Spillover Effects within Business Groups: The Case of Korean Chaebols

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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 there are positive spillovers (caused by positive market reactions) and negative spillovers (caused by negative market reactions) that are driven by the market reactions of event firms. Our analyses indicate that negative spillovers are more dominant than positive spillovers. Moreover, a spillover that is driven by a leading firm within a business group has stronger effects on other firms in the group than a spillover that is driven by a non-leading firm. This suggests 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 that are analyzed in our study are more noticeable when the business relationship between an event firm and other affiliated firms is closer. (JEL G14, G24)

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

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1. Introduction

This study investigates the spillover effects within Korean 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 study 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 by sharing many forms of resources with other member firms. This practice suggests that firms within a Korean business group (i.e., a chaebol) maintain significant business ties with other affiliated firms within the group.

Indeed, Bae et al. (2008) investigate 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. This indicates that a relationship exists among firms in the same business group. However, 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 a business group's insiders. Further, we focus on spillover effects that are driven by market participants across firms within a business group; thus, announcements concerning credit ratings are more suitable for our study's purpose. 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 crisis have caused greater dependence on external financing and that many of these changes in financing are concentrated in chaebol firms. Consequently, the announcements of credit rating changes are particularly suited for an examination of the phenomena with regard to chaebol firms.

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

In order to show the existence of 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 among chaebol-affiliated firms, spillover effects that occur 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 among firms in the same group is well known to the market participants. Thus, the abnormal

market reaction to an event is more important than the event's characteristics with regard to spillovers within a business group. Above all, the market reaction conditions the market's expectations about the credit rating change event; thus, the market reaction captures the surprise component of rating changes better than the rating changes themselves. 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 National Information & Credit Evaluation (NICE) credit rating agency decides to downgrade the credit rating of the Hyundai Motor Company, the effect on the stock prices of the members of the Hyundai Motor Group depends on the stock price of the Hyundai Motor Company. If the abnormal return of the Hyundai Motor Company is positive even though its credit rating has just been 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.

Further, we extend our analyses by comparing negative spillovers (caused by negative market reactions of event firms) with positive spillovers (caused by positive market reactions of event firms). Because negative events (or bad news) generally have a significant impact on market participants rather than positive events (or good news),[1] it could be worth asking if spillover effects that are driven by market reactions are asymmetric. Essentially, our results indicate that spillover effects have differential impacts in accordance with the signs of market

[1] In accordance with prospect theory (Kahneman and Tversky, 1979), asymmetric reaction to good and bad news can be explained by different responses to positive and negative perceptions. 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. In other words, reactions to negative information are much greater than reactions to positive information.

reactions. In this regard, negative spillovers are more dominant than positive spillovers. The findings also suggest that market participants react strongly against concerns about specific events caused by group-affiliated firms.

Korean business groups consist of leading firms that symbolically represent their chaebol groups. This situation is generally characterized by the large size of the leading firms' assets and their highly profitable and mature natures.[2] Further, not only insiders of a chaebol group but also market investors regard a leading firm as the prominent firm in a group. For example, with regard to the Samsung Group, Samsung Electronics should be the leading firm because it is the largest and most influential firm in the group. This approach suggests that spillovers that are driven by a leading firm are stronger than those that are driven by a non-leading firm. Our results conform to this argument because they reflect the implications of market perspectives on a business group. In other words, market participants are more interested in a leading firm and 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 relationship with group member firms are above the median or not.[3] Some information on the business associations among chaebol firms must be made public in accordance with government regulations in Korea. Even though such information is rare and ambiguous, its public availability means that market participants can perceive the specific

[2] We define a leading firm as the largest firm in a business group. The list of leading firms is calculated using the book value of total assets every year. In order to check robustness, we apply alternative criteria to define a leading firm such as total sales and the market value of equity. We obtain qualitatively identical results to those reported in the study.

[3] In order to measure business relationships between event firms and other affiliated firms, we employ diverse variables (e.g., receivables, payables, sales, and purchases) that are associated with affiliated firms.

business relations among a group's member firms. Thus, spillover effects should be more noticeable when an event firm has more business ties with its 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 rest of this paper is organized as follows: Section 2 presents a review of the related literature and develops the hypotheses. Section 3 explains our empirical approach and the associated data, and Section 4 discusses the results. Finally, Section 5 presents the concluding remarks.

