spillovers).

Finally, we examine the relationship between spillover effects and business relationships within business groups by separating our event samples into two subsamples in terms of whether the levels of business relationships with group member firms are above the median or not.<sup>3</sup> Even though it is rare and ambiguous, some information on the business associations between chaebol firms should be made public under government regulation in Korea. This means that market participants can realize the specific business relations between group member firms. Thus, spillover effects should be more noticeable when an event firm has more business ties with the

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<sup>2</sup> In our study, we define a leading firm as the biggest company in a business group. The list of leading firms is calculated using the book value of total assets every year. To check robustness, we apply alternative criteria of defining a leading firm such as total sales and market value of equity. We obtain qualitatively identical results reported in the paper.

<sup>3</sup> To measure business relationships between event firms and other affiliated firms, we employ diverse variables (e.g., receivables, payables, sales, and purchases, etc.) associated with affiliated firms.

affiliated firms. Consistent with this argument, our results show that the spillover effects analyzed in our study are more dominant when the business association between an event firm and its affiliated firms is closer.

The remainder of this paper is organized as follows: Section 2 presents a review of the related literature and hypothesis development. Section 3 discusses our empirical approach and the associated data, and Section 4 follows with a discussion of our results. Finally, Section 5 presents the concluding remarks.

## **2. Related Literature and Hypothesis Development**

### **2.1 Korean Business Groups: Chaebols**

Business groups are the principle and typical entities managing various businesses. There is considerable literature on business groups. Although business groups can be found all over the world regardless of whether a particular country is developing or not (Morck et al., 2005), Korean business groups (i.e., chaebols) have several distinguishing features that have been discussed in numerous prior studies.

First, chaebols participate in a variety of industries (Ungson et al., 1997) and greatly influence the Korean economy.<sup>4</sup> They account for a large fraction of the economic activity. For

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<sup>4</sup> Chaebols have played an important role in Korea's economic growth since the 1960s. Yoo and Lee (1987) note that Korean chaebols have been able to manage and grow successfully because of their unique characteristics and backgrounds.

example, the chaebol groups had 1,222 member companies and accounted for 56.4% of total assets, 43.5% of total sales, and 69.3% of total net income in Korea, as of 2013.<sup>5</sup>

Second, the ownership structure of a chaebol is heavily concentrated in the hands of owner-managers or founder families that exercise complete control over affiliated firms within a group. These controlling shareholders, rather than professional management, have the discretionary power to make major strategic decisions at the group level (Shin and Park, 1999; Song et al., 2012). Under this structure, such an ownership structure provides the controlling shareholders with an incentive to expropriate other investors in the firm. For example, Bae et al. (2002) show that chaebol firms benefit from acquisitions which provide a way for controlling shareholders so that they increase their wealth by increasing the value of other group firms (i.e., tunneling). Consistent with tunneling within business groups, Baek et al. (2006) also find that chaebol issuers involved in intragroup deals set the offering prices to benefit their controlling shareholders. Moreover, the ownership structure plays an important role in determining whether insiders expropriate minority shareholders (Lemmon and Lins, 2003). Indeed, Baek et al. (2004) shows that chaebol firms exhibited a larger drop in equity value when ownership was concentrated in controlling family shareholders compared to the firms with higher equity ownership by foreign investors during the 1997 Korean financial crisis. Similarly, Joh (2003) finds that poor corporate governance systems affected firm performance for Korean firms before the crisis.

Third, firms within a chaebol maintain considerable business ties with other affiliate firms within the group. Chang and Hong (2000) document that chaebol-affiliated firms are

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<sup>5</sup> In here, the definition of a chaebol follows the guideline of the Korea Fair Trade Commission (KFTC) and the ratios are calculated on the basis of non-financial sectors.



connected by cross-debt guarantees, reciprocal shareholdings, and internal business transactions. Therefore, they benefit from other firms within the same group by sharing intangible and financial resources. Chaebols operate like business units of a large corporation even though the affiliated firms are legally independent (Khanna and Rivkin, 2001; Song et al., 2012).

## **2.2 Korea's Credit Rating Reforms and Chaebols**

The Korean government initiated vigorous reforms for chaebols following the 1997 Asian financial crisis. Although chaebols have played an important role in developing the Korean Economy, their corporate activities have been criticized as one of the primary causes of the financial crisis owing to high leverage on credit allocation, over-investment, and a weak corporate governance structure (Lee et al., 2009). The government's reforms included decreasing the number of business units among the top five chaebols, making the consolidated financial statements public, and solving mutual debt guarantees among member firms (Bae et al., 2008).

One of the important goals of the reforms was the improvement of the credit rating system, which improved the Korean credit rating system significantly, following the financial crisis. Hahm (1999) notes the progress of upgrading the credit information and rating system, which includes strict government management of credit rating agencies, increasing transparency thorough public disclosure, and mandatory credit rating of all marketable debts. Indeed, Oh (2014) observes that the level of competition in the credit rating industry significantly increased following the financial crisis, and that the market structure became an oligopoly in a contestable market, which is economically equivalent to perfect competition.

Prior to the financial crisis, chaebol firms depended mostly on internal financing within chaebols. Shin and Park (1999) find evidence of internal capital markets in chaebols, where the parent or leading company may arrange financing for subsidiaries through cross-payment guarantees and affiliated banks. Almeida et al. (2014) show the workings of internal capital markets in business groups, by investigating the changes in investment by Korean firms during the period of the Asian financial crisis of 1997-1998. Lee et al. (2009) also report that while active internal capital markets existed within chaebols during the early 1990s, they appear to be limited in the post-crisis period. In fact, they demonstrate that internal capital markets within chaebols barely functioned after the 1997 financial crisis, and hence suggest that public debt markets can serve as substitutes for internal capital markets. Bereskin et al. (2015) note that governance reforms after the financial crisis caused an increased dependence on external financing, and that many of these changes in financing were concentrated in chaebol firms. Lim (2006) reports an increase in non-guaranteed corporate bond issuance after the financial crisis, which significantly increased the demand for credit ratings. Consequently, credit ratings became more important to chaebol-firms following the crisis.

### **2.3 Spillover Effects**

There is abundant literature on various transfer channels through which spillover effects within the industry, across industries, across countries, through supply chains, and among counterparties may occur. A prior study by Lang and Stulz (1992) investigates both a contagion effect and a competitive effect in the same industry by using stock price reactions of intra-industry rivals. They find that bankruptcy announcements have a negative impact on the value of

competitors' value-weighted portfolios. Slovin et al. (1999) report contagion and competitive effects in commercial banks. Hertz et al. (2008) further extend this investigation by analyzing the distress and bankruptcy filings of suppliers and customers of filing firms. Jorion and Zhang (2007) demonstrate the information transfer effect of bankruptcy filings over the industry on credit default swap spreads. Jorion and Zhang (2009) also provide the first empirical analysis of credit contagion via direct counterparty effects. They then examine intra-industry spillover effects on the stock market by using the events of bond rating changes in Jorion and Zhang (2010). Hertz et al. (2012) find evidence of an industry contagion effect on non-spread terms in bank loan contracts. Gande and Parsley (2005) and Ismailescu and Kazemi (2010) show that a sovereign credit rating change in one country affects the sovereign credit spread of other countries. Ferreira and Gama (2007) then extend the scope of the investigation to international stock markets. Adams et al. (2014) find that the size and duration of risk spillovers among financial institutions change according to the state of the market by using value-at-risk models. They show that while risk spillovers are small during normal times, equivalent shocks lead to sizable spillover effects during crisis times.

Though prior research on spillover or contagion effects is abundant, there is not much evidence on whether other affiliated firms in the same business group are affected by the event of a firm in a business group. Bae et al. (2008) report the stock-price effects of Korean business groups by using the earnings announcement. They find that announcing an increase (decrease) in earnings by a chaebol-affiliated firm has positive (negative) effects on the abnormal returns of other affiliated firms in the same group.<sup>6</sup> Similarly, with respect to the unique characteristics of

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<sup>6</sup> This positive association between the abnormal returns of chaebol-affiliated firms is stronger if the cash flow right of the announcing firm's controlling shareholder is higher, if the announcing firm is larger, if the announcing firm

chaebol groups, we expect that a specific event involving the credit rating of a chaebol-affiliated firm affects other member firms within a group in the same direction because the close business relationship between group member firms is publicly known.

Evidently, many studies have investigated the credit rating events in terms of abnormal stock or bond returns around an event date (Dichev and Piotrovski, 2001; Hand et al., 1992; Holthausen and Leftwich, 1986; Jorion and Zhang, 2010; Pinches and Singleton, 1978). Our study extends the findings of prior studies by using the announcement of credit rating changes to investigate the spillover effects within a business group. Furthermore, we focus on the market reactions of event firms rather than whether the credit rating changes are upgrades or downgrades because the market participants are more perceptive of the close association between group member firms. Specifically, the market response to the event of a firm is transferred from an event firm to other affiliates. Therefore, the market evaluation of the company for an event is crucial to determine the characteristics of spillover effects. This leads to our first hypothesis:

***Hypothesis 1: The market reaction of the event firm (to a credit rating change) is an important factor in explaining spillover effects within a business group.***

The second hypothesis examines whether negative spillovers and positive spillovers have differential impacts on other affiliated firms. In general, negative events (or bad news) spread intensively when compared to positive events (or good news). Soroka (2006) shows that public responses to negative news are much greater than those to positive news. Using time-series analyses of U.K. media and public opinion, strong evidence is found of asymmetry. Moreover, numerous studies report that negative credit rating events have a significant negative effect on

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performs well in the past, or if it has a higher debt guarantee ratio. These results are consistent with the existence of intragroup propping, which involves capital reallocation within affiliated firms to save a financially troubled affiliate.

stock and bond markets, but positive credit rating events are statistically insignificant. For example, Griffin and Sanvicente (1982) and Holthausen and Leftwich (1986) report this effect with stock market data by using Moody's and S&P rating changes. Norden and Weber (2004) report a summary of the empirical literature relating to the impact of credit rating announcements. Ferreira and Gama (2007) and Gande and Parsley (2005) indicate that the sovereign debt rating of one country has an asymmetric effect on the financial market of other countries. Similarly, we expect that the spillover effects driven by market reactions will be stronger when they are negative than when they are positive. This leads to the second hypothesis:

***Hypothesis 2: Negative spillover effects are stronger than positive spillover effects within a business group.***

An important aspect of Korean chaebols is the role of a leading firm. A leading firm is a representative company of a chaebol group, characterized by its large asset size as well as its profitable and mature nature. Further, a chaebol's leading firm is a symbolic identity in Korea. Therefore, we expect that spillover effects driven by a leading firm are more dominant than those driven by a non-leading firm because market participants pay more attention to leading firms. Based on these conjectures, we posit the third hypothesis:

***Hypothesis 3: The credit rating change driven by a leading firm has stronger spillover effects on other affiliated firms in the same business group than the change driven by a non-leading firm.***

### **3. Data and Empirical Methods**

#### **3.1 Data**

Our data are collected from numerous sources including the following: NICE Information Service Co. and Bloomberg for credit rating data; FnGuide for stock market data; the Korea Fair Trade Commission (KFTC) for chaebol data; and the TS2000 database provided by Korea Listed Companies Association for financial and accounting data.

The primary data set we examine is the list of chaebol-affiliated firms. We define a chaebol according to the guidelines of the KFTC, which has announced the list of chaebol groups annually since 1986 under the terms of the Fair Trade Act. The KFTC defines a chaebol in two steps: (1) stock ownership by controlling shareholders with the proportion of relevant persons greater than 30%; and (2) the total assets of the affiliated firms in the group (Almeida et al., 2014; Joe and Oh, 2015). Our sample consists of listed firms affiliated with chaebols from 2001 to 2013. Since we focus on the spillover effects of credit rating announcements within a business group, each event firm needs to have at least one or more listed affiliated firms, excluding itself. The list of chaebol groups with chaebol-affiliated firms varies every year depending on the criteria set by KFTC. For example, the KFTC announced the 30 largest chaebol groups each year from 1986 to 2001 but then started using a new criterion by including any group with total assets greater than a specific amount. This amount was two trillion won from 2002 to 2007 and five trillion won from 2008 onwards (Joe and Oh, 2015). As a result, we decide whether the event firm is a chaebol firm or not according to the time of the event; for example, the Tong-Yang Group was excluded from the 2013 chaebol list. If the credit rating of a Tong-Yang affiliated

firm was downgraded in 2013, we eliminate this event from our sample. However, if the credit rating downgrade occurs before 2013, we include this event in our sample.

Our other major dataset is the announcement of credit rating changes. There are four local credit rating agencies in Korea: National Information & Credit Evaluation (NICE), Korea Investor Services (KIS), Korea Ratings (KR), and Seoul Credit Rating & Information (SCI).<sup>7</sup> However, SCI specializes in rating asset-backed securities (ABS), and NICE, KIS, and KR accounted for almost 99.96% of the total sales in Korea's credit rating industry as of 2014. Thus, in our study, we focus on the credit ratings evaluated by NICE, KIS, and KR.

Table 1 describes the scale of the rating levels for both the Korean main rating agencies (i.e., NICE, KIS, and KR) and the top three global rating agencies (i.e. Moody's, S&P, and Fitch). This table indicates that the categories for credit ratings are very similar to each other. Korean domestic credit rating agencies also have provided information on Credit Watch and Outlook listings of firms in earnest since the mid-2000s. However, we exclude them in the rating sample because the number of events is too small to examine statistically.

**[Insert: Table 1]**

The rating files are directly provided by NICE Information Service Co., and are also compiled from Bloomberg.<sup>8</sup> There were 2,975 credit rating change events announced by credit rating agencies during 2001-2013. We subsequently exclude the events of non-chaebol firms and financial companies, and eliminate duplicate events, a close sequence of events, and withdrawn announcements. To focus on the contagion of credit rating change events, we exclude other firm-

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<sup>7</sup> KIS and KR are affiliated firms of Moody's and Fitch, respectively.