2. Related Literature and Hypothesis Development

2.1 Korean Business Groups: Chaebols

Business groups are the principal and typical entities that manage various businesses. Consequently, there is considerable literature on business groups. Although such groups can be found worldwide regardless of whether a country is developing or advanced (Morck et al., 2005), Korean business groups (i.e., chaebols) have several distinguishing features. These features 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.[4] Indeed, they account for a large part of economic activity. For

[4] 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, as of 2013, the chaebol groups had 1,222 member firms and accounted for 56.4% of total assets, 43.5% of total sales, and 69.3% of total net income in Korea.[5]

Second, the ownership structure of a chaebol is heavily concentrated in the hands of owner-managers or founding families that exercise complete control over the affiliated firms within a group. These controlling shareholders, rather than professional management, have the discretionary power to make major strategic decisions at group level (Shin and Park, 1999; Song et al., 2012). 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 that provide a way for controlling shareholders to increase their wealth by increasing the value of other group firms (i.e., tunneling). Consistent with tunneling within business groups, Baek et al. (2006) find that chaebol issuers involved in intragroup deals set the offer prices in order 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) show that during the 1997 Korean financial crisis, chaebol firms experienced a greater fall in equity value when ownership was concentrated among controlling family shareholders compared with firms that had higher equity ownership by foreign investors. Further, Joh (2003) finds that before the crisis, poor corporate governance systems affected performance for Korean firms.

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 connected by cross-debt guarantees, reciprocal shareholdings, and internal business transactions.

[5] Here, the definition of a chaebol follows the guideline of the Korea Fair Trade Commission (KFTC). The ratios are calculated on the basis of non-financial sectors.

Thus, such firms benefit from other firms within the same group by sharing intangible and financial resources. Further, 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 because of high leverage on credit allocations, overinvestment, and weak corporate governance structures (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 resolving mutual debt guarantees among member firms (Bae et al., 2008).

Following the financial crisis, one of the important goals of the reforms was the improvement of the Korean credit rating system. The result was that the system was significantly enhanced. Hahm (1999) notes the progress in upgrading the credit information and rating system. This progress includes strict government management of credit rating agencies, increasing transparency through public disclosure, and mandatory credit rating of all marketable debts. Further, Oh (2014) observes that the level of competition in the credit rating industry has significantly increased following the financial crisis and that the market structure has become an oligopoly in a contestable market, a situation that is economically equivalent to perfect competition.

Prior to the financial crisis, chaebol firms depended mostly on internal financing within chaebols. For example, Shin and Park (1999) find evidence of internal capital markets in chaebols, where the parent or leading firm may arrange financing for subsidiaries through cross-payment guarantees and affiliated banks. Almeida et al. (2015) 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. In addition, Lee et al. (2009) report that while active internal capital markets existed within chaebols during the early 1990s, the markets appear to be limited in the post-crisis period. Indeed, Lee et al. (2009) demonstrate that internal capital markets within chaebols have barely functioned after the 1997 financial crisis; hence, the authors suggest that public debt markets serve as substitutes for internal capital markets. Bereskin et al. (2015) note that governance reforms after the financial crisis have caused greater dependence on external financing and that many of these changes in financing are concentrated in chaebol firms. Further, Lim (2006) reports an increase in non-guaranteed corporate bond issuance after the financial crisis. This has significantly increased the demand for credit ratings. Consequently, credit ratings have become more important to chaebols following the Asian financial crisis.

2.3 Spillover Effects

Abundant literature exists on various transfer channels through which spillover effects within an industry, across industries, across countries, through supply chains, and among counterparties may occur. Lang and Stulz (1992) investigate 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, and Hertzel 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 an industry's bankruptcy filings 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 (Jorion and Zhang, 2010). Hertzel and Officer (2012) find evidence of an industry contagion effect on non-spread terms in bank loan contracts, while 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. With regard to the latter investigation, Ferreira and Gama (2007) extend the scope to international stock markets. By using value-at-risk models, Adams et al. (2014) find that the size and duration of risk spillovers among financial institutions change in accordance with the state of the market. The authors show that while risk spillovers are small during normal times, equivalent shocks lead to sizable spillover effects during crises.

Although prior research on spillover or contagion effects is abundant, little evidence exists about whether the event of a firm in a business group affects other affiliated firms in the same 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.[6] Similarly, with respect to the unique characteristics of chaebol groups, we expect that a specific event that involves the credit rating of a chaebol-affiliated firm affects other member firms within a group in the same direction because the close business relationship among group member firms is publicly known.