<sup>8</sup> NICE Information Service Co. covers two-thirds of the credit rating of rating files in Korea. To investigate the impact of credit rating events more extensively than in prior studies, we collect credit rating events via two channels, NICE Information Service Co. as well as Bloomberg.

specific information such as earnings announcements, M&As, and SEOs within nine business days (-4,4) of the event date of the credit rating changes.<sup>9</sup> Last, because we analyze spillover effects on the stock market, information on the daily stock returns needs to be available for each event firm. These screens generate a final sample of 359 events.

We also divide our event samples into two subsamples: the announcements of leading firms and non-leading firms. A “leading firm” denotes a firm representing a business group, which is characterized by a large, profitable, and mature firm. In our study, we simply define a leading firm as the biggest company (in terms of the book value of total assets) in a business group every year.<sup>10</sup>

Table 2 presents the frequency distribution of credit rating change events in our sample. Panel A of Table 2 reports the number of events by year and by event firm characteristics (i.e., whether the event firm is a leading firm or not). Among all the credit events, the leading firms account for 28.7% of the total number of samples (i.e., 103 events out of 359 events). Panel B of Table 2 shows the distribution of the sample according to business groups, organized by the number of events. The first column lists the names of business groups; the second lists the number of credit rating change events made by the firms belonging to each business group; the third lists the names of the leading firms matched with the business groups on the same line as of 2013. Among the business groups, Hyundai Motor, Samsung, LG, Kumho Asiana, and SK groups have a relatively large number of credit rating change events. These top 5 groups occupy 49.0% of the total events (i.e., 176 events out of 359 events).

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<sup>9</sup> We apply these screening criteria for both event firms and other member firms within the same groups.

<sup>10</sup> We employ other criteria to define a leading firm by using the market value of equity and total sales instead of the book value of total assets. However, more than 90% of firms in our sample remain intact. For example, when total sales are used instead, 93.04% of all samples remain unchanged.



**[Insert: Table 2]**

Table 3 shows the summary statistics of the variables for our sample of 359 event firms. The mean (median) book value of total assets is ₩4,940 (2,850) billion. The mean return on assets (ROA), which is calculated by net income to total assets is 0.3%. However, the distribution of ROA is highly skewed, with a median of 3.4%. The mean (median) leverage is 59.6% (59.8%), and the market to book ratio is 1.39 (1.07). The mean (median) ratio of R&D expenditures to total sales is 0.7% (0.1%) and that of cash holdings to total assets is 4.6% (3.5%).

**[Insert: Table 3]**

Table 3 also presents the descriptive statistics of our event firms in the two subsamples: leading firms and non-leading firms. The mean ROA of leading firms is 1.9%. In contrast, the ROA of non-leading firms is, on average, -0.4%. The mean market to book ratio of leading firms is lower than that of non-leading firms, which indicates that the characteristic of a leading firm is closer to a value firm rather than a growth firm. These results imply that leading firms are more profitable and mature than non-leading firms. This is consistent with the result that the mean ratio of R&D expenditure of leading firms is lower than that of non-leading firms.<sup>11</sup>

### **3.2 Methodology**

We employ the standard event study methodology (Brown and Warner, 1985) that calculates the abnormal returns (ARs) and the cumulative abnormal returns (CARs) for event firms using the market model following the event date of credit rating changes, and that also

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<sup>11</sup> The growth firm invests more in R&D than the value firm.

estimates the ARs and CARs for non-event firms in the same business group using the portfolio approach.<sup>12</sup> The AR for the stock of firm  $i$  at time  $t$  is defined as follows:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}),$$

where  $R_{it}$  and  $R_{mt}$  are the daily returns for the stock of event firm  $i$  at time  $t$  and the daily market index (KOSPI) return at time  $t$ , respectively. The parameters  $(\hat{\alpha}_i, \hat{\beta}_i)$  are estimated by ordinary least squares (OLS) market model regressions using a 180-trading-day estimation period ending 20 days prior to the event day. We calculate the CAR between dates  $t_1$  and  $t_2$  by adding the ARs from day  $t_1$  to day  $t_2$ . We basically compute the CARs of non-event affiliated firms in the business groups by using equal-weighting rather than value-weighting to effectively grasp the spillover effects within business groups.<sup>13</sup>

## 4. Empirical Results

### 4.1 Spillover Effects within Business Groups

Table 4 shows that the spillover effects driven by the market reactions of event firms exist. We report the mean two-day CAR (0,1) and five-day CAR (0,4) for both the event firms and other affiliated firms in the same business groups. We classify our event samples into the two subsamples according to the sign of the CARs of event firms to show the market reactions to credit rating changes. The subsample in Panel A includes event firms with a negative CAR,

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<sup>12</sup> We closely follow the empirical approach used by Bae et al. (2008).

<sup>13</sup> To check the robustness of our results, we repeat our analyses by using value-weighted CARs and find that our main conclusions remain intact.

while the subsample in Panel B includes event firms with a positive CAR. We test the statistical significance of CARs for event firms and other affiliates.

**[Insert: Table 4]**

The results show that the average two-day and five-day CARs of the event firms with negative market reactions to credit rating changes are -3.18% and -5.68%, respectively, which are significant at the 1% level. The average two-day and five-day CARs of the other corresponding affiliated firms show significant average excess returns of -0.83% and -1.77%, respectively. In contrast, the average two-day and five-day CARs of the event firms with positive market reactions to credit rating changes are 2.93% and 5.56%, respectively, which are significant at the 1% level. The average two-day CAR of the corresponding other affiliated firms shows average excess returns 0.30%, and is not statistically significant. The average five-day CAR of the corresponding other affiliated firms shows average excess returns of 1.53%, which is significant at the 1% level. These findings suggest that a credit rating change of a firm in a business group has spillover effects on the other affiliated firms within the group.

In Table 5, by conducting regressions, the market reaction of an event firm is shown to be an important factor in explaining spillover effects within a business group. We use the five-day CAR (0,4) of non-event affiliated firms in the business groups as the dependent variable. Our key explanatory variable of interest is “Market Reaction,” which is the five-day CAR (0,4) of the event firm. In regression (1), Market Reaction is used as the independent variable. In regressions (2) and (3), we add firm-level explanatory variables that are listed in Table 3 as well as “Credit Rating,” which denotes the credit rating of the event firm.<sup>14</sup> In regressions (4) and (5), we add

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<sup>14</sup> Table 1 describes categories for credit ratings as well as the numerical scale used in our analyses.

not only firm-level explanatory variables but also group-level explanatory variables. Regressions (3) and (5) are similar to (2) and (4), with the exception of year and industry fixed effects.<sup>15</sup>

**[Insert: Table 5]**

In our regression analyses, we focus on the five-day CAR (0,4) rather than the CAR of the short event periods such as the two-day CAR (0,1), because it might take time to be reflected in the market by an event. This is consistent with the conventional wisdom that emerging markets including the Korea market are less efficient than developed markets (i.e., weak-form efficient markets). The daily price limit in the Korea Stock Exchange which is 15% for all stocks is one of examples impeding market efficiency.<sup>16</sup> Bae et al. (2008) note that these price limit rules suggest that market participants might have continued to react even after the announcements. Indeed, almost 50 percent of our events experience (i.e., 176 events out of 359 events) the daily price limits of at least one more firms.

Moreover, using an ex post event windows such as the five-day CAR (0,4) helps analyze spillovers driven by the market reactions of event firms instead of the windows including ex ante periods like the CAR (-4,4). Our study focuses on the market reaction to the announcement of a credit rating change rather than the event itself. In general, ex ante periods are used on the assumption that the information of the event can be leaked before the announcement. As a result, using the five-day CAR (0,4) is the adaptive way to examine the spillover effects driven by the market reaction.<sup>17</sup>

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<sup>15</sup> In our regression analyses, we basically report the standard errors clustered at the group level in parentheses. We check that our results are robust to the different levels of clustering (i.e., industry and year clustering).

<sup>16</sup> Korea Stock Exchange introduced the upper and lower limits of daily stock prices in 1998.

<sup>17</sup> Analyses are also performed using the event windows (-4,4), (-1,1), (0,1) to check the robustness of our results. We find that our main conclusions remain intact.

We find that the coefficients for Market Reaction are positive and statistically significant at the 5% level for all five regressions. For example, the estimated coefficient for Market Reaction in regression (5) is approximately 0.57. That is, all else being constant, a 1% of increase in the market reaction of the event firm results in about 0.57% increase in the CARs of other group members. This result is consistent with the view that the market evaluation of the event firm plays an important role in determining the characteristics of spillover effects.

#### **4.2 Negative Spillovers vs. Positive Spillovers**

In this section, we demonstrate that spillovers driven by negative market reactions are more dominant than those driven by positive market reactions. Table 6 reports the regression estimates. In regressions (1) through (4), we include the indicator “Positive Reaction,” which takes the value of one if the market reaction of an event firm is positive, and zero otherwise. The coefficients for Positive Reaction are significantly negative for all regressions and statistically significant at least at the 10% level. We also add the interaction term between the Market Reaction and the Positive Reaction. The coefficients for the interaction term are negative and significant at least at the 5% level. These results suggest that negative spillovers (owing to negative market reactions) are stronger than positive spillovers (owing to positive market reactions).

**[Insert: Table 6]**

#### **4.3 Leading Firms vs. Non-Leading Firms**

Table 7 shows the impact of leading firms in the spillover effect by dividing our event samples into the two subsamples in terms of whether or not they are leading firms in the business groups. Specifically, Panel A of Table 7 shows the spillover effects driven by the credit rating changes of leading firms. In contrast, Panel B of Table 7 reports that the credit rating changes of non-leading firms lead to spillover effects on other affiliated firms in the business group.

**[Insert: Table 7]**

For leading firms, the mean CARs of other affiliated firms in the same business groups are statistically significant in all cases. Panel A of Table 7 indicates that the mean two-day and five-day CARs of the event firms with negative market reactions to credit rating changes are -2.96% and -5.44%, respectively, which are significant at the 1% level. The mean two-day and five-day CARs of the corresponding other affiliated firms show significant average excess returns of -1.03% and -2.67%, respectively. In addition, the average two-day and five-day CARs of the event firms with positive market reactions to credit rating changes are 2.93% and 6.10%, respectively, which are significant at the 1% level. The mean two-day and five-day CARs of the corresponding other affiliated firms show significant average excess returns of 1.26% and 3.91%, respectively.

In contrast, for non-leading firms, the magnitude of mean CARs of other affiliated firms is relatively small, and significant test results do not exist in some cases. In particular, Panel B of Table 7 notes that the average two-day and five-day CARs of the event firms with positive market reactions to credit rating changes are 2.93% and 5.38%, respectively. The average two-day and five-day CARs of the corresponding other group members are not statistically significant. These results suggest that spillover effects caused by a leading firm are stronger than

those caused by a non-leading firm. There is a big difference between them particularly in the case of positive spillovers.

We further conduct regression analyses, and the results are summarized in Table 8. We employ the indicator “Leading Firm,” which takes on the value of one if the event is driven by a leading firm, and zero otherwise. We also include an interaction term between the Market Reaction and the Leading Firm. The coefficients for the interaction term are significantly positive for all regressions, suggesting that the positive relation between the excess returns for the event firms and the excess returns for the other affiliated firms is stronger when the event firms are leading firms. This result is consistent with the view that the credit rating event driven by a leading firm has stronger spillover effects on other affiliated firms in the business group than the event driven by a non-leading firm.

**[Insert: Table 8]**

#### **4.4 Spillover Effects and Business Relationships within Business Groups**

Table 9 shows that the spillover effects analyzed in our study are more dominant when the business relationship between an event firm and affiliated firms is closer. To measure the extent of a business relationship, we employ diverse variables: “Receivable” (i.e., the ratio of the amount of receivables associated with affiliated firms to total assets of an event firm), “Payable” (i.e., the ratio of the amount of payables related to affiliated firms to total assets of an event firm), “Sales” (i.e., the ratio of the amount of sales to affiliated firms divided by the total sales of an event firm), “Purchases” (i.e., the ratio of the amount of purchases from affiliated firms divided

by the total sales of an event firm), “Debt Guarantee” (i.e., the ratio of the amount of debt guarantee for affiliated firms to total debt of an event firm), “Collateral” (i.e., the ratio of the amount of collateral for affiliated firms to total debt of an event firm), and “Ownership” (i.e., the ratio of the total amount of equity investment to affiliated firms and equity participation by affiliated firms divided by the entire market value of equity). By using these variables, we construct each dummy variable that takes the value of one if each variable is above its cross-sectional median, and zero otherwise.

**[Insert: Table 9]**

First, we simply repeat our prior regression analysis which is (5) of Table 5 by including a dummy variable which measures the level of a business relationship and an interaction term between the dummy variable and the Market Reaction. In Panel A of Table 9, the coefficients for interaction terms are positive for all regressions and six out of seven coefficients are statistically significant. Specifically, the spillover effects driven by market reactions are stronger when the firms possess a large amount of receivables or payables associated with affiliated firms, when the firms provide a relatively large amount of collateral or debt guarantee for the same group members, when the purchases from affiliated firms are higher, and when the firms have large ownerships associated with other member firms.