Many studies have investigated 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 Leftwitch, 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. Further, we focus on the market reactions of event firms rather than whether the credit rating changes are upgrades or downgrades. We adopt this approach because market participants are more perceptive about the close association among group member firms. Specifically, the market response to the event of a firm is transferred from an event firm to other affiliates. Thus, the market evaluation of a firm with regard to an event is crucial in order to determine the characteristics of spillover effects. This leads to our first hypothesis:

Hypothesis 1*: *The market reaction of an 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 and positive spillovers have differential impacts on other affiliated firms. In general, negative events (or bad news) spread intensively when compared with positive events (or good news). For example, Soroka (2006)

[6] This positive association among 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 performs well in the past, or if the announcing firm has a higher debt guarantee ratio. These results are consistent with the existence of intragroup propping, which involves capital reallocation within affiliated firms in order to save a financially troubled affiliate.

shows that public responses to negative news are much greater than those to positive news. Using time-series analyses of UK media and public opinion, the author finds strong evidence of asymmetry. In addition, numerous studies report that negative credit rating events have a significant negative effect on stock and bond markets; however, 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's rating changes. Norden and Weber (2004) also report a summary of the empirical literature relating to the impact of credit rating announcements. Further, 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 markets of other countries. Similarly, we expect that the spillover effects that are driven by market reactions are 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 firm of a chaebol group. It is characterized by the large size of its assets and its profitable and mature nature. Further, a chaebol's leading firm has a symbolic identity in Korea. Thus, we expect that spillover effects that are driven by a leading firm are more dominant than those that are driven by a non-leading firm because market participants pay more attention to leading firms. Based on this conjecture, we posit the third hypothesis:

***Hypothesis 3*: A credit rating change that is driven by a leading firm has stronger spillover effects on other affiliated firms in the same business group than a change that is 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 and Bloomberg for credit rating data; the FnGuide for stock market data; the Korea Fair Trade Commission (KFTC) for chaebol data; and the TS2000 database provided by the Korea Listed Companies Association for financial and accounting data.

The primary data set that we examine is the list of chaebol-affiliated firms. We define a chaebol according to the guidelines of the KFTC, which since 1986 has announced the list of chaebol groups annually under the terms of the Fair Trade Act. The KFTC defines a chaebol in two parts: (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., 2015). Our sample consists of listed firms affiliated with chaebols from 2001 to 2013. Because 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 the KFTC. For example, the KFTC announced the 30 largest chaebol groups each year from 1986 to 2001; however, it 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 onward. As a result, we decide whether or not an event firm is a chaebol firm in accordance with 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 occurred before 2013, we include this event in our sample.

Our other major data set is the announcement of credit rating changes. There are four local credit rating agencies in Korea: NICE, Korea Investor Services (KIS), Korea Ratings (KR), and Seoul Credit Rating & Information (SCI).[7] 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 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 have also 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]

[7] KIS and KR are affiliated firms of Moody's and Fitch respectively.

The rating files are directly provided by NICE and are also compiled from Bloomberg.[8] There are 2,975 credit rating change events announced by credit rating agencies during 2001–2013. We subsequently exclude 21 duplicate events, 783 withdrawn announcements, and 260 financial firms' events. We also eliminate 563 events that are sequentially close. In order to focus on the contagion of credit rating change events, we exclude other firm-specific information such as earnings announcements, mergers and acquisitions (M&As), and seasoned equity offerings (SEOs) within nine business days (-4, 4) of the event date of the credit rating changes.[9] Then, we eliminate the events of non-chaebol firms and firms whose financial data are not available. Based on these screening steps, 929 events are removed. Finally, because we analyze spillover effects on the stock market, information on the daily stock returns needs to be available for event firms and non-event firms. This screening process generates our 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 that represents a business group. It is characterized as a large, profitable, and mature firm. In our study, we simply define a leading firm as the largest firm (in terms of the book value of total assets) in a business group every year.[10]

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.,

[8] NICE covers two-thirds of the credit rating of rating files in Korea. In order to investigate the impact of credit rating events more extensively than in prior studies, we collect credit rating events via two channels, NICE and Bloomberg.

[9] We apply these screening criteria to event firms and other member firms within the same groups.

[10] 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.

whether an 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 of 359 events). Panel B of Table 2 shows the distribution of the sample by business groups, which are 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 corresponding business groups as of 2013. Among the business groups, the Hyundai Motor, Samsung, LG, Kumho Asiana, and SK groups have a relatively large number of credit rating change events. These top five groups have 49.0% of the total events (i.e., 176 of 359 events).

[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 the ratio of 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 expenditure 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 characteristics of a leading firm are closer to a value firm 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.[11]

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 by using the market model that follows the event dates of credit rating changes. The model also estimates the ARs and CARs for non-event firms in the same business group by using the portfolio approach.[12] 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 (Korea Composite Stock Price Index) 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 compute the CARs of non-event affiliated firms in the business groups by using equal-weighting rather than value-weighting in order to understand effectively the spillover effects within business groups.[13]

[11] The growth firm invests more in R&D than the value firm.
[12] We closely follow the empirical approach used by Bae et al. (2008).
[13] In order to check the robustness of our results, we repeat our analyses by using value-weighted CARs and find that our main conclusions remain intact.