Next, in Panels B and C of Table 9, we repeat prior regression analyses which are (2) of Table 6 and (2) of Table 8 by dividing our event samples into two subsamples based on whether the levels of business relationships (i.e., seven dummy variables) are high or low.<sup>18</sup> Specifically,

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<sup>18</sup> In these analyses, the fixed effects cannot be considered due to the limitation of sample number. That is, our regression models are not well specified because the number of each subsample is not high enough to apply the fixed effects.



the regressions of odd numbers in Panels B and C are performed with the event firms which have relatively close business ties with affiliates. In contrast, the samples of the regressions of even numbers in Panels B and C include the event firms which have weaker business connections with other group members on average. Panel B of Table 9 shows that the coefficients for interaction terms are lower in most cases (i.e., five out of seven) and those for Positive Reaction are significantly negative and lower in all cases when the levels of business relationships are high. Besides, the values of Adjusted R-Squared are overwhelmingly larger in the regression models of odd numbers. In Panel C of Table 9, most coefficients for interaction terms and all Adjusted R-Squared values are higher when each dummy variable in regard to a business relationship is equal to one. Overall, the results of Table 9 imply that the business relationship between group affiliated firms is one of the important factors to explain the spillover effects within business groups.

## **5. Concluding Remarks**

This paper provides evidence on the spillover effects within Korean business groups (i.e., chaebols). We document a statistically significant positive association between the abnormal returns of event firms and the abnormal returns of the portfolios consisting of other group members after the announcements of event firms' credit rating changes. The market evaluation of a credit rating change event is an important factor rather than the event itself in understanding the determinants of spillover effects in the group. Further, we find that spillover effects have differential impacts according to the signs of market reactions: On average, negative spillovers (owing to negative market reactions) are more dominant than positive spillovers (owing to

positive market reactions) regardless of whether the credit rating changes are upgrades or downgrades. We also find that a spillover driven by a leading firm of a business group has stronger effects on other firms in the group than that driven by a non-leading firm, which supports the idea that the market evaluation of a chaebol is conducted more on the basis of a leading firm than a non-leading firm. Finally, we show that the spillover effects analyzed in our study are more noticeable if the business relationship between business group members is closer.

In short, our empirical findings suggest important implications on the understanding of the spillover effects within a Korean business group and on the role of a leading firm of the group in the market.

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**Table 1: Credit Rating Scale**

This table describes the categories used for credit ratings to compare the Korean domestic agencies with the global rating agencies and also presents the numerical scale used in the paper.

Rating Agency			Numerical Value Assigned
Korea	Global		
NICE, KIS, KR	Moody's	S&P, Fitch	
AAA	Aaa	AAA	22
AA+	Aa1	AA+	21
AA	Aa2	AA	20
AA-	Aa3	AA-	19
A+	A1	A+	18
A	A2	A	17
A-	A3	A-	16
BBB+	Baa1	BBB+	15
BBB	Baa2	BBB	14
BBB-	Baa3	BBB-	13
BB+	Ba1	BB+	12
BB	Ba2	BB	11
BB-	Ba3	BB-	10
B+	B1	B+	9
B	B2	B	8
B-	B3	B-	7
CCC+	Caa1	CCC+	6
CCC	Caa2	CCC	5
CCC-	Caa3	CCC-	4
CC	Ca	CC	3
C	C	C	2
D	D	D	1

## Table 2: Number of Credit Rating Change Events

The table below shows the number of credit rating change events in our sample. Each event is driven by non-financial firms in Korean business groups listed on the Korean Stock Exchange between 2001 and 2013. A “leading firm” is defined as the firm whose book value of total assets is the highest in the group. Panel A summarizes the distribution of the sample by year and by characteristics of event firms (i.e., whether the event firm is a leading firm or not). Panel B reports the number of credit rating change events by business groups, organized by the number of events, and also shows leading firms in the business groups as of 2013.

### Panel A: Sample Distribution by Year and by Event Firm Characteristics

Year	Number of Events		
	Total	Leading Firms	Non-Leading Firms
2001	29	7	22
2002	25	9	16
2003	34	9	25
2004	21	8	13
2005	25	1	24
2006	15	5	10
2007	21	4	17
2008	33	17	16
2009	36	6	30
2010	41	10	31
2011	23	6	17
2012	24	8	16
2013	32	13	19
Total	359	103	256

**Panel B: Sample Distribution by Business Groups with Their Leading Firms**

Business Group	Number of Events	Leading Firm within the Business Group
Hyundai Motor	45	Hyundai Motor Company
Samsung	40	Samsung Electronics
LG	33	LG Electronics
Kumho Asiana	31	Asiana Airlines
SK	27	SK Corporation
Hyundai	18	Hyundai Merchant Marine
Daelim	16	Daelim Industries
Doosan	11	Doosan Heavy Industries
Dongbu	9	Dongbu Steel
Taihan Electronic Wire	8	Taihan Electronic Wire
Youngpoong	8	Korea Zinc
Dongkuk Steel	7	Dongkuk Steel
Seah	7	Seah Corporation
LS	7	LS Corporation
Hanjin	7	Korean Air
Hyundai Heavy Industries	7	Hyundai Heavy Industries
Tongyang	6	Tongyang Cement & Energy Corporation
Lotte	6	Lotte Shopping
Shinsegae	6	E-MART
C&	6	C& Heavy Industries
CJ	6	CJ Corporation
GS	6	GS Corporation
KEPCO	5	KEPCO
Kolon	4	Kolon Industries
POSCO	4	POSCO
Hyundai Department Store	4	Hyundai Department Store
Hyosung	4	Hyosung Corporation
Daesung	3	Daesung Industrial
Hanhwa	3	Hanhwa Corporation
KT	3	KT
Taekwang	3	Taekwang Industrial
Hansol	2	Hansol Paper
Hanjin Heavy Industries	2	Hanjin Heavy Industries Corporation
Hyundai Development	2	Hyundai Development Company
Orion	1	Orion Corporation
KCC	1	KCC Corporation
Taeyoung	1	Taeyoung Engineering & Construction
<b>Total</b>	<b>359</b>	



**Table 3: Summary Statistics of Event Firms' Characteristics**

The table below shows the summary statistics of event firms (credit rating changes) in our sample. Total Asset is the book value of total asset (billion ₩). Size, ROA, Leverage, M/B, R&D, and Cash are calculated by market value of equity, net income to total assets, total debt to total assets, market value of equity to book value of equity, R&D to sales, and cash to total assets, respectively.

Variables	Full Sample	Leading Firms	Non-Leading Firms	Difference t-test
	Mean (Median)	Mean (Median)	Mean (Median)	
Total Asset	4,940.0 (2,850.0)	7,800.0 (4,540.0)	3,800.0 (2,000.0)	4.15***
Size	3,254.2 (1,172.5)	4,638.7 (1,791.0)	2,697.1 (940.5)	1.96**
ROA	0.003 (0.034)	0.019 (0.043)	-0.004 (0.033)	1.81*
Leverage	0.596 (0.598)	0.614 (0.620)	0.589 (0.590)	1.07
M/B	1.39 (1.07)	1.25 (1.05)	1.44 (1.12)	1.72*
R&D	0.007 (0.001)	0.004 (0.001)	0.009 (0.001)	3.09***
Cash	0.046 (0.035)	0.044 (0.028)	0.046 (0.035)	0.52

**Table 4: Spillover Effects within Business Groups**

This table presents the spillover effects driven by the market reactions of event firms. The average two-day and five-day CARs are reported for both the event firms and other affiliate firms in the same business group. We classify our event samples into two subsamples according to the sign of the CARs of event firms. The subsample in Panel A includes event firms with negative CARs (negative spillovers), and the subsample in Panel B includes event firms with positive CARs (positive spillovers). Significance at the 10%, 5%, and 1% levels is indicated by \*, \*\*, and \*\*\*, respectively.