4. Empirical Results

4.1 Spillover Effects within Business Groups

Table 4 shows that the spillover effects that are 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 the event firms and other affiliated firms in the same business groups. We classify our event samples into the two subsamples in accordance with the sign of the CARs of event firms in order to show the market reactions to credit rating changes. The subsample in Panel A includes event firms with a negative CAR, 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. Both of these 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 -0.89% and -1.66% 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. Both of these are significant at the 1% level. The average two-day CAR of the corresponding other affiliated firms shows average excess returns of 0.46%, and is not statistically significant. The average five-day CAR of the corresponding other affiliated firms shows average excess returns of 1.59%, 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 CARs (0, 4) of non-event affiliated firms in the business groups as the dependent variables. Our key explanatory variable of interest is *Market Reaction*, which is the five-day CAR (0, 4) of an 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 together with *Credit Rating*, which denotes the credit rating of an event firm.[14] In regressions (4) and (5), we add 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.[15]

[Insert: Table 5]

In our regression analyses, we focus on the five-day CARs (0, 4) rather than the CARs of the short event periods such as the two-day CARs (0, 1) because the latter may take time to be reflected in the market by an event. This is consistent with the conventional wisdom that emerging markets, including the Korean market, are less efficient than developed markets (i.e., emerging markets are weak-form efficient markets). For example, the daily price limit in the Korea Stock Exchange is 15% for all stocks. This is one example of a hindrance to market efficiency.[16] Bae et al. (2008) note that the price limit rules suggest that market participants may have continued to react even after the announcements. Indeed, almost 50% of our events (i.e., 176 of 359 events) experience daily price limits with regard to at least one other firm.

[14] Table 1 describes categories for credit ratings and the numerical scale used in our analyses.
[15] In our regression analyses, we 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).
[16] The Korea Stock Exchange introduced the upper and lower limits of daily stock prices in 1998.

Moreover, using an ex post event window such as the five-day CAR (0, 4), instead of an ex ante event window such as the nine-day CAR (-4, 4), helps to analyze spillovers that are driven by the market reactions of event firms. In this regard, 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 information about an 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 that are driven by market reaction.[17]

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; namely, all else being constant, a 1% increase in the market reaction of an event firm leads to an approximately 0.57% increase in the CARs of other group members. This result is consistent with the view that the market evaluation of an event firm plays an important role in determining the characteristics of spillover effects.[18]

4.2 Negative Spillovers vs. Positive Spillovers

In this section, we demonstrate that spillovers that are driven by negative market reactions are more dominant than those that are driven by positive market reactions. Table 6 reports the regression estimates. In regressions (1) through (4), we include the indicator *Positive Reaction*, which takes a value of one if the market reaction of an event firm is positive and zero

[17] Analyses are also performed using the event windows (-4, 4), (-1, 1), (0, 1) in order to check the robustness of our results. We find that our main conclusions remain intact.

[18] Moreover, we investigate the lead and lag relationship between event firms and non-event firms in order to understand the spillover effects more accurately. Specifically, we regress the lead terms of CARs for non-event firms in business groups on the lag terms of CARs for event firms and vice versa. As a result, we verify that causality does not run from non-event firms to event firms.

otherwise. The coefficients for *Positive Reaction* are significantly negative for all regressions and statistically significant up to the 10% level. We also add the interaction term between *Market Reaction* and *Positive Reaction*. The coefficients for the interaction term are negative and significant up to the 5% level. These results suggest that negative spillovers (caused by negative market reactions) are stronger than positive spillovers (caused by positive market reactions).[19]

[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 two subsamples in terms of whether or not they are leading firms in their business groups. Specifically, Panel A of Table 7 presents the spillover effects that are driven by the credit rating changes of leading firms. In contrast, Panel B of Table 7 shows that the credit rating changes of non-leading firms lead to spillover effects on other affiliated firms in their business groups.

[Insert: Table 7]

With regard to 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

[19] There may be a relatively high correlation among *Market Reaction*, *Positive Reaction*, and the interaction term that is between them. Thus, to avoid the multicollinearity problem in the regressions that include these variables (i.e., the regressions in Table 6 and Panel B of Table 9), we measure the degree of multicollinearity by using the variance inflation factor (VIF). This is employed by many researchers in order to check the degree of multicollinearity (O'Brien, 2007). As a result, we verify that multicollinearity is not a significant issue that affects our main results.

rating changes are -2.96% and -5.44% respectively. Both of these 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 -1.72% and -2.13% 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. Both of these figures 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 2.19% and 2.39% respectively.