**Panel A: Negative Reactions of Event Firms (Negative Spillovers)**

Event Windows	Event Firms			Other Affiliates in Business Groups		
	N	CAR	t-stat.	N	CAR	t-stat.
Two-day CAR (0,1)	204	-3.18	-13.49***	204	-0.83	-3.41***
Five-day CAR (0,4)	206	-5.68	-10.50***	206	-1.77	-3.40***

**Panel B: Positive Reactions of Event Firms (Positive Spillovers)**

Event Windows	Event Firms			Other Affiliates in Business Groups		
	N	CAR	t-stat.	N	CAR	t-stat.
Two-day CAR (0,1)	155	2.93	10.84***	155	0.30	1.16
Five-day CAR (0,4)	153	5.56	11.03***	153	1.53	2.81***

**Table 5: The Role of Market Reactions in Spillovers**

This table presents estimates of OLS regressions with dependent variables of five-day CARs for non-event firms in business groups. The independent variables with regard to an event firm are Market Reaction (i.e., five-day CARs for the event firms in business groups); Size (i.e., the natural logarithm of the market value of equity); ROA (i.e., the ratio of net income to total assets); Leverage (i.e., the ratio of total debt to total assets); M/B (i.e., the ratio of the market value of equity to the book value of equity); R&D (i.e., the ratio of R&D expenditures to total sales); Cash (i.e., the ratio of cash to total assets); Credit Rating (i.e., the level of original credit rating of the event firm, with higher values indicating lower credit rating). The independent variables in regard to a business group are Number of Affiliates (i.e., the number of group member firms); Group Size (i.e., the mean Size of a business group); Group ROA (i.e., the mean ROA of a business group); Group Leverage (i.e., the mean Leverage of a business group); Group M/B (i.e., the mean M/B of a business group); Group R&D (i.e., the mean R&D of a business group); and Group Cash (i.e., the mean Cash of a business group). The standard errors reported in parentheses are robust and clustered at group level. \*\*\*, \*\*, and \* denote the significance of the parameter estimates at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Using Five-day CAR (0,4) as Dependent Variables				
Market Reaction	0.516*** (0.187)	0.554** (0.207)	0.554** (0.216)	0.562** (0.220)	0.568** (0.229)
Size		0.429 (0.392)	0.270 (0.485)	0.393 (0.495)	0.212 (0.568)
ROA		-9.608*** (3.004)	-9.457** (4.098)	-9.868*** (3.197)	-9.102** (4.303)
Leverage		1.625 (2.763)	2.339 (3.476)	1.786 (2.516)	2.466 (2.819)
M/B		-0.351 (0.222)	-0.288 (0.330)	-0.434 (0.279)	-0.311 (0.333)
R&D		5.707 (12.478)	6.843 (8.157)	1.990 (13.284)	-5.117 (10.317)
Cash		-1.228 (7.350)	-0.901 (6.070)	-1.774 (7.128)	-2.660 (5.863)
Credit Rating		-0.080 (0.179)	-0.028 (0.149)	-0.033 (0.192)	0.044 (0.164)
Number of Affiliates				-0.056* (0.028)	-0.417* (0.229)
Group Size				0.048 (0.351)	-0.142 (0.669)
Group ROA				0.785 (13.382)	0.431 (15.890)
Group Leverage				-6.339 (5.373)	-6.894 (5.452)
Group M/B				-0.170 (0.374)	-0.365 (0.421)
Group R&D				-39.075 (81.259)	-92.114 (88.517)
Group Cash				5.056 (20.145)	12.896 (21.376)

Constant	0.183 (0.272)	-3.986 (7.452)	-2.030 (9.263)	-3.480 (9.644)	0.602 (17.025)
Adjusted R-Squared	0.408	0.406	0.392	0.400	0.393
Observations	359	347	347	345	345
Chaebol Fixed Effects		Yes	Yes	Yes	Yes
Year Fixed Effects			Yes		Yes
Industry Fixed Effects			Yes		Yes

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**Table 6: Negative Spillovers vs. Positive Spillovers**

This table shows that spillovers driven by negative market reactions are more dominant than those driven by positive market reactions. All variables are defined in Table 5 with the exception of (1) Positive Reaction, which is an indicator variable equal to one if the market reaction of an event firm is positive, and zero otherwise; and (2) the interaction term between the Market Reaction and the Positive Reaction. The standard errors reported in parentheses are robust and clustered at group level. \*\*\*, \*\*, and \* denote the significance of the parameter estimates at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Using Five-day CARs (0,4) as Dependent Variables				
Market Reaction: a	0.829*** (0.193)	0.823*** (0.222)	0.859*** (0.219)	0.857*** (0.228)
Positive Reaction (indicator): b	-3.543** (1.709)	-3.683** (1.718)	-3.936* (2.037)	-4.051** (1.997)
a * b	-0.380*** (0.116)	-0.358*** (0.124)	-0.402** (0.151)	-0.379** (0.153)
Size	0.364 (0.261)	0.339 (0.309)	0.013 (0.437)	-0.052 (0.527)
ROA	-8.622*** (3.006)	-8.221** (3.408)	-7.400 (5.117)	-6.696 (5.381)
Leverage	1.825 (1.910)	2.269 (1.740)	1.839 (2.811)	2.185 (2.619)
M/B	-0.233 (0.253)	-0.323 (0.218)	-0.075 (0.303)	-0.157 (0.309)
R&D	0.447 (9.139)	1.181 (9.789)	0.542 (6.727)	-13.244 (9.413)
Cash	-2.890 (6.754)	-4.904 (6.995)	-4.698 (6.241)	-6.393 (6.120)
Credit Rating	-0.061 (0.128)	-0.019 (0.137)	-0.076 (0.141)	-0.022 (0.156)
Number of Affiliates	-0.024 (0.018)	-0.026 (0.022)	-0.203 (0.147)	-0.310* (0.184)
Group Size		0.285 (0.213)		-0.245 (0.555)
Group ROA		-2.168 (9.687)		0.103 (14.854)
Group Leverage		-1.378 (3.032)		-7.066 (5.249)
Group M/B		0.036 (0.104)		-0.170 (0.351)
Group R&D		-46.705** (21.193)		-129.841 (84.828)
Group Cash		-4.820 (9.652)		-0.131 (14.742)
Constant	-1.498 (4.702)	-4.377 (5.069)	4.825 (7.764)	12.161 (14.806)
Adjusted R-square	0.487	0.481	0.472	0.468

Observations	347	345	347	345
Chaebol Fixed Effects			Yes	Yes
Year Fixed Effects			Yes	Yes
Industry Fixed Effects			Yes	Yes

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**Table 7: Spillover Effects within Business Groups (Leading Firms vs. Non-Leading Firms)**

This table shows spillover effects driven by the market reactions of event firms by dividing our samples into the two subsamples according to whether or not they are “leading firms” in their business groups. Panel A shows spillover effects driven by the credit rating changes of leading firms, and Panel B shows spillover effects driven by the credit rating changes of non-leading firms. Each panel is methodologically equal to that of Table 4. Significance at the 10%, 5%, and 1% level is indicated by \*, \*\*, and \*\*\*, respectively.