In contrast, for non-leading firms, the magnitude of mean CARs of other affiliated firms is relatively small. Further, significant test results do not even exist in some cases. Panel B of Table 7 particularly 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 relatively small and not statistically significant. These results suggest that spillover effects caused by a leading firm are stronger than those caused by a non-leading firm. Indeed, there is a large difference between them, particularly with regard to positive spillovers.

We conduct further regression analyses, the results of which are summarized in Table 8. We employ the indicator *Leading Firm*, which takes a value of one if the event is driven by a leading firm and zero otherwise. We also include an interaction term between *Market Reaction* and *Leading Firm.* The coefficients for the interaction term are significantly positive for all regressions. This suggests that the positive relationship 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. The result is consistent with the view that the credit rating event that is driven by a

leading firm has stronger spillover effects on other affiliated firms in the business group than the event that is 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. In order 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 the total assets of an event firm), *Payable* (i.e., the ratio of the amount of payables related to affiliated firms to the 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 ratio of the amount of debt guarantee for affiliated firms to the total debt of an event firm), *Collateral* (i.e., the ratio of the amount of collateral for affiliated firms to the total debt of an event firm), and *Ownership* (i.e., the ratio of the total amount of equity investment for affiliated firms to the equity participation by affiliated firms divided by the entire market value of equity). By using these variables, we construct each dummy variable. These take a value of one if each variable is above its cross-sectional median and zero otherwise.

[Insert: Table 9]

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

Next, in Panels B and C of Table 9, we repeat prior regression analyses that correspond to column (2) of Table 6 and column (2) of Table 8 by dividing our event samples into two subsamples. These subsamples are based on whether the levels of business relationship (i.e., seven dummy variables) are high or low.[20] Specifically, the regressions of odd numbers in Panels B and C are performed with event firms that have relatively close business ties with affiliates. In contrast, the samples of the regressions of even numbers in Panels B and C include event firms that 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 relationship are high. Moreover, the values of adjusted R-squared are overwhelmingly larger in the regression models with odd numbers. In Panel C of Table 9, most

[20] In these analyses, the fixed effects cannot be considered because of the limitation of the sample number. Namely, our regression models are not well specified because the number of each subsample is not high enough to apply the fixed effects.

coefficients for interaction terms and all adjusted R-squared values are higher when each dummy variable with regard to a business relationship is equal to one. Overall, the results of Table 9 imply that the business relationship among group-affiliated firms is one of the important factors that explains the spillover effects within business groups.

5. Concluding Remarks

This paper provides evidence about 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 portfolios that consist of other group members after the announcements of event firms' credit rating changes. In order to understand the determinants of spillover effects in a group, the market evaluation of a credit rating change event is considered a more important factor than the event itself. Further, we find that spillover effects have differential impacts in accordance with the signs of market reactions. Thus, on average, negative spillovers (caused by negative market reactions) are more dominant than positive spillovers (caused by positive market reactions) regardless of whether the credit rating changes are upgrades or downgrades. We also find that a spillover that is driven by a leading firm of a business group has stronger effects on other firms in the group than a spillover that is driven by a non-leading firm. This finding 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 among business group members is closer.

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

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Table 1: Credit Rating Scale

This table describes the categories that are used for credit ratings in order to compare the Korean domestic agencies with the global rating agencies. It 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

This table 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 or not the event firm is a leading firm). 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
Total	359	

Table 3: Summary Statistics of Event Firms' Characteristics

This table shows the summary statistics of event firms (credit rating changes) in our sample. *Total Asset* is the book value of total assets (billion ₩). *Size*, *ROA*, *Leverage*, *M/B*, *R&D*, and *Cash* are calculated by the market value of equity, the ratio of net income to total assets, the ratio of total debt to total assets, the ratio of the market value of equity to the book value of equity, the ratio of R&D to sales, and the ratio of cash to total assets respectively. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and *** respectively.

Variables	Full Sample	Leading Firms	Non-Leading Firms	
	Mean (Median)	Mean (Median)	Mean (Median)	Difference t-test
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 that are driven by the market reactions of event firms. The average two-day and five-day CARs are reported for 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	Event Firms			Other Affiliates in Business Groups		
Windows	N	CAR	t-stat.	N	CAR	t-stat.
Two-Day CAR (0, 1)	204	-3.18	-13.49***	204	-0.89	-3.30***
Five-Day CAR (0, 4)	206	-5.68	-10.50***	206	-1.66	-3.20***

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

Event	Event Firms			Other Affiliates in Business Groups		
Windows	N	CAR	t-stat.	N	CAR	t-stat.
Two-Day CAR (0, 1)	155	2.93	10.84***	155	0.46	1.83
Five-Day CAR (0, 4)	153	5.56	11.03***	153	1.59	2.95***

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 expenditure to total sales); *Cash* (i.e., the ratio of cash to total assets); and *Credit Rating* (i.e., the level of the original credit rating of the event firm, with higher values indicating higher credit ratings). The independent variables with 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 CARs (0, 4) as Dependent Variables					
Market Reaction	0.516***	0.554**	0.554**	0.562**	0.568**
	(0.187)	(0.207)	(0.216)	(0.220)	(0.229)
Size		0.429	0.270	0.393	0.212
		(0.392)	(0.485)	(0.495)	(0.568)
ROA		-9.608***	-9.457**	-9.868***	-9.102**
		(3.004)	(4.098)	(3.197)	(4.303)
Leverage		1.625	2.339	1.786	2.466
		(2.763)	(3.476)	(2.516)	(2.819)
M/B		-0.351	-0.288	-0.434	-0.311
		(0.222)	(0.330)	(0.279)	(0.333)
R&D		5.707	6.843	1.990	-5.117
		(12.478)	(8.157)	(13.284)	(10.317)
Cash		-1.228	-0.901	-1.774	-2.660
		(7.350)	(6.070)	(7.128)	(5.863)
Credit Rating		-0.080	-0.028	-0.033	0.044
		(0.179)	(0.149)	(0.192)	(0.164)
Number of Affiliates				-0.056*	-0.417*
				(0.028)	(0.229)
Group Size				0.048	-0.142
				(0.351)	(0.669)
Group ROA				0.785	0.431
				(13.382)	(15.890)
Group Leverage				-6.339	-6.894
				(5.373)	(5.452)
Group M/B				-0.170	-0.365
				(0.374)	(0.421)
Group R&D				-39.075	-92.114
				(81.259)	(88.517)
Group Cash				5.056	12.896
				(20.145)	(21.376)

Constant	0.183	-3.986	-2.030	-3.480	0.602
	(0.272)	(7.452)	(9.263)	(9.644)	(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

Table 6: Negative Spillovers vs. Positive Spillovers

This table shows that spillovers that are driven by negative market reactions are more dominant than those that are driven by positive market reactions. All variables are defined in Table 5 with the exception of *Positive Reaction*, which is an indicator variable equal to one if the market reaction of an event firm is positive and zero otherwise, and *a * b*, which is the interaction term between *Market Reaction* and *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***	0.823***	0.859***	0.857***
	(0.193)	(0.222)	(0.219)	(0.228)
Positive Reaction (indicator): b	-3.543**	-3.683**	-3.936*	-4.051**
	(1.709)	(1.718)	(2.037)	(1.997)
*a * b*	-0.380***	-0.358***	-0.402**	-0.379**
	(0.116)	(0.124)	(0.151)	(0.153)
Size	0.364	0.339	0.013	-0.052
	(0.261)	(0.309)	(0.437)	(0.527)
ROA	-8.622***	-8.221**	-7.400	-6.696
	(3.006)	(3.408)	(5.117)	(5.381)
Leverage	1.825	2.269	1.839	2.185
	(1.910)	(1.740)	(2.811)	(2.619)
M/B	-0.233	-0.323	-0.075	-0.157
	(0.253)	(0.218)	(0.303)	(0.309)
R&D	0.447	1.181	0.542	-13.244
	(9.139)	(9.789)	(6.727)	(9.413)
Cash	-2.890	-4.904	-4.698	-6.393
	(6.754)	(6.995)	(6.241)	(6.120)
Credit Rating	-0.061	-0.019	-0.076	-0.022
	(0.128)	(0.137)	(0.141)	(0.156)
Number of Affiliates	-0.024	-0.026	-0.203	-0.310*
	(0.018)	(0.022)	(0.147)	(0.184)
Group Size		0.285		-0.245
		(0.213)		(0.555)
Group ROA		-2.168		0.103
		(9.687)		(14.854)
Group Leverage		-1.378		-7.066
		(3.032)		(5.249)
Group M/B		0.036		-0.170
		(0.104)		(0.351)
Group R&D		-46.705**		-129.841
		(21.193)		(84.828)
Group Cash		-4.820		-0.131
		(9.652)		(14.742)
Constant	-1.498	-4.377	4.825	12.161
	(4.702)	(5.069)	(7.764)	(14.806)
Adjusted R-Squared	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

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

This table shows spillover effects that are driven by the market reactions of event firms by dividing our samples into two subsamples according to whether or not they are "leading firms" in their business groups. Panel A shows spillover effects that are driven by the credit rating changes of leading firms and Panel B shows spillover effects that are 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% levels is indicated by *, **, and *** respectively.