**Panel A: Spillover Effects Driven by Leading Firms**

	Event Windows	Event Firms			Other Affiliates in Business Groups		
		N	CAR	t-stat.	N	CAR	t-stat.
Negative Spillovers	Two-day CAR (0,1)	62	-2.96	-7.66***	62	-1.03	-2.29**
	Five-day CAR (0,4)	65	-5.44	-4.84***	65	-2.67	-2.30**
Positive Spillovers	Two-day CAR (0,1)	41	2.93	5.69***	41	1.26	1.94*
	Five-day CAR (0,4)	38	6.10	5.72***	38	3.91	2.54**

**Panel B: Spillover Effects Driven by Non-Leading Firms**

	Event Windows	Event Firms			Other Affiliates in Business Groups		
		N	CAR	t-stat.	N	CAR	t-stat.
Negative Spillovers	Two-day CAR (0,1)	142	-3.27	-11.14***	142	-0.75	-2.56**
	Five-day CAR (0,4)	141	-5.78	-9.67***	141	-1.36	-2.51**
Positive Spillovers	Two-day CAR (0,1)	114	2.93	9.20***	114	-0.04	-0.17
	Five-day CAR (0,4)	115	5.38	9.40***	115	0.75	1.49

**Table 8: Leading Firms vs. Non-Leading Firms**

This table shows that spillovers driven by leading firms are more dominant than those driven by non-leading firms. All variables are defined in Table 5, with the exception of (1) Leading Firm, which is an indicator variable equal to one if the event firm is a leading firm, and zero otherwise; and (2) the interaction term between the Market Reaction and the Leading Firm. The standard errors reported in parentheses are robust and clustered at group level. \*\*\*, \*\*, and \* denote the significance of the parameter estimates at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Using Five-day CARs (0,4) as Dependent Variables				
Market Reaction: a	0.408** (0.177)	0.400** (0.186)	0.426** (0.204)	0.423* (0.221)
Leading Firm (indicator): b	0.438 (0.744)	1.183 (1.014)	2.296* (1.201)	2.338* (1.173)
a * b	0.357*** (0.078)	0.368*** (0.079)	0.357*** (0.096)	0.391*** (0.109)
Size	0.480** (0.221)	0.297 (0.368)	-0.109 (0.552)	-0.065 (0.617)
ROA	-6.027* (3.013)	-6.782* (3.446)	-7.696* (4.201)	-6.367* (3.702)
Leverage	1.239 (2.061)	1.809 (1.917)	1.605 (3.147)	2.564 (2.547)
M/B	-0.419*** (0.144)	-0.438** (0.182)	-0.088 (0.306)	-0.139 (0.298)
R&D	6.129 (9.075)	8.373 (11.442)	8.768 (12.195)	-3.463 (11.118)
Cash	-2.74 (6.730)	-6.12 (7.703)	-1.90 (5.528)	-3.96 (5.456)
Credit Rating	0.04 (0.125)	0.04 (0.127)	-0.08 (0.147)	0.00 (0.161)
Number of Affiliates	-0.01 (0.016)	-0.01 (0.024)	-0.278* (0.148)	-0.34 (0.201)
Group Size		0.552** (0.257)		0.357 (0.595)
Group ROA		-0.644 (10.196)		-1.732 (15.634)
Group Leverage		-2.98 (3.132)		-6.13 (4.817)
Group M/B		0.059 (0.097)		-0.115 (0.370)
Group R&D		-49.381** (23.203)		-121.194 (88.624)
Group Cash		-1.558 (9.402)		6.838 (19.974)
Constant	-7.081* (3.726)	-10.402** (3.957)	5.416 (10.399)	-0.864 (16.679)
Adjusted R-square	0.459	0.459	0.444	0.447



Observations	347	345	347	345
Chaebol Fixed Effects			Yes	Yes
Year Fixed Effects			Yes	Yes
Industry Fixed Effects			Yes	Yes

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**Table 9: Spillover Effects and Business Relationships within Business Groups**

These tables show that the spillover effects driven by the market reactions of event firms are more dominant if the business relationship between an event firm and affiliated firms is closer. The variables to measure the level of a business relationship are Receivable (i.e., the amount of receivables associated with affiliated firms to total assets of an event firm), Payable (i.e., the amount of payables related to affiliated firms to total assets of an event firm), Sales (i.e., the amount of sales to affiliated firms divided by the total sales of an event firm), Purchases (i.e., the amount of purchases from affiliated firms divided by the total sales of an event firm), Debt Guarantee (i.e., the amount of debt guarantee for affiliated firms to total debt of an event firm), Collateral (i.e., the amount of collateral for affiliated firms to total debt of an event firm), and Ownership (i.e., the amount of equity investment to affiliated firms and equity participation by affiliated firms divided by the entire market value of equity). By using these variables, we construct each indicator variable that takes the value of one if each variable is above its cross-sectional median, and zero otherwise. In Panel A, all regressions are repeated by including indicator variables and interaction terms between the indicator variables and the Market Reaction. All regressions in Panel B and C are repeated by dividing our event samples into two subsamples based on whether the levels of business relationships (i.e., seven indicator variables) are high or low. The standard errors reported in parentheses are robust and clustered at group level. \*\*\*, \*\*, and \* denote the significance of the parameter estimates at the 1%, 5%, and 10% levels, respectively.

**Panel A: The Role of Market Reactions in Spillovers (*Hypothesis 1*)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Using Five-day CARs (0,4) as Dependent Variables							
Market Reaction: a	0.513** (0.248)	0.210*** (0.059)	0.557** (0.250)	0.168** (0.083)	0.197*** (0.059)	0.187*** (0.049)	0.233** (0.090)
Receivable (indicator): b	0.729 (1.078)						
a * b	0.158* (0.079)						
Payable (indicator): c		1.365** (0.643)					
a * c		0.585*** (0.195)					
Sales (indicator): d			-0.134 (0.857)				
a * d			0.059 (0.109)				
Purchases (indicator): e				1.689* (0.848)			
a * e				0.578** (0.230)			
Debt Guarantee (indicator): f					-0.126 (0.776)		
a * f					0.545** (0.218)		
Collateral (indicator): g						-0.091 (1.294)	
a * g						0.612***	

Ownership (indicator): h						(0.196)	-0.217 (1.077)
a * h							0.451* (0.239)
Size	0.287 (0.588)	0.015 (0.484)	0.213 (0.604)	-0.016 (0.533)	0.358 (0.509)	-0.109 (0.484)	0.041 (0.550)
ROA	-9.675** (4.303)	-7.754* (4.402)	-9.259** (4.424)	-7.128 (5.057)	-4.271 (5.395)	-1.602 (6.139)	-10.995** (4.395)
Leverage	2.205 (2.868)	0.953 (2.728)	2.216 (2.899)	1.254 (2.815)	3.557 (2.421)	3.196 (2.422)	0.828 (2.494)
M/B	-0.441 (0.370)	-0.120 (0.328)	-0.504 (0.366)	-0.072 (0.409)	-0.341 (0.331)	-0.311 (0.334)	-0.287 (0.247)
R&D	-2.915 (17.036)	1.171 (17.293)	-4.560 (17.137)	-9.699 (14.938)	-5.227 (19.632)	-2.786 (17.209)	-6.472 (15.269)
Cash	-3.182 (7.551)	-1.376 (7.632)	-2.512 (7.815)	2.446 (6.880)	-2.618 (7.805)	-6.649 (7.353)	-3.146 (7.604)
Credit Rating	0.105 (0.194)	0.069 (0.207)	0.107 (0.190)	0.190 (0.195)	0.015 (0.220)	-0.012 (0.196)	0.135 (0.189)
Number of Affiliates	-0.850** (0.360)	-0.690** (0.276)	-0.849** (0.361)	-0.424 (0.268)	-0.621** (0.274)	-0.616** (0.262)	-0.808** (0.321)
Group Size	0.070 (0.970)	-0.021 (0.973)	-0.149 (0.987)	-0.195 (0.989)	-0.054 (0.893)	-0.068 (0.845)	-0.401 (1.026)
Group ROA	0.363 (14.003)	-1.345 (13.119)	0.456 (14.159)	1.014 (12.821)	3.379 (12.216)	2.150 (12.760)	0.889 (14.243)
Group Leverage	-7.883 (6.167)	-7.914 (5.040)	-9.779 (5.842)	-8.406 (5.206)	-7.699 (5.233)	-10.410* (5.671)	-11.178* (5.926)
Group M/B	-0.959 (1.681)	-0.888 (1.457)	-0.909 (1.707)	-0.250 (1.565)	-0.792 (1.511)	-0.577 (1.547)	-0.674 (1.712)
Group R&D	-80.779 (102.983)	-63.514 (108.481)	-100.555 (101.623)	-87.565 (99.311)	-92.729 (104.920)	-130.403 (105.501)	-154.341 (95.321)
Group Cash	16.112 (23.656)	9.429 (15.040)	20.830 (23.387)	-0.038 (14.504)	6.556 (15.936)	16.337 (18.439)	20.419 (21.125)
Constant	-2.464 (21.000)	6.449 (18.897)	1.108 (20.965)	6.289 (20.681)	-0.782 (18.347)	3.420 (18.958)	6.875 (19.997)
Adjusted R-Squared	0.410	0.526	0.400	0.500	0.497	0.528	0.453
Observations	321	321	321	321	321	321	321
Chaebol Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**Panel B: Negative Spillovers vs. Positive Spillovers (*Hypothesis 2*)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Using Five-day CARs (0,4) as Dependent Variables														
Business Relationship Level	Receivable		Payable		Sales		Purchases		Debt Guarantee		Collateral		Ownership	
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Market Reaction: a	0.815*** (0.163)	0.826** (0.312)	0.981*** (0.129)	0.231*** (0.054)	0.857*** (0.172)	0.804** (0.323)	0.942*** (0.142)	0.184*** (0.066)	0.994*** (0.127)	0.269*** (0.077)	1.043*** (0.127)	0.247*** (0.072)	0.916*** (0.183)	0.177 (0.114)
Positive Reaction (indicator): b	-5.178*** (1.823)	-3.254 (2.226)	-5.040*** (1.044)	0.674 (0.758)	-5.349*** (1.630)	-2.373 (2.473)	-4.950*** (1.455)	1.239 (1.043)	-4.339** (1.777)	-0.597 (0.980)	-4.088** (1.765)	-0.674 (0.673)	-5.529** (2.179)	0.521 (0.899)
a * b	-0.077 (0.196)	-0.433* (0.231)	-0.244* (0.128)	-0.108 (0.101)	-0.205 (0.297)	-0.428** (0.204)	-0.175 (0.251)	-0.064 (0.141)	-0.351* (0.203)	-0.113 (0.086)	-0.432* (0.238)	-0.025 (0.119)	-0.309 (0.196)	0.052 (0.201)
Difference Test of a * b (p-value)	0.2535		0.3908		0.5267		0.6827		0.1827		0.0539**		0.1730	
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Adjusted R-Squared	0.559	0.389	0.695	0.041	0.580	0.362	0.671	0.106	0.641	0.124	0.748	0.079	0.582	0.106
Observations	162	159	162	159	166	155	164	157	161	160	74	247	167	154

**Panel C: Leading Firms vs. Non-Leading Firms (*Hypothesis 3*)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Using Five-day CARs (0,4) as Dependent Variables														
Business Relationship Level	Receivable		Payable		Sales		Purchases		Debt Guarantee		Collateral		Ownership	
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Market Reaction: a	0.119*	0.520**	0.663***	0.146***	0.166***	0.556**	0.628**	0.134**	0.630**	0.182***	0.750***	0.140***	0.199***	0.526**
	(0.059)	(0.235)	(0.230)	(0.037)	(0.027)	(0.246)	(0.234)	(0.058)	(0.251)	(0.061)	(0.241)	(0.044)	(0.060)	(0.239)
Leading Firm (indicator): b	2.202	0.666	0.523	2.085**	2.490	0.668	0.901	0.960	2.656	0.517	-0.750	1.555	1.480	1.096
	(1.597)	(1.310)	(1.718)	(0.863)	(1.808)	(1.117)	(1.651)	(1.124)	(1.905)	(0.946)	(3.575)	(1.160)	(1.372)	(1.668)
a * b	0.754***	-0.176	0.218	0.262**	0.749***	-0.236	0.293	0.289***	0.210	0.017	0.087	0.361	0.630***	0.014
	(0.124)	(0.255)	(0.155)	(0.118)	(0.073)	(0.278)	(0.178)	(0.098)	(0.175)	(0.129)	(0.127)	(0.247)	(0.137)	(0.330)
Difference Test of a * b (p-value)	0.0043***		0.8022		0.0016***		0.9499		0.3651		0.2984		0.4045	
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Adjusted R-Squared	0.650	0.329	0.650	0.077	0.680	0.324	0.640	0.150	0.601	0.118	0.700	0.112	0.631	0.342
Observations	162	159	162	159	166	155	164	157	161	160	74	247	157	164