Panel A: Spillover Effects That are Driven by Leading Firms

	Event	Event Firms			Other Affiliates in Business Groups		
	Windows	N	CAR	t-stat.	N	CAR	t-stat.
Negative Spillovers	Two-Day CAR (0, 1)	62	-2.96	-7.66***	62	-0.79	-1.72*
	Five-Day CAR (0, 4)	65	-5.44	-4.84***	65	-2.46	-2.13**
Positive Spillovers	Two-Day CAR (0, 1)	41	2.93	5.69***	41	1.43	2.19**
	Five-Day CAR (0, 4)	38	6.10	5.72***	38	3.69	2.39**

Panel B: Spillover Effects That are Driven by Non-Leading Firms

	Event	Event Firms			Other Affiliates in Business Groups		
	Windows	N	CAR	t-stat.	N	CAR	t-stat.
Negative Spillovers	Two-Day CAR (0, 1)	142	-3.27	-11.14***	142	-0.93	-2.81**
	Five-Day CAR (0, 4)	141	-5.78	-9.67***	141	-1.29	-2.38**
Positive Spillovers	Two-Day CAR (0, 1)	114	2.93	9.20***	114	0.11	0.47
	Five-Day CAR (0, 4)	115	5.38	9.40***	115	0.90	1.82

Table 8: Leading Firms vs. Non-Leading Firms

This table shows that spillovers that are driven by leading firms are more dominant than those that are driven by non-leading firms. All variables are defined in Table 5, with the exception of *Leading Firm*, which is an indicator variable equal to one if the event firm is a leading firm and zero otherwise, and *a * b*, which is the interaction term between *Market Reaction* and *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**	0.400**	0.426**	0.423*
	(0.177)	(0.186)	(0.204)	(0.221)
Leading Firm (indicator): b	0.438	1.183	2.296*	2.338*
	(0.744)	(1.014)	(1.201)	(1.173)
*a * b*	0.357***	0.368***	0.357***	0.391***
	(0.078)	(0.079)	(0.096)	(0.109)
Size	0.480**	0.297	-0.109	-0.065
	(0.221)	(0.368)	(0.552)	(0.617)
ROA	-6.027*	-6.782*	-7.696*	-6.367*
	(3.013)	(3.446)	(4.201)	(3.702)
Leverage	1.239	1.809	1.605	2.564
	(2.061)	(1.917)	(3.147)	(2.547)
M/B	-0.419***	-0.438**	-0.088	-0.139
	(0.144)	(0.182)	(0.306)	(0.298)
R&D	6.129	8.373	8.768	-3.463
	(9.075)	(11.442)	(12.195)	(11.118)
Cash	-2.74	-6.12	-1.90	-3.96
	(6.730)	(7.703)	(5.528)	(5.456)
Credit Rating	0.04	0.04	-0.08	0.00
	(0.125)	(0.127)	(0.147)	(0.161)
Number of Affiliates	-0.01	-0.01	-0.278*	-0.34
	(0.016)	(0.024)	(0.148)	(0.201)
Group Size		0.552**		0.357
		(0.257)		(0.595)
Group ROA		-0.644		-1.732
		(10.196)		(15.634)
Group Leverage		-2.98		-6.13
		(3.132)		(4.817)
Group M/B		0.059		-0.115
		(0.097)		(0.370)
Group R&D		-49.381**		-121.194
		(23.203)		(88.624)
Group Cash		-1.558		6.838
		(9.402)		(19.974)
Constant	-7.081*	-10.402**	5.416	-0.864
	(3.726)	(3.957)	(10.399)	(16.679)
Adjusted R-Squared	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

Table 9: Spillover Effects and Business Relationships within Business Groups

The three panels of this table show that the spillover effects that are 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 used to measure the level of a business relationship are *Receivable* (i.e., the ratio of the amount of receivables associated with affiliated firms to the total assets of an event firm), *Payable* (i.e., the ratio of the amount of payables related to affiliated firms to the 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 ratio of the amount of debt guarantee for affiliated firms to the total debt of an event firm), *Collateral* (i.e., the ratio of the amount of collateral for affiliated firms to the total debt of an event firm), and *Ownership* (i.e., the ratio of the amount of equity investment for affiliated firms to the equity participation by affiliated firms divided by the entire market value of equity). By using these variables, we construct each indicator variable, which takes a value of one if the 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 *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 relationship (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**	0.210***	0.557**	0.168**	0.197***	0.187***	0.233**
	(0.248)	(0.059)	(0.250)	(0.083)	(0.059)	(0.049)	(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***	
						(0.196)	
Ownership (indicator): h							-0.217
							(1.077)
*a * h*							0.451*
							(0.239)
Size	0.287	0.015	0.213	-0.016	0.358	-0.109	0.041
	(0.588)	(0.484)	(0.604)	(0.533)	(0.509)	(0.484)	(0.550)
ROA	-9.675**	-7.754*	-9.259**	-7.128	-4.271	-1.602	-10.995**
	(4.303)	(4.402)	(4.424)	(5.057)	(5.395)	(6.139)	(4.395)
Leverage	2.205	0.953	2.216	1.254	3.557	3.196	0.828
	(2.868)	(2.728)	(2.899)	(2.815)	(2.421)	(2.422)	(2.494)
M/B	-0.441	-0.120	-0.504	-0.072	-0.341	-0.311	-0.287
	(0.370)	(0.328)	(0.366)	(0.409)	(0.331)	(0.334)	(0.247)
R&D	-2.915	1.171	-4.560	-9.699	-5.227	-2.786	-6.472
	(17.036)	(17.293)	(17.137)	(14.938)	(19.632)	(17.209)	(15.269)
Cash	-3.182	-1.376	-2.512	2.446	-2.618	-6.649	-3.146
	(7.551)	(7.632)	(7.815)	(6.880)	(7.805)	(7.353)	(7.604)
Credit Rating	0.105	0.069	0.107	0.190	0.015	-0.012	0.135
	(0.194)	(0.207)	(0.190)	(0.195)	(0.220)	(0.196)	(0.189)
Number of Affiliates	-0.850**	-0.690**	-0.849**	-0.424	-0.621**	-0.616**	-0.808**
	(0.360)	(0.276)	(0.361)	(0.268)	(0.274)	(0.262)	(0.321)
Group Size	0.070	-0.021	-0.149	-0.195	-0.054	-0.068	-0.401
	(0.970)	(0.973)	(0.987)	(0.989)	(0.893)	(0.845)	(1.026)
Group ROA	0.363	-1.345	0.456	1.014	3.379	2.150	0.889
	(14.003)	(13.119)	(14.159)	(12.821)	(12.216)	(12.760)	(14.243)
Group Leverage	-7.883	-7.914	-9.779	-8.406	-7.699	-10.410*	-11.178*
	(6.167)	(5.040)	(5.842)	(5.206)	(5.233)	(5.671)	(5.926)
Group M/B	-0.959	-0.888	-0.909	-0.250	-0.792	-0.577	-0.674
	(1.681)	(1.457)	(1.707)	(1.565)	(1.511)	(1.547)	(1.712)
Group R&D	-80.779	-63.514	-100.555	-87.565	-92.729	-130.403	-154.341
	(102.983)	(108.481)	(101.623)	(99.311)	(104.920)	(105.501)	(95.321)
Group Cash	16.112	9.429	20.830	-0.038	6.556	16.337	20.419
	(23.656)	(15.040)	(23.387)	(14.504)	(15.936)	(18.439)	(21.125)
Constant	-2.464	6.449	1.108	6.289	-0.782	3.420	6.875
	(21.000)	(18.897)	(20.965)	(20.681)	(18.347)	(18.958)	(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													
	Receivable		*Payable*		*Sales*		*Purchases*		*Debt Guarantee*		*Collateral*		*Ownership*	
Business Relationship Level	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Market Reaction: a	0.815***	0.826**	0.981***	0.231***	0.857***	0.804**	0.942***	0.184***	0.994***	0.269***	1.043***	0.247***	0.916***	0.177
	(0.163)	(0.312)	(0.129)	(0.054)	(0.172)	(0.323)	(0.142)	(0.066)	(0.127)	(0.077)	(0.127)	(0.072)	(0.183)	(0.114)
Positive Reaction (indicator): b	-5.178***	-3.254	-5.040***	0.674	-5.349***	-2.373	-4.950***	1.239	-4.339**	-0.597	-4.088**	-0.674	-5.529**	0.521
	(1.823)	(2.226)	(1.044)	(0.758)	(1.630)	(2.473)	(1.455)	(1.043)	(1.777)	(0.980)	(1.765)	(0.673)	(2.179)	(0.899)
*a * b*	-0.077	-0.433*	-0.244*	-0.108	-0.205	-0.428**	-0.175	-0.064	-0.351*	-0.113	-0.432*	-0.025	-0.309	0.052
	(0.196)	(0.231)	(0.128)	(0.101)	(0.297)	(0.204)	(0.251)	(0.141)	(0.203)	(0.086)	(0.238)	(0.119)	(0.196)	(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
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
Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No

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													
	Receivable		*Payable*		*Sales*		*Purchases*		*Debt Guarantee*		*Collateral*		*Ownership*	
Business Relationship Level	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
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
Fixed Effects	No	No	No	No	No	No	No	No	No	No	No	No	No	No